**FACULTÉ DES ÉTUDES SUPÉRIEURES ET POSTOCTORALES**

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**FACULTY OF GRADUATE AND POSDOCTORAL STUDIES**

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GRADE / DEGREE

Department of Geography
FACULTÉ, ÉCOLE, DÉPARTEMENT / FACULTY, SCHOOL, DEPARTMENT

A Topographic and Photogrammetric Study of Rock Glaciers in the Southern Yukon Territory
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# A topographic and photogrammetric study of rock glaciers in the southern Yukon Territory

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Thesis submitted to the
Faculty of Graduate and Postdoctoral Studies
In partial fulfilment of the requirements
for the MSc degree in Physical Geography

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Direction du
Patrimoine de l'édition

395, rue Wellington
Ottawa ON K1A 0N4
Canada

*Your file Votre référence*
*ISBN:* 978-0-494-61187-6
*Our file Notre référence*
*ISBN:* 978-0-494-61187-6

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# 1 Acknowledgements

Financial support for this research was provided by a Contribution Agreement between Natural Resources Canada and the University of Ottawa, the Federal Government of Canada International Polar Year Thermal State of Permafrost in Canada Project, the National Sciences and Engineering Research Council of Canada, the Canadian Foundation for Climate and Atmospheric Sciences, and the Cryo-Ex Exchange Program (funded by SIU, Norway) between the University of Ottawa, the University of Oslo and the University Centre in Svalbard.

I would like to give thanks to Antoni Lewkowicz for supervising this research, to Andreas Kääb for directing the parts carried out in Norway and for teaching me something new, and to Bernd Etzelmüller for facilitating my exchange. I appreciate the helpful comments provided by my committee, Luke Copland and Peter G. Johnson, lab space made available by Luke Copland, and the data and advice provided by J. Peter Johnson, Daisy-Claire Hartmann-Brenner, Panya Lipovsky and Jeff Bond, without which this research would have been impossible. Thanks to Jenny Throop for being an excellent field partner. I am eternally grateful to the students of the CryoLab, who were always there for me, both to commiserate and celebrate. You guys are the reason I showed up every day. Finally, I would like to thank my parents, who were interested even when they didn't understand and confident in me even when I'd given up. Thank you.

## 2 Abstract

This research statistically examined the topographic characteristics of rock glacier locations in the Yukon Territory and tested the suitability of the Canadian air photo collection for photogrammetrically measuring rock glacier velocities. A database of more than 1500 rock glacier locations in the Yukon was compiled. The topographic characteristics of rock glaciers in a 12% sample were compared by classifying the sample by morphology (lobate or tongue-shaped) and activity (active, inactive or relict) and testing the difference between the class properties of elevation, slope, aspect and area. Tongue-shaped rock glaciers occurred at significantly higher mean and minimum elevations than lobate forms. Active rock glaciers were significantly larger than inactive and relict forms, and active forms were significantly more north-facing than inactive forms. The photogrammetry study found that it is possible to measure rock glacier movement rates from multi-temporal air photos of the quality and frequency available for the Canadian North. It was also found that thermokarst development could be tracked on multi-temporal air photos, though its presence hinders the measurement of movement. With the continued acquisition of high quality photos, the technique should prove useful for monitoring both rock glacier movement and thermokarst development.

# 3 Introduction

## 3.1 Goals of the thesis

Rock glaciers are landforms composed of sediment and ice that are found in cold, mountainous regions. Their ice content allows for internal deformation causing down-slope creep. Rock glaciers come in several varieties, depending on their origin, shape, and ice content. Rock glaciers have different shapes and origins as a result of the surrounding topography, that is its shape, its geology, and its water sources. Active (containing ice and creeping) and inactive (containing ice and not creeping) rock glaciers are examples of permafrost. Because rock glaciers of different activity levels occur in zonal patterns in many parts of the world, it has been hypothesized that the level of activity may be useful as a means from which to infer the extent of permafrost presence in an area.

This thesis addresses questions regarding the topographic characteristics of rock glacier locations in the southern Yukon Territory in order to assess their spatial spread and their subsequent usefulness as regional permafrost distribution indicators within permafrost distribution modelling. A supplemental study examines the movement of several rock glaciers in the same region to determine their level of activity and rate of flow.

Research in the Rocky Mountains of Colorado by Janke (2007) found that tongue-shaped and lobate rock glaciers (shape examples given in Figure 1) formed statistically different populations when their elevation, aspect, slope and

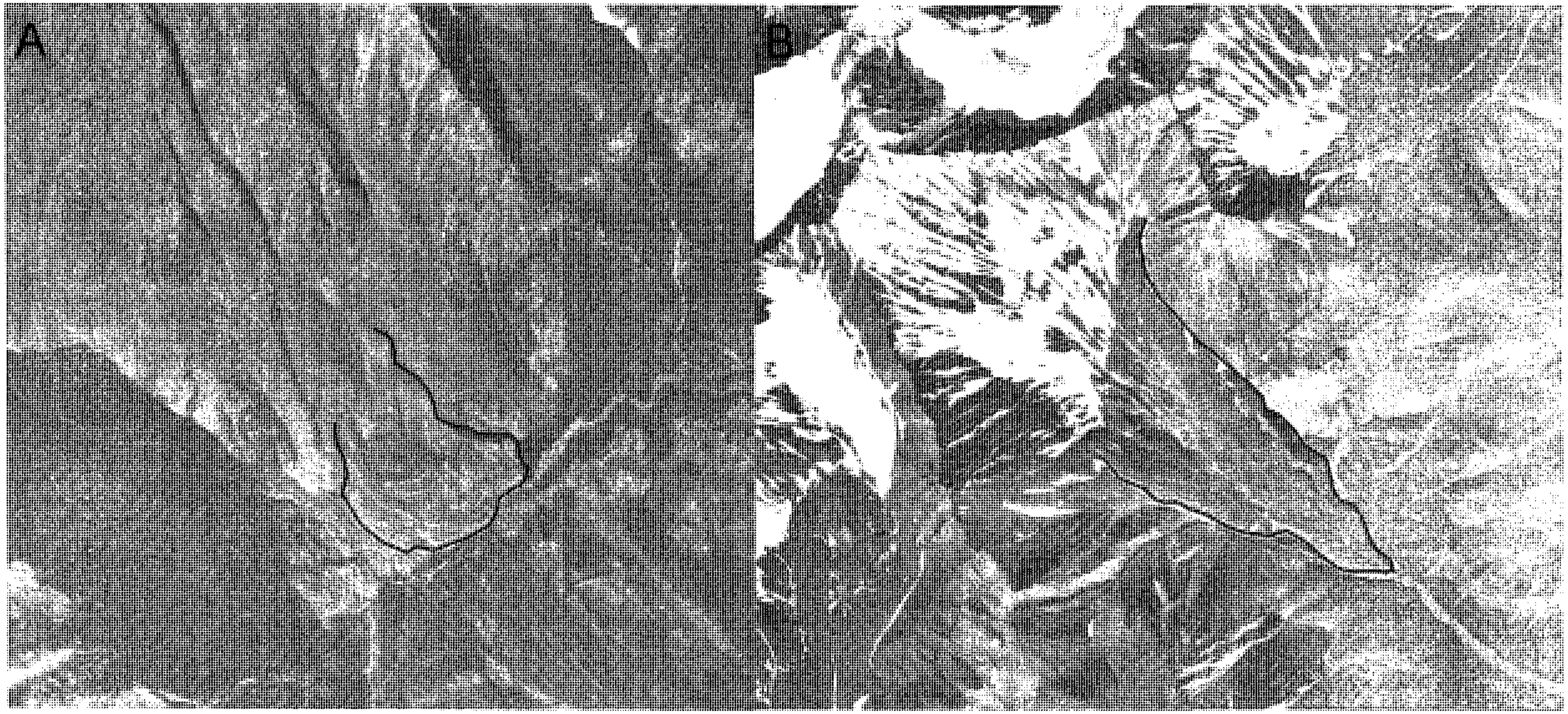

Figure 1 - Rock glacier morphologies: A: lobate; B: tongue-shaped (National Air Photo Library of Canada, A: A22355-207, B: A23794-119). Rock glacier extents indicated with the heavy black line.

area were compared. This study aims to test the relationships between the two groups using data from a higher latitude and a much larger study area.

To obtain the primary goal, a digital database of known rock glacier locations was created from existing surficial geology maps and from published (Sloan and Dyke, 1998) and unpublished research (J. P. Johnson and Hartmann-Brenner). No such database previously existed.

The purpose of the first set of results is to examine the differences in rock glacier populations as they relate to the prediction of permafrost distribution. Currently permafrost distribution in the Yukon is only understood at the most general level. Distribution modelling has the potential to provide an idea of where permafrost can and does occur at a more local scale. This is most important for environmental monitoring in an era of rapid change (indeed, even the establishment of baseline conditions), but is also useful for natural hazard assessment and infrastructure development.

The second part of this thesis deals with rock glacier movement. Very little work has been carried out on rock glacier dynamics in the Yukon Territory; the few publications include Johnson and Nickling (1979), Jackson and Macdonald (1980), Blumstengel and Harris (1988), Johnson (1998), and Sloan and Dyke (1998). These studies all included measurements taken directly on the rock glaciers over a period of time. The research outlined here attempts to evaluate whether it is possible and practical to discern rates of rock glacier movement from multi-temporal air photos. One of the sites looked at in the present study was also surveyed by Sloan and Dyke (1998), which facilitates comparison of the techniques and provides some degree of validation for the accuracy of the photogrammetric method.

Rock glacier movement is indicative of activity (i.e. presence of ice; Haeberli, 1985) and thus of climate (and permafrost) conditions. It is unknown how climate change will affect the dynamics of rock glaciers, but using existing air photos it may be possible to determine what the rates of movement have been over roughly the last 50 years, and in some cases to see if there has been a change in the rates within the period of photo coverage. This will give a spatially diverse sample of recent rock glacier dynamics, which will be useful for comparisons with future measurements.

## 3.2 Research questions

The specific questions that will be addressed in this research are as follows:

Part 1

- Are lobate and tongue-shaped rock glaciers statistically different populations, according to their elevations, slopes, aspects and areas, when a random stratified sample is taken from the known population south of 65°N in the Yukon Territory?
- If so, does this indicate different origins as suggested by Janke (2007)?
- How do the results affect the possibility of using rock glaciers to indicate permafrost presence for distribution modelling?

Part 2

- Is it possible to determine rock glacier movement rates from multi-temporal air photos of the quality and frequency available for the Canadian North?
- What are the rates found and how do they compare to rates determined by other methods?
- What changes have occurred in the rates over the period of photo coverage (where photo coverage allows)?

# 4 Literature review

Rock glaciers have been recognized in the literature as features of mountainous landscapes in cold climate zones since at least 1910 (Capps, 1910; Moffit and Capps, 1911; Tyrell, 1910). Since then many developments have been made in their understanding, including advancements in knowledge concerning their origins, dynamics and structure, and more recently their use in modelling the distribution of permafrost. The following review discusses rock glaciers under these three specific topics. Other aspects (such as climate constraints and geological landform composition) will also be touched upon, as they influence or are influenced by the three main sections, but they will not be examined separately. The dynamics section includes a review of remote sensing techniques as used to assess rock glacier movement. The modelling section discusses only the aspects relevant to the use of rock glaciers in modelling, as modelling is covered in detail elsewhere (e.g. Etzelmüller *et al.*, 2001; Lambiel and Reynard, 2001).

## 4.1 Origins

### *4.1.1 Early theories*

The origins of rock glaciers have long been a subject of speculation. In the late 1800s and early 1900s, many of the hypotheses were centred on the idea that a rock glacier was the result of some sort of mudflow or other mass movement of unconsolidated material (e.g. Bonney, 1902; Patton, 1910). Early descriptions of the landforms involve terms like "rock stream" (Cross and Howe,

1905) and "mud stream" (Bonney, 1902). These theories failed to consider that active and inactive rock glaciers are composed of ice-cemented sediments at depths of a few metres, and that their flow-indicating shapes could result from high frequency, low magnitude movement as well as from a catastrophic event (Bonney, 1902; Patton, 1910). Calling them "mud streams", Bonney (1902) described rock glaciers in the Alps, citing landslides as their initiating event and making a plea for their distinction from moraines, a category to which he felt they would be assigned if not given adequate inspection. The next earliest coherent description of what we now call rock glaciers was given by Cross and Howe in 1905 (as cited in Patton, 1910; and Wahrhaftig and Cox, 1959), who coined both of the terms "rock stream" and "rock glacier" in reference to the landforms that they hypothesized were created during periods of glacial retreat, when weathering on newly exposed cirque headwalls caused landslides. These slides would cover the diminishing glaciers below and would be carried downslope by the glacier until all of the ice had melted away, leaving behind the rock glacier form which they imagined was a sort of moraine. They also suggested that rock glaciers could be polygenetic, and gave examples of other means of their formation while qualifying that the largest rock glaciers could only have been formed with the help of glaciers due to the volume of sediment involved (as cited in Brown, 1925). Chamberlin and Salisbury (1906, as cited in Parsons, 1939) argued that solifluction created rock glaciers through a process of deposition and movement of talus down snowbanks, slow mass movement of talus bodies possibly including ice, and glacier-like movement. Patton (1910), referring to them as “rock streams” after Cross and Howe (1905), described rock glaciers in Colorado, arguing, like Bonney (1902), that they were formed by enormous landslides without the necessary presence of glaciers. He accounted for their absence in temperate climate zones by saying that they would be obscured by vegetation when occurring below treeline. At the time of Patton’s publication (1910), Cross and Howe (1910) changed their minds about how rock glaciers formed and agreed with Patton (1910). Moffit and Capps (1910) were the first to put forward the idea that rock glaciers contain contemporary ice and that it was responsible for at least some of their movement. They demonstrated the former by digging holes on a number of Alaskan rock glaciers, in all of which they encountered ice. Their description of the formation of the landforms followed the earlier theory of Cross and Howe (1905), except that there was never a complete melt out of ice within the rock glacier, and whether they thought the majority of it came from glacial ice or precipitation was unclear, as they recognized both as potential sources. This theory was based on the fact that small cirque glaciers headed some of the rock glaciers they encountered. They thus saw rock glaciers as successional forms related to the retreat and melt of ice glaciers. In response to the writings of Moffit and Capps (1910), Tyrell (1910) speculated that the cores of rock glaciers could be formed by the build-up of ice from the freezing of sub-talus springs which made ice bodies that he called “chrystocrenes”. His ideas were based on observations in Dawson City, Yukon, where these ice bodies were common at the base of a talus slope that bordered one end of the plain on which the city is built.

Few developments on the origins of rock glaciers occurred for many years after these original discussions. Two notable pieces of research were the digging of a tunnel up the length of one of the Colorado rock glaciers examined by Cross and Howe (1905, 1910) to the bedrock on which it sat by Brown (1925), providing a glimpse of the internal structure rarely matched to this day. This suggested that a glacier or snowbank was present under the head of the rock glacier but not under the majority of its length. The second development was the suggestion by Parsons (1939) that both glacial action and solifluction likely played a role in the formation of rock glaciers.

The rock glacier origin debate picked up with renewed vigour between the 1960s and 1980s following the comprehensive article by Wahrhaftig and Cox (1959) in which they concluded that the movement of rock glaciers results from the flow of the ice they contain, that they require steep weathering cliffs in order to form, and that they require "near-glacial" climate conditions. There were three main theories about rock glacier formation in this period: primarily glacial origin, primarily periglacial origin, and other means of formation.

### *4.1.2 Talus origin*

Wahrhaftig and Cox (1959) provided evidence to discredit many of the early theories regarding rock glacier formation. Having accumulated survey information indicating that rock glaciers are, for the most part, constantly moving at present, they used that to rule out formation by any means that would imply settling as the only residual movement. They ignored the possibility that creep could be initiated after a certain threshold of material accumulation had been reached. Thus they argued that landslides, talus accumulation on cirque floor snowbanks, and moraine forms could not explain the genesis of a rock glacier. They supported, therefore, the notion that rock glaciers form as a result of talus creep or solifluction.

Haeberli (1985) argued that rock glaciers could begin in scree slopes, talus cones, or sometimes in a frozen moraine. In his view, the origins of rock glaciers were poorly understood because there was a focus on studying large and well-developed features rather than smaller ones that were in earlier stages of development. He was convinced that with sufficient debris thickness, a frozen slope would begin to creep and would form a pro-talus rampart, which he considered to be the "embryonic" stage of rock glacier development. He, like some of the other researchers (e.g. Barsch, 1996; Humlum, 1982) who supported periglacial origins for rock glaciers, was adamant that their formation was entirely unrelated to glaciers: "relationships between rock glaciers and other phenomena, such as landslides or glaciers, are indirect, accidental or non-existent" (Haeberli, 1985, p.122). Barsch (1996) went so far as to declare, "the model of the so-called ice-cored (glacigenic) rock glacier has to be abolished" (p. 214, as cited in Clark *et al.*, 1998). These conclusions were based on a variety of analyses including seismic soundings, flow and density calculations, and rheological characteristics on rock glaciers others had claimed to be of glacial origin, where the authors found their test results not to be meaningfully different from those obtained from rock glaciers they considered to be of periglacial origin

(Clark *et al.*, 1998). To the outside observer lacking a personal investment in the outcome of these tests, it appears that the differences were caused by differing interpretation of the results of testing methods that lacked any real standard for their understanding, given that physical verification is rarely done due to its great cost and difficulty.

In the last 20 years, many of the hard-line periglacial origin proponents have softened their views as they and others have accumulated evidence for the roles of other processes, particularly avalanching (discussed in more detail in the "Other origins" section), in the maintenance, and possibly creation, of rock glaciers (Humlum 1996; Haeberli *et al.*, 2006; Humlum *et al.*, 2007). DC resistivity studies have also played a role in suggesting the likelihood of multiple origins for the ice found in rock glaciers (Haeberli and Vonder Mühll, 1996).

### *4.1.3 Glacial origin*

Several variations exist on the argument that rock glaciers can be formed from glaciers. One of the ideas relates to the process of continued ablation of an ice glacier such that the debris it contains melts out of the ice and builds up on its surface, creating an ice-cored rock glacier. Many rock glaciers thought to be of this type have been found (e.g. Humlum, 1996; Clark *et al.*, 1998; Ishikawa *et al.*, 2001). Numerous lines of evidence have been used to support this theory, including, in the case of Humlum (1996), the exposure of the massive ice core by a meltwater channel along the majority of the length of a rock glacier, in the case of Ishikawa *et al.* (2001), the differences in DC resistivity between the glacial-origin sample and a talus-origin sample, and in several cases (e.g. Capps, 1910; Humlum, 1996), the rock glacier observed was physically connected to an ice glacier, which formed its head.

A variation on the glacial-origin theory, that does not suggest ablation as the cause of debris build-up on the surface of a glacier, is that proposed by Shroder *et al.* (2000) following observations made in Pakistan. Their research, based on maps and remotely sensed imagery interpretation as well as site visits, found that rockfall debris (common on glaciers in the Himalayas) was building up on the surface of the glacier in question due to its inefficient transport mechanisms. The glacier studied, unlike others in the area, had not retreated over the preceding 50 years but simply did not flow fast enough to remove the debris as it was deposited.

### *4.1.4 Other origin theories*

On the "other" side of the debate, Johnson (1978, 1983, 1984) was a vocal proponent of landslides and other high-magnitude events, none of which necessarily require permafrost presence in a talus slope, as formative origins for rock glaciers. His research in the southwest Yukon led him to believe that, together with glacial origins, a major origin for rock glaciers was rapid mass movement. Citing many features, such as differently-aged lobes indicating several periods of activity of a rock glacier without the evidence of any of the older lobes having reactivated upon the return of favourable conditions for formation, the lack of down-valley curvature of valley-side rock glaciers, and morphological similarities between rock glaciers and landslide scars, he called into question the more popular talus creep origin hypothesis. He described a number of different scenarios in which catastrophic events could potentially cause the formation of a rock glacier based on the idea that slope instability caused by deglaciation, permafrost melt, melt of the remnants of a glacier encased within the talus slope, or erosion at the base of a slope could all cause massive slope failure and result in the landform known as a rock glacier (Johnson, 1984). One such scenario was that of rockfalls and landslides. It is known that weathering can be more active during deglaciation than it is today as a result of the release of pressure as the ice melts, and that with the loss of support from lateral moraines (as their ice cores melt) over-steepened slopes fail and created rock glaciers (Church and Ryder, 1972). Evidence provided to support this development includes the zonation of rock glacier distribution, which is denser in the areas deglaciated following the much larger Pleistocene glaciation than in the areas affected by the relatively insignificant Neoglacial.

Another mass movement rock glacier formation scenario not involving glaciation was that rock glaciers could be formed by a series of regressive slope failures starting at the bottom of the slope. Such an occurrence would explain the lack of a long run-out zone for the slide, as the amount of material moving at any one time would not be large and all flows except for the first would be effectively dammed by those preceding it. In this case the ridges and furrows found on many rock glaciers could be explained as being features created by the dissipation of momentum as the slides impacted the debris left by those that came before it (Johnson, 1983; Johnson, 1984).

A related scenario involves the creation of a rock glacier following avalanching of debris-laden snow, an idea that is supported by observations that many rock glaciers have a depression between the slope at their head and the lobate form at their toe, a morphology characteristic of avalanches (Johnson, 1978; Johnson, 1983; Johnson, 1984). The avalanche hypothesis is supported by a recent publication by Humlum *et al.* (2007). Observations of rock glaciers in Svalbard led the authors to conclude that debris-laden avalanches were maintaining, and may have created the landforms. Their claims were supported by the fact that the rock glaciers occurred in known avalanche zones, as well as by the fact that a layered structure (ice-rock-ice-rock, corresponding to winter avalanches and summer ablation) was present. Haeberli *et al.* (2006) also assert that avalanching and mass wasting are the key sources of debris for rock glaciers and suggest possible correlation between the size of the rockwall supplying the sediment and the size of the rock glacier. This is a process also supported by DC resistivity findings by Isaksen *et al.* (2000) in Svalbard that indicated a layered internal structure for the rock glacier examined.

A final scenario suggested in which rock glaciers form, with the help of neither glaciers nor pre-existing talus creep, is as a result of hydrostatic pressure (Johnson, 1983; Johnson, 1984). This would occur when a seasonally frozen talus slope freezes from the surface down incorporating refrozen meltwater and creating an impermeable skin. What was otherwise free drainage would be interrupted and hydrostatic pressure would build between the icy skin of the slope and the bedrock underneath. With sufficient pressure, the impermeable skin on the slope would give way and the water and saturated sediments would flow out from the bottom of the slope to be followed by the sediments above, which would have been undercut by the loss of support from below. This theory was based on studies of rock glacier hydrology, which demonstrated that a significant amount of drainage occurred directly from within a rock glacier to the ground below it, never forming distinct streams. It was also supported by knowledge that similar processes of pressure build-up and release occur in true glaciers. In this scenario, like the mass movement hypothesis, the ice that makes a pile of debris into a rock glacier is not necessarily present at the formation of the landform, but may come afterward with the build-up of interstitial ice.

It appears that in some cases, the origins of a rock glacier are quite clear (e.g. Capps, 1910; Humlum, 1996; Ishikawa *et al.*, 2001; Humlum *et al.*, 2007), but in others the issue has been debated for years (the Galena Creek rock glacier in Wyoming, for example; Steig *et al.*, 1998). The debate over the origins of rock glaciers seems not to be so much with the idea that they are polygenetic, which is now fairly well-entrenched, but the fact that origins can be difficult to identify in individual cases. This cannot simply be avoided because it has implications for landform dynamics, rock glacier use as a climatic indicator, and other properties of the landform.

## 4.2 Dynamics and structure

### *4.2.1 Structure*

The external morphology of rock glaciers is generally now well recognized as being a lobate or spatulate debris body (Figure 1), or alternatively a tongue-shaped form (narrower at the toe than at the head), depending on the surrounding topography, and usually increasing in thickness from its head to toe. It has the appearance from afar of a flowing, viscous liquid, the surface texture often being compared to thick lava or porridge (Figure 2). The surface features include concentric or lateral ridges and furrows in some cases. Another feature seen occasionally is a smooth depression found at the head of the rock glacier, where the permafrost body has pulled away from the rockwall. This is generally a wide, shallow depression, unlike the bergschründ found on ice glaciers, which usually takes the form of a crack. An active rock glacier has a steep front sitting approximately at the angle of repose of the unconsolidated material of which it is composed (Haeberli, 1985).

Rock glaciers appear to have variable internal structure based on their origins and the processes that maintain them, though there are some characteristics that are common to all. The key common feature is the active layer, the coarse debris layer on the outside of the landform. There is general agreement that it is a few metres thick and that average grain size decreases with increasing depth to the permafrost table (Haeberli *et al.*, 2006). Some examples follow to illustrate the differences possible in the internal structure of rock glaciers.

**Figure 2 – Rock glacier surface texture. Visible extent of rock glacier shown with white line. Ridge indicated by arrows.**

The top, active layer of a talus-derived rock glacier is described by Barsch (1978) as being a 2 to 5 m thick blocky layer, though he states that this layer can be up to 10 m thick on an inactive rock glacier. The same layer is described by Serrano *et al.* (2006) as being 1 to 5 m thick and composed of grains averaging 10 to 15 cm in length with some boulders in excess of 6 m. Furthermore, they describe a lateral sorting of grains in this layer, with those in the middle of the landform being smaller than those at the edges.

The second layer of the talus-derived rock glacier is the perennially frozen portion. Barsch (1978) describes it as averaging 40 to 50 m in thickness, and, based on drilling results, made up of gravel to silt-sized grains (whose average size decreases with depth) cemented together by interstitial ice and containing sporadic embedded boulders and lenses of clear ice. Another example of the same layer is described by Serrano *et al.* (2006) as a “frozen body” which contains embedded boulders, and is 10 to 20 m thick based on topographic and sedimentological analysis, DC resistivity, geodetic survey, and chronology assessment.

Barsch (1978) did not include a third layer in his description of the internal structure of a talus-derived rock glacier. Serrano *et al.* (2006) did, and described it as a thinner, unfrozen layer of sediment overlying the bedrock.

An internally layered rock glacier, suggested to be an avalanche-derived landform, was described by Isaksen *et al.* (2000) following examination using DC resistivity. Its active layer is blocky and between 1 and 5 m thick. Its second, frozen layer was a 20 to 50 m thick layer of ice and debris, containing alternating sub-layers with relatively higher and lower concentrations of debris. The sub-layers had an upward inclination near the head, approximately parallel to the surface near the middle, and towards the toe, they were angled downwards. The overall ice content was thought to be quite high and the ice was suspected of having come from a variety of different sources (Isaksen *et al.*, 2000). A third layer was present between the main frozen core and the bedrock. This third layer was less resistive than the overlying frozen core, with DC resistivity values typical of frozen, unconsolidated material, suggesting that this layer was permafrost with a low ice content (Isaksen *et al.*, 2000). Similar results were obtained by Bucki *et al.* (2004) for a rock glacier of undetermined origin in Alaska.

An ice-cored rock glacier in the Ötztal Alps, Austria, thought to be a glacially-derived form, was described by Berger *et al.* (2004). In this case, the active layer was said to be made up of an upper portion up to a few metres thick of debris that had an average diameter of 20 to 40 cm. A lower sub-layer 1.2 m thick followed this, with a distinct boundary between the two, with grains averaging less than 20 cm in diameter before the ice core was reached. Under the two portions of the active layer, there was a core of clean ice approximately 75 m thick, thought to be the remains of an ice glacier. This massive ice body directly overlaid the bedrock and no third layer was described (Berger *et al.*, 2004).

There is also limited evidence (e.g. Serrano *et al.*, 2006) for sorting of grain size lengthwise along the surface of the rock glacier with the mean grain size increasing from the head to the foot of the landform with the long axis of grains aligned parallel to the direction of flow.

While this is not an exhaustive look at the variation that is present in the structure of rock glaciers, it is sufficient to demonstrate that the differences are large and potentially important to understanding the origins and maintenance processes that contribute to rock glacier existence.

### *4.2.2 Dynamics*

Many of the early researchers thought that the movement of a rock glacier was essentially a catastrophic one, with the landform resulting from a landslide (e.g. Bonney, 1902; Cross and Howe, 1905; Patton, 1910). Few supporters of this model exist in more modern research, the main one being Johnson (1978, 1983, 1984), who argued for the case based on interpretation of morphology, as already discussed above. The dominant viewpoint now is that this is not generally the case. While it may be possible for rock glaciers to form following landslides onto ice bodies (e.g. Humlum, 1996; Shroder *et al.*, 2000) or following debris-laden avalanches (e.g. Haeberli *et al.*, 2006; Humlum *et al.*, 2007), there is continued movement of the rock glacier itself at low velocities that is the more important dynamic process both in terms of shaping the landform and, indeed, defining it as a rock glacier.

Rock glacier dynamics have been explored using photogrammetry and geodetic surveys since the 1960s (Haeberli, 1985). These methods are still used, but new technology has been added to the available tools with the development of computer based analysis (e.g. Kääb and Vollmer, 2000; Jansen and Hergarten, 2006), accurate global positioning systems (GPS; e.g. Berger *et al.*, 2004), and improved remote sensing and geophysical imaging techniques (e.g. Isaksen *et* al., 2000; Kääb and Vollmer, 2000; Shroder *et al.*, 2000; Serrano *et al.*, 2006).

Active rock glaciers creep downslope at rates, on average, between a few centimetres to up to about 1 m $yr^{-1}$, movement rates that are about an order of magnitude less than those of ice glaciers (Haeberli, 1985). Flow rates vary over geographic space. For example, two rock glaciers in Svalbard were measured as having velocities of between 7.4 to 10.4 cm $yr^{-1}$ for one and 0.4 to 2.0 cm $yr^{-1}$ for the other (Isaksen *et al.*, 2000). A survey of rock glaciers in the eastern Yukon gave an average flow of 20 cm $yr^{-1}$ (Sloan and Dyke, 1998), while an ice-cored one in the Northwest Territories was measured at 2.8 m $yr^{-1}$ (Jackson and Macdonald, 1980). It is commonly agreed that flow rates are influenced by air and hence ground temperatures (e.g. Brazier *et al.*, 1998; Sloan and Dyke, 1998; Kääb and Vollmer, 2000; Berger *et al.*, 2004; Roer *et al.*, 2005; Haeberli *et al.*, 2006), but the duration of temperature change which can induce flow change, and the speed at which this flow change occurs is not yet clear.

At the smaller scale, flow rates have been found to be variable over the surface of individual rock glaciers. In many cases, the upper portion of a rock glacier near its root has a higher annual velocity than its lower portion, and flow is faster towards the centre-line of a rock glacier and slower towards its margins (Isaksen *et* al., 2000; Berger *et al.*, 2004; Janke, 2005b). This has been established in avalanche-derived rock glaciers using central flow line velocities (Isaksen *et* al., 2000) and ice-cored rock glaciers using transects on the upper and lower portions of the landforms (Berger *et al.*, 2004), and by using digital elevation models (DEMs) created from orthophotos over several decades (Janke, 2005b). Analyses of orthophoto data from several European talus-derived rock glaciers over decade-long periods (in several separate studies) have not shown the same pattern to exist with this genetic variation, and the margins may in fact have faster rates of movement than the central areas, reflecting both the slope of the flow and the rock glacier's thickness at the zone in question (Haeberli *et al.*, 2006).

In terms of internal dynamics, rock glaciers are widely thought to move faster at or near the surface than at depth (Haeberli, 1985; Berger *et al.*, 2004; Roer *et al.*, 2005; Jansen and Hergarten, 2006). Reasons for this continue to be debated. Among those who favour the idea of a talus-derived rock glacier, and thus study bodies they believe to be so created, the dominant opinion is that flow is primarily due to internal deformation related to creep of the frozen material, generally *en masse*. In this case, it is suggested that variations (primarily seasonal) in air temperature are affecting the flow rates of the material closest to the surface (Haeberli *et al.*, 2006). While the development of shear planes is recognized as a possible contributor to flow in talus-derived rock glaciers (Zurawek, 2002; Roer *et al.*, 2005; Haeberli *et al.*, 2006), they are thought to have minimal impact. However for those who study ice-cored and internally layered rock glaciers, shear plane development appears to be a major factor in explaining rock glacier flow (Isaksen *et al.*, 2000; Jansen and Hergarten, 2006). Bucki and Echelmeyer (2004) and Bucki *et al.* (2005) also found shear planes to be important in the flow of Fireweed rock glacier in Alaska, which is of undetermined origin. Recent studies have suggested this is due to the development of shear planes, and the wider application of geophysical surveys has produced a growing body of data suggesting that many rock glaciers have major shear planes in their near-surface levels (e.g. Bucki *et al.*, 2004; Roer *et* al., 2005). Similar results were obtained through the excavation of a relict talus-derived rock glacier (Zurawek, 2002). A model of rock glacier flow created by Jensen and Hergarten (2006) using a decreasing distribution of "melted" pixels from the rock glacier surface (10%) to base (1%) and a random distribution of stress at initiation, found that shear planes developed spontaneously in relation to melt zones, leading to their concentration in the upper layers of the rock glacier, which mimics their structure as observed in the field. If both melt and stress are assigned randomly at the start of the model run, shear planes still develop but at random depths.

The topic of basal sliding has engendered a debate similar to that between the relative importance of creep and shearing. In this case, however, there is little evidence to suggest that basal sliding plays any significant role in the movement of a talus-derived rock glacier and it is generally assumed to be negligible. Sliding on unfrozen sub-rock-glacial debris may be a possibility (Haeberli, 1985) but it has not been researched at all. For other (and undetermined) types of rock glaciers, basal sliding is recognized as being a major contribution to flow (e.g.

Isaksen *et al.*, 2000; Bucki and Echelmeyer, 2004). In glacially derived rock glaciers, the presence of basal sliding is considered typical (Haeberli, 1985; Bucki and Echelmeyer, 2004).

As mentioned above, air temperature is a major and undisputed control on rock glacier velocity although the exact interactions are still incompletely understood. There are, of course, a number of other controls on dynamics that, by their nature, affect all types of rock glaciers. One of these is saturation level. Some argue that supersaturation (50-90% by volume) is a virtual necessity to maintaining steady state creep (Haeberli, 1985; Haeberli *et al.*, 1999). This, however, has been contradicted by Zurawek (2002), whose sedimentological examination of a relict rock glacier found that movement was still occurring very late in the "life" of the rock glacier when its ice content was very low.

Density of the rock glacier core is another factor that has obvious impacts on potential and actual flow rates. Density is determined in large part by the relative concentrations of rock and ice, and it affects the material strength and its deformation characteristics (Haeberli, 1985). Once again there is disagreement between proponents of the talus-derived rock glacier model, who estimate rock glacier density to be about 1.5 to 2.0 g $cm^{-3}$ (Barsch, 1978) and those who support the glacially-derived model, who estimate the density to be closer to 1.0 g $cm^{-3}$ (Clark *et al*, 1998). In reality, there is likely a range of densities depending on origin and a number of other factors. Lack of empirical knowledge of rock glacier densities greatly hinders attempts to model their flow.

### *4.2.3 Remote sensing of rock glacier dynamics*

Remote sensing comprises a useful set of tools for examining rock glacier dynamics. Both airborne and space-borne remote sensing methods, in the visible spectrum and radar, have been used. Space-borne methods have been limited to radar interferometry (Stozzi *et al.*, 2004). Air photos are a far more common means of assessing changes (horizontal and vertical) in rock glaciers over time. Multi-temporal air photos have been used successfully to measure rock glacier velocities, and in some cases thinning and thickening, in Europe (Kääb *et al.*, 1997; Kääb and Vollmer, 2000; Kääb *et al.*, 2002; Frauenfelder *et al.*, 2004; Stozzi *et al.*, 2004; Wangensteen *et al.*, 2006; Roer and Nyenhuis, 2007) and in the Colorado Front Range (Janke, 2005b).

The basic task to determine velocities with any type of visible imagery is to identify distinctive features on a rock glacier surface in two or more images from different times. The distance between the original and present position of the feature can then be measured. Usually this involves the creation of elevation models (requiring a pair of stereo images from each photo date) for the production of orthoimages, and this is essential if vertical (i.e. thickness) changes are to be measured. An automated system for feature matching has been tested (Kääb and Vollmer, 2000) and was, with good imagery, found to be as good as the commonly-employed user-supervised method. However, in cases with complex terrain or when shadows were present in the image, the user-supervised method was superior.

In a comparison of methods for determining rock glacier activity Stozzi *et al.* (2004) assessed the differences between traditional geomorphological mapping, satellite-borne radar, and aerial photography. This comparison found geomorphological mapping to be subjective and variable with the range of factors the geomorphologists could choose to consider – or not to consider – and which of those were clearly visible and distinct enough to be diagnostic in any given case. They recommended the use of photogrammetric methods to improve classification. In the case of satellite-borne radar, it was found to be most useful for determining activity as well as for measuring surface velocities over large areas. Air photo analysis was best for determining three-dimensional movement on active rock glaciers. Kääb *et al.* (2002) also demonstrated the limits of multi-temporal air photo analysis when the activity of a slow-moving (<1 cm $yr^{-1}$) Svalbard rock glacier, known to be active from long-term observations and geomorphic features, was not detected as moving using this method.

## 4.3 Rock glaciers in permafrost distribution modelling

### *4.3.1 Model building*

Air temperature is widely recognized as being the main control on permafrost distribution at the regional, continental and global scale. Attempts to develop climate constraints for rock glacier distribution have been made (e.g. Haeberli, 1985; Imhof, 1996), however the latter have been found to vary depending on methods and variables used (Lambiel and Reynard, 2001) and on regional location (Brazier *et al.*, 1998; Humlum, 1998). Some authors, Haeberli

(1985) in particular, have made broad statements regarding the distribution of rock glaciers, confining their occurrence to cold, arid mountain regions below the equilibrium line of ice glaciers. The author admits that this is an over-simplification and recognizes the potential for rock glaciers and ice glaciers to exist side-by-side in transitional climatic regions. Other researchers, however, maintain that rock glaciers can form and exist in maritime climates with high precipitation levels (1000-1700 mm annually) provided that sufficient debris is available (Humlum, 1998). Based on a synthesis of antecedent studies around the world, Humlum (1998) gave approximate mean annual air temperature (MAAT) constraints for talus-derived rock glaciers of -4 to -10°C, and for ice-cored rock glaciers of -1 to -10°C. However, he also refers to a case in which maritime rock glaciers form and remain active where the MAAT is slightly above 0°C. It is clear that the type of rock glacier being considered affects the inferences that can be drawn. It is also true that there is overlap between the two temperature ranges suggested, as well as many other factors at work that account for the large range of values found over the course of spatially diverse studies.

While the use of rock glaciers to develop probable air temperature isotherms has met with limited success, the rock glaciers themselves can be useful in approximating the distribution of discontinuous permafrost due to the fact that they *are* permafrost. While active and inactive rock glaciers are some of the most visible geomorphic exemplars of permafrost in mountainous regions, there are some factors that complicate their use in modelling its distribution. The activity level of the rock glaciers used must be taken into account. Activity is usually classified as one of three states: active, inactive, and relict (e.g. Imhof, 1996; Brazier *et al.*, 1998; Frauenfelder, 2005; Janke, 2005a). As alluded to in previous sections, active rock glaciers contain perennial ice and flow downslope, inactive rock glaciers contain perennial ice but no longer flow, and relict rock glaciers contain no ice and are not indicative of current permafrost. Because research has shown that the oldest existing rock glaciers probably developed in the Holocene (Lambiel and Reynard, 2001; Janke, 2005a), the likelihood of any relict rock glaciers being remnants of previous interglacials is very low. Relict rock glaciers can be useful to those trying to reconstruct Holocene climates, but they are of no use for mapping current permafrost distribution. It has been found in some areas that, at a regional scale, rock glacier distribution by activity is a good analogue for permafrost distribution, with active rock glaciers indicating "permafrost probable", inactive rock glaciers indicating "permafrost possible", and relict rock glaciers indicating "permafrost improbable" (Imhof, 1996). Some European and New Zealand research has indicated that the distribution of rock glacier occurrence by level of activity is zonal, corresponding to elevation (and other related controls on temperature), and fits well with the common permafrost distribution classifications of continuous, discontinuous/sporadic, and seasonally frozen (Imhof, 1996; Brazier *et al.*, 1998; Frauenfelder, 2005).

An additional complication in using rock glaciers to model permafrost distribution, on which consensus is generally lacking, is that of origin. Some researchers argue that rock glaciers of glacial origin are not reliable local indicators of permafrost due to the possibility that they are the result of a surging glacier that may have significantly over-run the altitudinal boundary line for permafrost existence, and thus would have been degrading over the entirety of their existence (e.g. Humlum, 1998). Others, such as Janke (2005), consider that perennially cryotic sediment, whether in a rock glacier or elsewhere, constitutes permafrost and thus are comfortable using rock glaciers of all origins as local permafrost indicators. This makes sense when considering the definition of permafrost (earth surface material at or below 0°C for at least two consecutive years) and the fact that it need not be in equilibrium to exist (in either a geomorphic feature like a rock glacier, or just in the ground).

Rock glaciers are local permafrost indicators, but as Imhof (1996) pointed out, while the existence of a rock glacier indicates the presence of permafrost, their absence does not indicate the absence of permafrost because the conditions needed for rock glacier development may be little related to the conditions needed for permafrost development. However, given their apparent tendency for zonal distribution and their abundance in many cold mountainous regions (excluding Scandinavia), rock glaciers do lend themselves to permafrost distribution modelling. Coupling this with good visibility and identifiability on air photos and remotely sensed imagery, they have been found useful overall as permafrost indicators for modelling projects at large scales (Etzelmüller *et al.*, 2001).

With mountain permafrost distribution modelling being a relatively new field (and with many of the variables included in modelling being poorly understood), there are no established practices for doing it. There are, however, some commonly accepted principles. Lapse rate is the key to modelling because it is assumed that if permafrost exists at a given elevation, it is more likely to exist at higher elevations where air temperatures should be lower. For this reason, rock glaciers are usually used to establish a lower boundary of permafrost since their existence is facilitated by convective cooling of their blocky surfaces (Brazier *et al.*, 1998; Frauenfelder, 2005; Etzelmüller *et al.*, 2007).

Almost all mountain permafrost distribution models include indicators other than rock glaciers in determining where permafrost probably exists. These include the basal temperature of snow (BTS; e.g. Lewkowicz and Ednie, 2004; Lewkowicz and Bonnaventure, 2008), geophysical survey information (e.g. Haeberli and Vonder Mühll, 1996; Evin *et al.*, 1997), hydrological measurements and models, vegetation (King *et al.*, 1992), solar radiation (Funk and Hoelzle, 1992), "frost number" and similar calculated indices (Nelson and Outcalt, 1987). These variables will not be discussed in depth, but it is important to realize that rock glaciers are not used alone to predict permafrost distribution.

The use of rock glaciers in permafrost distribution modelling can be considered, in its most basic sense, a type of empirical modelling. Empirical models are useful when the goal of a model is to determine the occurrence of a phenomenon without necessarily needing to understand all of the processes that cause it (Imhof, 1996). Rock glaciers are ideal for this type of model, when used to determine lower elevational permafrost limits, since they have a strong observed tendency to occur there (Barsch, 1978). A model could therefore be developed that uses the lowest occurring rock glaciers, and lines interpolated between them, to demarcate the lower elevational boundary of mountain permafrost. More realistically, the researcher usually tries to establish these limits in units of elevation or temperature (thereby incorporating additional variables into the model) such that they are understandable in a set of standard units and give the model potential transferability to other locations. Such a simple model, using environmentally constrained and locally variable indicators, would be useful at only the most general level (Barsch, 1978). However, with the addition of more predictive variables, this, and other similar single-variable models (like the use of a -2°C isotherm as the lower permafrost boundary; Barsch, 1978), can be improved in their predictive accuracy.

Though rock glaciers can be used alone to model permafrost occurrence, the inclusion of other variables usually means that the final model includes both empirical and process-based elements, often with sub-models within the larger whole. The mathematical form of the model depends on the relationships that exist between the variables included and can take many forms. Examples in the literature include additive (Brenning *et al.*, 2007), linear (included in countless models as lapse rate calculations; e.g. Etzelmüller *et al.*, 2001; Haeberli *et al.*, 2006), and multinomial regression (e.g. Janke 2005a; Janke, 2005c).

### *4.3.2 Model verification*

Verification should be an essential step in the development of any model. It allows the assessment of the accuracy with which a process model represents a physical process, or of the predictive capability of an empirical model. In the case of permafrost distribution models based on rock glacier occurrence, the key is to assess predictive ability. In rare examples (Etzelmüller *et al.*, 2001), this goes so far as to statistically test the confidence in the results. This, however, can only be done when the error associated with the predictive variables used is known, and in most cases it is not.

Although statistical tests are uncommon in this field, there are other ways a model can be tested. The ones most commonly used involve a comparison between the results of the model and independent indicators not included in the model (Etzelmüller *et al.*, 2001). This can be done with vegetation, where climate tolerance is known for a species (e.g. King *et al.*, 1992; Imhof, 1996), MAAT and BTS measurements (Janke, 2005c), and in many cases, there is simply no verification undertaken (e.g. Lambiel and Reynard, 2001; Janke, 2005a). Where rock glaciers have not been used in permafrost model development, they may be useful for verification. For example Imhof (1996) and Fukui *et al.* (2007), used rock glaciers to test the accuracy of the results of models created using climate-based predictive variables.

# 5 Study area

The area examined in this research was the southern half of the Yukon Territory, extending from 60 to 65°N and 124 to 141°W – an area of about 350,000 km$^2$ (Figure 3) Areas that lacked surficial geology maps or other maps identifying rock glaciers (about one quarter of the total area) were excluded from analysis.

Topographically, nearly half of the area is above 1000 m elevation, 8% is above 1500 m elevation, and 3% is above 2000 m (Figure 3). Several mountain ranges are present, including the Kluane Ranges, the Ruby Range, the Selwyn Mountains, the Pelly Mountains, and the Ogilvie Mountains. The Wrangell-St Elias Ranges and Icefields occupy the southwest corner of the study area and are home to extensive glaciers and Canada's highest peak, Mount Logan, at 5959 m.

All climate stations in the study area (shown in Figure 3) exhibit mean annual air temperatures (MAATs) below 0°C. The distribution of climate stations is limited, as they are few in number and none are located above 830 m elevation. Due to the limited climate data, little is known about the exact climate conditions in upper elevations, though it is known that air temperature inversions are a key influence in winter (Wahl *et al.*, 1987).

The study area covers a landmass that experiences a shift from a wetter, more maritime climate in the southwest (near the North Pacific Ocean) to a more arid climate on the inland side of the St Elias Mountains (Wahl *et al.*, 1987).

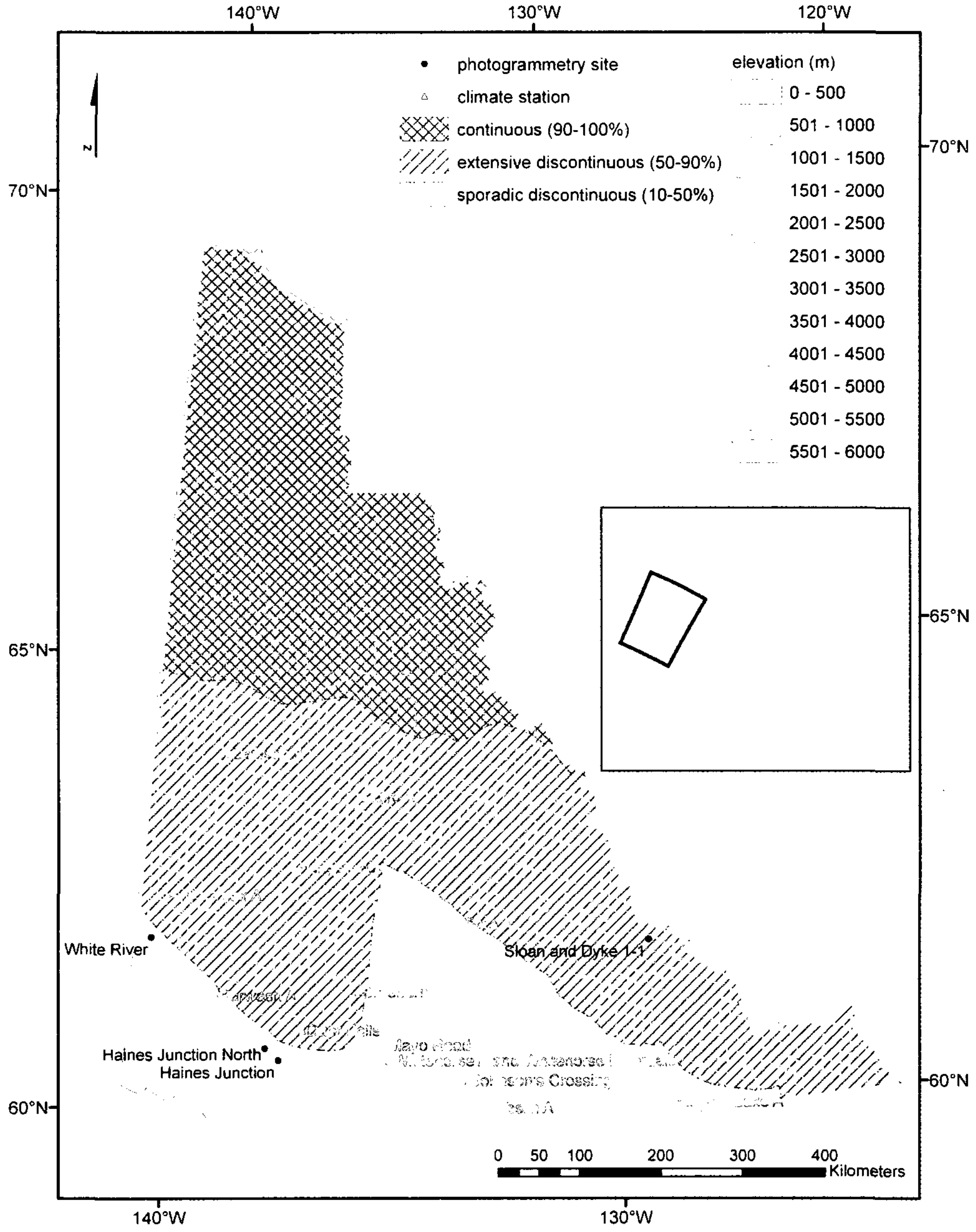

**Figure 3 – Study area with elevation, permafrost extent (after Heginbottom *et al.*, 1995), weather stations (Environment Canada, 2009), and photogrammetry study sites.**

Permafrost distribution (shown in Figure 3) in the Yukon is essentially continuous (underlying 90% of the terrain or greater) north of 65°N and sporadic discontinuous (10-50%) or extensive discontinuous (50-90%) south of this latitude. Rock glaciers occur widely in the mountainous areas of the study area but have not been studied as permafrost indicators in this region.

The sites examined in the second, photogrammetric, part of this study are spread across the larger study area. The White River site is located north of the Wrangell-St Elias Ranges and Icefields close to the western border with Alaska. The Haines Junction and Haines Junction North sites are located on the inland side of the Wrangell-St Elias Ranges close to the community of Haines Junction. The final site, Sloan and Dyke's (1998) 1-1 site, is located close to the eastern border between the Yukon and the Northwest Territories in the Selwyn Mountains.

# 6 Methods

## 6.1 Geostatistical examination of rock glacier location topography

For the geostatistical examination of southern Yukon rock glaciers, rock glacier locations were determined from digital versions of 51 surficial geology maps with scales ranging between 1:25,000 and 1:250,000, provided by the Yukon Geological Survey (YGS; see Appendix A). One map that had not yet been digitised (106C – Nadaleen River; Ricker, 1974) was supplied as a georeferenced image by the YGS, and the rock glaciers on it were digitised by hand. A final unpublished map of rock glaciers in the Kluane region was made available by J. Peter Johnson and Daisy-Claire Hartmann-Brenner, who had compiled it from air photo analysis. The rock glaciers shown on this map were also hand digitised. The inventory of rock glaciers from these sources totalled 1680.

The large number of rock glaciers present made it impossible to study the entire population, either on air photos or in the field. Consequently, a stratified random sample of 11.7% of the population was taken for analysis. The stratum used were those rock glaciers within 5 km of a road (possibly accessible field analysis sites) and those rock glaciers greater than 5 km from a road (inaccessible sites). 11.7% was chosen because it gave 10 potential sites for fieldwork, a number considered reasonable given the field season scheduling requirements.

The rock glaciers were classified as to morphology – tongue-shaped or lobate (Warhaftig and Cox, 1959) – and activity – active, inactive, or relict

(Haeberli, 1985) – from air photo analysis at the National Air Photo Library in Ottawa. The classifications of 29 of the original rock glacier sample were later verified in the field. Where rock glaciers were accessible, they were visited on-site, where elevation and slope were measured and observations were made of surface features and material, vegetation, stability, and other features. Where rock glaciers were visible but inaccessible (usually due to a river between the road and the rock glacier), they were photographed and observations made from a distance.

The air photo analysis and fieldwork uncovered errors in the rock glacier inventory. Twenty unmapped rock glaciers were observed in the field that were within 5 km of a road; they were subsequently added to the study group. Air photo analysis revealed that 12 landforms identified on the maps as rock glaciers were not. Most were cirque basins with incised drainage channels in their floors. These were excluded from further analysis. Other rock glaciers (12-18) were omitted from parts of the statistical analysis due to limited air photo coverage making classification impossible, or when their morphology contained both tongue-shaped and lobate elements.

Different morphology and activity groups were statistically compared for elevation, slope, area and aspect, as derived from a 30 m resolution National Topographic Database digital elevation model (DEM).

## 6.2 Photogrammetric examination of rock glacier dynamics

Three test sites were chosen from the above-described sample for the photogrammetric test study, based on the size of the rock glaciers present and the availability of multiple periods of air photo coverage. A fourth site was chosen from a previous study by Sloan and Dyke (1998) so it would be possible to compare the results of their surveyed measurements with those derived from the experimental photogrammetric method.

Copies of the images, scanned at 20 micron resolution, were used with the 30 m DEM to create orthophotos for each site at each time of photo coverage with PCI Geomatics' OrthoEngine. The collection of ground control points (GCPs) and tie points (TPs) during this process was complicated by the fact that camera calibration data, including fiducial mark spacing, was missing for all of the older photos as well as by the fact that the software used does not have the ability to process multiple images from different cameras at the same time. Because of this, fiducial mark spacing on the older photos had to be measured by hand and an "average" camera was calculated from the calibrations of the different photos for a site. For one site this was impossible because the fiducial marks were located in the corners on two photos and on the edges of the third photo, so the GCPs for the third photo had to be visually matched to the others in a separate session, most likely reducing the goodness of match of the resulting orthophoto with those produced from the photos with fiducial marks in the same location.

The orthophotos were then used with the CIAS software, developed by Kääb and Vollmer (2000), which probabilistically matches user-selected features on the surface of a rock glacier in older and newer photos and measures the displacement between them. A Helmert correction was used involving matching stable points outside a rock glacier so that only relative movement is measured and errors in photo-matching have lesser effects. It was sometimes challenging to find match sites that were certain because of poor photo quality, obstructions in the photo (cloud, shadow, and snow), and the development of thermokarst. To reduce the probability of false matches, sites were selected manually and any matches with a correlation coefficient of less than 0.7 were discarded from further analysis.

The results were then exported to a GIS for display and analysis.

An additional comparative examination was undertaken in which the Sloan and Dyke site was remeasured using a georeferenced image rather than an orthophoto. For this analysis, ESRI's ArcMap was used to georectify the 1986 photo (A27020 – 248) to a Landsat image of the site (L71056017 01720010817 B50) using a third order transformation. Then the earlier air photo of the site (A12343 – 139, 1949) was georectified to the 1986 image using a first order transformation. Following this, the measurement technique was identical to that already summarised, using CIAS software with the Helmert correction and discarding measurements with feature matching correlation coefficients of less than 0.7 and those that were obvious errors.

# 7 Results, presented in article format

## 7.1 Distribution and topographic characteristics of Yukon rock glaciers

Paper intended for submission to Canadian Journal of Earth Sciences

**Statement of contribution:**

**Amaris Page** – background research, research planning, fieldwork, data compilation, analysis and interpretation, written and graphic presentation

**Antoni Lewkowicz** – research planning, interpretation of results, written presentation (interaction of rock glaciers with forest), editing

**Panya Lipovsky** and **Jeffrey Bond** – creators of digital surficial geology maps, editing

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## Abstract

Existing surficial geology maps and unpublished sources were used to develop a spatial database comprising the rock glaciers located in the southern half of the Yukon Territory. Rock glaciers are present in all the main mountain ranges, but are especially numerous in the Wernecke, Ogilvie and Pelly Mountains, and in the Kluane Ranges. The highest densities were found in the Wernecke Mountains and the Kluane Ranges, reaching concentrations of up to 50-60 and 30-40 rock glaciers per 500 $km^2$, respectively. Densities in the other ranges attained maxima of 11-20 rock glaciers per 500 $km^2$ but typical values were 1-10 features per 500 $km^2$. Topographic variables (elevation, slope and aspect) were derived using a GIS for a 12% sample of the more than 1500 identified rock glaciers. Each feature in the sample was examined on aerial photographs to determine morphology (tongue-shaped or lobate) and activity status (active, inactive or relict). Tongue-shaped rock glaciers occurred at higher elevations than lobate forms, but differences in mean aspects, slopes, and areas for the two groups were not statistically significant. Active forms were significantly larger than inactive and relict forms and were also more likely to be northerly-facing. Elevations with climatic conditions suitable for tree growth overlap with those of rock glaciers so that some active features are forested while others are advancing into forested zones. Overall, rock glaciers occupy at least 320 $km^2$ and probably 540-750 $km^2$ of the Yukon Territory, which constitutes a maximum of 0.25% of the entire terrain and about 10% of the area covered by glaciers. Individual active or inactive rock glaciers can be used as point indicators (or exemplars) of the existence of permafrost but their distribution in this cold

environment does not appear to clearly demarcate a clear lower elevational limit for permafrost.

## Introduction

Rock glaciers are permafrost-related landforms (Haeberli *et al.,* 2006) that are common in many of the world's cold mountainous regions. They are particularly well-studied in the European Alps (e.g. Barsch, 1978; Haeberli, 1985; Haeberli and Vonder Mühll, 1996; Imhof, 1996; Kääb and Vollmer, 2000; Krainer and Mostler, 2000; Lambiel and Reynard, 2001; Berger *et al.*, 2004; Frauenfelder, 2005; Roer *et al.*, 2005; Haeberli *et al.*, 2006) but have also been examined in many other regions, including Svalbard (Isaksen *et al.*, 2000; Humlum *et al.*, 2007), Greenland (Humlum, 1996), Iceland (Etzelmüller *et al.*, 2007), New Zealand (Brazier *et al.*, 1998), central Asia (e.g. Shroder *et al.*, 2000; Ishikawa *et al.*, 2001; Fukui *et al.*, 2007), South America (e.g. Torombotto *et al.*, 1998) and Alaska (Wahrhaftig and Cox, 1959; Ellis and Calkin, 1979). Rock glacier research has examined a broad range of questions relating to landform dynamics, composition, origin, and their usefulness as regional permafrost indicators.

Research on rock glaciers in Canada has mainly focused geographically on the western Cordillera. Most of this body of work relates to case studies that discuss origins, activity, morphology and rheology (e.g. P.G. Johnson, 1978, 1980, 1981, 1984, 1992, 1998; J.P. Johnson and Nickling, 1979; Blumstengel and Harris, 1988; P.G. Johnson and Lacasse, 1988; P.G. Johnson, 1992, 1998; Evin *et al.*, 1997). A smaller number of studies have also examined rock glacier dynamics in the region (J.P. Johnson and Nickling, 1979; Jackson and Macdonald, 1980; P.G. Johnson, 1984; Sloan and Dyke, 1998). There remains a paucity of Canadian research on rock glacier distribution. Sloan (1998) attempted to model cirque rock glacier locations in part of the Selwyn Mountains using topographic and geological variables. Harris (1981) used data from a small number of sites that included Canadian examples in an attempt to link the distribution of rock glaciers to freezing and thawing indices. Neither of these studies developed a spatial database, such as that of Janke (2007) in the Colorado Front Range, suitable for modelling rock glacier development and examining patterns in the distribution of different types of rock glaciers.

This paper is focused on the Yukon Territory where prior work has shown rock glaciers to be numerous, but the vast extent of the region has prevented any real overview of their distribution. The goal of this study is to develop a spatial database of rock glacier locations, compiled from published and unpublished sources, that can be used for a variety of tasks including landform mapping and modelling, permafrost distribution modelling and hazard mapping in relation to climate change. Following Janke (2007), a sample of the rock glaciers in the database is employed to characterise morphology, activity and topographic characteristics.

## Study Area

The study area consists of the southern half of the Yukon Territory, from 60 to 65°N and 124 to 141°W, encompassing approximately 350,000 km$^2$. Surficial geology maps, which were the source of the majority of the rock glacier location data, exist for about three-quarters of the region (Figure 1, also see Appendix A). The area contains several major mountain ranges, including the Kluane Ranges, the Ruby Ranges, and the Selwyn, Pelly, and Ogilvie Mountains. The Wrangell-St Elias Ranges and Icefields in the southwest of the study area include Mount Logan, which is the highest peak in Canada at 5959 m. About half of the terrain in the study area is above 1000 m asl, 8% above 1500 m asl, and 3% above 2000 m asl.

Mean annual air temperatures measured at climate stations across the southern half of the Yukon are all less than 0°C with the lowest value at Beaver Creek (Table 1). The range of monthly temperatures increases towards the north and east as the climate becomes progressively more continental. The highest of these climate stations is at 830 m a.s.l., and little is known about the climatic characteristics of the elevation zones in the mountains where most rock glaciers are found. However, because of strong and persistent winter air temperature inversions (Wahl *et al.*, 1987), both the mean annual air temperature (MAAT) and the annual range of temperatures can be expected to decrease with elevation. Precipitation varies between 280 mm $yr^{-1}$ and 416 mm $yr^{-1}$ at the climate stations, but much higher amounts occur in the St. Elias Mountains in southwestern Yukon, because of their close proximity to the North Pacific Ocean (Wahl *et al.*, 1987).

Most of the Yukon south of 65°N is underlain by discontinuous permafrost, either falling into the sporadic (underlying 10-50% of the terrain) or extensive (50-90%) discontinuous zones (Figure 2). The continuous permafrost boundary extends across the Territory just south of 65°N, such that parts of the Ogilvie

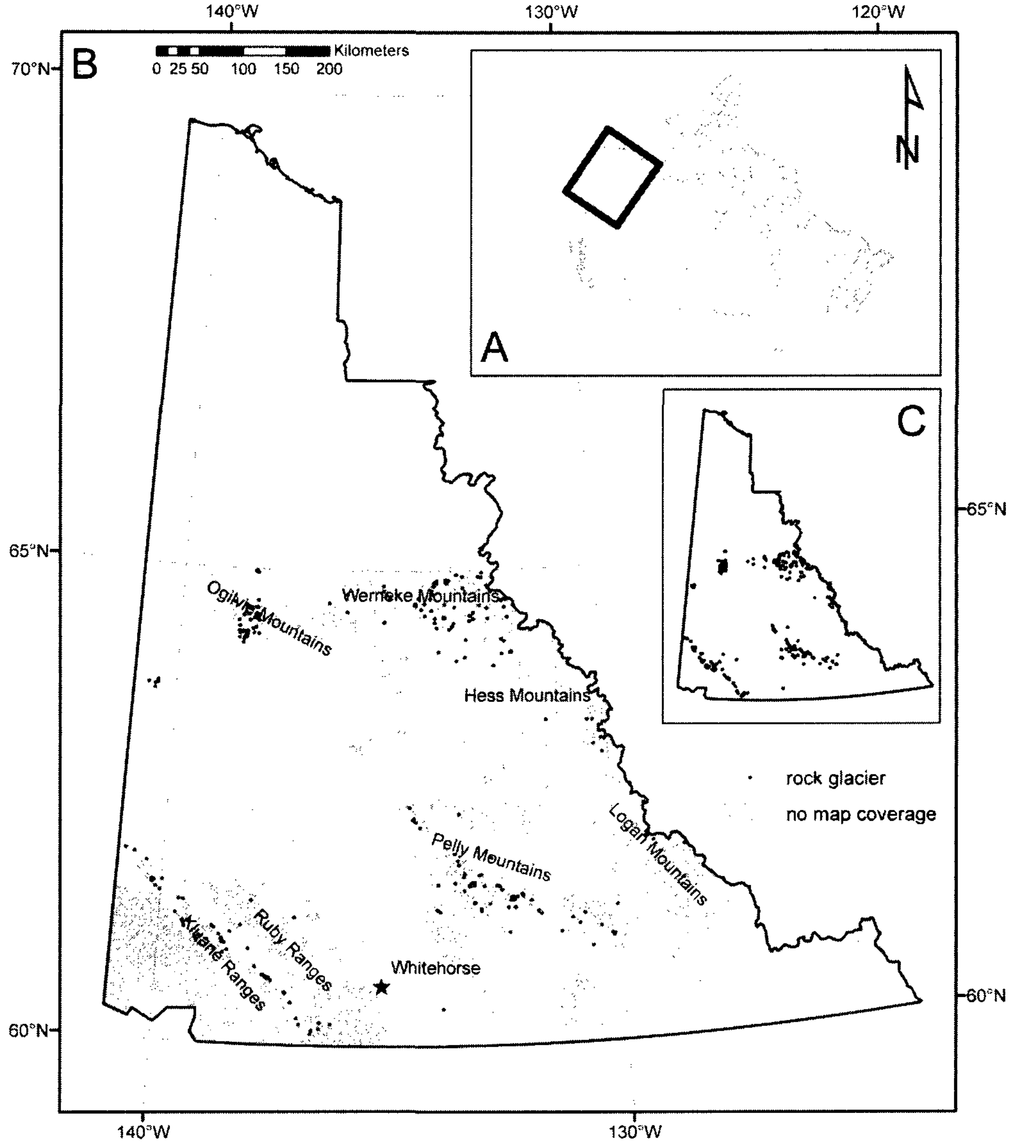


Figure 1 - A: Study area location within Canada; B: Rock glacier sites in the Yukon Territory (shown in black), compiled from published and unpublished maps. Areas not considered in the study due to lack of map coverage are shown in light grey. Elevations greater than 1500 m asl are shown with darker grey hillshade; C: Rock glacier sites included in the sample used in this study.

**Table 1 - Air temperature and precipitation normals (1971-2000[a]) for Yukon climatological stations (source: Environment Canada, 2009).**

| Station[b] | Latitude | Longitude | Elevation (m asl) | January mean (°C) | July mean (°C) | Mean annual (°C) | Mean annual precipitation (mm) |
|---|---|---|---|---|---|---|---|
| Beaver Creek A | 62.41 | -140.87 | 649 | -26.9 | 14 | -5.5 | 416 |
| Braeburn[a] | 61.47 | -135.78 | 716 | -21.2 | 13.6 | -3.1 | 280 |
| Burwash A | 61.37 | -139.05 | 807 | -22.0 | 12.8 | -3.8 | 278 |
| Dawson A | 64.04 | -139.13 | 370 | -26.7 | 15.6 | -4.4 | 324 |
| Faro A | 62.21 | -133.38 | 717 | -21.5 | 15 | -2.2 | 316 |
| Johnson's Crossing | 60.48 | -133.30 | 690 | -18.6 | 13.4 | -1.5 | 376 |
| Mayo A | 63.62 | -135.87 | 504 | -25.7 | 16 | -3.1 | 313 |
| Mayo Road[a] | 60.88 | -135.18 | 655 | -17.4 | 14.9 | -0.7 | 322 |
| Otter Falls[a] | 61.03 | -137.05 | 830 | -16.4 | 13.1 | -1.4 | 297 |
| Pelly Ranch | 62.82 | -137.37 | 454 | -27.5 | 15.5 | -3.9 | 310 |
| Teslin A | 60.17 | -132.74 | 705 | -19.2 | 13.9 | -1.2 | 343 |
| Watson Lake A | 60.12 | -128.82 | 687 | -24.2 | 15.1 | -2.9 | 404 |
| Whitehorse A | 60.71 | -135.07 | 706 | -17.7 | 14.1 | -0.7 | 267 |
| Whitehorse - Riverdale | 60.71 | -135.03 | 640 | -18.4 | 14.8 | -0.2 | 283 |

[a] Normals for these stations are based on fewer than 30 years of data.
[b] See Figure 2 for location of stations.

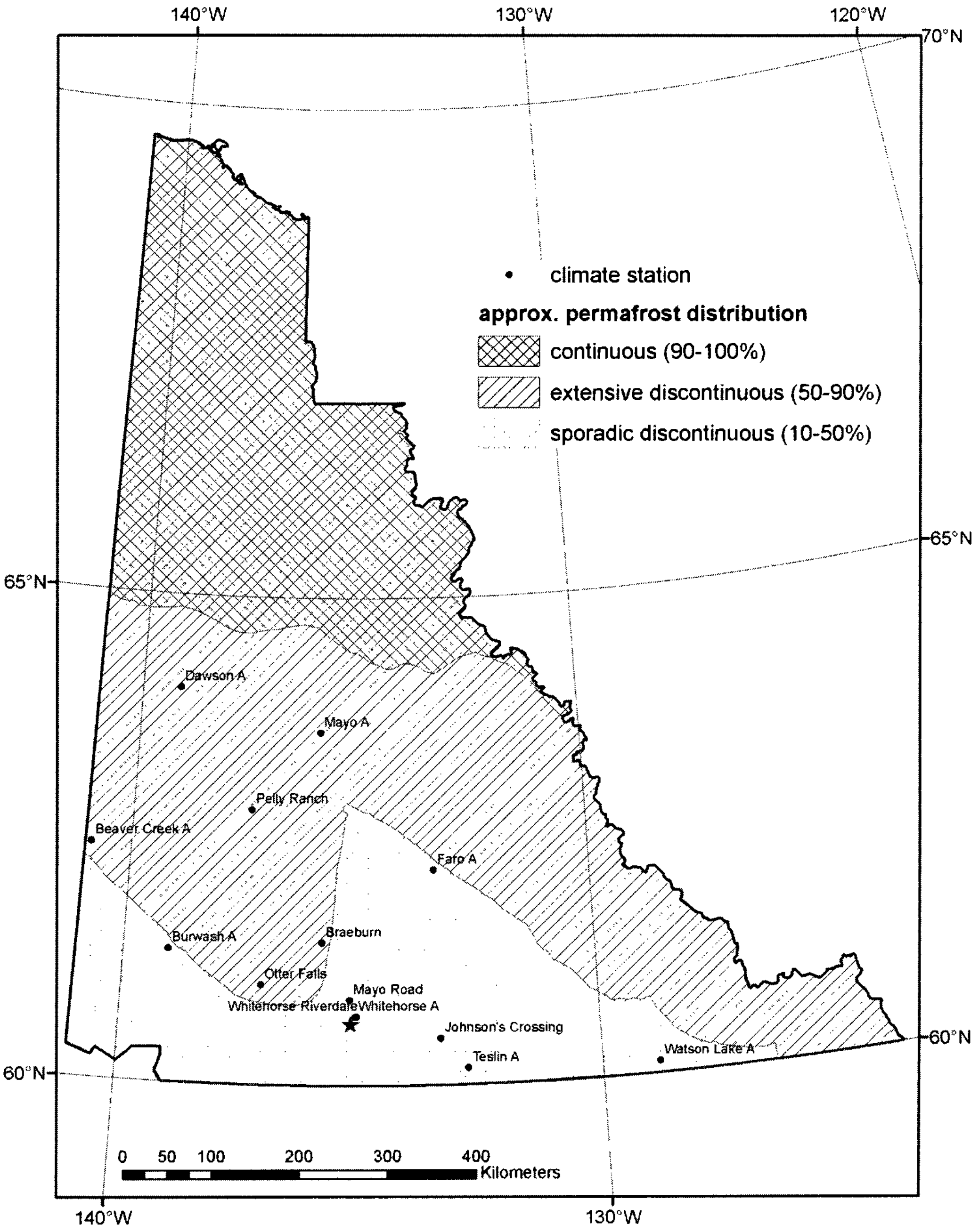


**Figure 2 - Permafrost limits in the Yukon Territory (after Heginbottom et al., 1995) and location of weather stations listed in Table 1 (Environment Canada, 2009).**

and Wernecke Mountains and all of the Yukon's land mass farther north lie within the continuous permafrost zone.

## Methods

Rock glacier locations were primarily extracted from GIS versions of 51 surficial geology maps that were recently converted into a standardized digital shapefile format by the Yukon Geological Survey (YGS). The maps that were included in this compilation ranged in scale from 1:25,000 to 1:250:000. One map (106C - Nadaleen River; Ricker, 1974) not yet included in the YGS compilation was available as a georeferenced image, and the rock glaciers on it were digitised by hand. Additional information was obtained from an unpublished map of rock glaciers in the Kluane area produced by J. Peter Johnson and Daisy-Claire Hartmann-Brenner from aerial photo analysis from which rock glaciers were also digitised on a georeferenced scan. A total of 1680 rock glaciers were initially identified from these sources. Their locations and topographic features are included in Appendix B.

It was not possible to examine all the features identified, either using aerial photos or in the field, so a sample of 196 was extracted for further analysis. The sample consisted of a random selection of 10 (11.7%) of the 85 rock glaciers located within 5 km of a road (those potentially accessible during fieldwork), and an additional random sample of 186 rock glaciers (11.6% of the population) located more than 5 km from a road. All of the remaining rock glaciers within 5 km of a road were also classified from air photos as potential field sites. Details of this classified group are included in Appendix C.

Rock glaciers can be divided into tongue-shaped or lobate (Figure 3) features based on their morphology (Wahrhaftig and Cox, 1959; Outcalt and Benedict, 1965). Tongue-shaped rock glaciers are longer than they are wide and lobate ones are wider than they are long. The controls on morphology are not definitively known, but it has been argued (e.g. Janke, 2007) that origin – glacial or talus – controls morphology, giving rise to tongue-shaped and lobate rock glaciers, respectively. Morphology and origins are intimately tied to local topography (cirques versus valley sides), which constrains landform development. Both forms occur in the study area.

Variations in ground temperatures, ice/water content and debris input mean that rock glaciers may also differ in terms of activity (i.e. rate of deformation). Activity status and rock glacier morphology are not indicated on the surficial geology maps and these were determined for all rock glaciers in the study sample or located within 5 km of a road by examining aerial photographs at the National Air Photo Library in Ottawa. The classifications were verified for 29 features in summer 2008 by visiting 3 rock glaciers in the field and observing and photographing 26 others from a distance.

The field studies and aerial photo interpretation of the sample showed that the original inventory was not complete nor was it error-free. Several instances occurred of other landforms, mostly cirque basins with incised drainage channels in their floors, being mistakenly classified as rock glaciers on the surficial maps (12, or 6% of the total study sample); these were excluded from further analysis. 12-18 other rock glaciers were omitted from part or all subsequent analyses because the scale of existing aerial photo coverage was not adequate for

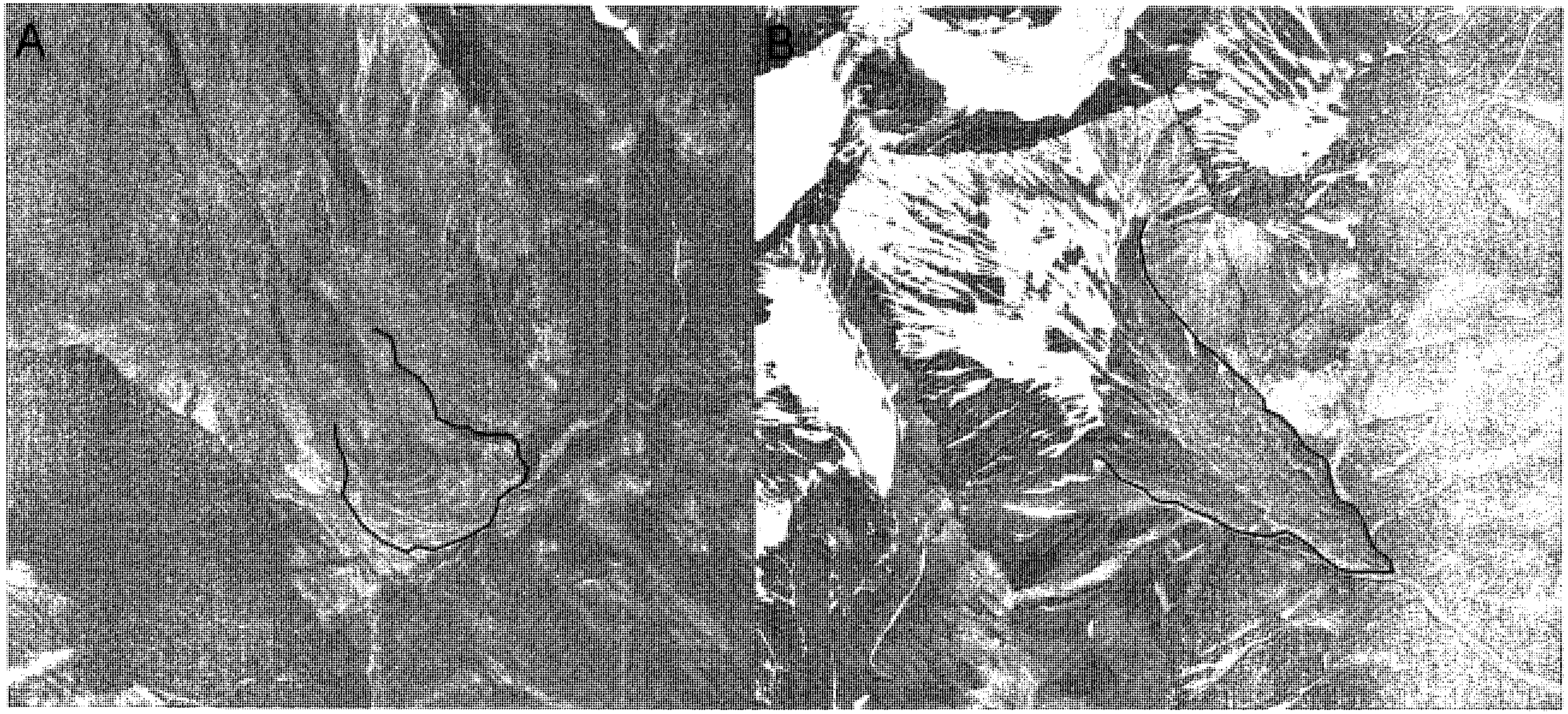


Figure 3 - Rock glacier morphologies: A: lobate; B: tongue-shaped (National Air Photo Library of Canada, A: A22355-207, B: A23794-119). Rock glacier extents indicated with the heavy black line.

classification, or because the forms exhibited both tongue-shaped and lobate elements. Twenty unmapped rock glaciers within 5 km of a road were observed in the field. These unmapped rock glaciers were subsequently included in the study sample and classified from air photos, bringing the total number of landforms classified to 273. Four of these new sites were visited, measured and described in the field and an additional 16 were photographed and observed from a distance. Totals classified for each analysis are given in the results section.

Rock glacier activity in the sample was classified on the basis of: (i) steepness of the front (near the angle of repose in an active rock glacier (Haeberli, 1985)) and its clear appearance on air photos; and (ii) appearance of the surface (i.e. pronounced ridges and furrows in active forms, smoother surfaces in inactive forms, and melt and collapse features in relict forms (Imhof, 1996)). Surface vegetation could not be used as a definitive activity indicator because there are Yukon examples of active rock glaciers with extensive forest cover (Blumstengel and Harris, 1988; Harris *et al.*, 1994). Overrun vegetation at the toe of a rock glacier, on the other hand, was considered to be a positive sign of activity. In the field, rock glaciers with stable surface boulders were considered inactive or relict, while those with unstable surface rocks were classified as active (Imhof, 1996).

Determination of morphology was based entirely on width, where tongue-shaped rock glaciers are wider at the head and lobate ones are wider at the toe. For all cases included in the study sample, it was unnecessary to distinguish morphology by considering local topographic features causing the differences in morphology (Outcalt and Benedict, 1965), or the orientation (transverse or lateral) of ridges (Janke, 2007).

Slope and aspect of the rock glaciers in the sample were derived from a 30 m resolution National Topographic Database digital elevation model (DEM) using ESRI ArcGIS 9.2. Zonal statistics were used to calculate the mean, maximum and minimum elevation and slope for each rock glacier, employing the values underlain by each rock glacier polygon. Means were compared using *t*-tests. Area was also derived for each rock glacier in the sample from the digital map. Mean aspect and aspect variance were calculated manually by extracting the aspect values for each pixel within a given rock glacier and calculating a directional mean and a circular variance (Gaile and Burt, 1980; Davis, 1986).

## Results

### *Rock glacier spatial distribution*

As expected, rock glaciers in the Yukon occur only in mountainous areas, but these constitute a large part of the Territory's area (Figure 1). A comparison of the distribution of the known population with the topography shows that the landforms are concentrated at elevations from 1400-1900 m with the greatest number from 1600-1800 m (Figure 4), based on their mean elevations. Almost 90% of the rock glaciers fall within the highest 20% of the Yukon's land mass.

Rock glacier densities are greatest in the Wernecke Mountains and Kluane Ranges where maximum values are approximately 50-60 features per 500 km$^2$ and 30-40 per 500 km$^2$ respectively (Figure 5). Maximum densities in

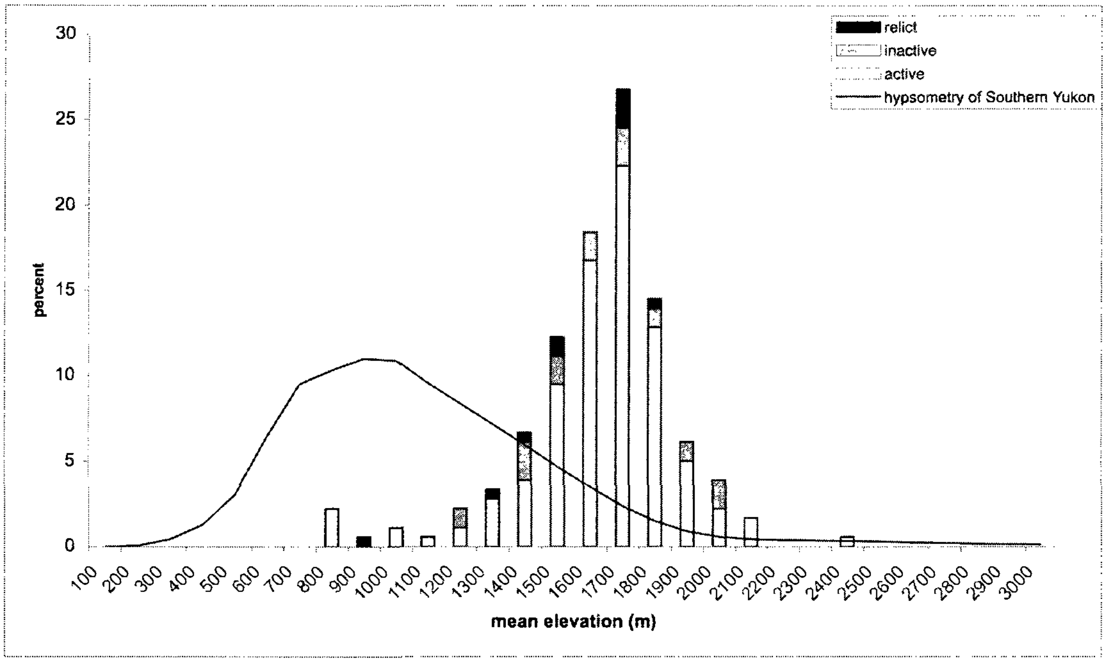


**Figure 4 - Comparison of hypsometry of the Southern Yukon with the number of rock glaciers in the database by 100 m elevation band.**

**Table 2 - Rock glacier classification for the sample group**

| | Tongue-shaped | | Lobate | | Both | | Total | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % |
| Active | 105 | 86 | 37 | 70 | 6 | 100 | 148 | 82 |
| Inactive | 14 | 12 | 9 | 17 | | | 23 | 13 |
| Relict | 3 | 2 | 7 | 13 | | | 10 | 5 |
| Total | 120 | | 53 | | 6 | | 179 | |

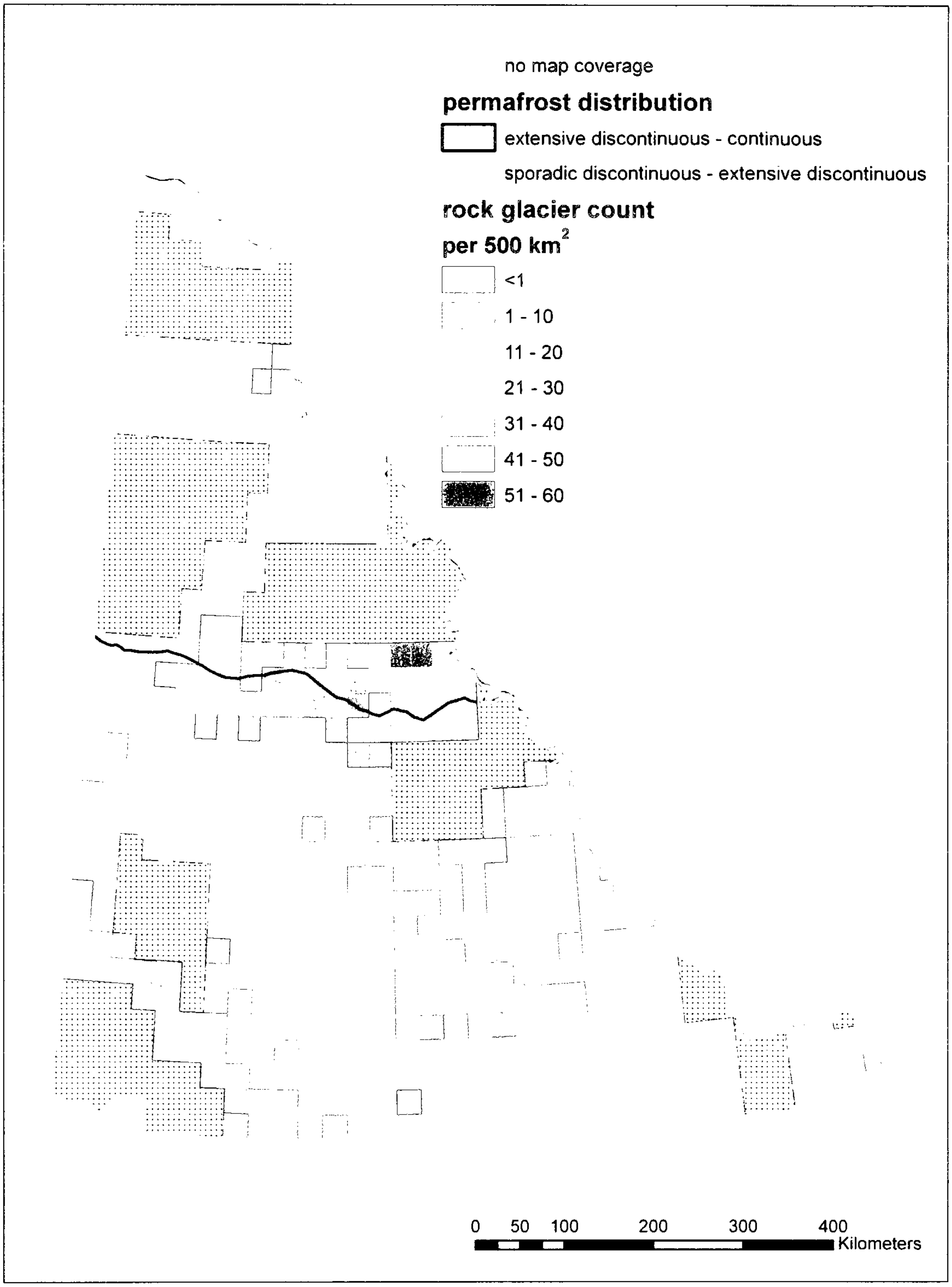


**Figure 5 - Rock glacier density in the Yukon Territory per 500 km$^2$. Density was mapped per 500 km$^2$ rather than per 1000 km$^2$ because none of the map sheets exceeds 1000 km$^2$. The map sheets vary in area from 770 km$^2$ at 60°N to 660 km$^2$ at 65°N.**

the other ranges are 11-20 rock glaciers per 500 km$^2$, and typical values are 1-10 per 500 km$^2$.

### *Rock glacier morphology*

Tongue-shaped rock glaciers formed the majority in the sample (67%), with lobate forms constituting the minority (30%). The vast majority of the tongue-shaped rock glaciers are active (86%), 12% are inactive and 2% are relict (Table 2). A smaller majority of lobate rock glaciers are active (70%), 17% are inactive and 13% are relict. Tongue-shaped rock glaciers have mean, average minimum and average maximum elevations that are 90-130 m higher than lobate forms (Table 3). Of these, the mean and mean minimum values are statistically different (Table 4). Tongue-shaped rock glaciers have slopes that are 1-2° more gentle on average than the lobate forms but the difference is not significant (Tables 3 and 4). The average size of the two morphotypes in the sample is effectively identical at 0.027 km$^2$ (Table 3) and mean aspects of 343-344° are virtually the same.

### *Rock glacier activity*

82% of the rock glaciers sampled were active, 13% were inactive, and 5% were relict (Table 5). Active rock glaciers in the sample occur most frequently with northwesterly to northeasterly aspects and at mean elevations between about 1300 and 1800 m (Figure 6A). Inactive rock glaciers show similar tendencies (Figure 6B). Relict forms (Figure 6C) are too few in number for definitive assessments. Kolmogorov-Smirnov tests showed that all distributions

**Table 3 - Summary statistics for tongue-shaped and lobate rock glaciers. Elevation and slope values include standard deviation in parentheses. Mean direction includes circular variance in parentheses.**

| | Tongue-shaped ($n$ = 120) | | | Lobate ($n$ = 53) | | |
|---|---|---|---|---|---|---|
| | Elevation (m) | Slope (°) | Aspect (°) | Elevation (m) | Slope (°) | Aspect (°) |
| Mean | 1616 (±217) | 23 (±7) | 343 (0.52) | 1500 (±292) | 25 (±8) | 344 (0.58) |
| Average minimum | 1501 (±231) | 7 (±6) | | 1370 (±288) | 9 (±8) | |
| Average maximum | 1747 (±224) | 39 (±8) | | 1660 (±300) | 40 (±7) | |
| Total area (km$^2$) | | 33.23 | | | 14.41 | |

**Table 4 - Difference of means tests comparing rock glacier form and activity status in the sample.**

| | Lobate vs. tongue-shaped rock glaciers | Active vs. inactive rock glaciers | Active vs. relict rock glaciers | Inactive vs. relict rock glaciers |
|---|---|---|---|---|
| **Area (m$^2$)** | | | | |
| *t* | 0.01 | -3.96 | 3.00 | -0.70 |
| Probability | 0.99 | **0.00** | **0.00** | 0.49 |
| **Mean elevation (m)** | | | | |
| *t* | 2.58 | -0.09 | 1.33 | 1.15 |
| Probability | **0.01** | 0.93 | 0.21 | 0.27 |
| **Minimum elevation (m)** | | | | |
| *t* | 1.99 | 2.04 | 2.23 | 2.13 |
| Probability | **0.00** | 0.86 | 0.20 | 0.20 |
| **Maximum elevation (m)** | | | | |
| *t* | 1.99 | 2.04 | 2.23 | 2.13 |
| Probability | 0.07 | 0.46 | 0.18 | 0.38 |
| **Mean aspect (°)** | | | | |
| *F* | 1.09 | 2.29 | 1.28 | 1.79 |
| Probability | 0.37 | **0.01** | 0.37 | 0.13 |
| **Mean slope (°)** | | | | |
| *t* | -1.71 | 0.87 | -1.31 | -0.58 |
| Probability | 0.09 | 0.39 | 0.22 | 0.57 |

Note: Bold values are significant at p = 0.05 or better.

**Table 5 - Comparison of topographic variables of active, inactive and relict rock glaciers in the sample. Standard deviation or circular variance is shown in parentheses.**

**Active rock glacier (n = 148)**

| | elevation (m) | slope (°) | aspect (°) |
|---|---|---|---|
| Average minimum | 1463 (±258) | 6 (±5) | |
| Average maximum | 1730 (±248) | 40 (±8) | |
| Mean | 1584 (±245) | 23 (±7) | 349 (0.52) |
| Total area of all active forms ($km^2$) | 44.69 | | |
| Average size ($km^2$) | 0.30 (±0.41) | | |
| Kolmogorov-Smirnov | KS = 0.87 | p-value = 0 | |

**Inactive rock glacier (n = 21)**

| | elevation (m) | slope (°) | aspect (°) |
|---|---|---|---|
| Average minimum | 1472 (±230) | 12 (±9) | |
| Average maximum | 1691 (±228) | 35 (±7) | |
| Mean | 1580 (±226) | 25 (±8) | 291 (0.55) |
| Total area of all inactive forms ($km^2$) | 3.27 | | |
| Average size ($km^2$) | 0.14 (±0.11) | | |
| Kolmogorov-Smirnov | KS = 0.99 | p-value = 0 | |

**Relict rock glacier (n = 10)**

| | elevation (m) | slope (°) | aspect (°) |
|---|---|---|---|
| Average minimum | 1340 (±272) | 11 (±9) | |
| Average maximum | 1602 (±271) | 41 (±6) | |
| Mean | 1466 (±273) | 26 (±8) | 279 (0.79) |
| Total area of all relict forms ($km^2$) | 1.68 | | |
| Average size ($km^2$) | 0.17 (±0.09) | | |
| Kolmogorov-Smirnov | KS = 0.95 | p-value = 0 | |

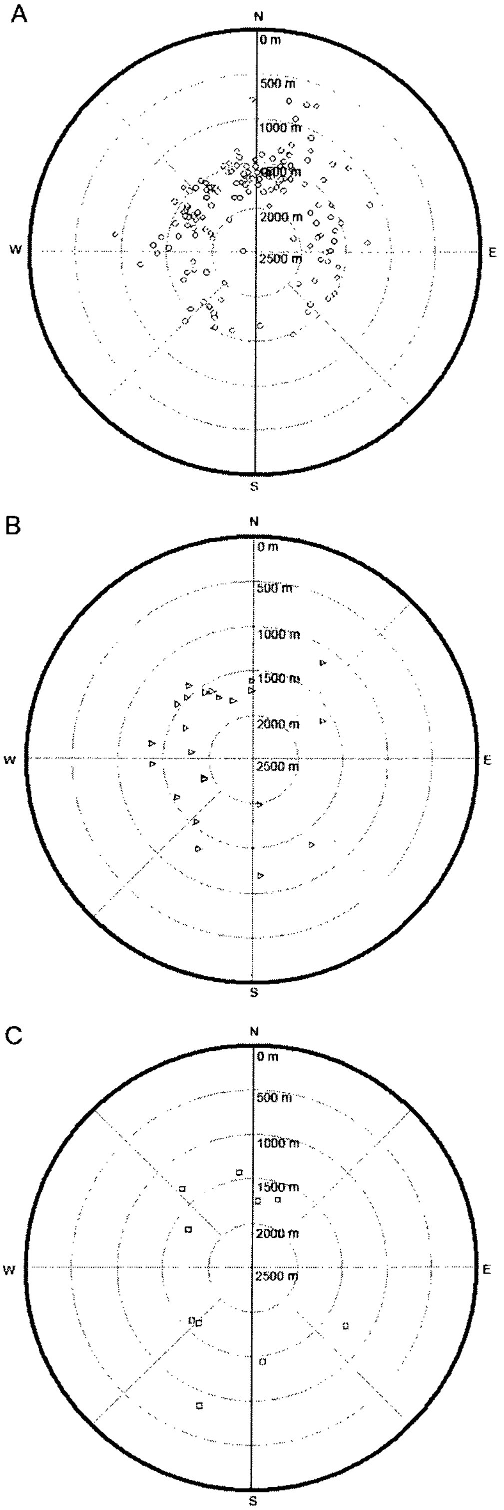


**Figure 6 - Orientation and mean elevation of rock glaciers in the sample classified by activity status: A: active; B: inactive; C: relict.**

were significantly different from a uniform distribution (active: KS = 0.87, p-value = 0; inactive: KS = 0.99, p-value = 0; relict: KS = 0.95, p-value = 0). Proportionally, there were more inactive and relict forms of the lobate variety than there were of the tongue-shaped type (Table 2). Active rock glaciers have significantly larger areas (0.030 $km^2$ on average), than inactive (0.014 $km^2$) or relict rock glaciers (0.017 $km^2$) (Tables 4 and 5). Active rock glaciers also have significantly more northerly aspects (average of 349°) than inactive ones (average of 291°). However, mean, average minimum and average maximum elevations were all very similar for both active and inactive forms. Although the values were about 100 m lower for relict forms, the difference was not great enough to be statistically significant. Slope differences between rock glaciers of different activity status were also insignificant (Table 4).

### *Fieldwork*

The results of the verification of classifications undertaken in the field highlighted some of the problems with the classification of rock glaciers, generally. Forty-nine percent of the rock glaciers visited or photographed in the field were assigned the same activity classification as they had been given from air photos; 29% were classifed in the field as one class more or less active than the classification from the aerial photos; 22% were relict and classified as active or *vice versa*, or were not detectable in the field.

Morphology classifications were also difficult to verify in the field due to the fact that in almost all cases, except for the seven where the rock glacier was actually climbed, it was impossible to see the entire landform. The upper and lower-most areas of a rock glacier are often out of sight when viewed from below due to the lower part being obscured by forest in front of it and the upper part lying within a cirque basin. Because of this, many of the verifications made from air photos were unverified even when the landform was observed in the field. The reliability of the morphology classifications made from air photos should be much greater, given that they are made using a bird's-eye view of (usually) the entire landform.

The number of lobate rock glaciers encountered in the field (24) was approximately equal to the number of tongue-shaped forms seen (23). Considering the number of each type present in the study sample, more than twice the number of tongue-shaped than the number of lobate forms (Table 3), the ratio seen in the field is probably partly a result of the elevation of the accessible field sites, that is at lower elevations where roads are located. The topography also likely plays a role, since roads are usually located in valley bottoms and lobate rock glaciers tend to form on valley sides. The cirques that often give rise to tongue-shaped features are usually only visible from the side on which the opening occurs, and the inside of the cirque is only visible if the opening has a steep enough angle to allow viewing from below.

An example is provided in Figure 7 of the observations from air photos and on a field visit at a rock glacier known as King's Throne. A comparison of all sites visited is included in Appendix D.

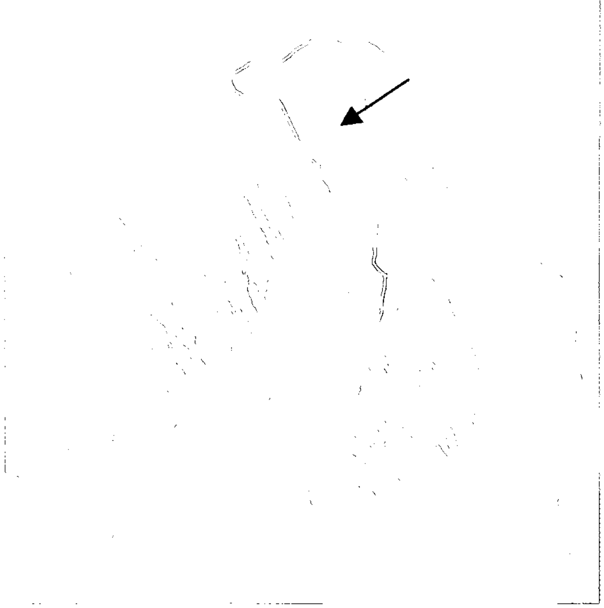
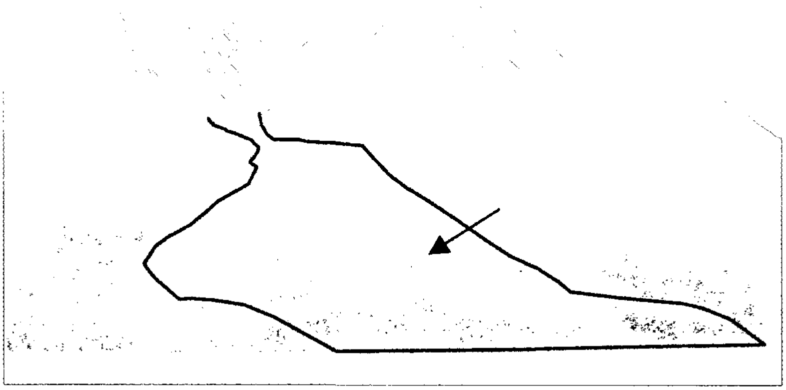
| | |
|---|---|
|  A23792 – 104 (National Air Photo Library of Canada): rock glacier extent shown by white line, upper toe shown by black arrow |  Photo 4820: Rock glacier extent shown by black line, upper toe shown by black arrow |
| Air photo observations:<br>• Active, lobate, down-valley flow, originates in a cirque, toe ends in a lake<br>GIS based-data:<br>• Mean elevation 1089 m, minimum elevation 781 m, maximum elevation 1717 m<br>• Mean slope 26°, minimum slope 6°, maximum slope 44°<br>• Mean aspect 25°<br>• Area 0.83 km$^2$ | Field observations:<br>• Elevation at road level (close to lake level) = 746 m<br>• 2nd toe from front (location shown with black arrows), angle 34°, elevation 817 m, grain size 2 – 50 cm with average about 10 cm (grain size about the same over the entire rock glacier), well vegetated (trees)<br>• Photo 4803 (middle of slope) taken at 938 m, above treeline, angle 30°<br>• Photo 4804 (middle of active area of slope) taken at 1118 m, angle 34°<br>• Top surface of rock glacier at 1251 m, photos 4805 – 4816, snow patches present, pronounced lateral ridges on surface, originates in cirque and spreads into many toes<br>• King's Throne from front: photos 4820, 4821 |

**Figure 7 – Comparison of observations from air photo and field visit for King's Throne site**

## Discussion

### *Effects of errors in the database*

Morphology classification errors in the sample database are thought to be negligible because all of the classification was done using aerial photographs that covered the entire extent of each rock glacier. Errors in activity classification are more likely due to the subjective nature of characterising the features that indicate status. Confidence was generally high when classifying rock glaciers as active, but inactive and relict forms were more difficult to differentiate. Thus errors are most likely to consist of misclassifications of rock glaciers between the inactive or relict groups.

Inaccuracies in the population database are believed to be more numerous. First, it is virtually certain that substantial numbers of rock glaciers exist in areas of the Territory that have not yet been mapped. For example, the highest concentrations of rock glaciers occur in the Selwyn Mountains (which include the Wernecke, Hess, and Logan Mountains) but the central section of this chain is unmapped (Figure 5). Second, the discovery of 20 additional rock glaciers, mainly in the Kluane Lake region and south along the road from Haines Junction to Haines, Alaska, during fieldwork that did not appear on the existing surficial geology maps suggests that unrecognised forms may be common, even in mapped areas. Finally, a small number of features mapped as rock glaciers appear to have other origins. Taking all these factors into account, our estimate is that there are 2500 to 3500 rock glaciers in the Yukon Territory.

Considering that the average area of all the rock glaciers in the sample database is 0.216 km$^2$ and the total number in the Yukon is in excess of 1500 (accounting for potential errors in the database), rock glaciers occupy at least 320 km$^2$ of the Territory. If the estimated range of totals is used, rock glaciers probably cover between 540-750 km$^2$, which while a very large value, still represents less than 0.25% of the Territory. In comparison, the glacierized area is an order of magnitude greater, at approximately 5000 km$^2$ (data from NSIDC, 2007).

Activity classification errors are likely to be present, however they should not present a bias in the data since, after attempting both air photo-based and fieldwork-based classification, it was decided to use only the air photo-based system due to the considerable discrepancies between the two methods. The field-based activity classifications are probably more accurate considering that surface features, matrix stability and slope are much more apparent in person than in an air photo (which is also potentially many years old, introducing the possibility of change in activity level). However, since it was not possible to visit all the sites in the study sample, the standard method had to be used.

Morphology classifications given are probably much more accurate than the activity classifications. Again in this case, it was decided to use the air photo-based class assignments. The morphology was much clearer on the air photos, where (usually) the whole landform was visible and seen at a bird's-eye view, than in the field, where both the upper and lower portions of rock glaciers were frequently obscured from view (by forest, surrounding topography, fog, and cloud, among others). Furthermore, the certainty of observing the correct feature is greater when comparing a location marked on a digital elevation model to an air photo than when comparing a location marked on a digital elevation model or as a GPS waypoint to the topography as usually seen from the lowest point of elevation in the landscape where the roads are situated.

### *Distribution trends*

Rock glacier density was highest in the northernmost mountain range within the study area. This may be because the area has continuous (90-100%) permafrost and thus local climate would not prevent rock glacier development in this region. However, it may also relate to the distribution of bedrock types suitable for rock glacier development.

The apparent absence of rock glaciers in some of the more southerly mountainous areas portrayed in Figure 1 may be due to two main causes. First, the southern area of the territory is thought to be underlain by sporadic (10-50%) permafrost. Consequently, climatic conditions may not favour rock glacier development or persistence at many sites. Second, we suspect that some rock glaciers are in fact present, but were not identified as such on the existing surficial geology maps.

### *Trends in elevation and aspect*

The mean elevation of active rock glaciers in the Yukon fits in well with the known gradient in elevation for active rock glaciers in North America (Figure 8). From north to south, the mean elevation of rock glaciers increases from 990 m in the Brooks Range, Alaska (Wahrhaftig and Cox, 1959), to 1584 m in the Yukon Territory (this study) to 3526 m in Colorado's Front Range (Janke, 2007), and 3697 m in the San Juan Mountains (White, 1979). The Alaska Range (Calkin *et*

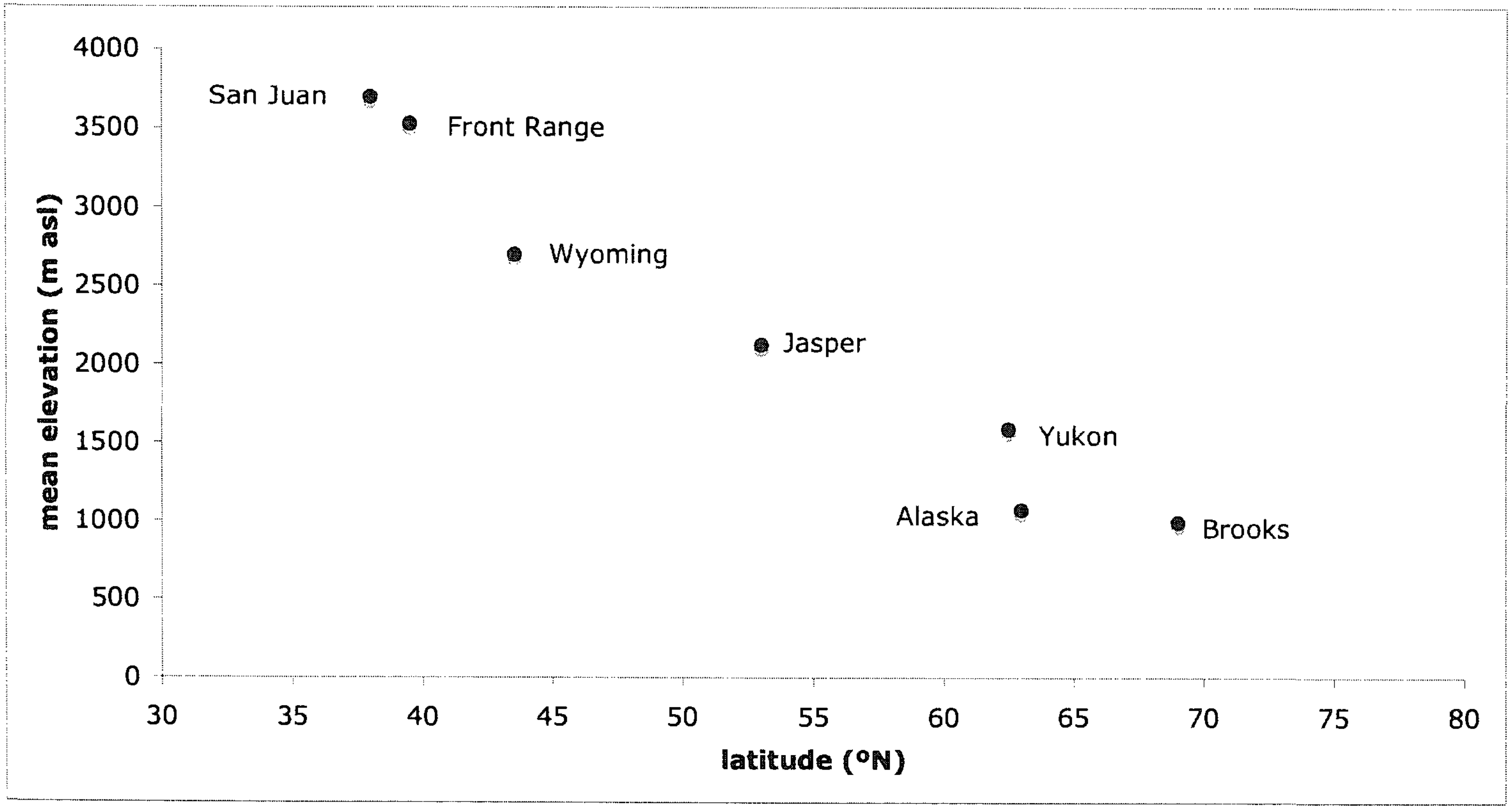


**Figure 8** - Mean elevation of active rock glaciers vs. latitude in North America. Sources: Brooks Range – Warhaftig and Cox, 1959; Front Range – Janke, 2007; San Juan Mountains – White 1979; Alaska Range – Calkin *et al.*, 1987; southern Rocky Mountains – Luckman and Crockett, 1978; Absaroka Range – Potter, 1972.

*al.*, 1987), southern Rocky Mountains (Luckman and Crocket, 1978) and the Absaroka Range in Wyoming (Potter, 1972) have intermediate values of 1070 m, 2125 m, and 2700 m, respectively.

Yukon examples also fit the rule of thumb that rock glaciers are more likely to be found with poleward facing aspects (e.g. Barsch, 1996). We hypothesized that aspect might play a less important role in determining rock glacier location with increasing latitude, and while individual rock glaciers can be oriented in any direction, Figure 9 shows that there is a clear tendency for more to occur on north-facing slopes, especially for active forms. Localised tendencies in aspect may be attributable to the orientation of mountain ranges themselves, but the Yukon results come from several ranges with differing orientations, so the 349° (NNW) mean aspect for active rock glaciers (Table 5) is likely due to a climatically-induced preference for north-facing slopes. Latitude is not significantly different between the active and inactive rock glaciers in the study sample, however it is significantly different ($p = 0.002$) between northward-facing forms (mean latitude = 62.8°N) and southward-facing forms (mean latitude = 63.8°N).

### *Comparison of active, inactive and relict rock glaciers*

Size appears to be the best way of distinguishing between the activity groups. Active forms average about twice the size of the inactive and relict forms (Table 5). These differences may have several potential causes, including the possibility that forms which are now relict or inactive have always been either climatically marginal, hydrologically marginal, or geologically marginal, and thus

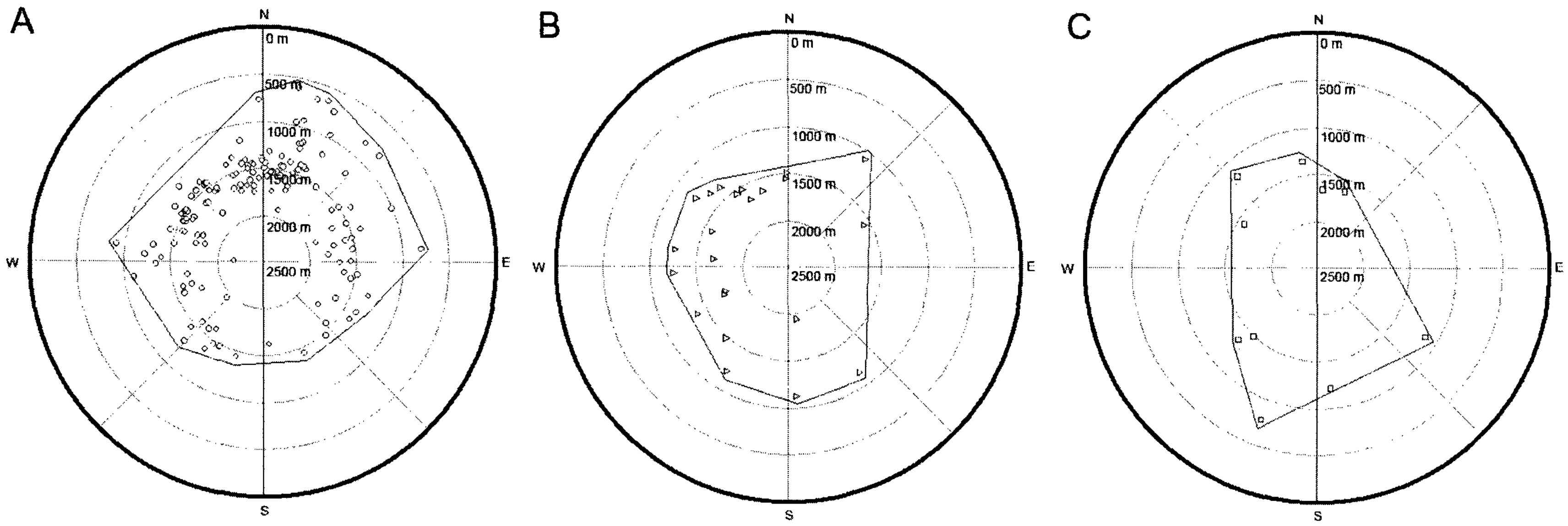


Figure 9 - Orientation and minimum elevation of rock glaciers in the sample with lines showing lower elevation limits for different activity groups: A: active; B: inactive; and C: relict.

never developed to the extent that those currently active did. Additionally, active forms may have been active longer and have, therefore, grown larger, or the active forms may be less marginal and so have grown faster. The fact that mean aspect is also significantly different between the active and inactive groups (Figure 9) lends support to the idea that north-facing slopes are more suitable to rock glacier maintenance and hence enlargement.

In contrast to the size and frequency differences, *t*-tests conducted on mean, average minimum, and average maximum elevations for active rock glaciers divided into groups facing the northern and southern halves of the compass exhibited no significant differences. Despite this, Figures 6A and 8A show that individual rock glaciers are present at lower elevations on north-facing slopes compared to south-facing ones. In contrast, inactive forms (Figure 6B) extend to their lowest elevations on southward-facing slopes. Relict forms (Figure 6C) are too few in number in the sample for the pattern to be conclusive but it is notable that the lowest one is on a slope facing SSE.

The climate of the Yukon with MAATs in valleys ranging from ~0°C to -5°C (see Table 1) means that large areas at higher elevations may be suitable climatically for rock glacier formation or preservation. Aspect does appear to play a role in rock glacier distribution, as the directional distribution of all activity classes was significantly non-uniform with a strong northerly component. Aspect and elevation, and by inference ground temperatures, however, are not the only influences contributing to the presence or absence of rock glaciers. Debris and water/ice input are also essential and the absence of either will mean that no rock glacier will form or that an existing one will become inactive (Haeberli, 1985). Bedrock geology also plays a major role, as the bedrock must weather to a suitable substrate for rock glacier formation. It will also affect the size and resultant form of a rock glacier (Ikeda and Matsuoka, 2006). Of the seven rock glaciers visited in the field, only one was of the "pebbly" variety (formed in shales and platy limestones) and the rest had larger "bouldery" surfaces (formed from crystalline rocks and resistant limestones; Ikeda and Matsuoka, 2006). Topography is a further constraint on rock glacier formation, as a steep headwall is required for debris supply (e.g. Haeberli, 1985; Ackert, 1998) and a slope below it is necessary to enable flow (Sloan, 1998; Kääb *et al.*, 2009). These factors contribute to the possibility that some relict and inactive rock glaciers may have ceased activity for reasons other than climatic change.

### *Comparison of tongue-shaped and lobate rock glaciers*

For the different morphological forms of the rock glaciers studied, elevation is the key differentiating characteristic out of the factors examined (Table 3, Table 4, Figure 10). Tongue-shaped forms frequently originate in cirque basins which are located at relatively high elevations. Lobate rock glaciers develop from talus slopes which often occur on valley sides at elevations that on average are 100-130 m lower. The same pattern was found by Ellis and Calkin (1979) and by Janke (2007) in studies of the Brooks Range and the Colorado Front Range, respectively. Similarly, Harris (1981) argued that the distribution of tongue-shaped rock glaciers relates to climatic conditions associated with glaciers while lobate rock glaciers relate to the distribution of discontinuous permafrost. In the Yukon sample, there is considerable overlap between the two groups (see Figure 10) but both mean and mean minimum elevations differ significantly (Table 4). Like White's (1979) study of the San Juan Mountains in Colorado, no significant differences were found between the aspect and slope of the lobate and tongue-shaped samples in the Yukon. Both forms have northwest aspects and slopes of 23 - 25°. As mentioned above, geology may play a role in determining rock glacier size, since pebbly rock glaciers tend to be smaller than bouldery ones (Ikeda and Matsuoka, 2006), but this factor was not examined in the present study and the sizes of tongue-shaped and lobate rock glaciers were statistically the same.

### *Interaction of rock glaciers with forest*

One of the aspects of rock glacier distribution in the Yukon that differentiates it from many other mountainous areas is the potential for interaction of active features with forest, either by being partially covered by forest where a suitable substrate (such as loess) is present (e.g. Blumstengel and Harris, 1988) or by extending below the treeline and disturbing forested slopes. This occurs because the northern continental climate of most of the Yukon, with cold winters but relatively warm summers and limited precipitation (Table 1), allows permafrost to persist in rock glaciers at relatively low elevations. A comparison of the elevations shown in Figure 4 with an analysis of mean July air temperatures at Yukon climate stations (Table 1) explains this possibility. July normal temperatures for 1971-2000 can be predicted using a statistically significant ($p=0.000$) multiple regression equation against longitude and elevation: $Y = 34.86 + 0.117*\text{longitude} - 0.007*\text{elevation}$ ($n=14$; adjusted $r^2 = 0.74$; standard

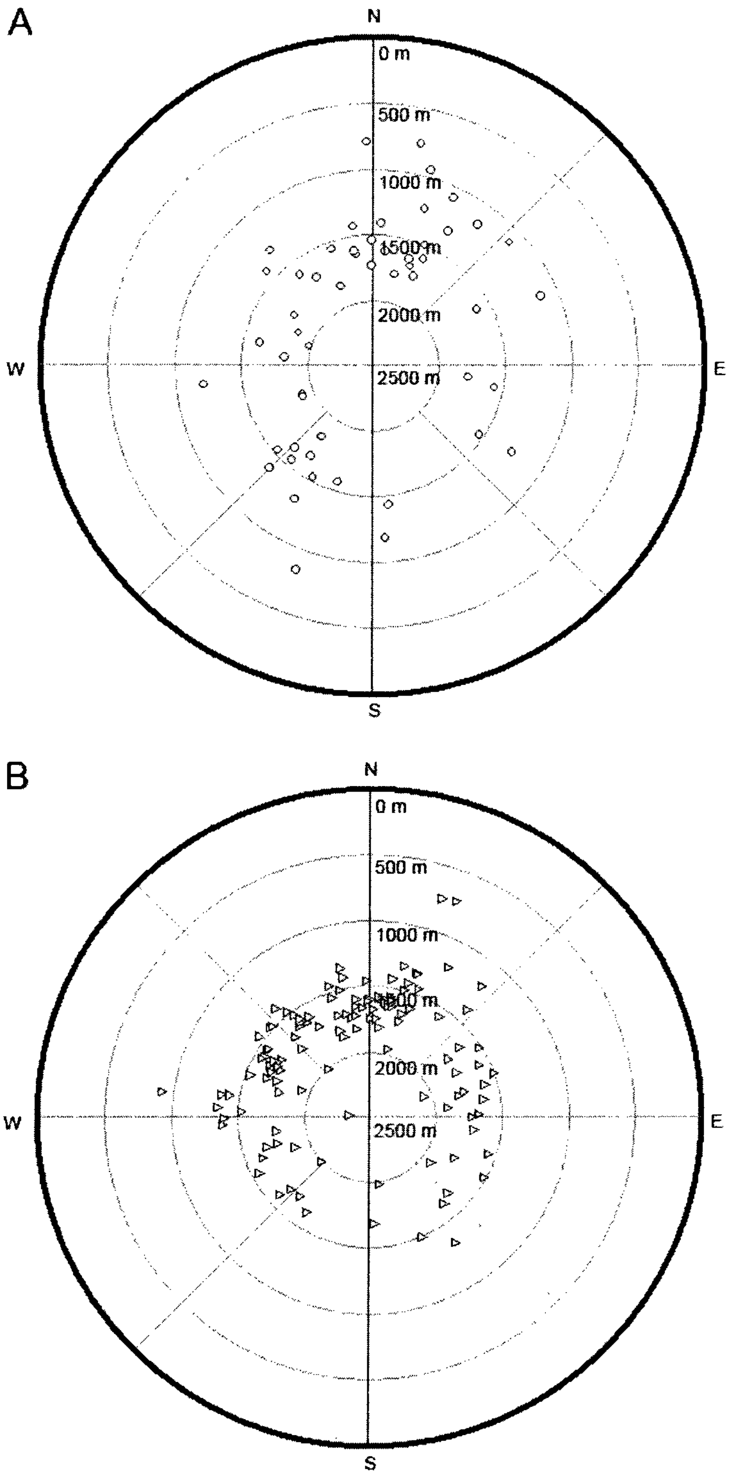


**Figure 10 - Orientation and mean elevation of rock glaciers in the sample classified by morphology: A: lobate; B: tongue-shaped.**

error = 0.5°C). Surprisingly, latitude played no significant role in a preliminary investigation and so was not included in the final equation. If the generally accepted altitudinal limit of trees is taken to be where the July normal temperature equals 10°C, this equation predicts that treeline will occur around 1200 m asl at 140°W (i.e. longitude -140°) in the western Yukon south of 65°N and at 1400 m asl at 128°W in the eastern Yukon, which corresponds closely with field observations (e.g. Danby and Hik, 2007). Figure 9A shows that many active rock glaciers extend below these elevations, so that forested rock glaciers cannot be automatically classified as inactive or relict.

### *Potential uses of rock glacier database*

The rock glacier database compiled in this study has several potential uses in addition to mapping the landforms and examining their distribution and the topography in which they occur. The rock glaciers can be used as single point indicators of permafrost, though not of elevational limits of permafrost, since permafrost occurs in valley floors as well in higher elevational bands where rock glaciers exist. The database can be used for a deeper examination of the relationships between rock glaciers and the topography and geology in which they occur. Finally, because rock glaciers have been suspected as a potential source of landslide debris if thawed (Kneisel *et al.*, 2007), this database will provide a key input for geohazard mapping and modelling.

## Conclusions

This study is the first attempt to examine the distribution and characteristics of rock glaciers across the Yukon Territory. The spatial database developed for this study is only an initial step towards more detailed analyses since fieldwork and aerial photograph examination show that it is subject to some inclusion and exclusion errors. Nevertheless, we are able to conclude the following:

1. More than 1500 rock glaciers are present in the major mountain ranges of the Yukon, and given that spatial coverage is still incomplete, the total is probably in the range of 2500-3500. The greatest spatial density occurs in the higher latitude mountain ranges, where it reaches 50-60 rock glaciers per 500 km$^2$. In total, rock glaciers occupy an area of at least 320 km$^2$ and probably 540-750 km$^2$, about one-tenth the areal extent of ice glaciers in the Territory.
2. Active rock glaciers are more numerous, larger and are more likely to have northerly orientations than inactive and relict features. All activity classes show a preferred orientation with a strong northerly or north-westerly component. Although the elevations of active, inactive and relict rock glaciers in the sample follow the typical elevational gradient from higher to lower, the differences are not statistically significant.
3. Tongue-shaped rock glaciers occur at slightly higher elevations on average than lobate forms. This fits the pattern found in previous studies in North America and elsewhere and is explained by differing origins and

topography generating the landforms (i.e. cirque basins produce tongue-shaped rock glaciers and talus slopes produce lobate forms).

4. The average active rock glacier elevation of 1580 m calculated for a sample fits within the general pattern of decreasing rock glacier elevation with latitude for the North American Cordillera.
5. The lower limit of active and inactive rock glaciers is about 1100 m on south-facing slopes and about 600 m on north-facing slopes. These observations illustrate the existing understanding of discontinuous permafrost distribution in the Yukon, in which permafrost can potentially be present at almost any elevation from valley bottoms to mountain peaks. They indicate that while rock glaciers may be used as single point indicators of the presence of permafrost, they may not be used to demarcate the lower elevational limit of permafrost in the Yukon as has been done elsewhere.

## Acknowledgements

This study was supported financially by a Contribution Agreement with Natural Resources Canada, the Canadian Foundation for Climate and Atmospheric Sciences and the Federal Government of Canada International Polar Year Thermal State of Permafrost in Canada Project. Dr. J. Peter Johnson and Daisy-Claire Hartmann-Brenner generously provided data for the Kluane Ranges. Special thanks are given to Dr. Luke Copland for the use of facilities in the University of Ottawa's Laboratory for Cryospheric Research. Jenny Throop

assisted in the field. Yukon College helped with accommodation during the fieldwork period.

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## 7.2 Research note: Measuring change in Yukon's rock glaciers from multi-temporal air photo analysis

Paper intended for submission to the Canadian Journal of Remote Sensing

**Statement of contribution**:

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**Andreas Kääb** – research planning, technical instruction, analysis and interpretation assistance, written presentation (software capabilities and error analysis), editing

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### Abstract

The feasibility of assessing rock glacier change, in particular horizontal displacements, using multi-temporal photogrammetric methods with the quality and frequency of air photos available for the Canadian North, was evaluated for several sites in the Yukon. Results showed that it is possible to determine general rates of flow and to observe changes in macro-features using the

examples tested. The quality of the photo scans available, problems with photo compression and photo distortion, and visual and physical obstructions (cloud cover and thermokarst) prevented the creation of detailed fields of flow vectors for entire rock glaciers. Extensive thermokarst development was observed in one case and maximum flow rates ranging between 28 and 117 cm $yr^{-1}$ were measured. This study shows that it should be possible to measure rates of rock glacier movement from original air photos or high quality scans.

## Introduction

A small body of European (Kääb and Vollmer, 2000; Kääb *et al.*, 2002; Kaufmann and Ladstädter, 2002; Frauenfelder *et al.*, 2004; Stozzi *et al.*, 2004; Wangensteen *et al.*, 2006; Roer and Nyenhuis, 2007) and North American (Janke, 2005) research has been developed showing that multi-temporal air photos can be used to measure flow rates and thickness changes on rock glaciers. These studies have been carried out mainly with high quality air photos taken from low flying heights (often 1:15000). Some studies, however, used regular map-update air photos, similar to the ones used in this study. Other areas that have high concentrations of rock glaciers, like the Canadian northwest, do not have coverage by high quality air photos (usually 1:35000 to 1:60000) but do have coverage over large areas, often for multiple dates (between 1947 and present, with many of the photos being from the late 1940s, mid-1970s, and mid-1980s). This study was thus designed to test the possibility of using these photos to measure rates of rock glacier flow.

Little is known about rock glacier dynamics for Canadian examples. A few case studies exist that include surveyed flow rates (Hughes and Rapp, 1965 as cited by Jackson and Macdonald, 1980; Johnson and Nickling, 1979; Jackson and Macdonald, 1980; Blumstengel and Harris, 1988; Johnson, 1998; Sloan and Dyke, 1998), but no large-scale or systematic attempt has been made to measure them. However complete air photo coverage of the North exists at 1:60000 and very extensive coverage exists at a scale of 1:40000. Given that such coverage is available, it appeared worthwhile to test its usefulness for regional-scale photogrammetric monitoring techniques.

## Study area

Study sites were chosen from Page *et al.*'s (in review) rock glacier inventory based on site characteristics and air photo availability. The locations chosen fall within the discontinuous permafrost zone of Canada's Yukon Territory (see Figure 1). Each site has an active rock glacier, with two lobes, except for the Haines Junction North site, which has only one. The White River, Haines Junction, and Haines Junction North sites all are located between the Kluane Mountains to the west and the Shakwak Trench to the east. The Sloan and Dyke 1-1 site (so called for Sloan and Dyke's (1998) study of the site) is situated within the Selwyn Mountains in the eastern portion of the Territory, close to the border with the Northwest Territories.

All climate stations in the southern Yukon exhibit mean annual air temperatures (MAATs) below 0°C (Environment Canada, 2004), meaning that the potential for permafrost exists. The distribution of climate stations is limited,

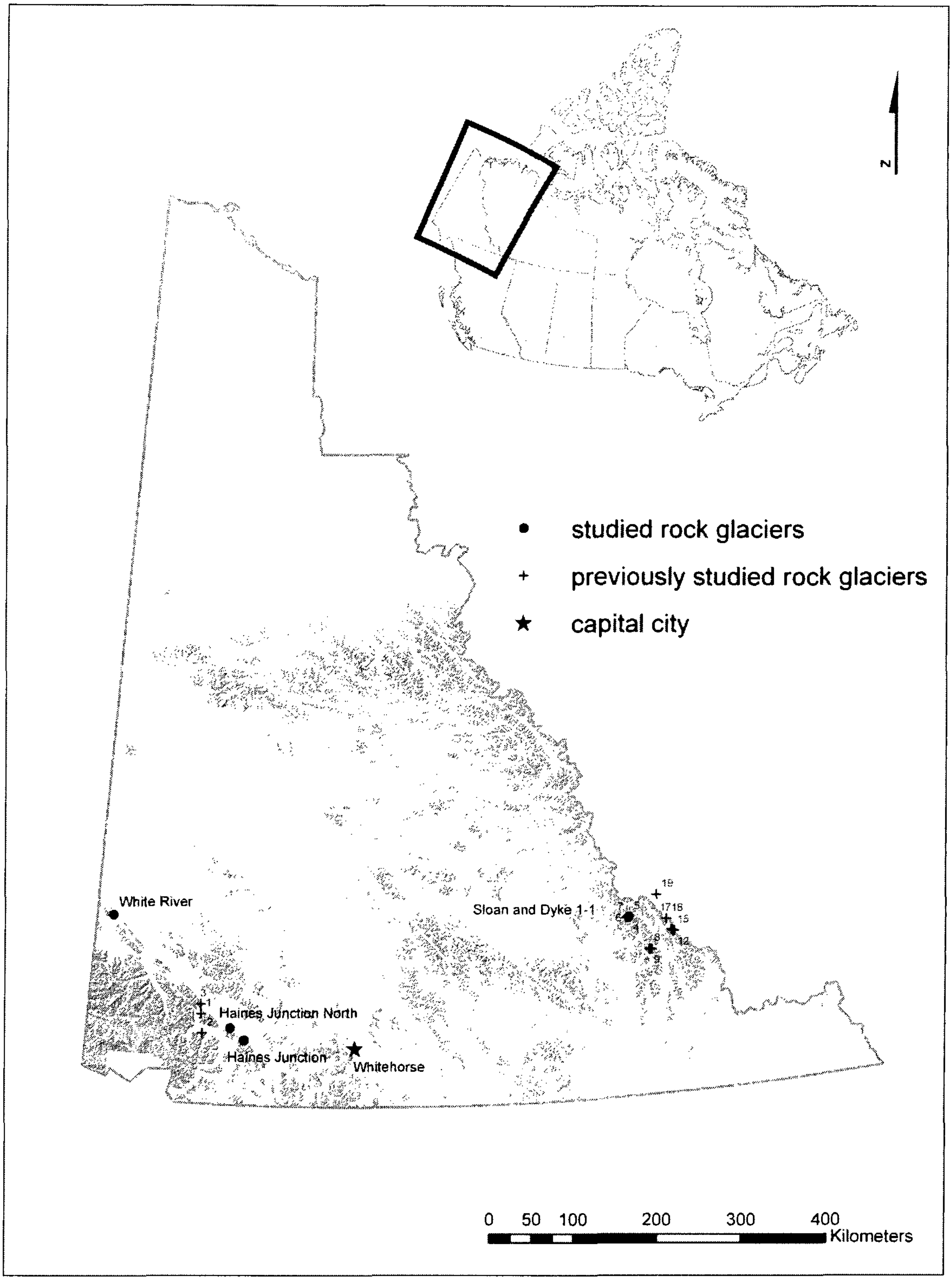

Figure 1 - Study sites and previously studied sites in the Yukon territory, Canada. Terrain with elevation above 1500 m asl shown in grey. Numbered sites have measured movement rates published in the literature (see Table 4): 1 – Slims River, 2 – Maxwell Creek, 3 – Sheep Mountain, 4-18 – Selwyn Mountains, 19 – Tungsten.

as they are few in number and none are located above 830 m elevation. Due to the limited climate data, little is known about the exact climate conditions in upper elevations: nearly half of the terrain is at an elevation of 1000 m or greater.

The study area covers a landmass that experiences a shift from a wetter, more maritime climate in the southwest (near the North Pacific Ocean) to a more arid climate on the inland side of the St Elias Mountains (Wahl *et al.*, 1987). Permafrost distribution in the Yukon is essentially continuous (underlying 90% of the terrain or greater) north of 65°N and sporadic discontinuous (10-50%) or extensive discontinuous (50-90%) south of 65°N.

The photos used for the four sites had resolutions between 1:35000 and 1:50000. The dates between pairs of photos were variable (evenly spaced photo intervals were not available), and range between 13 and 40 years. Topographic and photo information is provided in Table 1.

## Methods and challenges

### *Photo and data acquisition*

A selection of the largest rock glaciers from Page et al.'s (in review) inventory was chosen. This selection was then narrowed, using the resources of the National Air Photo Library in Ottawa, to those sites with at least two periods of photo coverage, aiming for sites where the separation between photo dates was approximately 30 years or greater. The best 10 of the possible sites were chosen based on visibility of the rock glaciers in the photos. Finally the three most promising sites in terms of rock glacier size and airphoto coverage and quality were chosen to be included based on preliminary analysis of the photos.

**Table 1 - Topographic and photo data for studied sites**

| Site name | Elevation (m) | Slope (°) | Aspect (°) | Area ($km^2$) | Roll and photo # | Date | Resolution |
|---|---|---|---|---|---|---|---|
| White River | 1401.6 | 18.6 | 69.8 | 2.012 | A11537-87<br>A27370-78 | 1948<br>1988 | 1:40000<br>1:50000 |
| Haines Junction | 1221.1 | 10.7 | 27.8 | 3.089 | A11539-40<br>A23898-134 | 1948<br>1974 | 1:40000<br>1:35000 |
| Haines Junction North | 1762.1 | 13.8 | 53.5 | 1.427 | A11478-40<br>A23794-119<br>A27217-216 | 1948<br>1974<br>1987 | 1:40000<br>1:35000<br>1:50000 |
| Sloan and Dyke 1-1a | 1746.5 | 12.7 | 6.5 | 0.431 | A12343-139<br>A27020-248 | 1949<br>1986 | 1:40000<br>1:50000 |
| Sloan and Dyke 1-1b | 1656.8 | 18.7 | 12.9 | 0.483 | A12343-139<br>A27020-248 | 1949<br>1986 | 1:40000<br>1:50000 |

The Sloan and Dyke 1-1 site was included because it has been previously surveyed, which provides a measure against which to compare the technique being tested in this study. All of the sites have two dates of photo coverage except for the Haines Junction North site, which has three.

The photos were scanned from photographic copies of the original photos at about 20 micron resolution and saved as .jpg files. Due to the experimental nature of this study and the relatively poor quality of the available photographic copies, the .jpg files were used and not replaced with uncompressed .tif files. The jpg-compression certainly reduced the quality of the image matching described below. The photographic copies scanned were, in many cases, old, with water damage and possibly distorted by humidity. It was not the purpose of this feasibility study to rely on the original negatives, copies of which are expensive to obtain, but rather to prepare for a more extensive future study that might rely on the original photos. The times between photo pairs was variable and their use was simply based on what was available in the archive. Some of the photos contained shadows from clouds but no better images were available. A final problem encountered was that camera calibration information, aside from focal length, was missing from all of the older photos. Fiducial mark locations were measured manually and an average for each photo was used.

The multitemporal image correlation procedure used in this study is based on repeat orthoimages. Rather than creating elevation models from stereo images as would be possible in theory from the air photos available, it was decided to use an existing 30 m digital elevation model (DEM; Yukon Department of Environment, Information Management & Technology Branch, 2005) for the creation of all orthophotos. Because of this, only horizontal rock glacier displacements were measured and not vertical changes. The DEM was generated from contours digitised from a topographic map and its quality is not perfect, as the interpolation used left the contours visible in the resulting DEM, effectively creating steps in the interpolated topography.

An additional comparison was carried out on the Sloan and Dyke 1-1 site, using georeferenced versions of the photos rather than orthophotos. This technique allowed elevation to be removed from the process of assigning geographic coordinates, since vertical movement is not being measured.

### *Software*

The software Geomatica PCI OrthoEngine was used for the creation of orthoimages. The major challenge in using this software was that it is incapable of having more than one camera calibration per "project", i.e. if one wishes to create two or more orthoimages at the same time, with the same ground control and tie points, all of the photos must have the same camera calibration values. This, of course, was not the case when the photos were taken 30 or 40 years apart, so the camera calibration values were averaged between the values for each different camera to create an "average camera calibration" that would be acceptable for all of the images. The combination of all multitemporal images within one photogrammetric model and a combined multitemporal bundle adjustment is a recommended measure in order to minimize distortions between the multitemporal orthoimages (Kääb and Vollmer, 2000). Errors in the "average camera calibration" relative to the correct parameters will mainly result in an incorrectly solved flying height for the photos used, and has a lesser effect on the orthoimages computed. In fact, comparisons showed that the orthoimages from the multitemporal image blocks matched significantly better than orthoimages from separate monotemporal photogrammetric models but using correct calibration parameters. For an extended study we recommend using a photogrammetric software capable of using more than one camera model within one image block (Kääb and Vollmer, 2000).

In one case, it proved impossible to create an "average camera", because the locations of the fiducial marks differed (corner vs. edge) on photos from the same site. Ground control and tie points were located by visually matching the locations.

For the analysis at the Sloan and Dyke site using georeferenced photos instead of orthophotos, ESRI's ArcMap was used to georectify the newest photo (A27020 – 248, 1986) to a Landsat image of the site (L71056017 01720010817 B50) and then to georectify the older image (A12343 – 139, 1949) to the newer one.

### *Ground control and tie point collection and orthophoto creation*

As mentioned above, ground control points and (multitemporal) tie points for the creation of the orthophotos were collected concurrently for all photos of the same study site. This way, all orthophotos for each site were created from the same photogrammetric model, ensuring the best possible match between the repeat orthoimages (Kääb and Vollmer, 2000).

Collecting sufficient ground control and tie points, as well as collecting accurate enough ground control and tie points to allow a good match between the same location in each of the resulting orthophotos, was a challenge, caused both by the poor image quality and especially by the comparatively low resolution of the DEM used. However, in the end, ground control point residuals were less than or equal to the original DEM resolution (30 m, RMSE of 30 or less) and the average ground control point residuals about half of that. While this accuracy describes the absolute georeference accuracy of an entire image block, the relative accuracy between the images is much better as ensured by the multitemporal tie points. Their accuracy was in the order of 1 m (ca. 1-2 pixels) on average.

The collection of tie points for the georeferencing process at the Sloan and Dyke site was not concurrent between the photos from the two time periods. The smallest error it was possible to obtain in georectifying the 1986 photo (A27020 - 248) to the Landsat image (L71056017 01720010817 B50), using a third order transformation, was a RMSE of 85.6, over twice what was possible with the orthophoto creation. The older photo (A12343 – 139) was then georectified to the georeferenced 1986 photo using a first order transformation resulting in a RMSE of 55.3, also higher than that obtained in the orthophoto creation. The higher errors are likely due to the fact that first and third order transformations are much lower order transformations than that used creating an orthophoto. It is a trade-off between the possibility of artificially moving features on the image (lower with the georeferencing method) and the goodness of fit between the tie points selected for the images (higher with the orthophoto creation), both of which are potential sources of error.

### *Velocity measurement*

Displacements between the multitemporal orthoimages were determined using the CIAS software (Kääb and Vollmer, 2000), which measures displacements by double cross-correlation between the orthophotos and georeferenced photos. The software possesses the capability to match displacements on a grid to produce a raster movement field, but due to the poor photo quality better results were achieved by having the software match user-selected points with the operator verifying that the match had been made correctly, a finding in agreement with the conclusions of Kääb and Vollmer (2000).

A Helmert correction function was used, in which stable points outside the rock glaciers were selected and matched before measuring movement, and residual co-registration parameters computed and applied to the raw displacements. This ensured that movement was measured relative to stable points and helped reduce the impact of imperfect matches between the orthophotos and georeferenced photos.

A window size must be defined for the software as it automatically finds the most similar site in one airphoto relative to the other one using this window. For high-resolution photos, a small window size is best because small features are visible, but for lesser resolution photos a large search window usually must be used because only large features on the rock glacier surface are discernible.

In this study a combination of 25 pixel (for comparably distinct features such as big rocks) and 60 pixel (for topographic features such as ridges) square windows were used. The results do not distinguish between measurements derived from the two window sizes.

One drawback to the software used is that it has no means of anomaly detection built into its matching mechanism. In other words, if a match is made between points that, for example, indicate a backward flow of the rock glacier, the software has no means to flag it as a potential error, since the user is unable to assign a flow direction. Nor is the software able to make an automatic comparison with the directions of the movement vectors already measured. Such filters have to be applied in a post-processing step (Kääb and Vollmer, 2000). However, the software provides the correlation value for each measurement.

Measurement values should be within the accuracy of the technique as they are reported or represented visually in this paper. The shortest time difference between photos is 13 years (1974 to 1987 at the Haines Junction North site), at which a rate of movement of 10 cm $yr^{-1}$ would be detectable based on the resolution of the photo. All other photo pairings have longer time intervals and it is thus possible to detect smaller rates of movement.

Once movement vectors had been derived, all measurements for which the correlation coefficient for the feature match between the two photos was less than 0.7 were discarded. The vectors were then exported for display and analysis in a GIS.

## Results

Orthophoto-based results are available for four rock glacier sites on a total of seven lobes (Figures 2-5A). And georeferenced photo-based results are available for one rock glacier site on a total of two lobes (Figure 5B).

A limited number of corresponding features between the multitemporal images were found due the low air photo quality and the lengthy elapsed time between image dates. In one case, strong surface change due to thermokarst activity prevented measurements in the areas where thermokarst was present. Maximum rock glacier velocities at the sites examined on orthophotos range from 66 to 117 cm $yr^{-1}$ (Table 2). When looking at each lobe of a rock glacier separately, the lobe with the highest maximum velocity also has the highest median velocity (calculated from the 10 fastest measured values), except in the case of the White River site (Figure 2) where the north lobe has a higher maximum velocity but a lower median. This low median could be because there are fewer measurements on the north lobe than on the southern one.

Although feature matching between photos of different periods was supervised and the features were matched correctly, in some areas "upwards" flows appeared to be present. These errors are probably caused by errors in orthophotos as of result of inaccuracies in the elevation model used for their creation, or mismatches where a feature receiving high correlation values was not actually a corresponding feature. Such results are not surprising given the low photo quality and long time span between the successive images, and they were discarded as obvious errors.

In the case of the Haines Junction North site (Figure 3), where two

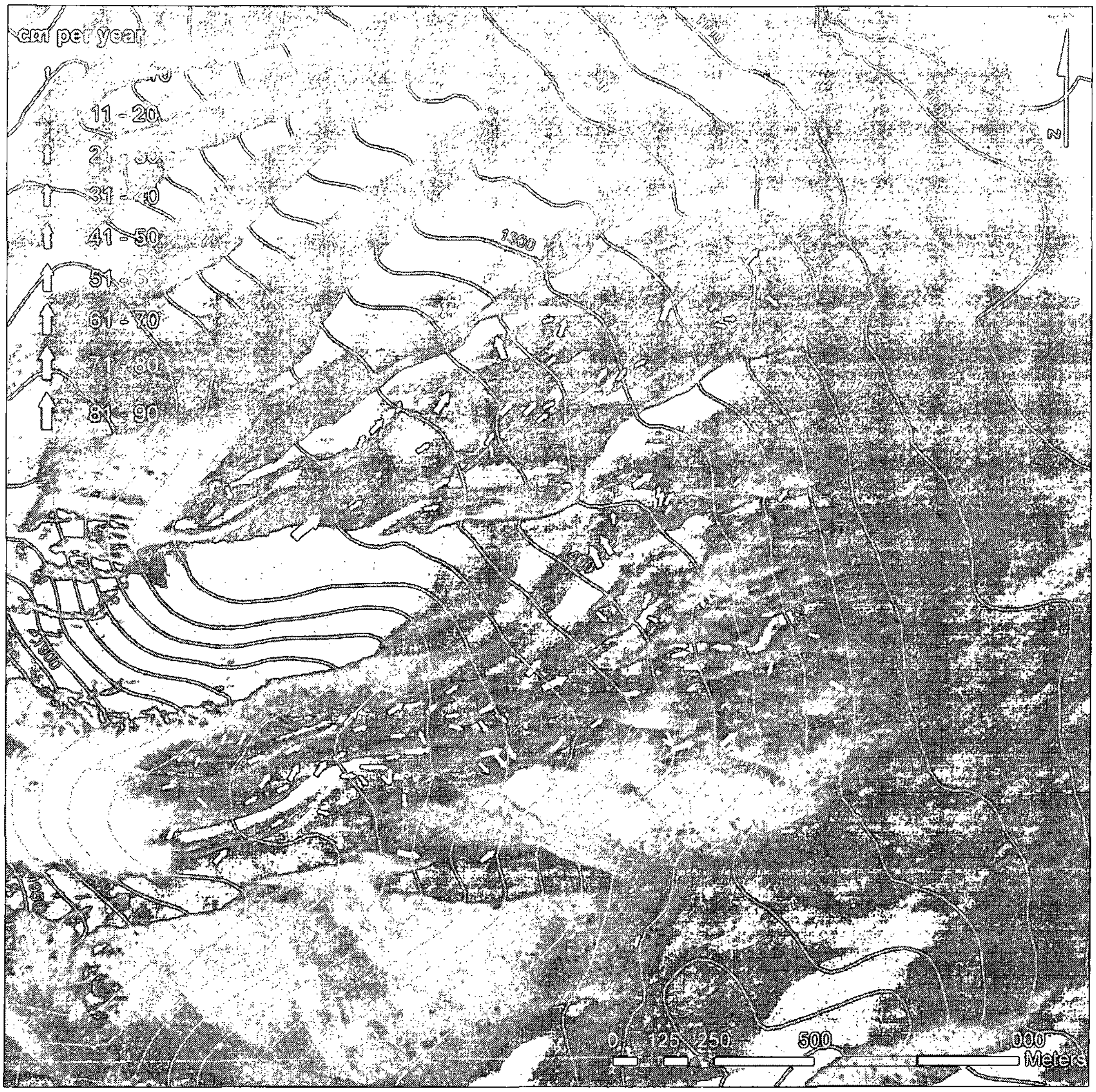

Figure 2 - White River, showing movement vectors derived from orthophotos, arrows sized relative to movement in cm yr$^{-1}$, 1948-1988 (photo: National Air Photo Library of Canada, A27370-78).

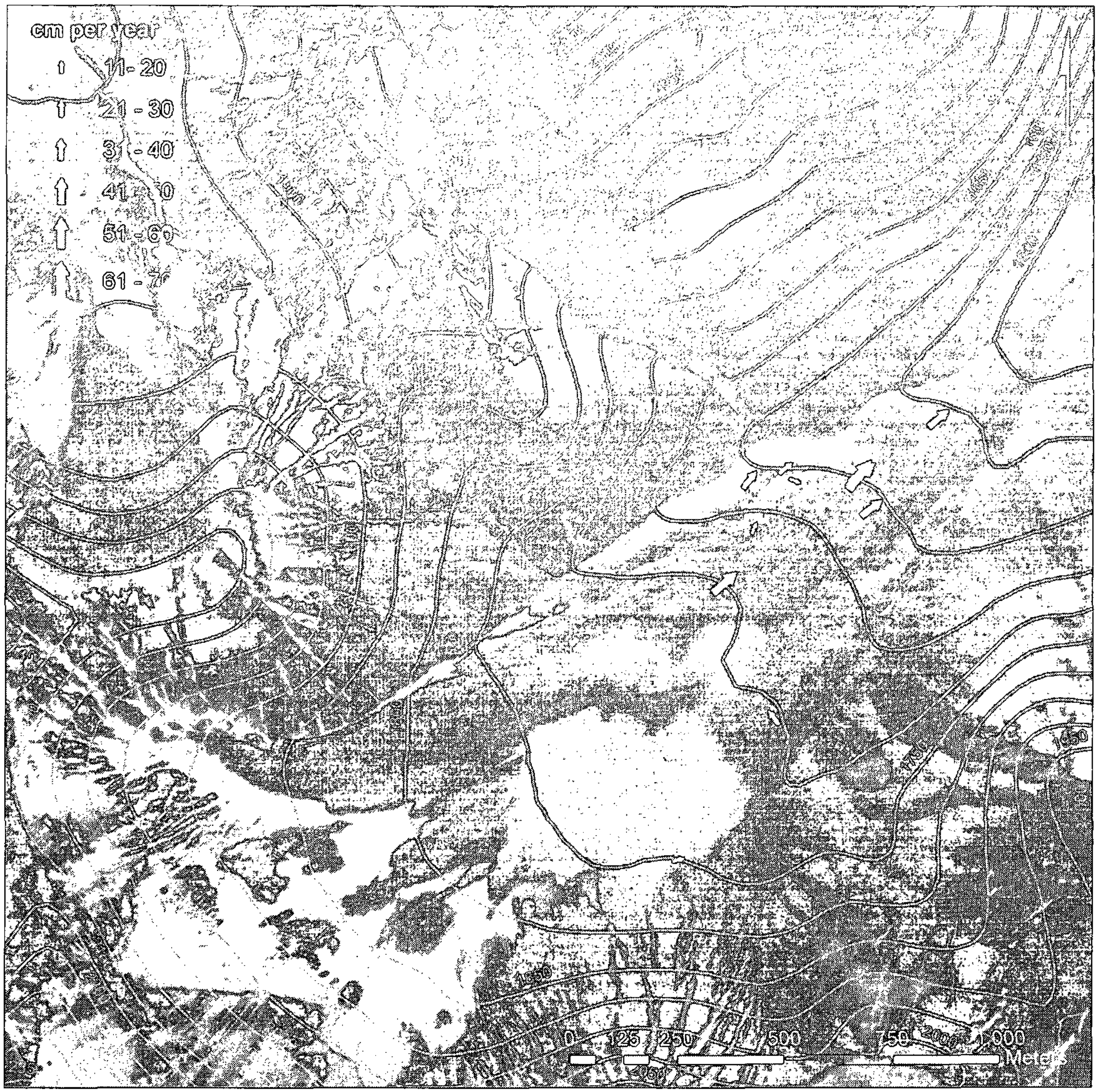

Figure 3 – Haines Junction North, showing movement vectors derived from orthophotos, arrows sized relative to movement in cm yr$^{-1}$, 1948-1987 (photo: National Air Photo Library of Canada, A27217-216).

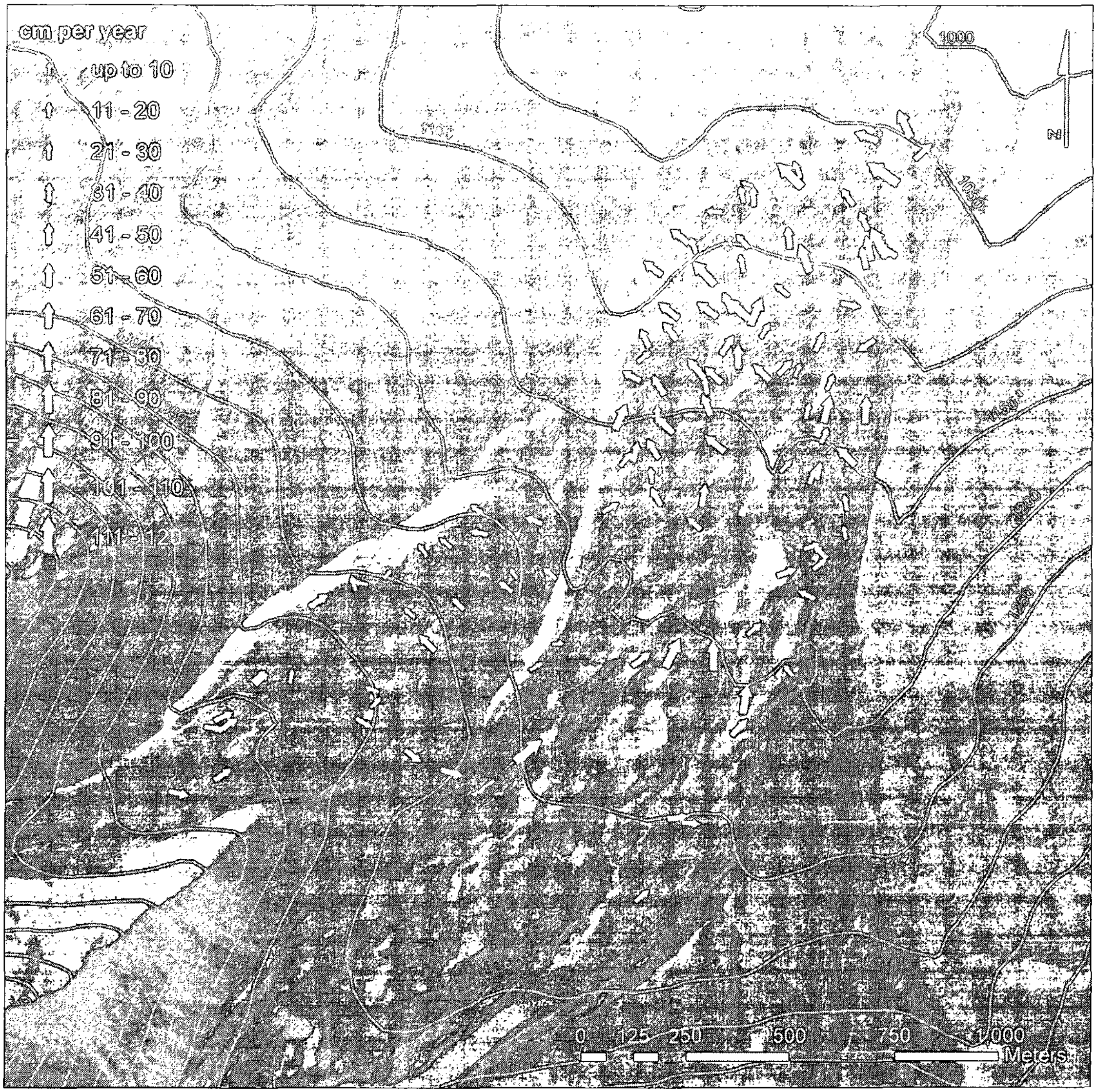

Figure 4 – Haines Junction, showing movement vectors derived from orthophotos, arrows sized relative to movement in cm $yr^{-1}$, 1948-1974 (photo: National Air Photo Library of Canada, A23893-134).

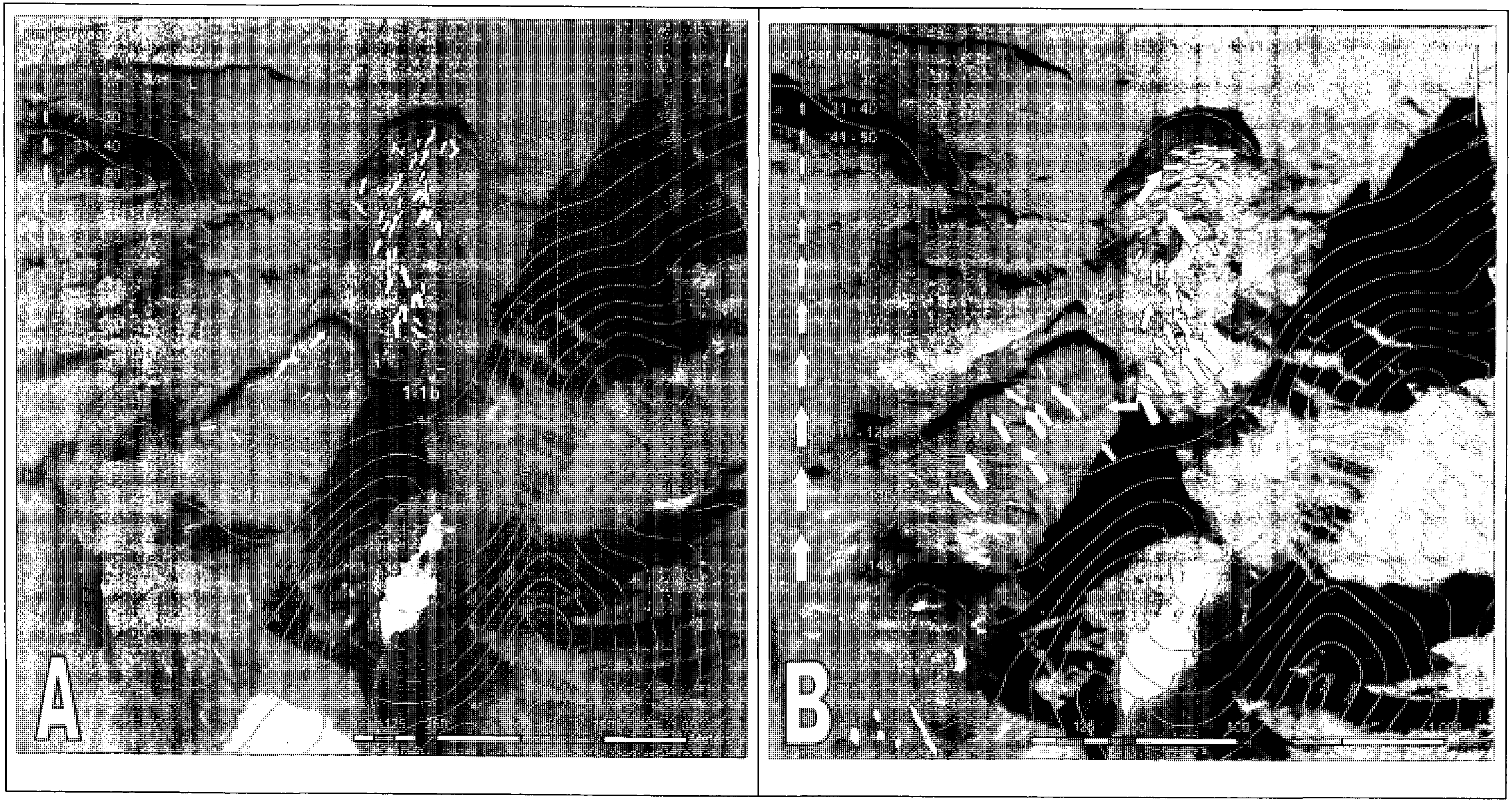

Figure 5 – Sloan and Dyke 1-1, showing movement vectors derived from orthophotos (A) and georeferenced photos (B), arrows sized relative to movement in cm yr$^{-1}$, 1949-1986 (photo: National Air Photo Library of Canada, A27020-248).

**Table 2 - Rock glacier maximum annual velocities**

| Site | Lobe (*n*) | Maximum velocity (cm yr$^{-1}$) | Median velocity of top 10 (cm yr$^{-1}$) |
|---|---|---|---|
| **Sloan and Dyke 1-1<br>1949-1986<br>GEOREFERENCED PHOTOS** | **both (45)** | **136** | **117** |
| | 1-1a (14) | 121 | 95 |
| | 1-1b (31) | 136 | 109 |
| **Sloan and Dyke 1-1<br>1949-1986<br>ORTHOPHOTOS** | **both (85)** | **66** | **50** |
| | 1-1a (27) | 61 | 38 |
| | 1-1b (58) | 66 | 47 |
| **White River<br>1948-1988** | **both (124)** | **83** | **48** |
| | north (32) | 83 | 28 |
| | south (92) | 58 | 45 |
| **Haines Junction North<br>1948-1987<br>(Coverage for 1974 also exists)** | **both (11)** | **67** | **39** |
| **Haines Junction<br>1948-1974** | **both (117)** | **117** | **97** |
| | large (89) | 117 | 97 |
| | small (28) | 58 | 49 |

different periods of photo coverage were available, the maximum velocity of 32 points measured over the 26 years from 1948 to 1974 was 86 cm yr$^{-1}$ (Table 3). For the 13 years between 1974 and 1987, the maximum velocity measured over 33 points was 201 cm yr$^{-1}$. For the entire period (1948 to 1987), it was only possible to find 11 matching features, and for those, the maximum velocity was 67 cm yr$^{-1}$.

In addition to flow velocities, it was also possible to see the development of extensive thermokarst at the Haines Junction site. This caused problems when trying to find features to match on the earlier and later photos, but was interesting in its own right. The thermokarst was particularly evident in the mid-section of the rock glacier, in the flat area between the slope near the cirque wall and the slope of the cirque outlet. The thermokarst had begun developing at the time of the earlier photo (1948, Figure 6A) and had significantly altered the surface appearance of the entire middle portion by the time of the second photo in 1974 (Figure 6B). The presence of thermokarst indicates that at least parts of the rock glacier are (or once were) ice-rich. The lower portion of the rock glacier appears intact and shows movement typical of that expected on an active rock glacier.

The comparison between the two measurement techniques at the Sloan and Dyke 1-1 site yielded two very different sets of results. The measurements derived from orthophotos gave a maximum velocity for the two lobes of 66 cm yr$^{-1}$, while the maximum velocity derived from the georeferenced photos was 136 cm yr$^{-1}$. The rates of each lobe as measured from georeferenced photos were about twice those measured from orthophotos.

**Table 3 - Haines Junction North site, changes in maximum velocity over time**

| | Number of points | Mean direction (°) | Maximum velocity (cm $yr^{-1}$) |
|---|---|---|---|
| 1948-1974 | 32 | 34 | 86 |
| 1974-1987 | 33 | 51 | 201 |
| 1948-1987 | 11 | 46 | 67 |

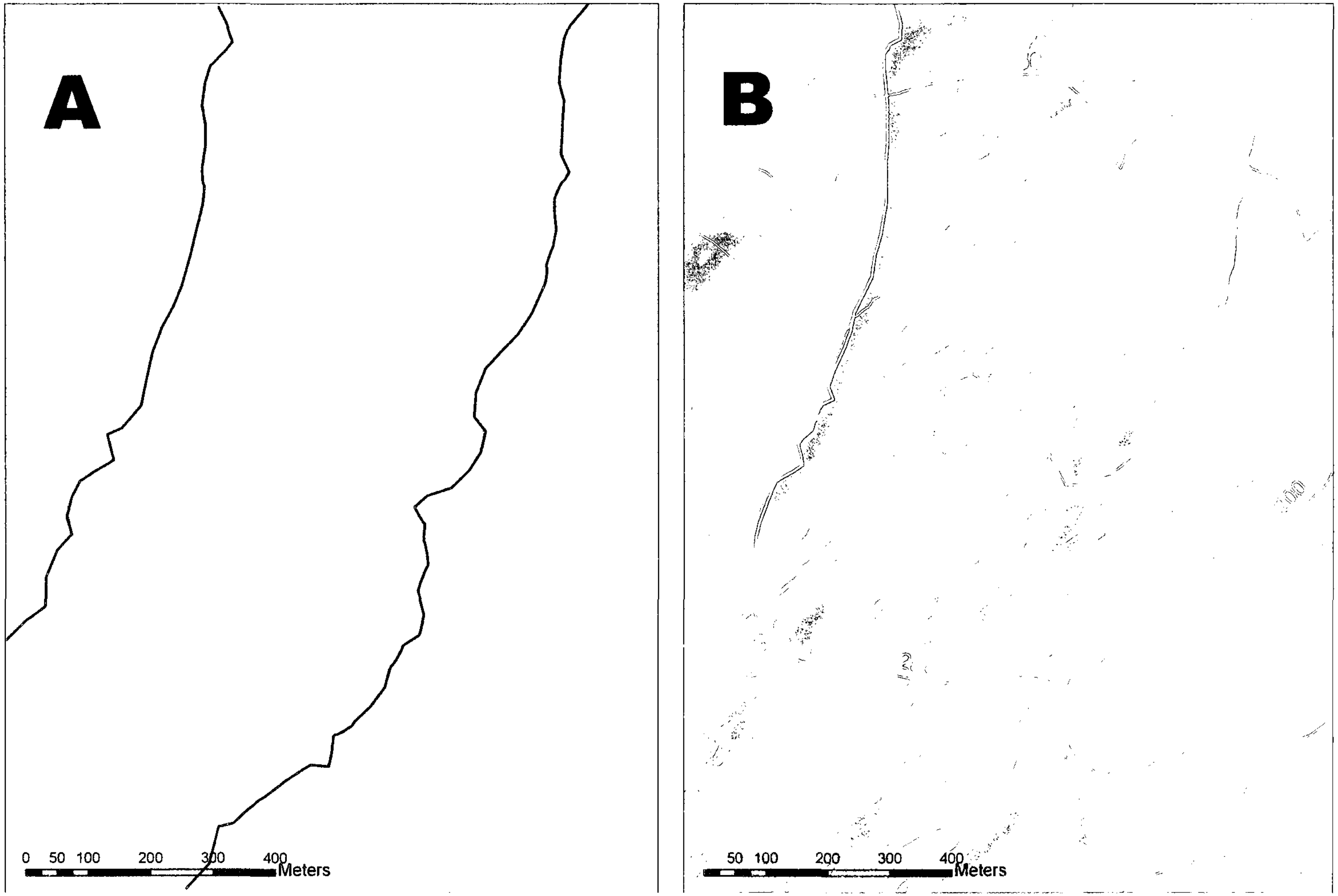

Figure 6 - Thermokarst development at the Haines Junction rock glacier site. A: 1948 photo (National Air Photo Library of Canada A1539-50; B: 1974 photo (National Air Photo Library of Canada A23893-134). Rock glacier extents are marked with heavy lines and prominent thermokarst features are highlighted in green.

## Discussion

### *Comparison with previous measurements*

The rock glacier velocities measured in this study fall within the range of values measured previously for other sites from 0 to more than 300 cm $yr^{-1}$ (Figure 1 and Table 4). Our measured values from orthophotos for the Sloan and Dyke 1-1 site of 61 and 66 cm $yr^{-1}$for lobes 1-1a and 1-1b, respectively, are each within 20 cm of their measurements of 43 and 72 cm $yr^{-1}$. The comparison is not precise because their survey encompassed 12 years of change (1983-1995), while the present study spans 37 years. The orthophoto technique appears to be deriving measurements of the correct order of magnitude, though more studies comparing the results with surveyed data are needed. The technique using georeferenced photos, on the other hand, gave measurements a great deal larger than those derived from either surveying or the orthophoto method, drawing its accuracy in this case into question. That is not to say the technique is invalid for this application, just that its use necessitates similar geomoetries for the two photos, and this was not the case here.

### *Velocity change through time*

A detailed examination of the two periods of photo coverage, as well as the total change, at the Haines Junction North site was undertaken to see if the apparent increase in velocity (Table 3) was reliable. The lack of any comparisons of identical features on all photo pairs (1948 and 1974, 1974 and 1987, and 1948 and 1987) made it impossible to say if the measured values were entirely accurate (i.e. total movement adding up to the sum of the two shorter increments,

**Table 4 - Previously measured Yukon rock glacier velocities**

| # on Fig 1 | Location | Movement rates | Method | Reference |
|---|---|---|---|---|
| 1 | Slims River Valley, Yukon | 0-20 cm yr$^{-1}$ at front<br>200 cm yr$^{-1}$ central lower portion | field survey | Blumstengel and Harris (1988) |
| 2 | Maxwell Creek, Yukon | 0.15 cm yr$^{-1}$ | inferred from overridden paleosols | Johnson (1998) |
| 3 | Sheep Mountain, Yukon | 10 cm yr$^{-1}$ lobe 1<br>20-30 cm yr$^{-1}$ year lobe 2<br>60 cm yr$^{-1}$ maximum lobe 2 | field survey | Johnson and Nickling (1979) |
| 4* | Selwyn Mountains, Yukon | 43 cm yr$^{-1}$ 1, rock glacier 1a | field survey | Sloan and Dyke (1998) |
| 5* | | 72 cm yr$^{-1}$ site 1, rock glacier 1b | | |
| 6 | | 37 cm yr$^{-1}$ site 1, rock glacier 2 | | |
| 7 | | 8 cm yr$^{-1}$ site 1, rock glacier 3 | | |
| 8 | | 15 cm yr$^{-1}$ site 3, rock glacier 1 | | |
| 9 | | 8 cm yr$^{-1}$ site 3, rock glacier 2 | | |
| 10 | | 6 cm yr$^{-1}$ site 3, rock glacier 3 | | |
| 11 | | 57 cm yr$^{-1}$ site 3, rock glacier 4 | | |
| 12 | | 12 cm yr$^{-1}$ site 4, rock glacier 1 | | |
| 13 | | 18 cm yr$^{-1}$ site 4, rock glacier 2 | | |
| 14 | | 9 cm yr$^{-1}$ site 4, rock glacier 3 | | |
| 15 | | 24 cm yr$^{-1}$ site 4, rock glacier 4 | | |
| 16 | | 60 cm yr$^{-1}$ site 4, rock glacier 5 | | |
| 17 | | 22 cm yr$^{-1}$ site 5, rock glacier 1 | | |
| 18 | | 127 cm yr$^{-1}$ site 5, rock glacier 2 | | |
| | | 35 cm yr$^{-1}$ mean for all rock glaciers | | |
| 19 | Tungsten, Northwest Territories | 51 cm yr$^{-1}$ maximum on surface | field survey | Jackson and Macdonald (1980) |
| 19 | Tungsten, Northwest Territories | 125 cm yr$^{-1}$ maximum at front<br>325 cm yr$^{-1}$ maximum on surface | field survey | Hughes and Rapp, 1965 as cited in Jackson and Macdonald, 1980 |

* Re-measured in this study

etc). Table 5 shows total measured movements for the three locations at which nearby measurements were possible. The differences in maximum velocities for three comparisons were quite high, with the later interval having a very high velocity of over 200 cm $yr^{-1}$. Again, because the features matched on each pair of photos were different, it is impossible to state conclusively that the apparent increase in velocity over time is, in fact, an increase. Other possibilities are that velocities have been as high throughout but in locations with no distinct features, or that the high velocity is an error. It must be noted, however, that the maximum value of 201 cm $yr^{-1}$ does not appear as an outlier, as measurements of 171 and 136 cm $yr^{-1}$ were also made.

### *Impact of photo quality*

The number of measurements possible on each given image pair was quite variable. There were several factors that influenced what was possible at each site. In the case of the Sloan and Dyke 1-1 site, the photo quality was quite good, and only the upper most parts of the rock glacier had shadow present that prevented measurements being taken there. At the White River site, the photo was poorer, meaning that it was possible only to identify macroforms as matchable features, such as ridges and furrows. Clouds on the photos blocked the view of parts of the rock glacier. At the Haines Junction site, the photo quality was good and many features were readily identifiable in the areas outside thermokarst development. In the areas with thermokarst development, however, changes were so extensive that identifying common features was impossible. At the Haines Junction North site, the quality of the 1948 photo was quite poor and

**Table 5 - Differences between total measured displacements and sub-divided measured displacements at the Haines Junction North site**

| Location | Period 1: 1948-1974 | Period 2: 1974-1987 | Total period: 1948-1987 | Difference |
|---|---|---|---|---|
| 1* | 5.0 m | 1.8 m | 10.5 m | -3.6 m |
| 2 | 15.3 m | 3.8 m | 18.0 m | 1.2 m |
| 3* | 5.6 m | 22.2 m | 20.9 m | 7.0 m |

*Movements were not all in exactly the same direction.

there was snow cover on much of the upper parts of the rock glacier, obscuring surface features. The 1974 photo was also taken when snow remained on the rock glacier, but the photo quality was better. The quality of the 1987 photo was also acceptable, but approximately one third of the rock glacier was covered by snow or blocked from view by clouds or their shadows.

None of the orthophotos overlaid perfectly with the other(s) for that site; in every case there were at least some areas with visually detectable discrepancies. During the creation of the orthophotos, attempts were made to ensure that these discrepancies did not affect the parts of the photos occupied by the rock glaciers.

Additionally, the possibility of tracking thermokarst development on rock glaciers (and indeed elsewhere) from multi-temporal air photo analysis was an unforeseen option. Thermokarst development impedes the measurement of surface velocities from air photos, but it is a phenomenon that is relevant to rock glacier activity.

### *Error analysis*

The cumulative error of our orthophoto measurements may be relatively high. This includes the following main terms (Kääb and Vollmer, 2000):

(1) Absolute orientation errors (i.e. ground control points) lead to a deviation between the airphotos and the DEM used for orthoprojection. The resulting error is similar to a vertical error in the DEM. Here, we achieved an absolute orientation better than the DEM resolution of 30 m.

(2) Vertical elevation errors lead to horizontal distortions in the orthoimages. This effect is proportional to the elevation error and the radial distance from the image centre. We tried to minimize this effect by choosing air photos that showed the studied rock glaciers in their centre. However, we consider this error term as one of the largest in our study, potentially introducing several meters of horizontal uncertainty for locations with large DEM errors. Such DEM errors stem from erroneous air photo compilation, contour line interpolation, and, in our case, from the fact that the DEM data does not always match the date of the orthoimages. Elevation changes over time introduce DEM errors. We consider this effect to be mainly relevant for the Haines Junction rock glacier that showed strong thermokarst development.

(3) Relative errors between the multitemporal orthoimages from errors in the relative orientation (i.e. tie points) or from air photo distortions introduce displacements that are not related to actual terrain movement. While we achieved a relative orientation accuracy in the order of 1-2 pixels for stable ground, the relative accuracy cannot be directly assessed over the rock glaciers, because their movement prevents the location of tie points on them. In addition to DEM errors we consider distortions of the photographic copies used to be the largest error contributor in our error budget. We attempted to minimize these effects by section-wise co-registering of the measurements using stable ground (see above described Helmert correction).

(4) Lack of suitable features in the images and mismatches between non-corresponding features over time are described above.

From the error budget considerations it is clear that measurement of an individual displacement might not be significant, with potential errors of the same size or even exceeding the true terrain displacement. The displacement results of this study should therefore be viewed as a group, and general flow patterns (or median values; see Table 2) should be interpreted rather than individual measurements (see Table 5).

The error in the measurements from the georeferenced photos is also likely to be high. This method removed the errors caused by elevation but added errors in image matching that were greater than with the previous method.

## Conclusions

This feasibility study shows that multi-temporal air photo analysis is a promising means of measuring Canadian rock glacier velocities in areas where multiple photo coverage exists. Indeed, even with what may be considered to be a "worst case scenario" when it comes to data quality, it was still possible to produce reasonable results. Our study showed that it is possible to measure rock glacier movement even over time periods of several decades, here around 40 years. This points to a large surface stability and coherent deformation in space and time of the rock glaciers investigated, that in turn suggests a considerable thermal stability. One site, however, showed pronounced thermokarst development and it would be interesting to investigate further whether this is due to its specific climatic or topographic settings, or changing boundary conditions.

For the Sloan and Dyke 1-1 site, where both the orthophoto and georeferenced photo techniques were tried, the orthophoto method appears to give results more in line with the values obtained by surveying. This does not negate the potential value of the georeferenced photo technique, but illustrates that it can only be effectively applied in instances where the geometry of the photos is very similar.

Although the results are not conclusive, the preliminary measurements obtained at the Haines Junction North site indicate that the rock glacier there has been moving at speeds of up to 2 m/year over the 1974 to 1987 period.

Before using this as a definitive measurement technique, further study is needed to compare rock glacier velocities measured from photogrammetric methods to those measured from surveys done on site. A photogrammetric study of the sites already surveyed in northwest Canada would likely be the simplest and most cost-effective way to do this.

Finally, the possibility of monitoring thermokarst development on rock glaciers, and elsewhere, by photogrammetric methods that arose in this study should be explored in more detail. The sites where this is possible are not likely the best sites for measuring rock glacier velocity photogrammetrically, but may reflect parallel or related developments worth studying.

## Acknowledgements

The authors would like to thank Professor Bernd Etzelmüller and the Oslo-Ottawa CryoEx program (funded by SIU, Norway) for supporting this research project. A. Kääb's work is supported by the Research Council of Norway CORRIA project (185906/V30). The National Sciences and Engineering Research Council of Canada, the Canadian Foundation for Climate and

Atmospheric Sciences, and a contribution agreement from Natural Resources Canada to the University of Ottawa provided additional financial support.

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# 8 Conclusions

## 8.1 Answers to research questions

### *8.1.1 Part 1: Statistical topographic comparison*

The first question this research was meant to address was whether lobate and tongue-shaped rock glaciers in the southern Yukon form statistically different populations according to the topographic characteristics examined: elevation, area, aspect and slope. The research showed that lobate and tongue-shaped rock glaciers are statistically different only in elevation. Tongue-shaped forms occur at elevations about 100 to 130 m higher, on average, than lobate forms. There are no statistical differences in the area, aspect and slope of the two morphologies.

Because a statistical difference was present, the next step was to assess whether it could be indicative of the different morphologies being caused by different origins, as suggested by Janke (2007). It is possible that the statistical difference in elevation indicates different origins. It is also possible that the morphologies are more indicative of local topography, which in may be the main determinant of origin.

The final question was to evaluate how the statistical results affect the potential use of rock glaciers as regional permafrost indicators in permafrost distribution modelling. The results affect the possibility of using rock glaciers to indicate permafrost presence for distribution modelling because rock glaciers in the Yukon do not have a strongly zonal elevation gradient when it comes to their level of activity. For this reason, it is impossible to use rock glacier activity to infer local permafrost continuity. Rock glaciers may still, however, be used as single point indicators of permafrost presence.

These findings suggest that there are many factors in addition to the ones examined in this study that affect the morphology, and particularly the activity, of rock glaciers in the Canadian North. This stands in contrast to European and New Zealand examples that found rock glaciers to have strongly zonal activity distributions. Elevation is clearly related to rock glacier morphology in northern Canada, as it is elsewhere, however the exact reason for this remains unclear. It has been hypothesized that origins may determine rock glacier morphology, and it appears true that certain types of topography favour certain morphologies, but the evidence examined in this study shows that it is not a firm rule.

### *8.1.2 Part 2: Experimental photogrammetric dynamics measurements*

The first goal of this part of the research was to determine if it is possible to measure the rates of rock glacier movement from multi-temporal air photos of the quality and frequency available for the Canadian North. It was possible to calculate rock glacier movement rates from multi-temporal air photos from the Canadian collection. In fact, it was possible using compressed scans of poor quality photos, so the prospects for success using uncompressed scans of negatives are great.

The second task, to verify the effectiveness of the photogrammetric measurement method, was to compare the rates measured in this study to those measured previously using other methods. The rates measured in this study ranged from 0 to 2 m $yr^{-1}$, which fit well with earlier measurements of 0 to 3 m $yr^{-1}$

for northern Canadian rock glaciers. The median photogrammetrically-derived velocities measured for Sloan and Dyke's (1998) site 1-1a, 38 cm $yr^{-1}$, and 1-1b, 47 cm $yr^{-1}$, seemed reasonable compared to their measurements of 43 and 72 cm $yr^{-1}$, respectively, given that the measurements accounted for different periods of time.

The final goal of the research was to assess whether there had been any changes to the rates of flow between time periods of photo coverage (where multiple periods of coverage exist). This was possible at one site (Haines Junction North), however the results regarding changes in flow rates over time were inconclusive. This was the result of being unable to compare the movement of identical features on each of the image pairs due to software limitations. Different flow rates were measured between subsequent photo pairs (1948-1974 maximum: 86 cm $yr^{-1}$; 1974-1987 maximum: 201 cm $yr^{-1}$; 1948-1987 maximum: 67 cm $yr^{-1}$), but it is impossible to tell if these differences represent an increase in velocity in the 1974-1987 period, actual velocities from various different locations that have been approximately unchanged all along, or errors in measurement. It must be noted that the 201 cm $yr^{-1}$ measurement does not appear to be an outlier.

Photogrammetric measurement of rock glacier velocities from orthophotos appears to have potential in the Canadian context. This study has shown that the process works and generates reasonable results in spite of many challenges. Measurement from georeferenced photos remains unproven by this experiment. The acquisition of suitable imagery is the main obstacle to the wider application of this technique.

## 8.2 Significance of the work

The database of known rock glacier locations created for the Yukon Territory as part of this study is projected to be an important tool for surficial geologists in the Territory, scientists currently studying permafrost distribution modelling, and for researchers who may undertake further work such as examining spatial relationships between rock glaciers and the factors that create and control them, or determining risk zones in geohazard mapping.

This study represents the first large-scale attempt to couple topographic characteristics with the forms and activity levels of rock glaciers in the Yukon Territory. While many of the factors examined were found to be non-significant statistically, some, like elevation and the combination of aspect and latitude, were found to be clearly related to form and activity level, respectively, of the rock glacier sample. This represents a good foundation on which future work in these areas can be based and gives some early hints as to which are the major controlling variables.

The implications of this work in the field of permafrost distribution modelling are critical. The major consequence of the findings presented here is that rock glacier activity in the southern Yukon Territory does not occur in a highly zonal elevation pattern the way it does elsewhere, and thus cannot be used to infer an associated level of permafrost distribution. As noted above however, rock glaciers are still useful for permafrost distribution modelling, since they are single point indicators of permafrost. The availability of a reasonably complete spatial database should help their use for this purpose.

The feasibility study carried out to determine if rock glacier dynamics could be measured from multi-temporal aerial photography of the quality and frequency available in Canada has achieved a positive result. Despite the fact that most of the data properties were what one might call "worst case scenarios," it was still possible to obtain movement vectors for all the cases attempted. The movements measured where earlier surveying had been done corresponded well with the previously obtained values. Furthermore, this study revealed the possibility of tracking thermokarst development on rock glaciers through photogrammetric methods.

## 8.3 Need for future work

There are many prospects for future research in the areas examined by this thesis. Many of them have been alluded to already, so they will simply be summarized in this section. Firstly, the possibility remains for undertaking a similar study using the entire rock glacier population rather than a sample. Due to the amount of work that would be involved with such a large population, this would be more suited in scope to a PhD thesis. Such a study could also include comparison of factors not included in the present research, such as the influence of vegetation and potential incoming solar radiation, as well as examining relationships between factors included, but not compared, in this study, like the relationship between activity and morphology.

Secondly, there is potential for research into the role of geology in the existence of rock glaciers. This could be done fairly simply given the existence of digital versions of Yukon bedrock geology maps and the rock glacier database created in this study. While this topic encompasses both physical geography and geology, a researcher with a strong background in geology would likely be able to get more out of such a study than a physical geographer, since he or she would be able to go deeper into the rock structure and geochemistry that make a rock type suitable – or not suitable – as a rock glacier substrate.

Finally, there are countless applications for the rock glacier database as a tool for research in areas broadly related to permafrost, climate change monitoring, and geohazards.

When it comes to photogrammetric measurement of rock glacier changes in the Yukon, there is plenty of room for expansion since the research summarized here was essentially the first of its kind, and the technique has been shown to work. A large-scale study of similar design has been suggested in order to get an idea of the rates of change of Yukon rock glaciers, which are essentially unknown. Such a study would involve a great deal of sorting through the available imagery with no guarantee that much of it would be useful. With continued future air photo acquisition, this technique would be very promising and it may also provide a means to monitor the impact of climate change on landforms like rock glaciers whose existence is to a large degree climatically determined.

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## Appendix A - Surficial geology map references

| Map sheet | Name | Author(s) | Scale | Date |
|---|---|---|---|---|
| 95C 08 | Babiche Mountain | Smith, I.R. | 50k | 2003 |
| 95C 09 | Chinkeh Creek | Smith, I.R. | 50k | 2003 |
| 95C 16 | Etanda Lakes | Smith, I.R. | 50k | 2003 |
| 105CDE | Whitehorse | Morison, S.R. and Klassen, R.W. | 250k | 1991 |
| 105F 1791A | Bruce Lake | Jackson, L.E., Jr. | 100k | 1993 |
| 105F 1792A | Gray Creek | Jackson, L.E., Jr. | 100k | 1993 |
| 105F 1793A | McConnell River | Jackson, L.E., Jr. | 100k | 1993 |
| 105G 1794A | Hoole River | Jackson, L.E., Jr. | 100k | 1993 |
| 105G 1795A | Fortin Lake | Jackson, L.E., Jr. | 100k | 1993 |
| 105G 1796A | Lonely Creek | Jackson, L.E., Jr. | 100k | 1993 |
| 105G 1797A | Rainbow Creek | Jackson, L.E., Jr. | 100k | 1993 |
| 105H 1674A | Dolly Varden Creek | Dyke, A.S. | 100k | 1990 |
| 105H 1676A | Yusezyu River | Dyke, A.S. | 100k | 1990 |
| 105H 1677A | Little Hyland River | Dyke, A.S. | 100k | 1990 |
| 105I | Nahanni | Jackson, L.E., Jr. | 250k | 1982 |
| 105J 1832A | Dragon Lake | Jackson, L.E., Jr., Morrisson, S.R., and McKenna, K. | 100k | 1993 |
| 105K 03 and 06 E | Mount Mye and Faro | Bond, J.D. | 25k | 1999 |
| 105K 05 NE | Rose Mountain | Bond, J.D. | 25k | 2000 |
| 105K 1819A | Earn River | Jackson, L.E., Jr. | 100k | 1993 |
| 105K 1820A | South Macmillan River | Jackson, L.E., Jr. | 100k | 1993 |
| 105K 1821A | Magundy River | Jackson, L.E., Jr. | 100k | 1993 |
| 105K 1822A | Olgie Lake | Jackson, L.E., Jr. | 100k | 1993 |
| 105L 1787A | Wilkinson Range | Ward, B.C. and Jackson, L.E., Jr. | 100k | 1993 |
| 105L 1789A | Telegraph Mountain | Ward, B.C. and Jackson, L.E., Jr. | 100k | 1993 |
| 105M NW | Mount Edwards | Hughes, O.L. | 100k | 1983 |
| 105M SE | Big Kalzas Lake | Hughes, O.L. | 100k | 1983 |
| 105M SW | Grey Hunter Peak | Hughes, O.L. | 100k | 1983 |
| 105O NE |  | Morison, S. R. and McKenna, K. | 100k | 1981 |
| 105O SE and P SW |  | Morison, S. R. and McKenna, K. | 100k | 1981 |
| 105O SW |  | Morison, S.R. and McKenna, K. | 100k | 1981 |
| 106C | Nadaleen River | Ricker, K.E. | 125k | 1973 |
| 106D 1172A | Nash Vreek | Vernon, P. and Hughes, O.L. | 253,440 | 1965 |
| 115A 01-03,06-08 | Frederic Lake | Rampton, V.N. and Paradis, S. | 100k | 1982 |
| 115A 11-14 | Pine Lake | Rampton, V.N. and Paradis, S. | 100k | 1982 |
| 115B and G-E | Congdon Creek | Rampton, V.N. | 100k | 1979 |
| 115F NE | Generic River | Rampton, V.N. | 100k | 1979 |
| 115G-C | Burwash Creek | Rampton, V.N. | 100k | 1979 |
| 115H 03-06 | West Aishihik River | Hughes, O.L. | 100k | 1989 |
| 115H 11-14 | Stevens Lake | Hughes, O.L. | 100k | 1989 |
| 115N 09 | Matson Creek | Jackson, L.E., Jr., Morison, S.R. and Mougeot, C. | 50k | 2005 |

| | | | | |
|---|---|---|---|---|
| 115N 10 | Borden Creek | Jackson, L.E., Jr. | 50k | 2005 |
| 115N 15 | Crag Mountain | Jackson, L.E., Jr. | 50k | 2005 |
| 115N 16 | Enchantment Creek | Jackson, L.E., Jr. | 50k | 2005 |
| 115O NE and P NW, 116B SE and A SW | North Klondike River | Thomas, R.D. and Rampton, V.N. | 100k | 1982 |
| 116A 1171A | Larsen Creek | Vernon, P. and Hughes, O.L. | 253,440 | 1966 |
| 116B | Dawson | Ricker, K.E. | 50k | 1967 |
| 116B and 116C | Dawson | Duk-Rodkin, A. | 250k | 1996 |
| 116B NE and 116A NW | Upper Blackstone River | Thomas, R.D. and Rampton, V.N. | 100k | 1982 |
| 116G SE | Engineer Creek | Thomas, R.D. and Rampton, V.N. | 100k | 1982 |
| 116P | Bell River | Hughes, O.L., Pilon, J., Veillette, J., Zoltai, S.C., Pettapiece, W. | 125k | 1973 |

Appendix B - Rock glacier inventory

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.99 | -140.75 | 1867.06 | 1690 | 2005 | 1876 | 29.78 | 40.07 | 4.29 | 0.17 |
| 61.97 | -140.80 | 1850.86 | 1696 | 1994 | 1841 | 32.65 | 40.49 | 7.21 | 0.13 |
| 61.97 | -140.78 | 1630.84 | 1549 | 1829 | 1613 | 20.77 | 46.57 | 5.99 | 0.17 |
| 61.95 | -140.61 | 1222.89 | 899 | 1474 | 1255 | 18.57 | 40.91 | 0.48 | 1.15 |
| 61.79 | -140.19 | 1503.54 | 1228 | 1840 | 1489 | 33.37 | 41.34 | 21.44 | 0.26 |
| 61.77 | -140.18 | 1303.86 | 1173 | 1420 | 1300 | 23.89 | 43.31 | 8.25 | 0.32 |
| 61.69 | -140.25 | 1527.79 | 1408 | 1672 | 1518 | 24.14 | 38.11 | 3.84 | 0.24 |
| 61.68 | -140.23 | 1692.94 | 1568 | 1805 | 1700 | 16.34 | 31.32 | 3.71 | 0.18 |
| 61.68 | -140.21 | 1679.28 | 1569 | 1795 | 1682 | 30.05 | 48.93 | 4.10 | 0.21 |
| 61.67 | -140.19 | 1616.62 | 1493 | 1778 | 1613 | 28.95 | 38.97 | 14.45 | 0.17 |
| 61.67 | -140.18 | 1756.52 | 1559 | 1973 | 1746 | 32.79 | 48.66 | 13.52 | 0.21 |
| 61.66 | -140.21 | 1555.40 | 1489 | 1631 | 1554 | 18.62 | 38.34 | 5.01 | 0.23 |
| 61.64 | -140.18 | 1547.69 | 1466 | 1648 | 1544 | 25.36 | 37.12 | 6.06 | 0.15 |
| 61.59 | -140.13 | 1337.41 | 1177 | 1526 | 1334 | 34.13 | 42.49 | 20.60 | 0.12 |
| 61.59 | -140.12 | 1315.06 | 1163 | 1465 | 1317 | 32.91 | 38.53 | 23.32 | 0.11 |
| 61.59 | -140.10 | 1395.25 | 1223 | 1546 | 1393 | 37.86 | 41.31 | 31.53 | 0.08 |
| 61.58 | -140.08 | 1392.58 | 1209 | 1572 | 1388 | 36.50 | 39.99 | 29.02 | 0.11 |
| 61.58 | -140.07 | 1352.29 | 1230 | 1490 | 1348 | 35.34 | 41.36 | 25.44 | 0.08 |
| 61.57 | -140.03 | 1367.61 | 1240 | 1525 | 1364 | 34.50 | 43.48 | 11.65 | 0.09 |
| 61.57 | -140.02 | 1329.38 | 1210 | 1473 | 1325 | 32.81 | 41.06 | 10.68 | 0.09 |
| 61.57 | -140.02 | 1328.42 | 1197 | 1477 | 1330 | 34.84 | 40.35 | 21.47 | 0.06 |
| 61.57 | -140.01 | 1295.85 | 1219 | 1417 | 1284 | 28.16 | 40.70 | 13.66 | 0.06 |
| 61.57 | -139.99 | 1296.31 | 1189 | 1437 | 1285 | 30.58 | 39.70 | 15.02 | 0.07 |
| 61.52 | -140.79 | 1898.38 | 1783 | 2080 | 1878 | 23.14 | 37.30 | 10.76 | 0.19 |
| 61.47 | -140.97 | 1740.95 | 1681 | 1862 | 1722 | 13.68 | 30.79 | 2.43 | 0.14 |
| 61.41 | -140.75 | 1565.76 | 1510 | 1707 | 1556 | 15.26 | 30.81 | 0.48 | 0.15 |
| 61.40 | -139.94 | 1761.53 | 1611 | 1924 | 1745 | 29.53 | 39.79 | 1.97 | 0.13 |
| 61.34 | -139.84 | 1483.99 | 1366 | 1706 | 1464 | 21.79 | 36.43 | 10.48 | 0.15 |
| 61.49 | -139.60 | 1654.92 | 1535 | 1865 | 1638 | 27.15 | 44.17 | 9.76 | 0.26 |
| 61.49 | -139.55 | 1829.30 | 1670 | 2081 | 1818 | 32.66 | 40.68 | 23.43 | 0.13 |
| 61.50 | -139.52 | 1643.00 | 1529 | 1776 | 1635 | 33.16 | 40.80 | 26.49 | 0.05 |
| 61.35 | -139.66 | 1603.90 | 1354 | 1805 | 1613 | 37.04 | 43.28 | 27.55 | 0.14 |
| 61.33 | -139.64 | 1384.04 | 1115 | 1692 | 1367 | 33.10 | 39.66 | 18.66 | 0.20 |
| 61.27 | -139.34 | 1966.04 | 1925 | 1998 | 1968 | 8.08 | 15.25 | 4.38 | 0.12 |
| 61.28 | -139.14 | 1454.80 | 1269 | 1748 | 1414 | 26.94 | 40.05 | 11.58 | 0.23 |
| 61.21 | -139.10 | 1496.45 | 1395 | 1668 | 1495 | 11.67 | 27.45 | 1.51 | 1.42 |
| 62.27 | -129.74 | 1448.13 | 1394 | 1507 | 1451 | 20.45 | 37.02 | 8.54 | 0.06 |
| 62.26 | -129.73 | 1449.24 | 1406 | 1490 | 1448 | 22.62 | 32.10 | 12.91 | 0.06 |
| 62.25 | -129.77 | 1564.11 | 1481 | 1639 | 1561 | 25.53 | 30.13 | 19.98 | 0.03 |
| 62.22 | -129.36 | 1758.25 | 1696 | 1853 | 1753 | 17.12 | 31.95 | 5.95 | 0.12 |
| 62.21 | -129.45 | 1695.79 | 1633 | 1727 | 1701 | 23.49 | 39.76 | 10.74 | 0.03 |
| 62.21 | -129.36 | 1731.11 | 1660 | 1906 | 1708 | 20.29 | 47.47 | 1.07 | 0.29 |
| 62.21 | -129.45 | 1661.31 | 1609 | 1706 | 1664 | 17.46 | 24.38 | 11.01 | 0.06 |
| 62.20 | -129.34 | 1765.02 | 1695 | 1890 | 1759 | 23.48 | 43.17 | 1.22 | 0.17 |
| 62.19 | -129.63 | 1677.99 | 1586 | 1766 | 1690 | 17.81 | 33.38 | 2.64 | 0.21 |
| 62.17 | -129.29 | 1780.04 | 1700 | 1897 | 1776 | 25.88 | 41.70 | 12.02 | 0.10 |
| 62.16 | -129.65 | 1691.89 | 1623 | 1845 | 1673 | 24.59 | 43.67 | 4.06 | 0.15 |
| 62.16 | -129.65 | 1567.31 | 1485 | 1712 | 1550 | 24.03 | 40.84 | 7.25 | 0.17 |
| 62.13 | -129.26 | 1486.75 | 1381 | 1621 | 1484 | 22.39 | 31.82 | 14.31 | 0.12 |
| 62.13 | -129.42 | 1637.45 | 1619 | 1645 | 1641 | 7.27 | 16.18 | 0.48 | 0.03 |
| 62.11 | -129.30 | 1351.20 | 1236 | 1486 | 1353 | 26.02 | 35.95 | 5.01 | 0.08 |
| 62.11 | -129.91 | 1522.82 | 1473 | 1582 | 1518 | 31.18 | 36.30 | 22.22 | 0.05 |
| 62.11 | -129.19 | 1847.88 | 1728 | 1995 | 1834 | 26.83 | 38.44 | 3.18 | 0.14 |
| 62.11 | -129.29 | 1539.70 | 1441 | 1593 | 1542 | 22.79 | 35.98 | 10.22 | 0.09 |
| 62.10 | -129.38 | 1615.80 | 1573 | 1650 | 1619 | 13.63 | 26.77 | 5.75 | 0.11 |
| 62.09 | -129.31 | 1591.85 | 1541 | 1684 | 1584 | 21.49 | 48.33 | 6.32 | 0.12 |
| 62.09 | -129.17 | 1707.93 | 1608 | 1863 | 1690 | 21.75 | 35.16 | 7.66 | 0.16 |
| 62.09 | -129.17 | 1730.22 | 1624 | 1873 | 1727 | 21.78 | 31.77 | 9.19 | 0.14 |
| 62.09 | -129.28 | 1773.03 | 1627 | 1923 | 1767 | 31.49 | 48.89 | 4.10 | 0.09 |
| 62.09 | -129.18 | 1724.73 | 1621 | 1842 | 1723 | 18.28 | 27.06 | 7.92 | 0.15 |
| 62.07 | -129.30 | 1686.66 | 1617 | 1778 | 1676 | 19.34 | 35.94 | 7.90 | 0.09 |
| 62.07 | -129.13 | 1743.50 | 1699 | 1796 | 1744 | 13.66 | 33.78 | 0.68 | 0.11 |
| 62.06 | -129.24 | 1750.98 | 1660 | 1856 | 1745 | 22.68 | 41.89 | 1.07 | 0.30 |
| 62.07 | -129.31 | 1709.67 | 1651 | 1798 | 1698 | 16.69 | 32.63 | 5.13 | 0.09 |
| 62.06 | -129.52 | 1646.77 | 1560 | 1783 | 1647 | 23.55 | 41.57 | 9.30 | 0.15 |
| 62.04 | -128.79 | 1652.51 | 1566 | 1748 | 1652 | 19.72 | 30.47 | 4.82 | 0.31 |
| 62.02 | -129.85 | 1491.39 | 1339 | 1653 | 1498 | 26.29 | 36.90 | 8.46 | 0.14 |
| 62.02 | -128.74 | 2015.26 | 1911 | 2078 | 2024 | 31.86 | 39.30 | 2.72 | 0.04 |
| 62.02 | -129.31 | 1301.25 | 1243 | 1377 | 1298 | 26.50 | 38.69 | 8.19 | 0.05 |
| 62.02 | -129.31 | 1326.45 | 1282 | 1376 | 1321 | 24.50 | 32.18 | 12.05 | 0.05 |
| 62.01 | -128.96 | 1714.47 | 1598 | 1825 | 1716 | 27.18 | 36.38 | 9.76 | 0.13 |
| 62.01 | -128.69 | 1559.83 | 1520 | 1608 | 1558 | 14.87 | 25.87 | 3.47 | 0.11 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.22 | -138.94 | 1832.84 | 1553 | 2192 | 1827 | 29.93 | 43.44 | 10.56 | 0.39 |
| 61.20 | -138.91 | 2065.25 | 1700 | 2404 | 2072 | 29.29 | 47.49 | 3.05 | 0.61 |
| 61.20 | -138.91 | 1868.75 | 1791 | 2032 | 1853 | 21.66 | 40.99 | 5.48 | 0.14 |
| 61.20 | -138.92 | 1977.68 | 1851 | 2312 | 1939 | 22.82 | 48.26 | 1.97 | 0.36 |
| 61.20 | -138.98 | 2047.31 | 1938 | 2164 | 2041 | 22.05 | 35.51 | 6.47 | 0.14 |
| 61.22 | -139.47 | 1377.98 | 1272 | 1533 | 1369 | 27.50 | 40.99 | 8.46 | 0.16 |
| 61.21 | -139.45 | 1396.38 | 1303 | 1515 | 1396 | 17.86 | 36.89 | 9.09 | 0.15 |
| 61.16 | -139.37 | 1351.78 | 1301 | 1413 | 1348 | 16.93 | 25.30 | 9.33 | 0.12 |
| 61.16 | -139.35 | 1444.75 | 1382 | 1516 | 1443 | 19.97 | 23.84 | 15.64 | 0.09 |
| 61.15 | -139.29 | 1703.11 | 1537 | 1951 | 1680 | 31.46 | 40.79 | 8.77 | 0.27 |
| 61.14 | -139.26 | 1693.76 | 1541 | 1869 | 1686 | 25.03 | 36.16 | 10.70 | 0.19 |
| 61.14 | -139.26 | 1549.85 | 1427 | 1738 | 1544 | 23.85 | 38.38 | 5.10 | 0.38 |
| 61.13 | -139.24 | 1739.33 | 1552 | 1958 | 1722 | 31.75 | 41.89 | 5.73 | 0.23 |
| 61.13 | -139.24 | 1645.05 | 1508 | 1844 | 1627 | 29.42 | 42.58 | 17.99 | 0.10 |
| 61.13 | -139.24 | 1640.74 | 1491 | 1927 | 1605 | 29.43 | 40.19 | 14.40 | 0.17 |
| 61.12 | -139.23 | 1745.51 | 1556 | 1981 | 1736 | 33.52 | 43.25 | 17.87 | 0.10 |
| 61.12 | -139.23 | 1802.91 | 1586 | 2078 | 1788 | 36.53 | 45.61 | 23.77 | 0.11 |
| 61.12 | -139.22 | 1800.48 | 1592 | 2048 | 1780 | 36.89 | 44.75 | 12.89 | 0.10 |
| 61.12 | -139.22 | 1701.82 | 1480 | 1963 | 1685 | 33.26 | 45.46 | 12.35 | 0.27 |
| 61.11 | -139.21 | 1872.47 | 1769 | 2016 | 1862 | 30.21 | 37.32 | 21.21 | 0.08 |
| 61.11 | -139.21 | 1834.34 | 1754 | 1957 | 1823 | 30.85 | 37.19 | 26.91 | 0.05 |
| 61.11 | -139.21 | 1790.97 | 1664 | 1932 | 1789 | 28.76 | 36.56 | 22.01 | 0.10 |
| 61.10 | -139.20 | 1770.43 | 1568 | 2026 | 1761 | 29.47 | 36.84 | 12.83 | 0.19 |
| 61.10 | -139.19 | 1920.29 | 1783 | 2094 | 1909 | 32.28 | 37.39 | 26.98 | 0.06 |
| 61.10 | -139.19 | 1909.79 | 1764 | 2100 | 1894 | 33.37 | 37.69 | 28.56 | 0.06 |
| 61.09 | -139.18 | 1887.73 | 1691 | 2053 | 1909 | 19.66 | 29.88 | 6.73 | 0.24 |
| 61.09 | -139.17 | 2124.25 | 2026 | 2325 | 2091 | 26.84 | 41.90 | 3.11 | 0.17 |
| 61.09 | -139.21 | 1545.44 | 1489 | 1663 | 1540 | 17.15 | 28.22 | 2.57 | 0.14 |
| 61.09 | -139.21 | 1549.47 | 1474 | 1675 | 1542 | 20.13 | 33.60 | 5.88 | 0.12 |
| 61.08 | -139.17 | 2123.63 | 1922 | 2284 | 2123 | 34.12 | 40.52 | 12.96 | 0.14 |
| 61.08 | -139.17 | 2307.52 | 2120 | 2471 | 2318 | 33.81 | 42.62 | 23.03 | 0.12 |
| 61.07 | -139.17 | 2010.48 | 1825 | 2218 | 1995 | 38.24 | 46.66 | 28.51 | 0.08 |
| 61.07 | -139.17 | 1986.78 | 1803 | 2254 | 1958 | 32.37 | 42.29 | 21.67 | 0.18 |
| 61.06 | -139.17 | 1901.99 | 1777 | 2056 | 1889 | 30.11 | 39.99 | 20.92 | 0.06 |
| 61.09 | -139.19 | 1961.92 | 1777 | 2174 | 1952 | 36.36 | 39.89 | 32.53 | 0.10 |
| 61.09 | -139.18 | 1920.24 | 1760 | 2100 | 1909 | 35.88 | 41.87 | 29.56 | 0.07 |
| 61.07 | -139.15 | 2376.97 | 2192 | 2531 | 2372 | 29.21 | 40.78 | 4.39 | 0.17 |
| 61.09 | -139.13 | 1781.97 | 1705 | 1893 | 1777 | 18.76 | 36.65 | 2.26 | 0.47 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 62.01 | -128.89 | 1835.15 | 1765 | 1930 | 1830 | 33.89 | 38.22 | 29.76 | 0.08 |
| 62.01 | -129.18 | 1509.04 | 1420 | 1617 | 1501 | 25.51 | 38.63 | 5.88 | 0.13 |
| 62.01 | -129.12 | 1769.08 | 1683 | 1813 | 1777 | 16.14 | 36.16 | 4.97 | 0.10 |
| 62.01 | -129.06 | 1721.96 | 1537 | 1972 | 1709 | 29.80 | 40.96 | 12.77 | 0.15 |
| 62.01 | -128.93 | 1813.88 | 1695 | 1923 | 1814 | 27.77 | 37.05 | 21.55 | 0.09 |
| 62.00 | -129.10 | 1505.13 | 1277 | 1769 | 1511 | 25.45 | 46.90 | 10.36 | 0.19 |
| 62.00 | -128.93 | 1775.31 | 1673 | 1882 | 1779 | 24.23 | 32.69 | 11.33 | 0.13 |
| 62.00 | -128.40 | 1716.31 | 1654 | 1837 | 1704 | 22.00 | 41.59 | 0.75 | 0.18 |
| 62.00 | -128.93 | 1734.77 | 1686 | 1805 | 1729 | 17.44 | 30.27 | 3.47 | 0.11 |
| 62.00 | -128.45 | 1640.24 | 1573 | 1727 | 1638 | 24.41 | 42.26 | 7.09 | 0.07 |
| 62.57 | -134.03 | 1572.54 | 1524 | 1632 | 1570 | 18.94 | 29.91 | 10.37 | 0.06 |
| 62.57 | -134.08 | 1622.82 | 1591 | 1653 | 1622 | 17.50 | 20.63 | 15.90 | 0.04 |
| 62.57 | -134.07 | 1640.00 | 1593 | 1689 | 1642 | 28.62 | 35.46 | 20.53 | 0.04 |
| 62.56 | -134.09 | 1694.50 | 1659 | 1728 | 1693 | 16.51 | 23.12 | 14.60 | 0.04 |
| 62.54 | -134.06 | 1652.51 | 1614 | 1721 | 1641 | 17.96 | 30.58 | 5.32 | 0.06 |
| 62.54 | -134.49 | 1694.14 | 1616 | 1808 | 1687 | 26.36 | 40.55 | 11.33 | 0.16 |
| 62.51 | -134.53 | 1535.36 | 1438 | 1651 | 1538 | 24.33 | 36.73 | 6.26 | 0.11 |
| 62.51 | -134.54 | 1614.57 | 1577 | 1681 | 1611 | 27.64 | 43.34 | 7.66 | 0.03 |
| 62.50 | -134.56 | 1877.13 | 1796 | 1962 | 1873 | 28.95 | 38.25 | 14.83 | 0.10 |
| 62.49 | -134.68 | 1714.36 | 1672 | 1765 | 1714 | 15.20 | 25.79 | 3.71 | 0.08 |
| 62.49 | -134.66 | 1741.03 | 1649 | 1831 | 1744 | 25.75 | 45.21 | 7.21 | 0.13 |
| 62.49 | -134.64 | 1694.60 | 1620 | 1785 | 1694 | 24.00 | 38.18 | 8.33 | 0.13 |
| 62.48 | -134.75 | 1543.90 | 1428 | 1705 | 1543 | 23.88 | 37.31 | 4.32 | 0.19 |
| 62.48 | -134.59 | 1600.98 | 1560 | 1643 | 1602 | 17.24 | 31.99 | 7.12 | 0.08 |
| 62.48 | -134.58 | 1678.35 | 1608 | 1822 | 1664 | 23.37 | 42.77 | 5.52 | 0.14 |
| 62.47 | -134.53 | 1593.65 | 1516 | 1677 | 1593 | 20.66 | 33.06 | 9.47 | 0.12 |
| 62.47 | -134.56 | 1721.49 | 1637 | 1817 | 1717 | 18.09 | 34.42 | 5.95 | 0.10 |
| 62.45 | -134.55 | 1579.69 | 1563 | 1598 | 1579 | 10.71 | 26.87 | 3.11 | 0.04 |
| 62.44 | -134.56 | 1664.18 | 1604 | 1757 | 1659 | 15.49 | 32.74 | 2.64 | 0.12 |
| 62.42 | -134.59 | 1733.43 | 1666 | 1801 | 1736 | 27.76 | 41.50 | 7.13 | 0.09 |
| 62.41 | -134.56 | 1595.86 | 1520 | 1654 | 1599 | 13.33 | 26.73 | 6.09 | 0.17 |
| 62.39 | -134.45 | 1696.26 | 1642 | 1780 | 1689 | 24.55 | 39.67 | 4.52 | 0.05 |
| 62.39 | -134.52 | 1523.97 | 1489 | 1598 | 1514 | 11.62 | 26.79 | 2.72 | 0.14 |
| 62.38 | -134.48 | 1678.05 | 1628 | 1727 | 1678 | 21.72 | 37.93 | 3.39 | 0.07 |
| 62.38 | -134.56 | 1673.22 | 1575 | 1763 | 1676 | 16.99 | 33.12 | 2.39 | 0.26 |
| 62.38 | -134.45 | 1640.11 | 1626 | 1671 | 1637 | 9.06 | 28.37 | 2.13 | 0.07 |
| 62.36 | -134.44 | 1789.08 | 1728 | 1882 | 1782 | 28.35 | 40.23 | 7.75 | 0.06 |
| 62.36 | -134.42 | 1724.17 | 1683 | 1784 | 1718 | 16.78 | 34.60 | 4.76 | 0.07 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.10 | -139.12 | 2071.74 | 1763 | 2480 | 2053 | 36.48 | 44.65 | 17.37 | 0.32 |
| 61.10 | -139.12 | 2022.99 | 1829 | 2271 | 2002 | 35.88 | 42.38 | 6.06 | 0.13 |
| 61.10 | -139.12 | 1943.68 | 1688 | 2238 | 1939 | 32.59 | 45.56 | 19.78 | 0.13 |
| 61.10 | -139.12 | 2017.12 | 1858 | 2150 | 2022 | 29.37 | 39.60 | 10.89 | 0.10 |
| 61.12 | -139.12 | 1641.37 | 1463 | 1860 | 1645 | 29.98 | 49.25 | 9.51 | 0.35 |
| 61.13 | -139.12 | 1473.46 | 1409 | 1644 | 1463 | 14.88 | 37.63 | 1.43 | 0.22 |
| 61.14 | -139.11 | 1434.92 | 1374 | 1609 | 1412 | 16.71 | 36.94 | 1.39 | 0.15 |
| 61.14 | -139.11 | 1413.40 | 1367 | 1565 | 1393 | 14.92 | 32.70 | 1.72 | 0.12 |
| 61.14 | -139.11 | 1411.25 | 1354 | 1598 | 1385 | 14.80 | 33.70 | 1.01 | 0.13 |
| 61.14 | -139.11 | 1445.33 | 1349 | 1632 | 1431 | 20.04 | 29.84 | 4.79 | 0.15 |
| 61.13 | -139.07 | 1545.96 | 1480 | 1689 | 1518 | 17.90 | 33.00 | 2.72 | 0.15 |
| 61.12 | -139.07 | 1654.28 | 1570 | 1749 | 1653 | 27.40 | 34.84 | 16.92 | 0.07 |
| 61.12 | -139.07 | 1744.57 | 1572 | 1969 | 1737 | 31.53 | 39.72 | 22.11 | 0.13 |
| 61.12 | -139.06 | 1638.48 | 1579 | 1750 | 1631 | 17.39 | 35.23 | 2.88 | 0.21 |
| 61.09 | -139.11 | 2018.79 | 1881 | 2254 | 1988 | 30.95 | 39.35 | 10.22 | 0.12 |
| 61.08 | -139.09 | 2098.34 | 1928 | 2278 | 2105 | 30.84 | 44.37 | 8.59 | 0.21 |
| 61.02 | -139.29 | 1818.68 | 1634 | 2046 | 1818 | 33.96 | 42.95 | 27.37 | 0.16 |
| 61.01 | -139.28 | 1831.23 | 1658 | 2027 | 1828 | 33.28 | 40.23 | 24.19 | 0.18 |
| 61.00 | -139.28 | 1871.02 | 1656 | 2111 | 1860 | 35.71 | 41.71 | 28.88 | 0.18 |
| 61.05 | -139.16 | 1866.30 | 1728 | 2053 | 1852 | 24.41 | 31.40 | 15.49 | 0.17 |
| 61.04 | -139.13 | 1925.65 | 1797 | 2072 | 1924 | 26.33 | 37.67 | 16.48 | 0.14 |
| 61.03 | -139.09 | 2230.90 | 2097 | 2385 | 2234 | 22.50 | 33.10 | 11.24 | 0.16 |
| 61.03 | -139.08 | 2349.62 | 2171 | 2566 | 2335 | 29.45 | 40.51 | 5.32 | 0.29 |
| 61.03 | -138.90 | 1876.06 | 1789 | 1995 | 1869 | 28.00 | 36.85 | 13.46 | 0.10 |
| 61.01 | -138.95 | 2083.15 | 1848 | 2378 | 2056 | 31.95 | 44.11 | 14.31 | 0.21 |
| 61.02 | -138.96 | 1791.01 | 1651 | 2147 | 1736 | 21.52 | 45.62 | 7.86 | 0.24 |
| 61.02 | -138.95 | 1976.33 | 1889 | 2049 | 1980 | 29.31 | 36.06 | 22.47 | 0.05 |
| 61.02 | -138.95 | 2241.14 | 2163 | 2330 | 2236 | 32.30 | 38.75 | 24.80 | 0.05 |
| 61.03 | -138.96 | 1943.10 | 1756 | 2117 | 1950 | 30.39 | 39.38 | 17.58 | 0.19 |
| 61.03 | -138.96 | 1902.54 | 1749 | 2111 | 1897 | 31.09 | 41.74 | 13.01 | 0.12 |
| 61.04 | -138.96 | 2002.73 | 1868 | 2194 | 1986 | 30.42 | 39.53 | 17.36 | 0.10 |
| 61.05 | -138.96 | 1885.90 | 1723 | 2134 | 1864 | 33.59 | 47.15 | 17.03 | 0.11 |
| 61.05 | -139.00 | 1667.72 | 1489 | 2048 | 1625 | 24.73 | 41.95 | 2.90 | 0.42 |
| 61.06 | -138.95 | 1759.04 | 1575 | 2060 | 1736 | 33.66 | 49.41 | 18.78 | 0.21 |
| 61.07 | -138.94 | 1702.87 | 1571 | 1830 | 1704 | 19.47 | 34.72 | 6.32 | 0.26 |
| 61.06 | -138.96 | 1926.32 | 1693 | 2166 | 1928 | 43.10 | 51.07 | 31.05 | 0.24 |
| 61.09 | -138.95 | 1548.67 | 1477 | 1677 | 1532 | 25.18 | 41.85 | 13.12 | 0.07 |
| 61.10 | -139.00 | 2196.43 | 2058 | 2316 | 2205 | 32.77 | 44.35 | 12.11 | 0.19 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 62.31 | -134.19 | 1671.60 | 1637 | 1746 | 1670 | 16.35 | 37.52 | 3.02 | 0.10 |
| 62.31 | -134.79 | 1427.64 | 1365 | 1532 | 1419 | 26.94 | 40.59 | 3.58 | 0.08 |
| 62.31 | -134.46 | 1572.75 | 1520 | 1649 | 1567 | 25.81 | 36.77 | 6.93 | 0.05 |
| 62.30 | -134.18 | 1701.06 | 1665 | 1754 | 1700 | 22.74 | 41.78 | 9.32 | 0.05 |
| 62.30 | -134.32 | 1719.57 | 1678 | 1755 | 1720 | 11.07 | 25.52 | 1.39 | 0.11 |
| 62.30 | -134.34 | 1765.43 | 1673 | 1873 | 1761 | 31.70 | 40.59 | 18.09 | 0.06 |
| 62.29 | -134.18 | 1726.46 | 1691 | 1777 | 1719 | 15.79 | 30.22 | 3.65 | 0.07 |
| 62.29 | -134.17 | 1690.59 | 1624 | 1718 | 1700 | 14.77 | 31.03 | 2.70 | 0.07 |
| 62.29 | -134.16 | 1779.61 | 1708 | 1859 | 1774 | 35.32 | 47.18 | 19.69 | 0.05 |
| 62.29 | -134.14 | 1632.23 | 1606 | 1668 | 1633 | 13.44 | 32.95 | 1.22 | 0.08 |
| 62.28 | -134.26 | 1538.64 | 1451 | 1630 | 1535 | 22.13 | 38.44 | 1.43 | 0.15 |
| 62.27 | -134.22 | 1656.49 | 1631 | 1700 | 1648 | 10.17 | 23.89 | 2.90 | 0.09 |
| 63.56 | -130.36 | 1434.58 | 1374 | 1527 | 1431 | 10.64 | 17.18 | 7.05 | 0.32 |
| 63.56 | -130.35 | 1425.80 | 1381 | 1475 | 1424 | 9.85 | 15.25 | 5.55 | 0.21 |
| 63.49 | -130.54 | 1668.92 | 1545 | 1828 | 1669 | 21.91 | 40.51 | 5.14 | 0.23 |
| 63.48 | -130.51 | 1845.15 | 1787 | 1935 | 1841 | 15.93 | 39.12 | 0.34 | 0.21 |
| 63.46 | -130.40 | 1588.37 | 1380 | 1705 | 1624 | 21.77 | 43.42 | 1.72 | 0.28 |
| 63.45 | -130.48 | 1760.10 | 1605 | 1932 | 1744 | 19.12 | 42.30 | 1.07 | 0.44 |
| 63.45 | -130.54 | 1595.15 | 1531 | 1670 | 1592 | 23.33 | 32.69 | 8.79 | 0.07 |
| 63.44 | -130.46 | 1890.83 | 1805 | 1976 | 1886 | 19.01 | 37.05 | 2.36 | 0.13 |
| 63.44 | -130.67 | 1179.16 | 1111 | 1303 | 1161 | 17.32 | 31.12 | 2.46 | 0.18 |
| 63.41 | -130.46 | 1686.60 | 1548 | 1853 | 1675 | 26.33 | 45.47 | 11.35 | 0.17 |
| 63.41 | -130.19 | 1856.11 | 1759 | 1944 | 1862 | 17.55 | 41.63 | 4.32 | 0.27 |
| 63.40 | -130.24 | 1933.64 | 1781 | 2145 | 1935 | 21.55 | 43.20 | 3.44 | 0.20 |
| 63.40 | -130.44 | 1863.57 | 1833 | 1906 | 1860 | 17.04 | 39.54 | 4.29 | 0.09 |
| 63.40 | -130.41 | 1651.18 | 1546 | 1774 | 1644 | 23.61 | 41.97 | 8.59 | 0.20 |
| 63.40 | -130.36 | 1781.01 | 1685 | 1848 | 1789 | 19.62 | 31.88 | 2.16 | 0.10 |
| 63.40 | -130.45 | 1766.36 | 1715 | 1813 | 1770 | 18.84 | 43.68 | 7.39 | 0.09 |
| 63.39 | -130.45 | 1772.28 | 1744 | 1822 | 1768 | 16.85 | 32.12 | 5.01 | 0.06 |
| 63.38 | -130.29 | 1628.62 | 1538 | 1728 | 1626 | 17.23 | 37.26 | 2.26 | 0.29 |
| 63.38 | -130.32 | 1740.01 | 1643 | 1805 | 1745 | 21.28 | 42.47 | 9.32 | 0.32 |
| 63.38 | -130.53 | 1590.66 | 1431 | 1724 | 1598 | 21.06 | 41.52 | 3.71 | 0.43 |
| 63.38 | -130.42 | 1727.60 | 1689 | 1770 | 1730 | 17.59 | 28.88 | 5.05 | 0.05 |
| 63.38 | -130.47 | 1677.68 | 1597 | 1763 | 1680 | 15.97 | 30.91 | 5.79 | 0.15 |
| 63.38 | -130.41 | 1552.43 | 1417 | 1647 | 1557 | 25.18 | 34.45 | 11.39 | 0.10 |
| 63.38 | -130.56 | 1545.52 | 1436 | 1639 | 1555 | 15.27 | 36.76 | 4.39 | 0.25 |
| 63.36 | -130.04 | 1720.99 | 1660 | 1773 | 1724 | 17.85 | 34.58 | 5.88 | 0.13 |
| 63.37 | -130.33 | 1757.38 | 1718 | 1794 | 1758 | 13.72 | 25.51 | 8.06 | 0.08 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.11 | -139.01 | 2249.58 | 2068 | 2476 | 2233 | 31.01 | 40.56 | 16.05 | 0.16 |
| 61.11 | -139.03 | 1893.66 | 1759 | 2128 | 1885 | 26.59 | 42.17 | 13.90 | 0.17 |
| 61.02 | -138.81 | 1643.35 | 1546 | 1707 | 1651 | 24.57 | 35.84 | 13.07 | 0.10 |
| 61.02 | -138.54 | 1136.01 | 968 | 1320 | 1138 | 32.47 | 43.44 | 18.43 | 0.17 |
| 61.23 | -138.84 | 1315.96 | 1144 | 1468 | 1319 | 24.42 | 33.08 | 14.92 | 0.16 |
| 61.30 | -138.41 | 1547.91 | 1451 | 1662 | 1548 | 19.08 | 35.53 | 6.42 | 0.17 |
| 61.39 | -138.19 | 1677.66 | 1594 | 1756 | 1676 | 18.46 | 37.88 | 5.14 | 0.24 |
| 61.43 | -138.22 | 1588.12 | 1515 | 1757 | 1562 | 22.96 | 34.51 | 2.43 | 0.08 |
| 61.45 | -138.11 | 1820.81 | 1796 | 1844 | 1823 | 10.24 | 19.93 | 2.26 | 0.08 |
| 61.46 | -138.09 | 1900.45 | 1824 | 2028 | 1888 | 21.61 | 28.88 | 12.37 | 0.10 |
| 61.46 | -138.12 | 1881.93 | 1815 | 1964 | 1876 | 36.70 | 45.39 | 21.32 | 0.08 |
| 61.47 | -138.11 | 1737.46 | 1633 | 1867 | 1732 | 26.38 | 36.41 | 6.62 | 0.14 |
| 61.51 | -138.26 | 1856.24 | 1758 | 1960 | 1864 | 27.40 | 40.29 | 7.06 | 0.08 |
| 61.51 | -138.02 | 1755.91 | 1666 | 1802 | 1763 | 24.73 | 41.72 | 10.03 | 0.11 |
| 61.51 | -138.05 | 1850.87 | 1693 | 2003 | 1850 | 28.67 | 38.25 | 16.75 | 0.16 |
| 61.66 | -138.24 | 1484.79 | 1394 | 1745 | 1451 | 20.91 | 40.06 | 3.18 | 0.21 |
| 61.65 | -138.23 | 1541.45 | 1472 | 1637 | 1535 | 24.30 | 35.93 | 6.17 | 0.14 |
| 61.64 | -138.20 | 1553.04 | 1447 | 1675 | 1549 | 21.78 | 27.72 | 15.95 | 0.11 |
| 61.64 | -138.18 | 1732.22 | 1561 | 1828 | 1759 | 27.75 | 38.32 | 8.08 | 0.12 |
| 61.64 | -138.17 | 1766.50 | 1651 | 1832 | 1769 | 22.50 | 38.99 | 3.52 | 0.19 |
| 61.94 | -138.86 | 1393.56 | 1306 | 1502 | 1390 | 26.27 | 39.10 | 12.91 | 0.18 |
| 61.95 | -138.84 | 1466.00 | 1356 | 1571 | 1472 | 25.00 | 39.53 | 4.38 | 0.19 |
| 61.95 | -138.82 | 1459.38 | 1351 | 1590 | 1454 | 23.35 | 35.14 | 3.02 | 0.21 |
| 61.95 | -138.66 | 1339.58 | 1249 | 1476 | 1331 | 25.11 | 35.71 | 5.73 | 0.29 |
| 60.46 | -124.39 | 1291.49 | 1198 | 1462 | 1283 | 14.47 | 34.55 | 0.95 | 0.63 |
| 60.29 | -124.17 | 1235.51 | 1127 | 1361 | 1234 | 19.90 | 31.15 | 13.26 | 0.27 |
| 63.08 | -129.80 | 1753.41 | 1715 | 1775 | 1757 | 9.22 | 19.38 | 3.04 | 0.10 |
| 64.98 | -138.23 | 1027.64 | 958 | 1105 | 1023 | 26.74 | 31.46 | 21.39 | 0.05 |
| 64.97 | -138.25 | 1010.42 | 934 | 1188 | 982 | 26.00 | 38.39 | 10.05 | 0.07 |
| 64.96 | -138.20 | 941.57 | 918 | 979 | 939 | 12.03 | 27.26 | 7.65 | 0.06 |
| 64.95 | -138.09 | 1282.28 | 1230 | 1360 | 1280 | 13.04 | 29.42 | 4.39 | 0.18 |
| 64.94 | -138.08 | 1385.98 | 1342 | 1432 | 1388 | 15.25 | 25.46 | 5.40 | 0.09 |
| 64.59 | -138.17 | 1587.84 | 1551 | 1679 | 1579 | 18.99 | 46.74 | 1.39 | 0.13 |
| 64.48 | -138.33 | 1378.68 | 1310 | 1490 | 1370 | 19.99 | 28.38 | 6.85 | 0.18 |
| 64.65 | -138.60 | 1470.07 | 1393 | 1553 | 1474 | 15.56 | 29.12 | 3.52 | 0.20 |
| 64.48 | -138.51 | 1753.63 | 1668 | 1854 | 1751 | 21.38 | 34.35 | 12.44 | 0.19 |
| 64.34 | -138.39 | 1211.92 | 994 | 1462 | 1215 | 22.26 | 35.60 | 10.11 | 0.45 |
| 64.34 | -138.61 | 1589.81 | 1554 | 1623 | 1589 | 18.10 | 33.08 | 6.38 | 0.06 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 63.37 | -130.32 | 1634.50 | 1576 | 1681 | 1639 | 16.36 | 23.12 | 9.83 | 0.08 |
| 63.37 | -130.54 | 1673.20 | 1590 | 1799 | 1661 | 19.58 | 34.57 | 6.89 | 0.11 |
| 63.34 | -130.10 | 1741.06 | 1678 | 1807 | 1741 | 18.99 | 32.96 | 9.21 | 0.10 |
| 63.34 | -130.11 | 1755.81 | 1670 | 1875 | 1751 | 20.91 | 38.84 | 5.48 | 0.18 |
| 63.34 | -130.17 | 1363.53 | 1334 | 1406 | 1361 | 10.68 | 22.16 | 1.22 | 0.12 |
| 63.34 | -130.16 | 1390.12 | 1377 | 1402 | 1390 | 8.51 | 13.24 | 3.11 | 0.04 |
| 63.33 | -130.19 | 1572.94 | 1472 | 1659 | 1582 | 15.22 | 32.22 | 3.02 | 0.21 |
| 63.34 | -130.70 | 1057.95 | 1008 | 1159 | 1056 | 9.52 | 26.62 | 4.76 | 0.31 |
| 63.32 | -130.15 | 1644.17 | 1525 | 1741 | 1649 | 14.77 | 28.99 | 1.07 | 0.22 |
| 63.32 | -130.16 | 1793.27 | 1642 | 1933 | 1783 | 18.65 | 44.78 | 1.39 | 0.39 |
| 63.32 | -130.18 | 1763.26 | 1720 | 1800 | 1765 | 24.51 | 33.59 | 13.58 | 0.03 |
| 63.31 | -130.20 | 1727.30 | 1582 | 1844 | 1736 | 19.19 | 43.37 | 1.69 | 0.28 |
| 63.31 | -130.23 | 1571.63 | 1514 | 1617 | 1576 | 17.11 | 23.48 | 10.66 | 0.08 |
| 63.31 | -130.18 | 1763.22 | 1697 | 1808 | 1768 | 10.76 | 23.59 | 1.07 | 0.17 |
| 63.31 | -130.52 | 1189.11 | 1109 | 1285 | 1183 | 16.18 | 26.98 | 7.92 | 0.23 |
| 63.27 | -130.23 | 1665.08 | 1454 | 1883 | 1668 | 29.05 | 48.68 | 10.40 | 0.28 |
| 63.27 | -130.24 | 1657.91 | 1567 | 1758 | 1660 | 23.36 | 38.59 | 10.20 | 0.08 |
| 63.27 | -130.21 | 1721.81 | 1611 | 1821 | 1722 | 22.29 | 40.23 | 9.30 | 0.12 |
| 63.27 | -130.34 | 1746.04 | 1650 | 1861 | 1747 | 23.27 | 46.47 | 6.53 | 0.20 |
| 63.28 | -130.80 | 1747.00 | 1660 | 1855 | 1741 | 22.32 | 30.57 | 12.34 | 0.07 |
| 63.27 | -130.48 | 1670.43 | 1611 | 1719 | 1672 | 19.30 | 37.67 | 10.07 | 0.14 |
| 63.24 | -130.26 | 1549.28 | 1418 | 1705 | 1541 | 24.17 | 43.92 | 5.05 | 0.24 |
| 63.24 | -130.27 | 1584.37 | 1463 | 1671 | 1597 | 23.80 | 44.54 | 10.16 | 0.20 |
| 63.24 | -130.34 | 1523.07 | 1487 | 1567 | 1524 | 18.19 | 22.75 | 11.67 | 0.05 |
| 63.21 | -130.29 | 1739.63 | 1629 | 1816 | 1747 | 16.41 | 32.95 | 1.07 | 0.23 |
| 63.20 | -130.31 | 1692.76 | 1579 | 1818 | 1696 | 24.26 | 40.59 | 11.28 | 0.16 |
| 63.18 | -130.13 | 1245.63 | 1195 | 1352 | 1239 | 13.65 | 33.38 | 2.70 | 0.09 |
| 63.18 | -130.14 | 1340.46 | 1191 | 1650 | 1314 | 20.03 | 38.52 | 2.78 | 0.46 |
| 63.17 | -130.05 | 1786.02 | 1719 | 1865 | 1787 | 25.20 | 31.89 | 7.59 | 0.05 |
| 63.16 | -130.01 | 1791.01 | 1699 | 1849 | 1801 | 15.59 | 28.65 | 5.57 | 0.12 |
| 63.07 | -130.84 | 1531.29 | 1449 | 1659 | 1524 | 16.84 | 32.58 | 3.65 | 0.19 |
| 63.16 | -130.58 | 1599.37 | 1483 | 1713 | 1606 | 18.63 | 31.92 | 7.66 | 0.16 |
| 63.04 | -130.10 | 1504.41 | 1373 | 1670 | 1501 | 17.19 | 35.05 | 2.86 | 0.51 |
| 63.04 | -129.98 | 1740.46 | 1658 | 1795 | 1748 | 15.98 | 25.57 | 7.06 | 0.15 |
| 63.14 | -130.46 | 1630.08 | 1515 | 1765 | 1622 | 23.04 | 40.31 | 3.05 | 0.13 |
| 63.13 | -130.35 | 1688.44 | 1630 | 1722 | 1694 | 14.76 | 30.51 | 1.07 | 0.12 |
| 63.13 | -130.31 | 1644.70 | 1581 | 1705 | 1646 | 16.15 | 37.32 | 0.00 | 0.12 |
| 63.12 | -130.39 | 1680.34 | 1550 | 1840 | 1679 | 24.45 | 42.23 | 1.39 | 0.26 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.34 | -138.74 | 1465.34 | 1435 | 1493 | 1467 | 9.07 | 17.68 | 4.58 | 0.16 |
| 64.27 | -138.34 | 1397.99 | 1243 | 1521 | 1403 | 20.91 | 32.75 | 8.48 | 0.35 |
| 64.27 | -138.47 | 911.38 | 769 | 1225 | 874 | 18.54 | 33.83 | 10.44 | 0.43 |
| 64.67 | -138.17 | 1467.00 | 1395 | 1578 | 1460 | 14.90 | 35.49 | 5.99 | 0.20 |
| 64.56 | -138.56 | 1791.21 | 1696 | 1929 | 1780 | 25.13 | 39.22 | 5.81 | 0.18 |
| 64.46 | -138.54 | 1792.52 | 1724 | 1869 | 1795 | 19.63 | 34.85 | 7.37 | 0.13 |
| 64.46 | -138.34 | 1621.97 | 1501 | 1746 | 1626 | 27.85 | 43.23 | 8.06 | 0.16 |
| 64.46 | -138.60 | 1687.06 | 1659 | 1734 | 1680 | 18.29 | 29.13 | 6.06 | 0.08 |
| 64.37 | -138.65 | 1538.91 | 1482 | 1652 | 1528 | 28.71 | 47.77 | 2.39 | 0.09 |
| 64.64 | -138.74 | 1591.86 | 1539 | 1644 | 1591 | 20.35 | 34.02 | 8.84 | 0.08 |
| 64.58 | -138.54 | 1682.82 | 1615 | 1755 | 1683 | 19.09 | 32.74 | 10.01 | 0.11 |
| 64.58 | -138.74 | 1594.42 | 1423 | 1754 | 1590 | 26.80 | 43.01 | 10.31 | 0.41 |
| 64.57 | -138.30 | 1196.52 | 1189 | 1204 | 1196 | 3.77 | 4.26 | 3.04 | 0.05 |
| 64.53 | -138.19 | 1686.61 | 1605 | 1764 | 1687 | 26.43 | 42.33 | 12.05 | 0.07 |
| 64.52 | -138.38 | 1778.81 | 1619 | 2020 | 1772 | 30.95 | 54.43 | 13.20 | 0.20 |
| 64.51 | -138.58 | 1498.89 | 1439 | 1604 | 1494 | 18.47 | 33.79 | 8.94 | 0.12 |
| 64.51 | -138.51 | 1492.22 | 1460 | 1589 | 1479 | 16.18 | 38.54 | 3.32 | 0.07 |
| 64.49 | -138.53 | 1755.14 | 1649 | 1851 | 1762 | 15.55 | 35.04 | 2.90 | 0.29 |
| 64.49 | -138.24 | 1368.39 | 1260 | 1500 | 1372 | 26.12 | 41.14 | 8.56 | 0.16 |
| 64.49 | -138.47 | 1552.29 | 1459 | 1794 | 1525 | 26.85 | 51.84 | 1.69 | 0.24 |
| 64.48 | -138.18 | 1146.11 | 997 | 1443 | 1106 | 22.07 | 36.71 | 4.68 | 0.48 |
| 64.48 | -138.36 | 1316.89 | 1230 | 1407 | 1319 | 18.04 | 29.39 | 7.01 | 0.19 |
| 64.47 | -138.59 | 1629.41 | 1572 | 1687 | 1635 | 19.70 | 30.77 | 5.15 | 0.08 |
| 64.47 | -138.37 | 1507.38 | 1475 | 1555 | 1506 | 17.06 | 26.25 | 3.65 | 0.10 |
| 64.47 | -138.60 | 1734.55 | 1660 | 1817 | 1734 | 24.14 | 42.99 | 8.44 | 0.10 |
| 64.46 | -138.12 | 1438.51 | 1215 | 1560 | 1473 | 12.24 | 27.43 | 4.11 | 0.41 |
| 64.46 | -138.61 | 1581.64 | 1541 | 1671 | 1579 | 15.83 | 38.16 | 1.97 | 0.13 |
| 64.45 | -138.66 | 1736.85 | 1665 | 1783 | 1742 | 24.89 | 33.66 | 12.73 | 0.06 |
| 64.44 | -138.61 | 1788.85 | 1706 | 1902 | 1789 | 21.01 | 39.52 | 8.77 | 0.12 |
| 64.39 | -138.19 | 1532.42 | 1402 | 1644 | 1527 | 20.70 | 32.24 | 10.92 | 0.18 |
| 64.39 | -138.17 | 1682.61 | 1610 | 1772 | 1677 | 27.70 | 36.90 | 17.36 | 0.07 |
| 64.40 | -138.73 | 1562.94 | 1464 | 1704 | 1560 | 29.46 | 50.84 | 13.63 | 0.18 |
| 64.39 | -138.20 | 1472.56 | 1365 | 1597 | 1467 | 21.23 | 34.84 | 9.14 | 0.14 |
| 64.37 | -138.26 | 1235.85 | 1046 | 1436 | 1221 | 12.02 | 33.39 | 0.48 | 1.61 |
| 64.38 | -138.61 | 1595.42 | 1540 | 1668 | 1593 | 9.71 | 23.65 | 3.93 | 0.34 |
| 64.34 | -138.18 | 1546.72 | 1417 | 1684 | 1549 | 24.50 | 34.62 | 13.71 | 0.25 |
| 64.34 | -138.24 | 1456.93 | 1396 | 1555 | 1450 | 15.66 | 29.50 | 4.06 | 0.23 |
| 64.35 | -138.57 | 1674.44 | 1618 | 1739 | 1674 | 25.20 | 40.53 | 2.36 | 0.07 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 63.12 | -130.49 | 1473.06 | 1383 | 1637 | 1457 | 31.15 | 39.90 | 16.42 | 0.09 |
| 63.09 | -130.03 | 1404.91 | 1346 | 1496 | 1398 | 15.44 | 29.08 | 5.89 | 0.12 |
| 63.09 | -130.02 | 1469.68 | 1372 | 1563 | 1471 | 19.35 | 36.20 | 9.88 | 0.15 |
| 63.11 | -130.49 | 1650.24 | 1568 | 1771 | 1645 | 20.39 | 43.14 | 6.63 | 0.16 |
| 63.08 | -129.99 | 1504.83 | 1462 | 1576 | 1503 | 18.13 | 30.40 | 7.33 | 0.06 |
| 63.08 | -130.00 | 1560.59 | 1440 | 1713 | 1552 | 31.88 | 37.62 | 20.12 | 0.08 |
| 63.07 | -129.82 | 1670.89 | 1635 | 1720 | 1667 | 21.75 | 27.68 | 13.90 | 0.04 |
| 63.07 | -129.97 | 1634.29 | 1555 | 1727 | 1636 | 22.30 | 36.62 | 13.92 | 0.10 |
| 63.04 | -130.13 | 1326.08 | 1143 | 1515 | 1327 | 24.73 | 34.79 | 10.64 | 0.26 |
| 63.42 | -131.38 | 1570.84 | 1506 | 1665 | 1561 | 14.61 | 26.80 | 4.04 | 0.19 |
| 63.21 | -131.17 | 1627.61 | 1549 | 1681 | 1633 | 23.87 | 36.15 | 9.70 | 0.09 |
| 63.41 | -131.38 | 1696.79 | 1597 | 1821 | 1690 | 21.70 | 44.30 | 4.58 | 0.21 |
| 63.38 | -131.45 | 1662.27 | 1583 | 1814 | 1662 | 21.39 | 44.18 | 4.97 | 0.15 |
| 63.37 | -131.45 | 1567.66 | 1554 | 1588 | 1565 | 12.54 | 22.43 | 1.43 | 0.07 |
| 63.16 | -131.41 | 1626.65 | 1564 | 1670 | 1625 | 11.58 | 38.96 | 0.34 | 0.27 |
| 63.15 | -131.39 | 1548.87 | 1498 | 1585 | 1553 | 11.89 | 28.55 | 0.75 | 0.17 |
| 63.14 | -131.44 | 1613.63 | 1538 | 1680 | 1614 | 22.33 | 33.60 | 9.58 | 0.07 |
| 63.14 | -131.40 | 1453.05 | 1408 | 1525 | 1450 | 9.59 | 31.85 | 2.43 | 0.26 |
| 61.97 | -130.13 | 1553.06 | 1479 | 1648 | 1544 | 23.31 | 38.20 | 5.13 | 0.14 |
| 61.96 | -130.25 | 1630.29 | 1555 | 1763 | 1615 | 23.27 | 40.83 | 5.79 | 0.16 |
| 61.93 | -130.24 | 1662.31 | 1561 | 1858 | 1652 | 30.98 | 51.26 | 8.84 | 0.10 |
| 61.90 | -130.21 | 1648.36 | 1472 | 1851 | 1653 | 25.67 | 40.62 | 10.91 | 0.23 |
| 61.88 | -130.15 | 1601.74 | 1491 | 1718 | 1591 | 26.54 | 38.69 | 6.92 | 0.13 |
| 61.54 | -131.80 | 1275.18 | 1193 | 1372 | 1268 | 14.37 | 27.64 | 5.10 | 0.25 |
| 61.57 | -131.89 | 1362.28 | 1333 | 1413 | 1352 | 18.77 | 30.33 | 5.88 | 0.05 |
| 61.52 | -131.89 | 1734.21 | 1666 | 1823 | 1731 | 25.94 | 36.89 | 15.13 | 0.06 |
| 61.52 | -131.90 | 1820.58 | 1697 | 1957 | 1818 | 31.67 | 41.32 | 13.52 | 0.10 |
| 61.52 | -131.71 | 1716.69 | 1626 | 1820 | 1722 | 21.19 | 36.46 | 6.85 | 0.12 |
| 61.51 | -131.69 | 1623.53 | 1475 | 1757 | 1624 | 16.22 | 30.09 | 6.14 | 0.37 |
| 61.51 | -131.72 | 1744.93 | 1650 | 1824 | 1758 | 22.83 | 35.54 | 12.57 | 0.09 |
| 61.51 | -131.67 | 1498.48 | 1347 | 1640 | 1488 | 17.17 | 32.98 | 5.76 | 0.37 |
| 61.51 | -131.73 | 1748.09 | 1623 | 1910 | 1747 | 34.43 | 41.44 | 24.65 | 0.07 |
| 61.42 | -130.87 | 1575.07 | 1515 | 1686 | 1572 | 14.93 | 28.83 | 4.90 | 0.12 |
| 61.42 | -130.02 | 1591.99 | 1515 | 1649 | 1596 | 17.64 | 31.03 | 7.73 | 0.15 |
| 61.41 | -130.90 | 1357.70 | 1316 | 1422 | 1354 | 13.67 | 28.56 | 2.39 | 0.14 |
| 61.38 | -130.76 | 1647.17 | 1560 | 1738 | 1649 | 21.56 | 31.43 | 11.99 | 0.10 |
| 61.38 | -130.93 | 1674.17 | 1526 | 1816 | 1684 | 24.96 | 41.68 | 7.83 | 0.15 |
| 61.37 | -130.96 | 1528.20 | 1455 | 1584 | 1535 | 9.91 | 17.42 | 3.77 | 0.20 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.35 | -138.67 | 1554.33 | 1479 | 1638 | 1552 | 19.09 | 41.86 | 5.81 | 0.23 |
| 64.34 | -138.38 | 1224.22 | 1116 | 1342 | 1206 | 19.00 | 31.51 | 7.39 | 0.19 |
| 64.34 | -138.48 | 1274.91 | 1132 | 1421 | 1275 | 29.02 | 37.67 | 21.34 | 0.13 |
| 64.33 | -138.24 | 1637.30 | 1588 | 1704 | 1633 | 18.49 | 32.09 | 6.80 | 0.14 |
| 64.33 | -138.53 | 1581.37 | 1472 | 1701 | 1576 | 35.81 | 49.68 | 19.48 | 0.12 |
| 64.33 | -138.39 | 1379.25 | 1166 | 1603 | 1384 | 24.89 | 37.40 | 10.76 | 0.28 |
| 64.32 | -138.16 | 1357.91 | 1200 | 1534 | 1359 | 20.56 | 33.89 | 4.86 | 1.01 |
| 64.32 | -138.12 | 1497.14 | 1358 | 1609 | 1500 | 29.74 | 36.57 | 21.83 | 0.12 |
| 64.32 | -138.40 | 1319.84 | 1187 | 1440 | 1320 | 23.97 | 31.00 | 13.64 | 0.22 |
| 64.32 | -138.57 | 1541.55 | 1464 | 1611 | 1538 | 29.19 | 41.80 | 4.32 | 0.07 |
| 64.31 | -138.41 | 1213.41 | 1087 | 1338 | 1217 | 25.32 | 38.22 | 15.18 | 0.16 |
| 64.29 | -138.43 | 1202.08 | 1047 | 1341 | 1207 | 20.45 | 29.12 | 9.09 | 0.33 |
| 64.28 | -138.20 | 1492.42 | 1426 | 1584 | 1491 | 19.80 | 32.57 | 6.80 | 0.16 |
| 64.31 | -138.59 | 1601.53 | 1530 | 1709 | 1587 | 27.80 | 43.32 | 6.99 | 0.10 |
| 64.30 | -138.19 | 1489.04 | 1458 | 1537 | 1488 | 20.49 | 37.49 | 14.91 | 0.06 |
| 64.30 | -138.39 | 1547.37 | 1299 | 1707 | 1559 | 25.12 | 42.28 | 0.00 | 0.42 |
| 64.30 | -138.43 | 1140.33 | 1007 | 1236 | 1151 | 18.07 | 25.53 | 8.94 | 0.19 |
| 64.28 | -138.41 | 1455.93 | 1197 | 1670 | 1462 | 20.49 | 41.77 | 6.75 | 0.61 |
| 64.28 | -138.45 | 1095.30 | 786 | 1396 | 1097 | 18.64 | 38.98 | 6.28 | 1.49 |
| 64.27 | -138.29 | 1269.01 | 1122 | 1405 | 1271 | 24.39 | 35.02 | 13.78 | 0.17 |
| 64.26 | -138.47 | 943.25 | 762 | 1217 | 913 | 17.63 | 30.83 | 7.75 | 0.57 |
| 64.26 | -138.30 | 1086.25 | 1015 | 1218 | 1077 | 20.18 | 30.42 | 12.35 | 0.21 |
| 64.22 | -138.49 | 1137.62 | 989 | 1252 | 1146 | 22.93 | 31.44 | 1.51 | 0.34 |
| 64.60 | -138.21 | 1630.09 | 1528 | 1702 | 1629 | 15.49 | 34.30 | 4.06 | 0.13 |
| 64.93 | -133.98 | 1404.53 | 1277 | 1539 | 1405 | 32.99 | 42.40 | 17.35 | 0.08 |
| 64.92 | -133.92 | 1191.31 | 1084 | 1347 | 1186 | 30.51 | 43.69 | 9.70 | 0.18 |
| 64.88 | -133.94 | 1511.58 | 1353 | 1828 | 1448 | 28.19 | 55.41 | 1.97 | 0.20 |
| 64.88 | -133.93 | 1400.84 | 1339 | 1485 | 1400 | 17.10 | 28.83 | 3.32 | 0.13 |
| 64.86 | -133.94 | 1948.30 | 1793 | 2072 | 1952 | 37.85 | 53.29 | 1.51 | 0.16 |
| 64.86 | -133.97 | 1588.14 | 1452 | 1725 | 1584 | 32.58 | 38.70 | 26.12 | 0.08 |
| 64.86 | -133.96 | 1608.68 | 1467 | 1771 | 1604 | 35.45 | 41.50 | 31.11 | 0.06 |
| 64.89 | -133.82 | 1382.78 | 1150 | 1562 | 1392 | 26.65 | 38.19 | 14.72 | 0.19 |
| 64.85 | -133.88 | 1649.06 | 1528 | 1817 | 1644 | 37.94 | 45.55 | 28.46 | 0.10 |
| 65.00 | -133.81 | 1158.22 | 1055 | 1329 | 1157 | 26.03 | 36.34 | 16.42 | 0.20 |
| 64.94 | -133.86 | 911.14 | 819 | 1076 | 893 | 20.03 | 37.75 | 0.00 | 0.21 |
| 64.89 | -133.94 | 1559.61 | 1435 | 1679 | 1547 | 26.99 | 35.72 | 1.51 | 0.15 |
| 64.91 | -133.83 | 1425.59 | 1317 | 1493 | 1430 | 25.50 | 37.71 | 10.64 | 0.20 |
| 64.90 | -133.84 | 1636.41 | 1549 | 1722 | 1632 | 28.66 | 39.24 | 22.38 | 0.10 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.38 | -130.50 | 1665.54 | 1584 | 1789 | 1658 | 17.75 | 32.36 | 3.11 | 0.24 |
| 61.37 | -130.94 | 1730.03 | 1662 | 1812 | 1730 | 17.82 | 33.11 | 3.39 | 0.11 |
| 61.37 | -130.96 | 1742.81 | 1679 | 1844 | 1732 | 21.95 | 33.75 | 4.90 | 0.09 |
| 61.36 | -130.97 | 1697.89 | 1611 | 1811 | 1692 | 25.19 | 36.66 | 6.40 | 0.10 |
| 61.36 | -130.99 | 1574.88 | 1480 | 1728 | 1563 | 26.15 | 39.83 | 7.21 | 0.09 |
| 61.36 | -130.54 | 1633.10 | 1520 | 1736 | 1635 | 22.85 | 28.08 | 9.74 | 0.10 |
| 61.36 | -130.74 | 1684.67 | 1652 | 1737 | 1678 | 13.99 | 28.57 | 4.76 | 0.09 |
| 61.33 | -130.74 | 1633.75 | 1591 | 1718 | 1620 | 15.11 | 32.72 | 3.44 | 0.12 |
| 61.31 | -130.96 | 1594.90 | 1494 | 1766 | 1579 | 28.78 | 46.33 | 5.55 | 0.11 |
| 61.25 | -130.86 | 1546.40 | 1451 | 1641 | 1553 | 15.36 | 38.52 | 5.79 | 0.22 |
| 61.25 | -130.99 | 1450.32 | 1399 | 1515 | 1445 | 16.89 | 29.60 | 8.33 | 0.11 |
| 61.24 | -130.79 | 1671.33 | 1593 | 1771 | 1670 | 29.34 | 41.50 | 18.83 | 0.07 |
| 61.23 | -130.78 | 1554.51 | 1504 | 1589 | 1557 | 17.40 | 25.30 | 12.98 | 0.04 |
| 61.22 | -130.94 | 1517.82 | 1429 | 1599 | 1517 | 21.10 | 36.51 | 11.00 | 0.19 |
| 61.21 | -130.40 | 1648.19 | 1580 | 1778 | 1639 | 23.05 | 46.21 | 9.72 | 0.11 |
| 61.21 | -130.44 | 1611.74 | 1495 | 1779 | 1612 | 26.04 | 41.66 | 7.59 | 0.33 |
| 61.20 | -130.87 | 1536.92 | 1342 | 1746 | 1533 | 22.56 | 39.76 | 11.77 | 0.31 |
| 61.19 | -130.40 | 1733.01 | 1676 | 1785 | 1738 | 11.60 | 26.11 | 0.34 | 0.14 |
| 61.18 | -130.65 | 1645.87 | 1534 | 1762 | 1650 | 23.98 | 35.82 | 13.96 | 0.13 |
| 61.17 | -130.62 | 1608.76 | 1550 | 1704 | 1601 | 22.48 | 36.09 | 6.17 | 0.10 |
| 61.17 | -130.63 | 1674.54 | 1613 | 1775 | 1671 | 20.57 | 40.95 | 1.39 | 0.15 |
| 61.17 | -130.26 | 1615.71 | 1564 | 1695 | 1612 | 19.26 | 39.59 | 6.99 | 0.09 |
| 61.16 | -130.75 | 1552.41 | 1458 | 1653 | 1552 | 25.14 | 34.92 | 14.20 | 0.10 |
| 61.16 | -130.35 | 1524.93 | 1447 | 1659 | 1521 | 15.49 | 33.53 | 3.81 | 0.41 |
| 61.14 | -130.84 | 1736.60 | 1694 | 1793 | 1731 | 20.61 | 37.54 | 3.32 | 0.07 |
| 61.13 | -130.81 | 1477.97 | 1412 | 1547 | 1480 | 18.80 | 30.87 | 9.72 | 0.11 |
| 61.13 | -130.88 | 1567.58 | 1472 | 1685 | 1564 | 21.25 | 37.33 | 7.75 | 0.16 |
| 61.13 | -130.16 | 1588.20 | 1526 | 1673 | 1583 | 25.94 | 36.49 | 15.48 | 0.10 |
| 61.13 | -130.11 | 1587.80 | 1537 | 1650 | 1585 | 24.18 | 42.36 | 8.81 | 0.06 |
| 61.12 | -130.13 | 1552.42 | 1522 | 1583 | 1554 | 13.13 | 28.50 | 2.72 | 0.12 |
| 61.12 | -130.14 | 1559.56 | 1509 | 1610 | 1560 | 14.47 | 29.67 | 7.45 | 0.11 |
| 61.11 | -130.16 | 1629.17 | 1483 | 1796 | 1633 | 26.09 | 43.81 | 4.53 | 0.31 |
| 61.11 | -130.15 | 1639.81 | 1535 | 1720 | 1640 | 21.59 | 29.09 | 9.75 | 0.11 |
| 61.11 | -130.12 | 1725.11 | 1690 | 1795 | 1722 | 14.52 | 37.68 | 4.17 | 0.08 |
| 61.11 | -130.24 | 1631.91 | 1574 | 1742 | 1625 | 19.23 | 42.41 | 5.71 | 0.13 |
| 61.11 | -130.12 | 1712.17 | 1646 | 1838 | 1703 | 25.40 | 47.94 | 10.48 | 0.07 |
| 61.10 | -130.86 | 1718.17 | 1608 | 1853 | 1707 | 25.92 | 49.10 | 14.55 | 0.09 |
| 61.11 | -130.11 | 1624.81 | 1576 | 1674 | 1625 | 16.22 | 32.05 | 9.97 | 0.08 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.90 | -133.85 | 1579.66 | 1454 | 1702 | 1578 | 35.80 | 42.17 | 28.51 | 0.08 |
| 64.89 | -133.81 | 934.37 | 845 | 1062 | 933 | 31.45 | 44.54 | 9.70 | 0.08 |
| 64.89 | -133.85 | 1275.62 | 1209 | 1364 | 1275 | 25.15 | 35.82 | 8.59 | 0.11 |
| 64.88 | -133.92 | 1639.81 | 1494 | 1796 | 1656 | 31.52 | 42.69 | 18.31 | 0.17 |
| 64.88 | -133.85 | 1782.62 | 1638 | 1864 | 1795 | 36.31 | 56.33 | 1.82 | 0.15 |
| 64.86 | -133.89 | 1596.87 | 1415 | 1692 | 1633 | 36.21 | 59.19 | 1.07 | 0.11 |
| 64.86 | -133.88 | 1368.17 | 1323 | 1447 | 1361 | 21.25 | 41.09 | 2.64 | 0.16 |
| 64.85 | -133.94 | 1580.61 | 1454 | 1759 | 1573 | 29.50 | 39.24 | 19.28 | 0.11 |
| 64.85 | -133.93 | 1624.20 | 1491 | 1800 | 1615 | 31.08 | 38.93 | 24.26 | 0.10 |
| 64.84 | -133.93 | 1635.04 | 1475 | 1813 | 1623 | 29.39 | 36.71 | 21.68 | 0.11 |
| 64.84 | -133.91 | 1809.46 | 1575 | 2095 | 1795 | 31.00 | 39.16 | 20.37 | 0.23 |
| 64.83 | -133.92 | 1473.20 | 1393 | 1616 | 1458 | 19.84 | 30.52 | 4.43 | 0.15 |
| 64.82 | -133.91 | 1541.62 | 1331 | 1759 | 1544 | 33.23 | 47.91 | 7.39 | 0.43 |
| 64.82 | -133.89 | 1427.68 | 1219 | 1772 | 1392 | 26.48 | 41.04 | 5.73 | 0.39 |
| 64.82 | -133.77 | 1654.10 | 1491 | 1803 | 1655 | 31.38 | 47.13 | 1.97 | 0.34 |
| 64.81 | -133.96 | 1780.66 | 1679 | 1982 | 1758 | 28.28 | 52.34 | 5.48 | 0.24 |
| 64.79 | -133.99 | 1878.24 | 1788 | 1993 | 1874 | 37.88 | 51.56 | 23.88 | 0.08 |
| 64.79 | -133.89 | 1316.23 | 1187 | 1571 | 1280 | 27.41 | 49.19 | 4.26 | 0.36 |
| 64.79 | -133.92 | 1715.84 | 1570 | 1853 | 1717 | 47.83 | 57.20 | 25.42 | 0.08 |
| 64.78 | -133.91 | 1742.05 | 1564 | 1888 | 1749 | 35.64 | 50.49 | 5.43 | 0.21 |
| 64.78 | -133.92 | 1679.55 | 1536 | 1883 | 1663 | 35.91 | 54.08 | 2.46 | 0.20 |
| 64.76 | -133.98 | 1618.03 | 1521 | 1822 | 1616 | 16.84 | 42.73 | 0.68 | 0.39 |
| 64.76 | -133.92 | 1622.44 | 1570 | 1722 | 1608 | 17.59 | 38.23 | 4.26 | 0.21 |
| 64.79 | -133.83 | 1437.35 | 1311 | 1579 | 1441 | 27.28 | 42.66 | 6.42 | 0.28 |
| 64.76 | -133.86 | 1562.92 | 1448 | 1847 | 1528 | 27.03 | 55.05 | 0.68 | 0.31 |
| 64.75 | -133.84 | 1374.62 | 1296 | 1485 | 1370 | 26.42 | 38.53 | 3.72 | 0.13 |
| 64.75 | -133.84 | 1369.48 | 1278 | 1507 | 1365 | 16.63 | 36.43 | 6.42 | 0.20 |
| 64.74 | -133.83 | 1402.59 | 1304 | 1541 | 1396 | 26.51 | 41.70 | 10.68 | 0.16 |
| 64.74 | -133.82 | 1385.79 | 1230 | 1571 | 1384 | 31.53 | 38.05 | 20.69 | 0.16 |
| 64.73 | -133.94 | 1593.40 | 1489 | 1743 | 1590 | 31.76 | 45.76 | 2.88 | 0.26 |
| 64.71 | -133.98 | 1562.70 | 1360 | 1771 | 1594 | 32.22 | 53.15 | 5.81 | 0.27 |
| 64.70 | -133.97 | 1661.86 | 1555 | 1816 | 1658 | 28.93 | 39.08 | 12.81 | 0.12 |
| 64.69 | -133.99 | 1429.11 | 1254 | 1599 | 1430 | 34.48 | 40.65 | 25.10 | 0.09 |
| 64.66 | -133.95 | 1577.10 | 1447 | 1726 | 1571 | 36.81 | 44.54 | 25.53 | 0.22 |
| 64.65 | -133.68 | 1952.37 | 1734 | 2137 | 1967 | 35.22 | 47.06 | 15.88 | 0.16 |
| 64.65 | -133.97 | 1743.64 | 1611 | 1925 | 1739 | 30.20 | 43.60 | 0.48 | 0.31 |
| 64.65 | -133.95 | 1870.44 | 1736 | 1979 | 1875 | 34.87 | 47.09 | 2.90 | 0.22 |
| 64.59 | -133.99 | 1644.97 | 1580 | 1754 | 1636 | 23.55 | 43.54 | 7.21 | 0.09 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.09 | -130.15 | 1589.26 | 1553 | 1655 | 1584 | 17.26 | 39.34 | 2.46 | 0.13 |
| 61.06 | -130.63 | 1566.84 | 1421 | 1751 | 1557 | 26.86 | 39.13 | 11.31 | 0.19 |
| 61.06 | -130.60 | 1560.94 | 1397 | 1698 | 1563 | 28.14 | 38.13 | 17.18 | 0.23 |
| 61.06 | -130.74 | 1638.84 | 1565 | 1726 | 1646 | 16.80 | 43.02 | 2.26 | 0.30 |
| 61.06 | -130.64 | 1641.81 | 1577 | 1689 | 1656 | 15.13 | 26.60 | 1.39 | 0.09 |
| 61.06 | -130.71 | 1467.33 | 1293 | 1568 | 1485 | 18.87 | 37.45 | 3.37 | 0.50 |
| 61.06 | -130.61 | 1609.07 | 1401 | 1792 | 1612 | 19.93 | 40.55 | 3.93 | 0.73 |
| 61.06 | -130.69 | 1549.94 | 1480 | 1655 | 1544 | 23.54 | 40.36 | 9.88 | 0.17 |
| 61.03 | -130.67 | 1548.15 | 1468 | 1641 | 1540 | 12.67 | 28.67 | 3.11 | 0.23 |
| 61.03 | -130.27 | 1534.64 | 1403 | 1639 | 1540 | 19.58 | 35.10 | 5.13 | 0.31 |
| 61.02 | -130.60 | 1519.86 | 1399 | 1698 | 1509 | 27.14 | 43.54 | 11.40 | 0.14 |
| 61.02 | -130.60 | 1639.40 | 1538 | 1745 | 1639 | 17.96 | 33.06 | 1.35 | 0.15 |
| 61.01 | -130.54 | 1634.54 | 1595 | 1713 | 1629 | 16.08 | 34.68 | 1.91 | 0.13 |
| 61.01 | -130.61 | 1650.40 | 1534 | 1809 | 1641 | 28.45 | 40.04 | 10.97 | 0.16 |
| 61.01 | -130.43 | 1544.95 | 1489 | 1645 | 1542 | 15.19 | 40.63 | 5.75 | 0.16 |
| 61.01 | -130.43 | 1560.62 | 1477 | 1683 | 1557 | 24.28 | 39.52 | 6.62 | 0.15 |
| 61.01 | -130.45 | 1498.99 | 1447 | 1550 | 1508 | 15.55 | 23.84 | 6.14 | 0.07 |
| 61.00 | -130.52 | 1494.90 | 1378 | 1668 | 1490 | 23.59 | 53.67 | 10.72 | 0.29 |
| 61.00 | -130.51 | 1544.16 | 1474 | 1619 | 1538 | 22.50 | 40.36 | 5.40 | 0.09 |
| 61.50 | -131.91 | 1776.91 | 1666 | 1899 | 1772 | 35.29 | 38.54 | 29.25 | 0.05 |
| 61.49 | -131.72 | 1702.75 | 1631 | 1773 | 1702 | 17.94 | 38.46 | 2.39 | 0.17 |
| 61.49 | -131.64 | 1519.33 | 1445 | 1606 | 1522 | 20.52 | 31.73 | 15.18 | 0.07 |
| 61.47 | -131.97 | 1678.78 | 1533 | 1879 | 1648 | 26.10 | 38.32 | 7.61 | 0.21 |
| 61.47 | -131.96 | 1766.23 | 1656 | 1878 | 1761 | 29.63 | 39.82 | 18.27 | 0.09 |
| 61.47 | -131.65 | 1593.68 | 1484 | 1696 | 1602 | 22.34 | 39.72 | 7.13 | 0.17 |
| 61.46 | -131.09 | 1640.01 | 1588 | 1712 | 1640 | 19.89 | 38.01 | 0.48 | 0.09 |
| 61.46 | -131.14 | 1689.73 | 1654 | 1756 | 1682 | 11.28 | 26.58 | 3.18 | 0.11 |
| 61.44 | -131.22 | 1703.73 | 1619 | 1822 | 1698 | 29.03 | 42.51 | 10.70 | 0.13 |
| 61.43 | -131.55 | 1480.73 | 1342 | 1584 | 1490 | 22.82 | 34.22 | 11.37 | 0.16 |
| 61.43 | -131.51 | 1653.80 | 1560 | 1736 | 1651 | 22.92 | 38.66 | 4.06 | 0.12 |
| 61.41 | -131.76 | 1323.99 | 1273 | 1412 | 1316 | 14.89 | 30.32 | 2.02 | 0.23 |
| 61.42 | -131.02 | 1755.34 | 1684 | 1844 | 1755 | 15.66 | 30.79 | 7.45 | 0.16 |
| 61.40 | -131.89 | 1546.46 | 1485 | 1646 | 1543 | 18.37 | 41.54 | 2.39 | 0.17 |
| 61.40 | -131.76 | 1518.24 | 1401 | 1696 | 1516 | 21.49 | 34.20 | 1.97 | 0.14 |
| 61.40 | -131.75 | 1578.12 | 1496 | 1660 | 1581 | 26.96 | 32.74 | 18.39 | 0.08 |
| 61.41 | -131.08 | 1696.41 | 1593 | 1836 | 1699 | 23.39 | 34.24 | 4.69 | 0.11 |
| 61.41 | -131.09 | 1661.89 | 1546 | 1791 | 1663 | 26.88 | 34.44 | 13.12 | 0.14 |
| 61.40 | -131.75 | 1547.30 | 1442 | 1662 | 1541 | 26.84 | 38.51 | 12.05 | 0.11 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.59 | -133.97 | 1858.50 | 1677 | 2018 | 1882 | 31.26 | 42.41 | 3.52 | 0.14 |
| 64.59 | -133.77 | 1494.54 | 1390 | 1675 | 1475 | 30.87 | 46.96 | 4.50 | 0.16 |
| 64.59 | -133.74 | 1579.91 | 1484 | 1789 | 1554 | 29.53 | 51.72 | 1.35 | 0.39 |
| 64.57 | -133.76 | 1812.08 | 1782 | 1850 | 1812 | 18.36 | 30.84 | 6.49 | 0.06 |
| 64.57 | -133.71 | 1882.98 | 1631 | 2096 | 1871 | 29.21 | 50.27 | 5.48 | 0.24 |
| 64.57 | -133.69 | 1764.24 | 1702 | 1863 | 1762 | 23.24 | 41.80 | 9.83 | 0.14 |
| 64.56 | -133.71 | 1968.25 | 1786 | 2214 | 1941 | 35.58 | 57.96 | 5.48 | 0.19 |
| 64.56 | -133.82 | 1536.57 | 1419 | 1746 | 1514 | 33.05 | 52.19 | 8.81 | 0.17 |
| 64.56 | -133.80 | 1863.24 | 1752 | 1995 | 1856 | 24.86 | 44.52 | 9.70 | 0.13 |
| 64.56 | -133.89 | 1462.01 | 1393 | 1558 | 1443 | 17.38 | 35.51 | 6.92 | 0.14 |
| 64.54 | -133.87 | 1622.61 | 1547 | 1699 | 1623 | 21.32 | 35.97 | 7.39 | 0.07 |
| 64.49 | -133.96 | 1664.18 | 1535 | 1904 | 1628 | 33.32 | 59.75 | 3.58 | 0.17 |
| 64.50 | -133.92 | 1812.73 | 1651 | 1920 | 1824 | 30.27 | 40.31 | 4.76 | 0.10 |
| 64.51 | -133.91 | 1689.46 | 1520 | 1890 | 1677 | 32.83 | 54.44 | 1.07 | 0.29 |
| 64.51 | -133.87 | 1767.38 | 1625 | 1914 | 1772 | 33.30 | 42.80 | 13.33 | 0.23 |
| 64.50 | -133.84 | 1586.78 | 1466 | 1748 | 1572 | 31.21 | 47.78 | 14.66 | 0.22 |
| 64.46 | -133.92 | 1571.74 | 1457 | 1770 | 1559 | 33.04 | 46.41 | 16.17 | 0.22 |
| 64.45 | -133.92 | 1634.63 | 1509 | 1765 | 1629 | 34.31 | 50.31 | 6.72 | 0.32 |
| 64.45 | -133.91 | 1582.57 | 1525 | 1638 | 1584 | 21.59 | 32.86 | 5.13 | 0.10 |
| 64.43 | -133.99 | 1624.96 | 1482 | 1789 | 1623 | 33.00 | 48.60 | 9.70 | 0.17 |
| 64.42 | -133.90 | 1516.41 | 1384 | 1615 | 1535 | 23.98 | 39.10 | 0.95 | 0.14 |
| 64.40 | -133.87 | 1610.08 | 1492 | 1744 | 1612 | 32.47 | 45.05 | 1.39 | 0.24 |
| 64.44 | -133.77 | 1322.98 | 1212 | 1473 | 1317 | 36.02 | 46.85 | 19.19 | 0.14 |
| 64.17 | -133.94 | 1519.24 | 1232 | 1755 | 1522 | 30.37 | 39.38 | 23.49 | 0.28 |
| 64.16 | -133.93 | 1657.94 | 1479 | 1769 | 1678 | 33.61 | 45.30 | 0.48 | 0.09 |
| 64.15 | -133.84 | 1538.07 | 1456 | 1629 | 1541 | 22.36 | 34.90 | 8.44 | 0.14 |
| 64.14 | -133.82 | 1621.07 | 1400 | 1766 | 1631 | 33.47 | 45.75 | 2.05 | 0.27 |
| 64.13 | -133.89 | 1641.91 | 1384 | 1826 | 1657 | 32.20 | 41.78 | 2.57 | 0.30 |
| 64.12 | -133.95 | 1353.85 | 1267 | 1448 | 1350 | 33.40 | 39.67 | 25.50 | 0.09 |
| 64.12 | -133.96 | 1360.80 | 1236 | 1519 | 1356 | 32.82 | 39.31 | 18.10 | 0.13 |
| 64.10 | -133.87 | 1490.00 | 1368 | 1583 | 1481 | 25.31 | 39.16 | 2.72 | 0.12 |
| 64.01 | -133.80 | 1403.10 | 1311 | 1455 | 1410 | 19.86 | 34.29 | 1.22 | 0.13 |
| 64.13 | -133.61 | 1710.48 | 1593 | 1818 | 1709 | 25.72 | 38.70 | 4.22 | 0.15 |
| 64.14 | -133.63 | 1597.40 | 1411 | 1818 | 1596 | 30.22 | 44.65 | 2.78 | 0.50 |
| 64.14 | -133.67 | 1673.75 | 1524 | 1768 | 1683 | 30.91 | 43.36 | 0.68 | 0.21 |
| 64.15 | -133.73 | 1541.90 | 1300 | 1768 | 1527 | 31.30 | 50.63 | 1.97 | 0.36 |
| 64.32 | -133.73 | 1502.61 | 1307 | 1802 | 1464 | 22.31 | 40.36 | 2.16 | 0.48 |
| 64.39 | -133.57 | 1663.27 | 1576 | 1719 | 1673 | 29.81 | 41.38 | 1.39 | 0.15 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.41 | -131.07 | 1724.71 | 1628 | 1888 | 1716 | 16.10 | 35.60 | 2.78 | 0.25 |
| 61.39 | -131.73 | 1416.09 | 1363 | 1457 | 1420 | 14.52 | 22.37 | 5.23 | 0.14 |
| 61.38 | -131.72 | 1580.38 | 1476 | 1658 | 1584 | 10.10 | 20.69 | 1.91 | 0.43 |
| 61.39 | -131.05 | 1491.29 | 1461 | 1549 | 1485 | 11.46 | 25.49 | 3.77 | 0.08 |
| 61.37 | -131.68 | 1498.59 | 1395 | 1654 | 1491 | 22.12 | 34.42 | 7.65 | 0.19 |
| 61.37 | -131.69 | 1574.92 | 1476 | 1705 | 1568 | 23.98 | 37.20 | 10.94 | 0.15 |
| 61.37 | -131.70 | 1625.35 | 1567 | 1717 | 1619 | 25.30 | 41.28 | 13.63 | 0.09 |
| 61.38 | -131.08 | 1692.35 | 1609 | 1760 | 1700 | 21.66 | 36.83 | 5.79 | 0.10 |
| 61.36 | -131.28 | 1591.15 | 1486 | 1697 | 1595 | 36.97 | 41.65 | 18.07 | 0.06 |
| 61.36 | -131.29 | 1538.75 | 1488 | 1601 | 1535 | 18.53 | 29.00 | 13.26 | 0.05 |
| 61.36 | -131.05 | 1535.74 | 1439 | 1648 | 1540 | 20.79 | 41.71 | 5.95 | 0.21 |
| 61.35 | -131.53 | 1543.70 | 1419 | 1673 | 1548 | 23.54 | 38.06 | 7.51 | 0.22 |
| 61.35 | -131.13 | 1543.39 | 1454 | 1642 | 1535 | 20.32 | 35.51 | 6.18 | 0.21 |
| 61.34 | -131.09 | 1667.15 | 1624 | 1748 | 1662 | 25.76 | 38.91 | 10.68 | 0.11 |
| 61.32 | -131.60 | 1642.16 | 1534 | 1761 | 1640 | 22.34 | 30.89 | 7.14 | 0.13 |
| 61.32 | -131.02 | 1506.06 | 1406 | 1559 | 1519 | 16.33 | 32.95 | 4.82 | 0.17 |
| 61.31 | -131.02 | 1559.67 | 1517 | 1635 | 1557 | 22.10 | 36.07 | 10.48 | 0.06 |
| 61.30 | -131.16 | 1652.10 | 1567 | 1771 | 1651 | 25.96 | 42.12 | 5.27 | 0.07 |
| 61.29 | -131.14 | 1555.43 | 1469 | 1642 | 1557 | 17.90 | 30.66 | 8.74 | 0.17 |
| 61.26 | -131.11 | 1550.88 | 1480 | 1639 | 1551 | 14.29 | 31.33 | 3.05 | 0.16 |
| 61.25 | -131.86 | 1541.43 | 1419 | 1674 | 1548 | 25.90 | 38.24 | 11.40 | 0.15 |
| 61.25 | -131.19 | 1545.60 | 1463 | 1653 | 1543 | 25.73 | 40.96 | 8.16 | 0.08 |
| 61.25 | -131.07 | 1638.58 | 1552 | 1758 | 1638 | 26.52 | 41.49 | 10.68 | 0.07 |
| 61.25 | -131.18 | 1476.88 | 1436 | 1566 | 1470 | 14.69 | 33.10 | 3.65 | 0.20 |
| 61.21 | -131.31 | 1443.05 | 1297 | 1605 | 1439 | 23.04 | 39.96 | 7.75 | 0.31 |
| 61.21 | -131.23 | 1438.61 | 1325 | 1572 | 1437 | 25.81 | 39.10 | 9.88 | 0.12 |
| 61.17 | -131.27 | 1586.55 | 1522 | 1686 | 1584 | 22.59 | 37.49 | 6.17 | 0.14 |
| 61.17 | -131.25 | 1421.28 | 1361 | 1478 | 1421 | 18.19 | 31.40 | 10.03 | 0.09 |
| 61.17 | -131.26 | 1595.58 | 1508 | 1698 | 1592 | 22.62 | 32.55 | 9.76 | 0.08 |
| 61.16 | -131.25 | 1613.54 | 1560 | 1658 | 1615 | 18.19 | 28.65 | 10.10 | 0.08 |
| 61.16 | -131.24 | 1610.24 | 1575 | 1653 | 1608 | 14.48 | 30.94 | 1.22 | 0.08 |
| 62.85 | -131.64 | 1522.56 | 1419 | 1627 | 1522 | 16.90 | 39.16 | 0.48 | 0.29 |
| 61.25 | -138.23 | 1672.85 | 1607 | 1744 | 1676 | 22.91 | 38.16 | 0.95 | 0.12 |
| 61.23 | -138.85 | 1208.41 | 1126 | 1289 | 1212 | 21.11 | 27.41 | 15.79 | 0.10 |
| 61.23 | -138.99 | 1825.97 | 1695 | 1942 | 1829 | 16.45 | 28.31 | 7.23 | 0.27 |
| 61.23 | -138.93 | 1778.46 | 1575 | 1983 | 1770 | 19.30 | 34.40 | 2.36 | 0.63 |
| 61.23 | -138.99 | 1775.97 | 1584 | 2028 | 1760 | 23.49 | 36.73 | 6.62 | 0.30 |
| 61.21 | -138.79 | 1060.37 | 954 | 1190 | 1058 | 19.81 | 36.63 | 6.93 | 0.36 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.41 | -133.59 | 1708.57 | 1634 | 1796 | 1707 | 30.76 | 43.59 | 2.88 | 0.12 |
| 64.42 | -133.60 | 1765.33 | 1663 | 1912 | 1753 | 32.10 | 45.74 | 4.76 | 0.13 |
| 64.39 | -133.75 | 1727.37 | 1524 | 1883 | 1747 | 39.34 | 54.27 | 2.90 | 0.16 |
| 64.40 | -133.74 | 1671.83 | 1456 | 1922 | 1660 | 41.71 | 56.46 | 5.32 | 0.30 |
| 64.43 | -133.69 | 1797.73 | 1697 | 1887 | 1803 | 25.59 | 37.89 | 4.82 | 0.23 |
| 64.45 | -133.65 | 1775.26 | 1670 | 1901 | 1775 | 32.70 | 49.98 | 3.11 | 0.19 |
| 64.51 | -133.68 | 1758.74 | 1683 | 1901 | 1737 | 26.31 | 41.43 | 2.86 | 0.12 |
| 64.51 | -133.71 | 1844.20 | 1651 | 1989 | 1842 | 39.99 | 51.84 | 2.72 | 0.16 |
| 64.53 | -133.70 | 1852.29 | 1610 | 2118 | 1851 | 36.40 | 52.30 | 2.46 | 0.42 |
| 64.52 | -133.58 | 1519.87 | 1449 | 1629 | 1522 | 28.20 | 44.65 | 2.26 | 0.16 |
| 64.54 | -133.67 | 1585.44 | 1535 | 1707 | 1579 | 21.25 | 52.41 | 2.90 | 0.19 |
| 64.56 | -133.62 | 1474.07 | 1397 | 1594 | 1462 | 20.76 | 34.85 | 5.99 | 0.18 |
| 64.56 | -133.65 | 1588.24 | 1486 | 1770 | 1577 | 35.31 | 53.51 | 11.77 | 0.22 |
| 64.60 | -133.69 | 1549.23 | 1455 | 1786 | 1547 | 19.13 | 48.67 | 2.43 | 0.43 |
| 64.60 | -133.65 | 1860.79 | 1719 | 2010 | 1860 | 42.29 | 50.02 | 27.92 | 0.11 |
| 64.60 | -133.64 | 1790.38 | 1645 | 1944 | 1788 | 33.39 | 42.85 | 24.28 | 0.11 |
| 64.63 | -133.62 | 1856.84 | 1634 | 2015 | 1852 | 37.01 | 51.40 | 5.72 | 0.20 |
| 64.74 | -133.55 | 1551.64 | 1378 | 1709 | 1549 | 32.23 | 39.04 | 2.16 | 0.11 |
| 64.81 | -133.49 | 1334.72 | 1172 | 1521 | 1326 | 28.65 | 38.29 | 8.28 | 0.24 |
| 64.77 | -133.45 | 1529.94 | 1454 | 1706 | 1512 | 18.56 | 38.59 | 3.02 | 0.30 |
| 64.76 | -133.45 | 1764.12 | 1676 | 1839 | 1766 | 30.04 | 42.04 | 10.03 | 0.11 |
| 64.83 | -133.47 | 1606.08 | 1442 | 1741 | 1607 | 30.75 | 37.56 | 0.75 | 0.25 |
| 64.90 | -133.46 | 1849.35 | 1706 | 2053 | 1833 | 34.16 | 44.52 | 4.50 | 0.15 |
| 64.83 | -133.56 | 1638.37 | 1542 | 1762 | 1628 | 23.95 | 43.33 | 2.05 | 0.22 |
| 64.84 | -133.54 | 1690.56 | 1489 | 1885 | 1713 | 27.07 | 39.30 | 7.09 | 0.34 |
| 64.85 | -133.57 | 1633.14 | 1437 | 1881 | 1626 | 37.02 | 49.27 | 23.20 | 0.19 |
| 64.85 | -133.63 | 1153.30 | 1046 | 1262 | 1151 | 32.52 | 39.68 | 24.10 | 0.09 |
| 64.85 | -133.62 | 1195.94 | 1073 | 1310 | 1200 | 35.46 | 46.27 | 25.21 | 0.11 |
| 64.85 | -133.59 | 1155.78 | 1005 | 1378 | 1146 | 34.74 | 51.23 | 14.04 | 0.24 |
| 64.30 | -133.77 | 1073.23 | 952 | 1169 | 1072 | 9.46 | 19.41 | 4.38 | 0.64 |
| 64.68 | -133.50 | 1606.03 | 1476 | 1732 | 1612 | 32.72 | 42.93 | 2.88 | 0.14 |
| 64.69 | -133.47 | 1554.31 | 1414 | 1663 | 1555 | 30.20 | 41.17 | 3.05 | 0.15 |
| 64.86 | -133.66 | 828.20 | 665 | 1078 | 812 | 26.10 | 40.49 | 3.05 | 0.40 |
| 64.87 | -133.63 | 1083.72 | 893 | 1294 | 1072 | 32.47 | 43.62 | 20.77 | 0.16 |
| 64.88 | -133.62 | 1338.12 | 1136 | 1514 | 1347 | 35.24 | 41.71 | 20.96 | 0.13 |
| 64.87 | -133.60 | 1056.29 | 905 | 1221 | 1049 | 31.41 | 42.05 | 21.77 | 0.09 |
| 64.88 | -133.60 | 1388.67 | 1246 | 1569 | 1381 | 36.26 | 44.75 | 25.52 | 0.14 |
| 64.88 | -133.62 | 1448.25 | 1209 | 1628 | 1467 | 34.79 | 47.14 | 19.18 | 0.26 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.21 | -138.80 | 1148.67 | 1070 | 1235 | 1147 | 27.58 | 37.03 | 20.10 | 0.06 |
| 61.21 | -138.90 | 1802.78 | 1463 | 2105 | 1813 | 22.70 | 43.95 | 5.72 | 0.81 |
| 61.19 | -138.92 | 2026.18 | 1855 | 2423 | 2011 | 17.12 | 42.81 | 0.00 | 1.20 |
| 61.19 | -138.90 | 1983.64 | 1862 | 2114 | 1968 | 20.27 | 38.97 | 1.39 | 0.34 |
| 61.18 | -138.94 | 1961.09 | 1821 | 2089 | 1964 | 18.93 | 38.47 | 4.04 | 0.51 |
| 61.16 | -138.88 | 1876.80 | 1807 | 1963 | 1871 | 26.18 | 41.02 | 16.03 | 0.07 |
| 61.15 | -138.74 | 1485.22 | 1350 | 1699 | 1471 | 26.78 | 38.66 | 10.94 | 0.22 |
| 61.14 | -138.69 | 1665.29 | 1389 | 2028 | 1659 | 26.99 | 43.80 | 7.92 | 0.56 |
| 61.15 | -138.96 | 1551.70 | 1494 | 1600 | 1553 | 24.74 | 34.77 | 17.69 | 0.04 |
| 61.13 | -138.87 | 1829.57 | 1749 | 1935 | 1822 | 25.23 | 43.67 | 9.30 | 0.22 |
| 61.10 | -138.63 | 1735.94 | 1424 | 2045 | 1739 | 27.87 | 48.23 | 5.43 | 0.87 |
| 61.07 | -138.62 | 1709.83 | 1521 | 1856 | 1728 | 21.59 | 40.10 | 5.55 | 0.47 |
| 61.09 | -138.61 | 1753.82 | 1447 | 1968 | 1774 | 28.93 | 48.57 | 7.37 | 0.79 |
| 61.09 | -138.73 | 1605.98 | 1495 | 1736 | 1597 | 33.56 | 45.22 | 20.47 | 0.11 |
| 61.09 | -138.99 | 2005.54 | 1867 | 2163 | 2012 | 20.37 | 38.12 | 4.39 | 0.28 |
| 61.09 | -138.69 | 1796.61 | 1675 | 1897 | 1805 | 25.84 | 42.34 | 11.99 | 0.23 |
| 61.08 | -138.95 | 1548.67 | 1411 | 1728 | 1533 | 23.08 | 41.28 | 1.22 | 0.59 |
| 61.06 | -138.55 | 1401.48 | 1032 | 1953 | 1335 | 28.01 | 40.23 | 12.30 | 0.38 |
| 61.06 | -138.97 | 1571.20 | 1453 | 1754 | 1561 | 22.25 | 48.70 | 7.90 | 0.76 |
| 61.06 | -138.99 | 1600.00 | 1489 | 1772 | 1595 | 19.71 | 35.50 | 9.65 | 0.21 |
| 61.02 | -138.52 | 1037.91 | 939 | 1131 | 1036 | 20.69 | 33.13 | 9.74 | 0.14 |
| 61.04 | -138.72 | 1654.85 | 1510 | 1888 | 1642 | 25.51 | 49.80 | 5.14 | 0.35 |
| 61.01 | -138.94 | 2078.79 | 1838 | 2281 | 2089 | 27.51 | 44.81 | 10.37 | 0.43 |
| 61.00 | -138.94 | 2008.86 | 1723 | 2303 | 2040 | 22.82 | 57.89 | 2.72 | 0.61 |
| 60.99 | -138.75 | 1375.71 | 1228 | 1532 | 1367 | 27.35 | 41.27 | 9.52 | 0.45 |
| 60.99 | -138.92 | 2067.42 | 1920 | 2210 | 2074 | 18.53 | 33.90 | 8.06 | 0.24 |
| 60.98 | -138.50 | 907.69 | 838 | 1021 | 902 | 17.24 | 36.17 | 0.34 | 0.24 |
| 60.99 | -138.85 | 1916.54 | 1862 | 1973 | 1920 | 17.71 | 29.03 | 7.21 | 0.09 |
| 60.99 | -138.81 | 1593.84 | 1539 | 1659 | 1593 | 21.10 | 32.48 | 4.06 | 0.06 |
| 60.99 | -138.81 | 1583.44 | 1501 | 1681 | 1580 | 29.89 | 42.23 | 9.58 | 0.07 |
| 60.99 | -138.77 | 1474.96 | 1390 | 1569 | 1472 | 28.07 | 37.48 | 14.87 | 0.10 |
| 60.96 | -138.58 | 902.14 | 779 | 1239 | 859 | 16.89 | 43.65 | 1.72 | 0.78 |
| 60.96 | -138.59 | 790.79 | 773 | 829 | 786 | 11.09 | 31.33 | 3.34 | 0.08 |
| 60.94 | -138.50 | 1290.12 | 1191 | 1408 | 1287 | 21.83 | 35.79 | 14.62 | 0.12 |
| 60.94 | -138.41 | 1918.17 | 1860 | 1996 | 1916 | 20.48 | 32.99 | 13.83 | 0.08 |
| 60.93 | -138.50 | 1399.79 | 1339 | 1499 | 1392 | 17.19 | 30.21 | 1.43 | 0.20 |
| 60.93 | -138.54 | 1814.24 | 1755 | 1854 | 1818 | 18.69 | 31.36 | 8.10 | 0.10 |
| 60.93 | -138.51 | 1638.52 | 1490 | 1836 | 1634 | 29.65 | 44.07 | 14.13 | 0.14 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.89 | -133.61 | 1707.66 | 1514 | 1928 | 1707 | 40.60 | 55.55 | 27.20 | 0.22 |
| 64.90 | -133.57 | 1585.72 | 1423 | 1775 | 1592 | 30.18 | 44.00 | 20.06 | 0.14 |
| 64.91 | -133.57 | 1415.46 | 1357 | 1516 | 1412 | 25.18 | 44.09 | 1.35 | 0.13 |
| 64.91 | -133.63 | 1787.19 | 1630 | 1980 | 1798 | 36.99 | 50.42 | 1.07 | 0.28 |
| 64.91 | -133.65 | 1464.25 | 1341 | 1701 | 1446 | 33.53 | 50.80 | 8.06 | 0.25 |
| 64.91 | -133.59 | 1506.48 | 1402 | 1588 | 1509 | 32.65 | 44.94 | 4.06 | 0.24 |
| 64.88 | -133.58 | 1020.94 | 697 | 1467 | 1034 | 27.23 | 46.47 | 2.13 | 0.45 |
| 64.92 | -133.59 | 1394.63 | 1334 | 1414 | 1402 | 11.74 | 30.82 | 0.34 | 0.08 |
| 64.93 | -133.62 | 1311.03 | 1219 | 1406 | 1312 | 21.74 | 31.50 | 13.77 | 0.13 |
| 64.94 | -133.50 | 1782.89 | 1613 | 1925 | 1794 | 34.51 | 44.96 | 7.72 | 0.12 |
| 64.94 | -133.50 | 1335.42 | 1253 | 1429 | 1335 | 22.64 | 44.81 | 5.73 | 0.13 |
| 64.95 | -133.61 | 1011.39 | 831 | 1369 | 967 | 22.49 | 41.65 | 1.39 | 0.50 |
| 64.96 | -133.56 | 1518.59 | 1347 | 1667 | 1530 | 34.95 | 48.05 | 12.35 | 0.18 |
| 64.97 | -133.57 | 1444.97 | 1325 | 1580 | 1440 | 25.45 | 40.67 | 2.72 | 0.26 |
| 64.97 | -133.61 | 1643.85 | 1444 | 1851 | 1649 | 34.22 | 42.97 | 16.63 | 0.20 |
| 64.98 | -133.61 | 1702.95 | 1397 | 2042 | 1696 | 36.23 | 47.17 | 5.71 | 0.46 |
| 64.99 | -133.52 | 1743.93 | 1609 | 1890 | 1740 | 37.46 | 43.42 | 22.78 | 0.14 |
| 64.98 | -133.56 | 1365.84 | 1207 | 1530 | 1367 | 27.74 | 36.68 | 13.14 | 0.27 |
| 64.99 | -133.64 | 1464.68 | 1333 | 1638 | 1456 | 31.77 | 42.07 | 22.74 | 0.18 |
| 64.98 | -133.66 | 1137.98 | 1010 | 1395 | 1112 | 22.51 | 38.95 | 6.20 | 0.24 |
| 64.96 | -133.46 | 1783.68 | 1707 | 1931 | 1778 | 27.70 | 42.12 | 6.06 | 0.16 |
| 64.97 | -133.49 | 1573.37 | 1372 | 1879 | 1540 | 26.82 | 47.31 | 0.68 | 0.60 |
| 64.99 | -133.48 | 1842.53 | 1665 | 1990 | 1842 | 31.98 | 39.95 | 7.66 | 0.12 |
| 64.99 | -133.34 | 1548.40 | 1493 | 1597 | 1549 | 14.70 | 31.58 | 6.62 | 0.18 |
| 65.00 | -133.30 | 1385.88 | 1339 | 1434 | 1388 | 28.85 | 44.44 | 9.92 | 0.05 |
| 64.98 | -133.36 | 1592.34 | 1555 | 1645 | 1587 | 9.23 | 22.47 | 1.35 | 0.19 |
| 64.97 | -133.34 | 1644.88 | 1515 | 1860 | 1637 | 24.66 | 45.87 | 1.51 | 0.18 |
| 64.98 | -133.31 | 1417.01 | 1305 | 1667 | 1385 | 25.74 | 48.83 | 1.51 | 0.29 |
| 64.98 | -133.29 | 1695.86 | 1525 | 1811 | 1701 | 32.50 | 42.16 | 20.07 | 0.27 |
| 64.94 | -133.41 | 1599.35 | 1494 | 1708 | 1587 | 25.78 | 48.11 | 4.26 | 0.17 |
| 64.94 | -133.41 | 1823.65 | 1679 | 2014 | 1812 | 48.77 | 56.52 | 30.49 | 0.09 |
| 64.93 | -133.42 | 1811.38 | 1692 | 2022 | 1783 | 28.12 | 54.38 | 5.10 | 0.16 |
| 64.92 | -133.42 | 1820.91 | 1647 | 1960 | 1823 | 34.19 | 55.64 | 1.69 | 0.36 |
| 64.92 | -133.41 | 1597.51 | 1544 | 1648 | 1596 | 15.22 | 40.97 | 7.12 | 0.14 |
| 64.93 | -133.37 | 1575.71 | 1454 | 1675 | 1576 | 38.41 | 46.23 | 15.17 | 0.12 |
| 64.93 | -133.37 | 1543.63 | 1453 | 1702 | 1522 | 23.30 | 43.11 | 5.75 | 0.16 |
| 64.92 | -133.35 | 1510.28 | 1492 | 1563 | 1508 | 10.64 | 29.93 | 0.00 | 0.08 |
| 64.93 | -133.35 | 1439.21 | 1387 | 1511 | 1436 | 23.52 | 36.98 | 4.32 | 0.10 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 60.92 | -138.45 | 1750.94 | 1499 | 2127 | 1753 | 17.59 | 48.39 | 1.39 | 1.77 |
| 60.92 | -138.38 | 1754.41 | 1594 | 1947 | 1761 | 20.16 | 37.03 | 6.17 | 0.41 |
| 60.90 | -138.28 | 2045.35 | 1906 | 2175 | 2053 | 27.73 | 37.90 | 10.68 | 0.25 |
| 61.99 | -140.84 | 1735.04 | 1614 | 1839 | 1741 | 25.33 | 39.01 | 4.06 | 0.22 |
| 61.99 | -140.79 | 1643.24 | 1523 | 1798 | 1645 | 15.78 | 36.09 | 2.13 | 0.28 |
| 61.64 | -140.08 | 1683.34 | 1532 | 1854 | 1683 | 21.86 | 33.08 | 7.95 | 0.20 |
| 61.51 | -140.74 | 2030.04 | 1895 | 2119 | 2042 | 19.21 | 33.19 | 7.72 | 0.20 |
| 61.96 | -140.63 | 1399.60 | 1067 | 1823 | 1384 | 18.61 | 39.22 | 0.48 | 2.01 |
| 61.97 | -140.78 | 1698.00 | 1608 | 1745 | 1708 | 15.84 | 32.78 | 1.69 | 0.09 |
| 61.95 | -140.68 | 1757.51 | 1699 | 1810 | 1761 | 16.11 | 25.05 | 8.56 | 0.09 |
| 61.94 | -140.64 | 1418.20 | 1397 | 1458 | 1412 | 13.59 | 31.47 | 2.02 | 0.04 |
| 61.94 | -140.68 | 1803.58 | 1688 | 1924 | 1800 | 33.08 | 39.38 | 15.82 | 0.06 |
| 61.94 | -140.62 | 1635.42 | 1583 | 1699 | 1634 | 20.69 | 34.03 | 8.38 | 0.09 |
| 61.92 | -140.51 | 898.69 | 836 | 990 | 889 | 10.49 | 22.50 | 1.39 | 0.42 |
| 61.92 | -140.62 | 1319.53 | 1139 | 1523 | 1320 | 25.79 | 39.70 | 8.77 | 0.47 |
| 61.88 | -140.36 | 1360.07 | 1152 | 1507 | 1376 | 20.56 | 36.72 | 5.81 | 0.29 |
| 61.64 | -140.04 | 1480.49 | 1411 | 1577 | 1478 | 17.94 | 31.23 | 9.46 | 0.14 |
| 61.85 | -140.32 | 1587.56 | 1511 | 1697 | 1586 | 22.17 | 38.50 | 6.99 | 0.12 |
| 61.82 | -140.25 | 1435.71 | 1212 | 1657 | 1437 | 24.39 | 40.92 | 13.43 | 0.30 |
| 61.83 | -140.96 | 1439.25 | 1346 | 1526 | 1438 | 24.74 | 36.77 | 12.36 | 0.25 |
| 61.82 | -140.28 | 1545.12 | 1481 | 1659 | 1540 | 22.89 | 41.09 | 7.65 | 0.09 |
| 61.82 | -140.97 | 1568.85 | 1511 | 1649 | 1565 | 23.83 | 33.76 | 4.58 | 0.09 |
| 61.81 | -140.23 | 1440.74 | 1277 | 1624 | 1431 | 25.31 | 44.15 | 10.86 | 0.31 |
| 61.80 | -140.21 | 1379.46 | 1148 | 1532 | 1403 | 20.98 | 39.33 | 1.07 | 0.37 |
| 61.97 | -140.82 | 1511.42 | 1436 | 1601 | 1508 | 17.87 | 37.93 | 4.39 | 0.33 |
| 61.97 | -140.66 | 1633.82 | 1485 | 1833 | 1615 | 18.21 | 43.32 | 0.34 | 0.41 |
| 61.96 | -140.71 | 1569.76 | 1427 | 1627 | 1584 | 13.18 | 32.93 | 0.00 | 0.36 |
| 61.95 | -140.69 | 1592.61 | 1431 | 1754 | 1576 | 16.19 | 36.98 | 0.75 | 0.90 |
| 61.88 | -140.37 | 1293.01 | 1173 | 1383 | 1306 | 20.95 | 32.06 | 9.76 | 0.12 |
| 61.68 | -140.15 | 1341.45 | 1300 | 1435 | 1336 | 20.42 | 43.59 | 8.06 | 0.09 |
| 61.68 | -139.96 | 1470.26 | 1389 | 1525 | 1479 | 17.79 | 28.56 | 7.57 | 0.13 |
| 61.54 | -139.97 | 1138.14 | 1050 | 1248 | 1129 | 14.50 | 22.61 | 5.48 | 0.21 |
| 61.73 | -140.11 | 1440.90 | 1207 | 1609 | 1457 | 18.35 | 40.26 | 3.81 | 0.59 |
| 61.71 | -140.01 | 1082.88 | 915 | 1454 | 1052 | 14.20 | 33.70 | 4.17 | 0.83 |
| 61.70 | -140.02 | 1464.24 | 1332 | 1583 | 1468 | 21.22 | 35.23 | 3.65 | 0.35 |
| 61.69 | -140.22 | 1397.50 | 1363 | 1447 | 1396 | 14.71 | 32.71 | 2.72 | 0.11 |
| 61.69 | -139.99 | 1445.48 | 1183 | 1661 | 1463 | 19.49 | 32.93 | 5.44 | 0.67 |
| 61.67 | -140.16 | 1610.73 | 1402 | 1799 | 1623 | 24.75 | 42.64 | 8.79 | 0.39 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.96 | -133.37 | 1623.06 | 1484 | 1762 | 1622 | 33.31 | 43.37 | 13.27 | 0.26 |
| 64.95 | -133.31 | 2042.27 | 1938 | 2132 | 2045 | 33.37 | 49.95 | 2.43 | 0.20 |
| 64.96 | -133.29 | 1686.32 | 1567 | 1815 | 1683 | 35.15 | 49.02 | 20.82 | 0.12 |
| 64.90 | -133.42 | 1525.24 | 1369 | 1913 | 1468 | 28.36 | 52.17 | 3.84 | 0.50 |
| 64.91 | -133.39 | 1549.96 | 1485 | 1629 | 1544 | 30.82 | 36.56 | 25.80 | 0.05 |
| 64.90 | -133.38 | 1440.95 | 1220 | 1678 | 1445 | 36.15 | 43.43 | 24.26 | 0.24 |
| 64.88 | -133.42 | 1124.97 | 829 | 1419 | 1132 | 33.68 | 43.91 | 15.65 | 0.31 |
| 64.88 | -133.28 | 1153.98 | 926 | 1463 | 1116 | 30.88 | 42.11 | 15.06 | 0.24 |
| 64.76 | -133.42 | 1815.42 | 1623 | 2098 | 1797 | 35.10 | 51.99 | 0.68 | 0.32 |
| 64.75 | -133.43 | 1779.84 | 1639 | 1915 | 1783 | 30.52 | 43.67 | 8.11 | 0.26 |
| 64.75 | -133.38 | 1469.39 | 1397 | 1666 | 1439 | 16.35 | 38.95 | 1.91 | 0.26 |
| 64.74 | -133.39 | 1874.58 | 1781 | 1925 | 1878 | 24.24 | 36.77 | 1.39 | 0.14 |
| 64.74 | -133.33 | 1732.32 | 1646 | 1805 | 1735 | 31.79 | 44.37 | 2.26 | 0.17 |
| 64.75 | -133.32 | 1662.82 | 1558 | 1714 | 1675 | 29.35 | 42.77 | 8.46 | 0.10 |
| 64.74 | -133.32 | 1858.80 | 1769 | 1951 | 1852 | 27.99 | 39.52 | 2.16 | 0.13 |
| 64.71 | -133.35 | 1702.49 | 1620 | 1789 | 1705 | 22.69 | 34.51 | 5.52 | 0.18 |
| 64.62 | -133.44 | 1573.69 | 1239 | 2009 | 1568 | 36.24 | 54.17 | 15.91 | 0.35 |
| 64.43 | -133.37 | 1599.82 | 1477 | 1679 | 1601 | 26.21 | 35.68 | 2.16 | 0.20 |
| 64.45 | -133.46 | 1537.43 | 1393 | 1707 | 1530 | 33.93 | 41.99 | 18.23 | 0.13 |
| 64.43 | -133.44 | 1654.15 | 1415 | 1902 | 1661 | 33.19 | 50.47 | 18.00 | 0.23 |
| 64.43 | -133.48 | 1468.99 | 1349 | 1595 | 1465 | 35.63 | 39.49 | 31.24 | 0.08 |
| 64.43 | -133.48 | 1526.32 | 1410 | 1637 | 1524 | 24.31 | 37.78 | 10.91 | 0.17 |
| 64.42 | -133.49 | 1813.67 | 1609 | 2095 | 1802 | 38.46 | 55.91 | 0.68 | 0.43 |
| 64.41 | -133.51 | 1722.54 | 1633 | 1798 | 1721 | 34.80 | 51.80 | 4.11 | 0.11 |
| 64.42 | -133.40 | 1528.12 | 1268 | 1752 | 1550 | 28.98 | 40.28 | 21.04 | 0.25 |
| 64.42 | -133.52 | 1729.04 | 1671 | 1792 | 1725 | 32.12 | 38.11 | 26.06 | 0.05 |
| 64.38 | -133.36 | 1504.41 | 1369 | 1620 | 1498 | 28.39 | 37.72 | 1.69 | 0.19 |
| 64.14 | -133.53 | 1600.77 | 1394 | 1741 | 1624 | 27.37 | 45.37 | 5.73 | 0.28 |
| 64.06 | -133.38 | 1322.78 | 1129 | 1493 | 1315 | 29.90 | 41.41 | 2.26 | 0.42 |
| 64.06 | -133.39 | 1399.46 | 1329 | 1479 | 1397 | 29.73 | 39.64 | 2.78 | 0.09 |
| 64.05 | -133.40 | 1422.37 | 1240 | 1656 | 1421 | 30.73 | 42.59 | 11.01 | 0.22 |
| 64.05 | -133.41 | 1322.57 | 1199 | 1469 | 1317 | 33.47 | 42.87 | 13.52 | 0.14 |
| 64.08 | -133.16 | 1752.96 | 1625 | 1856 | 1748 | 36.12 | 50.61 | 13.68 | 0.16 |
| 64.08 | -133.17 | 1662.74 | 1452 | 1861 | 1678 | 29.33 | 53.59 | 1.07 | 0.76 |
| 64.09 | -133.19 | 1464.01 | 1366 | 1625 | 1452 | 32.76 | 45.92 | 10.87 | 0.13 |
| 64.09 | -133.24 | 1745.56 | 1612 | 1854 | 1748 | 29.20 | 43.07 | 8.46 | 0.18 |
| 64.09 | -133.21 | 1701.01 | 1487 | 1865 | 1698 | 32.88 | 51.71 | 1.69 | 0.30 |
| 64.10 | -133.20 | 1543.28 | 1449 | 1632 | 1537 | 32.30 | 46.04 | 11.65 | 0.10 |
| 61.67 | -140.18 | 1498.06 | 1446 | 1590 | 1491 | 20.54 | 42.81 | 5.52 | 0.10 |
| 61.66 | -140.14 | 1657.78 | 1474 | 1838 | 1662 | 18.81 | 40.29 | 1.07 | 0.60 |
| 61.63 | -140.08 | 1795.68 | 1629 | 1952 | 1800 | 26.93 | 42.12 | 8.17 | 0.47 |
| 61.63 | -140.12 | 1675.78 | 1481 | 1901 | 1677 | 21.39 | 39.52 | 3.44 | 0.88 |
| 61.63 | -140.11 | 1862.82 | 1763 | 1986 | 1854 | 28.83 | 39.57 | 16.12 | 0.10 |
| 61.63 | -140.11 | 1848.59 | 1753 | 1956 | 1854 | 21.09 | 38.02 | 7.39 | 0.13 |
| 61.62 | -140.06 | 1565.72 | 1518 | 1614 | 1565 | 16.58 | 31.69 | 3.39 | 0.17 |
| 61.62 | -140.08 | 1752.63 | 1671 | 1814 | 1755 | 15.23 | 30.16 | 0.48 | 0.52 |
| 61.61 | -140.05 | 1602.01 | 1426 | 1848 | 1588 | 17.80 | 42.29 | 3.18 | 1.16 |
| 61.62 | -140.15 | 1699.41 | 1569 | 1826 | 1704 | 16.92 | 32.74 | 5.26 | 0.26 |
| 61.61 | -140.12 | 1576.27 | 1529 | 1666 | 1570 | 17.32 | 36.00 | 5.01 | 0.11 |
| 61.60 | -140.03 | 1791.83 | 1643 | 1920 | 1794 | 19.45 | 34.18 | 1.69 | 0.28 |
| 61.54 | -140.00 | 1154.07 | 1055 | 1231 | 1162 | 16.36 | 30.68 | 6.06 | 0.21 |
| 61.51 | -139.63 | 1542.18 | 1424 | 1685 | 1540 | 19.56 | 35.68 | 4.68 | 0.44 |
| 61.50 | -139.57 | 1537.19 | 1357 | 1699 | 1540 | 17.45 | 36.83 | 4.53 | 0.50 |
| 61.99 | -140.77 | 1607.75 | 1478 | 1795 | 1584 | 23.91 | 41.29 | 7.80 | 0.31 |
| 61.87 | -140.99 | 1376.73 | 1319 | 1458 | 1376 | 16.29 | 31.02 | 7.39 | 0.11 |
| 61.99 | -140.81 | 1619.21 | 1447 | 1831 | 1596 | 18.99 | 43.41 | 0.75 | 1.05 |
| 61.68 | -139.43 | 1070.94 | 894 | 1322 | 1067 | 27.10 | 51.43 | 13.66 | 0.21 |
| 61.58 | -138.77 | 1832.70 | 1675 | 2038 | 1832 | 26.63 | 38.85 | 11.98 | 0.19 |
| 61.53 | -138.75 | 1524.03 | 1465 | 1588 | 1519 | 36.41 | 39.10 | 33.12 | 0.03 |
| 61.49 | -139.50 | 1627.23 | 1451 | 1839 | 1617 | 26.95 | 42.53 | 14.28 | 0.28 |
| 61.27 | -138.96 | 1509.87 | 1357 | 1640 | 1509 | 26.69 | 35.36 | 17.39 | 0.21 |
| 61.27 | -139.49 | 2025.65 | 1813 | 2297 | 2036 | 20.95 | 49.03 | 4.52 | 0.69 |
| 61.26 | -139.45 | 2341.29 | 2167 | 2520 | 2331 | 19.84 | 41.59 | 1.69 | 0.51 |
| 62.44 | -133.44 | 1838.87 | 1666 | 1973 | 1843 | 30.48 | 38.77 | 15.04 | 0.13 |
| 62.44 | -133.47 | 1546.63 | 1469 | 1648 | 1545 | 15.52 | 21.50 | 7.54 | 0.14 |
| 62.44 | -133.50 | 1595.77 | 1497 | 1721 | 1597 | 22.91 | 38.16 | 9.33 | 0.11 |
| 62.44 | -133.49 | 1603.44 | 1518 | 1710 | 1603 | 19.21 | 37.15 | 8.22 | 0.22 |
| 62.44 | -133.51 | 1673.96 | 1588 | 1776 | 1663 | 23.71 | 34.93 | 3.18 | 0.10 |
| 62.44 | -133.52 | 1673.98 | 1540 | 1775 | 1678 | 28.30 | 38.93 | 3.71 | 0.11 |
| 62.02 | -133.56 | 1899.85 | 1834 | 1990 | 1894 | 39.43 | 43.66 | 34.97 | 0.04 |
| 62.02 | -133.73 | 1628.85 | 1546 | 1763 | 1630 | 22.69 | 39.44 | 1.39 | 0.15 |
| 62.03 | -133.55 | 1642.34 | 1580 | 1700 | 1645 | 13.22 | 27.95 | 5.75 | 0.17 |
| 62.02 | -133.55 | 1703.76 | 1662 | 1754 | 1701 | 13.93 | 24.90 | 7.36 | 0.06 |
| 62.02 | -133.56 | 1748.64 | 1665 | 1845 | 1745 | 20.53 | 33.61 | 7.65 | 0.09 |
| 62.50 | -132.30 | 1478.11 | 1433 | 1523 | 1480 | 13.63 | 26.13 | 3.44 | 0.11 |
| 62.49 | -132.33 | 1484.86 | 1399 | 1571 | 1488 | 24.01 | 32.93 | 11.20 | 0.10 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.11 | -133.22 | 1673.50 | 1432 | 1811 | 1682 | 36.75 | 50.95 | 10.36 | 0.21 |
| 64.11 | -133.12 | 1598.62 | 1434 | 1741 | 1616 | 29.49 | 46.23 | 4.90 | 0.27 |
| 64.16 | -133.30 | 1661.80 | 1468 | 1791 | 1689 | 26.79 | 42.29 | 5.05 | 0.35 |
| 64.28 | -133.17 | 1576.27 | 1410 | 1697 | 1597 | 26.32 | 40.15 | 9.14 | 0.24 |
| 64.34 | -133.11 | 1659.66 | 1488 | 1824 | 1679 | 33.16 | 53.04 | 2.88 | 0.45 |
| 64.42 | -133.28 | 1466.09 | 1308 | 1611 | 1464 | 27.29 | 37.18 | 18.45 | 0.28 |
| 64.62 | -133.22 | 1894.82 | 1767 | 2051 | 1896 | 35.49 | 52.45 | 6.18 | 0.23 |
| 64.67 | -133.25 | 1821.18 | 1692 | 1898 | 1833 | 31.26 | 43.31 | 3.05 | 0.16 |
| 64.70 | -133.18 | 1626.87 | 1513 | 1759 | 1620 | 29.15 | 38.33 | 17.15 | 0.16 |
| 64.70 | -133.16 | 1532.87 | 1346 | 1799 | 1506 | 25.11 | 39.36 | 5.01 | 0.27 |
| 64.69 | -133.16 | 1611.38 | 1462 | 1828 | 1586 | 26.46 | 39.42 | 10.74 | 0.17 |
| 64.69 | -133.15 | 1766.18 | 1675 | 1837 | 1769 | 29.22 | 36.77 | 2.16 | 0.07 |
| 64.70 | -133.08 | 1795.19 | 1696 | 1915 | 1791 | 28.42 | 36.58 | 14.32 | 0.19 |
| 64.71 | -133.10 | 1871.24 | 1767 | 1947 | 1881 | 28.68 | 37.25 | 14.25 | 0.06 |
| 64.71 | -133.09 | 2030.46 | 1933 | 2105 | 2036 | 30.77 | 40.42 | 7.37 | 0.10 |
| 64.73 | -133.28 | 1699.79 | 1494 | 1951 | 1688 | 25.62 | 46.95 | 8.54 | 0.71 |
| 64.74 | -133.14 | 1891.01 | 1824 | 1947 | 1894 | 29.66 | 40.42 | 4.53 | 0.08 |
| 64.74 | -133.15 | 1790.46 | 1581 | 1993 | 1791 | 31.09 | 44.89 | 12.35 | 0.42 |
| 64.76 | -133.10 | 1655.01 | 1568 | 1767 | 1648 | 28.67 | 35.77 | 15.33 | 0.11 |
| 64.77 | -133.10 | 1887.34 | 1750 | 2009 | 1891 | 33.17 | 44.65 | 10.89 | 0.11 |
| 64.78 | -133.16 | 1692.41 | 1563 | 1829 | 1702 | 22.43 | 35.72 | 4.97 | 0.18 |
| 64.82 | -133.20 | 1895.13 | 1741 | 2006 | 1900 | 27.63 | 39.59 | 5.43 | 0.25 |
| 64.82 | -133.23 | 1987.42 | 1838 | 2078 | 2000 | 34.51 | 52.60 | 3.58 | 0.23 |
| 64.83 | -133.23 | 1848.66 | 1625 | 2115 | 1831 | 33.25 | 58.83 | 4.73 | 0.68 |
| 64.85 | -133.23 | 1683.10 | 1508 | 1834 | 1681 | 32.11 | 48.79 | 2.64 | 0.38 |
| 64.86 | -133.24 | 1701.15 | 1484 | 1932 | 1705 | 33.78 | 50.35 | 0.00 | 0.42 |
| 64.92 | -133.17 | 1933.48 | 1777 | 2085 | 1926 | 35.55 | 45.43 | 1.69 | 0.14 |
| 64.92 | -133.15 | 1922.58 | 1692 | 2141 | 1921 | 34.12 | 46.53 | 9.30 | 0.25 |
| 64.90 | -133.17 | 1894.70 | 1795 | 1955 | 1897 | 28.03 | 41.52 | 4.06 | 0.15 |
| 64.91 | -133.21 | 1703.99 | 1433 | 1972 | 1720 | 41.13 | 53.83 | 15.16 | 0.28 |
| 64.91 | -133.21 | 1502.01 | 1362 | 1674 | 1491 | 23.40 | 41.98 | 2.16 | 0.33 |
| 64.89 | -133.09 | 1496.94 | 1431 | 1578 | 1494 | 26.89 | 37.72 | 6.34 | 0.14 |
| 64.94 | -133.26 | 1823.48 | 1607 | 1984 | 1849 | 35.15 | 55.40 | 3.34 | 0.60 |
| 64.94 | -133.23 | 1538.89 | 1483 | 1641 | 1539 | 15.11 | 34.34 | 4.26 | 0.23 |
| 64.95 | -133.24 | 1777.79 | 1607 | 2034 | 1754 | 32.18 | 46.93 | 5.13 | 0.32 |
| 64.94 | -133.14 | 1634.21 | 1419 | 1863 | 1621 | 32.41 | 46.45 | 11.33 | 0.20 |
| 64.95 | -133.16 | 1784.12 | 1594 | 1923 | 1818 | 27.99 | 47.03 | 1.82 | 0.19 |
| 64.96 | -133.11 | 1344.67 | 1036 | 1763 | 1309 | 30.77 | 44.45 | 3.18 | 0.65 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 62.96 | -132.43 | 1657.35 | 1593 | 1749 | 1654 | 30.08 | 43.89 | 15.20 | 0.09 |
| 61.97 | -133.94 | 1642.55 | 1593 | 1744 | 1634 | 23.54 | 43.01 | 5.81 | 0.07 |
| 61.61 | -133.44 | 1658.23 | 1593 | 1731 | 1659 | 30.63 | 41.94 | 12.47 | 0.06 |
| 62.97 | -132.41 | 1614.83 | 1483 | 1787 | 1616 | 25.27 | 48.10 | 5.32 | 0.34 |
| 62.97 | -132.47 | 1624.85 | 1521 | 1745 | 1616 | 28.72 | 39.42 | 11.04 | 0.10 |
| 62.97 | -132.40 | 1628.89 | 1468 | 1809 | 1629 | 32.49 | 46.99 | 6.47 | 0.16 |
| 62.95 | -132.12 | 1539.60 | 1441 | 1711 | 1535 | 22.12 | 44.85 | 4.52 | 0.23 |
| 62.91 | -132.30 | 1341.73 | 1284 | 1388 | 1345 | 6.93 | 16.08 | 1.91 | 0.28 |
| 62.90 | -132.31 | 1513.99 | 1391 | 1704 | 1518 | 19.77 | 42.25 | 3.11 | 0.33 |
| 62.78 | -132.44 | 1249.81 | 1182 | 1420 | 1225 | 21.05 | 41.13 | 2.70 | 0.15 |
| 62.78 | -132.44 | 1270.52 | 1181 | 1392 | 1259 | 29.64 | 41.67 | 12.02 | 0.07 |
| 62.77 | -132.70 | 1467.36 | 1405 | 1597 | 1444 | 24.40 | 43.17 | 6.89 | 0.06 |
| 62.76 | -132.74 | 1490.87 | 1459 | 1559 | 1486 | 10.81 | 28.93 | 3.81 | 0.18 |
| 62.76 | -132.69 | 1593.36 | 1487 | 1678 | 1597 | 16.72 | 31.35 | 6.06 | 0.23 |
| 62.54 | -132.34 | 1676.79 | 1603 | 1793 | 1662 | 30.59 | 45.35 | 15.51 | 0.05 |
| 62.52 | -132.34 | 1543.44 | 1492 | 1632 | 1537 | 22.27 | 30.29 | 4.11 | 0.06 |
| 62.52 | -132.35 | 1684.67 | 1616 | 1768 | 1680 | 21.97 | 29.88 | 10.18 | 0.08 |
| 62.00 | -133.70 | 1770.42 | 1728 | 1828 | 1766 | 29.03 | 41.41 | 10.43 | 0.04 |
| 62.00 | -133.71 | 1796.16 | 1743 | 1874 | 1795 | 35.27 | 43.33 | 23.13 | 0.04 |
| 62.00 | -133.71 | 1790.69 | 1746 | 1861 | 1784 | 22.59 | 41.93 | 8.29 | 0.09 |
| 61.98 | -133.49 | 1824.39 | 1728 | 1929 | 1827 | 23.73 | 38.34 | 13.07 | 0.14 |
| 61.98 | -133.52 | 1649.86 | 1482 | 1894 | 1650 | 17.26 | 37.20 | 0.75 | 0.47 |
| 61.98 | -133.96 | 1740.85 | 1668 | 1850 | 1731 | 27.80 | 41.29 | 2.43 | 0.07 |
| 61.96 | -133.52 | 1706.15 | 1665 | 1771 | 1704 | 18.22 | 34.92 | 3.18 | 0.14 |
| 61.95 | -133.58 | 1760.34 | 1700 | 1810 | 1761 | 19.94 | 34.76 | 6.06 | 0.10 |
| 61.95 | -133.51 | 1892.75 | 1835 | 1979 | 1894 | 23.74 | 38.11 | 12.69 | 0.07 |
| 61.95 | -133.57 | 1768.51 | 1668 | 1925 | 1765 | 25.45 | 46.95 | 3.05 | 0.18 |
| 61.95 | -133.49 | 1824.78 | 1739 | 1947 | 1820 | 27.64 | 44.23 | 12.21 | 0.11 |
| 61.95 | -133.64 | 1785.06 | 1646 | 2015 | 1761 | 25.35 | 43.28 | 1.82 | 0.52 |
| 61.94 | -133.70 | 1780.36 | 1655 | 1937 | 1781 | 38.63 | 49.89 | 20.78 | 0.11 |
| 61.94 | -133.35 | 1707.57 | 1641 | 1777 | 1710 | 17.57 | 27.54 | 8.06 | 0.12 |
| 61.94 | -133.57 | 1741.50 | 1679 | 1910 | 1716 | 20.99 | 49.03 | 2.05 | 0.17 |
| 61.94 | -133.45 | 1659.39 | 1528 | 1777 | 1667 | 20.44 | 46.16 | 3.37 | 0.22 |
| 61.94 | -133.54 | 1710.68 | 1644 | 1756 | 1717 | 27.95 | 43.34 | 9.02 | 0.04 |
| 61.94 | -133.94 | 1634.94 | 1559 | 1787 | 1626 | 21.45 | 41.49 | 5.73 | 0.14 |
| 61.94 | -133.57 | 1721.94 | 1659 | 1846 | 1705 | 26.81 | 48.89 | 3.93 | 0.05 |
| 61.94 | -133.52 | 1876.23 | 1787 | 2033 | 1873 | 31.11 | 43.94 | 5.32 | 0.10 |
| 61.93 | -133.38 | 1751.81 | 1666 | 1870 | 1753 | 23.06 | 38.93 | 5.43 | 0.13 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.97 | -133.21 | 1506.75 | 1386 | 1618 | 1505 | 23.51 | 37.22 | 9.75 | 0.15 |
| 64.97 | -133.16 | 1819.74 | 1615 | 1981 | 1826 | 34.51 | 47.33 | 1.07 | 0.22 |
| 64.97 | -133.13 | 1813.86 | 1742 | 1884 | 1812 | 30.51 | 40.60 | 8.69 | 0.07 |
| 64.97 | -133.11 | 1726.08 | 1653 | 1800 | 1721 | 30.18 | 38.46 | 11.31 | 0.06 |
| 64.98 | -133.10 | 1526.40 | 1407 | 1619 | 1528 | 33.65 | 40.92 | 7.73 | 0.07 |
| 64.97 | -132.96 | 1557.67 | 1502 | 1623 | 1553 | 17.02 | 32.67 | 5.88 | 0.13 |
| 64.98 | -132.93 | 1393.55 | 1373 | 1430 | 1393 | 7.78 | 21.09 | 1.91 | 0.14 |
| 64.97 | -132.89 | 1528.57 | 1421 | 1625 | 1528 | 34.37 | 40.96 | 26.61 | 0.15 |
| 64.92 | -133.06 | 1668.22 | 1531 | 1777 | 1666 | 33.84 | 45.35 | 3.11 | 0.19 |
| 64.94 | -132.89 | 1912.48 | 1788 | 2015 | 1925 | 33.12 | 40.36 | 8.38 | 0.10 |
| 64.92 | -132.88 | 1228.96 | 1073 | 1424 | 1223 | 31.12 | 40.92 | 19.17 | 0.14 |
| 64.92 | -132.86 | 1333.71 | 1134 | 1498 | 1336 | 35.38 | 42.45 | 18.70 | 0.09 |
| 64.91 | -132.85 | 1303.03 | 1075 | 1518 | 1307 | 33.66 | 40.00 | 22.11 | 0.15 |
| 64.89 | -133.06 | 1308.22 | 1271 | 1362 | 1307 | 20.29 | 36.77 | 4.52 | 0.09 |
| 64.88 | -133.07 | 1831.19 | 1691 | 1924 | 1841 | 32.41 | 48.04 | 4.53 | 0.10 |
| 64.89 | -133.05 | 1612.29 | 1462 | 1798 | 1614 | 31.31 | 48.68 | 13.96 | 0.28 |
| 64.87 | -133.06 | 1913.90 | 1805 | 2011 | 1912 | 32.41 | 47.07 | 1.43 | 0.18 |
| 64.84 | -133.07 | 1842.25 | 1691 | 1956 | 1848 | 28.61 | 45.67 | 1.07 | 0.34 |
| 64.84 | -133.04 | 1734.57 | 1599 | 1866 | 1735 | 29.10 | 39.66 | 11.20 | 0.19 |
| 64.84 | -133.04 | 1567.47 | 1468 | 1675 | 1562 | 28.14 | 44.89 | 0.68 | 0.27 |
| 64.85 | -133.05 | 1533.28 | 1433 | 1676 | 1523 | 26.90 | 41.90 | 6.80 | 0.19 |
| 64.83 | -133.00 | 1904.25 | 1730 | 2081 | 1889 | 31.13 | 50.54 | 2.16 | 0.25 |
| 64.90 | -132.84 | 1173.31 | 923 | 1495 | 1148 | 29.28 | 42.70 | 13.15 | 0.28 |
| 64.89 | -132.82 | 1140.07 | 810 | 1587 | 1104 | 26.44 | 38.58 | 11.82 | 0.40 |
| 64.79 | -132.89 | 1633.46 | 1435 | 2380 | 1562 | 38.62 | 68.84 | 8.11 | 0.42 |
| 64.78 | -133.06 | 2068.41 | 1915 | 2223 | 2066 | 39.68 | 56.99 | 10.43 | 0.12 |
| 64.79 | -133.07 | 2008.52 | 1828 | 2192 | 1996 | 37.17 | 51.35 | 16.18 | 0.14 |
| 64.78 | -133.08 | 1998.36 | 1928 | 2070 | 2006 | 31.04 | 42.36 | 6.89 | 0.08 |
| 64.77 | -133.06 | 2022.10 | 1796 | 2163 | 2030 | 37.72 | 51.96 | 5.57 | 0.32 |
| 64.75 | -133.04 | 1903.15 | 1756 | 2037 | 1904 | 30.59 | 50.61 | 11.08 | 0.09 |
| 64.73 | -132.89 | 1917.67 | 1675 | 2137 | 1887 | 41.65 | 60.71 | 3.39 | 0.12 |
| 64.74 | -132.88 | 1629.08 | 1457 | 1799 | 1632 | 39.57 | 56.84 | 11.50 | 0.35 |
| 64.72 | -132.91 | 1755.97 | 1603 | 1920 | 1746 | 29.05 | 36.70 | 3.95 | 0.12 |
| 64.72 | -132.87 | 1774.99 | 1694 | 1960 | 1753 | 26.35 | 50.50 | 6.80 | 0.13 |
| 64.71 | -132.90 | 1719.49 | 1589 | 1906 | 1708 | 20.64 | 31.31 | 8.74 | 0.30 |
| 64.58 | -133.11 | 1713.31 | 1662 | 1782 | 1709 | 21.31 | 33.59 | 7.85 | 0.13 |
| 64.58 | -133.08 | 1710.18 | 1633 | 1809 | 1706 | 23.71 | 39.10 | 8.06 | 0.11 |
| 64.59 | -133.05 | 1694.33 | 1595 | 1827 | 1688 | 30.18 | 44.42 | 8.72 | 0.24 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.93 | -133.59 | 1617.64 | 1520 | 1854 | 1598 | 27.40 | 50.08 | 2.64 | 0.23 |
| 61.93 | -133.41 | 1736.86 | 1601 | 1849 | 1737 | 20.19 | 40.54 | 4.38 | 0.38 |
| 61.93 | -133.63 | 1841.79 | 1712 | 1982 | 1840 | 32.53 | 47.03 | 12.26 | 0.11 |
| 61.93 | -133.47 | 1716.41 | 1667 | 1768 | 1716 | 11.70 | 25.56 | 5.76 | 0.14 |
| 61.93 | -133.58 | 1744.76 | 1610 | 1923 | 1749 | 24.31 | 44.81 | 8.87 | 0.20 |
| 61.93 | -133.58 | 1818.25 | 1666 | 1942 | 1822 | 34.05 | 42.64 | 18.91 | 0.08 |
| 61.93 | -133.60 | 1840.51 | 1741 | 1967 | 1828 | 27.97 | 47.13 | 10.74 | 0.13 |
| 61.93 | -133.48 | 1829.98 | 1744 | 1937 | 1820 | 26.95 | 46.17 | 6.49 | 0.12 |
| 61.93 | -133.57 | 1775.95 | 1696 | 1942 | 1759 | 28.96 | 42.01 | 10.10 | 0.08 |
| 61.93 | -133.57 | 1790.14 | 1724 | 1851 | 1789 | 19.08 | 36.44 | 6.76 | 0.10 |
| 61.92 | -133.53 | 1835.41 | 1782 | 1929 | 1833 | 17.49 | 39.77 | 4.32 | 0.11 |
| 61.92 | -133.47 | 1856.58 | 1802 | 1925 | 1854 | 18.46 | 42.25 | 5.95 | 0.08 |
| 61.90 | -133.37 | 1554.18 | 1546 | 1577 | 1552 | 9.80 | 27.68 | 0.95 | 0.07 |
| 61.54 | -133.22 | 1641.71 | 1518 | 1754 | 1657 | 28.86 | 46.89 | 11.80 | 0.07 |
| 61.85 | -133.51 | 1610.80 | 1537 | 1683 | 1614 | 16.69 | 35.34 | 5.06 | 0.18 |
| 61.74 | -133.33 | 1738.62 | 1644 | 1905 | 1733 | 27.57 | 49.55 | 10.89 | 0.10 |
| 61.65 | -133.20 | 1525.77 | 1475 | 1594 | 1526 | 25.08 | 48.85 | 9.42 | 0.06 |
| 61.90 | -133.47 | 1694.22 | 1613 | 1779 | 1698 | 18.63 | 49.50 | 4.07 | 0.22 |
| 61.90 | -133.57 | 1851.24 | 1764 | 1975 | 1839 | 38.26 | 46.06 | 16.53 | 0.05 |
| 61.83 | -133.35 | 1846.41 | 1767 | 1955 | 1846 | 37.87 | 44.76 | 27.90 | 0.04 |
| 61.83 | -133.35 | 1761.00 | 1714 | 1845 | 1752 | 24.97 | 39.83 | 10.22 | 0.04 |
| 61.82 | -133.35 | 1923.89 | 1892 | 1956 | 1925 | 15.12 | 28.76 | 9.74 | 0.03 |
| 61.81 | -133.34 | 1794.99 | 1748 | 1883 | 1793 | 22.79 | 40.09 | 10.61 | 0.08 |
| 61.81 | -133.35 | 1745.04 | 1669 | 1875 | 1736 | 27.40 | 43.32 | 10.01 | 0.08 |
| 61.80 | -133.65 | 1662.13 | 1575 | 1741 | 1670 | 25.54 | 40.45 | 11.65 | 0.08 |
| 61.78 | -133.37 | 1594.61 | 1538 | 1657 | 1592 | 14.89 | 29.42 | 4.76 | 0.11 |
| 61.77 | -133.37 | 1732.58 | 1682 | 1781 | 1734 | 13.88 | 29.54 | 3.77 | 0.07 |
| 61.77 | -133.38 | 1787.83 | 1707 | 1950 | 1772 | 28.16 | 48.56 | 9.46 | 0.12 |
| 61.77 | -133.39 | 1709.61 | 1643 | 1789 | 1710 | 27.29 | 40.58 | 14.62 | 0.09 |
| 61.76 | -133.35 | 1710.58 | 1630 | 1785 | 1709 | 23.27 | 34.79 | 13.68 | 0.09 |
| 61.76 | -133.33 | 1637.09 | 1556 | 1740 | 1633 | 21.64 | 38.34 | 8.08 | 0.11 |
| 61.76 | -133.58 | 1733.79 | 1707 | 1782 | 1731 | 19.34 | 35.60 | 5.55 | 0.07 |
| 61.76 | -133.56 | 1770.46 | 1688 | 1912 | 1757 | 26.82 | 42.72 | 5.75 | 0.11 |
| 61.76 | -133.57 | 1720.07 | 1683 | 1822 | 1712 | 18.48 | 39.41 | 5.05 | 0.08 |
| 61.73 | -133.60 | 1662.01 | 1554 | 1842 | 1654 | 21.19 | 44.43 | 6.89 | 0.27 |
| 61.73 | -133.47 | 1649.17 | 1556 | 1789 | 1649 | 27.60 | 56.67 | 9.33 | 0.13 |
| 61.72 | -133.32 | 1775.07 | 1700 | 1894 | 1767 | 19.55 | 44.59 | 5.32 | 0.14 |
| 61.72 | -133.13 | 1533.25 | 1468 | 1590 | 1534 | 19.26 | 25.14 | 8.84 | 0.07 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.58 | -133.02 | 1836.45 | 1708 | 1922 | 1834 | 34.01 | 45.75 | 0.95 | 0.12 |
| 64.59 | -133.01 | 1773.55 | 1635 | 1884 | 1784 | 33.66 | 42.19 | 20.91 | 0.16 |
| 64.57 | -133.00 | 1897.99 | 1773 | 2037 | 1898 | 32.46 | 46.87 | 10.03 | 0.15 |
| 64.56 | -132.99 | 1781.70 | 1649 | 1908 | 1772 | 18.52 | 38.32 | 3.93 | 0.31 |
| 64.56 | -132.98 | 1863.53 | 1706 | 1928 | 1890 | 25.50 | 41.58 | 0.75 | 0.17 |
| 64.56 | -132.98 | 1803.28 | 1762 | 1843 | 1802 | 31.00 | 34.54 | 24.75 | 0.02 |
| 64.54 | -132.95 | 1858.03 | 1708 | 1993 | 1870 | 24.24 | 38.36 | 1.35 | 0.26 |
| 64.53 | -133.08 | 1698.48 | 1576 | 1802 | 1704 | 30.93 | 40.39 | 8.46 | 0.14 |
| 64.53 | -133.05 | 1739.46 | 1555 | 1874 | 1770 | 24.24 | 47.19 | 0.75 | 0.24 |
| 64.53 | -133.03 | 1710.58 | 1565 | 1885 | 1706 | 28.65 | 45.01 | 4.39 | 0.23 |
| 64.53 | -133.01 | 1501.99 | 1437 | 1628 | 1494 | 17.70 | 39.24 | 5.01 | 0.25 |
| 64.52 | -133.01 | 1782.97 | 1632 | 1890 | 1794 | 31.13 | 39.06 | 1.51 | 0.13 |
| 64.49 | -132.99 | 1606.44 | 1413 | 1870 | 1567 | 28.79 | 45.24 | 4.17 | 0.45 |
| 64.48 | -132.97 | 1666.87 | 1540 | 1820 | 1660 | 25.80 | 43.59 | 0.48 | 0.39 |
| 64.48 | -132.94 | 1671.86 | 1526 | 1827 | 1666 | 26.16 | 50.23 | 0.68 | 0.55 |
| 64.47 | -133.08 | 1644.17 | 1466 | 1956 | 1632 | 29.01 | 46.08 | 1.72 | 0.44 |
| 64.48 | -132.99 | 1766.37 | 1665 | 1836 | 1775 | 29.20 | 40.12 | 4.10 | 0.12 |
| 64.35 | -133.07 | 1674.11 | 1579 | 1740 | 1675 | 25.86 | 36.74 | 2.64 | 0.13 |
| 64.35 | -133.06 | 1668.86 | 1561 | 1799 | 1663 | 30.76 | 43.48 | 3.72 | 0.24 |
| 64.36 | -133.02 | 1601.33 | 1523 | 1677 | 1602 | 30.09 | 35.50 | 25.75 | 0.08 |
| 64.35 | -133.02 | 1601.34 | 1504 | 1666 | 1605 | 24.78 | 40.98 | 14.06 | 0.13 |
| 64.35 | -133.02 | 1769.93 | 1674 | 1860 | 1772 | 29.86 | 42.55 | 5.43 | 0.18 |
| 64.14 | -133.05 | 1174.97 | 1051 | 1255 | 1191 | 25.10 | 39.65 | 0.95 | 0.19 |
| 64.10 | -132.92 | 1448.68 | 1311 | 1557 | 1452 | 28.31 | 37.93 | 9.65 | 0.12 |
| 64.09 | -132.84 | 1590.17 | 1463 | 1845 | 1574 | 24.59 | 41.46 | 11.02 | 0.31 |
| 64.08 | -132.80 | 1741.58 | 1577 | 1858 | 1755 | 31.76 | 45.02 | 3.58 | 0.28 |
| 64.10 | -132.81 | 1675.39 | 1532 | 1766 | 1694 | 26.25 | 41.02 | 2.57 | 0.29 |
| 64.08 | -132.85 | 1782.67 | 1662 | 1865 | 1789 | 35.30 | 41.52 | 25.28 | 0.06 |
| 64.08 | -132.84 | 1712.28 | 1620 | 1797 | 1712 | 31.73 | 47.67 | 6.63 | 0.11 |
| 64.27 | -132.77 | 1447.84 | 1359 | 1552 | 1443 | 25.16 | 32.56 | 13.20 | 0.14 |
| 64.28 | -132.72 | 1694.87 | 1555 | 1880 | 1676 | 30.14 | 48.91 | 1.39 | 0.28 |
| 64.30 | -132.71 | 1617.15 | 1464 | 1831 | 1613 | 32.75 | 51.42 | 4.07 | 0.25 |
| 64.44 | -132.75 | 1503.36 | 1307 | 1650 | 1522 | 22.14 | 36.76 | 2.72 | 0.40 |
| 64.43 | -132.70 | 1663.09 | 1495 | 1865 | 1649 | 31.02 | 39.26 | 6.02 | 0.20 |
| 64.49 | -132.71 | 1306.17 | 1178 | 1480 | 1282 | 19.11 | 32.75 | 4.07 | 0.41 |
| 64.50 | -132.79 | 1655.73 | 1485 | 1828 | 1670 | 30.41 | 47.03 | 1.07 | 0.39 |
| 64.52 | -132.85 | 1752.13 | 1592 | 1893 | 1761 | 28.38 | 41.49 | 5.01 | 0.33 |
| 64.53 | -132.83 | 1542.77 | 1421 | 1694 | 1538 | 28.13 | 42.95 | 8.58 | 0.28 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.72 | -133.16 | 1680.14 | 1622 | 1761 | 1673 | 19.16 | 48.28 | 5.95 | 0.12 |
| 61.71 | -133.19 | 1672.17 | 1607 | 1777 | 1666 | 22.38 | 43.23 | 3.44 | 0.10 |
| 61.71 | -133.17 | 1711.20 | 1680 | 1757 | 1710 | 20.51 | 38.31 | 12.05 | 0.04 |
| 61.71 | -133.56 | 1753.50 | 1607 | 1990 | 1744 | 34.28 | 53.55 | 17.14 | 0.20 |
| 61.71 | -133.20 | 1677.02 | 1625 | 1758 | 1666 | 18.17 | 36.41 | 5.81 | 0.08 |
| 61.71 | -133.28 | 1735.94 | 1655 | 1802 | 1740 | 22.37 | 33.84 | 14.20 | 0.08 |
| 61.70 | -133.26 | 1560.96 | 1459 | 1657 | 1563 | 17.12 | 36.04 | 2.72 | 0.17 |
| 61.70 | -133.27 | 1657.26 | 1621 | 1761 | 1651 | 17.99 | 48.33 | 4.06 | 0.06 |
| 61.70 | -133.25 | 1650.81 | 1604 | 1701 | 1649 | 21.36 | 45.53 | 7.54 | 0.10 |
| 61.70 | -133.93 | 1700.44 | 1563 | 1847 | 1695 | 37.15 | 48.19 | 20.86 | 0.09 |
| 61.69 | -133.13 | 1609.82 | 1486 | 1687 | 1630 | 25.96 | 42.86 | 6.06 | 0.06 |
| 61.69 | -133.24 | 1612.80 | 1571 | 1657 | 1615 | 11.78 | 22.87 | 4.38 | 0.15 |
| 61.68 | -133.22 | 1535.61 | 1444 | 1674 | 1527 | 22.87 | 51.96 | 5.99 | 0.43 |
| 61.67 | -133.16 | 1794.70 | 1686 | 1888 | 1790 | 32.22 | 52.42 | 2.39 | 0.05 |
| 61.67 | -133.23 | 1788.46 | 1739 | 1862 | 1779 | 23.20 | 38.25 | 8.41 | 0.06 |
| 61.65 | -133.21 | 1603.47 | 1541 | 1650 | 1607 | 20.24 | 30.57 | 8.08 | 0.04 |
| 61.63 | -133.36 | 1642.88 | 1583 | 1698 | 1651 | 20.70 | 34.84 | 13.04 | 0.04 |
| 61.51 | -133.13 | 1601.92 | 1489 | 1752 | 1610 | 24.61 | 44.54 | 8.81 | 0.20 |
| 61.50 | -133.11 | 1714.86 | 1505 | 1928 | 1723 | 30.73 | 52.33 | 1.07 | 0.62 |
| 61.59 | -133.34 | 1547.09 | 1519 | 1583 | 1547 | 10.24 | 21.01 | 3.32 | 0.12 |
| 61.59 | -133.34 | 1676.29 | 1594 | 1776 | 1670 | 34.62 | 46.78 | 25.85 | 0.05 |
| 61.97 | -132.74 | 909.18 | 883 | 939 | 910 | 11.64 | 22.95 | 7.43 | 0.08 |
| 61.97 | -132.74 | 905.23 | 876 | 941 | 908 | 11.24 | 23.85 | 2.39 | 0.08 |
| 61.95 | -132.70 | 900.10 | 883 | 924 | 900 | 8.46 | 19.03 | 0.00 | 0.06 |
| 61.61 | -132.36 | 1790.52 | 1678 | 1923 | 1790 | 23.74 | 38.75 | 9.32 | 0.15 |
| 61.61 | -132.34 | 1777.87 | 1659 | 1893 | 1780 | 28.25 | 46.27 | 17.14 | 0.25 |
| 61.61 | -132.36 | 1844.27 | 1769 | 1953 | 1831 | 26.62 | 41.69 | 7.37 | 0.06 |
| 61.61 | -132.38 | 1733.58 | 1628 | 1841 | 1735 | 21.99 | 40.36 | 7.13 | 0.15 |
| 61.50 | -132.82 | 1659.33 | 1510 | 1793 | 1664 | 24.12 | 40.04 | 9.90 | 0.38 |
| 61.50 | -132.81 | 1744.89 | 1648 | 1857 | 1747 | 26.33 | 40.86 | 11.67 | 0.09 |
| 61.80 | -132.97 | 1584.88 | 1484 | 1733 | 1570 | 25.99 | 43.06 | 4.82 | 0.19 |
| 61.72 | -132.77 | 1717.38 | 1621 | 1806 | 1717 | 28.69 | 33.74 | 22.42 | 0.08 |
| 61.72 | -132.80 | 1651.26 | 1596 | 1724 | 1648 | 23.34 | 37.72 | 14.76 | 0.06 |
| 61.71 | -132.68 | 1667.50 | 1547 | 1796 | 1661 | 30.78 | 47.34 | 18.70 | 0.20 |
| 61.72 | -132.78 | 1752.67 | 1695 | 1840 | 1746 | 18.59 | 34.73 | 7.13 | 0.08 |
| 61.72 | -132.92 | 1601.53 | 1512 | 1714 | 1600 | 19.41 | 35.09 | 8.22 | 0.24 |
| 61.71 | -132.68 | 1742.62 | 1637 | 1857 | 1733 | 24.04 | 39.98 | 6.80 | 0.31 |
| 61.71 | -132.79 | 1806.67 | 1738 | 1903 | 1801 | 22.76 | 37.04 | 12.77 | 0.07 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.53 | -132.82 | 1726.81 | 1513 | 1923 | 1760 | 31.64 | 43.78 | 3.05 | 0.19 |
| 64.52 | -132.79 | 1538.80 | 1489 | 1645 | 1524 | 24.12 | 46.09 | 5.06 | 0.11 |
| 64.52 | -132.78 | 1655.02 | 1553 | 1712 | 1669 | 27.62 | 38.06 | 0.34 | 0.11 |
| 64.64 | -132.83 | 1591.27 | 1478 | 1693 | 1594 | 30.35 | 49.70 | 3.72 | 0.21 |
| 64.70 | -132.78 | 1671.05 | 1568 | 1824 | 1672 | 26.37 | 53.04 | 6.34 | 0.32 |
| 64.75 | -132.75 | 1351.60 | 1229 | 1734 | 1308 | 29.44 | 65.19 | 0.34 | 0.30 |
| 64.79 | -132.81 | 1859.83 | 1717 | 1949 | 1870 | 28.34 | 50.73 | 2.02 | 0.18 |
| 64.80 | -132.85 | 1483.08 | 1342 | 1707 | 1471 | 40.37 | 57.28 | 10.48 | 0.23 |
| 64.81 | -132.87 | 1382.11 | 1241 | 1564 | 1379 | 39.75 | 48.53 | 31.77 | 0.22 |
| 64.81 | -132.81 | 1489.38 | 1351 | 1663 | 1480 | 24.02 | 38.68 | 12.35 | 0.22 |
| 64.90 | -132.78 | 1731.45 | 1600 | 1878 | 1723 | 38.38 | 49.37 | 27.68 | 0.09 |
| 64.90 | -132.78 | 1651.45 | 1597 | 1709 | 1653 | 22.94 | 44.71 | 8.38 | 0.10 |
| 64.90 | -132.79 | 1902.36 | 1783 | 2029 | 1902 | 35.25 | 48.43 | 16.31 | 0.22 |
| 64.90 | -132.76 | 1624.90 | 1535 | 1777 | 1617 | 28.46 | 47.78 | 0.48 | 0.31 |
| 64.90 | -132.75 | 1806.54 | 1661 | 1892 | 1815 | 28.00 | 39.78 | 3.63 | 0.09 |
| 64.91 | -132.74 | 1562.76 | 1442 | 1732 | 1556 | 35.00 | 47.67 | 24.21 | 0.14 |
| 64.91 | -132.81 | 2010.53 | 1907 | 2106 | 2005 | 31.52 | 43.29 | 3.93 | 0.13 |
| 64.92 | -132.78 | 1878.23 | 1708 | 1980 | 1879 | 31.58 | 51.15 | 0.48 | 0.33 |
| 64.91 | -132.66 | 1757.09 | 1644 | 1879 | 1754 | 33.25 | 45.50 | 20.98 | 0.15 |
| 64.91 | -132.67 | 1833.36 | 1706 | 2001 | 1814 | 34.57 | 51.35 | 16.67 | 0.13 |
| 64.92 | -132.70 | 1663.47 | 1500 | 1768 | 1670 | 32.24 | 38.08 | 25.65 | 0.08 |
| 64.93 | -132.77 | 1760.81 | 1594 | 1833 | 1778 | 28.44 | 47.82 | 2.05 | 0.20 |
| 64.94 | -132.76 | 1621.53 | 1512 | 1793 | 1599 | 27.67 | 40.07 | 8.00 | 0.19 |
| 64.93 | -132.79 | 1783.68 | 1559 | 2006 | 1794 | 40.89 | 53.73 | 25.63 | 0.43 |
| 64.94 | -132.84 | 1708.38 | 1521 | 2004 | 1675 | 26.41 | 50.22 | 6.05 | 0.21 |
| 64.94 | -132.86 | 1567.61 | 1507 | 1624 | 1572 | 17.51 | 40.54 | 4.82 | 0.11 |
| 64.95 | -132.78 | 1476.90 | 1361 | 1622 | 1473 | 28.96 | 43.18 | 4.76 | 0.23 |
| 64.96 | -132.77 | 1302.14 | 1237 | 1392 | 1297 | 21.39 | 35.39 | 5.01 | 0.18 |
| 64.96 | -132.84 | 1430.84 | 1289 | 1627 | 1421 | 35.07 | 44.49 | 23.84 | 0.26 |
| 64.98 | -132.82 | 910.06 | 877 | 948 | 909 | 10.09 | 24.54 | 0.34 | 0.34 |
| 64.98 | -132.76 | 925.86 | 910 | 943 | 926 | 3.74 | 20.00 | 0.00 | 0.33 |
| 64.94 | -132.58 | 1798.69 | 1674 | 1937 | 1799 | 26.10 | 35.50 | 3.05 | 0.15 |
| 64.94 | -132.57 | 1631.62 | 1493 | 1756 | 1631 | 35.87 | 49.64 | 15.48 | 0.14 |
| 64.92 | -132.50 | 1785.19 | 1612 | 1966 | 1788 | 28.46 | 41.38 | 9.19 | 0.20 |
| 64.94 | -132.54 | 1569.32 | 1394 | 1759 | 1568 | 35.04 | 47.59 | 17.25 | 0.26 |
| 64.94 | -132.53 | 1393.98 | 1375 | 1437 | 1392 | 13.24 | 37.54 | 2.46 | 0.08 |
| 64.91 | -132.64 | 1592.08 | 1436 | 1764 | 1583 | 29.99 | 40.29 | 18.57 | 0.21 |
| 64.91 | -132.65 | 1595.34 | 1509 | 1660 | 1599 | 16.73 | 38.51 | 3.52 | 0.17 |
| 61.71 | -132.78 | 1777.44 | 1702 | 1889 | 1768 | 26.22 | 36.86 | 7.23 | 0.13 |
| 61.71 | -132.89 | 1575.12 | 1519 | 1627 | 1576 | 14.77 | 20.66 | 5.72 | 0.10 |
| 61.70 | -132.59 | 1412.35 | 1230 | 1745 | 1387 | 24.27 | 43.91 | 1.07 | 0.50 |
| 61.70 | -132.68 | 1880.99 | 1803 | 1950 | 1883 | 20.49 | 34.36 | 10.74 | 0.13 |
| 61.69 | -132.55 | 1381.28 | 1307 | 1508 | 1369 | 19.99 | 35.55 | 2.64 | 0.22 |
| 61.69 | -132.69 | 1802.33 | 1630 | 2018 | 1777 | 28.38 | 38.69 | 14.41 | 0.20 |
| 61.68 | -132.55 | 1451.89 | 1384 | 1531 | 1451 | 19.00 | 29.24 | 5.23 | 0.09 |
| 61.68 | -132.65 | 1843.53 | 1789 | 1897 | 1847 | 12.18 | 29.31 | 2.36 | 0.22 |
| 61.68 | -132.53 | 1683.93 | 1627 | 1755 | 1683 | 26.24 | 38.54 | 9.65 | 0.14 |
| 61.68 | -132.63 | 1605.43 | 1454 | 1781 | 1601 | 24.60 | 52.48 | 7.36 | 0.57 |
| 61.68 | -132.67 | 1805.79 | 1655 | 1958 | 1803 | 28.08 | 36.99 | 11.55 | 0.31 |
| 61.67 | -132.58 | 1591.55 | 1553 | 1639 | 1590 | 18.99 | 29.44 | 9.01 | 0.04 |
| 61.67 | -132.67 | 1888.17 | 1766 | 2025 | 1889 | 29.69 | 40.25 | 11.85 | 0.14 |
| 61.68 | -132.92 | 1830.48 | 1714 | 1917 | 1835 | 30.79 | 39.92 | 8.90 | 0.08 |
| 61.67 | -132.66 | 1891.17 | 1800 | 2000 | 1884 | 24.37 | 38.33 | 9.39 | 0.16 |
| 61.67 | -132.65 | 1866.82 | 1789 | 1997 | 1848 | 22.97 | 38.08 | 5.14 | 0.11 |
| 61.67 | -132.65 | 1891.64 | 1796 | 2005 | 1887 | 28.77 | 38.95 | 13.93 | 0.12 |
| 61.67 | -132.69 | 1764.17 | 1670 | 1840 | 1771 | 21.42 | 38.04 | 6.80 | 0.25 |
| 61.66 | -132.70 | 1831.17 | 1790 | 1878 | 1832 | 15.31 | 28.58 | 4.06 | 0.13 |
| 61.66 | -132.67 | 1900.26 | 1840 | 2005 | 1892 | 24.18 | 46.42 | 4.86 | 0.21 |
| 61.65 | -132.39 | 1766.73 | 1671 | 1845 | 1772 | 28.73 | 37.67 | 19.36 | 0.07 |
| 61.65 | -132.64 | 1637.84 | 1515 | 1851 | 1615 | 27.62 | 45.98 | 7.85 | 0.12 |
| 61.65 | -132.42 | 1755.23 | 1649 | 1856 | 1765 | 21.59 | 41.92 | 10.72 | 0.14 |
| 61.64 | -132.60 | 1609.31 | 1509 | 1712 | 1614 | 25.15 | 38.25 | 12.63 | 0.16 |
| 61.64 | -132.48 | 1674.11 | 1540 | 1824 | 1676 | 22.64 | 44.25 | 9.65 | 0.24 |
| 61.64 | -132.58 | 1611.92 | 1554 | 1695 | 1606 | 23.62 | 34.42 | 7.19 | 0.11 |
| 61.63 | -132.53 | 1375.19 | 1273 | 1526 | 1364 | 24.44 | 32.43 | 15.50 | 0.13 |
| 61.62 | -132.37 | 1730.57 | 1632 | 1846 | 1717 | 33.55 | 44.54 | 18.87 | 0.04 |
| 61.58 | -132.09 | 1507.56 | 1397 | 1658 | 1500 | 17.21 | 29.32 | 5.73 | 0.19 |
| 61.58 | -132.09 | 1548.63 | 1424 | 1699 | 1545 | 21.28 | 35.53 | 7.85 | 0.24 |
| 61.58 | -132.10 | 1572.49 | 1497 | 1647 | 1573 | 19.45 | 26.97 | 8.41 | 0.13 |
| 61.56 | -132.08 | 1719.95 | 1611 | 1856 | 1705 | 35.57 | 47.04 | 20.38 | 0.10 |
| 61.57 | -132.83 | 1736.98 | 1587 | 1858 | 1746 | 26.76 | 33.72 | 14.31 | 0.12 |
| 61.56 | -132.21 | 1405.49 | 1184 | 1828 | 1357 | 21.31 | 48.39 | 0.00 | 0.63 |
| 61.56 | -132.20 | 1377.32 | 1185 | 1509 | 1394 | 23.93 | 34.95 | 11.80 | 0.13 |
| 61.56 | -132.27 | 1615.03 | 1503 | 1772 | 1599 | 19.73 | 40.12 | 3.11 | 0.56 |
| 61.56 | -132.29 | 1619.95 | 1518 | 1778 | 1599 | 22.66 | 40.63 | 3.37 | 0.40 |
| 61.55 | -132.30 | 1727.57 | 1545 | 1900 | 1743 | 23.43 | 49.19 | 3.37 | 0.49 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.90 | -132.64 | 1787.11 | 1639 | 1977 | 1783 | 36.58 | 50.12 | 28.53 | 0.15 |
| 64.91 | -132.48 | 1887.99 | 1782 | 1932 | 1903 | 17.57 | 33.67 | 2.13 | 0.12 |
| 64.90 | -132.53 | 1400.94 | 1360 | 1493 | 1393 | 18.99 | 37.27 | 3.18 | 0.18 |
| 64.89 | -132.52 | 1699.81 | 1481 | 1826 | 1708 | 31.09 | 51.35 | 5.06 | 0.17 |
| 64.89 | -132.48 | 1913.79 | 1841 | 1959 | 1917 | 20.02 | 29.82 | 2.86 | 0.09 |
| 64.88 | -132.67 | 1770.21 | 1613 | 1971 | 1762 | 38.76 | 49.99 | 24.98 | 0.14 |
| 64.87 | -132.66 | 1991.27 | 1857 | 2135 | 1986 | 33.38 | 41.87 | 11.13 | 0.15 |
| 64.87 | -132.64 | 1751.92 | 1668 | 1856 | 1741 | 16.74 | 35.47 | 0.68 | 0.30 |
| 64.86 | -132.65 | 1908.93 | 1778 | 2040 | 1907 | 35.13 | 42.17 | 20.94 | 0.18 |
| 64.84 | -132.65 | 1430.82 | 1306 | 1625 | 1419 | 25.89 | 46.63 | 5.48 | 0.34 |
| 64.83 | -132.63 | 1859.37 | 1725 | 1981 | 1864 | 31.30 | 40.62 | 5.10 | 0.13 |
| 64.82 | -132.62 | 1976.00 | 1940 | 2008 | 1977 | 14.01 | 23.28 | 5.01 | 0.01 |
| 64.82 | -132.60 | 2003.64 | 1955 | 2061 | 2007 | 23.04 | 36.33 | 2.05 | 0.04 |
| 64.80 | -132.60 | 1745.71 | 1481 | 1932 | 1779 | 33.84 | 42.18 | 22.23 | 0.23 |
| 64.80 | -132.59 | 2022.19 | 1975 | 2047 | 2029 | 21.79 | 34.06 | 3.95 | 0.03 |
| 64.78 | -132.63 | 943.84 | 871 | 1098 | 940 | 14.37 | 32.29 | 0.75 | 0.35 |
| 64.67 | -132.66 | 1546.69 | 1493 | 1624 | 1536 | 14.71 | 38.92 | 0.75 | 0.17 |
| 64.67 | -132.58 | 1774.43 | 1574 | 1985 | 1781 | 26.23 | 52.37 | 2.72 | 0.55 |
| 64.68 | -132.55 | 1529.39 | 1427 | 1656 | 1523 | 31.51 | 36.74 | 24.81 | 0.11 |
| 64.63 | -132.59 | 1499.88 | 1432 | 1615 | 1491 | 21.41 | 37.27 | 4.26 | 0.17 |
| 64.61 | -132.66 | 1822.52 | 1737 | 1916 | 1822 | 22.74 | 40.23 | 0.95 | 0.15 |
| 64.60 | -132.68 | 1859.42 | 1786 | 1976 | 1853 | 26.16 | 48.83 | 2.57 | 0.14 |
| 64.54 | -132.67 | 1764.25 | 1672 | 1830 | 1772 | 31.27 | 44.15 | 5.44 | 0.13 |
| 64.52 | -132.58 | 1609.72 | 1487 | 1682 | 1616 | 25.33 | 36.58 | 3.02 | 0.24 |
| 64.50 | -132.56 | 1604.97 | 1436 | 1800 | 1587 | 25.52 | 49.50 | 3.65 | 0.30 |
| 64.50 | -132.51 | 1705.48 | 1542 | 1920 | 1681 | 32.00 | 45.12 | 8.58 | 0.20 |
| 64.50 | -132.65 | 1685.29 | 1582 | 1838 | 1676 | 29.75 | 43.76 | 18.81 | 0.21 |
| 64.48 | -132.65 | 1621.70 | 1456 | 1847 | 1607 | 37.71 | 52.89 | 1.72 | 0.24 |
| 64.37 | -132.53 | 1595.00 | 1433 | 1805 | 1584 | 28.94 | 43.86 | 8.10 | 0.24 |
| 64.31 | -132.65 | 1489.70 | 1336 | 1670 | 1484 | 29.02 | 45.95 | 1.69 | 0.30 |
| 64.30 | -132.65 | 1591.15 | 1435 | 1826 | 1587 | 36.50 | 53.74 | 19.20 | 0.19 |
| 64.25 | -132.68 | 1660.44 | 1495 | 1801 | 1654 | 33.52 | 48.40 | 2.90 | 0.23 |
| 64.27 | -132.53 | 1535.12 | 1357 | 1650 | 1544 | 30.03 | 44.34 | 1.35 | 0.17 |
| 64.26 | -132.57 | 1631.14 | 1455 | 1829 | 1614 | 28.19 | 46.24 | 3.02 | 0.28 |
| 64.23 | -132.55 | 1817.29 | 1711 | 1887 | 1823 | 27.04 | 37.24 | 3.81 | 0.16 |
| 64.23 | -132.63 | 1518.97 | 1077 | 1949 | 1510 | 31.76 | 44.40 | 4.06 | 0.43 |
| 64.22 | -132.65 | 1426.02 | 1090 | 1793 | 1433 | 28.43 | 49.89 | 1.72 | 0.39 |
| 64.22 | -132.62 | 1603.22 | 1436 | 1890 | 1554 | 28.04 | 53.44 | 3.84 | 0.39 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.55 | -132.31 | 1758.13 | 1707 | 1807 | 1759 | 14.69 | 23.83 | 7.09 | 0.08 |
| 61.55 | -132.33 | 1678.65 | 1588 | 1801 | 1671 | 19.84 | 38.43 | 6.93 | 0.20 |
| 61.54 | -132.87 | 1742.81 | 1675 | 1794 | 1746 | 23.48 | 36.43 | 10.70 | 0.12 |
| 61.53 | -132.29 | 1548.93 | 1482 | 1649 | 1541 | 26.28 | 42.82 | 1.97 | 0.16 |
| 61.53 | -132.27 | 1547.93 | 1419 | 1686 | 1549 | 34.64 | 48.75 | 14.07 | 0.17 |
| 61.53 | -132.34 | 1566.95 | 1461 | 1716 | 1564 | 22.37 | 42.77 | 2.57 | 0.19 |
| 61.53 | -132.97 | 1759.51 | 1680 | 1857 | 1758 | 23.16 | 35.76 | 13.07 | 0.17 |
| 61.52 | -132.36 | 1601.03 | 1497 | 1702 | 1598 | 23.43 | 36.72 | 5.27 | 0.46 |
| 61.52 | -132.34 | 1687.00 | 1585 | 1824 | 1672 | 32.13 | 45.39 | 14.23 | 0.09 |
| 61.52 | -132.35 | 1611.17 | 1545 | 1700 | 1612 | 20.82 | 36.25 | 3.05 | 0.20 |
| 61.50 | -133.14 | 1699.42 | 1610 | 1849 | 1682 | 25.68 | 40.74 | 9.37 | 0.13 |
| 61.49 | -133.24 | 1597.16 | 1539 | 1687 | 1589 | 23.84 | 42.19 | 6.70 | 0.10 |
| 61.47 | -133.74 | 1022.70 | 895 | 1172 | 1015 | 26.51 | 38.52 | 1.39 | 0.17 |
| 61.46 | -133.34 | 1585.04 | 1539 | 1668 | 1573 | 13.57 | 31.16 | 2.64 | 0.15 |
| 61.43 | -133.96 | 1734.17 | 1557 | 1886 | 1738 | 34.54 | 41.80 | 21.60 | 0.13 |
| 61.41 | -133.88 | 1619.23 | 1542 | 1713 | 1611 | 21.08 | 32.25 | 11.62 | 0.12 |
| 61.41 | -133.93 | 1692.14 | 1604 | 1802 | 1693 | 28.65 | 42.54 | 13.80 | 0.09 |
| 61.38 | -133.93 | 1650.69 | 1580 | 1723 | 1644 | 22.78 | 35.85 | 4.82 | 0.08 |
| 61.38 | -133.94 | 1663.22 | 1639 | 1741 | 1656 | 20.97 | 38.48 | 3.71 | 0.02 |
| 61.38 | -133.93 | 1672.07 | 1634 | 1730 | 1667 | 15.28 | 32.81 | 4.52 | 0.09 |
| 61.06 | -133.61 | 1676.58 | 1580 | 1790 | 1668 | 32.84 | 44.50 | 4.53 | 0.10 |
| 61.05 | -133.46 | 1578.35 | 1499 | 1663 | 1582 | 21.18 | 38.13 | 6.20 | 0.22 |
| 61.38 | -133.93 | 1677.53 | 1643 | 1709 | 1678 | 11.36 | 30.16 | 2.90 | 0.07 |
| 61.35 | -133.17 | 1645.49 | 1534 | 1823 | 1650 | 23.84 | 51.98 | 7.45 | 0.13 |
| 61.33 | -133.16 | 1715.64 | 1602 | 1842 | 1718 | 36.47 | 45.45 | 23.19 | 0.06 |
| 61.33 | -133.15 | 1726.89 | 1653 | 1818 | 1722 | 31.65 | 41.10 | 21.03 | 0.02 |
| 61.12 | -133.51 | 1580.95 | 1539 | 1644 | 1578 | 18.39 | 36.88 | 4.97 | 0.11 |
| 61.15 | -133.61 | 1752.17 | 1679 | 1855 | 1745 | 27.27 | 35.71 | 13.96 | 0.08 |
| 61.15 | -133.96 | 1628.25 | 1584 | 1681 | 1630 | 17.12 | 28.50 | 6.73 | 0.08 |
| 61.15 | -133.95 | 1732.88 | 1691 | 1800 | 1730 | 17.60 | 31.75 | 10.46 | 0.07 |
| 61.49 | -132.16 | 1685.37 | 1545 | 1837 | 1682 | 39.43 | 45.64 | 31.77 | 0.12 |
| 61.49 | -132.79 | 1641.20 | 1504 | 1760 | 1654 | 22.60 | 38.62 | 3.81 | 0.23 |
| 61.49 | -132.76 | 1665.45 | 1593 | 1730 | 1671 | 19.24 | 33.71 | 8.11 | 0.19 |
| 61.47 | -132.25 | 1603.76 | 1444 | 1814 | 1604 | 26.92 | 40.31 | 9.01 | 0.29 |
| 61.48 | -132.71 | 1639.49 | 1544 | 1740 | 1635 | 30.93 | 40.65 | 5.10 | 0.08 |
| 61.47 | -132.72 | 1666.98 | 1577 | 1724 | 1671 | 29.22 | 37.33 | 2.26 | 0.04 |
| 61.46 | -132.88 | 1501.56 | 1439 | 1600 | 1495 | 26.79 | 43.55 | 5.06 | 0.05 |
| 61.45 | -132.26 | 1612.81 | 1459 | 1763 | 1612 | 23.63 | 39.71 | 7.01 | 0.51 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.21 | -132.59 | 1500.19 | 1377 | 1703 | 1486 | 26.28 | 41.29 | 5.89 | 0.42 |
| 64.21 | -132.61 | 1546.99 | 1442 | 1660 | 1553 | 25.54 | 38.97 | 11.20 | 0.14 |
| 64.21 | -132.64 | 1647.82 | 1398 | 1863 | 1676 | 29.45 | 48.51 | 0.95 | 0.55 |
| 64.12 | -132.71 | 1505.86 | 1341 | 1588 | 1526 | 24.39 | 34.77 | 0.00 | 0.29 |
| 64.00 | -132.60 | 1465.82 | 1437 | 1525 | 1457 | 13.06 | 30.84 | 1.39 | 0.12 |
| 64.00 | -132.57 | 1572.75 | 1505 | 1717 | 1559 | 25.71 | 44.61 | 4.04 | 0.11 |
| 64.00 | -132.54 | 1791.17 | 1670 | 1861 | 1804 | 27.00 | 49.29 | 2.26 | 0.22 |
| 64.01 | -132.53 | 1753.18 | 1646 | 1825 | 1762 | 24.83 | 41.55 | 1.22 | 0.16 |
| 64.00 | -132.52 | 1660.15 | 1488 | 1799 | 1661 | 33.69 | 46.98 | 1.72 | 0.29 |
| 64.00 | -132.51 | 1584.37 | 1454 | 1708 | 1586 | 26.95 | 42.78 | 6.18 | 0.14 |
| 64.13 | -132.40 | 1694.52 | 1539 | 1777 | 1706 | 31.07 | 42.13 | 0.68 | 0.44 |
| 64.11 | -132.46 | 1728.17 | 1533 | 1888 | 1732 | 32.33 | 46.65 | 6.92 | 0.22 |
| 64.12 | -132.33 | 1580.39 | 1493 | 1671 | 1583 | 23.30 | 44.69 | 8.11 | 0.17 |
| 64.20 | -132.34 | 1746.18 | 1603 | 1914 | 1752 | 28.65 | 42.78 | 2.88 | 0.33 |
| 64.18 | -132.32 | 1763.74 | 1528 | 1975 | 1758 | 32.82 | 47.48 | 10.62 | 0.30 |
| 64.19 | -132.30 | 1678.53 | 1526 | 1940 | 1665 | 33.41 | 51.81 | 7.36 | 0.19 |
| 64.19 | -132.28 | 1696.59 | 1600 | 1789 | 1701 | 28.34 | 38.04 | 2.13 | 0.14 |
| 64.20 | -132.32 | 1607.15 | 1495 | 1713 | 1607 | 34.24 | 43.10 | 17.18 | 0.14 |
| 64.20 | -132.33 | 1683.31 | 1549 | 1900 | 1667 | 33.27 | 50.49 | 6.85 | 0.15 |
| 64.19 | -132.36 | 1791.48 | 1654 | 1889 | 1796 | 33.81 | 47.07 | 5.60 | 0.13 |
| 64.20 | -132.39 | 1641.63 | 1447 | 1873 | 1657 | 23.38 | 46.72 | 0.48 | 0.39 |
| 64.20 | -132.41 | 1530.26 | 1348 | 1828 | 1479 | 29.14 | 47.86 | 1.69 | 0.39 |
| 64.20 | -132.41 | 1693.35 | 1507 | 1819 | 1702 | 32.83 | 53.31 | 2.36 | 0.33 |
| 64.19 | -132.44 | 1661.27 | 1491 | 1916 | 1637 | 27.99 | 50.52 | 10.80 | 0.29 |
| 64.21 | -132.44 | 1400.00 | 1147 | 1801 | 1361 | 24.34 | 52.56 | 6.89 | 0.59 |
| 64.24 | -132.44 | 1724.93 | 1570 | 1886 | 1713 | 33.67 | 54.35 | 0.75 | 0.19 |
| 64.27 | -132.36 | 1476.02 | 1410 | 1606 | 1469 | 24.74 | 42.96 | 3.11 | 0.23 |
| 64.27 | -132.34 | 1713.27 | 1551 | 1998 | 1692 | 34.24 | 48.38 | 7.33 | 0.15 |
| 64.29 | -132.31 | 1748.96 | 1568 | 1925 | 1751 | 34.25 | 43.63 | 3.44 | 0.15 |
| 64.28 | -132.46 | 1524.83 | 1463 | 1711 | 1515 | 22.13 | 48.35 | 4.76 | 0.20 |
| 64.46 | -132.37 | 1561.60 | 1440 | 1827 | 1524 | 30.07 | 54.02 | 5.72 | 0.15 |
| 64.55 | -132.42 | 1879.96 | 1674 | 1998 | 1896 | 33.52 | 46.19 | 1.01 | 0.26 |
| 64.57 | -132.42 | 1753.72 | 1677 | 1881 | 1741 | 19.03 | 49.26 | 3.39 | 0.26 |
| 64.57 | -132.43 | 1998.52 | 1715 | 2280 | 2012 | 40.66 | 61.87 | 3.39 | 0.34 |
| 64.70 | -132.35 | 1591.44 | 1515 | 1680 | 1589 | 16.60 | 28.55 | 7.13 | 0.29 |
| 64.68 | -132.31 | 1669.67 | 1378 | 1993 | 1659 | 21.61 | 43.89 | 5.06 | 0.70 |
| 64.67 | -132.26 | 1553.46 | 1482 | 1689 | 1548 | 25.52 | 43.89 | 5.24 | 0.12 |
| 64.69 | -132.29 | 2022.10 | 1874 | 2104 | 2035 | 33.06 | 44.88 | 1.51 | 0.23 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.45 | -132.40 | 1511.59 | 1427 | 1609 | 1507 | 16.06 | 31.77 | 4.58 | 0.18 |
| 61.43 | -132.19 | 1708.10 | 1612 | 1821 | 1705 | 23.84 | 35.00 | 12.57 | 0.11 |
| 61.43 | -132.20 | 1676.49 | 1522 | 1831 | 1671 | 24.99 | 39.92 | 8.11 | 0.18 |
| 61.43 | -132.24 | 1739.22 | 1661 | 1876 | 1735 | 22.20 | 37.71 | 12.52 | 0.14 |
| 61.43 | -132.25 | 1589.40 | 1513 | 1665 | 1594 | 15.15 | 39.61 | 3.58 | 0.30 |
| 61.43 | -132.24 | 1662.97 | 1616 | 1738 | 1659 | 12.31 | 23.15 | 4.06 | 0.14 |
| 61.43 | -132.39 | 1517.17 | 1458 | 1638 | 1516 | 20.05 | 39.66 | 3.58 | 0.08 |
| 61.42 | -132.35 | 1609.11 | 1511 | 1661 | 1619 | 17.53 | 30.08 | 2.72 | 0.13 |
| 61.44 | -133.00 | 1784.59 | 1721 | 1872 | 1781 | 25.95 | 36.38 | 14.76 | 0.06 |
| 61.42 | -132.22 | 1684.75 | 1606 | 1761 | 1689 | 16.19 | 32.93 | 5.99 | 0.18 |
| 61.43 | -132.96 | 1633.02 | 1506 | 1798 | 1629 | 29.49 | 36.63 | 13.59 | 0.12 |
| 61.42 | -132.33 | 1579.38 | 1496 | 1682 | 1568 | 19.81 | 42.42 | 6.32 | 0.12 |
| 61.42 | -132.40 | 1666.86 | 1531 | 1800 | 1672 | 28.73 | 38.97 | 13.38 | 0.19 |
| 61.42 | -132.16 | 1482.64 | 1360 | 1563 | 1495 | 14.84 | 33.04 | 5.15 | 0.23 |
| 61.43 | -132.92 | 1533.08 | 1441 | 1651 | 1526 | 31.87 | 39.61 | 13.34 | 0.07 |
| 61.43 | -132.96 | 1718.44 | 1681 | 1760 | 1722 | 16.21 | 36.23 | 5.13 | 0.07 |
| 61.42 | -132.87 | 1625.06 | 1562 | 1700 | 1624 | 21.27 | 34.37 | 9.93 | 0.06 |
| 61.41 | -132.36 | 1500.36 | 1391 | 1615 | 1498 | 18.50 | 39.13 | 4.52 | 0.20 |
| 61.42 | -132.99 | 1524.76 | 1438 | 1639 | 1516 | 30.54 | 40.36 | 3.20 | 0.22 |
| 61.39 | -132.94 | 1579.41 | 1539 | 1624 | 1574 | 27.01 | 33.20 | 12.30 | 0.02 |
| 61.39 | -132.94 | 1579.15 | 1497 | 1745 | 1564 | 16.66 | 43.97 | 3.32 | 0.23 |
| 61.38 | -132.77 | 1639.39 | 1594 | 1702 | 1634 | 17.57 | 33.80 | 5.14 | 0.09 |
| 61.37 | -132.85 | 1688.35 | 1657 | 1747 | 1683 | 19.72 | 36.00 | 4.38 | 0.06 |
| 61.36 | -132.71 | 1650.08 | 1524 | 1783 | 1650 | 28.08 | 39.41 | 9.63 | 0.10 |
| 61.32 | -132.42 | 1459.56 | 1373 | 1518 | 1465 | 20.84 | 26.84 | 13.69 | 0.08 |
| 61.30 | -132.26 | 1416.69 | 1303 | 1516 | 1418 | 27.15 | 36.94 | 15.18 | 0.23 |
| 61.20 | -132.29 | 1069.94 | 1064 | 1079 | 1070 | 4.10 | 7.39 | 2.39 | 0.06 |
| 61.19 | -132.39 | 1246.35 | 1175 | 1290 | 1253 | 12.44 | 21.19 | 7.54 | 0.14 |
| 64.31 | -136.61 | 1371.54 | 1317 | 1503 | 1363 | 16.37 | 42.14 | 4.79 | 0.32 |
| 64.85 | -135.17 | 1442.39 | 1278 | 1672 | 1437 | 27.48 | 43.05 | 0.00 | 1.03 |
| 64.85 | -134.25 | 1711.65 | 1618 | 1842 | 1695 | 37.13 | 49.72 | 28.05 | 0.06 |
| 64.84 | -135.14 | 1417.62 | 1287 | 1691 | 1378 | 21.01 | 44.71 | 0.75 | 0.81 |
| 64.84 | -134.10 | 1519.57 | 1445 | 1597 | 1524 | 22.33 | 41.65 | 9.09 | 0.15 |
| 64.81 | -136.11 | 1450.10 | 1372 | 1543 | 1448 | 26.89 | 34.46 | 14.85 | 0.12 |
| 64.75 | -136.02 | 1463.43 | 1389 | 1529 | 1470 | 13.17 | 26.07 | 0.75 | 0.15 |
| 64.73 | -136.08 | 1286.46 | 1209 | 1384 | 1283 | 21.04 | 32.82 | 8.59 | 0.18 |
| 64.73 | -136.05 | 1377.13 | 1294 | 1510 | 1383 | 15.36 | 55.05 | 1.39 | 0.41 |
| 64.71 | -136.16 | 924.08 | 882 | 1034 | 914 | 9.23 | 24.51 | 0.34 | 0.38 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.69 | -132.28 | 1877.01 | 1826 | 1969 | 1876 | 21.12 | 40.33 | 1.22 | 0.20 |
| 64.69 | -132.30 | 1834.71 | 1723 | 2064 | 1817 | 24.93 | 39.99 | 1.97 | 0.30 |
| 64.71 | -132.29 | 1845.83 | 1628 | 2082 | 1834 | 24.41 | 37.71 | 3.32 | 0.52 |
| 64.72 | -132.34 | 1640.99 | 1554 | 1748 | 1635 | 15.40 | 38.26 | 4.11 | 0.32 |
| 64.76 | -132.32 | 1618.51 | 1441 | 1815 | 1618 | 33.93 | 42.60 | 18.57 | 0.17 |
| 64.79 | -132.38 | 2043.79 | 1986 | 2089 | 2045 | 22.50 | 36.17 | 5.44 | 0.05 |
| 64.71 | -132.08 | 2064.70 | 2050 | 2080 | 2064 | 12.50 | 18.91 | 7.37 | 0.01 |
| 64.71 | -132.17 | 2014.82 | 1929 | 2067 | 2018 | 32.67 | 42.60 | 4.32 | 0.04 |
| 64.71 | -132.11 | 1946.60 | 1916 | 2030 | 1928 | 19.02 | 31.69 | 0.95 | 0.02 |
| 64.71 | -132.23 | 1563.63 | 1470 | 1707 | 1549 | 26.88 | 41.94 | 12.89 | 0.18 |
| 64.72 | -132.25 | 1655.92 | 1522 | 1767 | 1661 | 30.65 | 40.32 | 12.11 | 0.22 |
| 64.70 | -132.24 | 1734.43 | 1625 | 1823 | 1734 | 27.94 | 39.95 | 11.35 | 0.10 |
| 64.70 | -132.25 | 1842.84 | 1785 | 1863 | 1851 | 17.66 | 45.38 | 0.34 | 0.16 |
| 64.70 | -132.24 | 1797.96 | 1706 | 1880 | 1796 | 18.78 | 30.01 | 9.14 | 0.11 |
| 64.69 | -132.24 | 1898.91 | 1807 | 1960 | 1897 | 16.55 | 32.15 | 5.48 | 0.14 |
| 64.70 | -132.04 | 1998.87 | 1923 | 2074 | 2002 | 28.26 | 39.26 | 5.13 | 0.06 |
| 64.70 | -132.06 | 2052.25 | 2047 | 2060 | 2049 | 10.74 | 20.25 | 3.32 | 0.00 |
| 64.70 | -132.16 | 1899.17 | 1814 | 2061 | 1901 | 26.39 | 49.26 | 1.22 | 0.42 |
| 64.69 | -132.18 | 2059.80 | 1909 | 2274 | 2045 | 42.88 | 57.82 | 21.24 | 0.24 |
| 64.68 | -132.11 | 1966.14 | 1794 | 2200 | 1952 | 34.35 | 50.74 | 9.75 | 0.22 |
| 64.67 | -132.11 | 1825.45 | 1721 | 2024 | 1794 | 26.55 | 47.48 | 3.52 | 0.19 |
| 64.65 | -132.05 | 1760.64 | 1570 | 1961 | 1767 | 42.22 | 52.48 | 12.83 | 0.24 |
| 64.65 | -132.08 | 1325.00 | 1278 | 1440 | 1310 | 15.13 | 32.28 | 0.00 | 0.25 |
| 64.65 | -132.13 | 1761.29 | 1630 | 1881 | 1763 | 34.45 | 40.35 | 6.18 | 0.16 |
| 64.63 | -132.18 | 1801.82 | 1683 | 1961 | 1794 | 21.76 | 44.40 | 1.43 | 0.39 |
| 64.63 | -132.21 | 1705.73 | 1562 | 1914 | 1688 | 26.90 | 39.54 | 6.80 | 0.32 |
| 64.62 | -132.25 | 1721.93 | 1518 | 1971 | 1710 | 28.22 | 43.16 | 1.51 | 0.40 |
| 64.61 | -132.24 | 1785.49 | 1572 | 2014 | 1798 | 23.25 | 40.55 | 2.43 | 0.53 |
| 64.60 | -132.21 | 1861.06 | 1726 | 1970 | 1859 | 29.36 | 44.41 | 0.95 | 0.14 |
| 64.59 | -132.20 | 1871.38 | 1736 | 2032 | 1858 | 33.01 | 43.28 | 19.30 | 0.08 |
| 64.58 | -132.03 | 1680.21 | 1550 | 1956 | 1656 | 19.38 | 45.84 | 3.02 | 0.51 |
| 64.60 | -132.07 | 1555.14 | 1412 | 1701 | 1549 | 28.75 | 39.55 | 13.36 | 0.23 |
| 64.61 | -132.05 | 1476.06 | 1335 | 1664 | 1464 | 22.81 | 32.03 | 13.78 | 0.28 |
| 64.62 | -132.02 | 1754.98 | 1559 | 1966 | 1740 | 31.60 | 46.78 | 2.13 | 0.36 |
| 64.56 | -132.01 | 1777.09 | 1692 | 1909 | 1773 | 21.76 | 38.97 | 5.26 | 0.29 |
| 64.48 | -132.05 | 1553.48 | 1500 | 1623 | 1552 | 20.52 | 42.11 | 3.93 | 0.15 |
| 64.51 | -132.26 | 1769.58 | 1619 | 1935 | 1777 | 42.06 | 48.90 | 22.65 | 0.08 |
| 64.50 | -132.20 | 1647.14 | 1542 | 1863 | 1627 | 31.43 | 49.04 | 4.50 | 0.21 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.66 | -136.27 | 1515.18 | 1421 | 1710 | 1490 | 28.29 | 44.89 | 0.95 | 0.22 |
| 64.66 | -136.44 | 1429.32 | 1355 | 1568 | 1431 | 17.36 | 50.47 | 5.43 | 0.15 |
| 64.66 | -136.50 | 1371.24 | 1308 | 1429 | 1372 | 16.73 | 37.36 | 4.58 | 0.18 |
| 64.60 | -136.48 | 1458.13 | 1362 | 1657 | 1439 | 22.63 | 41.34 | 4.76 | 0.29 |
| 64.58 | -136.23 | 1447.12 | 1378 | 1584 | 1436 | 24.87 | 49.42 | 0.48 | 0.22 |
| 64.57 | -136.00 | 1362.04 | 1337 | 1386 | 1362 | 6.87 | 16.73 | 2.13 | 0.13 |
| 64.57 | -136.01 | 1426.82 | 1394 | 1473 | 1427 | 11.32 | 22.71 | 2.02 | 0.14 |
| 64.54 | -136.10 | 1553.57 | 1478 | 1699 | 1548 | 23.41 | 43.39 | 8.71 | 0.16 |
| 64.54 | -136.12 | 1593.82 | 1530 | 1695 | 1587 | 27.17 | 47.51 | 1.39 | 0.18 |
| 64.49 | -137.70 | 1490.23 | 1451 | 1543 | 1492 | 15.75 | 22.87 | 1.51 | 0.17 |
| 64.49 | -137.69 | 1670.77 | 1556 | 1811 | 1665 | 30.42 | 41.46 | 20.92 | 0.13 |
| 64.45 | -137.69 | 1648.24 | 1521 | 1792 | 1646 | 14.87 | 37.25 | 0.75 | 0.43 |
| 64.45 | -137.64 | 1523.10 | 1454 | 1609 | 1527 | 16.33 | 35.29 | 1.01 | 0.25 |
| 64.44 | -137.57 | 1578.60 | 1460 | 1767 | 1559 | 24.03 | 46.40 | 1.69 | 0.30 |
| 64.43 | -137.79 | 1668.16 | 1531 | 1795 | 1667 | 21.25 | 40.30 | 1.01 | 0.48 |
| 64.43 | -137.71 | 1824.65 | 1588 | 1981 | 1839 | 34.72 | 51.85 | 5.44 | 0.43 |
| 64.42 | -137.87 | 1702.20 | 1557 | 1915 | 1678 | 26.75 | 49.57 | 1.72 | 0.75 |
| 64.43 | -137.50 | 1532.68 | 1397 | 1713 | 1529 | 19.26 | 46.22 | 0.75 | 0.87 |
| 64.42 | -137.57 | 1699.52 | 1554 | 1849 | 1701 | 22.69 | 39.31 | 7.95 | 0.21 |
| 64.41 | -137.90 | 1696.65 | 1550 | 1911 | 1685 | 31.25 | 48.87 | 6.20 | 0.40 |
| 64.42 | -137.10 | 1357.82 | 1225 | 1518 | 1358 | 14.53 | 29.51 | 6.28 | 0.76 |
| 64.42 | -137.51 | 1608.47 | 1407 | 1807 | 1601 | 24.01 | 37.69 | 9.58 | 0.43 |
| 64.39 | -137.75 | 1638.50 | 1469 | 1881 | 1627 | 33.01 | 48.11 | 8.84 | 0.74 |
| 64.38 | -137.59 | 1534.29 | 1426 | 1738 | 1507 | 27.48 | 46.42 | 0.75 | 0.28 |
| 64.37 | -137.70 | 1599.75 | 1454 | 1713 | 1604 | 33.90 | 42.03 | 26.86 | 0.24 |
| 64.38 | -137.62 | 1511.78 | 1418 | 1624 | 1502 | 30.31 | 47.22 | 14.23 | 0.21 |
| 64.36 | -137.20 | 1518.21 | 1436 | 1698 | 1497 | 23.00 | 40.90 | 1.22 | 0.19 |
| 64.34 | -136.45 | 1481.07 | 1377 | 1670 | 1458 | 15.48 | 33.83 | 5.71 | 0.47 |
| 64.30 | -137.06 | 1502.14 | 1431 | 1562 | 1505 | 13.54 | 32.01 | 5.48 | 0.21 |
| 64.29 | -136.38 | 1438.25 | 1366 | 1534 | 1425 | 15.90 | 27.95 | 5.99 | 0.17 |
| 64.20 | -137.36 | 1387.83 | 1262 | 1566 | 1374 | 22.90 | 34.36 | 12.34 | 0.21 |
| 64.44 | -136.54 | 1472.69 | 1373 | 1556 | 1474 | 22.87 | 35.13 | 8.29 | 0.19 |
| 64.99 | -134.04 | 729.19 | 605 | 991 | 705 | 23.98 | 51.22 | 3.37 | 0.30 |
| 64.96 | -134.25 | 1364.46 | 1244 | 1436 | 1374 | 20.65 | 43.15 | 3.11 | 0.33 |
| 64.94 | -135.45 | 1589.08 | 1448 | 1735 | 1583 | 36.30 | 55.21 | 23.91 | 0.26 |
| 64.90 | -134.03 | 1458.12 | 1381 | 1555 | 1459 | 26.33 | 42.31 | 8.41 | 0.24 |
| 64.88 | -134.23 | 1499.63 | 1370 | 1610 | 1507 | 25.29 | 50.31 | 4.04 | 0.28 |
| 64.87 | -134.15 | 1659.57 | 1488 | 1872 | 1655 | 38.77 | 55.82 | 6.09 | 0.20 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.51 | -132.17 | 1611.96 | 1495 | 1767 | 1603 | 23.87 | 42.47 | 8.59 | 0.25 |
| 64.49 | -132.28 | 1652.21 | 1572 | 1787 | 1644 | 28.45 | 50.78 | 8.65 | 0.38 |
| 64.46 | -132.17 | 1216.06 | 1150 | 1341 | 1204 | 20.42 | 33.61 | 2.88 | 0.14 |
| 64.36 | -132.02 | 1191.46 | 1122 | 1350 | 1164 | 15.51 | 29.69 | 2.70 | 0.28 |
| 64.35 | -132.03 | 1667.99 | 1533 | 1818 | 1662 | 32.14 | 42.92 | 1.82 | 0.29 |
| 64.35 | -132.05 | 1764.30 | 1659 | 1840 | 1772 | 29.82 | 48.69 | 2.43 | 0.12 |
| 64.35 | -132.06 | 1617.84 | 1578 | 1677 | 1621 | 17.18 | 38.21 | 2.72 | 0.10 |
| 64.35 | -132.12 | 1416.88 | 1215 | 1643 | 1431 | 27.33 | 38.66 | 1.51 | 0.41 |
| 64.32 | -132.15 | 1680.55 | 1586 | 1777 | 1677 | 26.03 | 37.17 | 10.76 | 0.12 |
| 64.34 | -132.11 | 1484.41 | 1378 | 1610 | 1484 | 23.13 | 35.26 | 9.47 | 0.22 |
| 64.34 | -132.09 | 1604.62 | 1487 | 1804 | 1591 | 29.70 | 39.33 | 11.49 | 0.24 |
| 64.23 | -132.26 | 1597.34 | 1527 | 1763 | 1565 | 17.21 | 41.04 | 3.77 | 0.26 |
| 64.23 | -132.19 | 1669.24 | 1452 | 1926 | 1658 | 36.34 | 49.26 | 4.38 | 0.15 |
| 64.25 | -132.19 | 1565.61 | 1385 | 1710 | 1577 | 26.79 | 42.11 | 7.43 | 0.20 |
| 64.27 | -132.23 | 1849.84 | 1740 | 1922 | 1865 | 31.12 | 42.16 | 2.90 | 0.09 |
| 64.25 | -132.21 | 1693.01 | 1502 | 1967 | 1687 | 38.86 | 49.94 | 23.31 | 0.49 |
| 64.25 | -132.27 | 1489.88 | 1450 | 1546 | 1484 | 14.82 | 29.70 | 4.86 | 0.10 |
| 64.25 | -132.26 | 1597.46 | 1546 | 1671 | 1590 | 14.41 | 36.62 | 0.00 | 0.34 |
| 64.24 | -132.11 | 1661.59 | 1581 | 1729 | 1670 | 25.32 | 36.53 | 2.02 | 0.13 |
| 64.24 | -132.13 | 1618.71 | 1487 | 1775 | 1606 | 30.79 | 44.56 | 4.68 | 0.29 |
| 64.20 | -132.04 | 1719.82 | 1601 | 1861 | 1719 | 31.81 | 40.38 | 16.05 | 0.30 |
| 64.18 | -132.14 | 1757.93 | 1638 | 1856 | 1767 | 27.96 | 46.62 | 2.13 | 0.37 |
| 64.18 | -132.12 | 1725.01 | 1616 | 1800 | 1735 | 31.29 | 42.23 | 1.51 | 0.15 |
| 64.10 | -132.25 | 1487.20 | 1418 | 1621 | 1471 | 22.10 | 34.34 | 2.57 | 0.18 |
| 64.10 | -132.24 | 1562.64 | 1464 | 1712 | 1551 | 23.13 | 40.17 | 8.08 | 0.27 |
| 64.09 | -132.23 | 1880.94 | 1814 | 1928 | 1883 | 28.81 | 42.00 | 3.18 | 0.14 |
| 64.08 | -132.23 | 1435.21 | 1253 | 1576 | 1449 | 29.15 | 40.36 | 16.18 | 0.20 |
| 64.09 | -132.19 | 1232.04 | 1127 | 1383 | 1222 | 26.35 | 35.64 | 15.47 | 0.16 |
| 64.10 | -132.18 | 1291.04 | 1164 | 1467 | 1282 | 34.92 | 43.02 | 16.80 | 0.12 |
| 64.10 | -132.19 | 1667.08 | 1591 | 1741 | 1665 | 25.55 | 36.55 | 3.47 | 0.13 |
| 64.11 | -132.22 | 1717.23 | 1599 | 1817 | 1717 | 30.52 | 44.49 | 0.68 | 0.28 |
| 64.11 | -132.19 | 1560.31 | 1382 | 1728 | 1580 | 31.45 | 38.51 | 3.58 | 0.15 |
| 64.16 | -132.25 | 1654.55 | 1315 | 1889 | 1694 | 30.21 | 47.53 | 2.43 | 0.41 |
| 64.17 | -132.24 | 1541.42 | 1213 | 1849 | 1552 | 24.54 | 42.05 | 0.75 | 0.48 |
| 64.17 | -132.24 | 1525.51 | 1335 | 1783 | 1513 | 29.69 | 41.16 | 11.58 | 0.38 |
| 64.17 | -132.19 | 1621.86 | 1437 | 1922 | 1568 | 31.15 | 56.48 | 1.22 | 0.31 |
| 64.17 | -132.17 | 1776.07 | 1676 | 1862 | 1778 | 29.86 | 47.62 | 3.72 | 0.17 |
| 64.17 | -132.16 | 1622.73 | 1550 | 1755 | 1615 | 22.79 | 40.99 | 3.77 | 0.24 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.84 | -135.05 | 1541.81 | 1475 | 1651 | 1534 | 21.22 | 38.27 | 2.46 | 0.32 |
| 64.84 | -135.10 | 1352.99 | 1278 | 1471 | 1343 | 28.51 | 40.83 | 15.81 | 0.09 |
| 64.84 | -135.09 | 1437.31 | 1369 | 1509 | 1440 | 33.47 | 38.90 | 26.12 | 0.07 |
| 64.83 | -135.08 | 1382.66 | 1325 | 1451 | 1381 | 29.97 | 36.83 | 21.52 | 0.07 |
| 64.83 | -134.07 | 1578.28 | 1452 | 1803 | 1564 | 22.95 | 41.89 | 5.32 | 0.32 |
| 64.83 | -134.17 | 1524.30 | 1416 | 1732 | 1509 | 32.88 | 55.12 | 7.09 | 0.28 |
| 64.83 | -134.15 | 1676.36 | 1550 | 1847 | 1658 | 30.69 | 55.31 | 6.39 | 0.14 |
| 64.82 | -134.01 | 1633.58 | 1581 | 1689 | 1633 | 19.35 | 39.36 | 4.38 | 0.16 |
| 64.80 | -134.02 | 1552.25 | 1374 | 1669 | 1561 | 15.54 | 45.19 | 2.72 | 0.92 |
| 64.79 | -135.14 | 1591.87 | 1537 | 1667 | 1590 | 19.89 | 39.41 | 2.72 | 0.19 |
| 64.79 | -134.14 | 1484.64 | 1389 | 1552 | 1490 | 27.02 | 49.07 | 4.82 | 0.15 |
| 64.78 | -134.14 | 1489.55 | 1373 | 1560 | 1493 | 23.13 | 38.00 | 0.68 | 0.14 |
| 64.75 | -134.13 | 1538.87 | 1487 | 1630 | 1536 | 20.17 | 42.28 | 3.37 | 0.20 |
| 64.74 | -134.24 | 1702.40 | 1584 | 1845 | 1695 | 34.11 | 42.99 | 22.12 | 0.23 |
| 64.74 | -135.08 | 1668.45 | 1579 | 1823 | 1655 | 32.48 | 45.12 | 7.36 | 0.22 |
| 64.73 | -134.06 | 1649.02 | 1550 | 1743 | 1649 | 27.83 | 50.86 | 3.18 | 0.29 |
| 64.73 | -134.17 | 1628.51 | 1493 | 1807 | 1621 | 32.09 | 44.02 | 22.06 | 0.22 |
| 64.73 | -134.32 | 1399.45 | 1366 | 1444 | 1399 | 12.05 | 19.63 | 2.46 | 0.16 |
| 64.73 | -134.41 | 1546.94 | 1457 | 1695 | 1526 | 26.59 | 50.73 | 3.44 | 0.36 |
| 64.73 | -135.73 | 1704.84 | 1610 | 1791 | 1709 | 27.84 | 35.93 | 16.23 | 0.11 |
| 64.73 | -134.39 | 1533.22 | 1464 | 1624 | 1527 | 25.97 | 43.11 | 3.84 | 0.16 |
| 64.72 | -134.26 | 1639.10 | 1545 | 1774 | 1624 | 25.57 | 52.15 | 5.13 | 0.22 |
| 64.72 | -135.03 | 1425.61 | 1358 | 1622 | 1419 | 25.94 | 57.37 | 4.50 | 0.20 |
| 64.72 | -134.31 | 1517.86 | 1444 | 1640 | 1513 | 15.86 | 36.54 | 0.75 | 0.32 |
| 64.72 | -135.70 | 1537.22 | 1423 | 1758 | 1496 | 22.66 | 39.00 | 1.69 | 0.43 |
| 64.71 | -134.07 | 1794.74 | 1722 | 1880 | 1789 | 23.55 | 45.84 | 2.16 | 0.20 |
| 64.71 | -135.00 | 1612.97 | 1532 | 1727 | 1609 | 22.88 | 37.94 | 4.39 | 0.14 |
| 64.71 | -134.01 | 1578.39 | 1551 | 1651 | 1572 | 14.54 | 36.41 | 4.39 | 0.10 |
| 64.71 | -134.42 | 1532.64 | 1432 | 1722 | 1516 | 21.88 | 50.67 | 2.05 | 0.62 |
| 64.70 | -135.76 | 1385.45 | 1333 | 1455 | 1386 | 14.41 | 37.40 | 0.95 | 0.28 |
| 64.70 | -134.22 | 1489.43 | 1447 | 1566 | 1484 | 11.72 | 36.21 | 1.07 | 0.26 |
| 64.70 | -135.72 | 1465.85 | 1425 | 1542 | 1462 | 20.26 | 38.01 | 2.39 | 0.20 |
| 64.69 | -135.80 | 1456.63 | 1350 | 1667 | 1451 | 22.48 | 46.12 | 3.93 | 0.30 |
| 64.69 | -135.69 | 1564.44 | 1372 | 1777 | 1544 | 30.10 | 51.34 | 3.37 | 0.34 |
| 64.69 | -134.33 | 1437.29 | 1359 | 1535 | 1433 | 14.99 | 54.01 | 0.95 | 0.50 |
| 64.69 | -135.82 | 1499.21 | 1389 | 1712 | 1494 | 24.03 | 52.63 | 5.88 | 0.30 |
| 64.69 | -134.21 | 1616.16 | 1553 | 1726 | 1611 | 16.40 | 42.24 | 3.63 | 0.24 |
| 64.69 | -135.67 | 1449.51 | 1362 | 1608 | 1432 | 21.39 | 44.06 | 1.07 | 0.26 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.16 | -132.11 | 1717.42 | 1585 | 1861 | 1719 | 31.88 | 43.49 | 5.96 | 0.21 |
| 64.16 | -132.09 | 1705.46 | 1611 | 1768 | 1706 | 27.25 | 36.25 | 2.02 | 0.10 |
| 64.16 | -132.09 | 1688.24 | 1589 | 1766 | 1697 | 27.59 | 36.10 | 2.13 | 0.10 |
| 64.15 | -132.11 | 1836.47 | 1708 | 1924 | 1839 | 27.21 | 40.39 | 1.69 | 0.21 |
| 64.14 | -132.10 | 1555.21 | 1491 | 1628 | 1554 | 20.38 | 32.10 | 5.44 | 0.20 |
| 64.13 | -132.03 | 1763.49 | 1670 | 1946 | 1740 | 22.96 | 48.32 | 2.46 | 0.23 |
| 64.15 | -132.05 | 1721.06 | 1631 | 1841 | 1719 | 17.50 | 40.59 | 3.02 | 0.25 |
| 64.15 | -132.03 | 1487.88 | 1463 | 1553 | 1482 | 12.68 | 27.47 | 0.95 | 0.18 |
| 64.16 | -132.05 | 1619.91 | 1525 | 1742 | 1613 | 32.13 | 47.24 | 7.33 | 0.16 |
| 64.16 | -132.04 | 1485.82 | 1411 | 1653 | 1471 | 22.63 | 43.68 | 4.53 | 0.16 |
| 64.16 | -132.03 | 1484.77 | 1426 | 1586 | 1481 | 16.79 | 32.43 | 3.20 | 0.15 |
| 64.15 | -132.14 | 1613.35 | 1484 | 1729 | 1617 | 28.96 | 38.22 | 22.56 | 0.13 |
| 64.15 | -132.13 | 1633.69 | 1486 | 1858 | 1629 | 24.05 | 38.63 | 3.44 | 0.55 |
| 64.14 | -132.14 | 1835.19 | 1623 | 1948 | 1852 | 31.55 | 51.51 | 1.39 | 0.24 |
| 64.13 | -132.28 | 1185.91 | 1154 | 1263 | 1180 | 9.94 | 28.76 | 1.07 | 0.28 |
| 64.13 | -132.21 | 1276.38 | 1234 | 1377 | 1264 | 11.71 | 28.25 | 1.22 | 0.36 |
| 64.13 | -132.12 | 1740.48 | 1615 | 1850 | 1740 | 34.90 | 43.67 | 19.03 | 0.11 |
| 64.12 | -132.07 | 1628.21 | 1496 | 1820 | 1618 | 23.24 | 40.54 | 2.13 | 0.46 |
| 64.09 | -132.12 | 1618.25 | 1490 | 1737 | 1630 | 26.13 | 44.72 | 2.36 | 0.27 |
| 64.01 | -132.04 | 1297.63 | 1149 | 1432 | 1299 | 28.08 | 38.11 | 12.91 | 0.26 |
| 64.00 | -132.02 | 1637.02 | 1551 | 1734 | 1633 | 31.48 | 38.98 | 14.51 | 0.13 |
| 64.69 | -139.41 | 925.46 | 853 | 1064 | 907 | 16.43 | 40.11 | 0.34 | 0.25 |
| 64.66 | -138.58 | 1515.96 | 1446 | 1643 | 1502 | 24.07 | 50.97 | 4.82 | 0.25 |
| 64.44 | -138.70 | 1815.04 | 1672 | 2040 | 1796 | 33.20 | 56.09 | 2.39 | 0.25 |
| 64.40 | -138.58 | 1695.76 | 1612 | 1841 | 1699 | 17.34 | 57.43 | 4.73 | 0.25 |
| 64.40 | -138.59 | 1679.23 | 1585 | 1791 | 1684 | 22.79 | 42.12 | 8.28 | 0.25 |
| 64.36 | -138.59 | 1592.98 | 1472 | 1743 | 1589 | 23.45 | 46.09 | 3.52 | 0.42 |
| 64.27 | -138.58 | 1518.34 | 1387 | 1687 | 1505 | 24.22 | 38.42 | 8.72 | 0.25 |
| 65.16 | -137.81 | 987.28 | 845 | 1181 | 974 | 30.44 | 43.73 | 15.07 | 0.26 |
| 65.16 | -137.81 | 836.37 | 818 | 868 | 837 | 6.69 | 21.19 | 0.00 | 0.23 |
| 65.10 | -137.81 | 1330.34 | 1244 | 1429 | 1327 | 20.92 | 38.61 | 3.77 | 0.24 |
| 65.05 | -137.77 | 1196.92 | 1068 | 1292 | 1199 | 22.29 | 36.19 | 6.93 | 0.25 |
| 65.05 | -138.02 | 1068.45 | 994 | 1191 | 1064 | 14.33 | 31.18 | 7.72 | 0.35 |
| 65.02 | -137.84 | 1392.35 | 1319 | 1502 | 1385 | 13.79 | 36.46 | 4.72 | 0.45 |
| 62.17 | -129.26 | 1852.09 | 1735 | 1997 | 1826 | 35.88 | 54.14 | 4.86 | 0.05 |
| 62.09 | -129.29 | 1845.69 | 1789 | 1903 | 1839 | 36.50 | 43.25 | 31.49 | 0.04 |
| 62.07 | -129.53 | 1535.51 | 1460 | 1637 | 1540 | 16.22 | 35.93 | 1.97 | 0.31 |
| 62.07 | -129.16 | 1769.57 | 1722 | 1810 | 1770 | 20.75 | 33.43 | 10.65 | 0.06 |
| 64.69 | -134.24 | 1758.89 | 1596 | 1947 | 1761 | 28.47 | 54.99 | 1.82 | 0.51 |
| 64.68 | -134.19 | 1759.36 | 1658 | 1965 | 1750 | 23.23 | 49.69 | 1.91 | 0.58 |
| 64.68 | -135.08 | 1637.30 | 1551 | 1820 | 1616 | 21.62 | 38.12 | 0.95 | 0.25 |
| 64.68 | -134.26 | 1690.67 | 1625 | 1800 | 1682 | 23.04 | 39.16 | 8.85 | 0.16 |
| 64.67 | -134.22 | 1825.48 | 1658 | 1981 | 1824 | 36.35 | 58.03 | 2.36 | 0.22 |
| 64.67 | -135.85 | 1523.35 | 1444 | 1651 | 1511 | 25.25 | 39.82 | 9.90 | 0.14 |
| 64.67 | -135.17 | 1617.51 | 1465 | 1786 | 1613 | 26.91 | 42.69 | 1.01 | 0.28 |
| 64.66 | -135.81 | 1526.29 | 1390 | 1675 | 1535 | 34.78 | 53.16 | 3.11 | 0.32 |
| 64.66 | -134.15 | 1674.67 | 1567 | 1801 | 1668 | 25.45 | 49.26 | 4.53 | 0.30 |
| 64.66 | -134.33 | 1466.08 | 1392 | 1566 | 1462 | 16.95 | 32.74 | 2.72 | 0.40 |
| 64.66 | -135.89 | 1514.69 | 1390 | 1818 | 1472 | 31.67 | 53.90 | 4.72 | 0.16 |
| 64.66 | -134.22 | 1578.06 | 1492 | 1710 | 1580 | 14.62 | 38.71 | 3.39 | 0.38 |
| 64.66 | -134.42 | 1627.09 | 1442 | 1866 | 1625 | 30.99 | 41.86 | 6.85 | 0.20 |
| 64.66 | -134.45 | 1695.03 | 1484 | 1831 | 1712 | 34.69 | 49.27 | 2.72 | 0.12 |
| 64.66 | -134.37 | 1433.00 | 1383 | 1509 | 1427 | 16.70 | 32.86 | 2.16 | 0.22 |
| 64.65 | -134.22 | 1697.63 | 1597 | 1851 | 1691 | 30.10 | 44.43 | 8.94 | 0.21 |
| 64.66 | -135.23 | 1534.10 | 1386 | 1697 | 1532 | 24.85 | 39.04 | 9.11 | 0.35 |
| 64.65 | -134.45 | 1658.23 | 1556 | 1777 | 1650 | 23.68 | 47.08 | 5.32 | 0.22 |
| 64.65 | -134.04 | 1652.08 | 1600 | 1733 | 1649 | 15.96 | 33.51 | 6.93 | 0.15 |
| 64.64 | -134.23 | 1395.53 | 1350 | 1447 | 1395 | 6.63 | 21.68 | 0.95 | 0.33 |
| 64.64 | -134.39 | 1912.39 | 1767 | 2068 | 1914 | 33.47 | 43.70 | 10.78 | 0.25 |
| 64.64 | -134.37 | 1690.82 | 1581 | 1861 | 1677 | 24.08 | 44.40 | 5.43 | 0.36 |
| 64.63 | -134.18 | 1706.05 | 1643 | 1785 | 1704 | 19.81 | 38.01 | 4.53 | 0.28 |
| 64.63 | -134.06 | 1627.87 | 1437 | 1818 | 1631 | 30.50 | 44.64 | 7.06 | 0.37 |
| 64.63 | -134.14 | 1640.65 | 1558 | 1813 | 1635 | 21.68 | 49.98 | 4.43 | 0.29 |
| 64.63 | -134.19 | 1679.58 | 1562 | 1838 | 1671 | 21.42 | 53.40 | 3.20 | 0.57 |
| 64.63 | -134.08 | 1572.65 | 1470 | 1731 | 1563 | 29.29 | 51.84 | 3.81 | 0.38 |
| 64.62 | -134.32 | 1478.50 | 1381 | 1567 | 1478 | 26.62 | 46.27 | 6.70 | 0.28 |
| 64.62 | -134.14 | 1629.42 | 1521 | 1767 | 1627 | 32.26 | 46.05 | 8.81 | 0.15 |
| 64.62 | -134.38 | 1487.93 | 1434 | 1516 | 1494 | 8.24 | 22.56 | 0.34 | 0.31 |
| 64.62 | -134.22 | 1598.48 | 1484 | 1747 | 1591 | 19.00 | 41.69 | 3.77 | 0.44 |
| 64.62 | -134.40 | 1465.98 | 1407 | 1556 | 1462 | 20.84 | 35.74 | 7.95 | 0.13 |
| 64.61 | -134.41 | 1454.58 | 1402 | 1539 | 1451 | 12.71 | 33.91 | 3.02 | 0.21 |
| 64.61 | -134.17 | 1591.51 | 1562 | 1645 | 1585 | 10.99 | 27.37 | 2.70 | 0.21 |
| 64.60 | -134.24 | 1413.18 | 1322 | 1557 | 1416 | 19.77 | 39.37 | 1.07 | 0.35 |
| 64.60 | -135.40 | 1415.05 | 1392 | 1462 | 1414 | 10.45 | 32.15 | 2.64 | 0.18 |
| 64.58 | -134.07 | 1661.10 | 1594 | 1723 | 1662 | 29.11 | 37.58 | 19.21 | 0.10 |
| 64.57 | -135.95 | 1610.59 | 1445 | 1778 | 1609 | 30.39 | 41.45 | 1.22 | 0.22 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 62.13 | -129.42 | 1638.79 | 1601 | 1682 | 1637 | 14.48 | 27.14 | 6.53 | 0.05 |
| 62.25 | -129.76 | 1584.47 | 1485 | 1701 | 1579 | 30.63 | 41.24 | 17.78 | 0.05 |
| 62.12 | -129.25 | 1624.56 | 1534 | 1767 | 1600 | 20.96 | 35.76 | 6.99 | 0.16 |
| 62.12 | -129.25 | 1656.61 | 1566 | 1818 | 1634 | 20.82 | 33.86 | 3.11 | 0.15 |
| 62.70 | -129.62 | 1597.20 | 1504 | 1744 | 1579 | 25.98 | 38.92 | 9.02 | 0.09 |
| 62.27 | -129.58 | 1463.03 | 1389 | 1540 | 1463 | 20.30 | 27.32 | 9.72 | 0.08 |
| 62.88 | -129.83 | 1586.63 | 1521 | 1631 | 1596 | 15.13 | 22.23 | 2.13 | 0.11 |
| 62.85 | -129.96 | 1584.60 | 1568 | 1599 | 1585 | 15.84 | 23.68 | 11.24 | 0.03 |
| 62.84 | -129.95 | 1661.96 | 1621 | 1747 | 1652 | 19.15 | 44.65 | 5.10 | 0.12 |
| 62.75 | -129.89 | 1672.90 | 1619 | 1734 | 1674 | 17.33 | 30.78 | 7.45 | 0.07 |
| 62.70 | -129.63 | 1707.63 | 1601 | 1831 | 1698 | 32.78 | 40.15 | 24.52 | 0.06 |
| 62.59 | -129.68 | 1514.11 | 1441 | 1589 | 1517 | 22.23 | 28.47 | 11.37 | 0.06 |
| 62.48 | -129.31 | 1624.63 | 1572 | 1692 | 1622 | 26.60 | 32.92 | 16.17 | 0.08 |
| 62.47 | -129.28 | 1439.06 | 1358 | 1539 | 1439 | 18.57 | 34.18 | 1.22 | 0.23 |
| 62.46 | -129.29 | 1522.27 | 1458 | 1666 | 1495 | 19.84 | 34.25 | 2.26 | 0.12 |
| 62.46 | -129.27 | 1555.92 | 1430 | 1748 | 1547 | 23.39 | 38.54 | 5.73 | 0.38 |
| 62.46 | -129.25 | 1590.67 | 1555 | 1645 | 1588 | 16.02 | 29.26 | 4.86 | 0.08 |
| 62.31 | -129.96 | 1018.47 | 1006 | 1036 | 1018 | 5.42 | 11.99 | 1.69 | 0.08 |
| 63.67 | -140.48 | 941.02 | 763 | 1092 | 949 | 13.20 | 21.62 | 8.06 | 0.76 |
| 63.67 | -140.49 | 980.57 | 877 | 1097 | 976 | 12.53 | 17.03 | 9.19 | 0.51 |
| 63.66 | -140.50 | 980.80 | 898 | 1055 | 982 | 11.63 | 16.12 | 9.46 | 0.37 |
| 63.77 | -140.55 | 1419.63 | 1391 | 1443 | 1421 | 15.18 | 18.59 | 12.30 | 0.04 |
| 63.77 | -140.54 | 1328.13 | 1172 | 1511 | 1317 | 13.86 | 26.11 | 5.71 | 0.62 |
| 63.78 | -140.53 | 1259.63 | 1050 | 1537 | 1242 | 14.54 | 25.52 | 7.97 | 1.07 |
| 63.78 | -140.50 | 1173.42 | 915 | 1526 | 1145 | 18.62 | 28.26 | 9.26 | 1.64 |
| 67.83 | -136.65 | 793.69 | 727 | 895 | 785 | 23.06 | 34.35 | 2.57 | 0.28 |
| 67.73 | -137.20 | 965.15 | 879 | 1079 | 954 | 15.38 | 33.90 | 1.22 | 0.72 |
| 67.57 | -136.32 | 1123.48 | 1054 | 1154 | 1129 | 8.87 | 25.68 | 0.48 | 0.31 |
| 67.54 | -136.33 | 1460.24 | 1365 | 1619 | 1444 | 26.90 | 37.69 | 12.35 | 0.17 |
| 67.54 | -136.33 | 1372.98 | 1304 | 1468 | 1371 | 22.41 | 36.74 | 8.85 | 0.17 |
| 67.53 | -136.41 | 1081.90 | 1000 | 1177 | 1081 | 20.91 | 32.90 | 5.71 | 0.30 |
| 67.54 | -136.39 | 884.13 | 818 | 980 | 884 | 16.26 | 39.68 | 1.97 | 0.39 |
| 67.56 | -136.39 | 809.95 | 731 | 892 | 807 | 15.76 | 33.02 | 1.22 | 0.77 |
| 64.95 | -137.86 | 1502.77 | 1419 | 1585 | 1503 | 27.32 | 38.00 | 5.48 | 0.15 |
| 64.84 | -137.79 | 1249.84 | 1188 | 1309 | 1251 | 20.45 | 31.64 | 11.78 | 0.08 |
| 64.83 | -138.11 | 1251.18 | 1250 | 1254 | 1251 | 1.35 | 3.05 | 0.00 | 0.03 |
| 64.82 | -138.15 | 1316.28 | 1283 | 1349 | 1316 | 9.43 | 15.48 | 4.90 | 0.13 |
| 64.70 | -138.70 | 1314.71 | 1215 | 1386 | 1323 | 17.62 | 33.02 | 5.10 | 0.13 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.57 | -134.15 | 1475.44 | 1337 | 1611 | 1480 | 21.97 | 38.00 | 1.07 | 0.46 |
| 64.57 | -134.11 | 1707.12 | 1629 | 1829 | 1700 | 28.27 | 49.89 | 2.90 | 0.21 |
| 64.54 | -134.20 | 1386.96 | 1329 | 1424 | 1392 | 10.82 | 24.77 | 2.57 | 0.19 |
| 64.54 | -134.22 | 1472.32 | 1356 | 1604 | 1474 | 24.03 | 40.51 | 7.54 | 0.23 |
| 64.54 | -134.13 | 1440.86 | 1371 | 1523 | 1440 | 21.48 | 37.36 | 4.17 | 0.32 |
| 64.53 | -134.15 | 1495.52 | 1448 | 1623 | 1486 | 21.00 | 41.56 | 0.48 | 0.21 |
| 64.52 | -134.22 | 1600.44 | 1552 | 1676 | 1597 | 22.84 | 39.27 | 5.40 | 0.13 |
| 64.51 | -134.22 | 1437.13 | 1324 | 1524 | 1452 | 18.38 | 31.84 | 4.53 | 0.20 |
| 64.47 | -135.12 | 1351.58 | 1187 | 1559 | 1347 | 20.47 | 44.91 | 3.34 | 0.96 |
| 64.46 | -135.13 | 1391.60 | 1264 | 1544 | 1393 | 23.55 | 34.09 | 7.36 | 0.21 |
| 64.42 | -134.82 | 1425.41 | 1376 | 1498 | 1432 | 10.36 | 23.87 | 0.48 | 0.18 |
| 64.36 | -135.39 | 1421.04 | 1350 | 1534 | 1416 | 22.76 | 37.20 | 2.13 | 0.23 |
| 64.30 | -135.78 | 1463.27 | 1349 | 1687 | 1434 | 18.46 | 35.74 | 1.22 | 0.55 |
| 64.23 | -135.12 | 1421.11 | 1166 | 1721 | 1421 | 25.13 | 40.83 | 4.68 | 0.91 |
| 63.84 | -140.99 | 1385.34 | 1217 | 1526 | 1395 | 10.30 | 30.82 | 0.95 | 2.70 |
| 63.79 | -140.93 | 1088.12 | 950 | 1246 | 1088 | 13.43 | 23.91 | 8.41 | 0.61 |
| 63.79 | -140.89 | 1052.91 | 871 | 1213 | 1061 | 11.14 | 15.35 | 7.51 | 0.63 |
| 63.78 | -140.90 | 995.33 | 811 | 1180 | 1005 | 10.75 | 17.46 | 6.38 | 1.49 |
| 63.82 | -140.83 | 1148.19 | 1022 | 1271 | 1152 | 14.12 | 23.28 | 5.01 | 0.53 |
| 63.74 | -140.81 | 964.17 | 803 | 1136 | 962 | 10.54 | 19.79 | 2.70 | 1.49 |
| 63.71 | -140.71 | 1286.72 | 1198 | 1359 | 1289 | 13.49 | 20.56 | 9.14 | 0.14 |
| 63.72 | -140.69 | 1286.30 | 1123 | 1462 | 1290 | 10.36 | 21.73 | 4.26 | 1.70 |
| 63.73 | -140.70 | 1120.13 | 1000 | 1235 | 1124 | 10.70 | 22.87 | 3.63 | 0.82 |
| 63.72 | -140.62 | 1385.21 | 1317 | 1463 | 1387 | 9.08 | 19.31 | 5.96 | 0.39 |
| 63.73 | -140.60 | 1340.36 | 1315 | 1369 | 1341 | 6.45 | 12.65 | 2.88 | 0.11 |
| 63.72 | -140.59 | 1207.70 | 1085 | 1350 | 1212 | 6.00 | 22.75 | 1.51 | 1.05 |
| 63.71 | -140.58 | 1342.63 | 1209 | 1451 | 1342 | 19.97 | 26.51 | 11.08 | 0.14 |
| 63.75 | -140.68 | 1264.33 | 1200 | 1333 | 1265 | 8.07 | 12.36 | 3.37 | 0.37 |
| 63.74 | -140.67 | 1340.37 | 1306 | 1395 | 1338 | 12.17 | 22.05 | 6.65 | 0.11 |
| 63.75 | -140.65 | 1418.40 | 1390 | 1457 | 1420 | 7.62 | 24.15 | 1.39 | 0.33 |
| 63.77 | -140.65 | 1223.88 | 1107 | 1378 | 1197 | 10.97 | 25.51 | 3.20 | 0.85 |
| 63.76 | -140.63 | 1314.09 | 1255 | 1382 | 1319 | 8.61 | 21.34 | 2.43 | 0.22 |
| 63.76 | -140.61 | 1433.36 | 1322 | 1540 | 1438 | 14.67 | 24.90 | 8.25 | 0.20 |
| 63.79 | -140.59 | 1102.09 | 912 | 1299 | 1094 | 12.34 | 22.01 | 1.69 | 1.12 |
| 63.77 | -140.56 | 1385.39 | 1282 | 1534 | 1374 | 15.92 | 26.88 | 8.65 | 0.25 |
| 63.77 | -140.44 | 1067.28 | 864 | 1308 | 1054 | 21.24 | 29.71 | 13.92 | 0.49 |
| 63.77 | -140.45 | 1107.81 | 975 | 1251 | 1100 | 19.22 | 26.73 | 13.15 | 0.32 |
| 63.75 | -140.44 | 1146.81 | 1042 | 1237 | 1146 | 13.29 | 21.78 | 8.84 | 0.29 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 64.66 | -138.14 | 1563.57 | 1503 | 1623 | 1560 | 13.60 | 29.65 | 1.22 | 0.31 |
| 64.61 | -138.46 | 1565.34 | 1404 | 1690 | 1577 | 30.36 | 41.87 | 20.78 | 0.14 |
| 64.62 | -138.44 | 1604.66 | 1520 | 1681 | 1604 | 23.12 | 37.15 | 12.91 | 0.13 |
| 64.58 | -138.37 | 1473.85 | 1354 | 1663 | 1457 | 22.84 | 41.66 | 10.44 | 0.22 |
| 64.60 | -138.53 | 1625.10 | 1494 | 1773 | 1625 | 28.63 | 40.06 | 17.69 | 0.17 |
| 64.59 | -138.55 | 1569.17 | 1483 | 1713 | 1564 | 22.86 | 41.75 | 10.92 | 0.12 |
| 64.55 | -138.45 | 1407.71 | 1326 | 1599 | 1378 | 21.25 | 43.00 | 4.10 | 0.19 |
| 64.54 | -138.46 | 1406.28 | 1341 | 1497 | 1402 | 15.57 | 33.38 | 7.33 | 0.13 |
| 64.59 | -138.09 | 1714.99 | 1646 | 1811 | 1714 | 33.67 | 48.67 | 3.58 | 0.14 |
| 64.50 | -138.71 | 1840.13 | 1778 | 1925 | 1841 | 25.13 | 35.32 | 2.88 | 0.09 |
| 64.52 | -138.12 | 1357.02 | 1225 | 1561 | 1356 | 19.64 | 37.20 | 1.91 | 0.58 |
| 64.51 | -138.05 | 1565.62 | 1496 | 1661 | 1555 | 14.82 | 28.71 | 3.63 | 0.13 |
| 64.54 | -138.00 | 1473.08 | 1389 | 1547 | 1467 | 15.69 | 25.05 | 7.57 | 0.11 |
| 64.52 | -137.98 | 1652.67 | 1496 | 1822 | 1647 | 15.95 | 30.92 | 0.48 | 0.51 |
| 64.53 | -137.96 | 1544.12 | 1306 | 1782 | 1571 | 18.07 | 36.95 | 1.22 | 1.13 |
| 63.87 | -134.99 | 1354.53 | 1313 | 1456 | 1339 | 16.13 | 35.43 | 4.58 | 0.07 |
| 63.79 | -134.42 | 1487.39 | 1446 | 1526 | 1486 | 12.32 | 19.33 | 2.78 | 0.25 |
| 63.19 | -134.23 | 1386.53 | 1357 | 1436 | 1382 | 11.19 | 20.72 | 1.91 | 0.22 |
| 63.12 | -134.00 | 1544.20 | 1499 | 1589 | 1544 | 15.92 | 24.91 | 3.52 | 0.12 |
| 63.09 | -135.61 | 1664.11 | 1546 | 1744 | 1675 | 25.72 | 38.81 | 6.28 | 0.12 |
| 63.11 | -135.63 | 1677.83 | 1609 | 1742 | 1678 | 22.36 | 40.97 | 6.18 | 0.12 |
| 63.14 | -135.76 | 1677.22 | 1629 | 1741 | 1677 | 15.75 | 34.91 | 3.44 | 0.17 |
| 63.15 | -135.83 | 1745.34 | 1666 | 1894 | 1737 | 25.48 | 44.03 | 3.47 | 0.21 |
| 62.04 | -140.78 | 1415.10 | 1324 | 1541 | 1408 | 23.69 | 35.27 | 12.64 | 0.12 |
| 62.03 | -140.85 | 1450.97 | 1393 | 1553 | 1443 | 21.24 | 26.30 | 15.52 | 0.03 |
| 62.02 | -140.85 | 1631.79 | 1552 | 1750 | 1624 | 30.33 | 45.42 | 13.66 | 0.07 |
| 62.01 | -140.82 | 1338.62 | 1250 | 1465 | 1327 | 27.26 | 39.29 | 7.39 | 0.08 |
| 62.00 | -140.78 | 1322.91 | 1272 | 1377 | 1322 | 13.03 | 31.03 | 0.68 | 0.24 |
| 61.99 | -140.85 | 1534.93 | 1454 | 1651 | 1534 | 20.19 | 39.88 | 6.26 | 0.18 |
| 61.83 | -137.83 | 1315.75 | 1203 | 1414 | 1332 | 16.35 | 32.68 | 3.84 | 0.22 |
| 61.19 | -138.95 | 2137.34 | 2069 | 2254 | 2131 | 23.04 | 42.12 | 2.46 | 0.15 |
| 61.17 | -138.95 | 1799.94 | 1706 | 1904 | 1797 | 26.36 | 37.91 | 9.02 | 0.09 |
| 61.17 | -138.95 | 1775.29 | 1706 | 1857 | 1769 | 27.01 | 37.62 | 9.44 | 0.09 |
| 61.34 | -137.06 | 914.96 | 914 | 915 | 915 | 0.17 | 1.35 | 0.00 | 0.04 |
| 61.35 | -137.07 | 915.54 | 914 | 920 | 915 | 1.02 | 2.78 | 0.00 | 0.06 |
| 61.16 | -137.75 | 1662.16 | 1580 | 1742 | 1659 | 30.27 | 42.54 | 9.47 | 0.17 |
| 61.07 | -137.56 | 1517.80 | 1449 | 1616 | 1517 | 20.81 | 36.06 | 1.39 | 0.21 |
| 61.00 | -138.04 | 1513.36 | 1423 | 1595 | 1510 | 22.76 | 31.89 | 9.72 | 0.06 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 63.75 | -140.46 | 1253.59 | 1136 | 1358 | 1258 | 15.72 | 25.13 | 11.04 | 0.33 |
| 63.75 | -140.48 | 1299.03 | 1205 | 1391 | 1301 | 14.60 | 24.30 | 10.16 | 0.32 |
| 63.75 | -140.49 | 1314.59 | 1264 | 1358 | 1316 | 14.56 | 30.89 | 10.46 | 0.15 |
| 63.75 | -140.50 | 1313.81 | 1223 | 1386 | 1316 | 22.00 | 28.00 | 14.67 | 0.12 |
| 63.74 | -140.48 | 1392.82 | 1371 | 1414 | 1392 | 9.36 | 12.54 | 6.89 | 0.08 |
| 63.74 | -140.49 | 1413.33 | 1373 | 1462 | 1410 | 10.26 | 14.43 | 6.85 | 0.15 |
| 63.73 | -140.50 | 1340.48 | 1241 | 1450 | 1339 | 11.96 | 22.38 | 8.05 | 0.43 |
| 63.73 | -140.47 | 1228.36 | 1167 | 1294 | 1225 | 14.30 | 20.01 | 10.48 | 0.15 |
| 63.72 | -140.48 | 1245.36 | 1139 | 1371 | 1244 | 14.78 | 25.14 | 9.42 | 0.34 |
| 63.72 | -140.49 | 1265.68 | 1187 | 1343 | 1269 | 12.05 | 17.46 | 8.48 | 0.28 |
| 63.71 | -140.50 | 1226.08 | 1103 | 1318 | 1235 | 12.66 | 20.36 | 7.73 | 0.34 |
| 63.69 | -140.50 | 961.30 | 903 | 1018 | 959 | 12.19 | 19.18 | 7.83 | 0.26 |
| 63.68 | -140.48 | 936.07 | 815 | 1033 | 944 | 12.92 | 20.89 | 8.70 | 0.58 |
| 63.68 | -140.47 | 915.40 | 766 | 1047 | 914 | 14.97 | 20.91 | 7.83 | 0.55 |
| 60.16 | -136.64 | 1693.32 | 1632 | 1802 | 1687 | 18.36 | 47.82 | 0.68 | 0.15 |
| 60.13 | -136.61 | 1551.18 | 1511 | 1629 | 1543 | 16.93 | 32.77 | 2.39 | 0.12 |
| 60.13 | -136.66 | 1558.19 | 1517 | 1615 | 1556 | 18.87 | 34.22 | 3.32 | 0.08 |
| 60.05 | -136.61 | 1614.20 | 1542 | 1664 | 1632 | 14.70 | 30.19 | 3.58 | 0.09 |
| 60.05 | -136.63 | 1690.02 | 1563 | 1852 | 1679 | 28.92 | 48.48 | 8.11 | 0.14 |
| 60.06 | -136.66 | 1522.52 | 1513 | 1554 | 1520 | 9.29 | 27.99 | 0.95 | 0.06 |
| 60.28 | -136.47 | 1789.11 | 1747 | 1867 | 1778 | 18.83 | 32.58 | 6.32 | 0.07 |
| 60.28 | -136.36 | 929.97 | 848 | 1044 | 922 | 17.69 | 34.75 | 7.45 | 0.19 |
| 60.24 | -136.37 | 1766.55 | 1706 | 1818 | 1773 | 16.02 | 28.31 | 2.16 | 0.07 |
| 60.25 | -136.37 | 1811.64 | 1730 | 1894 | 1813 | 29.96 | 37.85 | 16.03 | 0.11 |
| 60.24 | -136.48 | 1803.91 | 1725 | 1940 | 1797 | 19.21 | 44.27 | 1.97 | 0.23 |
| 60.23 | -136.45 | 1812.25 | 1799 | 1860 | 1809 | 10.25 | 36.41 | 2.86 | 0.06 |
| 60.22 | -136.40 | 1764.79 | 1698 | 1830 | 1762 | 29.68 | 36.59 | 14.52 | 0.07 |
| 60.21 | -136.41 | 1705.75 | 1695 | 1730 | 1706 | 7.83 | 30.03 | 0.00 | 0.08 |
| 60.20 | -136.50 | 1686.80 | 1637 | 1777 | 1679 | 22.02 | 44.01 | 0.75 | 0.07 |
| 60.17 | -136.49 | 1779.34 | 1694 | 1963 | 1764 | 23.85 | 47.86 | 0.75 | 0.39 |
| 60.17 | -136.47 | 1814.00 | 1748 | 1901 | 1813 | 18.25 | 25.58 | 10.37 | 0.12 |
| 60.20 | -136.37 | 1851.88 | 1712 | 1897 | 1857 | 15.62 | 44.89 | 1.22 | 0.33 |
| 60.22 | -136.24 | 1575.57 | 1523 | 1610 | 1580 | 12.90 | 24.47 | 2.36 | 0.09 |
| 60.23 | -136.27 | 1973.34 | 1860 | 2059 | 1977 | 28.45 | 37.28 | 2.72 | 0.11 |
| 60.21 | -136.28 | 1700.85 | 1627 | 1791 | 1700 | 19.52 | 37.89 | 3.37 | 0.18 |
| 60.12 | -135.40 | 1483.53 | 1132 | 1842 | 1498 | 29.40 | 45.74 | 9.75 | 0.26 |
| 60.12 | -135.42 | 1327.46 | 1031 | 1858 | 1289 | 28.07 | 52.81 | 5.32 | 0.83 |
| 63.14 | -135.62 | 1709.59 | 1598 | 1806 | 1710 | 19.26 | 37.46 | 5.05 | 0.16 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 60.84 | -137.86 | 1368.43 | 1307 | 1491 | 1351 | 13.69 | 31.11 | 4.26 | 0.42 |
| 60.99 | -136.29 | 1669.29 | 1586 | 1766 | 1663 | 27.25 | 38.25 | 20.00 | 0.07 |
| 61.00 | -136.30 | 1652.50 | 1573 | 1729 | 1649 | 23.92 | 34.73 | 15.07 | 0.08 |
| 60.28 | -136.96 | 1149.84 | 1077 | 1211 | 1149 | 19.41 | 24.63 | 15.53 | 0.10 |
| 60.22 | -136.91 | 1303.50 | 1113 | 1576 | 1306 | 26.84 | 43.73 | 12.20 | 0.30 |
| 60.29 | -136.71 | 1719.64 | 1660 | 1773 | 1728 | 26.78 | 35.97 | 5.05 | 0.09 |
| 60.16 | -136.63 | 1801.77 | 1722 | 1877 | 1804 | 26.56 | 41.99 | 9.43 | 0.08 |

| latitude | longitude | mean elevation | minimum elevation | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | area in km2 |
|---|---|---|---|---|---|---|---|---|---|
| 61.97 | -140.74 | 1433.14 | 1382 | 1526 | 1421 | 20.85 | 38.22 | 3.02 | 0.12 |
| 60.27 | -136.68 | 1679.64 | 1652 | 1700 | 1682 | 20.38 | 32.40 | 7.25 | 0.03 |
| 60.27 | -136.68 | 1783.73 | 1735 | 1839 | 1780 | 25.86 | 33.84 | 3.95 | 0.02 |
| 60.25 | -136.64 | 1689.24 | 1626 | 1749 | 1685 | 16.63 | 30.26 | 4.97 | 0.13 |
| 60.24 | -136.68 | 1692.91 | 1624 | 1796 | 1686 | 26.49 | 41.06 | 4.32 | 0.11 |
| 60.20 | -136.65 | 1726.69 | 1668 | 1782 | 1728 | 14.72 | 34.27 | 0.48 | 0.19 |
| 60.20 | -136.66 | 1701.26 | 1603 | 1795 | 1714 | 30.04 | 43.67 | 1.22 | 0.06 |

Appendix C - Studied rock glaciers

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| active | 64.98 | -138.23 | 1028.37 | 958 | 1105 | 1023 | 26.85 | 32.74 | 21.39 | 109.58 | 5.00 | 3 | inactive | lobate | talus |
| active | 64.97 | -138.25 | 1011.76 | 934 | 1191 | 982 | 26.09 | 38.39 | 10.05 | 119.83 | 7.18 | 4 | relict | lobate | talus, just scree? |
| active | 64.96 | -138.20 | 942.01 | 918 | 979 | 939 | 12.13 | 27.26 | 7.65 | 359.84 | 6.14 | 5 | active | lobate | talus |
| dormant | 64.59 | -138.17 | 1587.47 | 1551 | 1679 | 1578 | 18.85 | 46.74 | 1.39 | 314.46 | 12.52 | 8 | inactive | tongue | cirque |
| active | 64.34 | -138.39 | 1211.06 | 994 | 1452 | 1213 | 22.24 | 35.60 | 10.11 | 303.59 | 45.02 | 12 | active | tongue | cirque |
| dormant | 64.34 | -138.61 | 1589.81 | 1554 | 1623 | 1589 | 18.10 | 33.08 | 6.38 | 341.38 | 6.10 | 13 | | | no RG |
| active | 64.27 | -138.47 | 910.81 | 769 | 1223 | 872 | 18.57 | 33.83 | 10.44 | 296.50 | 43.11 | 16 | relict | lobate | talus, vegd, just scree? |
| unknown | 64.67 | -138.17 | 1467.07 | 1395 | 1578 | 1462 | 14.88 | 35.49 | 5.99 | 358.54 | 19.92 | 17 | active | tongue | cirque, @least 2 lobes |
| unknown | 64.46 | -138.34 | 1622.96 | 1501 | 1746 | 1627 | 27.86 | 43.23 | 8.06 | 359.22 | 16.37 | 20 | inactive | tongue | cirque, 3 melt lakes |
| active | 64.64 | -138.74 | 1592.10 | 1539 | 1644 | 1592 | 20.26 | 34.02 | 8.84 | 204.35 | 8.32 | 23 | | | no photos available |
| active | 64.57 | -138.30 | 1196.38 | 1189 | 1204 | 1196 | 3.78 | 4.26 | 3.04 | 317.35 | 4.59 | 26 | relict | lobate | talus, just scree? |
| unknown | 64.53 | -138.19 | 1686.14 | 1605 | 1764 | 1685 | 26.59 | 42.33 | 12.05 | 294.77 | 6.89 | 27 | inactive | tongue | talus, 2 lobes |
| unknown | 64.52 | -138.38 | 1777.69 | 1619 | 2020 | 1770 | 30.64 | 54.43 | 13.20 | 315.81 | 19.67 | 28 | active | tongue | cirque |
| active | 64.51 | -138.51 | 1492.22 | 1460 | 1589 | 1479 | 16.18 | 38.54 | 3.32 | 321.99 | 7.16 | 30 | active | tongue | cirque, dv |
| active | 64.49 | -138.24 | 1368.60 | 1260 | 1500 | 1372 | 26.08 | 41.14 | 8.56 | 331.11 | 15.69 | 32 | active | tongue | cirque |
| dormant | 64.48 | -138.18 | 1145.25 | 997 | 1443 | 1105 | 22.05 | 36.71 | 4.68 | 268.84 | 47.89 | 34 | active | lobate | talus |
| active | 64.46 | -138.12 | 1438.07 | 1215 | 1560 | 1473 | 12.24 | 27.43 | 4.11 | 173.88 | 40.69 | 39 | relict | lobate | talus, multilobe |
| active | 64.46 | -138.61 | 1581.73 | 1541 | 1671 | 1579 | 16.09 | 39.45 | 1.97 | 324.53 | 13.47 | 40 | | | photos missing |
| active | 64.39 | -138.19 | 1532.40 | 1402 | 1644 | 1527 | 20.67 | 32.24 | 10.92 | 272.56 | 18.21 | 43 | active | tongue | cirque, multilobe |
| active | 64.37 | -138.26 | 1235.37 | 1046 | 1436 | 1220 | 12.01 | 33.39 | 0.48 | 247.37 | 161.08 | 47 | relict | tongue | cirque |
| active | 64.34 | -138.38 | 1223.21 | 1112 | 1342 | 1206 | 19.09 | 31.51 | 7.39 | 278.41 | 18.78 | 53 | active | lobate | talus, no veg |
| unknown | 64.34 | -138.48 | 1274.79 | 1132 | 1421 | 1275 | 29.04 | 37.67 | 21.34 | 122.11 | 13.26 | 54 | relict | lobate | talus, just scree?, no veg |
| active | 64.33 | -138.24 | 1635.51 | 1588 | 1697 | 1631 | 18.11 | 29.69 | 6.80 | 248.60 | 13.81 | 55 | active | tongue | cirque, dv |
| active | 64.33 | -138.53 | 1577.79 | 1472 | 1701 | 1573 | 35.82 | 49.68 | 19.48 | 299.49 | 12.50 | 56 | active | tongue | cirque |
| unknown | 64.33 | -138.39 | 1379.94 | 1166 | 1603 | 1384 | 24.89 | 37.40 | 10.76 | 301.33 | 28.24 | 57 | | | no RG visible in cirque |
| active | 64.32 | -138.12 | 1497.04 | 1358 | 1609 | 1500 | 29.69 | 36.57 | 21.83 | 312.93 | 11.86 | 59 | inactive | tongue | cirque, 3 tongues, drainage |
| unknown | 64.32 | -138.40 | 1320.21 | 1187 | 1440 | 1324 | 24.01 | 31.00 | 13.64 | 307.78 | 22.42 | 60 | active | tongue | cirque |
| active | 64.32 | -138.57 | 1541.21 | 1464 | 1611 | 1538 | 29.19 | 41.80 | 4.32 | 321.64 | 7.01 | 61 | active | tongue | cirque, lumpy |
| unknown | 64.31 | -138.41 | 1214.34 | 1087 | 1338 | 1218 | 25.33 | 38.22 | 15.18 | 279.13 | 16.49 | 62 | active | tongue | cirque |
| active | 64.29 | -138.43 | 1201.20 | 1047 | 1341 | 1206 | 20.43 | 29.12 | 9.09 | 287.73 | 32.66 | 63 | active | lobate | talus |
| unknown | 64.30 | -138.39 | 1546.81 | 1299 | 1707 | 1557 | 25.09 | 42.28 | 0.00 | 283.56 | 41.90 | 67 | active | tongue | cirque |
| active | 64.30 | -138.43 | 1137.96 | 1007 | 1236 | 1150 | 17.99 | 25.53 | 8.94 | 277.10 | 18.88 | 68 | relict | lobate | talus, vegd, just scree? |
| unknown | 64.28 | -138.41 | 1455.41 | 1197 | 1660 | 1461 | 20.50 | 40.36 | 6.75 | 283.03 | 60.63 | 69 | active | tongue | cirque |
| unknown | 64.28 | -138.45 | 1094.15 | 786 | 1390 | 1096 | 18.57 | 38.98 | 6.28 | 295.90 | 149.37 | 70 | relict | lobate | talus, vegd, just scree? |
| dormant | 64.26 | -138.47 | 942.54 | 762 | 1217 | 913 | 17.59 | 30.83 | 7.75 | 285.06 | 56.77 | 72 | relict | lobate | talus, vegd, just scree? |
| dormant | 64.22 | -138.49 | 1135.60 | 986 | 1252 | 1144 | 23.12 | 31.44 | 1.51 | 295.05 | 33.91 | 74 | relict | lobate | talus, just scree? |
| unknown | 64.60 | -138.21 | 1630.09 | 1528 | 1702 | 1629 | 15.49 | 34.30 | 4.06 | 8.08 | 12.57 | 75 | active | tongue | cirque, multilobe |
| active | 64.90 | -133.84 | 1577.98 | 1454 | 1689 | 1576 | 35.88 | 42.17 | 28.51 | 141.24 | 8.37 | 90 | | | no RG |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| dormant | 64.88 | -133.92 | 1638.32 | 1494 | 1796 | 1656 | 31.39 | 42.69 | 18.31 | 223.81 | 17.40 | 93 | relict | lobate | talus, cv |
| active | 64.88 | -133.85 | 1782.89 | 1638 | 1864 | 1795 | 36.29 | 56.33 | 1.82 | 116.23 | 15.08 | 94 | active | tongue | cirque, dv |
| active | 64.85 | -133.94 | 1581.50 | 1454 | 1759 | 1573 | 29.59 | 39.24 | 19.28 | 197.08 | 11.09 | 97 | active | lobate | talus, cv |
| active | 64.84 | -133.92 | 1632.93 | 1475 | 1813 | 1623 | 29.47 | 36.71 | 21.68 | 212.51 | 11.40 | 99 | active | tongue | talus |
| dormant | 64.79 | -133.99 | 1877.14 | 1788 | 1982 | 1874 | 37.71 | 50.36 | 23.88 | 293.85 | 8.31 | 106 | active | lobate | huge lumpy 10 converg talus |
| active | 64.76 | -133.98 | 1617.98 | 1521 | 1809 | 1616 | 16.83 | 42.73 | 0.68 | 281.50 | 38.81 | 111 | active | lobate | talus, cv, steep front |
| unknown | 64.65 | -133.68 | 1952.30 | 1734 | 2137 | 1967 | 35.23 | 47.06 | 15.88 | 291.89 | 16.32 | 124 | active | tongue | covergence of 2 glaciers |
| active | 64.59 | -133.99 | 1647.10 | 1580 | 1761 | 1636 | 24.13 | 44.47 | 7.21 | 326.90 | 8.82 | 127 | active | tongue | cirque, dv |
| active | 64.50 | -133.92 | 1813.56 | 1651 | 1920 | 1825 | 30.31 | 41.45 | 4.76 | 341.28 | 10.10 | 140 | inactive | tongue | cirque, melt lake |
| active | 64.46 | -133.91 | 1573.52 | 1457 | 1773 | 1559 | 33.06 | 46.41 | 16.17 | 10.04 | 22.21 | 144 | active | tongue | steep sides & f, ridged surface |
| dormant | 64.40 | -133.87 | 1610.95 | 1492 | 1744 | 1612 | 32.35 | 45.05 | 1.39 | 350.06 | 23.49 | 149 | active | lobate | talus, cv |
| unknown | 64.15 | -133.84 | 1536.75 | 1456 | 1629 | 1540 | 22.26 | 34.90 | 8.44 | 228.74 | 14.05 | 153 | active | lobate | ridges at toe, steep front |
| active | 64.39 | -133.57 | 1662.91 | 1576 | 1719 | 1673 | 29.84 | 41.38 | 1.39 | 134.36 | 15.17 | 165 | active | tongue | steep front |
| unknown | 64.51 | -133.68 | 1760.24 | 1683 | 1911 | 1738 | 26.54 | 41.43 | 2.86 | 63.47 | 12.15 | 172 | active | tongue |  |
| unknown | 64.51 | -133.71 | 1845.41 | 1651 | 1989 | 1847 | 40.08 | 51.84 | 2.72 | 337.52 | 15.48 | 173 | active | lobate | talus, smooth surface |
| active | 64.88 | -133.62 | 1338.70 | 1136 | 1514 | 1347 | 35.24 | 41.71 | 20.96 | 145.68 | 12.52 | 200 | inactive | tongue | talus, no cirque here |
| active | 64.87 | -133.60 | 1056.68 | 905 | 1221 | 1054 | 31.67 | 42.05 | 21.77 | 156.01 | 8.52 | 201 |  |  | alluvial fan |
| active | 64.88 | -133.60 | 1390.66 | 1246 | 1569 | 1383 | 36.32 | 44.75 | 25.52 | 125.70 | 13.82 | 202 |  |  | no RG |
| dormant | 64.90 | -133.57 | 1586.73 | 1423 | 1775 | 1592 | 30.19 | 44.00 | 20.06 | 54.79 | 13.78 | 205 |  |  | no RG |
| dormant | 64.91 | -133.57 | 1414.71 | 1356 | 1516 | 1412 | 24.88 | 44.09 | 1.35 | 327.98 | 13.37 | 206 |  |  | no RG |
| dormant | 64.91 | -133.63 | 1788.15 | 1632 | 1980 | 1800 | 36.88 | 50.42 | 1.07 | 96.74 | 27.48 | 207 | active | lobate | multilobe, ridges @ convergence |
| dormant | 64.91 | -133.65 | 1464.32 | 1341 | 1701 | 1444 | 33.48 | 50.80 | 8.06 | 342.60 | 24.96 | 208 | active | tongue |  |
| active | 64.96 | -133.37 | 1622.91 | 1484 | 1762 | 1621 | 33.45 | 43.37 | 13.27 | 139.43 | 25.94 | 242 | active | tongue | cirque, dv |
| dormant | 64.62 | -133.44 | 1574.80 | 1239 | 2009 | 1568 | 36.20 | 54.17 | 15.91 | 298.86 | 34.48 | 258 |  |  | no RG |
| unknown | 64.45 | -133.46 | 1537.17 | 1393 | 1707 | 1529 | 33.97 | 41.99 | 18.23 | 329.25 | 13.09 | 260 |  |  | no photos available |
| unknown | 64.42 | -133.49 | 1815.11 | 1617 | 2095 | 1805 | 38.44 | 55.91 | 0.68 | 8.57 | 43.09 | 264 |  |  | no photos available |
| dormant | 64.41 | -133.51 | 1723.03 | 1633 | 1798 | 1721 | 34.86 | 51.80 | 4.11 | 166.20 | 10.76 | 265 |  |  | no photos available |
| active | 64.05 | -133.41 | 1320.18 | 1195 | 1469 | 1315 | 33.17 | 42.87 | 13.52 | 318.29 | 14.04 | 273 | relict | lobate | glacial |
| active | 64.09 | -133.21 | 1700.64 | 1487 | 1865 | 1698 | 32.88 | 51.71 | 1.69 | 97.29 | 30.35 | 278 | active | tongue | both cirque/talus inputs |
| dormant | 64.28 | -133.17 | 1575.54 | 1410 | 1689 | 1595 | 26.37 | 40.15 | 9.14 | 300.94 | 23.77 | 283 |  |  | no RG |
| dormant | 64.82 | -133.23 | 1987.19 | 1838 | 2078 | 2000 | 34.49 | 52.60 | 3.58 | 287.20 | 22.56 | 302 | active | lobate | 2 lobes |
| dormant | 64.94 | -133.23 | 1538.21 | 1483 | 1641 | 1538 | 14.95 | 34.34 | 4.26 | 208.52 | 22.89 | 313 | active | lobate | talus, cv, 2 lobes |
| active | 64.56 | -132.98 | 1863.61 | 1706 | 1928 | 1890 | 25.43 | 41.58 | 0.75 | 342.42 | 17.40 | 360 | active | tongue | cirque, multilobe, in cir |
|  | 64.53 | -133.08 | 1697.91 | 1576 | 1802 | 1704 | 30.98 | 40.39 | 8.46 | 220.35 | 14.21 | 363 | active | tongue | talus, lat ridges |
|  | 64.53 | -133.05 | 1739.82 | 1555 | 1874 | 1771 | 24.19 | 47.19 | 0.75 | 297.87 | 24.41 | 364 | active | tongue | 2 lobes, south active for sure |
|  | 64.49 | -132.99 | 1607.24 | 1413 | 1880 | 1569 | 28.78 | 45.24 | 4.17 | 24.49 | 45.10 | 368 | active | lobate | cirque, huge, multilobe |
|  | 64.47 | -133.08 | 1645.27 | 1466 | 1956 | 1633 | 29.04 | 46.08 | 1.72 | 11.43 | 43.41 | 371 | active | tongue | cirque, dv |
|  | 64.64 | -132.83 | 1591.03 | 1478 | 1693 | 1594 | 30.11 | 49.70 | 3.72 | 300.19 | 20.53 | 397 | active | tongue | cirque |
|  | 64.93 | -132.77 | 1760.85 | 1594 | 1833 | 1779 | 28.42 | 47.82 | 2.05 | 74.94 | 20.30 | 415 | active | tongue | cirque, dv |
|  | 64.94 | -132.84 | 1709.54 | 1521 | 2004 | 1676 | 26.44 | 50.22 | 6.05 | 303.62 | 20.94 | 418 | active | tongue | cirque, multilobe |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 64.98 | -132.76 | 925.82 | 910 | 943 | 926 | 3.78 | 20.00 | 0.00 | 277.06 | 33.34 | 424 | active | tongue | cirque, long |
|  | 64.92 | -132.50 | 1784.54 | 1612 | 1966 | 1788 | 28.44 | 41.38 | 9.19 | 302.57 | 20.25 | 427 | active | lobate | talus, lobe 1 runs over lobe 2 |
|  | 64.84 | -132.65 | 1431.06 | 1306 | 1625 | 1419 | 25.95 | 46.63 | 5.48 | 278.98 | 34.21 | 441 | active | tongue | talus, cv |
|  | 64.82 | -132.62 | 1979.44 | 1940 | 2008 | 1988 | 15.61 | 23.28 | 5.01 | 171.12 | 0.98 | 443 | inactive | tongue | talus, dv |
|  | 64.82 | -132.60 | 2001.19 | 1949 | 2061 | 2006 | 24.47 | 36.33 | 2.05 | 226.15 | 4.08 | 444 | active | tongue | cirque, dv |
|  | 64.61 | -132.66 | 1822.38 | 1737 | 1916 | 1822 | 22.71 | 40.23 | 0.95 | 6.05 | 14.89 | 452 | active | tongue | cirque |
|  | 64.50 | -132.64 | 1685.29 | 1582 | 1838 | 1676 | 29.75 | 43.76 | 18.81 | 2.06 | 21.18 | 458 | active | tongue | cirque |
|  | 64.00 | -132.54 | 1790.89 | 1670 | 1861 | 1803 | 26.94 | 49.29 | 2.26 | 261.17 | 22.18 | 476 | active | tongue | cirque |
|  | 64.12 | -132.33 | 1580.25 | 1493 | 1671 | 1583 | 23.31 | 44.69 | 8.11 | 303.17 | 17.12 | 482 | active | tongue | cirque, multilobe, dv |
|  | 64.27 | -132.34 | 1709.63 | 1551 | 1977 | 1686 | 33.83 | 48.38 | 6.42 | 299.28 | 14.45 | 497 | active | tongue | cirque, melt lake @ bottom |
|  | 64.68 | -132.31 | 1669.67 | 1378 | 1993 | 1659 | 21.63 | 43.89 | 5.06 | 214.96 | 69.54 | 505 | active | lobate | talus, cv |
|  | 64.69 | -132.24 | 1899.27 | 1807 | 1960 | 1897 | 16.45 | 32.15 | 5.48 | 83.10 | 14.12 | 522 | active | tongue | cirque, dv |
|  | 64.69 | -132.18 | 2061.45 | 1909 | 2274 | 2047 | 42.79 | 57.82 | 20.01 | 69.09 | 23.89 | 526 | active | tongue | cirque, multilobe |
|  | 64.61 | -132.24 | 1786.55 | 1574 | 2014 | 1799 | 23.24 | 40.55 | 2.43 | 12.60 | 53.14 | 535 | active | lobate | talus |
|  | 64.62 | -132.02 | 1755.66 | 1559 | 1966 | 1740 | 31.67 | 46.78 | 2.13 | 23.62 | 36.28 | 541 | active | lobate | talus, poss PTR, cv |
|  | 64.51 | -132.17 | 1612.06 | 1495 | 1763 | 1603 | 23.89 | 42.47 | 8.59 | 0.08 | 25.09 | 546 | active | tongue | cirque, dv |
|  | 64.25 | -132.27 | 1489.22 | 1450 | 1546 | 1483 | 14.81 | 29.70 | 4.86 | 312.16 | 10.31 | 562 | active | tongue | cirque, multilobe, dv |
|  | 64.14 | -132.10 | 1555.96 | 1491 | 1630 | 1555 | 20.37 | 32.10 | 5.44 | 27.51 | 20.34 | 588 |  |  | no photos available |
|  | 64.14 | -132.14 | 1835.61 | 1623 | 1948 | 1855 | 31.55 | 51.51 | 1.39 | 216.31 | 23.88 | 597 | active | lobate | multilobe, talus, cv |
|  | 64.40 | -138.59 | 1680.33 | 1585 | 1796 | 1685 | 22.95 | 42.12 | 8.28 | 115.91 | 24.57 | 609 |  |  | photos missing |
|  | 64.27 | -138.58 | 1518.66 | 1387 | 1687 | 1505 | 24.20 | 38.42 | 8.72 | 118.14 | 24.57 | 611 | active | tongue | huge, cirque |
|  | 62.12 | -129.25 | 1624.46 | 1534 | 1767 | 1600 | 20.92 | 35.76 | 6.99 | 5.34 | 15.46 | 624 | active | lobate | talus, cv |
|  | 62.47 | -129.28 | 1439.89 | 1358 | 1539 | 1439 | 18.68 | 34.18 | 1.22 | 9.52 | 22.50 | 635 | active | tongue | cirque |
|  | 62.46 | -129.25 | 1590.76 | 1555 | 1645 | 1588 | 16.06 | 29.26 | 4.86 | 324.67 | 7.90 | 638 | inactive | tongue | cirque, dv |
|  | 62.11 | -129.30 | 1355.24 | 1236 | 1495 | 1355 | 26.42 | 37.21 | 7.37 | 17.77 | 8.03 | 654 | active | tongue | cirque |
|  | 62.07 | -129.13 | 1743.42 | 1699 | 1796 | 1743 | 13.45 | 33.78 | 0.68 | 16.79 | 10.95 | 665 | active | tongue | cirque, multilobe |
|  | 62.00 | -128.40 | 1716.40 | 1654 | 1837 | 1704 | 21.99 | 41.59 | 0.75 | 19.95 | 17.60 | 683 | active | tongue | talus, multilobe |
|  | 62.00 | -128.45 | 1640.27 | 1573 | 1727 | 1641 | 24.02 | 42.26 | 7.09 | 358.08 | 7.30 | 685 | active | tongue | cirque, multilobe |
|  | 62.51 | -134.54 | 1614.57 | 1577 | 1681 | 1611 | 27.64 | 43.34 | 7.66 | 325.16 | 3.21 | 693 | active | tongue | cirque |
|  | 62.39 | -134.45 | 1696.62 | 1642 | 1780 | 1689 | 24.58 | 39.67 | 4.52 | 343.14 | 5.19 | 707 | active | tongue | cirque |
|  | 62.38 | -134.48 | 1678.42 | 1628 | 1727 | 1679 | 21.76 | 37.93 | 3.39 | 176.83 | 7.40 | 709 | active | tongue | cirque |
|  | 62.36 | -134.42 | 1724.39 | 1683 | 1784 | 1718 | 16.57 | 34.60 | 4.76 | 352.18 | 7.34 | 713 | active | tongue | cirque, dv |
|  | 62.30 | -134.32 | 1719.50 | 1678 | 1755 | 1720 | 11.08 | 25.52 | 1.39 | 331.17 | 10.79 | 718 | inactive | tongue | cirque, dv, melt lake |
|  | 63.38 | -130.29 | 1628.24 | 1538 | 1728 | 1625 | 17.09 | 37.26 | 2.26 | 81.45 | 28.70 | 743 | active | tongue | cirque, dv |
|  | 63.38 | -130.42 | 1727.60 | 1689 | 1770 | 1730 | 17.59 | 28.88 | 5.05 | 90.14 | 4.91 | 746 | active | tongue | cirque |
|  | 63.18 | -130.13 | 1245.44 | 1195 | 1345 | 1239 | 13.69 | 32.54 | 2.70 | 349.18 | 8.61 | 778 | active | lobate | talus |
|  | 63.18 | -130.13 | 1341.24 | 1191 | 1650 | 1314 | 20.02 | 38.52 | 2.78 | 347.59 | 45.74 | 779 | active | lobate | talus |
|  | 63.17 | -130.05 | 1786.33 | 1719 | 1865 | 1787 | 25.21 | 31.89 | 7.59 | 28.15 | 5.00 | 780 | active | tongue | cirque, multilobe |
|  | 63.13 | -130.31 | 1644.36 | 1581 | 1705 | 1646 | 15.77 | 37.32 | 0.00 | 328.29 | 12.16 | 788 | active | tongue | big, cirque |
|  | 63.04 | -130.13 | 1324.20 | 1143 | 1513 | 1323 | 24.66 | 34.79 | 10.64 | 304.91 | 25.85 | 798 | active | tongue | talus |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 63.41 | -131.38 | 1696.79 | 1597 | 1821 | 1690 | 21.70 | 44.30 | 4.58 | 253.25 | 20.98 | 801 | active | tongue | cirque, dv |
|  | 61.52 | -131.90 | 1818.99 | 1697 | 1957 | 1817 | 31.45 | 41.32 | 13.52 | 275.82 | 9.61 | 816 | inactive | lobate | talus, cv, shallow slope |
|  | 61.42 | -130.02 | 1594.53 | 1519 | 1660 | 1599 | 17.63 | 34.21 | 7.73 | 74.50 | 15.32 | 823 | active | tongue | cirque, multilobe or incised |
|  | 61.36 | -130.74 | 1684.98 | 1652 | 1737 | 1678 | 14.04 | 28.57 | 4.76 | 17.61 | 8.73 | 834 | active | tongue | cirque |
|  | 61.25 | -130.86 | 1547.17 | 1451 | 1641 | 1555 | 15.33 | 38.52 | 5.79 | 323.54 | 22.31 | 837 | active | tongue | big, cirque |
|  | 61.21 | -130.40 | 1648.74 | 1580 | 1778 | 1640 | 23.15 | 46.21 | 9.72 | 9.22 | 10.95 | 842 | active | tongue | cirque |
|  | 61.13 | -130.16 | 1588.20 | 1526 | 1673 | 1583 | 25.94 | 36.49 | 15.48 | 351.48 | 9.47 | 855 |  |  | no RG, small lakes in cirque |
|  | 61.12 | -130.13 | 1552.51 | 1522 | 1583 | 1554 | 13.23 | 28.50 | 2.72 | 340.00 | 12.22 | 857 | active | lobate | talus, poss also tongue too |
|  | 61.11 | -130.15 | 1638.53 | 1535 | 1720 | 1639 | 21.54 | 29.09 | 9.75 | 322.56 | 10.92 | 860 | active | tongue | cirque, dv |
|  | 61.01 | -130.61 | 1650.32 | 1534 | 1809 | 1641 | 28.41 | 40.04 | 10.97 | 297.35 | 16.30 | 879 | active | tongue | cirque, dv |
|  | 61.40 | -131.76 | 1520.24 | 1401 | 1696 | 1516 | 21.52 | 34.20 | 1.97 | 57.61 | 13.67 | 899 | active | tongue | cirque, dv |
|  | 61.40 | -131.75 | 1578.86 | 1496 | 1660 | 1581 | 27.02 | 32.74 | 18.39 | 303.92 | 7.98 | 900 | active | tongue | cirque |
|  | 61.40 | -131.75 | 1546.58 | 1442 | 1662 | 1541 | 26.81 | 38.51 | 12.05 | 289.43 | 10.78 | 903 | active | tongue | small, cirque |
|  | 61.37 | -131.68 | 1500.00 | 1396 | 1659 | 1492 | 22.23 | 34.42 | 7.65 | 22.94 | 18.96 | 908 | active | lobate | talus, cv |
|  | 61.31 | -131.02 | 1506.90 | 1406 | 1559 | 1519 | 16.19 | 32.95 | 4.39 | 70.62 | 16.49 | 919 | active | tongue | cirque |
|  | 61.17 | -131.27 | 1587.16 | 1522 | 1686 | 1584 | 22.67 | 37.49 | 6.17 | 64.44 | 13.97 | 930 | active | tongue | cirque |
|  | 61.25 | -138.23 | 1672.85 | 1607 | 1744 | 1676 | 22.91 | 38.16 | 0.95 | 356.38 | 11.55 | 936 | active | tongue | cirque |
|  | 61.23 | -138.84 | 1209.19 | 1126 | 1294 | 1212 | 21.15 | 27.41 | 15.79 | 53.85 | 9.76 | 937 | inactive | tongue | forested, talus |
|  | 61.21 | -138.79 | 1061.15 | 954 | 1195 | 1058 | 19.83 | 36.63 | 6.93 | 62.25 | 35.83 | 941 | inactive | lobate | forested, multilobe, ta |
|  | 61.21 | -138.80 | 1150.03 | 1070 | 1235 | 1147 | 27.71 | 37.03 | 20.10 | 55.19 | 5.57 | 942 | inactive | lobate | forested, talus |
|  | 61.14 | -138.69 | 1665.96 | 1389 | 2028 | 1659 | 26.99 | 43.80 | 7.92 | 35.78 | 55.67 | 949 | active | tongue | cirque |
|  | 61.10 | -138.62 | 1736.35 | 1424 | 2045 | 1740 | 27.86 | 48.23 | 5.43 | 0.96 | 87.02 | 952 | active | tongue | cirque |
|  | 61.07 | -138.62 | 1710.85 | 1521 | 1856 | 1729 | 21.64 | 40.10 | 5.55 | 45.53 | 46.56 | 953 | relict | tongue | talus, just scree? |
|  | 61.09 | -138.61 | 1753.97 | 1447 | 1968 | 1774 | 28.82 | 48.57 | 7.37 | 0.83 | 79.02 | 954 | active | tongue | cirque |
|  | 61.08 | -138.95 | 1548.87 | 1411 | 1728 | 1534 | 23.09 | 41.28 | 1.22 | 123.29 | 58.73 | 958 | active | lobate | talus, cv |
|  | 61.06 | -138.55 | 1401.48 | 1032 | 1953 | 1335 | 28.01 | 40.23 | 12.30 | 64.65 | 38.13 | 959 | active | tongue | cirque |
|  | 60.98 | -138.50 | 907.75 | 838 | 1021 | 902 | 17.28 | 36.17 | 0.34 | 343.29 | 23.74 | 968 | active | lobate | talus |
|  | 60.99 | -138.77 | 1475.36 | 1390 | 1569 | 1475 | 28.07 | 37.48 | 14.87 | 338.35 | 9.56 | 972 | active | both | cirque and talus |
|  | 60.96 | -138.59 | 790.97 | 773 | 829 | 787 | 11.12 | 31.33 | 3.34 | 358.04 | 8.19 | 974 | active | lobate | vegd, talus |
|  | 61.99 | -140.84 | 1735.22 | 1614 | 1843 | 1741 | 25.32 | 39.01 | 4.06 | 350.04 | 21.57 | 983 | active | tongue | talus, cv |
|  | 61.96 | -140.63 | 1400.56 | 1067 | 1823 | 1385 | 18.64 | 39.22 | 0.48 | 69.81 | 201.22 | 987 | active | tongue | cirque, 2 coalescent RGs |
|  | 61.88 | -140.36 | 1360.76 | 1155 | 1522 | 1376 | 20.55 | 36.72 | 5.81 | 18.35 | 29.30 | 995 | active | tongue | cirque |
|  | 61.69 | -139.98 | 1446.20 | 1183 | 1661 | 1463 | 19.45 | 32.93 | 5.44 | 16.41 | 67.16 | 1016 | active | tongue | cirque, multilobe |
|  | 61.67 | -140.16 | 1610.36 | 1402 | 1799 | 1623 | 24.69 | 40.68 | 8.79 | 320.98 | 38.74 | 1017 | active | lobate | talus |
|  | 61.61 | -140.12 | 1575.61 | 1529 | 1666 | 1570 | 17.25 | 36.00 | 5.01 | 298.68 | 10.58 | 1028 | active | tongue | cirque, 2 lobes |
|  | 61.49 | -139.50 | 1627.07 | 1451 | 1839 | 1617 | 27.08 | 42.53 | 14.28 | 20.41 | 28.19 | 1039 | active | tongue | cirque |
|  | 61.27 | -139.49 | 2025.64 | 1813 | 2297 | 2036 | 20.90 | 49.03 | 4.52 | 319.59 | 68.91 | 1041 | active | tongue | cirque, poss real glacier |
|  | 62.44 | -133.44 | 1840.36 | 1666 | 1973 | 1846 | 30.46 | 38.77 | 15.04 | 33.39 | 13.23 | 1043 |  |  | no RG |
|  | 62.02 | -133.55 | 1703.30 | 1662 | 1754 | 1699 | 14.03 | 24.90 | 7.36 | 347.26 | 5.68 | 1052 | active | tongue | cirque |
|  | 61.95 | -133.49 | 1824.78 | 1739 | 1947 | 1820 | 27.64 | 44.23 | 12.21 | 352.01 | 10.67 | 1083 | active | tongue | cirque, multilobe |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 61.90 | -133.47 | 1693.76 | 1613 | 1779 | 1697 | 18.59 | 49.50 | 4.07 | 300.78 | 21.62 | 1111 | active | tongue | cirque |
| | 61.81 | -133.34 | 1794.30 | 1745 | 1883 | 1790 | 22.61 | 40.09 | 10.61 | 285.41 | 7.62 | 1116 | active | tongue | cirque |
| | 61.78 | -133.37 | 1594.56 | 1538 | 1657 | 1592 | 14.80 | 26.34 | 4.76 | 5.90 | 11.30 | 1119 | active | tongue | cirque |
| | 61.72 | -133.13 | 1533.25 | 1468 | 1590 | 1534 | 19.26 | 25.14 | 8.84 | 42.29 | 6.82 | 1131 | inactive | tongue | cirque |
| | 61.72 | -133.16 | 1679.44 | 1622 | 1761 | 1672 | 18.99 | 48.28 | 5.95 | 337.59 | 11.54 | 1132 | active | tongue | cirque |
| | 61.71 | -133.56 | 1751.83 | 1598 | 1990 | 1742 | 34.14 | 53.55 | 17.11 | 290.96 | 20.40 | 1135 | active | tongue | cirque |
| | 61.71 | -133.20 | 1677.75 | 1625 | 1758 | 1666 | 18.31 | 36.41 | 5.81 | 317.35 | 7.92 | 1136 | active | tongue | cirque |
| | 61.70 | -133.93 | 1698.80 | 1557 | 1847 | 1688 | 37.15 | 48.19 | 20.86 | 327.26 | 8.69 | 1141 | active | lobate | cirque, dv |
| | 61.69 | -133.13 | 1609.82 | 1486 | 1687 | 1630 | 25.96 | 42.86 | 6.06 | 321.16 | 6.10 | 1142 | active | tongue | cirque |
| | 61.69 | -133.24 | 1613.25 | 1571 | 1657 | 1615 | 11.77 | 22.87 | 4.38 | 61.26 | 14.82 | 1143 | inactive | lobate | talus, cv, shallow front, vegd |
| | 61.68 | -133.22 | 1535.64 | 1441 | 1674 | 1527 | 22.91 | 51.96 | 5.05 | 352.97 | 43.11 | 1144 | active | both | c&t, 1-2 tongue, 2-3 lobate |
| | 61.63 | -133.36 | 1642.88 | 1583 | 1698 | 1651 | 20.70 | 34.84 | 13.04 | 52.30 | 3.68 | 1148 | active | tongue | cirque |
| | 61.51 | -133.13 | 1601.89 | 1489 | 1752 | 1609 | 24.47 | 44.54 | 8.81 | 328.69 | 19.62 | 1149 | active | tongue | cirque, multilobe |
| | 61.50 | -133.11 | 1714.95 | 1502 | 1928 | 1724 | 30.62 | 52.33 | 1.07 | 335.36 | 61.98 | 1150 | active | tongue | multicirque, multilobe |
| | 61.97 | -132.74 | 909.61 | 883 | 939 | 910 | 11.61 | 22.95 | 7.43 | 50.31 | 7.82 | 1153 | | | no photos available |
| | 61.97 | -132.74 | 905.44 | 876 | 941 | 908 | 11.33 | 23.85 | 2.39 | 48.51 | 8.44 | 1154 | | | no photos available |
| | 61.80 | -132.97 | 1586.63 | 1484 | 1733 | 1575 | 26.20 | 43.06 | 4.82 | 42.56 | 18.79 | 1162 | inactive | tongue | cirque |
| | 61.68 | -132.63 | 1605.76 | 1454 | 1781 | 1601 | 24.58 | 52.48 | 7.36 | 353.57 | 56.94 | 1179 | active | tongue | cirque/hanging val, cv |
| | 61.67 | -132.58 | 1593.16 | 1557 | 1639 | 1592 | 19.29 | 29.44 | 9.01 | 10.66 | 4.45 | 1181 | active | tongue | cirque, dv |
| | 61.68 | -132.92 | 1830.40 | 1714 | 1917 | 1835 | 30.77 | 39.92 | 8.90 | 285.66 | 8.03 | 1183 | active | tongue | cirque |
| | 61.63 | -132.53 | 1373.32 | 1270 | 1521 | 1359 | 24.34 | 32.43 | 15.50 | 278.56 | 12.61 | 1196 | inactive | tongue | cirque |
| | 61.58 | -132.09 | 1508.28 | 1397 | 1661 | 1500 | 17.28 | 29.32 | 5.73 | 15.15 | 19.02 | 1198 | active | tongue | cirque, 1198/1199/1200 |
| | 61.58 | -132.09 | 1547.78 | 1424 | 1688 | 1545 | 21.21 | 35.53 | 7.85 | 352.28 | 24.26 | 1199 | active | tongue | cirque, 1198/1199/1200 |
| | 61.58 | -132.10 | 1574.06 | 1497 | 1647 | 1576 | 19.63 | 26.97 | 8.41 | 24.21 | 12.56 | 1200 | active | tongue | cirque, 1198/1199/1200 |
| | 61.56 | -132.07 | 1718.74 | 1611 | 1856 | 1704 | 35.42 | 47.04 | 20.38 | 295.69 | 10.15 | 1201 | active | tongue | cirque, snow in June30/92 |
| | 61.56 | -132.20 | 1405.01 | 1184 | 1828 | 1358 | 21.34 | 48.39 | 0.00 | 178.09 | 62.70 | 1203 | inactive | tongue | cirque |
| | 61.56 | -132.20 | 1375.47 | 1179 | 1508 | 1392 | 23.84 | 34.95 | 5.40 | 163.96 | 13.32 | 1204 | inactive | tongue | cirque |
| | 61.56 | -132.27 | 1616.08 | 1503 | 1772 | 1600 | 19.81 | 40.12 | 3.11 | 1.55 | 55.25 | 1205 | active | tongue | cirque |
| | 61.56 | -132.29 | 1620.09 | 1518 | 1782 | 1599 | 22.64 | 40.63 | 3.37 | 8.93 | 39.92 | 1206 | active | tongue | cirque |
| | 61.55 | -132.31 | 1759.55 | 1707 | 1810 | 1759 | 14.90 | 25.87 | 7.09 | 22.88 | 8.26 | 1208 | active | tongue | cirque |
| | 61.55 | -132.33 | 1677.97 | 1586 | 1801 | 1671 | 19.83 | 38.43 | 6.93 | 295.63 | 19.55 | 1209 | active | tongue | cirque |
| | 61.53 | -132.29 | 1548.93 | 1482 | 1649 | 1541 | 26.28 | 42.82 | 1.97 | 14.93 | 16.18 | 1211 | active | tongue | cirque |
| | 61.53 | -132.27 | 1547.74 | 1419 | 1686 | 1550 | 34.41 | 48.75 | 14.07 | 358.75 | 17.27 | 1212 | active | lobate | talus |
| | 61.53 | -132.34 | 1566.49 | 1461 | 1716 | 1564 | 22.46 | 42.77 | 2.57 | 320.09 | 19.16 | 1213 | active | tongue | cirque, @least 2 small lobes |
| | 61.52 | -132.34 | 1684.03 | 1585 | 1821 | 1671 | 31.96 | 45.39 | 14.23 | 309.09 | 9.07 | 1216 | active | tongue | cirque |
| | 61.50 | -133.14 | 1699.37 | 1610 | 1840 | 1682 | 25.73 | 40.74 | 9.37 | 291.62 | 12.47 | 1218 | active | tongue | cirque, multilobe |
| | 61.43 | -133.96 | 1736.26 | 1557 | 1886 | 1744 | 34.57 | 41.80 | 21.60 | 358.69 | 13.07 | 1222 | inactive | lobate | cv, 2 melt lakes |
| | 61.41 | -133.88 | 1619.02 | 1542 | 1713 | 1611 | 21.03 | 32.25 | 11.62 | 328.89 | 11.58 | 1223 | inactive | tongue | cirque, shallow front, vegd |
| | 61.49 | -132.79 | 1641.07 | 1504 | 1760 | 1654 | 22.66 | 38.62 | 3.81 | 18.13 | 23.04 | 1239 | active | lobate | talus |
| | 61.45 | -132.26 | 1612.88 | 1459 | 1763 | 1612 | 23.71 | 39.71 | 7.01 | 323.93 | 50.84 | 1245 | active | tongue | cirque, multilobe |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevatic | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air photc | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 61.45 | -132.40 | 1511.84 | 1427 | 1609 | 1507 | 15.98 | 31.77 | 4.58 | 346.87 | 17.94 | 1246 | active | tongue | cirque, dv |
| | 61.44 | -133.00 | 1783.61 | 1721 | 1872 | 1781 | 25.47 | 36.38 | 9.88 | 314.68 | 6.39 | 1254 | active | tongue | cirque |
| | 61.42 | -132.99 | 1524.32 | 1438 | 1639 | 1516 | 30.52 | 40.36 | 3.20 | 330.79 | 22.27 | 1264 | active | tongue | cirque |
| | 61.19 | -132.39 | 1246.35 | 1175 | 1290 | 1253 | 12.44 | 21.19 | 7.54 | 17.62 | 13.77 | 1273 | active | lobate | talus, cv, 3 lobes |
| | 64.84 | -135.14 | 1416.07 | 1287 | 1691 | 1378 | 20.96 | 44.71 | 0.75 | 311.43 | 80.46 | 1277 | active | lobate | talus, multilobe |
| | 64.75 | -136.02 | 1464.10 | 1389 | 1529 | 1472 | 13.19 | 26.07 | 0.75 | 21.06 | 14.96 | 1280 | active | tongue | cirque, d-v |
| | 64.66 | -136.44 | 1428.87 | 1355 | 1568 | 1431 | 17.35 | 50.47 | 5.43 | 351.49 | 14.78 | 1285 | relict | lobate | talus |
| | 64.57 | -136.01 | 1426.54 | 1394 | 1473 | 1427 | 11.26 | 22.71 | 2.02 | 349.17 | 14.11 | 1290 | active | tongue | talus, cv |
| | 64.79 | -135.14 | 1592.80 | 1537 | 1677 | 1590 | 20.13 | 39.41 | 2.72 | 4.51 | 19.44 | 1331 | active | tongue | cirque, dv |
| | 64.74 | -135.08 | 1667.65 | 1579 | 1823 | 1654 | 32.35 | 45.12 | 7.36 | 300.54 | 22.03 | 1336 | relict | tongue | cirque, dv |
| | 64.72 | -134.30 | 1517.69 | 1444 | 1634 | 1513 | 15.66 | 36.54 | 0.75 | 316.44 | 31.57 | 1345 | active | both | cirque and tals, dv and cv |
| | 64.71 | -135.00 | 1611.61 | 1532 | 1727 | 1607 | 22.65 | 37.94 | 4.39 | 296.69 | 14.38 | 1348 | active | both | cirque and talus |
| | 64.71 | -134.01 | 1578.92 | 1551 | 1651 | 1572 | 14.80 | 36.41 | 4.39 | 100.23 | 9.55 | 1349 | active | lobate | talus, cv |
| | 64.66 | -134.15 | 1675.12 | 1567 | 1801 | 1668 | 25.52 | 49.26 | 4.53 | 88.66 | 29.94 | 1368 | active | tongue | cirque, multilobe |
| | 64.66 | -134.37 | 1433.40 | 1383 | 1509 | 1427 | 16.75 | 32.86 | 2.16 | 301.73 | 21.52 | 1374 | active | both | cirque |
| | 64.64 | -134.39 | 1913.91 | 1767 | 2068 | 1915 | 33.49 | 43.70 | 10.78 | 127.24 | 25.14 | 1380 | active | tongue | cirque, 3 lobes, dv |
| | 64.64 | -134.37 | 1688.67 | 1581 | 1861 | 1676 | 23.80 | 44.40 | 5.43 | 226.46 | 35.82 | 1381 | active | tongue | cirque, multilobe |
| | 64.60 | -134.24 | 1413.17 | 1322 | 1557 | 1416 | 19.87 | 39.37 | 1.07 | 2.84 | 34.94 | 1394 | active | lobate | talus, cv, 2 RGs |
| | 64.53 | -134.15 | 1494.78 | 1448 | 1623 | 1485 | 20.86 | 41.56 | 0.48 | 156.15 | 20.64 | 1403 | active | tongue | cirque |
| | 64.47 | -135.12 | 1352.39 | 1187 | 1559 | 1347 | 20.57 | 44.91 | 3.34 | 348.57 | 95.88 | 1406 | active | tongue | cirque, multilobe |
| | 64.46 | -135.13 | 1391.12 | 1264 | 1544 | 1393 | 23.51 | 34.09 | 7.36 | 266.66 | 21.17 | 1407 | inactive | tongue | cirque, lacks ridges |
| | 63.75 | -140.65 | 1418.42 | 1390 | 1457 | 1420 | 7.65 | 26.90 | 1.39 | 319.14 | 32.93 | 1427 | inactive | tongue | cirque |
| | 63.77 | -140.44 | 1067.58 | 864 | 1308 | 1055 | 21.25 | 29.71 | 12.73 | 340.62 | 49.10 | 1433 | | | no RG |
| | 63.75 | -140.44 | 1147.49 | 1042 | 1239 | 1147 | 13.28 | 21.78 | 8.84 | 7.70 | 28.92 | 1435 | | | photos missing |
| | 63.74 | -140.49 | 1413.27 | 1373 | 1462 | 1410 | 10.27 | 14.43 | 6.85 | 154.52 | 14.72 | 1441 | | | photos missing |
| | 63.69 | -140.50 | 962.18 | 909 | 1022 | 960 | 12.14 | 19.18 | 7.59 | 91.40 | 26.42 | 1447 | | | no RG |
| | 64.61 | -138.46 | 1563.90 | 1404 | 1690 | 1574 | 30.39 | 41.87 | 20.78 | 242.38 | 13.62 | 1471 | inactive | tongue | cirque |
| | 64.62 | -138.44 | 1604.66 | 1520 | 1681 | 1604 | 23.12 | 37.15 | 12.91 | 300.07 | 12.55 | 1472 | inactive | tongue | cirque |
| | 64.58 | -138.37 | 1473.69 | 1354 | 1657 | 1459 | 22.83 | 41.66 | 10.44 | 317.92 | 21.70 | 1473 | | | no RG in cirque |
| | 64.54 | -138.46 | 1406.03 | 1341 | 1497 | 1402 | 15.52 | 33.38 | 7.33 | 269.24 | 12.55 | 1477 | active | tongue | talus, 3 lobes |
| | 64.52 | -138.12 | 1356.97 | 1225 | 1561 | 1357 | 19.54 | 37.20 | 1.91 | 273.70 | 58.35 | 1480 | active | tongue | cirque |
| | 61.34 | -137.06 | 914.96 | 914 | 915 | 915 | 0.22 | 1.72 | 0.00 | 257.47 | 4.09 | 1503 | | | lake |
| | 61.35 | -137.07 | 915.54 | 914 | 920 | 915 | 1.02 | 2.78 | 0.00 | 347.84 | 6.36 | 1504 | | | lake |
| | 61.00 | -138.04 | 1513.36 | 1423 | 1595 | 1510 | 22.76 | 31.89 | 9.72 | 184.78 | 5.89 | 1507 | inactive | tongue | cirque, winter photo |
| | 60.28 | -136.96 | 1149.17 | 1077 | 1211 | 1149 | 19.41 | 24.63 | 15.53 | 263.85 | 10.12 | 1511 | relict | lobate | talus, forested |
| | 60.22 | -136.91 | 1301.75 | 1113 | 1558 | 1302 | 26.75 | 43.73 | 12.20 | 224.95 | 29.85 | 1512 | active | tongue | cirque |
| | 60.16 | -136.64 | 1694.21 | 1632 | 1802 | 1692 | 18.44 | 47.82 | 0.68 | 19.72 | 15.43 | 1521 | relict | lobate | forested, talus |
| unknown | 60.13 | -136.66 | 1558.61 | 1517 | 1615 | 1556 | 18.51 | 34.22 | 3.32 | 342.47 | 7.94 | 1523 | active | tongue | cirque |
| active | 60.24 | -136.48 | 1804.77 | 1725 | 1940 | 1797 | 19.34 | 44.27 | 1.97 | 76.26 | 22.53 | 1531 | active | tongue | cirque |
| active | 60.17 | -136.49 | 1778.95 | 1694 | 1963 | 1764 | 23.82 | 47.86 | 0.75 | 253.71 | 38.68 | 1536 | active | tongue | cirque |

| activity - original geology map | latitude | longitude | mean elevation | minimum elevati | maximum elevation | median elevation | mean slope | maximum slope | minimum slope | mean aspect (directional mea | area in hectares | Amaris' ID code | activity - air phot | morphorphology air photo | comments - air photo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| active | 60.22 | -136.24 | 1575.57 | 1523 | 1610 | 1580 | 12.90 | 24.47 | 2.36 | 34.77 | 8.57 | 1539 | active | tongue | cirque |
| active | 61.68 | -140.21 | 1677.66 | 1569 | 1790 | 1678 | 30.02 | 48.93 | 4.10 | 290.90 | 21.12 | 1554 | active | tongue | cirque, dv |
| active | 61.66 | -140.21 | 1555.08 | 1489 | 1631 | 1554 | 18.64 | 38.34 | 5.01 | 221.16 | 23.24 | 1557 | inactive | lobate | talus, cv |
| dormant | 61.57 | -140.02 | 1327.76 | 1210 | 1473 | 1322 | 32.43 | 41.06 | 9.05 | 210.57 | 8.98 | 1565 | inactive | lobate | talus, big, cv |
| active | 61.49 | -139.60 | 1655.16 | 1535 | 1865 | 1639 | 27.25 | 44.17 | 9.76 | 352.75 | 26.53 | 1574 | active | tongue | cirque, dv, debris-cov glac |
| active | 61.35 | -139.66 | 1602.75 | 1354 | 1805 | 1613 | 37.03 | 43.28 | 27.55 | 228.58 | 14.00 | 1577 | relict | tongue | cirque, dv, forested |
| active | 61.27 | -139.34 | 1966.25 | 1925 | 1998 | 1968 | 8.09 | 15.25 | 4.39 | 15.10 | 11.59 | 1579 | active | tongue | cirque, dv |
| active | 61.21 | -139.45 | 1395.56 | 1303 | 1515 | 1395 | 17.78 | 36.89 | 9.06 | 225.64 | 15.26 | 1588 | active | lobate | talus, poss PTR |
| dormant | 61.10 | -139.19 | 1919.25 | 1783 | 2094 | 1909 | 32.25 | 37.39 | 26.98 | 248.55 | 5.65 | 1605 | inactive | lobate | talus, cv |
| active | 61.06 | -139.17 | 1898.15 | 1777 | 2045 | 1887 | 29.93 | 38.44 | 20.92 | 247.60 | 6.49 | 1615 | active | tongue | cirque, dv, debris-cov glac |
| unknown | 61.09 | -139.18 | 1918.21 | 1760 | 2100 | 1909 | 35.88 | 41.87 | 29.56 | 246.41 | 6.57 | 1617 | inactive | lobate | talus, cv |
| dormant | 61.12 | -139.12 | 1640.69 | 1463 | 1860 | 1643 | 29.95 | 49.25 | 9.51 | 350.55 | 35.43 | 1624 | active | lobate | talus, cv, had trees |
| dormant | 61.03 | -139.08 | 2348.51 | 2171 | 2566 | 2334 | 29.40 | 40.51 | 5.32 | 273.61 | 29.02 | 1642 | active | tongue | cirque, dv, debris-cov glacier |
| dormant | 61.23 | -138.84 | 1317.89 | 1152 | 1468 | 1319 | 24.52 | 33.08 | 15.13 | 57.22 | 16.29 | 1662 |  |  | not RG, dr chans in cir floor |
| unknown | 61.51 | -138.02 | 1756.31 | 1666 | 1804 | 1763 | 24.61 | 41.72 | 10.03 | 3.76 | 10.80 | 1671 | relict | tongue | cirque, dv |
|  | 60.55 | -137.21 | 1115.22 | 823 | 1700 | 1032 | 16.49 | 38.51 | 3.52 | 47.33 | 179.92 | Beside KT | active | lobate |  |
|  | 61.18 | -138.45 | 843.56 | 781 | 971 | 828 | 27.62 | 40.20 | 3.63 | 200.78 | 5.68 | CultusBay RG | relict | lobate |  |
|  | 60.45 | -137.09 | 1261.81 | 802 | 1767 | 1340 | 17.27 | 40.28 | 3.32 | 84.93 | 80.09 | Dezadeash | active | both |  |
|  | 60.70 | -137.62 | 1558.12 | 1325 | 1803 | 1560 | 23.85 | 41.29 | 3.37 | 107.56 | 90.43 | HJ | active | tongue | debris-covered glacier |
|  | 60.71 | -137.59 | 1200.38 | 824 | 1648 | 1172 | 11.46 | 27.43 | 1.01 | 40.53 | 290.56 | HJ2 | active | tongue | debris-covered glacier |
|  | 60.69 | -137.57 | 1221.08 | 973 | 1501 | 1237 | 10.74 | 34.44 | 0.00 | 27.80 | 308.85 | HJ3 | active | tongue | debris-covered glacier |
|  | 60.68 | -137.52 | 1404.34 | 1209 | 1626 | 1415 | 12.66 | 27.02 | 0.75 | 42.62 | 79.10 | HJ4 | active | tongue | debris-covered glacier |
|  | 60.56 | -137.24 | 1088.77 | 731 | 1717 | 1058 | 26.14 | 44.07 | 5.81 | 25.17 | 83.02 | King's Throne | active | lobate |  |
|  | 64.97 | -138.26 | 1170.00 | 1089 | 1264 | 1168 | 29.19 | 31.13 | 26.57 | 35.89 | 3.86 | N of 4 | inactive | lobate |  |
|  | 64.96 | -138.19 | 952.12 | 935 | 1000 | 947 | 15.52 | 33.94 | 6.26 | 15.91 | 2.95 | Neighbour to 5 | active | lobate |  |
|  | 60.71 | -137.63 | 1330.98 | 971 | 1688 | 1338 | 20.91 | 42.99 | 6.05 | 13.07 | 86.20 | NHJ1 | active | tongue | debris-covered glacier |
|  | 60.72 | -137.67 | 1334.22 | 1193 | 1431 | 1341 | 25.34 | 46.59 | 12.34 | 28.63 | 20.23 | NHJ2 | active | lobate |  |
|  | 60.73 | -137.70 | 776.31 | 608 | 1055 | 749 | 27.83 | 45.06 | 13.21 | 11.71 | 27.84 | NHJ3 | active | lobate |  |
|  | 60.73 | -137.71 | 759.74 | 676 | 962 | 729 | 17.05 | 37.82 | 3.11 | 18.38 | 25.30 | NHJ4 | active | tongue |  |
|  | 60.74 | -137.72 | 737.88 | 651 | 814 | 736 | 15.27 | 27.41 | 6.02 | 21.90 | 15.41 | NHJ5 | active | tongue |  |
|  | 60.39 | -133.85 | 1137.75 | 1013 | 1240 | 1142 | 15.67 | 27.00 | 4.90 | 67.08 | 63.45 | Possible RG | active | lobate |  |
|  | 60.82 | -137.88 | 1762.06 | 1501 | 2054 | 1749 | 13.79 | 38.81 | 1.07 | 53.49 | 142.66 | S of 1508 | active | tongue |  |
|  | 64.52 | -138.21 | 1190.49 | 1125 | 1300 | 1171 | 15.52 | 29.15 | 0.68 | 176.14 | 18.19 | TombLeft | inactive | lobate |  |
|  | 64.51 | -138.15 | 1465.47 | 1274 | 1648 | 1464 | 23.33 | 37.39 | 3.11 | 306.20 | 53.42 | TombRight | inactive | tongue |  |
|  | 61.80 | -133.03 | 1205.37 | 1101 | 1334 | 1203 | 27.84 | 36.04 | 20.82 | 263.60 | 15.44 | Unmked RG | active | lobate |  |

Appendix D - Comparison: field and air photo observations

| Amaris' ID code | activity - field | morphorphology - field | comments - field | | activity - air photo | morphorphology - air photo | comments - air photo |
|---|---|---|---|---|---|---|---|
| 3 | relict | tongue | visit #1: possibly a RG, looks detached from talus but could be due to surface collapse, visit #2: lots of veg: lichens, juniper, lab tea, cranberry, cloudberry, willow, etc., minimal surface morphology (i.e. ridges) | | inactive | lobate | talus |
| 4 | inactive/relict | | melt depression on surface between fronts 1 and 2 | | relict | lobate | talus, just scree? |
| 5 | active | | | | active | lobate | talus |
| 12 | inactive | tongue | on right side of same cirque as 189 | | active | tongue | cirque |
| 16 | active | tongue | lateral ridges, doesn't have much of a headwall | | relict | lobate | talus, vegd, just scree? |
| 26 | | tongue | not a RG, photos are of supposed location | | relict | lobate | talus, just scree? |
| 27 | | | visit #1: should be visible in better weather, visit #2: can't find a rock glacier here, could photos 4919, 4920 show what was marked as a rock glacier? I don't think it is; the headwall is more like a hill and there are two types of rock, red and grey; I think the "rock glacier" is just a grey rock outcrop. | | inactive | tongue | talus, 2 lobes |
| 32 | active | | visit #1: veg is lichens, visit #2: large, heavily ridged surface but has low veg on surface and low toe angle; Blackstone River is between road/campground and rock glacier | | active | tongue | cirque |
| 34 | inactive | | visit #1: possibly somewhat active; veg is lichens and short veg, few trees; at km post 68, visit #2: upper front has veg on sides with patches on surface and front, the middle front has patchy veg throughout and huge clasts, the lowest front is fully vegetated and the road runs along the bottom edge of the front. There are many smaller fronts in between formed by very strange troughs leading me to suspect that the upper front is a rg, the middle "front" is actually a series of frontal (push) moraines, and the lower front was a creeping ice-cored moraine which is now relict. active, 2nd visit actually climbed it and saw rhizocarpon geographicum on whole thing - maybe inactive? | | active | lobate | talus |
| 39 | inactive | | lower part looks like talus has fallen over a ridge - don't think morphology is entirely due to rock fall, lower part has veg and is fan-shaped, flow is diagonal, upper has some volume and no veg, surface morphology is present but not pronounced (ridges and troughs), upper is tongue shaped | | relict | lobate | talus, multilobe |
| 53 | inactive | tongue | | | active | lobate | talus, no veg |

| Amaris' ID code | activity - field | morphorphology - field | comments - field | | activity - air photo | morphorphology - air photo | comments - air photo |
|---|---|---|---|---|---|---|---|
| 54 | inactive | | lower is well-treed, upper slope of RG has meltwater/drainage channels (therefore inactive?), talus slope is veg'd too therefore likely inactive | | relict | lobate | talus, just scree?, no veg |
| 57 | inactive | | very wide, talus slope and just below are unveg'd, lower part is veg'd | | | | no RG visible in cirque |
| 60 | inactive | tongue | veg and meltwater channel to left of RG, can't see veg on upper part of RG, it is somewhat lumpy with more volume at the top than the bottom, lower part is vegetated, looks fairly flat and inactive despite lack of veg on upper | | active | tongue | cirque |
| 62 | active | | flat surface, talus above is veg'd - can it still be active? | | active | tongue | cirque |
| 63 | active | | quite lumpy, toe has a few trees on it and upper has low veg - can it still be active? | | active | lobate | talus |
| 70 | inactive | tongue | trees at toe, low veg on rest, surface ridges present but not pronounced | | relict | lobate | talus, vegd, just scree? |
| 74 | relict | tongue | | | relict | lobate | talus, just scree? |
| 954 | active | tongue | | | active | tongue | cirque |
| 959 | | tongue | is a scree slope | | active | tongue | cirque |
| 968 | | | | | active | lobate | talus |
| 987 | active | tongue | above White River RV park | | active | tongue | cirque, 2 coalescent RGs |
| 1131 | | lobate | not a RG, photos are of supposed location | | inactive | tongue | cirque |
| 1149 | active | tongue | this is a "debris-covered glacier" | | active | tongue | cirque, multilobe |
| 1150 | inactive/relict | upper = tongue, lower = lobate/fan-shaped | if this is a RG, it is inactive/relict, highly veg'd | | active | tongue | multicirque, multilobe |
| 1162 | | wide tongue | side profile, front looks steep-ish but is veg'd, upper talus unvegetated | | inactive | tongue | cirque |
| 1473 | | wide tongue | not a RG, it is a ridge running down the centre of a small cirque, there are bedrock outcrops on its surface | | | | no RG in cirque |
| 1511 | inactive/relict | wide tongue | inconclusive - can't see toe, bottom area is vegetated and doesn't have a pronounced front, could be inactive/relict rock glacier, possibly a landslide, but not an active rock glacier | | relict | lobate | talus, forested |
| 1512 | | lobate | landslide | | active | tongue | cirque |
| Beside KT | active | tongue | active upper, fully veg'd lower | | active | lobate | |
| CultusBay RG | inactive | lobate | upper slope (above where lower slope has been modified by the road) = 30, large platy schist, 3-300cm, avg - 50cm, well lichenized, well-developed soil on sides, trees on surface, possible collapse features on surface, waypoint taken on road surface, lobate-ish - very short, maybe 50m from front to back, road cuts straight across toe (no deformation and very little rock fall), toe ends in Kluane Lake, surface about 50-60m above lake surface | | relict | lobate | |

| Amaris' ID code | activity - field | morphorphology - field | comments - field |  | activity - air photo | morphorphology - air photo | comments - air photo |
|---|---|---|---|---|---|---|---|
| Dezadeash | active | tongue | upper part is active - bent over trees, no lichens, rocks with impact marks, elev = 831m, middle front = 7007m, old bottom front = 679m, road = 650m |  | active | both |  |
| HJ | active | tongue | vegetated front area, upper is unvegetated, highly ridged, and has a lot of volume |  | active | tongue | debris-covered glacier |
| HJ2 | active | tongue |  |  | active | tongue | debris-covered glacier |
| HJ3 | active | tongue |  |  | active | tongue | debris-covered glacier |
| HJ4 | active | tongue |  |  | active | tongue | debris-covered glacier |
| King's Throne | active | lobate | 2nd front from bottom elev = 817m, well-veg'd, 938m no more trees, top surface = 1251m |  | active | lobate |  |
| N of 4 | inactive | tongue | front is vegetated with low plants and trees so it is probably inactive, lots of rhizocarpon geographicum on front, this is a pebbly rock glacier with a platy matrix, possibly slate or shale; active, 2nd visit I said inactive because of veg |  | inactive | lobate |  |
| Neighbour to 5 | inactive/relict | tongue |  |  | active | lobate |  |
| NHJ1 | active | tongue |  |  | active | tongue | debris-covered glacier |
| NHJ2 | active | tongue |  |  | active | lobate |  |
| NHJ3 | active | lobate |  |  | active | lobate |  |
| NHJ4 | active | tongue |  |  | active | tongue |  |
| NHJ5 | inactive | lobate |  |  | active | tongue |  |
| Possible RG | relict | tongue | treed |  | active | lobate |  |
| S of 1508 | active | lobate | ridges on toe |  | active | tongue |  |
| Tomb Left | active | tongue | vegetated front with cracks (where movement has occurred?), cracks on sides and near top like a bergschrund, only upper talus is unveg'd, landslide-derived? |  | inactive | lobate |  |
| Tomb Right | active | lobate | shape due to topo? Veg on surface but not on front, crack at top like a bergschrund - active? Landslide-derived? |  | inactive | tongue |  |
| Unmked RG | active | lobate | upper part is active at least |  | active | lobate |  |