

## Chapter 3

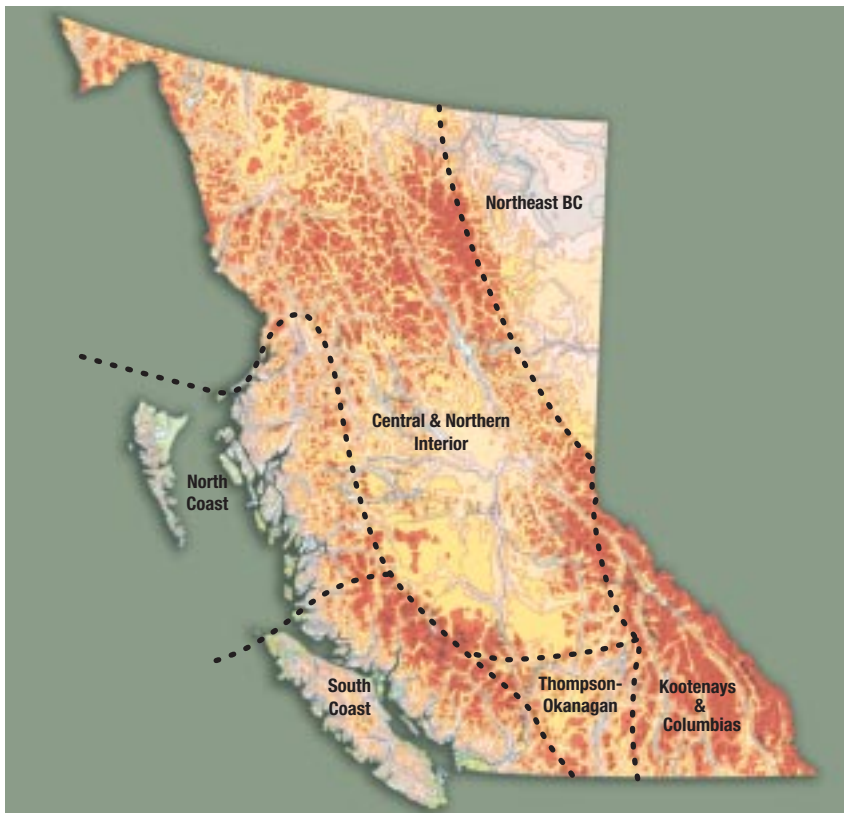
### Weather Patterns of British Columbia

#### Introduction

“Weather is what you get, climate is what you expect.”

Weather is what happens. Weather is also transitory, seldom lasting more than a matter of hours. Climate speaks to the weather history of a location, the how and why the weather varies between seemingly identical locations. Why is Abbotsford open when all other nearby airfields are closed in fog? What are the predominate winds at Penticton? Meteorologists use their knowledge of both weather and climate when producing forecasts. This constant conflict between “what you expect” and “what you get” is unending; it is a problem that becomes much more difficult when you have to take mountainous terrain into consideration.

#### Geography of British Columbia



Map 3-1 - Topography of GFA 31 Domain

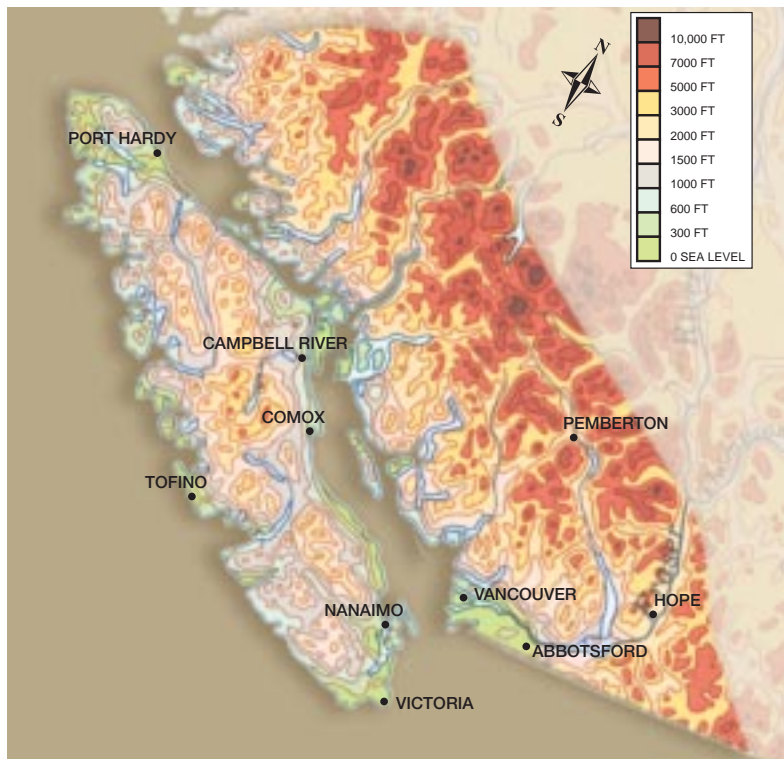
At first glimpse, British Columbia can quickly be divided into two distinctive areas; the coast and the interior. The coast of British Columbia, almost 500 miles in length, lies at mid-latitudes along the western boundary of North America. To the west of it lies the largest ocean in the world, the Pacific Ocean.

The ocean edge is itself dominated by the Coast Mountains that seem to rise right out of the sea. This range of mountains contains numerous valleys, some of which are flooded with water from the ocean resulting in a string of islands and coastal inlets.

On the leeward side of the Coastal Mountains lie the interior regions of British Columbia, a mixture of mountain ranges, deep valleys and plateau areas. The most prominent feature of the interior is the Rocky Mountains. These mountains extend out of the United States along the Alberta - British Columbia border to near Jasper, then continue northwestward to pass just to the west of Fort Nelson.

To the east of the northern Rocky Mountains lies Northeastern British Columbia. An extension to the Canadian Prairies, the terrain here is almost flat, rising steadily in elevation from the Alberta border until it reaches the Rocky Mountains.

**South Coast**



Map 3-2 - The South Coast

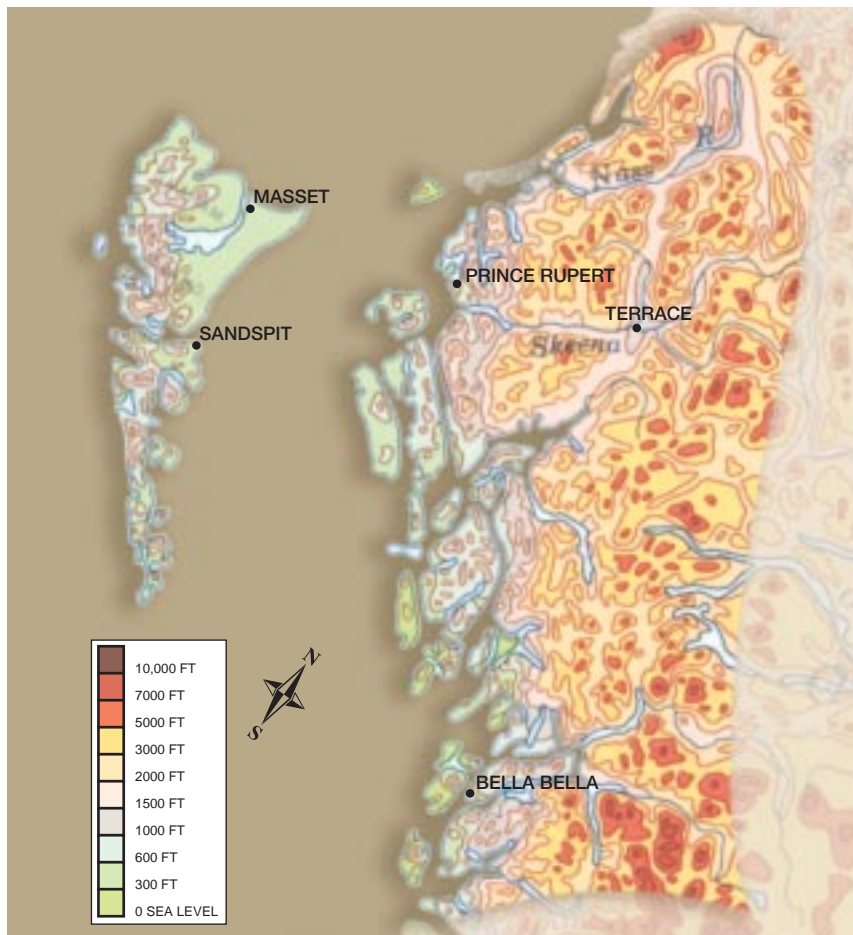
The South Coast runs for approximately 250 nautical miles from the Canada/United States border to just north of Vancouver Island. The general flow pattern is dominated by the westerlies which means that moist weather systems are spawned over the Pacific Ocean and carried into the coast.

The ocean also supplies heat which acts to moderate the temperatures along the coast, as compared to the inland areas. In turn, this moderation of temperature plays a significant role in determining just what type of precipitation will fall over the area. At the same time, the interaction of the warm air with the cold air “energizes” lows. During the winter, a typical low approaching the coast will begin to draw cold air down from the north. This causes the low to intensify resulting in rapidly falling pressures and strengthening winds.

Dividing the moist coastal environment from the dry environment of the interior are the Coast Mountains, which lie along the mainland coast and the Insular Mountains on Vancouver Island. These mountains have an average height of 6,000 to 7,000 feet ASL; however, just to the east of Campbell River the Coast Mountains rise to an average height of 10,000 feet. Along this barrier of rugged, tree covered slopes are numerous valleys, some dry, some flooded, of which the Fraser Valley is the largest and most significant.

Mountains impact significantly on the weather in this area. Storms approaching the coast are lifted rapidly along the windward slopes, resulting in widespread precipitation. Much of the heaviest precipitation occurs along the western slopes of the Insular Mountains and the Olympic Mountains of Northern Washington State (elevation 6,000 to 8,000 feet). The variability in annual precipitation between upslope areas and subsident “rain shadow” areas is significant. Tofino, on the west coast of Vancouver Island, receives an average of 3,000 millimetres of precipitation each year while Nanaimo, on the east coast of Vancouver Island, receives a paltry 1,150 millimetres. The Coast Mountains also serve as a barrier to the arctic air that occasionally moves into the interior so that only the strongest incursion can force its way through the various passes and valleys.

North Coast



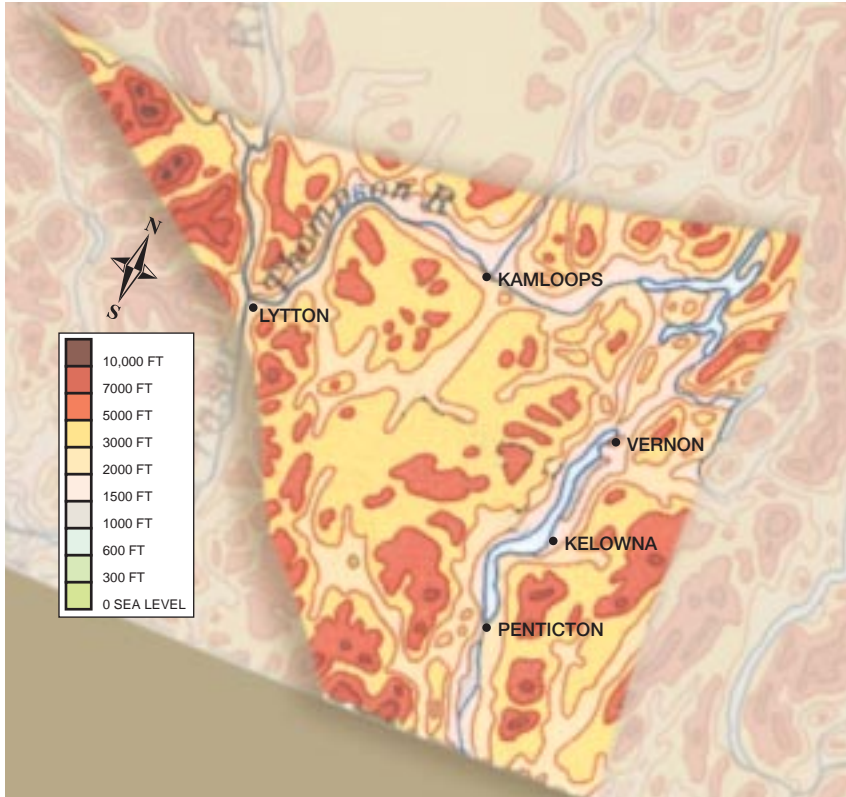
Map 3-3 - The North Coast

The North Coast is approximately 300 miles in length and extends in a north-northwest to south-southeast line from just north of Vancouver Island to Stewart. To the west of these mountains lie the Queen Charlotte Islands and the Pacific Ocean. In many ways the North Coast can be considered as a “nastier” version of the South Coast. Lacking the sheltering bulk of Vancouver Island, ocean storms can run right up onto the coast venting their full fury.

Along the coast runs the northern extension of the Coast Mountains, with a mean height of 6,500 feet ASL. These mountains are carved with numerous flooded valleys, resulting in a string of islands and coastal inlets. Sixty miles off the coast are the Queen Charlotte Islands whose Insular Mountains rise to an average height of 3,000 feet.

The heat from the ocean strongly moderates coastal temperatures; however, outflow winds through the inland valleys can easily carry cold air from the interior. During the winter this clash between warmer coastal air and cold air flowing out of the interior can make for extremely variable precipitation types.

### Thompson-Okanagan



Map 3-4 - Thompson-Okanagan

The Thompson-Okanagan extends from the Fraser Canyon in the west to the slopes of the Monashee Mountains in the east, and from the US/Canada border to and east-west line just to the north of Kamloops and Shuswap Lake. The topography consists of a mixture of mountains and valleys. The mountains are largely tree-covered with extensive cut blocks (areas that have been logged) that are in various stages of re-growth. The valley bottoms are dry except for rivers and lakes, and contain some of the largest population centres in the interior.

The weather in this area tends to be benign for the large part and is controlled to a great extent by the Coast Mountains. Sitting to the lee of these mountains, subsidence has reduced the precipitation so that much of the area is arid or semi-arid.

Annual precipitation ranges between 250 and 360 millimetres per year and tends to be divided up nearly equally between the various months.

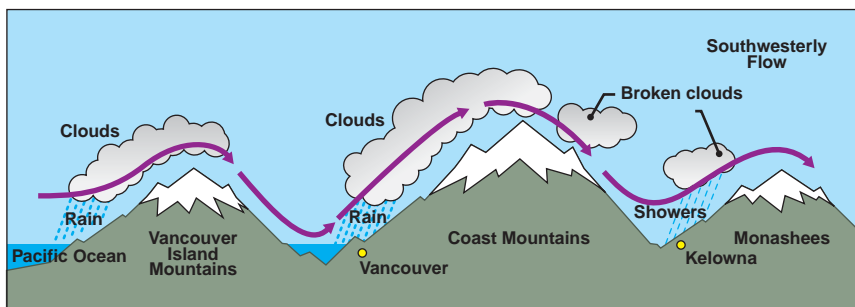


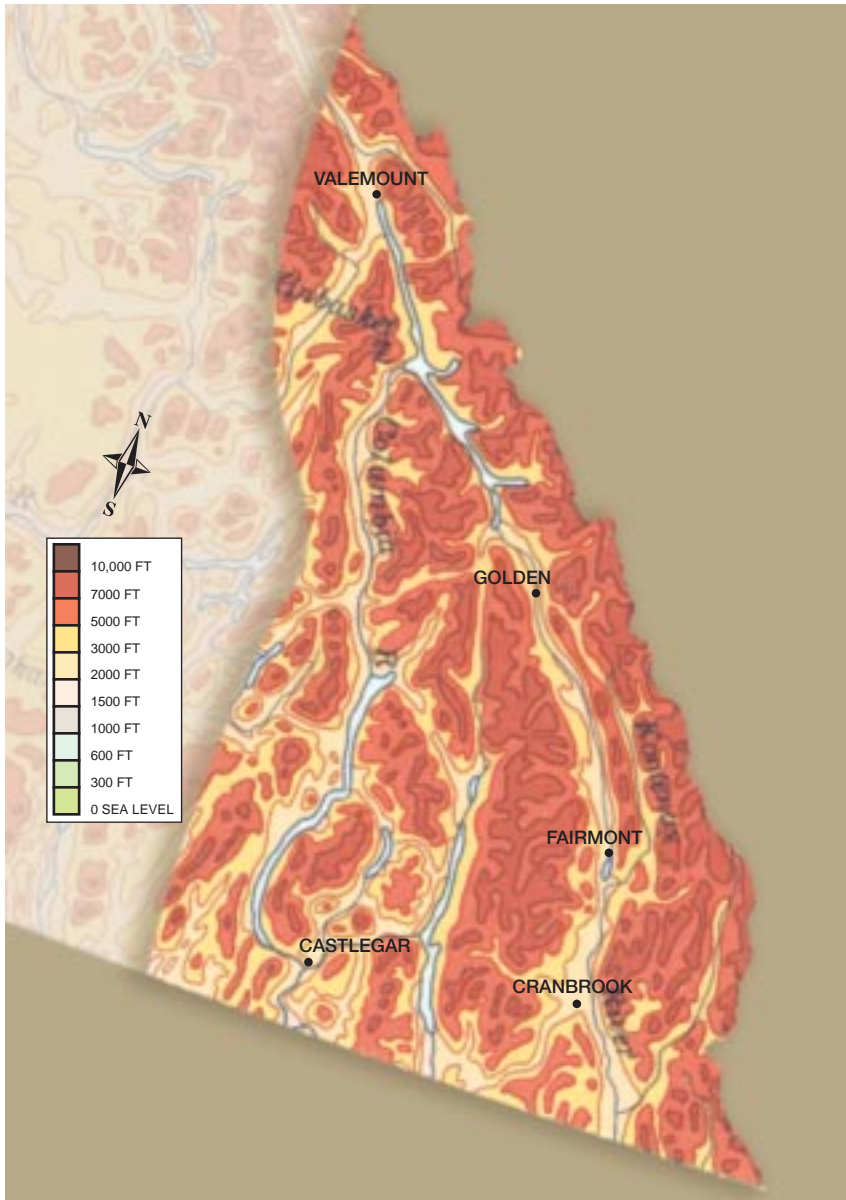
Fig. 3-1 - The most notable effect of mountains is their impact on precipitation

Summer in this area is noted for the incursion of the Pacific High and the development of hot and dry weather. The weather tends to be dry and sunny with late afternoon or evening thunderstorms occurring mainly along the ridges. Eventually, the Pacific High does break down and, when this happens, it is common for widespread thunderstorms to develop as cooler, moist air begins to move into the area.

Winters are a different story. Mountain valleys allow cold air to pool, creating inversions. Most of the valleys have rivers and lakes that seldom freeze up resulting in abundant moisture that the inversion can trap, supporting the development of low “valley cloud”. On the positive side, because of its location, only the strongest incursions of arctic air can force its way into this area. This being said, the temperatures in the area do tend to hover around freezing, and the cold surface layer can be difficult to remove, as the warm air moving in from the coast rides over the top of the cold air. The only real warming occurs with southerly winds, but this respite only lasts a few days as cold air is quick to re-establish itself in the valley bottoms.



## Kootenays and Columbias



Map 3-5 - The Kootenays and Columbias

The eastern and southeastern section of the interior consists of a mixture of mountain ranges and deep valleys. The mountains are largely tree-covered and the valleys narrow and steeply-sided. The valley bottoms contain rivers and lakes with little in the way of cleared areas other than around towns and forestry cuts.

The most prominent feature in this area is the Rocky Mountains. These mountains extend out of the United States along the Alberta - British Columbia border to Jasper then continue on in a northwesterly direction into the Yukon. Over the southern half of the province, the Rocky Mountains rise to average of 9,000 to 11,000 feet ASL.

To the west of the Rockies, the area is carved up by a series of other mountain ranges: the Monashees, the Selkirks, and the Purcells, with narrow valleys between them. Most of these valleys contain rivers or lakes, along with the population centres of various sizes.

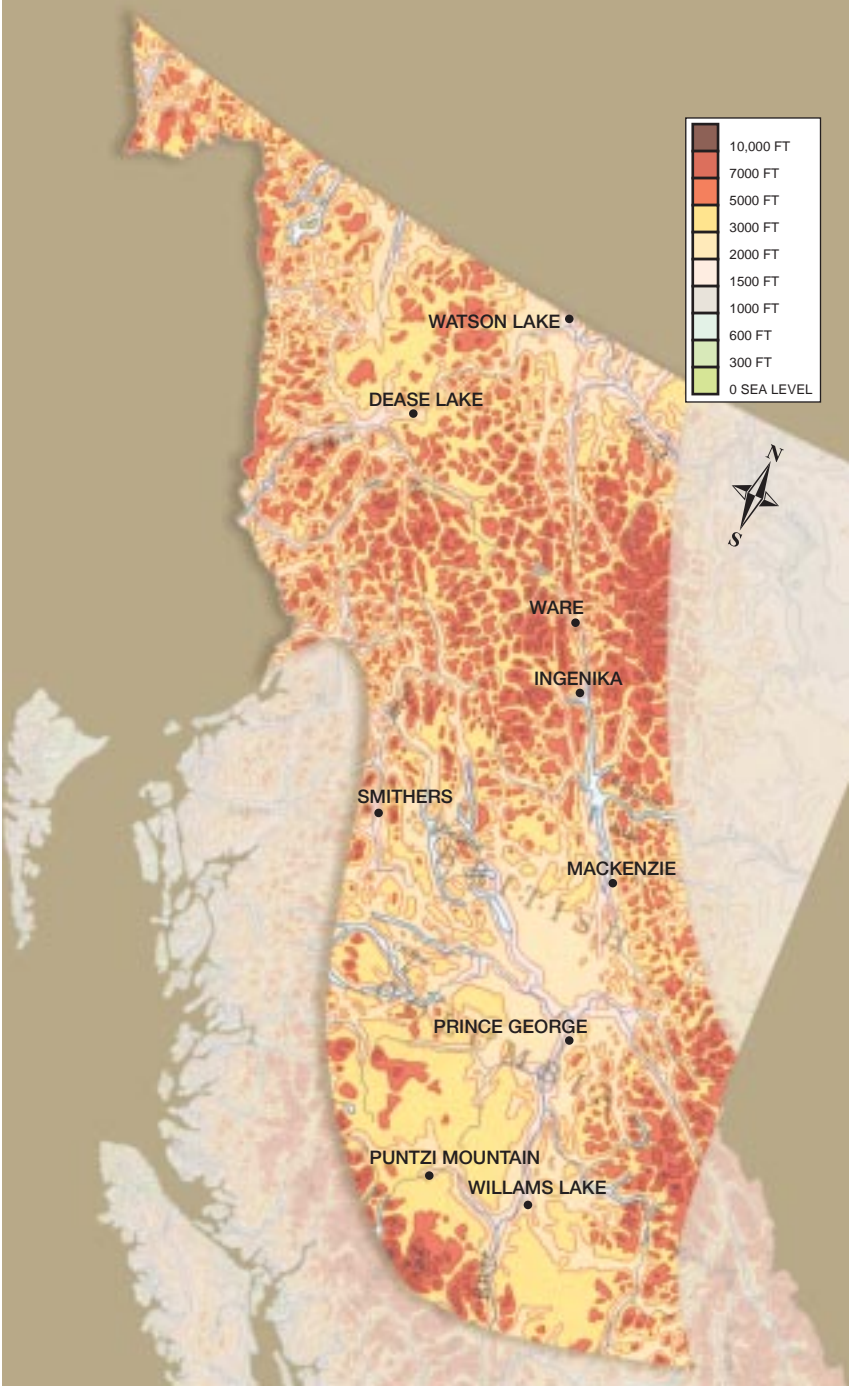
A prominent feature of British Columbia is the Rocky Mountain Trench. A broad gash in the terrain, the Trench begins in the south near Cranbrook and moves north-westward through Golden and Valemount, passes just to the east of Prince George, then continues north-northwestward.

The pronounced variation in terrain in the Interior has a strong influence on its climate. On the small scale, the changing topographical features such as elevation, orientation to the mean winds, slope, and exposure all combine to alter the local climate. Higher elevations tend to have lower average temperatures and increased precipitation. Low-lying areas, such as valleys, tend to allow cold air to drain into them, creating higher occurrences of frost and fog.

On the larger scale, the Rocky Mountains act as a barrier. All but the strongest incursions of Arctic air are held out of the southern British Columbia interior, maintaining temperatures much above those on the Prairies.



Central and Northern Interior



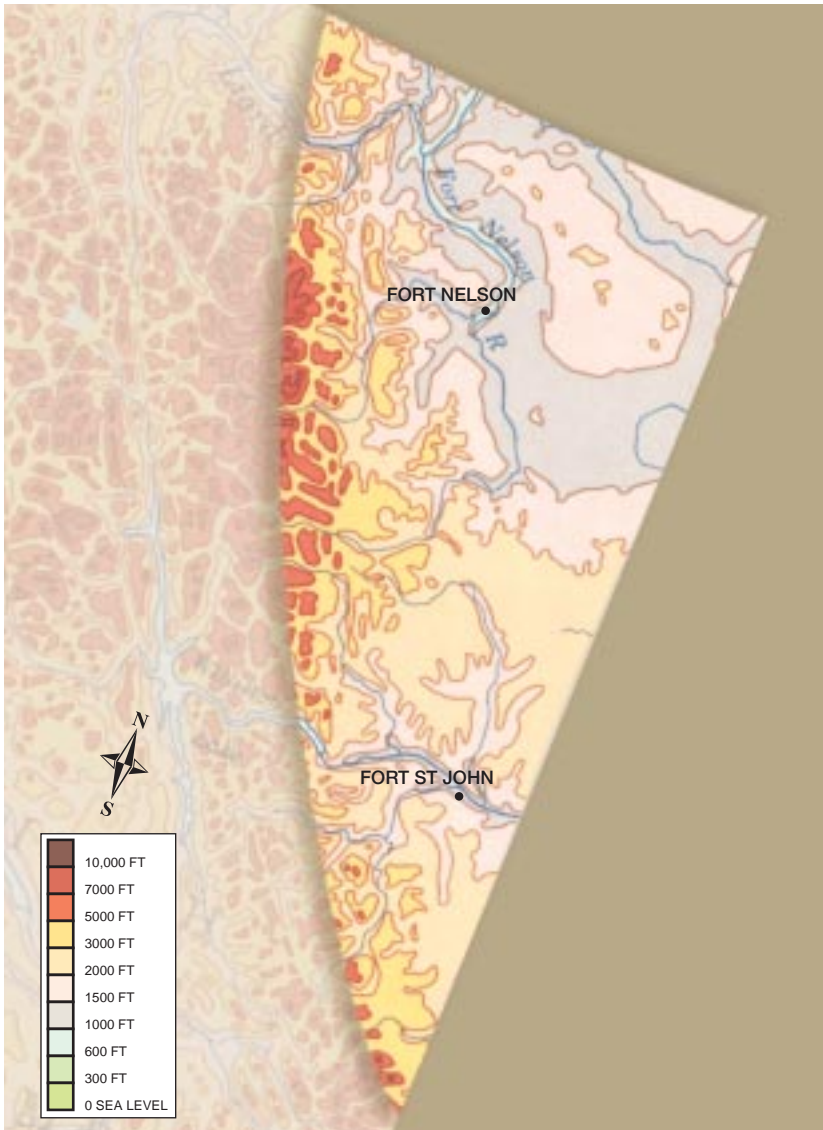
Map 3-6 - The Central and Northern Interior

The Central and Northern Interior, like the rest of BC, are largely mountainous; however, there are two major plateaux located in this area. These are the Central Interior Plateau, west of Williams Lake and Prince George, and the Atlin-Stikine Plateau, over northwestern British Columbia. Throughout the area are a series of rivers and lakes, some of which, such as Quesnel and Williston Lakes, are quite large.

The Rocky Mountain Trench is also prominent in this area. Beginning in the southeast interior, it passes just to the east of Prince George, forms Williston Lake, then narrows and continues northwestward towards Watson Lake in the Yukon.

The plateaux have a significant impact on the weather. During the summer, the flattened terrain can develop significant convection. Moderate to heavy thunderstorms are not uncommon and, on occasion, a tornado or funnel cloud will be reported in the Prince George area. Winter produces its own problems. The incursion of arctic air is fairly common and, this, coupled with moisture from local forestry mills, produces widespread and frequent low stratus and fog. Even when warm air does invade from the Pacific, it frequently flows over top of the cold air at low levels, making it difficult to erode the stratus and fog.

## Northeast British Columbia



Map 3-7 - Northeast British Columbia

The western boundary of this area is marked by the Rocky Mountains that lie in a north-northwest to south-southeast line from Jasper to just west of Fort Nelson and then into the Yukon. While not as high as the southern part of the Rockies, they still rise to a respectable average height of 7,000 feet ASL. To the east of the Rockies is an extension to the Canadian Prairies; the terrain here is almost flat, rising steadily in elevation from the Alberta border until it reaches the Rocky Mountains.

The climate here is more like that of Alberta than the remainder of British Columbia. The summer tends to be hot and convective. The occasional cold low does move across the area; however, giving widespread precipitation and cloudy, cool conditions. Winter is cold as arctic air dominates. Warm air moving eastward overtop the cold air will give snow but does little to moderate the temperature. Despite this, a strong southwesterly flow will produce Chinook conditions that drive temperatures, in such places as Fort St. John, above freezing.

**Mean Upper Atmospheric Circulation**

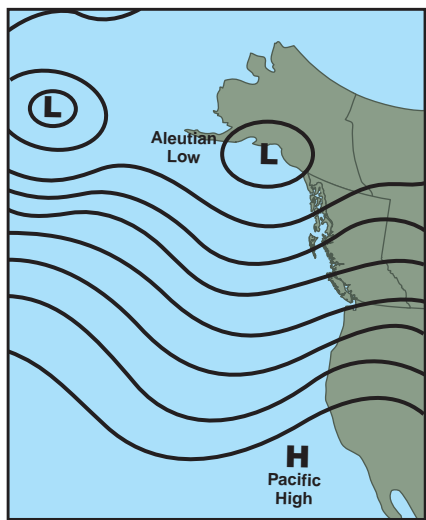


Fig. 3-2 - Typical winter pattern

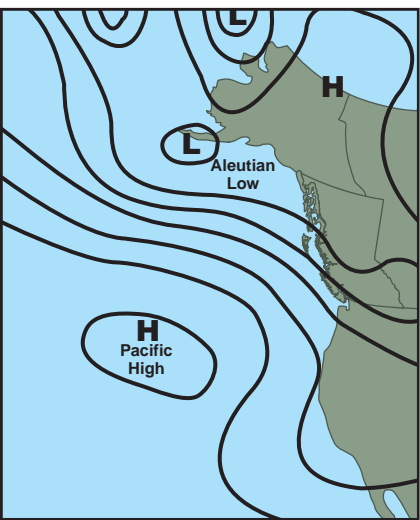


Fig. 3-3 - Typical summer pattern

The mean circulation of the upper level winds over British Columbia is the result of two semi-permanent features. The “Pacific High” extends from the area east of Hawaii to the West Coast of the United States. The “Aleutian Low” occurs in the Gulf of Alaska and over the Aleutian Islands. The combination of the counterclockwise circulation around the Aleutian Low and the clockwise circulation around the Pacific High results in a mean westerly flow onto the west coast of North America.

The Aleutian Low is strongest in the winter, which causes the mean circulation to take on a southwesterly component, while the Pacific High is strongest in the summer causing a more northwesterly flow. Complicating this simple relationship are the upper troughs of low pressure, upper ridges of high pressure and other weather systems that move along with the upper winds, altering or disrupting the normal pattern.

## Upper Troughs and Upper Ridges

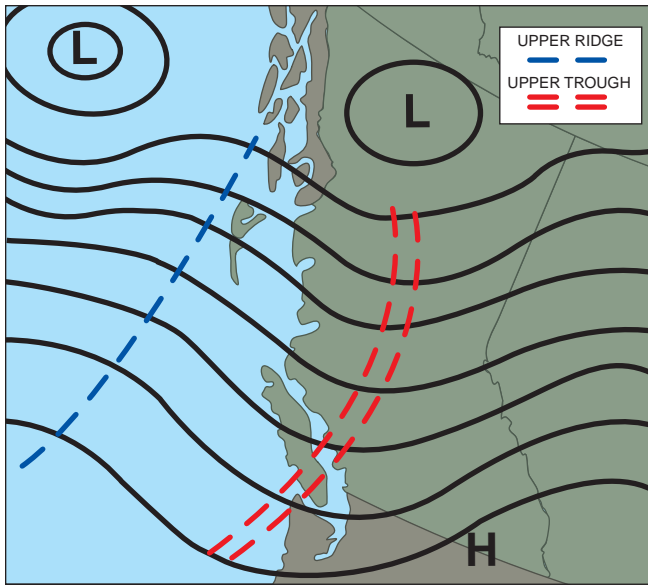


Fig.3-4 - Typical winter pattern with upper troughs and ridges added

Although the mean upper flow is generally from west to east, there tends to be a series of upper troughs and ridges embedded within this flow. Upper troughs induce vertical lift in the atmosphere, which in turn is associated with cloud and precipitation. In the winter, these troughs are at their strongest and frequently create broad areas of cloud with widespread precipitation. This process can be further enhanced if an orographic feature lifts the air mass at the same time. During the summer months, the cloud shields associated with upper troughs are narrower and usually quite convective in nature. The vertical lift and upper level cooling produced by the trough will intensify any preexisting instability in the atmosphere, and some of the worst summertime thunderstorms are produced when such a trough moves over a region that has already been destabilized by daytime heating. If an upper trough crosses an area where strong baroclinicity (temperature gradient) exists, it can set off a chain of events that results in the development of a surface low pressure system and/or frontal wave. These will further enhance the cloud and precipitation. Clearing behind an upper trough can be gradual in the winter, but tends to be quite rapid in the summer.

Any surface pressure system associated with an upper trough moving eastward across British Columbia often fills (weakens) as the system encounters the mountainous terrain.

Upper ridges, on the other hand, are associated with clear skies and good weather as they induce regions of descent within the atmosphere. It is common, both in the

summer and winter, to have a large north-south upper ridge sitting over British Columbia. This pattern is frequently stationary for days in a row.

Both the upper trough and the upper ridge interact with the Pacific High and the Aleutian Low. An upper ridge will strengthen the Pacific High and weaken the Aleutian Low. This tends to dissipate or divert cloud northwards away from the British Columbia coast and into Alaska, or across the Yukon. An upper trough will cause the Aleutian Low to deepen and the Pacific High to weaken, so that weather systems will follow a general westerly track over the Gulf of Alaska and into British Columbia.

**Semi-Permanent Surface Features:**

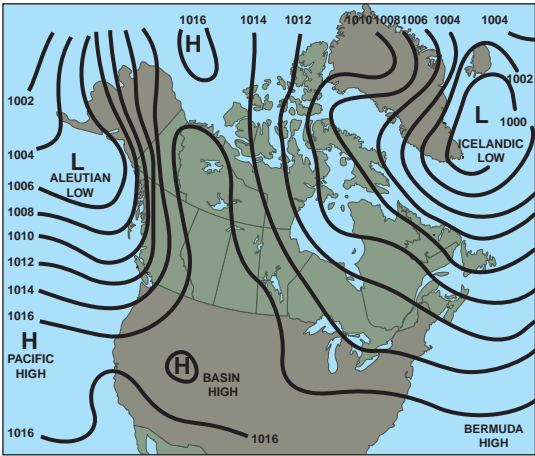


Fig. 3-5 - January mean sea level pressure

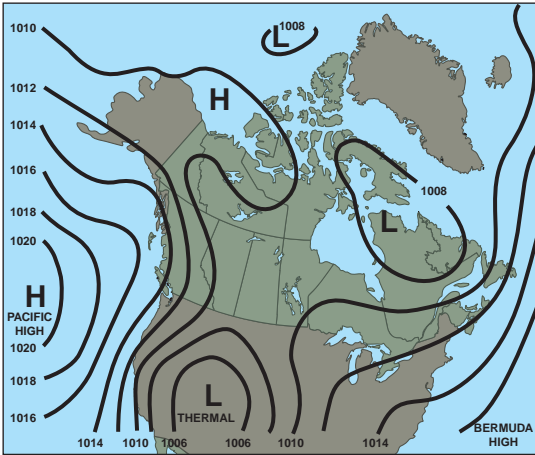


Fig. 3-6 - July mean sea level pressure



There is a tendency for the flow of the atmosphere to conform to certain recurring patterns, partly due to the physical geography of the earth below. In particular, there are four large scale and semi-permanent pressure systems affecting Canadian weather. These features are named for the regions where they normally occur:

1. The Icelandic Low located over the north Atlantic near Iceland.
2. The Aleutian Low located south or southwest of Alaska.
3. The Subtropical High located in the Atlantic near the island of Bermuda.
4. The Pacific High located off the west coast of the United States, sometimes extending inland in the winter forming the so-called “Basin High”.

The January mean sea level surface pressure chart shows that the Aleutian low is well out in the Pacific and the Icelandic low is southeast of Greenland. A ridge of high pressure extends from the southwest U.S.A. northwards across Alberta into the Mackenzie River Valley. As the year advances towards summer, both the Aleutian and Icelandic Lows weaken. The July mean sea level surface pressure chart shows that the Pacific High becomes established off the west coast of North America. At the same time, a thermal low forms over the American southwest and extends a trough into the Pacific Northwest. These influences act together to put BC under a weaker, less predictable flow during the summer months.

## **Migratory Weather Systems**

Closer to the surface are the migratory or traveling surface weather systems (low pressure areas, high pressure areas, frontal systems) that are carried into British Columbia and produce the day-to-day weather. These travelling surface weather systems vary in intensity with the seasons and are more frequent in the winter months (Oct. to Apr.). On average, 10 to 15 such storms will occur monthly during the winter.

## **Winter Storms**

During the winter, low-pressure systems develop over the Pacific Ocean and move toward the coast. Most of these storms are either Gulf of Alaska lows, which tend to remain well offshore, or coastal lows which approach the coast before developing rapidly. Coastal lows, while not as powerful as the Gulf of Alaska low, can be quite dramatic in terms of their development and speed of movement.

On a few occasions during the winter, a low will combine the characteristics of both the Gulf of Alaska low and the coastal low. In this situation, the low first moves into the Gulf of Alaska and begins to weaken. The front sweeps over the coast giving strong winds and widespread precipitation, especially along windward slopes. After a time the low, which now sits over the Gulf of Alaska, begins to drift southeastward toward the British Columbia coast and strengthens once again.

The map shows the average tracks that the different types of lows usually follow. The actual track of any individual storm can vary somewhat from those shown.

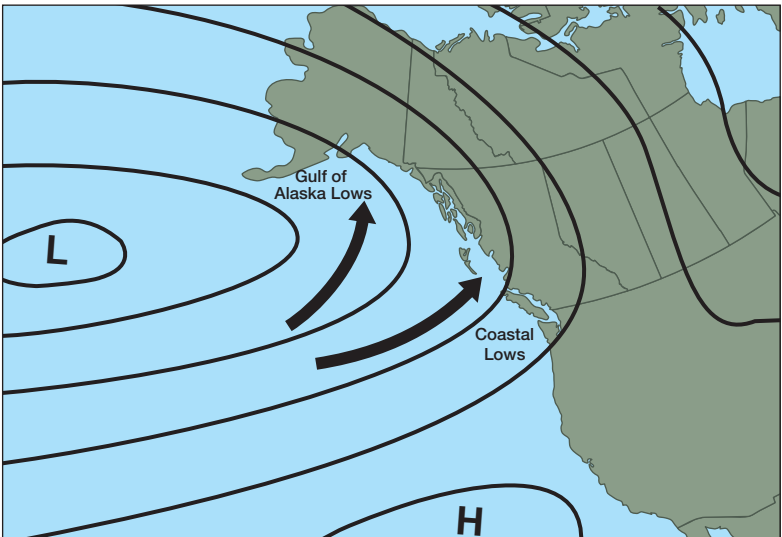


Fig. 3-7 - Principal winter storm tracks are superimposed on a January mean sea-level pressure pattern

### Gulf of Alaska Lows

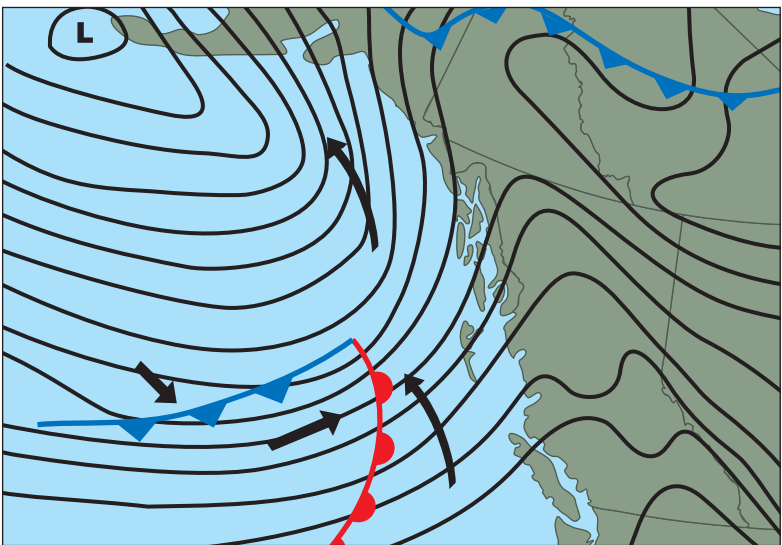


Fig. 3-8 - This sea-level pressure pattern indicates a Gulf of Alaska low with the associated frontal system approaching the B.C. coast

A Gulf of Alaska low usually forms south of the Aleutians as a frontal wave between the cold northern air and warmer air to the south. Such a wave may travel a

considerable distance eastward before it begins to take shape as a low pressure system. Once the low starts to develop, pressures fall rapidly and the entire low pressure system increases in size.

The low, travelling eastwards at typically 35 to 40 knots, reaches its lowest central pressure (970 hPa or lower) over the Gulf of Alaska then turns northeastward toward the northern end of the Alaskan Panhandle. The frontal system that accompanies the low continues eastward onto the coast, bringing widespread cloud, precipitation, and strong winds. Behind the cold front, a period of strong northwesterly winds of 35 to 50 knots heralds the arrival of a colder, unstable airmass.

## Coastal Lows

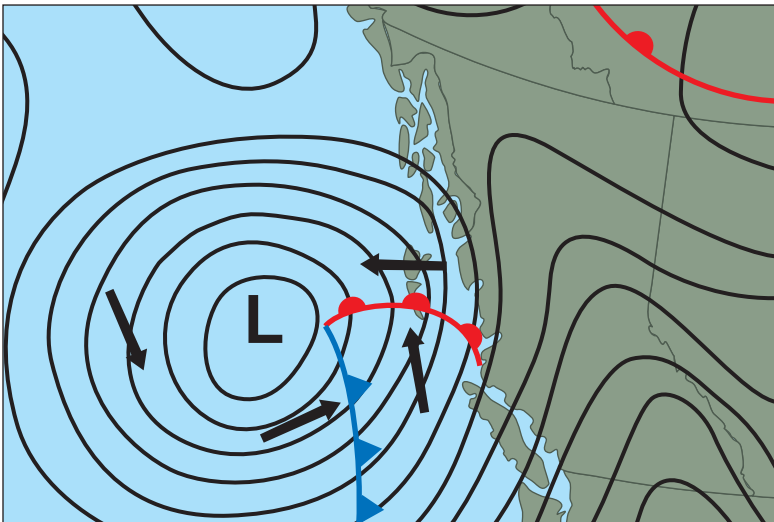


Fig. 3-9 - A typical sea-level pressure pattern for a coastal low and associated frontal system with wind pattern superimposed

Coastal lows usually intensify very rapidly just before they move over the British Columbia coastal waters and can change from a very weak system into a severe storm in as little as 9 hours. Lows which do develop in such a rapid, or explosive manner, are referred to by the forecasters as “bombs.” On the coast, very strong winds will occur usually to the east and southeast of the low, just ahead of the associated frontal system. Winds here may reach southeasterly 70 knots with gusts to 100 knots in the most severe storms. Often, a second band of strong winds occur behind the cold front in the area to the southwest of the low pressure centre. Here, winds may range up to 65 knots from the west or northwest. Once the low moves ashore, it will fill rapidly over the Coast Mountains and frequently dissipate before penetrating very far into the interior. On occasion, the low will be able to draw down cold air from the north and maintain its intensity. This results in a strong wind event for the interior.

The coastal lows often move through Queen Charlotte Sound or over the Queen Charlotte Islands. Occasionally, a low will move eastward, passing just south of Vancouver Island. The lows which follow this southern track can bring the strongest winds and heavy rains to the Vancouver and Victoria areas.

### Winter Frontal Systems

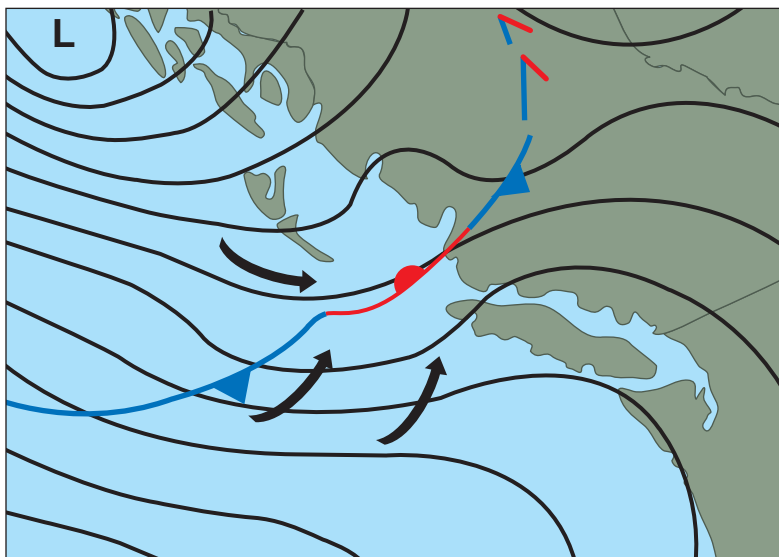


Fig. 3-10 - A typical winter pressure pattern shows a front crossing the coast with an indication of the winds near the front

While low pressure systems either die along the Coastal Mountains, or curl northward into the Gulf of Alaska, the associated frontal systems will push across the coast and inland. The favourite track takes the frontal wave across central British Columbia, with the trailing cold front sliding southward across the South Coast and Southern Interior of British Columbia. An occluded front usually extends northward from the frontal wave and moves across northern British Columbia.

As the front moves inland, it tends to weaken due to subsidence to the lee of the Coastal Mountains but still gives steady or intermittent precipitation that will vary with the local temperatures

### Winter High Pressure Systems

Surface high pressure systems are stronger in the winter than in the summer. Along the coast, it is the ridges of high pressure that provide the only break between active weather systems. As the ridge of high pressure approaches the coast, the higher level clouds dissipate and the lower cloud layer break-up, leaving scattered to broken cumulus cloud as the developing surface ridge will cap the deep convection.

In the Southern Interior, areas of high pressure have a lesser impact because of the widespread valley cloud. Cold air stagnating in the bottom of the valleys causes a strong low level inversion to form, which traps any moisture from local sources. Under this inversion, valley cloud will form and show a great reluctance to clear. Higher elevations; however, will be clear and cold.

The northern half of British Columbia is subject to valley cloud only during the early part of the season, as the lakes and rivers generally freeze over completely. Thus, ridges of high pressure during mid and late winter bring widespread clear, cold weather.

### Arctic Outbreaks

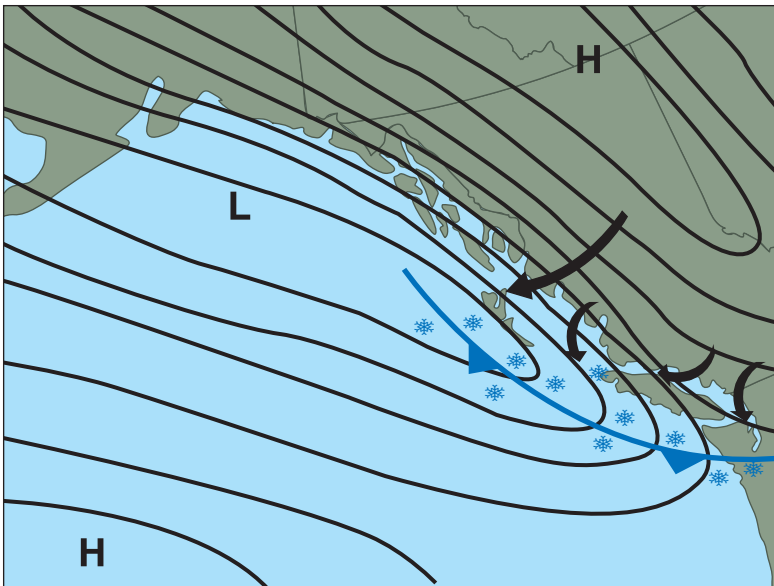


Fig. 3-11 - A ridge of high pressure builds over the province as the cold, arctic air flows into the interior. This pushes the cold front out onto the coast. Strong outflow winds occur through the mainland inlets and near the mouth of the inlets.

During winter, a strong area of high pressure forms in the very cold air over Alaska, the Yukon and the northern end of the Mackenzie River Valley. This cold arctic air moves southeastwards into the Prairies but can also spread over northern and central British Columbia. Most often, the arctic air pushes southward into the Central Interior before coming to rest. At the same time, arctic air also flows through the mountain passes from Alberta and fills the Rocky Mountain Trench. At least once or twice each year, the advance of arctic air is so strong that it spreads into the Southern Interior.

# **Outflow**

If the cold air deepens sufficiently over the interior of British Columbia, it can flow through the coastal mountain passes down the coastal inlets, and cascade out over the coastal waters far enough to cover the Queen Charlottes and Vancouver Island. This condition of cold air spilling through the coastal inlets is referred to as “outflow” and it can persist for days. Outflow is a common occurrence over the North and Central Coast areas of British Columbia and infrequent over the South Coast.



Fig. 3-12 - Strong winds funnel down the main-land inlets often reaching speeds up to 60 knots

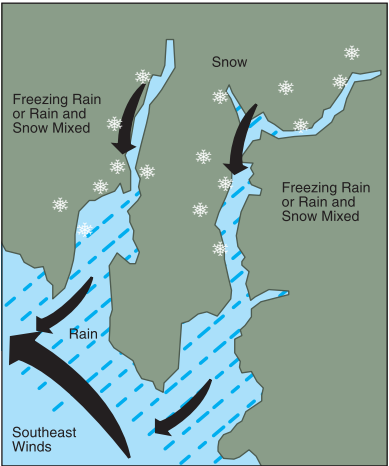


Fig. 3-13 - The end of an arctic outbreak occurs when the cold air is forced back inland by the arrival of warmer air being driven ahead of a Pacific storm

# **Inflow**

The end of an arctic outbreak occurs when the cold air is forced back inland by the arrival of warmer air being driven ahead of a Pacific storm. As the low approaches pressure will begin to fall over the interior. In response to this pressure fall, the out-flow winds will gradually ease as the southeast winds strengthen along the coast. Eventually, the pressure falls will induce an inflow of warm air. During this transition time, from cold outflow to warm inflow, precipitation forecasting becomes very difficult. Snow changes to rain but not without the chance of freezing rain.

When a frontal system moves across the coast the rising pressures over the offshore waters induce an inflow wind through the coastal inlets. This inflow carries the post-frontal low cloud into the inlets effectively plugging them in a manner similar to marine stratus. This cloud will dissipate as drying occurs but, for a period of time, the inlet is impassable. This inflow effect occurs year-round.



## Summer Weather

In the summer months (May to September) the frequency and severity of the storms are much reduced. Low pressure areas usually remain offshore as the Pacific High strengthens and moves further north. This northward shift causes the main storm track to shift into the northern Gulf of Alaska and across northern British Columbia. South of this track, minor frontal systems, upper troughs and thunderstorms produce most of the weather. In August and September, weeks can pass between weather systems.

### Summer fronts

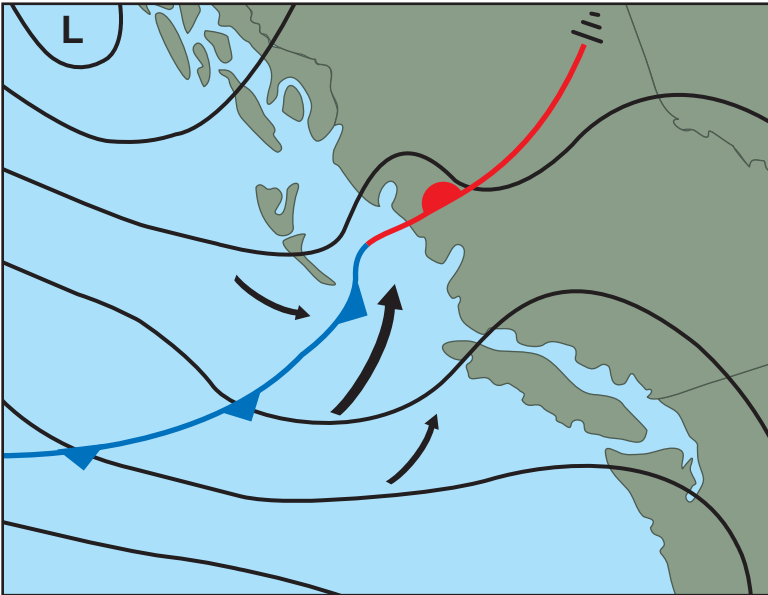


Fig. 3-14 - A typical summer pressure pattern shows a front crossing the coast with an indication of the winds near the front

During the summer months, fronts tend to approach the coast from the northwest across the Gulf of Alaska. Over the northern coastal areas, the front is usually accompanied by a narrow band of cloud and light rainfall. Southeast winds will tend to increase along the coast just ahead of the front, then shift into the northwest with its passage. As the front continues southward and presses further into the Pacific High, the rain area often disappears and the clouds begin to dissipate.

As the front moves inland, it is weakened by subsidence to the lee of the Coast Mountains.

## Thermal Troughs

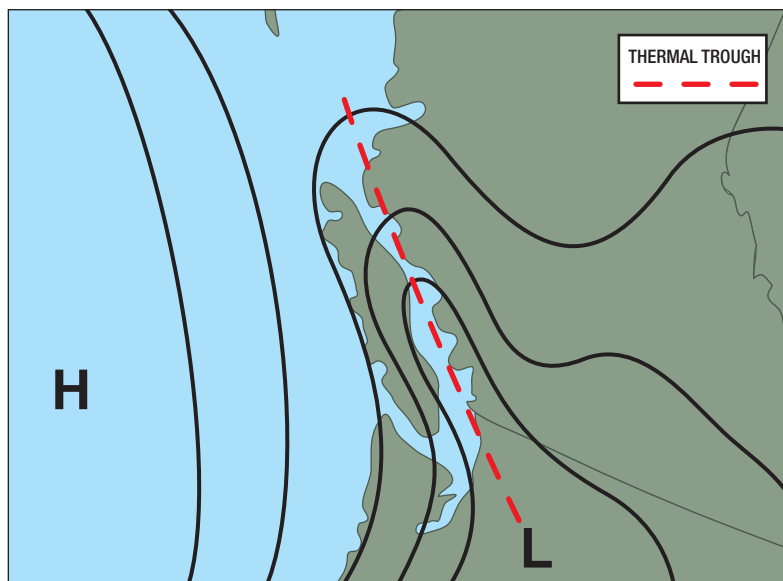


Fig. 3-15 - Thermal trough

The usual summer pressure pattern has a high pressure area over the eastern Pacific and troughs of low pressure in the southern interior of BC. This trough forms due to prolonged heating and is referred to as a thermal trough. The effect of this trough is to create a light, disorganized wind pattern as air flows toward the hottest locations. Along the coast, light winds in the morning are replaced by strengthening inflow winds during the afternoon and evening in most inlets and valleys, as the cool coastal air is drawn towards the interior. Locations in BC with marked inflow winds are the Strait of Juan de Fuca, Portland Inlet, Howe Sound, through the Hope area and up the Fraser Canyon.

On occasion, during the summer the thermal trough will move out from the interior and onto the coast. When it does, it normally lies over Georgia Strait causing subsident outflow winds from the interior which gives clear skies and light winds along the coast.

After a few days, the thermal trough will shift back into the interior causing westerly winds of 20 to 30 knots through Juan de Fuca Strait and into southern Georgia Strait. Sea fog and stratus will accompany these winds and may extend as far as Vancouver Airport and Boundary Bay. In the strongest cases, the fog will lift into stratus and spread up the Fraser Valley to Hope.

## Cold Lows

A cold low is a large, nearly circular area of the atmosphere in which temperatures get colder toward the centre of the low, both at the surface and aloft. While a surface low pressure centre is usually present beneath the cold low, its true character is most evident on upper charts. The significance of cold lows is that they produce large areas of cloud and precipitation, tend to persist in one location for prolonged periods of time and are difficult to predict.

Cold lows can occur at any time of the year, but the most frequent occurrence, known as “cold low season,” is from the end of May to mid-July. At this time, pools of cold air break away from the Aleutian Low and move southeastwards to take up a nearly stationary position off the British Columbia or Washington coast. Once established, the cold low will generate a series of upper cold fronts which will rotate across southern British Columbia. The overall effect is to produce a widespread area of cool, unstable air in which bands of cloud, showers and thundershowers occur. Along the deformation zone to the northeast of the cold low, the enhanced vertical lift will thicken the cloud cover and can produce widespread precipitation. In many cases, the deformation zone is where widespread and prolonged thunderstorm activity occurs.

Eventually, a strong system will approach from the west and will have sufficient strength to force the cold low inland, usually in the form of a strong upper trough. A favourite track is across the northern United States, but alternate tracks are across southern British Columbia or even northeastward along a line from Seattle to Fort St. John. As it crosses the area, widespread cloud, showers, thundershowers, or even steady rain can occur for a period of 24 to 48 hours. Normally, while the original cold low is moving off, the next one is already moving across the Gulf of Alaska on its way to take up residence off the coast.

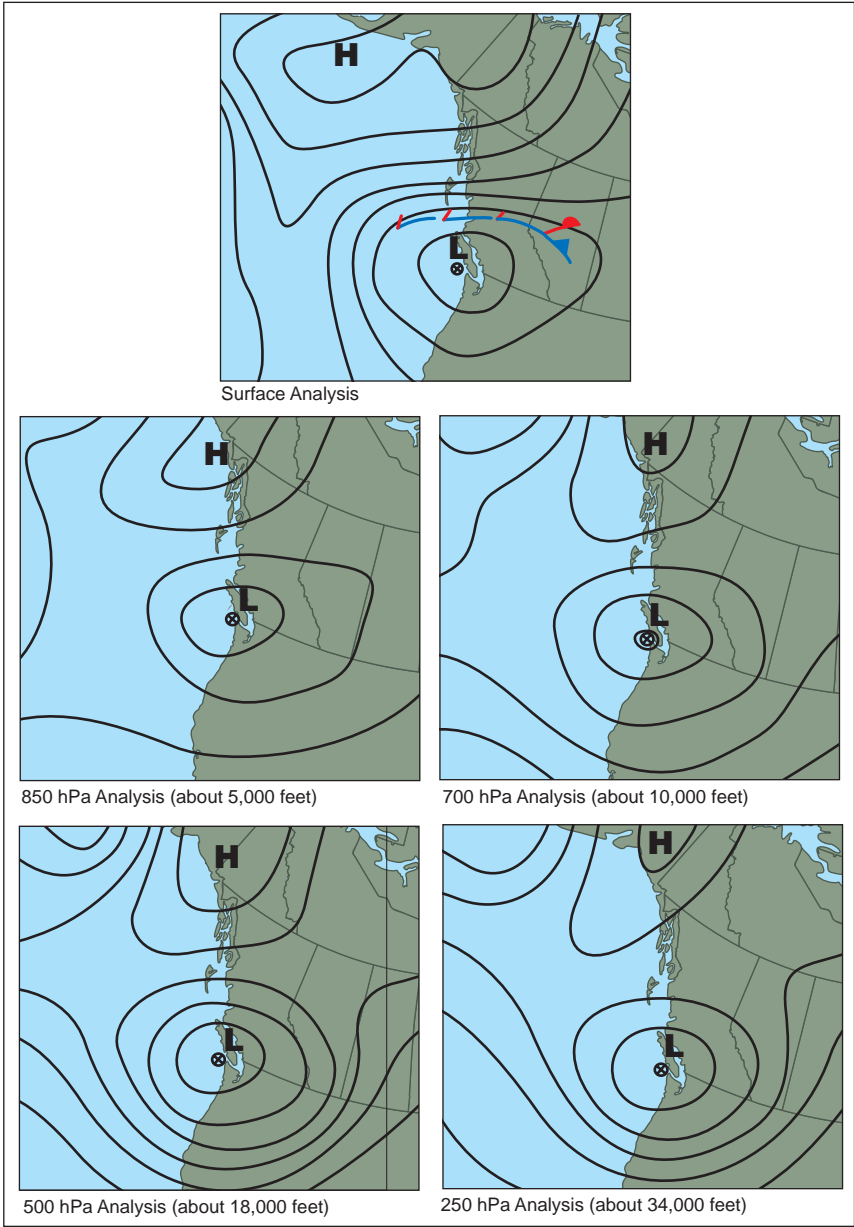


Fig. 3-16 - Typical surface and upper level pattern for a cold low event

Notes:

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**Table 3: Symbols Used in this Manual**

	<p><b>Fog symbol (3 horizontal lines)</b></p> <p>This standard symbol for fog indicates areas where fog is frequently observed.</p>
	<p><b>Cloud areas and cloud edges</b></p> <p>Scalloped lines show areas where low cloud (preventing VFR flying) is known to occur frequently. In many cases, this hazard may not be detected at any nearby airports.</p>
	<p><b>Icing symbol (2 vertical lines through a half circle)</b></p> <p>This standard symbol for icing indicate areas where significant icing is relatively common.</p>
	<p><b>Choppy water symbol (symbol with two wavelike points)</b></p> <p>For float plane operation, this symbol is used to denote areas where winds and significant waves can make landings and takeoffs dangerous or impossible.</p>
	<p><b>Turbulence symbol</b></p> <p>This standard symbol for turbulence is also used to indicate areas known for significant windshear, as well as potentially hazardous downdrafts.</p>
	<p><b>Strong wind symbol (straight arrow)</b></p> <p>This arrow is used to show areas prone to very strong winds and also indicates the typical direction of these winds. Where these winds encounter changing topography (hills, valley bends, coastlines, islands), turbulence, although not always indicated, can be expected.</p>
	<p><b>Funnelling / Channelling symbol (narrowing arrow)</b></p> <p>This symbol is similar to the strong wind symbol except that the winds are constricted or channeled by topography. In this case, winds in the narrow portion could be very strong while surrounding locations receive much lighter winds.</p>
	<p><b>Snow symbol (asterisk)</b></p> <p>This standard symbol for snow shows areas prone to very heavy snowfall.</p>
	<p><b>Thunderstorm symbol (half circle with anvil top)</b></p> <p>This standard symbol for cumulonimbus (CB) cloud is used to denote areas prone to thunderstorm activity.</p>
	<p><b>Mill symbol (smokestack)</b></p> <p>This symbol shows areas where major industrial activity can impact on aviation weather. The industrial activity usually results in more frequent low cloud and fog.</p>
	<p><b>Mountain pass symbol (side-by-side arcs)</b></p> <p>This symbol is used on aviation charts to indicate mountain passes, the highest point along a route. Although not a weather phenomenon, many passes are shown as they are often prone to hazardous aviation weather.</p>