

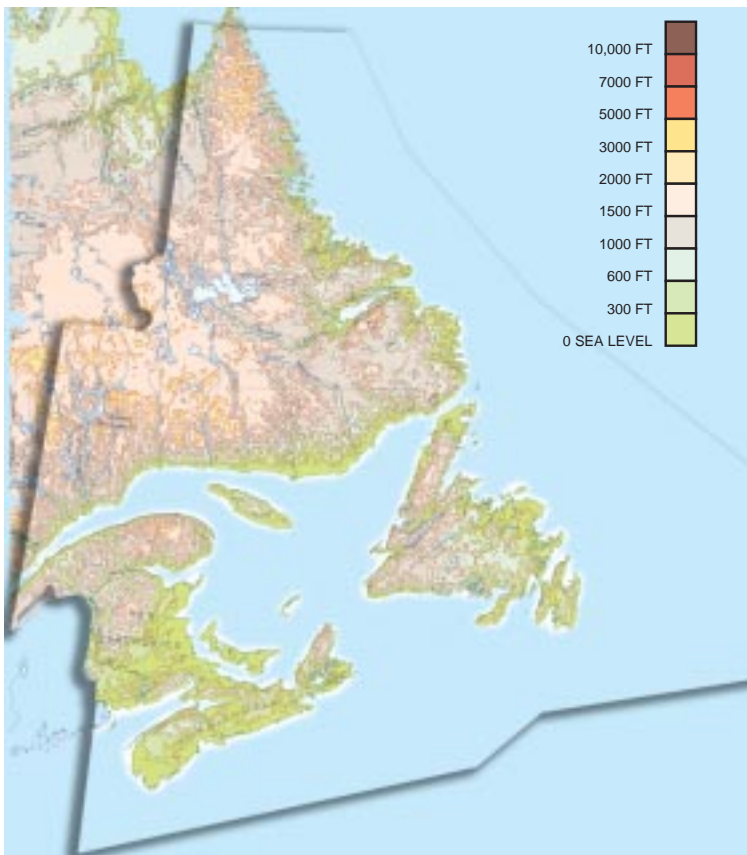
Chapter 3

Weather Patterns

Introduction

“Weather is what you get; climate is what you expect.” – (anon.)

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. It is how and why the weather varies between seemingly identical locations. Why is Stephenville open when all other airfields in Newfoundland are closed in fog and drizzle? What are the predominant winds at Halifax? 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 elevated terrain and large bodies of water into account.



Map 3-1 - Topography of GFA CN 34 Domain

Geography

Maritimes



Map 3-2 - New Brunswick, Nova Scotia and Prince Edward Island

The climatology of the Maritimes is highly dependent on the physical geography of a particular location and the presence of the Atlantic Ocean. Since no place in the Maritimes is farther than 100 n. miles from the coast, it is obvious that this region is highly influenced by the water.

The coastline of the Bay of Fundy is somewhat irregular and characterized by mountains on both the New Brunswick and the Nova Scotia sides of the bay. The highest elevations (as high as 1,400 feet) are found on the New Brunswick side with somewhat lower elevations over the Cobequid Mountains and the North and South Mountains. The Bay of Fundy has a strong influence on the flying weather in this region due to its relatively cold temperatures in the summer and comparatively warm temperatures in the winter. High tides averaging near 30 feet occur in the Minas Basin and the highest tide in the world was registered here at nearly 53 feet. These enormous tidal ranges cause the bay to be flushed out daily and prevent the water from being either heated or cooled significantly.

The remainder of Nova Scotia has many coastal bays and inlets, some of which extend far inland. The undulating to rolling coastal landscape rises from sea level to the Cobequid Mountains, which run generally in an east-northeast to west-southwest direction through the northern part of the province. The average height of these mountains is 700 to 1,000 feet.

Cape Breton Island, located at the southern edge of the Gulf of St. Lawrence, oriented along a general northeast to southwest line, is divided into two main sections by Bras d'Or Lake and St. Andrews Channel. The Cape Breton Highlands to the north rise to an average height of 1,000 to 1,500 feet with the highest peak being 1,748 feet in the Cape Breton Highlands National Park. Over the southern portion of the island, the hills west of Sydney range from 800 to 1,100 feet with the terrain gradually sloping towards the Atlantic Ocean.

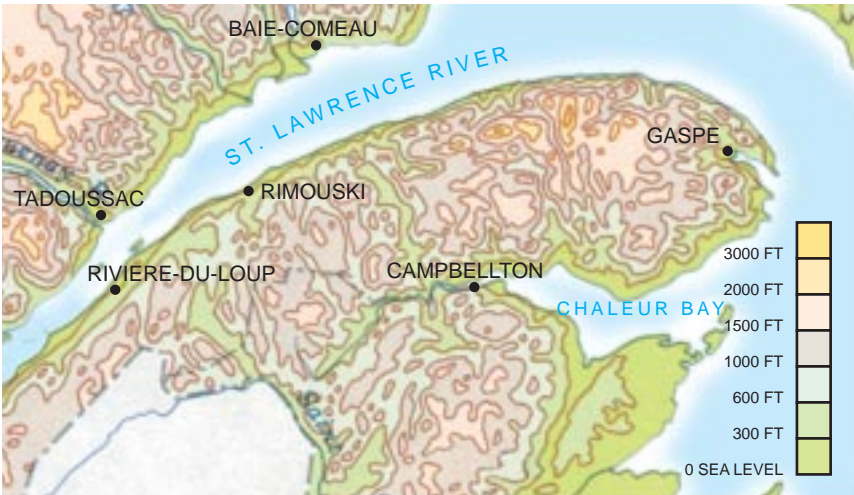
The eastern coastline of New Brunswick is fairly uniform and exhibits a gentle rise towards the west, although there are some cliffs along Chaleur Bay. Over the Acadian Peninsula the terrain gently slopes upward towards the west to an elevation of about 600 feet. Along the coast from Bathurst to Campbellton, however, the terrain rises somewhat more abruptly until reaching the New Brunswick Highlands. Ice in Chaleur Bay usually forms in mid-to-late December and usually melts by late April.

Western New Brunswick is characterised by rolling mountainous terrain in the north that slopes into rolling hills to the south and east. The Highlands to the northwest, which are an extension of the Appalachian Mountain range, contain the highest elevations in the Maritime Provinces, with Mount Carleton rising to 2,690 feet. The Saint John River Valley extends from Saint John up through Fredericton and northward along the New Brunswick and Maine border. The relatively flat topography, along the southern portion of the Saint John River Valley, extends eastward from the Fredericton Airport to the Grand Lake area.

The topography over Prince Edward Island consists for the most part of gently rolling hills; the highest elevation is about 470 feet just west of Hunter River. Some areas of the sandy coastline are interrupted by rocky sandstone cliffs. An important feature of this area is the water temperature in the Northumberland Strait. Water temperatures here are some of the warmest summer sea-surface temperatures observed in the Maritime Provinces.

The Gulf of St. Lawrence is generally frozen from the beginning of January to the beginning of April. In extreme cases the gulf may freeze over in mid December and become ice-free as late as the end of April or early May. During this time, the ice is not necessarily solid throughout but is broken up by tides, currents, strong winds and temporary thaws that occur during winter. The Iles-de-la-Madeleine, or Magdalen Islands, located in the middle of the Gulf of St. Lawrence, are mostly flat to gently rolling hills which rise from sea level to an average elevation of 300 feet. The highest peak is 543 feet just south of Fatima.

Gaspe Peninsula



Map 3-3 - Gaspé Peninsula

The Gaspé Peninsula, an extension of the Appalachians, is generally comprised of mountainous terrain which runs east-northeast to west-southwest. The entire northern shore borders the St. Lawrence River while the southern section borders Chaleur Bay and northern New Brunswick. The Notre Dame Mountain Range runs the length of the peninsula and rises from sea level along the St. Lawrence coast to approximately 3,500 to 4,000 feet. The highest elevation is Mont Jacques-Cartier, rising to 4,190 feet above sea level. The terrain slopes somewhat more gently southward towards Chaleur Bay. Several rivers pass through hard-cut valleys and travel in a general north-south direction. Two major river valleys are the Madawaska, which flows into the St. John River, and the Matapédia flowing southward into Chaleur Bay. The St. Lawrence River, which ranges from 15 to 75 n. miles in width along the peninsula, plays a major role in the aviation weather of the peninsula.

Farther up the south shore of the St. Lawrence River Valley, the region known as the Lower St. Lawrence is considerably flatter than on the north shore. It is generally a low plain and is comprised of forest and agricultural land rising gently towards hillier terrain to the southeast. Elevations as high as 2,325 feet are located near the Quebec-Maine border.

Newfoundland



Map 3-4 - Newfoundland

As with most areas in Newfoundland, the topography of the northeastern part of the island plays a significant role in local weather conditions. The terrain gently slopes upwards from the coast towards the southwest reaching elevations as high as 2,000 feet. The surface is predominantly bare and rocky with several bogs, ponds, and rivers. There are also many small islands along the coast from the Bonavista Peninsula to White Bay.

The Avalon Peninsula, located on the east end of Newfoundland, along a north to south line is elevated some 800 to 1,000 feet above sea level. While some areas of the peninsula do slope gradually to rocky beaches, steep cliffs that drop off into the Atlantic Ocean mark most of the coastline. The coast is fairly irregular with numerous bays, inlets, and smaller peninsulas.

The south coast of Newfoundland runs in a general east to west direction and is fairly regular from Port-aux-Basques to the Hermitage Bay area. Further east, the

coastline gets more irregular with several bays and the Burin and Avalon Peninsulas. Steep cliffs run parallel to the western portion of the coast with several narrow, steep-sided north-south running bays that produce gap winds in a northeast circulation. Terrain rises towards the north with the highest peaks over the mountains along the southwest part of the coast.

The West Coast and Northern Peninsula of Newfoundland are characterized by the Long Range Mountains that provide some of the most majestic aerial views on the island. The mountains are at their highest along the mid part of the West Coast and rise to a maximum elevation of 2,672 feet over the Lewis Hills, the highest point on the island. The terrain is for the most part exposed bedrock with little or no surface sediment. Ice starts to form in the extreme northeastern part of the Gulf of St. Lawrence, on average, the last week of December or first week of January to cover most of the northeast Gulf area by late March. It usually becomes ice-free by late April. Along the west coast of the Northern Peninsula, the immediate coastline is fairly flat and somewhat marshy. However, beyond these areas mountainous terrain prevails with peaks ranging from 2,000 to 2,500 feet. The Strait of Belle Isle lies to the west of the peninsula while the Labrador Sea (Atlantic Ocean) is found on the east side.

North Shore of Quebec and Anticosti Island



Map 3-5 - North Shore of Quebec and Anticosti Island

This area of coastline extends from the La Malbaie area to Blanc Sablon at the Quebec-Labrador border. The coast from La Malbaie to the Sept-Iles region rises abruptly above the St. Lawrence River to the 1,500 to 3,000 foot range. The Saguenay River empties into the St. Lawrence River just south of Tadoussac and is a prominent waterway along this stretch of coastline. The tall cliffs along the lower section of the Saguenay River Valley are known to produce strong gap winds and low-level turbu-

lence. The Manicougan is another important river that empties into the St. Lawrence just north of Baie-Comeau. Northeast of the mouth of the Saguenay River, the St. Lawrence River gradually widens until reaching Baie-Comeau, where it begins to narrow up to Pointe-des-Monts, causing gap winds here as well. The river begins to widen rapidly again east of Pointe-des-Monts.

The terrain along the coast from Sept-Iles to Blanc Sablon is somewhat flatter in the immediate vicinity of the coast. Hills in the 1,500 to 3,000 foot range also exist along this section of the coast but are generally farther inland. Downslope winds from the northwest usually causes low cloud to break up as it descends from the higher terrain to the north. Airports along the coast, like Sept-Iles and Natashquan, will tend to have better conditions than northern areas in cool moist north or northwesterly circulations. The coast is mostly devoid of soils and trees providing an excellent opportunity for the formation of a number of inlets. Small islands become more and more numerous over the eastern section of the St. Lawrence coast.

Away from the coastline, the terrain rises and becomes more rugged with deeply incised river valleys that flow southward into the St. Lawrence River. This area is characterized by the Manicougan Reservoir, which is a large ring shaped meteorite crater. Elevations in this region range from 2,500 to 3,500 feet, with the higher peak reaching 3623 feet at Mont Veyrier, just northeast of the Manicougan Reservoir. This region is comprised of dark, dense forests, which extend from the St. Lawrence northward to the tundra in Labrador.

Anticosti Island, situated in the northern part of the Gulf of St. Lawrence, is an outlier of the boreal forest. The island is oriented along a northwest to southeast direction and is about 110 n. miles long, with a maximum width of approximately 30 n. miles. The relief is generally low, with elevations seldom reaching 500 feet, with the exception of a 1,025-foot peak near the central part of the southern coast. Wave-cut terraces up to 200 feet in elevation occur on both north and south shores, being generally wider on the south side.

Labrador and Eastern Ungava Bay Area



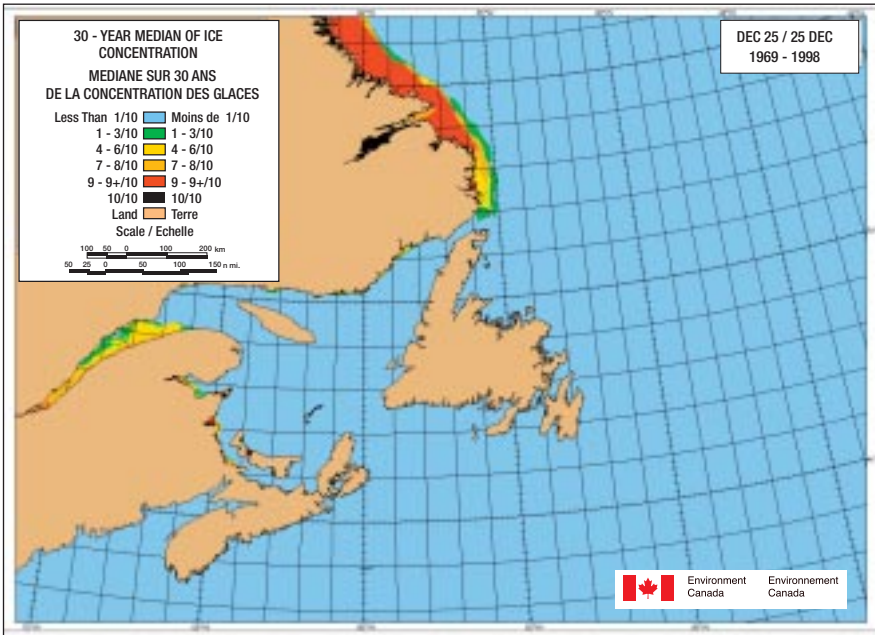
Map 3-6 - Labrador and Eastern Ungava Bay Area

Labrador has a steep and rugged coastline, which is dotted with numerous small islands, bays and east-west oriented inlets. The terrain becomes more mountainous with fjordic inlets north of Cape Harrigan. This topography results in drastic local effects due to funnelling and channelling. Here, the Torngat Mountains are prominent and by far contain the highest peaks in the entire GFA domain. Of these mountains, Mount Caubvick, or Mont D'Iberville as it is called in Quebec, is the highest peak at nearly 5,430 feet.

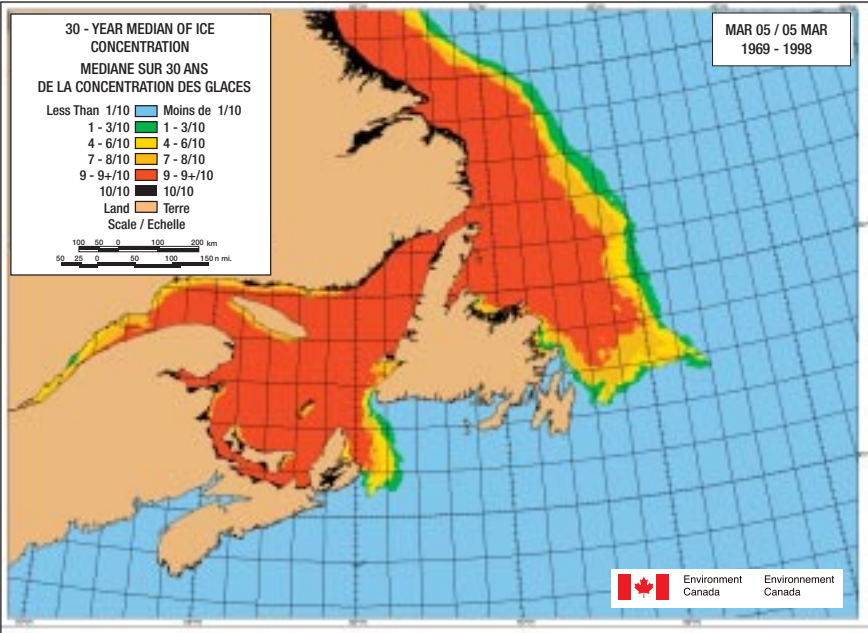
South of the Ungava Basin, the terrain remains mountainous over the western Torngats but becomes flatter along the north-south oriented George River Valley. The Smallwood Reservoir and the eastward flowing Churchill River are prominent farther south. The Smallwood Reservoir freezes in the colder months but is often a source of moisture for cloud, or fog, to develop in the spring and fall.

The terrain south of the Churchill River ranges in elevation from 2,000 to 3,000 feet and is mostly peat covered with a few conspicuous eskers and areas of exposed bedrock. The Mealy Mountains south of Lake Melville are the highest peaks in this area (as high as 3,900 feet) and play an important role on the weather at Goose Bay Airport. The landscape also contains numerous lakes and rivers, most of which freeze over during winter months.

The waters along the Labrador coast are cold. Ice tends to form along the north Labrador coast by late November and moves quickly southward to cover the south coast by early to mid-December. Melting usually begins in May or June. Coastal sections of Ungava Bay along the Quebec side of the Torngats, slope upward more gently than on the east side along the Labrador coast. This coastline is also indented with several long northwest to southeast oriented inlets and fjords. Coastal ice in Ungava Bay exists for long periods in the summer and is usually ice free by late summer.



Map 3-7 - Average Ice Coverage in Late December



Map 3-8 - Average Ice Coverage in Early March

Ocean Currents

The role ocean currents play on weather in Eastern Canada cannot be over emphasized. The two major ocean currents that have the most effect on weather in this part of the country are the Gulf Stream and the Labrador Current. The Gulf Stream is a very warm ocean current that flows northward along the east coast of the United States and northeastward through the Grand Banks.

The Labrador Current, on the other hand, is a cold ocean current originating in the Arctic. It flows southward along the coast of Labrador and the east coast of Newfoundland, where it branches out into smaller currents. The distribution of these different ocean currents determines the weather on both small and large scales.

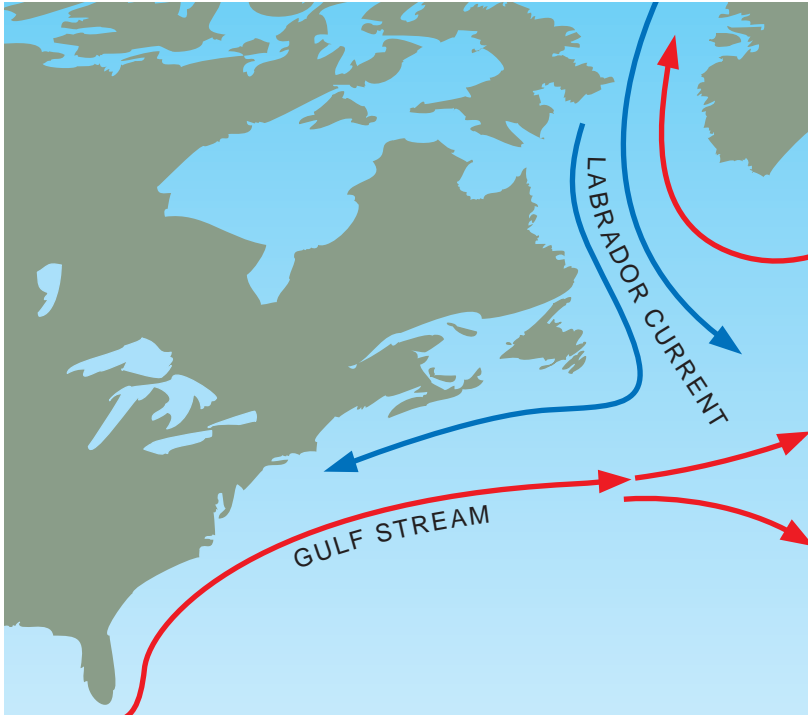


Fig. 3-1- Gulf Stream and Labrador Current

Mean Atmospheric Circulation

The mean atmospheric circulation aloft over Eastern Canada and the western North Atlantic is generally west to east. In the summer, the winds aloft at all levels are predominantly from the west, with the jet stream lying between 45 and 60 degrees north latitude.

Upper level winds in the winter months can be as much as 60 percent stronger than in the summer months, due to the stronger temperature gradient that exists between northern and southern latitudes. The strength of the jet stream, which is proportional to this temperature gradient, is stronger and much better defined during this period.

A larger scale trough in the mean flow also characterizes the circulation aloft in winter over Eastern Canada. This contributes to the development of surface low pressure systems that move up the coast of the United States and into Eastern Canada.

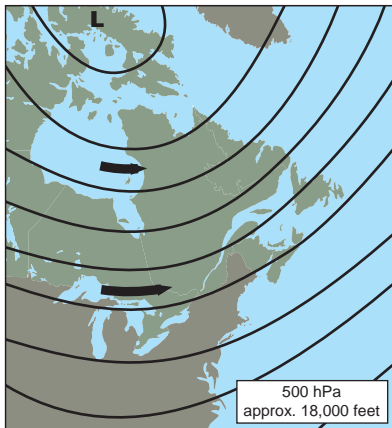


Fig. 3-2 - Mean Summer Upper Wind Pattern

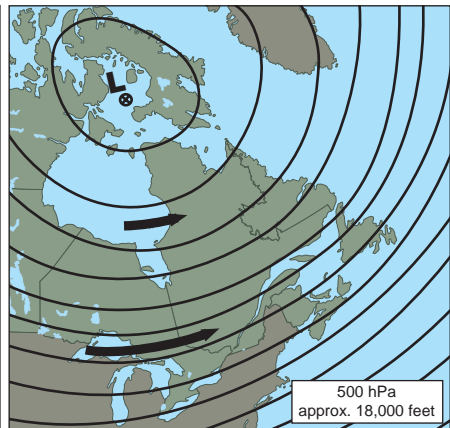


Fig. 3-3 - Mean Winter Upper Wind Pattern

Upper Troughs and Upper Ridges

The most common features that move with the upper flow are the upper ridges and upper troughs. Over Eastern Canada, upper ridges usually bring good weather while upper troughs will usually bring relatively bad weather.

That being said, the position of the upper ridge plays a significant role in the impact it will have on the weather. When the upper ridge lies directly over the region, it forces the travelling storms to pass either to the north or south of the area. In such cases, the weather becomes stagnant with very light winds at all levels. In the summer, hot, dry, sunny conditions dominate while in the winter the skies are clear.

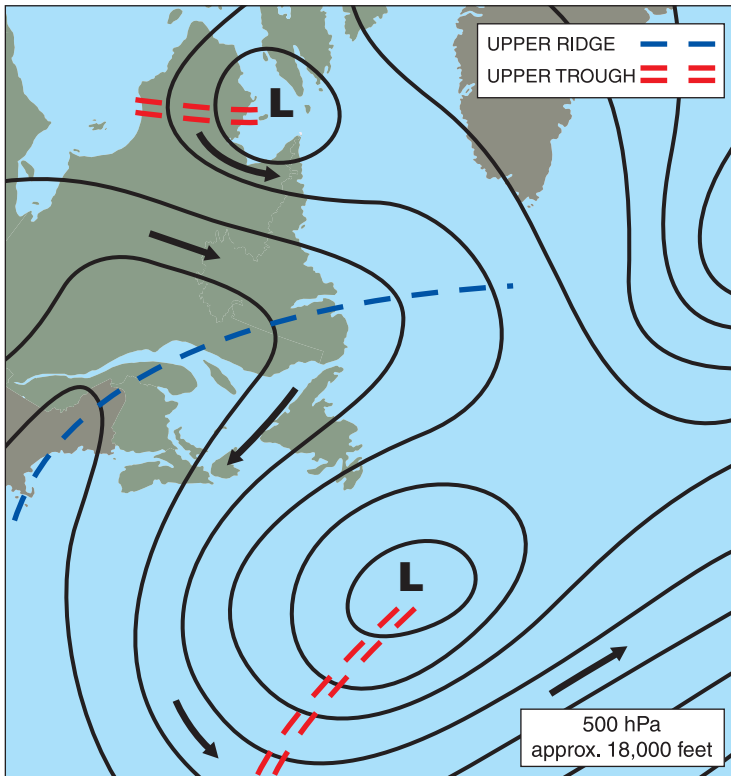


Fig. 3-4 - Typical Upper Ridge Pattern showing upper ridge and upper troughs.

The upper ridge may also lie over the North Atlantic, thereby causing low pressure systems to either track across Eastern Canada or become stalled south of Newfoundland or Nova Scotia. While the weather may be good over western sections of the domain, eastern areas may be under the influence of a persistent easterly flow with rain, drizzle and fog. Meteorologists often call this a “blocking pattern” or “omega block” since the ridge has the shape of the Greek letter omega (Ω).

Upper troughs, because of the induced vertical lift, are areas of cloud and precipitation. Upper troughs tend to be strongest in the winter and often have broad cloud shields and widespread precipitation, particularly in upslope areas. During the summer months, the cloud shields associated with upper troughs are narrower, usually quite convective and produce mainly showers and thundershowers. Upper troughs may have a surface low pressure system or a frontal system associated with them, further enhancing the cloud and precipitation. Clearing behind an upper trough can be gradual but tends to be quite rapid in the summer.

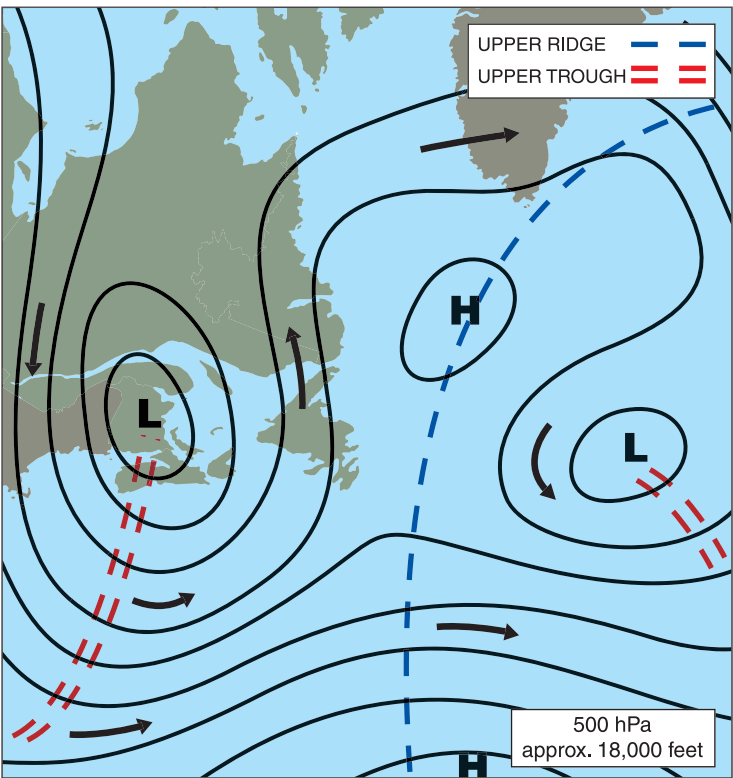


Fig. 3-5 - Omega Block - a blocking pattern that can cause an upper low to stall over Eastern Canada

Semi-Permanent Surface Features

An examination of the average sea level pressure distribution over a number of years shows the presence of relatively fixed features in the winter and summer pressure patterns. The Icelandic Low is located near, or just west of, Iceland with a trough extending from Scandinavia southwestward to the Davis Strait. As low pressure systems deepen and move northeastward in the North Atlantic, they become occluded and decelerate significantly; some even remain almost stationary for extended periods of time. This accounts for the presence of the Icelandic Low, which is much deeper and more extensive in the winter.

The Bermuda High or Azores High, on the other hand, is located farther south and is usually elongated east to west with the major axis near 35 degrees north. This feature is more prominent in the summer and accounts for the warm south or south-westerly flow over the GFACN34 domain in the summer months.

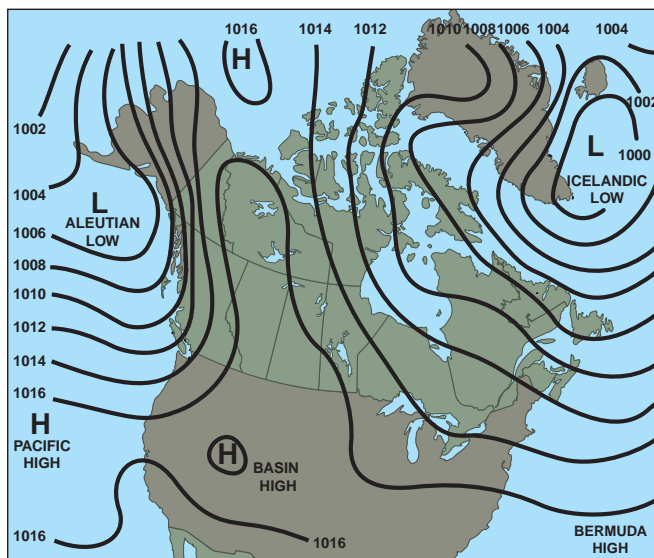


Fig. 3-6 - January mean sea level pressure

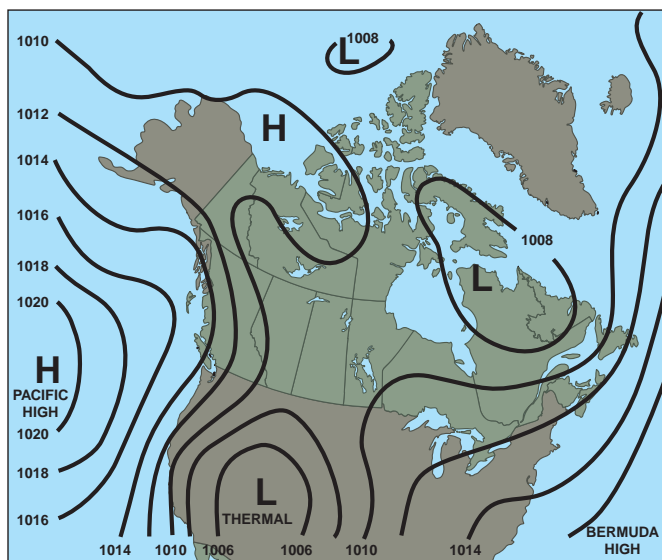


Fig. 3-7 - July mean sea level pressure

Migratory Systems

The mean surface patterns discussed above are a result of frequent motion of individual low and high pressure systems. Low pressure systems can be classified as extra-tropical (systems originally forming over the mid-latitudes) and tropical (those that develop near the tropics). Of these, it is the extra-tropical lows that affect this area the most. The majority of these features develop south or west of the region and move east or northeastward. As they track through the region, these storms usually intensify and then eventually become occluded, then begin to slow down significantly or even “retrograde” (move slowly westward).

Winter Storms

Winter storms are more frequent and also more intense due to the greater temperature differences between northern and southern latitudes. Lows that develop usually move northeastward and bring snow, freezing rain and high winds, depending on the specific track. There are several locations that are most favourable for winter storm development or intensification.

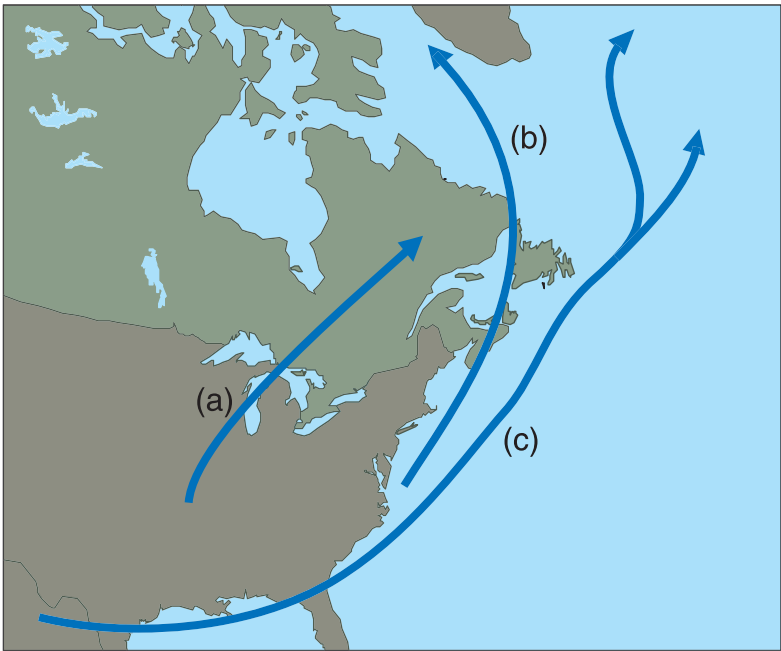


Fig.3-8 - January Storm Tracks - (a) Great Lakes Lows; (b) Cape Hatteras Lows; (c) Gulf of Mexico Lows

Summer Storms

In the summer months, the frequency and severity of the storms are reduced and low pressure areas follow a more northerly track as they cross the region. This north-

ward shift pushes the main storm track over the Gulf of St. Lawrence and southern Labrador. South of this track, minor frontal systems, upper troughs and thunderstorms produce most of the weather.

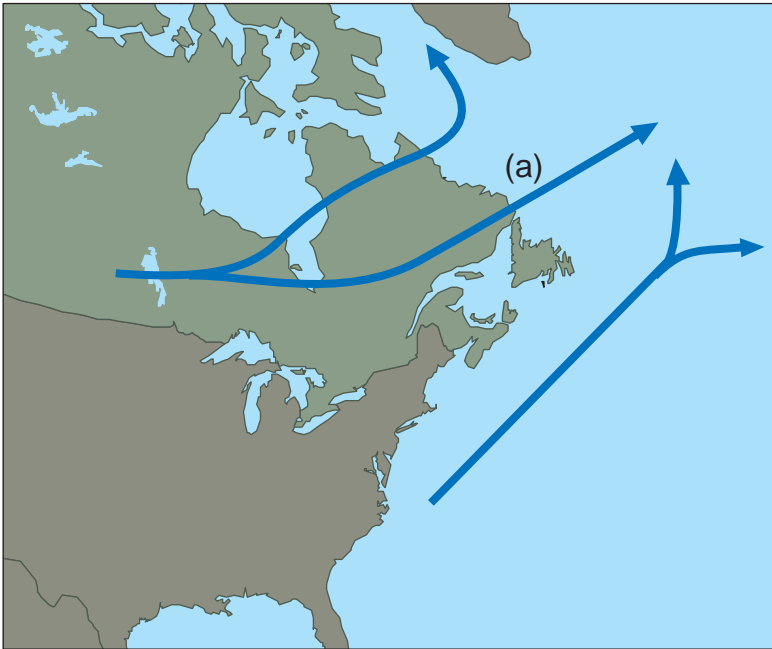


Fig. 3-9 - July Storm Tracks - (a) Hudson Bay Lows

Hatteras Lows

Hatteras Lows develop just off the coast of Cape Hatteras, North Carolina where the Gulf Stream causes a rapid increase in water and air temperature as you move off-shore. When cold air plunges southeastward off the Carolinas and meets the warm, moist air over the Gulf Stream, the perfect ingredients are in place for development of intense storm systems. During the winter, when these temperature differences are at their peak, very intense storm systems, called “bombs”, will develop in this region. “Bombs” are defined as storms that deepen, or intensify, at least 24 hPa in 24 hours. They usually cause severe winter weather conditions along the northeast United States and Eastern Canada and are often difficult to forecast.

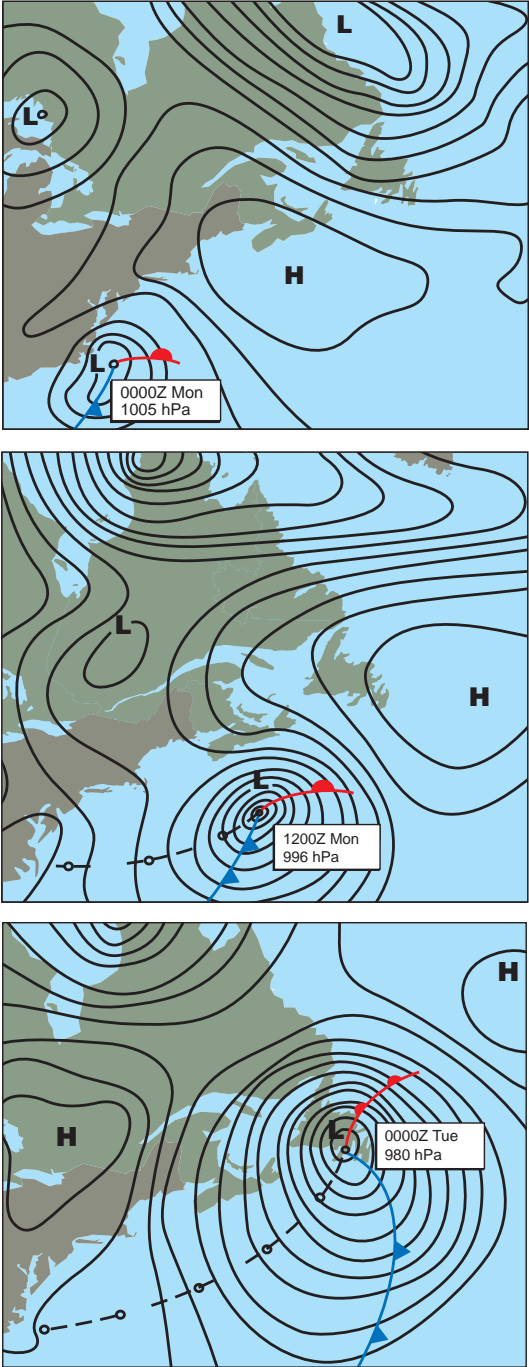


Fig. 3-10 - Typical track and development of an East Coast Bomb

Gulf of Mexico Lows

Another location that favours winter storm development is over the warm waters of the Gulf of Mexico. As cold air sweeps down over the southeast United States, it interacts with the warm, moist air of the Gulf region and a strong temperature contrast is created. In these situations, lows will develop in the same manner as they do off Cape Hatteras. Lows forming in this area get caught in the upper level circulation and track north or northeastward up into Eastern Canada. If a particular low's track brings it over the Gulf Stream, it will often undergo significant intensification.

Great Lakes Lows

The Great Lakes area is yet another favourable location for low pressure development. Heat and moisture from the lakes are injected into the lower levels of the atmosphere causing lows to either form here or intensify as they approach from the west or southwest. These systems tend to be less intense than coastal lows but can still give widespread poor conditions and strong, gusty winds. Great Lakes lows usually follow two main tracks, with one bringing the systems north or northeastward up into Quebec and Labrador, and the other bringing the systems east off the coast of the United States where they normally intensify.

Hudson Bay Lows

A frequent storm track in both summer and winter is for lows developing over Hudson Bay to move eastward across Quebec and Labrador. These lows are even less intense than Great Lakes lows or east coast lows. While flying conditions will remain generally good, areas of low ceilings and poor visibility in light rain or snow will occur over the northern areas. In winter, the air masses associated with these systems are usually very dry and conditions usually improve rapidly in their wake. However, considerable moisture is acquired in the lower levels during the summer causing stratocumulus ceilings to develop even well after the lows move away from the region.

Polar Lows

Although less frequent than frontal systems, polar lows also affect the area. A polar low is an intense maritime polar cyclone ranging from 60 to 600 miles across, with surface winds exceeding 30 knots. These lows are mostly found over the coastal waters of Labrador during very cold outbreaks when air-sea temperature differences are at least 20 degrees. At the mature stage, heavy snowshowers and blowing snow with reduced visibilities can be expected with rapidly changing wind direction, occasional lightning and severe aircraft icing. They often move very fast with speeds of 30 to 40 knots and dissipate rapidly as soon as they move over land or ice packs. Because of their relatively small size and rapid formation, polar lows are very difficult to forecast.

Highs

Areas of high pressure found over the domain have a wide variety of tracks. The ones that move eastward off the American continent are usually cold domes and, in the winter, these weaken or disappear after they reach the warmer waters of the Atlantic. When the center of the high is west of the area, a cold Arctic outbreak will develop and west or northwesterly flow will generally give snow squall activity to onshore areas. In summer, they usually merge with the Azores or Bermuda High. Occasionally, a high moving eastward off the Labrador coast will continue to build for two or three days and spread, more or less, straight to Europe.

Tropical Depressions, Tropical Storms and Hurricanes

During the late summer and early fall, tropical cyclones originating over the tropical latitudes move westward with the trade winds, turn towards the north and usually weaken as they accelerate northward. In the Atlantic Ocean, storms with sustained winds of 20 to 33 knots are referred to as “tropical depressions,” 34 to 63 knots are called “tropical storms,” and winds with 64 knots or more are known as “hurricanes.” Once a storm has reached hurricane strength, it is classified according to the Saffir-Simpson scale (see Glossary).

Tropical cyclones that affect Eastern Canada form north of the equator over warm waters (at least 26°C). They often begin as disturbances off the coast of Africa and, if conditions are favourable, will intensify as they move westward. Conditions that are favourable for development include an unstable atmosphere, very little or no wind shear, and a building area of high pressure in the upper levels above the storm. The main fuel for the storms, however, is the warm water of the tropics. The warm water helps drive the convection within the storm where a large amount of water vapour is condensed, releasing latent heat. That, in turn, provides energy for the storm. As long as the storm stays over warm water, it will have enough energy to survive. Tropical cyclones have a tendency to travel along common paths until they dissipate and their individual movement is determined by the steering currents in the atmosphere. When tropical storms or hurricanes reach the Caribbean or southeast United States, some continue westward, however, most make a northward turn and head up the coast or out to sea.

On average, 4 to 5 tropical cyclones threaten Eastern Canada each year with the highest frequency being in Newfoundland. Since Atlantic Canadian waters are much cooler than tropical waters where hurricanes are formed, approaching cyclones usually lose their energy source and most begin the decaying stage of their life cycle. Storms that have moved inland also weaken rapidly because they are removed from their source of energy and are weakened by the frictional drag of the land. Although no longer visible on a weather map, the energy of a dissipated storm can continue to move through the atmosphere. Heavy rain from the very moist tropical air may con-

tinue to fall over the region. As well, tropical storm force, or even hurricane force winds often remain above the boundary layer even after the storm has moved well inland. Often, a tropical cyclone will undergo a post-tropical transition - a change from a tropical cyclone to a mid-latitude frontal storm - while it is in the proximity of Atlantic Canada. As these storms move into the stronger air streams and cooler air temperatures of the middle latitudes, their rain and wind patterns change as they accelerate. The heaviest rains shift to the left side of the accelerating storm while the strongest winds are found on the right side. Because of these pattern changes, land areas in Atlantic Canada frequently witness the heavy rains, but seldom experience the strongest winds.

Although there are regular research and reconnaissance flights into hurricanes, these storms are clearly no place for commercial or general aviation. Virtually every type of aviation weather hazard exists in these storms. Care must also be taken by aircraft on the ground with the approach of tropical cyclones. Torrential rains and very strong winds can usually be expected with these storms and can easily damage aircraft that have not been properly sheltered.

Cold Lows

A cold low, or “cut-off” low, is a large, nearly circular area of the atmosphere in which temperatures get colder towards the centre, both at the surface and aloft. It is the final stage in the development of a low and is not reached by all storms. While a surface low pressure centre may or may not be 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. They tend to occur more frequently over southern latitudes in the spring, while occurring more frequently over northern latitudes in the winter. During these periods, low pressure systems will approach the region from the south or southwest and sometimes become “cut-off” from the prevailing circulation aloft as cold air becomes completely wrapped around the low pressure centre. The overall effect is to produce a widespread area of cool, unstable air in which bands of cloud, showers and thundershowers occur. Cold lows are also a favourable location for aircraft icing. Along the deformation zone to the northeast of the cold low, the enhanced vertical lift will thicken the cloud cover and produce widespread, steady precipitation. Eventually, the low will either weaken to the point that it is no longer detectable on the upper charts, or will be pushed out by stronger systems approaching from the west.

Vertical structure of a Cold Low

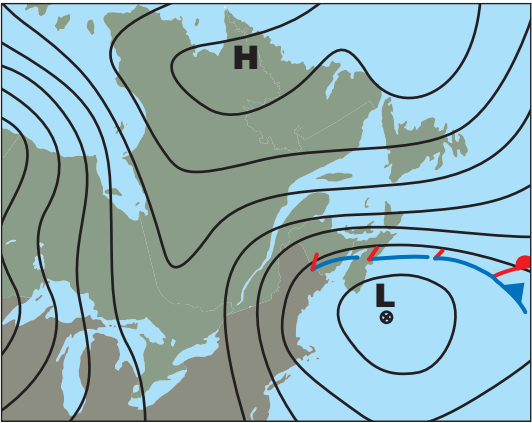


Fig. 3-11 - Surface Analysis

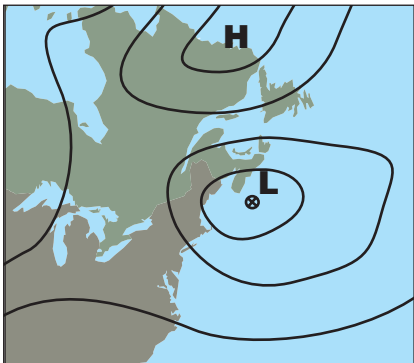


Fig. 3-12 - 850 hPa Analysis (about 5,000 feet)

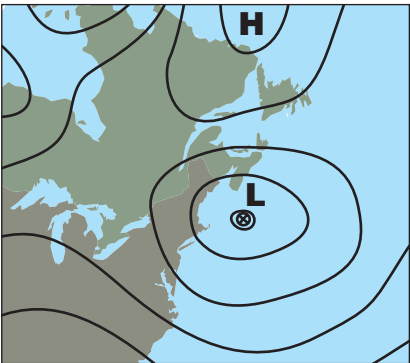


Fig. 3-13 - 700 hPa Analysis (about 10,000 feet)

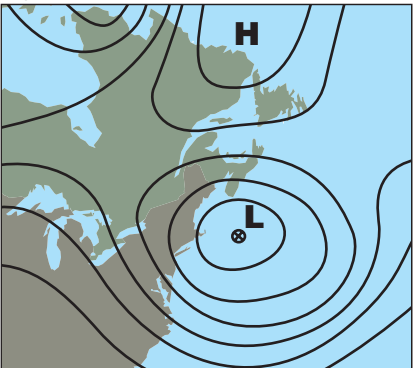


Fig. 3-14 - 500 hPa Analysis (about 18,000 feet)

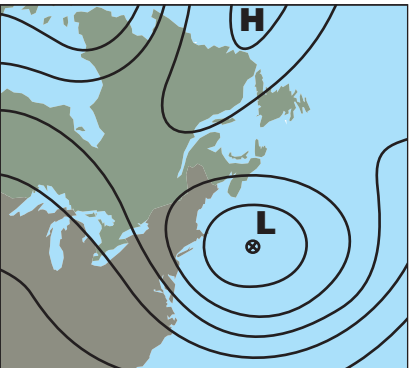













Fig. 3-15 - 250 hPa Analysis (about 34,000 feet)

Notes

Table 3: Symbols Used in this Manual

	<p>Fog symbol (3 horizontal lines)</p> <p>This standard symbol for fog indicates areas where fog is frequently observed.</p>
	<p>Cloud areas and cloud edges</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>Icing symbol (2 vertical lines through a half circle)</p> <p>This standard symbol for icing indicate areas where significant icing is relatively common.</p>
	<p>Choppy water symbol (symbol with two wavelike points)</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>Turbulence symbol</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>Strong wind symbol (straight arrow)</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>Funnelling / Channelling symbol (narrowing arrow)</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>Snow symbol (asterisk)</p> <p>This standard symbol for snow shows areas prone to very heavy snowfall.</p>
	<p>Thunderstorm symbol (half circle with anvil top)</p> <p>This standard symbol for cumulonimbus (CB) cloud is used to denote areas prone to thunderstorm activity.</p>
	<p>Mill symbol (smokestack)</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>Mountain pass symbol (side-by-side arcs)</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>

Chapter 4

Seasonal Weather and Local Effects

Introduction

This chapter is devoted to local weather hazards and effects observed in the GFACN34 area of responsibility. After extensive discussions with weather forecasters, FSS personnel, pilots and dispatchers, the most common and verifiable hazards are listed.

Most weather hazards are described in symbols on the many maps along with a brief textual description located beneath it. In other cases, the weather phenomena are better described in words. Table 3 provides a legend for the various symbols used throughout the local weather sections.



Map 4-1 - Topographical overview of the GFACN 34

Maritimes Including the Gaspé Peninsula

(a) Summer

In the summer the frequency and intensity of storms that affect this area decreases significantly. (see fig. 3-9) As a result, air masses tend to remain over the region for longer periods of time and become stagnant. At the same time, the Bermuda High becomes more prominent causing the prevailing circulation to become southwesterly over the Maritimes and the Gaspé Peninsula. These winds tend to advect pollution from the northeast United States and, combined with the stagnant air masses, will often reduce prevailing visibility in haze.

Advection sea fog is also very common during this time of the year, especially in the early summer months. As the prevailing circulation shifts to the southwest, warm, moist air is pushed northward and cools from below causing fog to develop over the water along the Atlantic coast and the Bay of Fundy areas. This fog often moves inland during the evening hours and usually burns off in the morning.

Thunderstorms are most prevalent over northern and central New Brunswick, as well as over the Gaspé Peninsula. They either form in these regions or they will develop over Maine and then move eastward. New Brunswick and the Gaspé Peninsula have thunderstorm activity occurring, on average, between 10 to 20 days a year while Nova Scotia and Prince Edward Island receive only about half of this number, or less.

The Maritimes and the Gaspé Peninsula have many miles of coastline giving rise to an onshore sea breeze circulation on warm, sunny days. These onshore sea breezes occasionally get funnelled along the coast especially over the Gaspé Peninsula.

By late summer and early fall, tropical cyclones become a threat to the southern Maritimes. They tend to pass south of Nova Scotia but can still produce strong winds and heavy rains over inland areas. Occasionally, a hurricane or tropical storm will move northward and may even make landfall over Nova Scotia or southern New Brunswick, as was seen with hurricane Hortense in 1991.

(b) Winter

The general circulation over the Maritimes and the Gaspé Peninsula is stronger in the winter and predominantly from the west or northwest. Storms are also more powerful and occur at greater frequencies during this time of year with their track being further south than in the summer. (see fig. 3-8)

The first snowfalls usually occur over the higher terrain of the Gaspé Peninsula in mid to late fall and gradually extend southward as winter approaches. Three major snow belts can be found in this region. The first is found over the northern half of the Gaspé Peninsula, the second over northwest and north central New Brunswick and

the third over southeast New Brunswick and northern Nova Scotia/Cape Breton. These snow belts are a result of both system snowfalls and onshore snow squall events. Snow squalls and streamers often develop in the wake of low pressure systems especially during the early winter. The areas most prone to this are the Annapolis Valley and northern Nova Scotia including the Cape Breton Highlands, Prince Edward Island and Les Iles-de-la-Madeleine.

Freezing precipitation can also be a problem during the winter months. Freezing rain and ice pellets will often develop ahead of approaching warm fronts resulting in very hazardous icing conditions. Onshore flow will also cause freezing drizzle to develop over the Gulf of St. Lawrence and near the coast, such as in eastern New Brunswick and northern Nova Scotia, where winds blow onshore. These conditions are most prevalent early in the season when the gulf is relatively ice-free.

Although thunderstorms can occur at any time of year, they tend to be quite rare in the winter. One exception is over the extreme southern portion of the region. Here, the relatively warm water heats the colder air, creating a very unstable situation that allows thunderstorms to develop along the various winter frontal systems that migrate through the area.

(c) Local Effects

Southwest Nova Scotia - Yarmouth to Halifax and Vicinity



Map 4-2 - Yarmouth to Halifax

During the summer, dense fog is a frequent problem. Here, warm, moist, southwest winds combine with the relatively cold ocean waters to create advection fog that can

blanket the ocean and coastline. When the winds are light, the fog will usually retreat 2 or 3 miles offshore by early afternoon only to move in again in the evening. Some local pilots refer to this as the “duty fog bank”. Under similar conditions, it will move in and out at roughly the same time each day and remain just off shore all day long. The tops of these fog banks are often not very thick, ranging from 500 to 1,000 feet. For example, the towers south of the Bedford Basin are often visible through the fog.

A typical fog event in this area would be near zero visibility along the coast up to Halifax International Airport. Low stratus cloud of 500 to 800 feet can then be found as far north as Greenwood and Debert. Conditions will clear out at Greenwood and Debert first, then gradually burn off southward. Typical timing for the clearing is shortly after sunrise for the northern stations, 9 or 10 a.m. local time for Halifax and Liverpool, and around noon or shortly after for Shearwater. When fog remains over coastal sections in these conditions, it is usually only within 10 miles or so and better conditions will be found farther inland. When the winds are stronger, or when there is thick higher cloud present, the diurnal improvement is less pronounced and is usually negligible if rain develops.

Strong easterly winds tend to develop over this area ahead of a low pressure system approaching from the southwest. Coastal convergence, however, will cause these winds to be generally stronger and back to northeasterly direction in a band several miles wide just off the coast.

On warm summer days, sea breezes usually develop all along the coast and can be funnelled and channelled in the bays that mark the coastline. A strong sea breeze reaching 20 to 25 knots can develop at Lawrencetown Beach, for example. During these sea breeze conditions, light turbulence can be expected along the coast. Also, when sea breezes develop in the afternoon and there is fog just offshore, the south or southwest sea breeze can advect the fog onshore earlier than expected, but this will generally burn off within a few miles inland.

Fog or stratus cloud can develop over the inland lakes, such as Lake Rossignol and Lake Shubenacadie, and then drift over Liverpool and Halifax International Airport respectively. However, this fog or low cloud will burn off fairly quickly after sunrise. A similar condition, known as the Mahone Bay or St. Margarets Bay effect, develops when winds are from 210 to 240 degrees and between 15 and 25 knots. Fog develops in the bay and gets pushed onshore and upslope, reaching Halifax International Airport shortly afterwards.

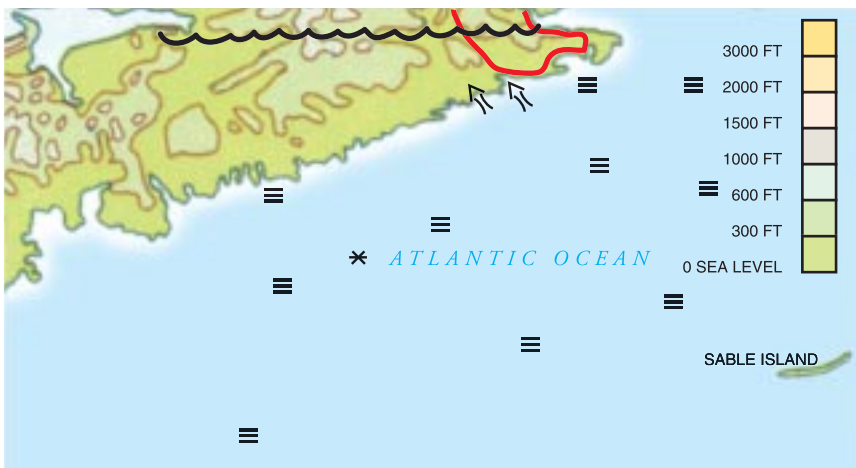
In the winter, snow showers that develop over the Fundy region can reach as far south as the coast, depending on the wind speed and direction. A related occurrence is for the snow showers to dissipate before reaching the coast, but snowflakes and ice crystals continue to be blown southward by the winds. This usually reduces visibility downwind although there is no actual cloud present. When the air is cold enough and

is pushed sufficiently southward, convective snow showers will redevelop off the Atlantic coast and reach Sable Island. When these snow shower outbreaks develop, significant icing and turbulence can be encountered within these clouds. Stratocumulus cloud originating over the water will be very conducive for icing conditions.

Freezing rain can sometimes be a problem in the Halifax International Airport area with the approach of a warm front. Temperatures along the coast, at Shearwater for example, will modify rapidly, helped by the warm ocean waters. Meanwhile, temperatures at the Halifax Airport will remain colder for a longer period of time, causing a delay in the changeover from freezing rain and ice pellets to rain.

A common route to and from Halifax in bad weather is from Mahone Bay northward to the Annapolis Valley via Panuke Lake. Another route to the north is to follow the Shubenacadie River Valley up to Cobequid Bay. From here, pilots can usually proceed west over the water or north through the Wentworth Valley.

Offshore Nova Scotia - Sable Region



Map 4-3 - Offshore Nova Scotia

Whether it is fishing surveillance, helicopter operations for the offshore oil industry or military exercises, the Sable and offshore area of Nova Scotia definitely has its share of air traffic. As over most marine areas, very strong winds are common here, especially during the winter. At the very least, this causes a nuisance as the strong winds can result in very slow groundspeeds. Mechanical turbulence is usually not a problem over the water, however, but can become significant near the coast.

Fog is another factor in this area and has the greatest impact on helicopter flights to the oilrigs. Fog can be a problem any time of year but is most prominent in May,

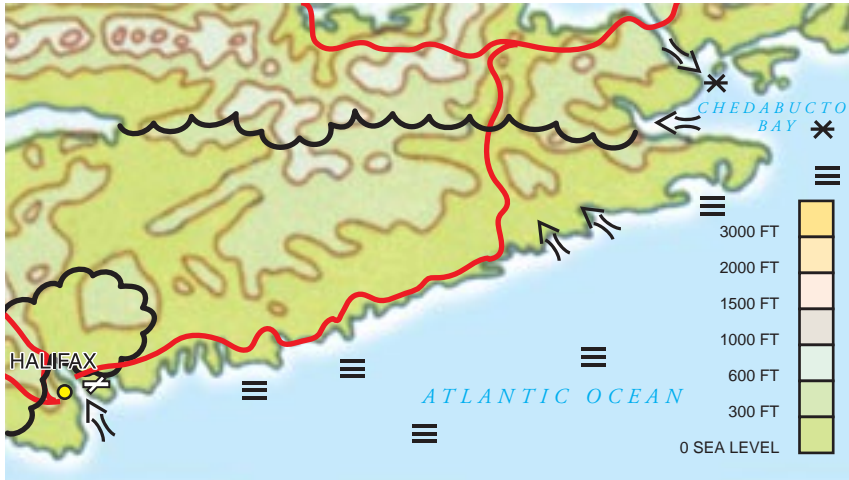
June and July. As mentioned earlier, fog banks will usually develop over the Atlantic Ocean when warm moist air masses move over the colder water. These fog banks, known collectively as the “duty fog bank”, will burn off over land in the daytime but will remain over the water, until there is a change in the large-scale weather pattern. The fog is usually based at the surface and is typically only topped at 300 to 700 feet, but tops in the 1,200 to 1,500 foot range are not entirely uncommon.

The fog tops will often have a tendency to undulate or exhibit a wave-like structure. Helicopter pilots have landed on the oil platforms in clear conditions with the fog lurking just below the helicopter deck, only to be shrouded in fog within 15 minutes and then in the clear again 15 minutes later.

The horizontal extent of the fog may vary as well, especially near and south of Sable Island. Warm pools of water, called warm rings or warm eddies, break off from the Gulf Stream and move northward embedded within the colder water. This results in rapidly changing water temperatures in relatively short distances. Fog can be expected over the colder water with clear areas over the warm eddies. Pilots concerned about fog will often study sea surface temperature charts and look for these warm eddies before heading offshore.

In the winter, icing becomes the worst problem in this area. Marine stratus and stratocumulus cloud will be extremely moist and contain lots of supercooled water droplets when temperatures are below freezing. Icing studies off the east coast of Canada have shown that the prime temperature range for icing conditions in marine cloud is between 0°C and -11°C. It should be noted, however, that icing has been encountered in temperatures as low as -24°C. Pilots who regularly fly here indicate that if icing conditions are encountered, it is usually possible to get out of it by descending closer to the water where the air temperature will usually be just above freezing. Another winter hazard common to this area is snow squall activity during very cold outbreaks. These snowsqualls can cause turbulence, icing and near zero visibilities locally. They generally persist until the wind diminishes in advance of a high pressure system.

Halifax to Chedabucto Bay



Map 4-4 - Halifax to Chedabucto Bay

Conditions in this region are very similar to those experienced in the previous area. Problems with fog exist in the spring and summer in moist, southerly winds. Fog moves inland at night and retreats to the coast during the daytime. Several bays that run northwest to southeast characterize the coastline, causing funnelling and channelling when winds are from these directions. East to northeast winds are generally stronger just off the coast, due to coastal convergence. Sea breezes are common here in the summer as well. These usually start off as southerly, and shift to southwest by mid to late afternoon.

When stratocumulus cloud hangs over the coast, ceilings tend to be lower between Sheet Harbour and Guysborough, than farther west. Conditions are usually better between Halifax and Musquodoboit Harbour. A common route for helicopter pilots inbound from the oilrigs is to follow Porter's Lake up to Halifax International Airport. Farther east, lower cloud and shower activity is often encountered at Chedabucto Bay and near the Strait of Canso, in northwest or southeast winds.

The terrain is somewhat more rugged in this region and, therefore, mechanical turbulence is more prevalent from the Halifax area eastward to Chedabucto Bay, when winds are 20 to 25 knots or more.

Snow squall activity from the Bay of Fundy generally does not reach this area when the winds are out of the northwest. When winds are more northerly however, snow squalls from the Northumberland Strait and the Gulf of St. Lawrence routinely cross Nova Scotia and can reach the coast. Again, these snow showers can reduce visibility to a quarter mile, or so, and contain significant icing and turbulence. Stratocumulus cloud will also signify icing conditions in the colder months.

In north or northwest winds in any season, fog, low cloud and occasional showers often develop over St. Georges Bay, which can then drift over the land all the way to Chedabucto Bay. Weather is often reported as being worse and winds stronger here than in surrounding areas. Pilots call this the “Port Hawkesbury Wall” and will often be the worst part of the trip between Halifax and Sydney.

Annapolis Valley and the Fundy Region of Nova Scotia



Map 4-5 - Bay of Fundy

Local flying weather in this area is, for the most part, determined by two major topographic features. The bay itself is the biggest factor, with the mountains south and east of the bay also playing an important role. Pilots indicate that the flying weather at Greenwood is generally a good representation of the weather in the entire Annapolis Valley.

Very high tides occur in the Minas Basin and in the Bay of Fundy. These tides have an average of 30 feet with the highest tide in the world registered here at an impressive 52 feet. The enormous tidal ranges cause the bay to be flushed out daily and prevent the water from being heated or cooled significantly. Consequently, the water remains relatively cold in the summer and warm in the winter.

Fog is a big problem in the Bay of Fundy area in spring and summer as warm, moist air from the south is cooled from below by the bay waters. It will typically blanket the area from Yarmouth, or just offshore, all along the coast to Chignecto Bay and Cobequid Bay, especially in southwest winds. This fog is often not very thick, as Isle Haute at the entrance of Minas Channel and Cape Split will protrude out of the fog on a typical day. From Minas Basin towards Cobequid Bay, fog or low stratus can also penetrate about 10 to 20 miles inland. This often produces very poor flying weather near and south of Debert Airport. During the daytime, there is marked improvement in the ceilings and visibilities at or near low tide.

Fog from the Bay of Fundy generally does not reach the Annapolis Valley due to the North Mountains. When the winds in this area are more southerly, they tend to be offshore and, as a result, fog will not be as bad here as on the New Brunswick side of the bay. Fog can, however, move into St. Mary's Bay and the Annapolis Basin through Digby Gut. Fog events in the Bay of Fundy become somewhat less frequent late in the summer when the water temperatures are at their highest. Early morning radiation fog, however, is more common in the valley, especially in the spring and early summer. In moderate southerly flow, fog from the south coast of Nova Scotia often reaches the valley well after midnight, usually as stratus cloud based at 500 to 1,000 feet, but burns off rapidly after sunrise.

Thunderstorms often form south of the Annapolis valley and along the Cobequid and South Mountains. Sometimes thunderstorms will develop over the hills on the New Brunswick side of the bay, or the Cobequid Mountains, and drift southeastward over Chignecto Bay and Minas Channel. Cape Split has a high percentage of lightning strikes because, as thunderstorms cross over the Minas Basin, the cape is the highest point in the vicinity and often gets struck first. Cape Split is also a favourable location for turbulence, according to local pilots.

In the winter time, with the approach of a winter warm front, cold air will tend to remain entrenched in the Annapolis Valley, causing freezing rain or ice pellets to persist longer than in surrounding areas. This effect will also cause strong wind shear in the valley and may give problems for aircraft on approach to Waterville, Greenwood and, to a lesser extent, Digby. A good indicator is to look at the REMARK section of the Greenwood METAR as it includes the winds at the top of Windy Hill (just to the north). A comparison of the surface winds at Greenwood and the Windy Hill winds will usually tell the story.

Turbulence is quite common in the Annapolis Valley, especially when the winds blow perpendicular to the valley. In north or northwesterly winds, the air will sometimes flow down the south side of the valley and then continue northward along the valley floor. Pilots on approach to Greenwood in these situations will report a northerly crosswind until reaching the height of the mountains, then somewhat turbulent conditions down to the runway, where a light southerly crosswind can be expected. Turbulence is also particularly noticeable at the west end of the runway at Waterville, especially in a southerly wind.

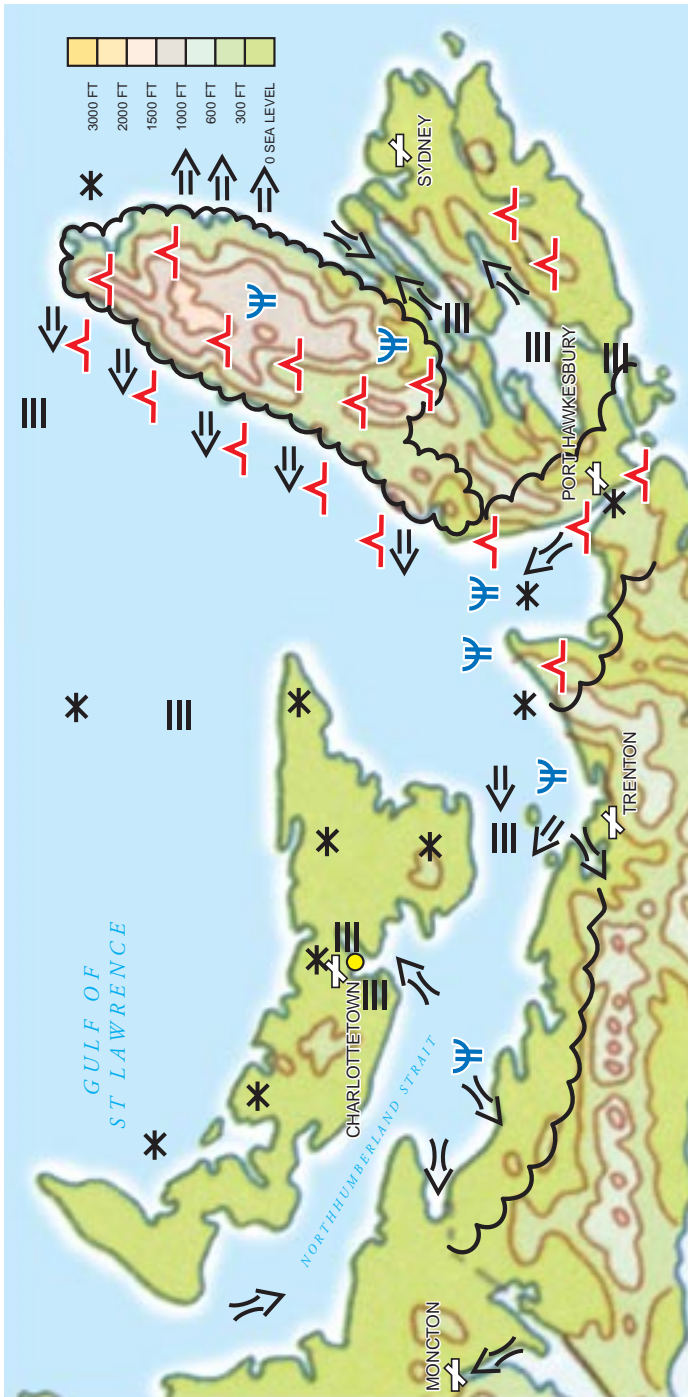
Snow showers and streamers are another major problem in the Bay of Fundy region and are appropriately referred to as "Fundy Flurries" by local pilots. As mentioned earlier, the tides in the bay prevent the water from getting too cold in the winter and, therefore, the bay does not freeze. During cold outbreaks, snow showers and streamers will develop over the relatively warmer water and give local blizzard conditions on the Nova Scotia side of the bay. This usually develops 6 to 12 hours after the passage

of a cold front and will continue as long as the winds are moderate to strong and are aligned up to about 9,000 feet. Streamers are more prone to develop in a west-north-west wind than a northerly wind because of the greater fetch over the water. From the air, these snow squalls look like a wall of fast moving snow and can easily surprise an unsuspecting pilot.

Southwest winds are funnelled into Chignecto Bay and tend to be very strong in Cumberland Basin. Northwest winds are also quite strong in this area. Likewise, funnelling is common in Digby Gut in northwest winds and is noticeable even in a 15-knot wind.

A common “bad weather route” going north or east is to follow the valley out to the Minas Basin, then follow the Parrsboro River Valley northward. Another option is to continue eastward to the Wentworth Valley, then turn north. Pilots indicate, however, that if the Parrsboro route is impassable, it will usually not be possible to proceed north via any route.

Northern Nova Scotia - Cape Breton



Map 4-6 - Northern Nova Scotia - Cape Breton

The Cobequid Mountains in northern Nova Scotia are quite prone to cloudiness and shower activity. The mountains run east to west and winds with any kind of northerly or southerly component will be upslope here, causing cloud to develop. Even when skies are clear elsewhere, scattered cumulus or stratocumulus cloud will top these hills. Likewise, when scattered cloud is reported elsewhere, broken to overcast cloud will be encountered over the hills, with possible shower activity as well. Although this is a common occurrence, this effect is quite local and often will not be explicitly forecast. Pilots on low level cross-country flights between Halifax and Moncton should be aware of this effect. Cloud may be close to the tops of the hills but conditions will generally be good on either side. Pilots should also expect icing conditions within these clouds in the colder months, especially in northerly winds before the Northumberland Strait freezes over. This is also an area where precipitation tends to be heavier during storms.

Other areas where cloud and showery conditions are frequent are the Strait of Canso and St. Georges Bay, as far west as Tracadie. Northwest winds will generally pick up lots of moisture from the Gulf of St. Lawrence and the topography in these areas will enhance upward vertical motion, causing cloud to develop or linger. Pilots report that weather changes very quickly in this area, especially near the causeway. Strong gap winds occur in the Strait of Canso in both southeasterly and northwesterly winds but are more pronounced in the northwesterlies. During late fall and early winter, these northwest winds can be accompanied by snow squalls causing very treacherous flying conditions.

Although large portions of the Gulf of St. Lawrence freeze over in the winter, this does not generally occur until mid winter and, even then, open areas are usually present. When very cold, arctic air flows over the water, snow showers and streamers develop and are pushed onshore, only to end when the wind dies down. Like in the Bay of Fundy area, the true snow squall activity will not start immediately after a cold frontal passage, but 6 to 12 hours afterwards. The area that is most prone to heavy snow squall activity extends from Tatamagouche to the Strait of Canso.

Mechanical turbulence is generally not a big problem in this area but can be encountered over the Cobequid Mountains in strong, gusty winds. The Cape George area is also known to be somewhat turbulent on windy days. Low-level wind shear and turbulence is also often encountered on approach from the east at Trenton Airport, especially when the winds are above 30 knots.

As mentioned in the last section, the Parrsboro and Wentworth Valley routes may be an option to pilots caught in bad weather. If transiting between Prince Edward Island and the Annapolis Valley in similar situations, it may also be possible to get through between Baie Verte and the Cumberland Basin. The terrain is quite low here, although power lines and towers are significant hazards.

Cape Breton often experiences some of the worst turbulence encountered in the Maritime Provinces. One of the best known local effects in eastern Canada occurs over the Cape Breton Highlands. Southeast winds ahead of low pressure systems will be quite violent here, due to mountain waves developing off the highlands. This effect is similar to the “Wreckhouse” winds in Newfoundland and is referred to locally as “les suêtes”, derived from the French word for southeasterlies. They occur near Cheticamp and extend out to about 3 miles from the mountain peak. Here severe turbulence, downdrafts (as much as 1,000 feet/min) and wind speeds as much as double those of surrounding areas can be expected. The downdrafts on the northwest side of the mountains will hit the water and flow outward, much like microbursts, producing patterns on the water that are readily seen from the air. Local pilots call these patterns “cat tracks” or “cat paws”. Even when the winds are as light as 10 to 12 knots at Sydney, the Highlands can be quite turbulent. The vertical extent of the turbulence depends on the wind speed, but pilots will typically be out of the worst conditions above 4,000 ft.

Within the mountain valleys, shadows on one side of the valley will cause the air to cool faster than the opposite side. This cooler air tends to sink to the bottom of the valley causing local downslope drainage winds, some of which may be quite difficult to overcome. Turbulence and wind shear induced airspeed changes are also often reported by pilots on approach from the west at Sydney Airport.

As in the northern part of Mainland Nova Scotia, snow squall activity is very common here in the late fall and early winter, especially from Inverness northward. The Cape Breton Highlands are not only a favourable location for snow showers, but also for heavier precipitation associated with organized low pressure systems. That is to say that pilots flying in rain or snow caused by a low will normally encounter heavier precipitation near the highlands. This will usually be on the north side when a low is approaching.

Even if precipitation does not develop, cloud will often top the mountains north of Sydney, while Sydney may be clear. This is most prominent from the fall to the spring seasons and can sometimes cause a problem for pilots heading to Cape North from Newfoundland. This is the shortest distance across the Cabot Strait and pilots transiting this route should expect cloud near the hills and at Cape North, in northeast to northwest winds. Lower cloud is also often found on the north side of the highlands. Pilots note, however, that in a northeast flow, conditions are markedly better southwest of Margaree than surrounding areas, due to downslope flow.

When conditions are good elsewhere and temperature-dew point spreads are only a few degrees, low stratus cloud occasionally forms near the Sydney Airport due to emissions from a power plant located north of the field. This cloud is usually between 800 and 1,200 feet and, when it forms, will often drift over the airport. The most

common time of occurrence of this effect is in the evening hours. Fog or low stratus sometimes forms over the Mira River in the fall and spring and can cause localized low ceilings for aircraft en route from the southwest, but rarely causes problems at Sydney Airport. Winds from the northeast to southeast generally bring the lowest ceilings over most of Cape Breton in any season. Thunderstorm activity tends to be more frequent north of the Bras d'Or Lakes and north of Sydney.

Fog and low stratus cloud will often form over the Bras d'Or Lakes especially in the spring and fall seasons. The fog will generally dissipate rapidly in a southwest wind and usually will not reach Sydney. When cloud is widespread in the area, VFR pilots should try to stay on the upwind side of the lakes, to stay away from of the lower cloud.

In the previous scenario, the low cloud can linger in an east or southeast wind and move into Port Hawkesbury, where the weather is often significantly different than at Sydney. Pilots indicate that an easterly or southeasterly wind at Port Hawkesbury will generally bring in low flying conditions within 6 to 12 hours but the deterioration will be gradual. This, however, is not the case for a northwesterly wind where cloud and shower activity can move in very quickly from the Strait of Canso. Northwesterly winds can also cause turbulence for light aircraft on approach from the southeast at Port Hawkesbury.

Prince Edward Island - Northumberland Strait



Map 4-7 - Prince Edward Island - Northumberland Strait

Prince Edward Island's weather is highly affected by the Gulf of St. Lawrence and the Northumberland Strait. Probably the most pronounced effect is enhanced snow-fall during winter storms and onshore circulation snow squalls in the late fall and winter. When cold arctic air meets the open sea of the gulf, areas of cumulus and towering cumulus cloud develop with locally heavy snow squalls. This generally happens in north to northwest winds but can also develop in cold west or southwesterlies before the Northumberland Strait freezes over.

Conditions can become especially bad on the eastern end of the island, east of a line from Tracadie Bay to Wood Islands. The snow squalls here can result in almost continuous snow and blowing snow until the wind direction changes. This is due to the air being squeezed between the Gaspé Peninsula and Anticosti Island far to the north, and being forced to rise. This upward forcing produces a band of snow showers, or streamers, that stretches all the way down to Prince Edward Island. Strong winds are common here, as well, and can cause significant reduced visibilities in drifting snow, even when snow is not falling.

When low pressure systems pass near or to the south of the island during the winter, freezing precipitation becomes a threat. Freezing rain can develop ahead of an approaching warm front and, depending on the speed of the low, can last for several hours. Freezing drizzle is also common in persistent easterly or northeasterly winds off the ice covered Gulf of St. Lawrence.

Fog is one of the biggest problems during the spring as the ice begins to break up and warmer air masses begin to move up over the Maritimes. Low stratus can also develop in northerly winds off the gulf. In winds from the north-northeast, the Charlottetown Airport will often get stratus spilling over the hills to the north and move in at about 200 feet. This happens frequently in the spring and develops very fast. Cloud will also often move up from the Bay of Fundy in southwest winds. This can occur any time of year but is most prevalent in the summer when there is fog in the Fundy area. The cloud will be advected over the lower terrain north of the Cobequid Mountains and move into the Northumberland Strait and Prince Edward Island, as stratus or stratocumulus cloud based between 800 and 2,000 feet.

Although Prince Edward Island can be quite windy, turbulence is generally not a problem due to the flat terrain. The approach from the northeast at Summerside Airport can be somewhat turbulent on hot summer days or cool nights, due to the difference in terrain near the shoreline of Malpeque Bay. Sea breezes can develop, especially over eastern areas of the island, because of the colder Gulf of St. Lawrence. During the early summer, thunderstorms moving east from New Brunswick tend to die out as they cross the cooler waters of the Northumberland Strait. Later in the season, though, the water becomes warm enough to sustain or even strengthen thunderstorms as they move across the strait into Prince Edward Island.

Convection in the Northumberland Strait does not have to reach the thunderstorm stage to cause problems for aviators. By the fall into early winter, cumulus and towering cumulus regularly form on calm, cool nights over the strait from Cape Wolfe to near East Point, due to the relatively warm waters. They usually develop shortly after sunset and dissipate 2 to 3 hours after sunrise. Pilots flying cross-country across the strait should keep this in mind during this time of year, as no cloud will be present in the evening and skies may be clear at Moncton and Charlottetown during the night. The cloud over the strait will likely be difficult to detect and may be inadvertently flown into. By late fall and early winter, snow showers may develop as well, adding to the hazard.

Fundy Region of New Brunswick



Map 4-8 - Fundy Region of New Brunswick

As most local pilots are already aware, fog can be a major problem here in the spring and summer. It develops over the cold Bay of Fundy in warm, moist, southwest winds and is then advected onshore. It tends to be prevalent throughout the entire bay in these situations, but will creep farther inland on the New Brunswick coast than it will on the Nova Scotia side of the bay.

Fog typically extends inland to Grand Bay and can push as far north as Oak Point, in the Saint John River Valley, and also as far as Hampton. To the west, the fog will extend as far as the imaginary line that can be drawn between Oak Point and St. Stephen whereas, to the east, 1,400 foot hills will have a tendency to act as a barrier and prevent the fog from penetrating inland. Pilots report that when fog does move in from the bay, it always does so very rapidly and can remain, with little diurnal variation near the coast, as long as the flow is from the southwest. Thicker fog will usually extend from Pennfield to just east of St. Martins along the coast. It can also push farther east into Chignecto Bay and Shepody Bay, but usually burns off north of Hopewell Cape and Dorchester.

A good indicator as to whether or not fog will develop is to look at the forecast winds at 3,000 and 6,000 feet. When these winds parallel the bay, fog can usually be expected until the winds shift significantly. A common tool in timing the fog at Saint John Airport is to look at the tide tables for the Saint John Harbour. Fog often moves into the airport 30 to 40 minutes prior to high tide. Another good predictor of fog development is to look at coastal stations along the coast of Maine. If fog is observed at Bar Harbour and Rockland, fog in the bay is almost guaranteed.

Loch Lomond Reservoir to the northeast of the Saint John Airport will also have an effect on weather in the area, as will several smaller nearby lakes. In the spring time, when the reservoir and lakes are still cold, fog or low stratus will form and drift over the airport. This is not Bay of Fundy fog and is much more localized at the airport.

Pollution is another restriction to visibility and occurs frequently in the summer. It moves up the Saint John River Valley from the south, with typical visibilities around 6 miles in haze, as far north as Hampton, Kennebecasis River and up to Belle Isle Bay. The height of the worst pollution is about 300 to 400 feet and is generally yellowish in colour.

Also in the summer, thunderstorm activity will often remain north of the sea breeze front, or over the hills to the northeast. They may, however, reach the Saint John Airport when associated with a frontal system.

Sea breezes and coastal convergence are common here and can produce bands of strong southwest winds. Winds are also channelled around Kennebecasis Island in a southerly wind. The air flows around the island and converges on the north side, producing gusty winds and possible low level turbulence. Pilots also report turbulence over the hills northeast of the Saint John Airport in northerly winds, and, along the shoreline in south to southwest winds. Conditions typically smooth out above about 3,500 feet. Strong winds often develop on the west side of Grand Manan Island as prevailing winds get funnelled and channelled between the island and the mainland.

Another effect that is seen on the New Brunswick side of the bay is variations in the types of precipitation during the approach of low pressure systems. The warm

water will tend to keep the lower levels of the atmosphere warm, causing snow to change over to rain or freezing rain sooner than is forecast. Local pilots also indicate that significant icing conditions exist in stratocumulus cloud over the Bay of Fundy in the winter.

Southeastern New Brunswick - Moncton to Miramichi



Map 4-9 - Southeastern New Brunswick

West or northwest winds over eastern New Brunswick generally bring good flying weather in any season. Winds from the easterly quadrants are another matter, however. These winds are onshore and upslope here and will tend to give low cloud or fog. This will result in icing conditions within the cloud in the colder months. This onshore cloud tends to be based higher once the Northumberland Strait is frozen.

Often, after the passage of a cold front in any season, southeast New Brunswick will be slow in clearing out if winds are from the north or north-northeast. Conditions will generally not improve until there is no easterly component to the 3,000 and 6,000-foot winds. This may be several hours after clearing has taken place everywhere else in the province. This effect is more pronounced south of Miramichi. During the winter, the Petitcodiac River does not freeze completely leaving a moisture source for fog or cloud to develop. When the winds are light and temperatures are cold, fog will form over the river with the incoming tide. This fog occasionally drifts over the airport at Moncton, reducing ceilings and visibility. The Moncton METAR will often indicate the presence of fog over the city in the REMARK section an hour or so before it reaches the airport. This can also occur in the spring and early summer as warmer air flows over the colder water. In this case, the City of Moncton could be clear while the airport could be shrouded in fog.

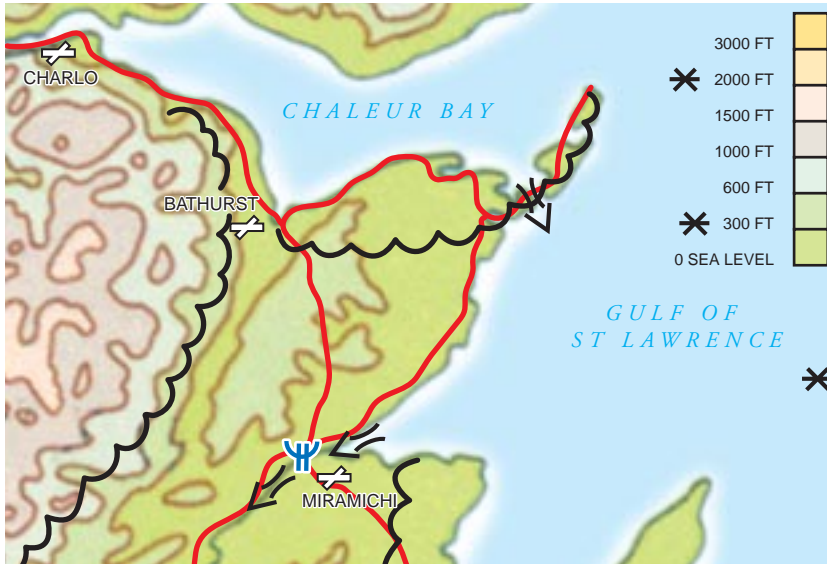
Storms tracking to the south will generally give east to northeasterly winds to this area, which will usually result in low ceilings and visibility, especially from late fall to spring. Local pilots know that as soon as the winds go northeast at Moncton or Miramichi, it will not be long before ceilings between 800 and 1,200 feet will move onshore. When rain is falling, ceilings come down even further to about 400 feet. Strong winds associated with storms moving up the coast in winter will give heavy snow and blowing snow over the entire area. The southeast coast of New Brunswick is known as a snow belt area, as snowfall is enhanced by the moisture in the Gulf of St. Lawrence and the upslope flow.

In the summer time, fog from the Bay of Fundy will occasionally come up through Shepody Bay and the Petitcodiac River at night, but will quickly burn off shortly after sunrise. Moncton is sheltered by the Albert County Hills and does not experience the extended fog events that Saint John does, but will get stratus fractus cloud based between 1,000 and 1,500 feet. These hills will also act as a barrier to low-level jets ahead of cold fronts during winter storms. Pilots on final approach to Moncton will occasionally report a sudden loss of airspeed below 400 feet when a cold front lies to the west. In a southwesterly wind, these hills will also induce shower activity which tend to remain south of the Moncton Airport. Haze can also cause reduced visibilities to about 6 miles during the summer months.

Sea breezes are a fact of life along this part of the coast especially during the spring and early summer but tend to be less frequent in late summer, due to the relatively warm waters of the Northumberland Strait.

Most of the thunderstorm activity in this part of the province actually originates farther west over central and northwestern New Brunswick. The strongest storms are those associated with frontal systems. Air mass thunderstorms are usually scattered and tend to break up as they approach Moncton, with some passing to the north and some to the south.

Northeastern New Brunswick - Miramichi and Vicinity to Charlo



Map 4-10 - Northeastern New Brunswick

The flying weather along this part of the coast is in many ways similar to the south-east coast of New Brunswick. Southeast to northeast winds will bring the lowest conditions, especially in the spring to fall months, when there is a large temperature contrast between the water and the land. Ceilings will generally be lower farther inland if precipitation develops under these circumstances. Pilots say that when ceilings at Miramichi, Bathurst and Charlo are 300 to 500 feet, ceilings at Pokemouche Airport, which is closer to the coast, will almost always be 700 to 900 feet.

Fog or stratus fractus is common over the Miramichi River in the spring or fall and may even roll in towards the airport early in the morning. Stratocumulus cloud and local flurry activity are also common over the Acadian Peninsula in the fall and early winter. This cloud usually develops in colder air over the Bay of Chaleur and is advected inland by north or northwest winds. This cloud is typically based between 1,500 and 3,000 feet.

Also in the winter, freezing precipitation can also be a problem either ahead of warm fronts or in onshore winds along the coast. When the winds are out of the east or northeast, cloud associated with these winds will tend to be very moist and will be prone to icing conditions. Freezing drizzle will often be reported in these situations

as well. Freezing precipitation associated with warm fronts will often last longer at Miramichi, and especially at Charlo, due to local topography. Winter storms often track to the south or southeast of this area, resulting in periods of heavy snowfall. Onshore winds also tend to enhance the snowfall along the coast and even blizzard conditions are not uncommon here, especially over the Acadian Peninsula.

In the summer, sea breezes usually develop along the Gulf of St. Lawrence coast and along the Bay of Chaleur coast, east of Dalhousie. They typically develop around 11 am or noon local time and tend to be from the east or southeast, turning a pleasant sunny morning into a cool afternoon. Often fog will lie just offshore and, once the sea breeze develops, the fog will be pushed onshore. During mid afternoon, the sun will normally be strong enough to keep the fog at bay. Once the sun starts to set, however, the fog will start to roll in, usually as stratus based around 800 feet. Ceilings usually continue to descend until it is actually fog by about 9 or 10 p.m. local time.

Most of the thunderstorm activity develops farther inland but, when the air is sufficiently unstable, scattered thunderstorms can develop by mid afternoon due to surface heating. It is often possible to circumnavigate the storms but, when they become too widespread, one possible out is to head east towards the coast. Often by mid afternoon, a sea breeze will have developed along the coast “cutting off” any convection and producing an area of clear skies from Miscou Island to Moncton. This is often readily seen on satellite imagery.

Central and Northwestern New Brunswick

This area has some of the best flying weather in the Maritimes. Westerly to northerly winds are downslope and will generally provide good conditions. Winds from the south to the east will be upslope and tend to give lower ceilings and visibilities. The Saint John River Valley is prominent in this area and winds have a tendency to be channelled through the valley. Patches of radiation fog are common all along the river valley from spring to early fall, during clear nights. The fog, which is typically 500 to 1,000 feet thick, usually develops over the river shortly before dawn and gradually spreads outward to about 3 to 5 miles on either side of the river, often reaching the Fredericton and St. Leonard Airports. This fog usually burns off within 2 to 4 hours after sunrise.

Fog forming south of this area in the Bay of Fundy rarely reaches this far north but can extend up to Fredericton as low stratus cloud. It will usually take rain to bring the ceilings down further to result in fog. Low cloud and drizzle, or freezing drizzle in the winter, often develops when a high pressure system lies to the north and a low is to the south or southwest.



Map 4-11 - Central and Northwestern New Brunswick

Morning fog and stratus will often form over Grand Lake in any season but most often in the spring and fall. This usually burns off quickly but may also drift southward over the Gagetown training area. Fog may also form over the headpond of Mactaquac Dam in the fall and slowly drift towards the City of Fredericton and the airport. Over northwestern sections, radiation fog will form in the valleys in the summer but this burns off very quickly and is usually not a problem for visual navigation.

With a persistent high southeast of the Maritimes in the summer, southwest winds will bring pollutants up from the northeast United States and southern New Brunswick. This, along with haze, will typically reduce the visibility to 6 to 10 miles over a wide area, with local areas being diminished to as low as 2 to 3 miles. This haze has been observed at altitudes of up to 10,000 feet.

Northwest New Brunswick experiences the highest incidences of thunderstorms in the entire region. Convective activity first tends to develop over Maine or northwest New Brunswick due to orographic lift, then moves east or southeastward. When the air is sufficiently unstable, a typical day would start off sunny but somewhat hazy in

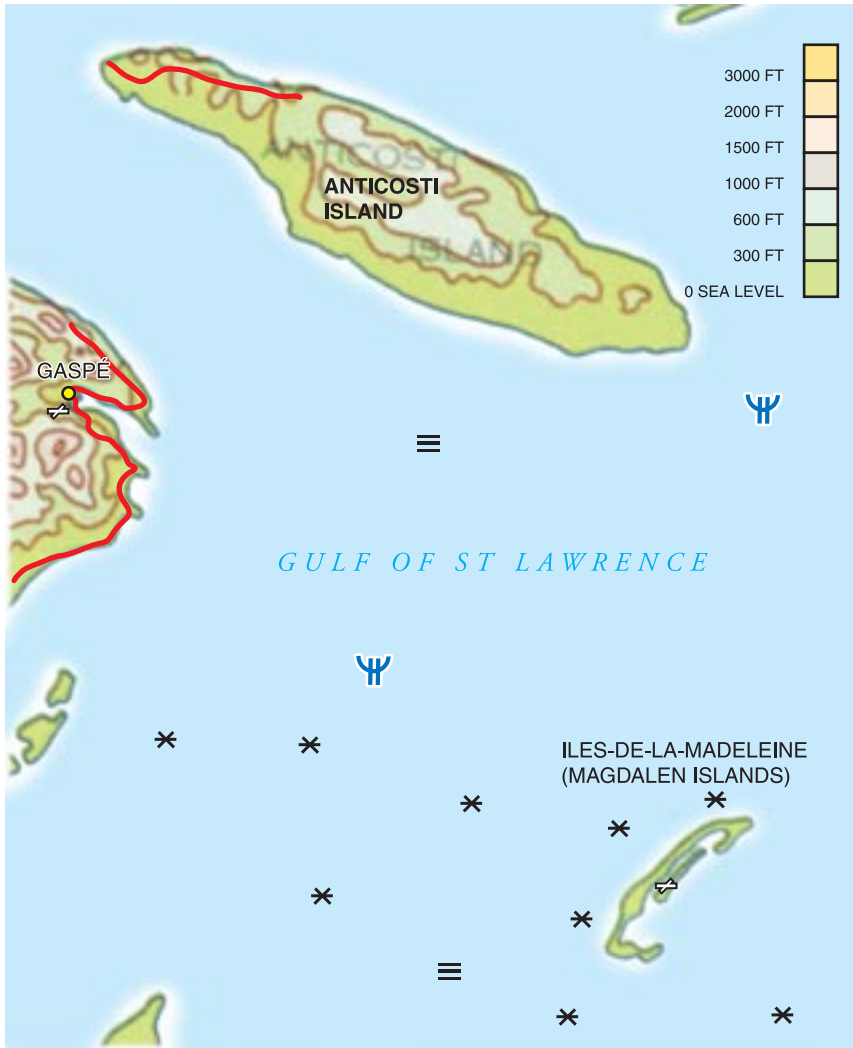
the morning. Scattered cumulus cloud would begin to develop by 11 a.m. local time and grow to towering cumulus by early to mid afternoon. Shortly after this, the first thunderstorms are observed west and northwest of Fredericton. As the afternoon progresses, thunderstorm activity will increase and move in a general easterly direction. Thunderstorms will tend to break up as they approach Fredericton and pass north and south of the city, often missing the airport. Although not always the case, this effect occurs quite often. In fact, local pilots refer the area north of Fredericton as “thunderstorm alley”.

Often, when only scattered cloud will be present over southern and eastern New Brunswick, stratocumulus ceilings will develop over the higher terrain in northern New Brunswick, causing problems for low-level traffic heading north from southern New Brunswick, or west from Miramichi, Bathurst or Charlo. This occurs quite often and in any season. Turbulence is also much more prominent over these mountainous terrain as well. Pilots also notice that turbulence can be significant on approach from the east at Fredericton Airport on hot, sunny days, due to differential heating between the land and the Saint John River.

Fronts approaching from the west will often slow down as they cross over Maine and western New Brunswick, due to the rough terrain. Local pilots also report that, as low pressure systems pass over southern New Brunswick and a changeover from snow to rain is forecast, central areas of the province will often be slow in changing over. Freezing rain or ice pellets will tend to last longer than over southern or southeastern areas of the province. North of Florenceville, snow rarely changes over to freezing rain or rain, as long as the low passes to the south.

Pilots and radiosonde technicians at CFB Gagetown often report low-level nocturnal jets over central New Brunswick in the fall and spring. Strong inversions will develop after sunset and surface winds of 4 or 5 knots may increase to 50 knots at about 800 to 1,000 feet. This is observed on a fairly regular basis on otherwise clear nights.

Gulf of St. Lawrence - Les Iles-de-la-Madeleine



Map 4-12 - Gulf of St. Lawrence - Iles-de-la-Madeleine

Flying weather in the Gulf of St. Lawrence is highly dependent on the season and whether or not ice is present in the gulf. Freeze-up usually starts in the northern part of the gulf by mid to late November and progresses southward to cover much of the western areas by late January. There usually is, however, ample open water over the gulf for instability snow showers and streamers to develop, especially in the early part winter.

The best winds for instability snow showers and streamers over the Gulf of St.

Lawrence are from the west-northwest to northerly. These winds will provide a large enough fetch while ushering in ample cold air. Cold southwest winds can also give rise to snow flurries but there is often too much shear in the low to mid levels for true snow squalls to develop. Westerly winds are more conducive but the snow squalls will tend to form farther out in the gulf. In west-northwest to northerly winds, provided there is enough open water, streamers will develop south of Anticosti Island. A favourable source for the development of streamers is between Anticosti Island and the Gaspé Peninsula as the air is forced upwards. The best direction for streamers to affect Les Iles-de-la-Madeleine is from the northwest. Typical conditions in snow showers would be a visibility above 6 miles and ceilings between 1,000 and 3,000 feet, with brief periods of 1/4-mile visibility in snow and vertical visibility near 100 feet.

When snow squalls develop over the gulf, significant icing and turbulence can be expected. The worst conditions are not uniform, however, and pilots often break out into clear skies within a few miles. It is often better to go up and fly over these snow showers, as they are usually confined to altitudes below 8,000 feet.

Les Iles-de-la-Madeleine Airport can be quite difficult to get into in the winter. Not only do snow squalls cause problems, but difficulties are often encountered even when snow is not falling. In the wake of low pressure systems, the winds are usually quite strong and gusty but the direction may not be favourable for streamers at the airport. The winds will, however, cause heavy drifting snow in the lowest 50 feet. Pilots may be in clear skies for most of the approach but, when descending into this shallow layer of drifting snow, it is often impossible to see the runway, necessitating an overshoot. Turbulence can also be moderate to severe in these situations.

Also during the winter and early spring months, freezing drizzle can become a significant icing hazard in this area. When the gulf is mostly ice covered, east to northeast winds will be most conducive for this to develop. With other wind directions, freezing drizzle will often be encountered downwind of any patches of open water. Pilots flying low-level over the Gulf of St. Lawrence would be advised to examine ice cover charts to locate these open water areas.

Ice usually starts to melt in the gulf by late March or early April. Once ice break-up has begun, fog becomes a factor over the gulf. Northern areas are more prone to fog because the water is deeper and tends to be colder than southern sections. During the late spring and summer, it usually takes precipitation to saturate the lower levels for fog or low stratus to develop over the gulf. The extent will depend on the precipitation pattern over the area. Although the usual thickness is about 1,000 to 2,000 feet, when the fog or stratus is very thin, it will burn off during the day but may leave behind an area of haze over the gulf with reduced visibilities. When fog is prevalent over the Atlantic Ocean south of Nova Scotia, it may enter through the Cabot Strait and affect eastern areas of the gulf. Cape Breton Island and mainland Nova Scotia usually shelter western areas of the gulf from this effect.

Thunderstorms moving eastward off the New Brunswick coast will usually die out once over the Gulf of St. Lawrence. The exception occurs when the convection is associated with a front, or in cold outbreaks in the late summer or fall, when the water is relatively warm. In the latter case, waterspouts may even develop as on one day in late August 2000, when the weather observer at Les Iles-de-la-Madeleine reported 5 waterspouts.

Gaspe Peninsula



Map 4-13 - Gaspé Peninsula and St. Lawrence River

The Gaspé Peninsula is quite mountainous which brings about a lot of turbulence in windy conditions. When winds are above 25 knots, moderate mechanical turbulence becomes widespread over the peninsula and can progress to severe at times when the air is unstable. Turbulence is not restricted to mechanical, however, but convective as well. Pilots report that on hot sunny days, flying over the Gaspé Peninsula can be very rough up to 5,000 or 6,000 feet, especially over the Notre Dame Mountains. These mountains are in the 3,500 to 4,000 foot range and rise abruptly from the St. Lawrence River. Mountain waves are also frequent in northwest winds behind cold fronts. Gaspé Airport, for instance, is reported as being very turbulent on approach, especially when the surface winds are from the east and the upper winds are strong southerly. Marsoui, which is just east of St-Anne-des-Monts, is also notorious for whirlwinds and severe turbulence. Drainage winds can develop in the narrower river valleys at night, resulting in strong southerly surface winds near the coast with strong wind shear in the low levels.

Another effect that can cause significant turbulence in this area is strong southerly winds that often develop when a low approaches from the southwest and passes north of the St. Lawrence. These winds are associated with low-level jets and often reach the surface south of the warm front. This effect is most dramatic at Cap-Chat and

St-Anne-des-Monts. From late fall to early spring, these strong low-level jets are much stronger and even more common. They are usually from the southwest when low pressure systems track to the north of the St. Lawrence River Valley, and from the northeast when the lows' tracks are to the south. Turbulence and significant wind shear should be expected with these features, and tends to be worse over ice-free areas on the St. Lawrence.

Funnelling and channelling are more pronounced from Rimouski eastward due to the higher mountains on both sides of the river. The orientation of the valley tends to channel the winds in either a northeast or southwest direction. Winds are also stronger between Matane and Cap-Chat due to coastal convergence and funnelling between this area and Pointe-des-Monts on the North Shore. A series of wind turbines have been installed here for this very reason and can be a hazard when low cloud is present. As long as the St. Lawrence River is open, upslope north or northwest winds will tend to cause cloud to develop over the mountains, capping the tops. This can occur in any season, but is most prevalent when the temperature difference between the water and the land is greatest. Funnelling also occurs in southeasterly and northwesterly winds in the Honguedo Strait, between the eastern end of the Gaspé Peninsula and Anticosti Island.

Convective activity is quite common in the mountains over the Gaspé Peninsula. The same convective currents that cause turbulence often continue to grow, making this area a favourable location for thunderstorm development in the summertime. Even when thunderstorms do not develop, shower activity is frequent in the hills while good conditions prevail elsewhere. In the fall, when the freezing levels get lower, snow flurries can be encountered in the mountains while only showers, or even no precipitation, will be reported at the coastal airports.

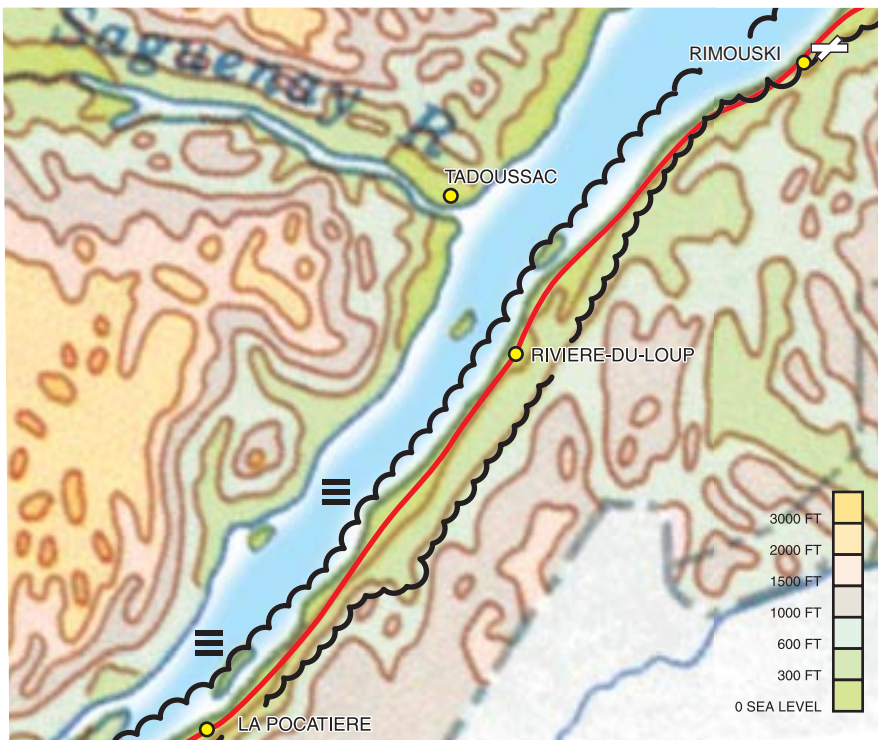
Snowfall is usually heavier in the Parc-de-la-Gaspésie and Murdochville areas. When the St. Lawrence River is open and winds are from 250 to 290 degrees, the Gaspé Peninsula is prone to onshore snow squall activity up to Cap-des-Rosiers. This occurs more often in the late fall and early winter. The combination of falling snow and blowing snow can cause local visibility to deteriorate briefly, to as low as 1/4-mile. The area south of Cap-des-Rosiers is somewhat sheltered from the worst flurry activity, however, snowfall associated with winter storms tends to be heavier here due to the added moisture from the Gulf of St. Lawrence. Precipitation type can also vary greatly in relatively short distances and different elevations. For example, when light rain is observed at the Rimouski Airport, freezing rain or freezing drizzle can be reported at Mont-Joli Airport and snow a few miles inland. This is especially common in the fall or spring.

The southeastern part of the Gaspé Peninsula tends to be adversely affected by the same weather as does northeastern New Brunswick. East to southeast winds generally bring the lowest conditions. Fog and low stratus are more common in the fall and

spring when the land-sea temperature difference is higher. Pabok and Bonaventure Airports may have a ceiling of 800 to 1,200 feet, but hills to the north and northwest will be capped. In west-northwest to northerly winds, these airports may have good ceilings, or even just scattered cloud, but unless the air is very dry, stratocumulus ceilings will be encountered in the mountains to the north and west.

Several “bad weather routes” exist between the Gaspé Peninsula and New Brunswick, but two of the better known ones are the Cascapedia River Valley and the Matapedia River Valley. The Cascapedia River Valley is not as wide as the Matapedia River Valley but has much less in the way of power lines.

Lower St Lawrence - La Pocatiere to Rimouski



Map 4-14 - Lower St. Lawrence - La Pocatiere to Rimouski

Along the Lower St. Lawrence, from La Pocatiere to Rimouski, the river tends to narrow somewhat, but funnelling is kept to a minimum due to the relatively flat terrain. This area also has better ceilings and visibilities in southerly winds associated with storms, due to the downslope effect of the mountains to the south. Even in north or northwesterly winds, any stratocumulus ceilings that develop will likely be higher in this area, although visibilities can often be reduced in snow squalls in the late fall or early winter. Snowfall also tends to be heavier and linger behind weather systems in the St-Louis-du-Ha-Ha and the St-Honore areas.

When the general circulation is from the northwest, the winds get funnelled out of the Saguenay River Valley at high speeds and shift towards the east. This results in a band of strong southwest winds on the south shore of the Lower St. Lawrence up to Ile Bicquette, but not quite reaching Rimouski.

Fog, usually topped between 500 and 1,000 feet, is common over the water if warm moist air moves up from the southwest in the summer. This fog can sometimes drift inland with minor shifts in wind direction. Low ceilings and visibilities are also common all along the coast in east or northeast winds, often reaching below landing thresholds when precipitation is falling

Newfoundland

It is no surprise that wind is the biggest factor in determining local weather in Newfoundland. Winds are rarely calm and are always onshore somewhere on the island, regardless of the direction. The predominant flow is from the northwest in the winter and southwest in the summer. Because of the wind patterns in Newfoundland, the weather is extremely variable and can change more rapidly than almost anywhere in the country.

(a) Summer

During the summer months, low pressure systems have a tendency to be weaker than in the winter months, however, they still follow preferred tracks. (See Fig. 3-9) Most systems will track across southern Labrador or the North Shore of Quebec and then cross north of Newfoundland. A second and less frequent track carries lows south of the island and then out to sea. In both cases, fronts associated with these systems are diffuse and little contrast exists between air masses. Precipitation tends to be of the showery type although steadier rains occur with the slower, more developed systems.

Summer weather across Newfoundland is as variable as in any other season. Seldom will all areas of the island experience good flying weather. The best synoptic situation for good flying weather is a strong ridge of high pressure off the coast of Nova Scotia and a southwest flow over the island. If the southwest flow is moist enough, that is, the dew points associated with the air mass are higher than the temperature of the surrounding waters, fog will develop and be pushed onshore. Fog will often be observed all along the south and west coasts of the island in these situations.

In the late summer and early fall, tropical storms that have spawned near the equator may bring windy, wet weather while they pass to the southeast of the island before dying, or redeveloping, in the North Atlantic. A common pattern is for a tropical system to approach Atlantic Canada, interact with a front and then begin to develop extra-tropical characteristics. These systems will move very rapidly and can produce strong winds and heavy rains, much like a tropical system.

Although not frequent, thunderstorms do occur in Newfoundland and can occur in any season. The highest occurrence of thunderstorms on the island is in the central and northeastern part of the province.

(b) Winter

Local weather conditions in the winter are highly dependent on the track of synoptic weather systems. (See fig. 3-8) There are significant differences in the effects of these systems, depending on where a particular station is located relative to the system's centre. In the winter, lows are more intense, more frequent and have fronts that

are much more distinct. Similarly, high pressure systems are also stronger in the winter.

Three basic weather patterns that occur frequently in the winter are lows passing to the south or southeast of the island, lows passing to the west or northwest of the island, and high pressure systems approaching Newfoundland from the west.

The strongest lows are those that approach from the south or southwest and pass either over or just to the south of the island. Lows following these tracks spend extended periods of time over the water where they have ample time to develop and gain energy.

A typical scenario that occurs as a low pressure system approaches the island from the south is for winds to gradually increase from the east or southeast. Occasionally, flurries will develop ahead of the primary areas of snowfall, reducing visibility to approximately 5 miles. Flurries, however, usually cease before the onset of the main area of snow, which, when it develops, will rapidly drop the visibility to 1/2 to 2 miles. Snow and blowing snow will then often persist for several hours depending on the speed of the low. East of the low's track the snow may become mixed with, or change to, ice pellets usually between about 60 to 100 miles ahead of the warm front. Closer to the warm front, freezing rain may be observed before it changes to rain south of the warm front. West of the low's track, precipitation will generally remain as snow. The heavier snow will be found within approximately 120 miles west of the storm's track. Once the low passes and the cold front swings across the island, a strong west to northwest flow is established and precipitation will typically end over the inland areas, while snow showers may persist in onshore flow.

Another favoured track has the low pressure centre approach from the southwest and pass to the west or northwest of the island. Such a trajectory keeps the low over land for much of its journey. With the absence of the water to provide energy to develop, these lows generally do not become as deep as those that track over the ocean. It should be said, however, that even these storms can bring bad flying weather to the entire island.

As storms move away from the island, high pressure systems tend to build to the west and move east or southeastward towards Newfoundland. Ahead of these high pressure areas, cold arctic air will flood the region producing instability snow showers or "streamers" over the water and to places where winds blow onshore.

A different situation becomes apparent when a high pressure area over Labrador and a slow moving low east of the island are present. In this case, a northerly flow will persist for several hours or even days. These persistent, northerly winds will be very moist and result in freezing drizzle along northern coastal sections until the winds subside.

Periods of extended freezing precipitation are common in Newfoundland. The area between St. John's and Gander is especially prone to prolonged periods of freezing precipitation that can last for several hours or, intermittently, for two days or more. This area receives, on average, 175 hours of freezing precipitation each winter. This number is almost twice the average for anywhere else on the continent, making it the worst area for aircraft icing in North America.

(c) Local Effects

Deer Lake and Vicinity to Port-aux-Basques



Map 4-15 - Deer Lake to Port-Aux-Basques

The area from Deer Lake to Port-aux-Basques is wide open to the effects of the Gulf of St. Lawrence in both the summer and the winter. In the fall months, as the air that passes over the Gulf becomes colder and the water remains comparatively warm, there is an increase in the instability occasioned by the surface heating resulting in flat, stratocumulus clouds with relatively good ceilings. By the latter part of November, snow showers and streamers develop in cold west to northwest winds and reduce the ceilings and visibility. Local visibility of 1/4 - mile and vertical visibility of 100 feet are not uncommon, but have a tendency to be intermittent in nature. The extent to which these streamers are pushed inland is completely dependent on the wind speed; the stronger the wind speed, the farther inland the streamers will extend. Pilots in the area report, however, that the stronger snow showers usually do not penetrate past the Buchans Plateau and the Annieopsquotch Mountains. The occurrence of streamers in the winter subsides in the latter part of the season, as ice forms over the gulf.

A particular phenomenon called the “Anticosti Shadow Effect” occurs when winds are from the west-northwest. In this situation, Anticosti Island acts as a barrier for the development of snow shower activity and an area of predominant clear skies is found downwind. This area of clear skies is roughly the width of Anticosti Island and can extend as west far as the coast of Newfoundland. Often, this narrow area of good weather will cover the Stephenville Airport and therefore, weather reports from this airport will frequently not be indicative of the weather in the surrounding area. In such cases, while Stephenville Airport is reporting scattered cloud, possible heavy snow showers will exist north and south of the field.

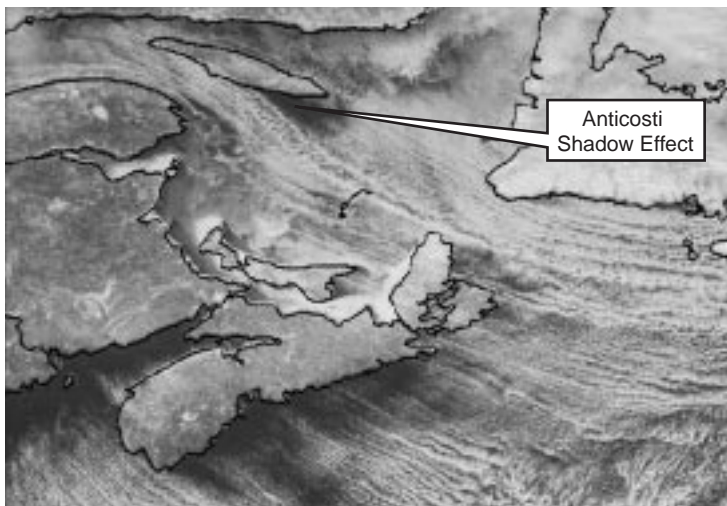


Photo 4-1 - Snowsqualls over the Gulf of St. Lawrence credit: Unknown

Fog in the Gulf of St. Lawrence becomes quite frequent by mid spring and remains so until late summer. Air masses approaching from the southwest are warmer and, thus, have higher moisture contents. Since the water is still fairly cold (with an average of about 4°C for May) the warm, moist air is cooled from below, causing thick fog to become widespread. The southwest winds usually move the fog into the bays and inlets along this part of the coast. When fog is pushed into St. George's Bay, it will usually move into the Stephenville Airport giving very low ceilings and visibility. There is ordinarily some diurnal variation at Stephenville and conditions are generally much better a few miles inland. At times the cooling of the air, due to passage over the water, will not be quite sufficient enough to result in condensation during the day. However, the added cooling at night will cause fog to develop, especially in the presence of precipitation, since precipitation hastens formation. Even after a wind shift, fog in the bay will tend to linger for several hours longer due to the sheltering effect of the bay. Southwesterly or westerly winds of about 15 knots seem to be most conducive to fog or stratus formation at Stephenville.

When the winds are light, a light drainage wind from the northeast sometimes occurs, hindering the movement of fog onto the airfield.

As a result of the heating of the air due to downslope flow, winds from directions other than west or southwest at Stephenville Airport will provide good ceilings and visibility, even when the eastern and southern portions of the island are "fogged in". Incidentally, when Stephenville is closed due to fog or stratus with west or southwest winds, Gander or St. John's will almost always have good ceilings and serve as an alternate and vice versa.

Often in onshore flow when ceilings are good at Stephenville and Deer Lake, cloud will still top the hills all along the coast. When this occurs, it is possible to follow the coast to or from Stephenville. When approaching from the north, it may also be possible to fly through the narrow isthmus at Port-au-Port although this route may be quite turbulent, especially in northerly flow. If this is impassable, it may still be possible to get to Stephenville by following the Port-au-Port Peninsula coastline.

Fog also commonly occurs along the southern part of this coastline. In south or southwest flow, fog is reported to be more frequent at Port-aux-Basques than up the coast at Cape Ray. However, when showery conditions exist in west to northwest flow, the weather is often much better at Port-aux-Basques.

A well-known hazard exists in east to southeast winds from St. Andrews to Cape Ray. These extremely strong, downslope winds, called "the Wreckhouse Winds", cause severe turbulence near and below the crests of the hills on the lee side. Funnelling may further enhance these winds. The most treacherous conditions occur just west of the ridgeline or on the lee side. Severe turbulence in strong whirlwinds and downdrafts can be expected in these areas, which local pilots agree, may cause

light aircraft to break up in flight. It is usually best to fly over the ridge if there is no cloud capping the hills. Even in a 30-knot wind the top of the ridge will be fairly smooth. However, when pilots stray just west of the peaks they will encounter severe turbulence. If cloud caps the hills, it may be possible to fly about 2 to 5 miles offshore where the turbulence will be much less severe. Westerly winds are usually pretty good as far as turbulence is concerned for the “Wreckhouse” area.

Port-aux-Basques to the Burin Peninsula



Map 4-16 - Port-Aux-Basques to the Burin Peninsula

Probably the main aviation weather hazard on this part of the island is thick fog along the coast and offshore. The water off the south coast of Newfoundland does not freeze in the winter but can cool to temperatures of near 0°C. The cold water tends to cool the warm, moist air masses from below resulting in the development of fog throughout the year. However, this is much more prevalent in the spring and summer when the air to sea temperature difference is at its maximum. When winds are from the south or southwest during this time of year, fog can be expected all along the coast and is usually pushed into the numerous bays and inlets. The distance the fog extends inland is highly dependent on the strength of the wind. If rain is present in this situation, fog will generally extend far into central Newfoundland and even up toward the northeast coast with no diurnal improvement. During the summer when precipitation and higher cloud are absent, fog will typically extend about 60 to 80 n. miles inland and lift, near noon local time, to approximately 500 feet or so. This will sometimes make it possible to sneak into the coast via the valleys. Caution should be used, however, since fog will quickly move in again by late afternoon. A related hazard reported by pilots flying in these conditions is the high level of bird activity.

Belle Bay, just west of the Burin Peninsula, will often have better conditions than other bays in the area since it is sheltered from almost every direction. Helicopter pilots report that visibility in Belle Bay is usually better and winds lighter than in Fortune Bay in southwesterly flow.

The south coast of Newfoundland is oriented along a rough east to west line and has steep cliffs with numerous bays and inlets oriented in a north to south direction. This causes a variety of local wind patterns and low-level turbulence up and down the coast. In northeasterly flow, winds are channelled and funnelled through Bay de Loup just to the northeast of Burgeo, producing very strong winds at the mouth of the bay. Burgeo has recorded winds as high as 85 knots in these situations. Whirlwinds can also be expected near and south of Burgeo causing low-level turbulence generally below 2,000 feet. This is only one example of this effect that occurs at several locations along the coast.

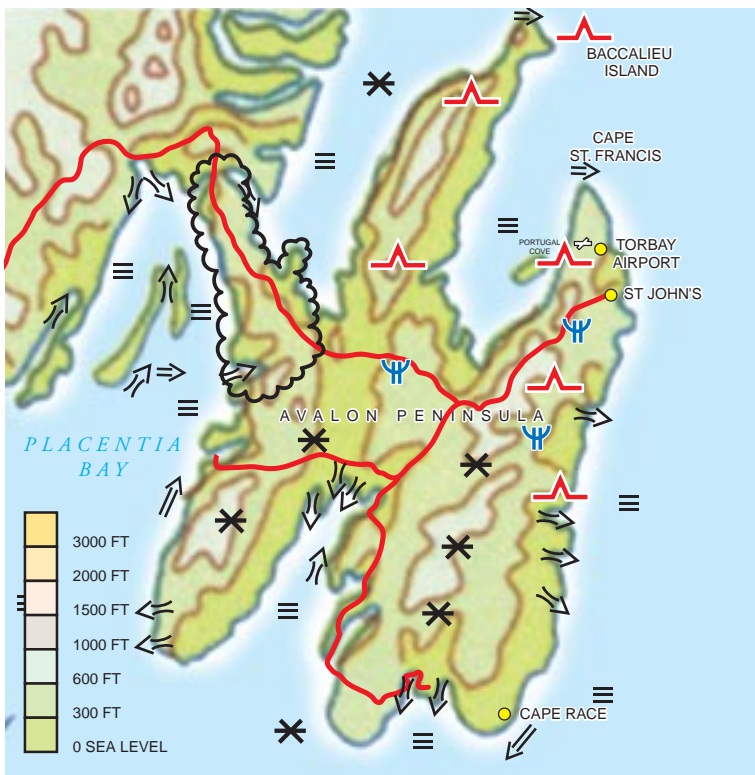
From Port-aux-Basques to Hermitage Bay, winds out of the north will cause down-drafts near the coast and will presumably result in problems for helicopter operations, especially near Francois and Grey River. Northerly winds also get funnelled down White Bear Bay between the steep cliffs and can be very strong at the mouth of the bay, causing turbulence and whirlwinds around Bear Island. In the summer, cool and gusty drainage winds from the north are common in the early morning hours at the mouths of the bays along this stretch of coastline.

From winter to late summer, warm southerly winds will often push the colder air northward where it becomes trapped against the steep cliffs of the coast. The warm southerly winds ride up over this colder air which brings about an easterly circulation

near the coast. In winter, a layer of cold air, generally below freezing, will remain from the coast up to 15 miles offshore and will extend almost to the top of the cliffs. Although confined to the extreme low levels, this may result in freezing precipitation and icing conditions within this layer of colder air. This effect can often be confirmed by checking the winds from Burgeo and Sagona Island, which would be from the east and south respectively.

As mentioned earlier, the seas off the south coast usually do not freeze in the wintertime. This will cause snow showers and streamers to develop during cold arctic outbreaks. In northwest winds, the flow is offshore and streamers will generally not develop near land. However, when cold west or southwest winds develop, heavy snow showers will be quite prevalent along the coast and often result in blizzard conditions over the Burin Peninsula, which protrudes out into the path of the snow showers. Visibility will often be reported as zero in snow and blowing snow and strong, gusty winds will be experienced over the peninsula while only scattered cloud and isolated flurries will be reported inland.

Placentia Bay and Southern Avalon Peninsula



Map 4-17 - Avalon Peninsula

Placentia Bay is extremely susceptible to fog in south to southwest winds in every season, although it occurs more frequently in the spring and summer. The fog here forms very rapidly, as soon as the air mass is cooled to its dew point due to the cooler waters, and is usually very thick, exhibiting very little diurnal improvements. When frontal fog develops and floods Trepassey, St. Mary's and Placentia Bays, it will usually linger in the bays for several hours behind the cold front, after the winds shift to westerly.

When Torbay Airport at St. John's, which lies to the northeast of the area, falls below one mile of visibility in fog and the surface winds are southeast through northeast, low cloud and fog will advect into the area. Ceilings from 600 to 800 feet and visibility from 3 to 5 miles can be expected over the eastern coast of Placentia Bay approximately 6 to 8 hours later, although this time will vary depending on the strength of the winds. If the above conditions at Torbay persist over 10 to 12 hours, the ceilings and visibility along the coast will usually lower to between 200 to 400 feet and the visibility from one to 2 miles.

A band of stronger winds is often reported near the coast on the east side of Placentia Bay in a southwesterly flow. This is due to coastal convergence and also occurs on the west side of the bay in a northeasterly flow.

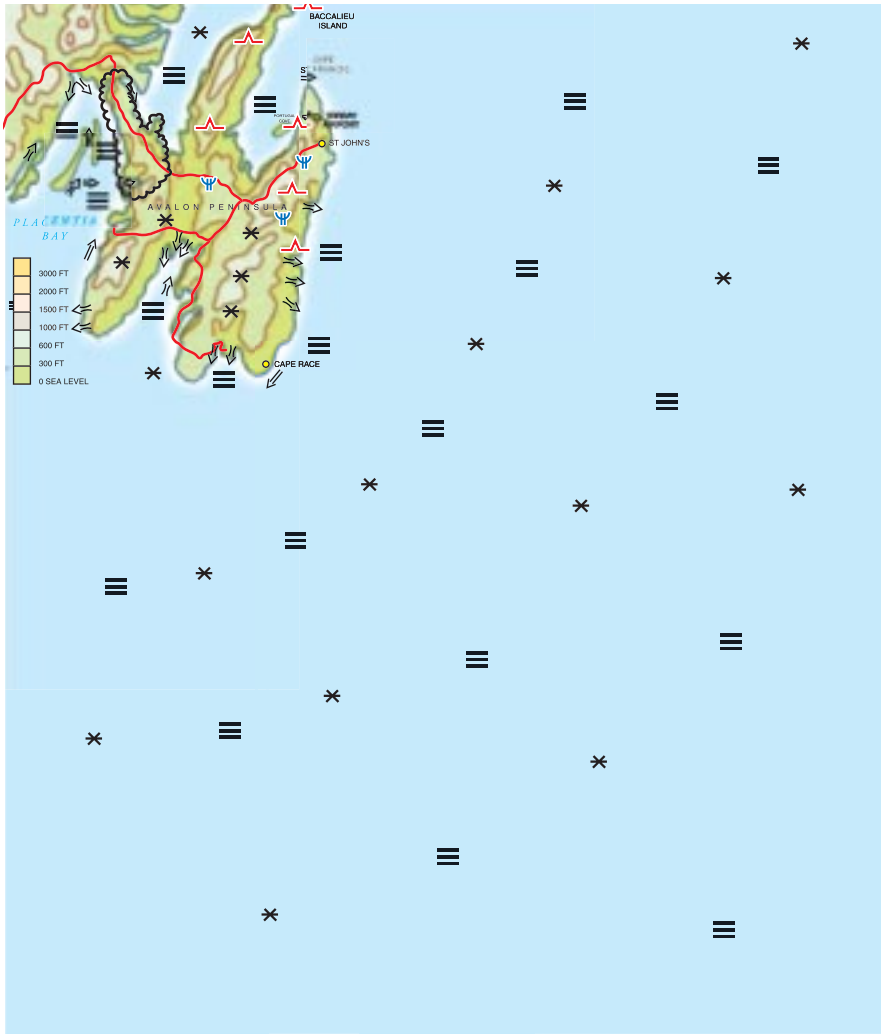
When the winds are from the east, they pass over the hills that are found on the southwestern tip of the Avalon Peninsula and become funnelled through the valleys, producing very strong gap winds along the coast at St. Brides.

In the winter, winds behind cold fronts will often be from the west or southwest for a period of time before eventually shifting to northwest. In these cold west or southwest winds, snow showers and streamers will develop and will usually have no difficulty in crossing the southern part of the Avalon, resulting in relatively brief periods of low ceilings and visibility.

The southern part of the Avalon Peninsula is relatively flat, barren and wide open to the fury of storms approaching from the south. Accordingly, this area is prone to winds as high as 80 knots when deep low pressure systems come up the eastern seaboard.

The cornering of winds occurs at several locations along the coast of Newfoundland. The most extreme and well-known case is along the southeastern part of the Avalon Peninsula at Cape Race. Cornering and coastal convergence act together in northeasterly flow to produce winds as high as 25 knots stronger than the rest of the area.

Offshore Newfoundland - Grand Banks



Map 4-18 - Offshore Newfoundland - Grand Banks

From an aircraft operations standpoint, the Grand Banks has one of the world's harshest environments. Fog and icing conditions are the two greatest challenges that aircraft operators face on an almost daily basis.

Fog can and does occur any time of year but is a bigger problem in the spring and summer. July is the worst month with visibilities of one half-mile occurring about 50 percent of the time. The fog is also much more persistent during this time of year with almost 60 percent of the fog occurrences lasting more than six hours. Advection sea fog is the predominant type over the Grand Banks and occurs most frequently in a southeast to southwesterly flow. During the summer months, there is usually a notice-

able improvement during the daytime hours. Unless there is precipitation occurring or a thick layer of higher cloud present, the fog will often lift to low stratus cloud based at 200 to 600 feet by noon or 1 p.m. local time. By late afternoon, though, the stratus deck will again lower to the surface resulting in widespread fog.

Similar to the Sable region south of Nova Scotia, the fog and low stratus is extremely variable here. Fog patches can develop and dissipate quickly and have a relatively wide range of tops. Helicopter pilots flying to the Hibernia Platform have noted they can be five miles away and have the platform in sight, only to have it shrouded in fog by the time they reach the platform.

During the winter, the focus turns to icing. Stratocumulus decks are quite common over the water from late fall to early spring. As cold air floods the region, cumulus clouds start to build and eventually spread out into a gray, stratocumulus overcast. These cloud decks are usually thicker over the water, reaching as high as 8,000 feet or more, and contain lots of supercooled water droplets. Pilots should expect at least light to moderate icing within the clouds with the worst icing conditions found near the top of the clouds. Aircraft with low rates of climb are particularly susceptible when climbing through the clouds. The best place to be is usually on top of the cloud deck or well below it.

Another problem that faces pilots heading offshore is lightning. As storm systems move up the coast, they tend to be in the developing stage when they reach the Grand Banks and often have thunderstorms embedded within them. A contributing factor to this problem is the fact that lightning strikes so far offshore may not be detected by the Canadian Lightning Detection Network, thus rendering the forecaster's task of confirming the presence of thunderstorm activity very difficult.

Northern Avalon Peninsula - St. John's and Vicinity



Map 4-19 - Avalon Peninsula

It is no great revelation that fog is a major problem to aviation around the Avalon Peninsula. April, May and June have the highest frequency of thick fog over the northern part of the Avalon Peninsula while September, October and November have the lowest number of occurrences. When fog occurs during the winter months, it is usually associated with low pressure systems and warm, moist southerly flows. For this reason, and the fact that the sun is low in winter, there is very little in the way of diurnal variation in fog. It isn't until well into spring that there is some diurnal improvements. The worst time of the day for fog is usually just prior to sunrise.

Because of sharp upsloping terrain and exposure to the ocean, very low ceilings and visibility are frequent when the winds are from the northeast to southeast. Ceilings from zero to 400 feet and corresponding visibilities are found if the air temperature is warmer than the water temperature east of Newfoundland. A slight diurnal improvement will occur if the flow from this sector is not prolonged. If the flow is very weak, breaks in the lowest cloud layer may even occur. When conditions are low on the east coast of the Avalon Peninsula, they are often somewhat better on the western side,

along the Conception Bay coast. The helicopter base at Long Pond always reports better ceilings than St. John's in these situations.

In winter, south winds usually provide operational ceilings. However, very low conditions can occur if the flow is weak and fog blankets the water south of the Avalon Peninsula, such as in advance of a warm front. Winds from the south-southwest to westerly give operational ceilings, although in a warmer air mass, areas of low stratus cloud and poor visibility in fog or mist will exist. Good ceilings and visibilities occasionally occur when the winds are from northeast especially when the air is cold in the winter. In this case scattered, light snow flurries may occur.

A cold, unstable southwesterly flow is an excellent producer of snow showers reducing local ceilings and visibility. These snow showers tend to be widespread over the Southern Avalon Peninsula but occasionally snow showers will also make it to the northern part including Torbay.

Winds from the west-northwest to north yield fairly good flying conditions although snow showers may be frequent in a cold flow and fog and drizzle may persist in an extended mild and moist flow. Broken to overcast stratus may last for a period of four hours at a height of 200 to 400 feet after the passage of a cold front. Troughs of low pressure or cold fronts advancing from the north usually become weaker before reaching Torbay, however a brief period of low conditions in stratus or either snow or freezing drizzle sometimes occurs.

Icing conditions in freezing drizzle are common over northern sections of the peninsula during the winter and spring months, whenever the winds are from the north to the northeast. Cool, moist air flows over the cold water or ice creating an inversion in the low levels. Freezing drizzle or snow grains usually develop below this inversion and can persist for days as long as the flow remains from these directions. This is a very common occurrence when low pressure systems stall east of Newfoundland. Often there will be occasions when freezing drizzle does not occur, yet a thick layer of stratocumulus cloud will still be present in the area and out over the water. These clouds will usually be quite moist and will be a favourable location for aircraft icing.

Frontal depressions passing through the area or to the south bring low conditions in snow or rain, drizzle and fog with easterly winds. If an occluding low stalls to the east or southeast of the Avalon Peninsula, these conditions can persist as long as the low remains, with little diurnal improvement noted. This feature of the weather develops mostly in the spring season when western Atlantic blocks are present. Torbay may not become operational until these blocks break down, which can be several days.

The summer is a gentler season. Sea breezes are common when the gradient winds

are light. When winds shift to easterly due to a sea breeze, any fog offshore will usually be advected over land either as low stratus cloud or fog. Sea breezes are not frequent on the east side of Trinity Bay due to the high cliffs along that coast, yet can reach 20 to 25 knots on the western side of the bay.

When winds are light to moderate from the west, they usually increase and become quite gusty in the afternoon due to instability created by daytime heating. Funnelling through the numerous east to west bays and inlets will cause these winds to increase even further. This effect can extend out as far as ten miles and can create turbulence near the coast.

The terrain over the northern half of the Avalon Peninsula is somewhat more rugged and, consequently, mechanical turbulence is much more prevalent here than on the southern part of the peninsula. Generally, winds of 20 knots will result in moderate turbulence to helicopters and lighter aircraft. Above 20 knots, a great deal of turbulence is usually experienced over the northern Avalon Peninsula and around Torbay airport. Once pilots get over land, all the approaches are reported as being rough, however, the ILS for runway 16 is the worst. Pilots often encounter severe turbulence below 2,200 feet to approximately 300 feet above ground level. This is most likely due to steep cliffs from Portugal Cove to Cape St. Francis. Southeast winds will "fall off" the cliffs, often causing whirlwinds, while westerly winds will crash up against them producing severe turbulence in both cases. Many pilots prefer to use another runway and take the crosswind rather than to shoot the approach for runway 16. This turbulence is so common that it is mentioned in the Canadian Flight Supplement under CAUTION.

Baccalieu Island, just east of the Bay De Verde Peninsula, can be quite treacherous in northerly winds. Helicopter pilots often report severe downdrafts at the southern tip of the island.

Avalon Peninsula to Gander



Map 4-20 - Avalon Peninsula to Gander

Pilots heading from the Avalon Peninsula westward generally like to follow the isthmus joining the Avalon to the rest of the island and then proceed westward. This often creates difficulties since the isthmus is prone to low cloud, especially in south or southeast winds. Conditions are particularly bad when fog or low stratus cloud is present in Placentia Bay. If there is a moderate, southerly flow the fog will remain over the isthmus all day. However, in summer, when the flow is light, conditions usually

improve by 10 or 11 a.m. local time and start deteriorating again by 4 p.m. Local pilots try to cross over the isthmus by 4 p.m. local time when trying to get back to the other side. After 4 p.m. chances of getting through are small. When heading west and cloud is going to be a problem over the isthmus, Chapel Arm will usually be the point where low-level traffic will be forced to turn around. This cloud may also develop in north to northeast flow but is usually not as bad. In a northwest wind the isthmus will generally be open.

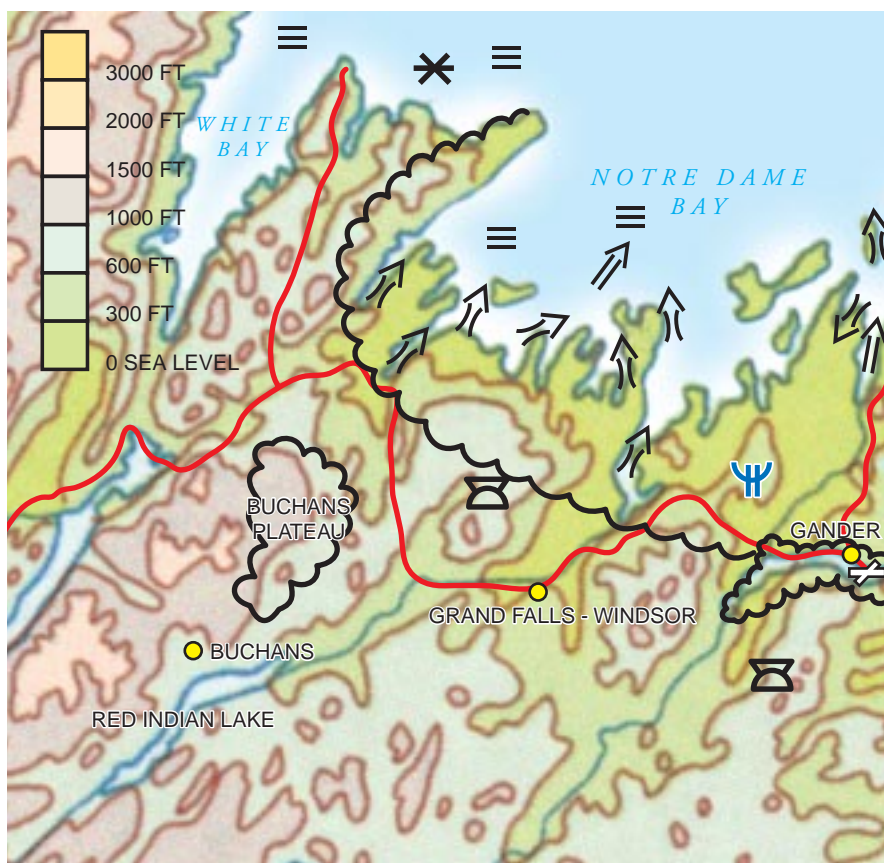
Trinity Bay usually has good conditions in southwest winds but, when thick fog is present in Placentia Bay in spring or early summer and the isthmus is capped in, fog or low stratus may spill over into the southern part of Trinity Bay. Low-level pilots on their way to St John's from Gander normally turn back if there is low cloud or fog in Trinity Bay.

This area is one of the most favourable locations for thunderstorm activity on the island. A typical case is for air mass cumulus and towering cumulus cloud, originating in the southwest corner of the island, to continue to grow as they move north-eastward. They usually reach the cumulonimbus stage just southwest of Gander and continue to move towards the Bonavista Peninsula.

In the mid to late summer, when the water in Bonavista Bay reaches its highest temperature, fog usually remains off the coast from about 15 miles east of Cabot Island to 30 miles northeast of Cape Bonavista. When east or northeast winds advect the fog into the bay and onshore, the warm water of the bay tends to lift the fog and, therefore, low stratus cloud is likely in the bay and along the coast.

This area is also prone to freezing drizzle in north-northwest to northeast winds. The worst area for this effect is between the Bonavista Peninsula and Fogo Island and typically extends to approximately 50 miles inland, depending on the winds. The stronger the winds, the farther inland the freezing drizzle will extend.

Gander and Vicinity to White Bay



Map 4-21 - Gander to White Bay

Similar to the two previous areas, this region is also extremely prone to significant icing conditions in freezing drizzle in the winter and spring. North to northeast winds that have had a large trajectory over the water will almost always generate incidences of freezing drizzle. It should be noted that although freezing drizzle becomes less frequent west of Fogo Island, it still poses a significant hazard.

Flying weather here can vary significantly not only with season, wind direction and time of day, but even with the type of weather feature producing the wind. During the winter months, a north to northwest flow associated with a high pressure system will generally produce a broken to scattered layer of stratocumulus cloud based at 1,500 to 2,500 feet. However, if the flow is associated with a low pressure system, then stratus cloud will give ceilings of 200 to 300 feet and a visibility of one-half to three miles in freezing drizzle or snow grains. In either case, there is usually noticeable daytime improvement by mid-winter into spring, but daytime improvements are often negligible in the early winter.

Rapid deterioration to stratus ceilings of 200 to 500 feet and visibilities of one-quarter to two miles in light snow or freezing drizzle can be expected with the passage of a front or trough of low pressure from the north. If the system is strong, conditions may fall to near zero visibility in snow and blowing snow. These conditions usually persist for two to five hours then, if the flow is stable, the ceilings usually lift as the wind backs to northwest.

When winds are from the north-northeast to east-southeast in the winter, rapid deterioration can be anticipated with the approach of a warm front. Precipitation usually commences as snow but, as the frontal wave nears the area, a rapid change to rain after a brief period of freezing rain or ice pellets often occurs if the low passes to the west. When these winds are associated with a high pressure system, stratocumulus ceilings of 1,200 to 1,500 feet and occasional snow showers are common. In this case, if the flow persists, stratus ceilings of 300 to 500 feet and a visibility of one to three miles in light snow and snow grains can be expected.

In the spring and summer, a north to northwest flow will typically produce an area of cloud near Norris Arm, which gets progressively lower as you head east. The cloud usually starts off as stratocumulus based near 2,000 feet AGL, at or just west of Norris Arm, and can gradually become stratus ceilings of zero to three hundred feet, with a visibility of zero to one mile in drizzle and fog at Gander Airport. Daytime improvement to stratocumulus ceilings of 300 to 600 feet usually occurs over eastern areas by mid summer.

During the summer and early fall, the passage of a front or trough of low pressure from the north may result in two to four hours of stratus ceilings of 200 to 400 feet and a visibility of one to three miles. When the flow is from this direction and associated with a high pressure system, scattered to broken stratocumulus based at 2,000 to 3,000 feet can be expected.

If north-northeast to east-southeast winds are caused by a blocking low in the spring and summer, then ceilings will fall to 100 to 300 feet in fog and stratus. The visibility will diminish to zero to one mile in fog and drizzle, or freezing drizzle. Daytime improvement to stratus ceilings of 500 to 800 feet is common, but if the flow persists for several days, improvement becomes negligible. Such a flow is common ahead of an approaching warm front and fairly rapid deterioration in flying conditions usually occurs once precipitation begins.

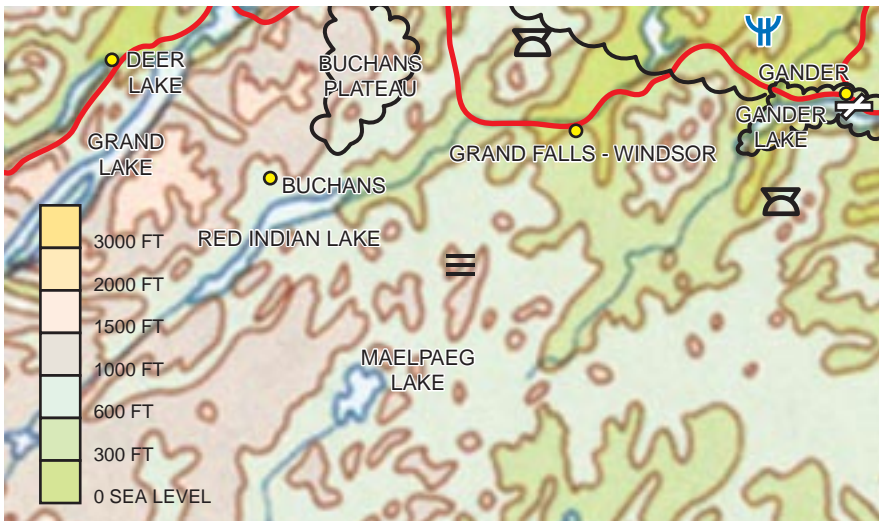
South to southeast winds will frequently result in near zero ceilings and visibilities at night in moist, stable flow but during the day ceilings will usually be variable near 300 feet, with a visibility around four to eight miles. The approach of a warm front in the summer will also bring deteriorating conditions, especially after dusk, causing ceilings and visibilities to fall to near zero. The ceiling and visibility usually improves rapidly after its passage. When fog is widespread along the south coast of

Newfoundland, low stratus cloud will often make its way across the island and may reach as far as Gander a few hours after midnight.

Southwest to west-northwest winds generally provide the best weather. These winds typically give clear to broken stratocumulus cloud based at about 1,500 to 2,500 feet. In the moist, warm sector of a low in the summer, stratus ceilings of 400 to 600 feet and a visibility of 3 to 6 miles in showers and mist can be expected. However, there is usually rapid clearing behind the cold front. Fog from Gander Lake occasionally moves over Gander Airport as stratus cloud based between 600 and 800 feet, during the night, but this is usually variable and burns off quickly at sunrise.

As mentioned earlier, this area is prone to thunderstorm activity in the summer time. Thunderstorms tend to develop farther to the southwest and move towards Gander and often either pass to the northwest or southeast of the airport.

Central Newfoundland



Map 4-22 - Central Newfoundland

The numerous ponds and lakes in this area cause patchy stratus cloud to develop shortly after sunset in the late spring and summer when otherwise clear skies are being observed.

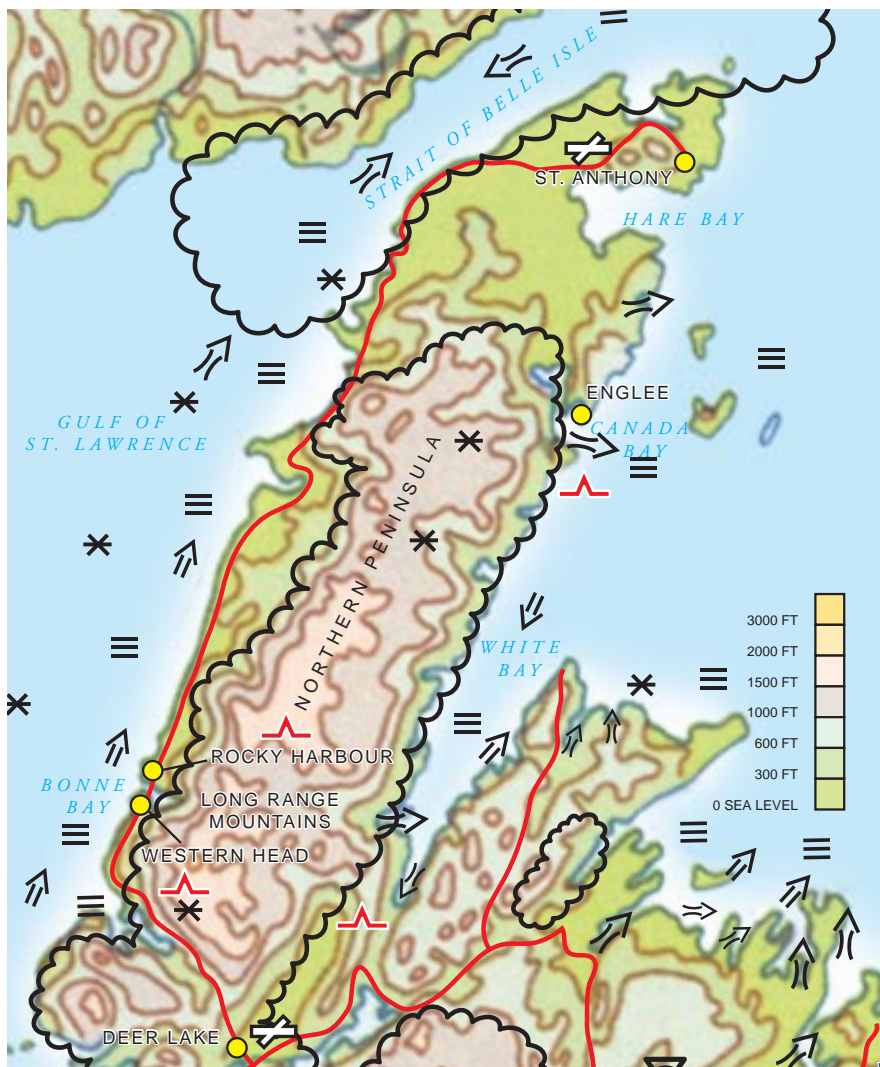
For example, fog or low stratus may develop over Red Indian Lake in the spring and summer, but this effect is quite local and generally does not cause problems for pilots flying in the area during the day.

Where these ponds and lakes may be a hazard is at night. With the lack of reference points at night, pilots can easily become disoriented if they inadvertently fly into

these patches of cloud. Unless reported, these patches are difficult to detect and, therefore, difficult to forecast. Pilots flying visually at night should be aware of this even when the temperature-dew point spreads are large.

Pilots heading to the west coast of the island from the east will often encounter lower ceilings near the Topsail Hills or Buchans Plateau area. Cloud here will tend to linger behind as low pressure systems move away. Unless the air is very dry and stable, afternoon instability cloud will also develop and cap in the hills. A report of scattered cloud during the morning hours at Deer Lake will often mean that broken to overcast stratocumulus cloud will top the hills by the afternoon. This is also a favourable area for thunderstorm development.

Northern Peninsula - St. Anthony and Vicinity



Map 4-23 - Northern Peninsula

Although the Northern Peninsula experiences some of the harshest weather on the island, there is often one side of the peninsula that is better than the other depending on the wind direction. In a northwest to southwest wind, the west side will tend to be worse than the east side, while the reverse is true if the winds are from the northeast to southeast. Because of this, pilots flying low-level to and from St. Anthony generally stay on the downwind side of the mountains. The west side of the Northern Peninsula is a preferred route since there is plenty of lower ground near the

coast whereas the east coast is characterized by steep cliffs that do not offer any place to let down in case of an emergency.

The east coast from White Bay to St. Anthony can be particularly hazardous in the late winter and early spring when winds are from the east or northeast. Winds from these directions tend to be quite moist and, as the air is pushed up against the steep cliffs that line this section of the coast, it is cooled from below by the ice pack. The cold air will remain trapped against the high cliffs and often produce freezing precipitation all along the coast with temperatures hovering just above and below the freezing point. During these situations, icing will usually be restricted to the lower 2,500 feet and above freezing temperatures will be found above this level.

When winds are from the western quadrant in the late fall and winter, snow squalls can become a problem. Snow squalls are especially frequent in west to northwest winds from Port au Choix southward. By about mid January, the snow showers become less frequent as that part of the Gulf of St. Lawrence and the Strait of Belle Isle become ice covered. During the summer, southwest winds will bring fog to the Strait of Belle Isle and the west coast of the peninsula while the east coast will often be clear.

Once the winds reach about 20 knots, mechanical turbulence is common below 4,000 feet. Mountain waves are also customary over the Long Range Mountains both in easterly or westerly winds and can cause severe turbulence downwind and near the mountaintops.

A well-known local effect occurs at the mouth of Canada Bay in a west or northwest wind. These winds are channelled and funnelled through the cliffs that line the bay and produce winds two to three times stronger at Englee than those reported further north.

Fog is common in and around Hare Bay and will often drift over the airport at St. Anthony as fog or low stratus cloud in south or southeast winds. A moderate westerly wind will usually keep the fog away from the airport. Pilots who regularly fly to St. Anthony will often ask whether there is any fog in the bay when getting a weather briefing. When fog is present in the Strait of Belle Isle, a strong southwest wind can sometimes push stratus cloud into St. Anthony Airport.

On the west side of the peninsula, fog can creep into the mouth of Bonne Bay almost as far as Rocky Harbour. This occurs in the spring and summer in a west or southwest wind. High terrain around Western Head prevents the fog from pushing further into the bay but low cloud will often cap the hills to the southeast all the way to Deer Lake.

North Shore of Quebec and Anticosti Island

(a) Summer

The storm tracks that affect the North Shore of Quebec and Anticosti Island are similar to those that affect southern Labrador (See fig. 3-9). One track the weather systems take during this time of year is through central Quebec, into southern Labrador and then out to sea. The second track tends to carry systems across northern Labrador leaving a trailing cold front to move southeastward through the area. In both cases, these systems tend to be much smaller in area and much weaker in strength. Weather associated with these frontal systems is usually more of the showery type.

The strengthening of the Bermuda High over the Atlantic also plays a role in the summer weather pattern. This causes a shift in the prevailing winds direction from northwest to a more southerly, or southwesterly, direction. This means that warm, moist air gets pushed farther northward and often results in fog along the North Shore, especially east of Anticosti Island. Another scenario for low cloud and fog is a persistent easterly wind. In such a case, there will often be precipitation in the form of rain or drizzle, which will help contribute to the poor flying conditions over the region.

Thunderstorm activity during the summer is most often associated with frontal systems although, occasionally, air mass thunderstorms will develop in moist and unstable conditions. The air mass thunderstorms that develop in this area are mostly over the mountains and near the Labrador border.

(b) Winter

Storms tend to follow a more southerly track during the winter season (See fig. 3-8). Similar to Labrador and Newfoundland, one of the main storm tracks brings frontal systems up from the south or southwest through the Gulf of St. Lawrence. A second major track is for systems to approach from the west and cross over the North Shore of Quebec as they head towards Newfoundland. The first scenario tends to be the track that brings the major winter storms to this area. When low pressure systems remain to the south over the Gulf of St. Lawrence, heavy snowfalls can often be expected, especially in over the mountains north of the coastline due to upslope flow.

Storms passing to the west will usually have a warm front pushing northward to the right of the low's track. In these cases, an area of rain or freezing rain will often affect the coast. Freezing drizzle occasionally develops along the North Shore of Quebec, in east or southeast winds, if the Gulf of St. Lawrence is partly free of ice. Otherwise, freezing precipitation in this region is relatively short lived and is associated with migrating pressure systems.

Cold continental air normally floods the region in the wake of these passing lows and is often accompanied by strong and gusty winds. This will often produce wide-

spread drifting snow, especially south of the mountains. The air is significantly colder north of the mountains than it is along the coast. Occasionally, ice crystals can develop when the air reaches -30°C or colder. As in Labrador, if enough of the crystals are present, aggregation will occur producing a snow-like precipitation in the absence of cloud.

Along the North Shore of Quebec, ice begins to form in December in the St. Lawrence River and the small bays along the coast. By mid January, ice covers most of the St. Lawrence River and a large portion of the Gulf of St. Lawrence. The ice pack here will usually peak by March then start to break up with the approach of warmer temperatures.

(c) Local Effects

Tadoussac to Baie-Comeau



Map 4-24 - Tadoussac to Baie-Comeau

Winds along this part of the North Shore and Gulf of St. Lawrence get funnelled along the coast and become either southwesterly or northeasterly, depending on the prevailing direction. Near Tadoussac, west-northwest to northwest winds will often produce strong gap winds along the Saguenay River Valley and may cause turbulence at the mouth of the river valley.

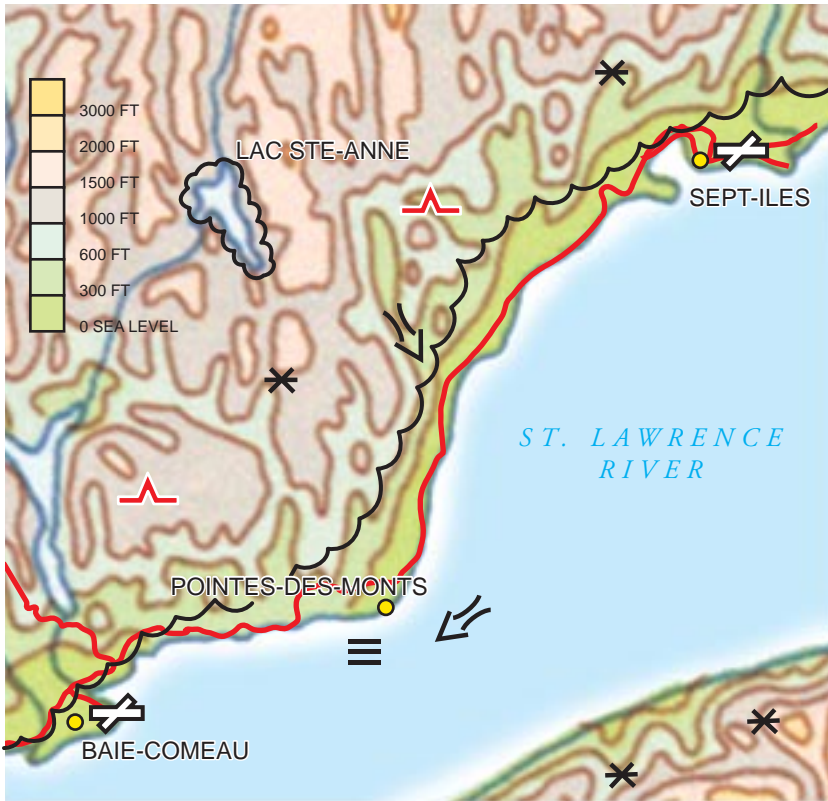
From late fall to early spring, strong wind shear can be expected at altitudes as low as 300 to 500 feet in strong north to northwest winds. The strongest winds often tend to “skip” the North Shore, but will reach the surface a mile or so off shore. The strong winds just above the surface will not be observed at the surface along the coast. Turbulence and significant wind shear can be expected in such conditions on approach to Baie-Comeau, for instance.

In the summer and early fall, southwest winds tend to be stronger and gustier at Baie-Comeau Airport on warm, sunny days due to daytime heating. Light to moderate low-level convective turbulence can also be expected under these conditions.

Low stratus cloud will be most prevalent in northeast winds with the worst conditions occurring when rain is falling. Ceilings can be somewhat lower near the mouth of the Saguenay River in the fall and spring seasons. Northeast winds will also cause a band of stronger winds up to two miles wide off the coast, due to coastal convergence.

In the winter, flurries developing over the St. Lawrence River will generally be more prominent downwind from this stretch of the coast and do not cause problems, although Baie-Comeau occasionally is affected in a cold southwesterly wind. With the approach of storms, however, the opposite will be true. This area will be prone to heavier snowfalls than will the south shore, due to upslope flow.

Baie-Comeau to Sept-Iles



Map 4-25 - Baie-Comeau to Sept-Iles

Funnelling due to the St. Lawrence River occurs here as well, although not as pronounced as farther west. In spring and early summer, low stratus cloud and poor visibility is common all along the coast with the approach of low pressure systems from the south. A common place for fog to linger is in the Pointes-des-Monts area where it usually takes a good wind shift to the northwest for conditions to improve. Pilots report that the weather is often worse between Pointes-des-Monts and Sept-Iles than it is from Pointes-des-Monts to Baie-Comeau in these situations. Katabatic winds are common all along this stretch of coastline, due to the numerous valleys perpendicular to the coast, and may cause strong winds and turbulence up to 3,000 feet at night.

In north or northwest winds, there is often stratocumulus cloud over the hills to the north but ceilings usually are better near the coast in these situations, due to downslope flow. When broken stratocumulus ceilings hinder low-level traffic along the coast, it will often be better just offshore where the stratocumulus cloud will thin into a scattered condition.

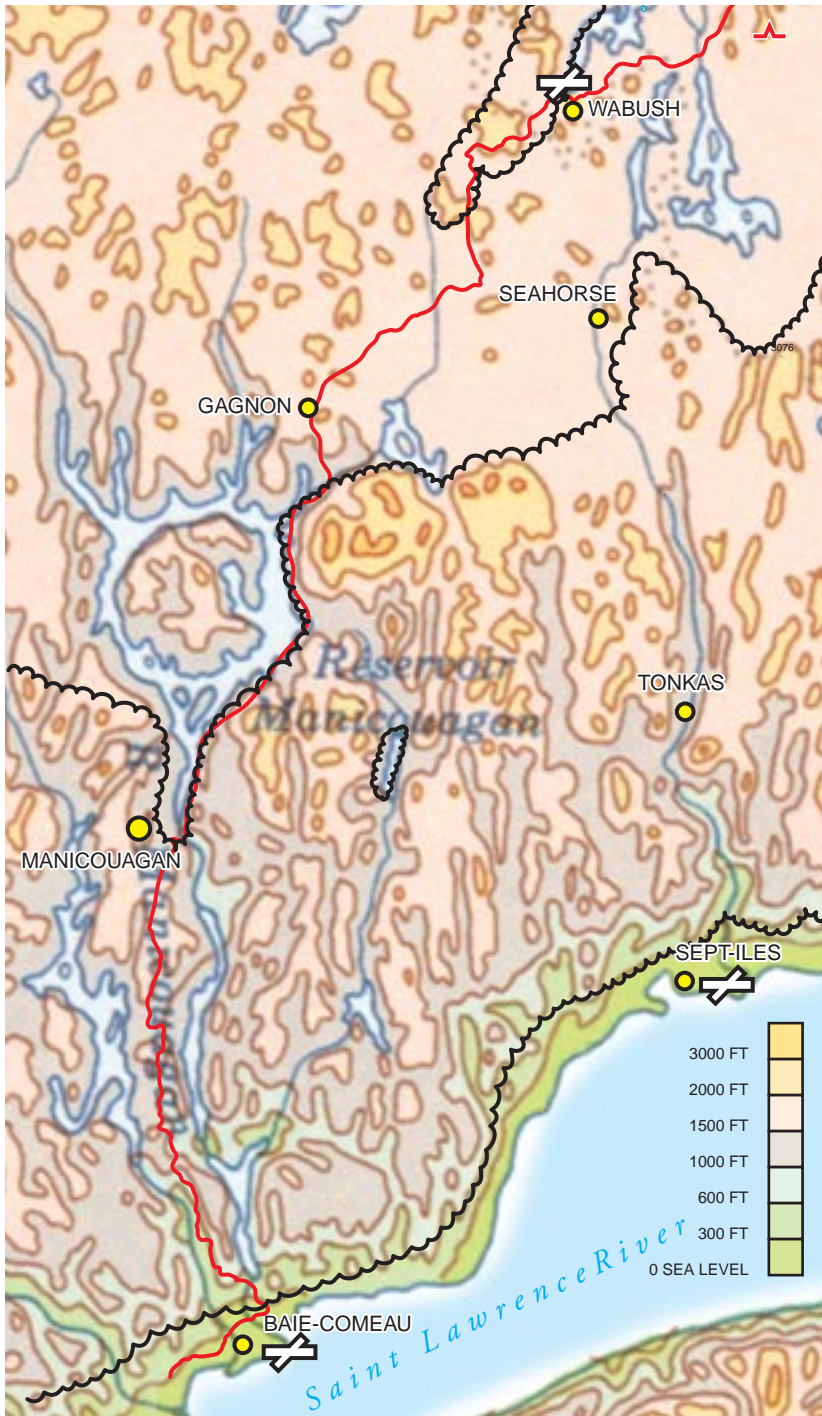
Sea breezes are common along the coast in spring and summer. After a sea breeze develops, it keeps growing and can reach up to 15 miles inland. Pilots should expect significant and rapid windshifts causing low-level turbulence and possible runway changes when sea breezes develop.

Baie-Comeau/Sept-Iles to Labrador (See map next page)

Common routes in this area are the Baie-Comeau and Sept-Iles to Labrador routes. In northeast to southeast winds, low ceilings and visibilities generally render this route very difficult, if not impossible, for low-level traffic. Winds from other directions will bring better flying conditions although upslope cloud is often encountered over the mountains to the north. Northerly or northwest winds usually cause cloud to develop over these hills. Sept-Iles and Baie-Comeau can have good ceilings due to the downslope nature of these winds, but if you can't see the mountains from Sept-Iles due to cloud, it definitely will not be possible to maintain low-level flight over the mountains to Labrador. In the winter, snow flurry activity will often be encountered in these situations within about 10 miles inland. Turbulence will also be encountered with winds above 20 or 25 knots in any season. This turbulence is always worse when the air is unstable.

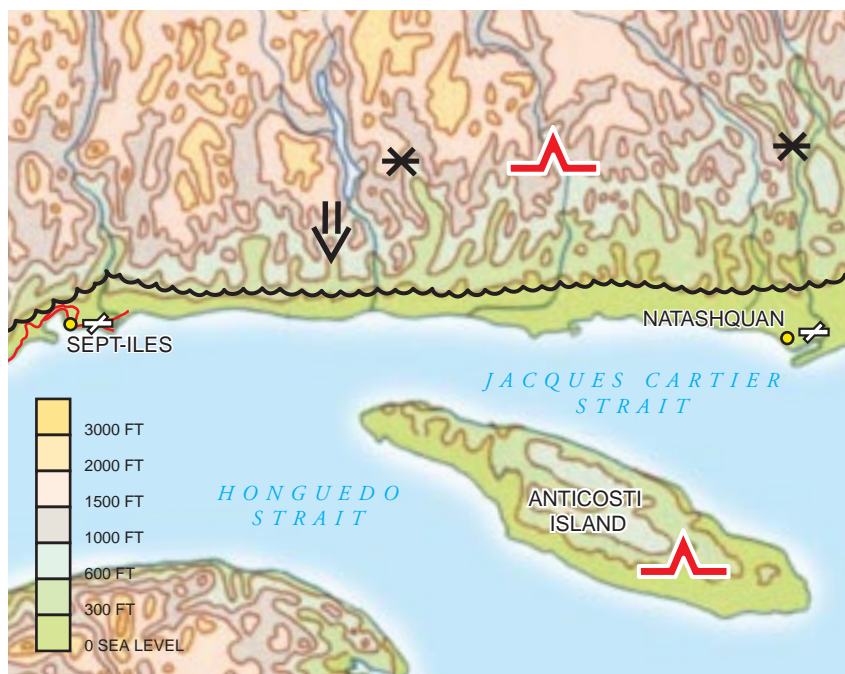
Pilots who follow the railroad tracks or power lines indicate that low cloud tends to form and linger at several places. Along the railway from Sept-Iles at Mile Douze (mileage marker twelve) is one area prone to low cloud, but usually only if it rains. Another area that is prone to low cloud or scud is a one or two mile stretch along the railroad just south of Tonkas. Radiation fog with typical tops around 500 feet often develops in the valleys from late spring to the fall, especially along the St. Marguerite River Valley up to SM3 (Sainte-Marguerite-3). This fog generally burns off rapidly after sunrise.

Another area of concern for pilots transiting to and from the North Shore to Labrador is the Seahorse area. Seahorse, just north of the Labrador-Quebec border on the railway from Sept-Iles to Churchill Falls, is known as an area that is prone to icing conditions in the fall and winter.



Map 4-26 - Labrador Routes from Sept-Îles to Baie-Comeau

Sept-Iles to Natashquan including Anticosti Island



Map 4-27 - Sept-Iles to Natashquan including Anticosti Island

This area experiences its worst conditions in east to southeast winds. Moist eastlies or southeasterlies will typically usher in stratus cloud based at about 500 feet. Any precipitation will lower the ceilings further. As long as the winds are from the east or southeast, conditions along the coast will not improve.

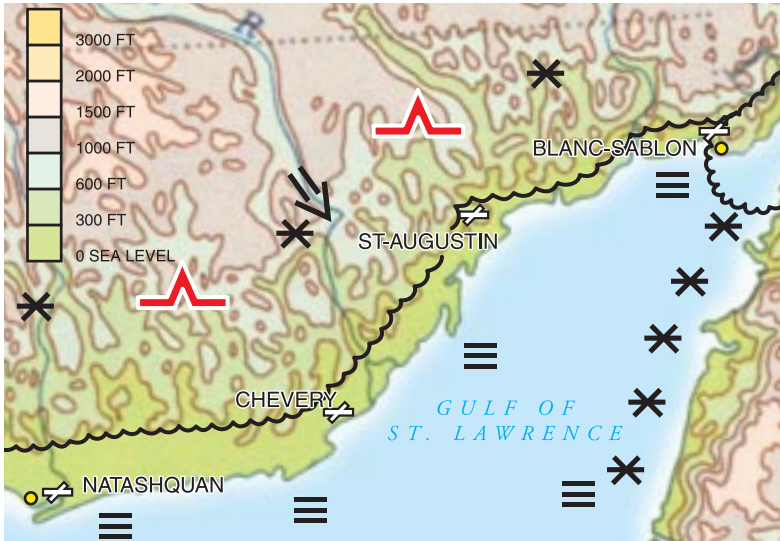
Once the winds shift to northerly or northwesterly, conditions tend to improve along the coast, although stratocumulus ceilings will still likely be encountered farther inland. In the winter, these winds will often cause flurry activity near Anticosti Island. Turbulence can also become significant around Anticosti Island in windy conditions. Turbulence is also often encountered when approaching from the east at Sept-Iles.

With approaching storms, there tends to be more cloud and intense precipitation southeast of Sept-Iles due to low-level convergence. As the winds are funnelled and channelled in the Jacques-Cartier Strait between the coast and Anticosti Island, they converge with southeast wind through the Honguedo Strait, resulting in enhanced vertical motion in this area. Up and down drafts can also be encountered when flying along the coast in these conditions.

In late spring and summer, fog and low stratus are very common in this part of the Gulf of St. Lawrence. As warm, moist air approaches from the south, it is cooled by the relatively cold waters over the gulf causing fog to develop and become widespread.

Since southwesterly winds will bring the lowest conditions, this area of the coast will generally not experience the worst ceilings because of the sheltering effect of Anticosti Island.

Natashquan to Blanc-Sablon



Map 4-28 - Natashquan to Blanc-Sablon

Fog that forms in warm, moist southwest winds tends to be worse along the coast, from just east of Natashquan up to Blanc-Sablon. This area tends to stay shrouded in fog for days as long as the winds are out of the southwest in the spring and summer. It usually takes a significant change in wind direction for conditions to improve. It is not uncommon for Chevery and Blanc-Sablon to be below minimums in fog or low stratus all day. St Augustin is somewhat more protected and will sometimes get better conditions.

The Gulf of St. Lawrence provides ample moisture in a southerly flow even when fog does not develop. The onshore and upslope nature of southerly winds will result in significant cloud along the coast with even lower ceilings inland over the mountains.

Southerly low-level jets associated with storm systems tend to remain aloft near the coast but may reach the surface over the higher terrain inland. This tends to create strong low-level wind shear which pilots should be aware of on approach to coastal airports.

Katabatic winds are common all along this stretch of coastline, also due to the valleys perpendicular to the coast, and may cause strong winds and turbulence up to 3,000 feet at night.

Labrador and Eastern Ungava Bay Area

(a) Summer

Two major storm tracks affect Labrador and Eastern Ungava Bay Area during the summer season (See Fig. 3-9). One track carries the weather systems through central Quebec eastward over southern Labrador and then out to sea. The second, more northerly track, brings systems originating over Hudson Bay eastward across northern Labrador. In both cases, given the reduced north-to-south temperature difference compared to winter, these systems tend to be much smaller in area and much weaker in strength. Weather associated with these frontal systems is usually more of the showery type, although periods of rain lasting several hours may occur. With the passage of the cold front precipitation ceases fairly quickly.

Behind the cold front, the winds will tend to be from the westerly quadrants and will be unstable and somewhat moist, due to the numerous lakes and ponds in this area. This often results in the development of broken to overcast cumulus or stratocumulus with daytime heating. Where the flow is upslope, scattered showers may also develop. Clearing generally will occur when the air becomes drier or when the flow weakens sufficiently for the cloud to “burn off”.

When warm, moist air moves out over the cold waters off the Labrador coast an inversion will form. Under this inversion, extensive areas of sea fog and marine stratus are quick to form. Westerly winds will generally hold the fog and stratus offshore but any flow from the southeast to northeast quadrants will allow it to move into coastal stations. If the prevailing winds over the area are light, even from a westerly direction, easterly sea breezes will often develop along the coast and may advect the fog and stratus towards the coast, turning a pleasant summer morning into a cool, foggy afternoon. Depending on the strength of the prevailing winds, the fog and stratus may persist throughout the night.

Most of the thunderstorms in this area are associated with frontal systems although occasionally air mass thunderstorms will occur in moist and unstable conditions. The area of highest thunderstorm frequency in this region is in central Labrador with most occurring in the late afternoon to early evening. A secondary problem related to thunderstorm activity is forest fires caused by lightning strikes. Smoke from these forest fires will generate near zero visibility near the fire and may produce widespread poor visibilities especially when the winds are light.

(b) Winter

During the winter season, migratory frontal systems tend to track farther south than during the summer (See Fig. 3-8). One of the two main winter storm tracks brings frontal systems up from the south or southwest through the Gulf of St. Lawrence up into southeastern Labrador or out to sea. The second major track is for

systems to approach from the west and cross over the North Shore of Quebec or the Gulf of St. Lawrence before heading towards Newfoundland. Although not as common, low pressure systems approaching from the south can also head northeast towards Newfoundland and curve north or even northwestward and stall just off the coast of Labrador. In these situations, a prolonged period of poor weather will affect coastal sections of Labrador with marginal conditions further inland.

Cold continental arctic air is the predominant air mass over Labrador and the Eastern Ungava Bay area during winter. After freeze-up of the lakes and ponds, this air mass is, for the most part, stable and will give generally clear skies. Stratocumulus ceilings sometimes develop in areas of upslope flow, however, conditions always improve on the other side of the hills or mountains. When conditions are particularly cold, -30°C or colder, an interesting form of precipitation is observed frequently. Water vapour from moisture sources such as mines, mills and fast flowing rivers will condense directly into ice crystals. If enough of the crystals are present, aggregation will occur producing a snow-like precipitation although the actual sky conditions may be reported as clear.

Freezing precipitation along the Labrador coast is a frequent problem in the winter. With extended periods of east or northeasterly winds, the air becomes very moist. As this moisture reaches the coast, it is cooled by the ice pack and forced upward causing freezing drizzle or light freezing rain all along the coast. Conditions usually do not improve until the winds shift around to west or northwesterly.

Since the different pressure systems that affect the region are stronger in the wintertime, it follows that the winds are stronger during this part of the season as well. As weather systems track across the Gulf of St. Lawrence or move up into the Labrador Sea, the winds will gradually increase to east or northeast before shifting to northwesterly as the systems passes. The northwesterly winds behind these systems tend to be fairly strong and can reach 60 to 80 knots along the Labrador coast in the more intense winter storms. The winds are also affected by the countless variations in local terrain, especially in the Torngat Mountains.

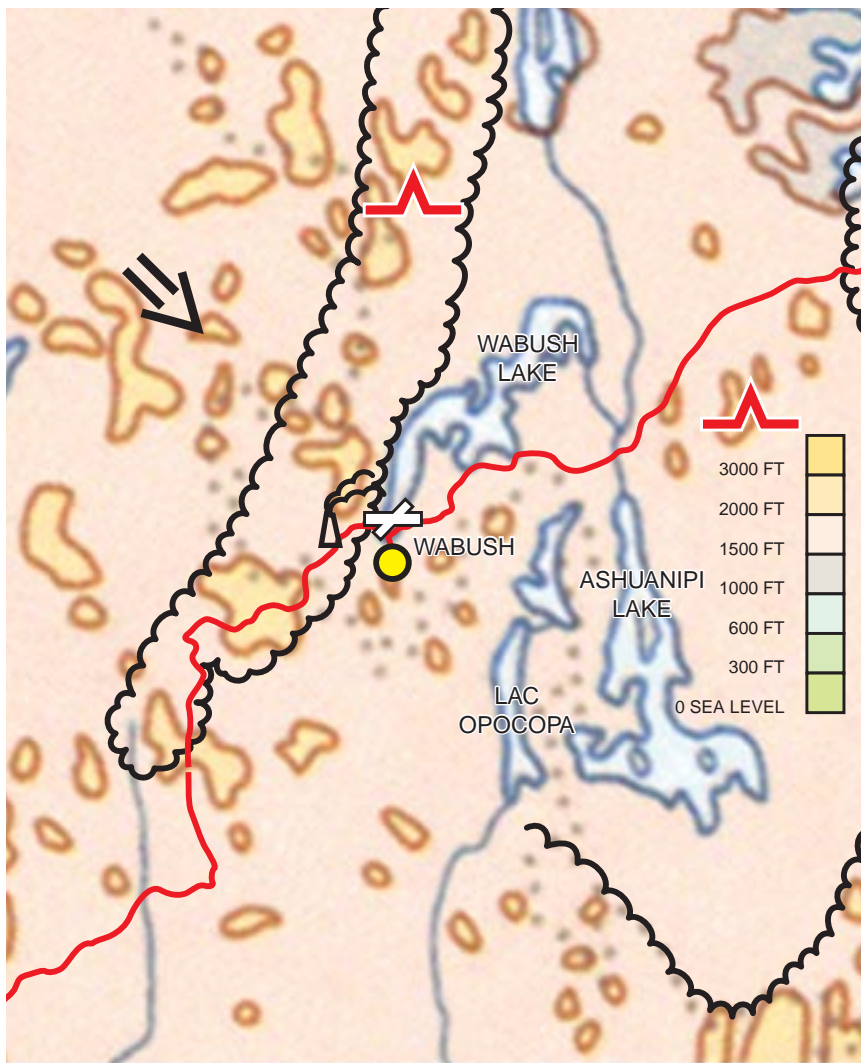
Ice coverage is an important factor when it comes to determining local weather conditions. Starting in late November, ice begins to form along the Labrador coast in the inlets, fjords and sheltered bays. In December, the ice pack continues to spread southward, almost totally covering Lake Melville by early-to-mid month and the rest of the southeast coast of Labrador by the first of January. The ice pack usually reaches a maximum by March or April then begins to break up. On average, the entire south coast of Labrador including Lake Melville is mostly ice free by mid June and the north coast by mid July.

Spring and fall are basically considered transition periods between winter and summer. In the fall, the land is still fairly warm and there is still a considerable amount of open water to affect cold air masses invading the region. In such a situation, it is com-

mon for sufficient instability to develop with daytime heating to produce cumulus cloud and scattered shower activity. As the colder air flows over relatively warm water, steam, fog or low stratus will often develop and give lower ceilings and reduced visibility. These conditions will tend to occur near sunrise, under clear skies with light winds, until freeze-up.

(c) Local Effects

Wabush and Vicinity



Map 4-29 - Wabush and Vicinity

Local weather conditions in western Labrador are for the most part continental in nature. In summer however, the numerous lakes and rivers do provide moisture to the

low levels. Along the 2,000 to 2,500 foot hills west of Wabush, upslope flow will cause these clouds to become broken or overcast and prevent low-level traffic from proceeding over the hilltops.

A localized but potentially very hazardous problem occurs in dry, windy conditions near Wabush Airport. Iron ore tailings from the nearby mine get picked up by the wind and become suspended in the lower 2,000 to 5,000 feet near the airport. These tailings consist predominantly of extremely fine particles that are rejected from the mining process. They tend to form a dark, ominous cloud that can sometimes drift over the end of the runways and cause problems for aircraft on approach or take-off. A check of the Wabush METAR during a dry, windy day will always provide some insight as to whether this situation is occurring. An example is shown below:

**METAR CYWK 231800Z 02015G25KT 15SM VCBLDU FEW200 22/04 A3009
RMK C12 VSBY SE 2MI**

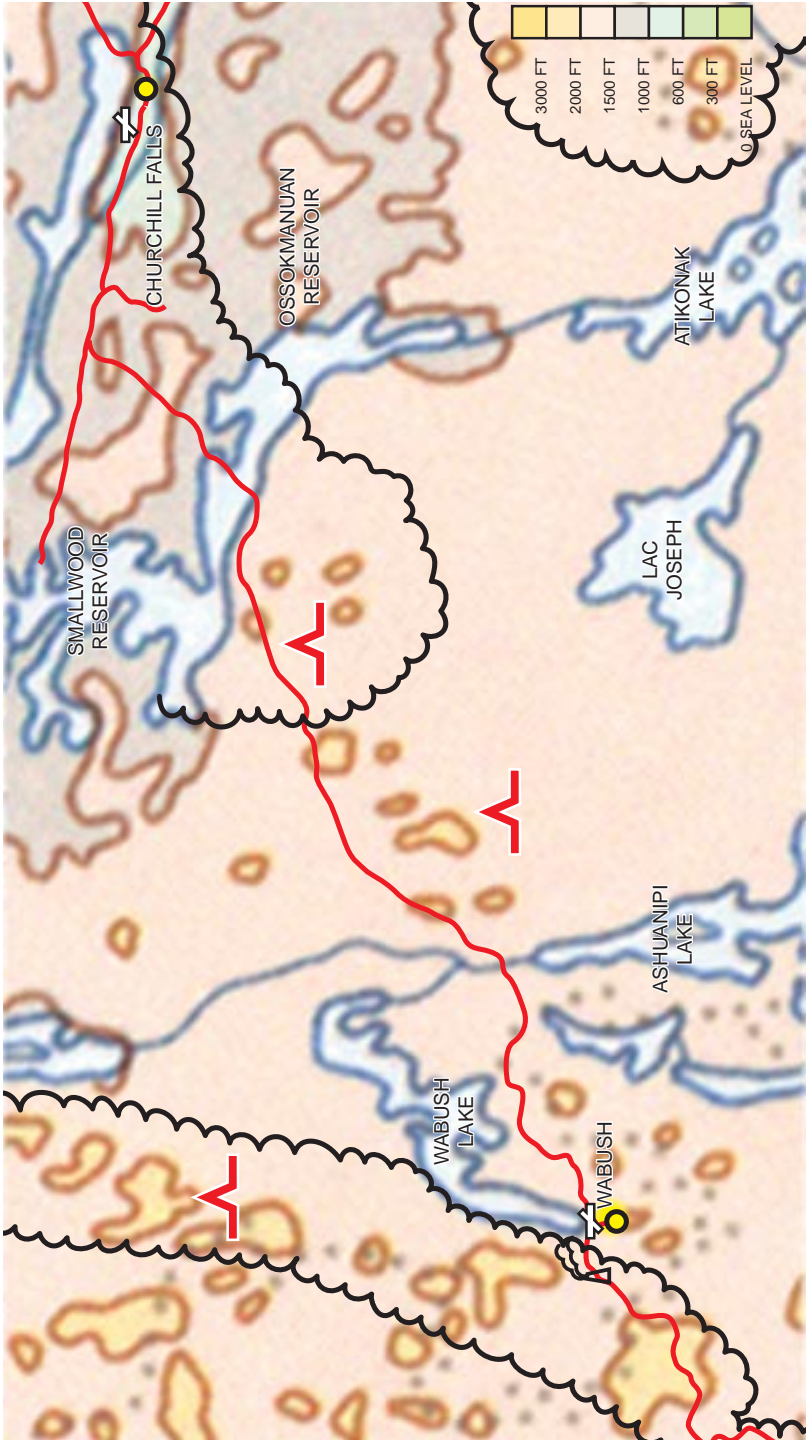
Southward from Wabush

See data for these routes as described in a previous section under Baie-Comeau/Sept-Iles to Labrador.

Wabush to Churchill Falls (See map next page)

Pilots flying low-level from Wabush to Churchill Falls, or vice versa, often prefer to follow the power lines. Strong northwest winds will tend to pick up moisture from Smallwood Reservoir and cause stratocumulus ceilings over most of this route until freeze-up. In lighter north or northwest winds, fog may develop over the reservoir and drift slowly southward. Northeast to southeast winds will also generally give 1,000 to 2,000-foot stratus or stratocumulus ceilings along this route. Pilots find that they often get through by following the river valley, although this can be tricky since there is always a lot of “scud” in the valley in these situations.

Radiation fog in the summer is a common occurrence in the river valley and will sometimes reach the airport in Churchill Falls. In the winter, ice crystals often occur in the area during cold arctic outbreaks. Small waterfalls and fast flowing rivers that do not freeze in the winter provide the moisture source needed for this phenomenon to develop.



Map 4-30 - Wabush to Churchill Falls

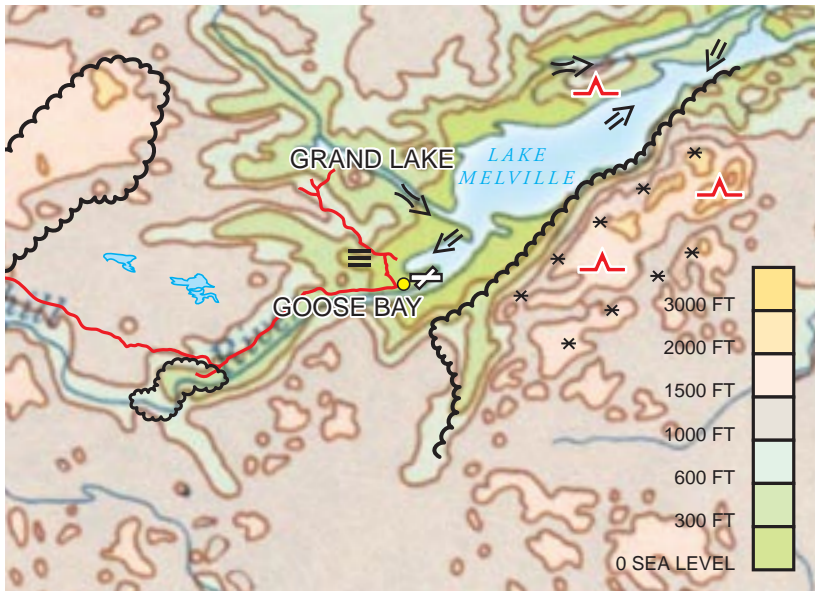
Churchill Falls to Goose Bay



Map 4-31 - Churchill Falls to Goose Bay

Very similar conditions exist on the route from Goose Bay to Churchill Falls as do from Churchill Falls to Wabush. Most pilots flying this route like to follow the power lines as well. Upslope cloud will generally be worse over the hills midway between Goose Bay and Churchill Falls.

Goose Bay and Vicinity/Lake Melville



Map 4-32 - Goose Bay and Vicinity

The Goose Bay area experiences some of the best flying weather in Labrador. The fact that air masses approaching from any direction except the northeast must subside means that Goose Bay Airport has more sunshine and less precipitation than surrounding uplands. The cool temperatures and fog so typical of the Labrador coast rarely penetrate beyond the Narrows at Rigolet. Winds in this area tend to be strongest from the northeast and southwest due to funnelling and channeling. Southwest winds will bring excellent flying conditions while northeast winds will bring low ceilings and poor visibility. This holds true for any season although the lowest conditions due to the northeast winds occur during spring.

As winter or fall storms approach from the south, it usually takes longer for strong winds to develop here due to the valley and the Mealy Mountains to the south. Winds will often be light in an otherwise strong southeasterly gradient and only increase once the gradient becomes more easterly. At this point, the winds usually increase and shift quite abruptly to northeasterly as they get funnelled down the valley.

In the warmer months, there will often be radiation fog and low stratus in and around Goose Bay and in the river valley in the morning. It is not uncommon to have ceilings of 100 feet all around the airport in the early morning hours, however this is usually more of a problem for float planes at Otter Creek and rarely reaches the airport in Goose Bay. These low ceilings usually improve by 8 or 9 am local time. Sea breezes also develop on warm sunny days and are most noticeable when winds are light.

On clear days, winds will often increase and become quite gusty in the afternoon due to the rugged terrain and differential surface heating. This will usually cause turbulence up to the 3,000 to 5,000 foot level until the evening hours. Lenticular cloud formations associated with standing waves are frequently observed over and to the lee of the surrounding ridges. Occasional severe turbulence at low levels to the lee and below the crest of the Mealy Mountains can develop in south or southeast winds in any season.

Strong northwest winds in the wake of cold fronts will also cause mechanical turbulence over the surrounding area. Often in cool north or northwesterly flow, upslope cloud will develop over the Mealy Mountains preventing traffic from heading directly southeast towards the coast from Goose Bay.

On average, Goose Bay airport gets about 7 thunderstorm days during the summer with most of them being associated with frontal systems. Thunderstorm activity tends to die out once over a lake and are rarely a problem north of Goose Bay and Lake Melville.

Goose Bay to Cartwright



Map 4-33 - Goose Bay to Cartwright

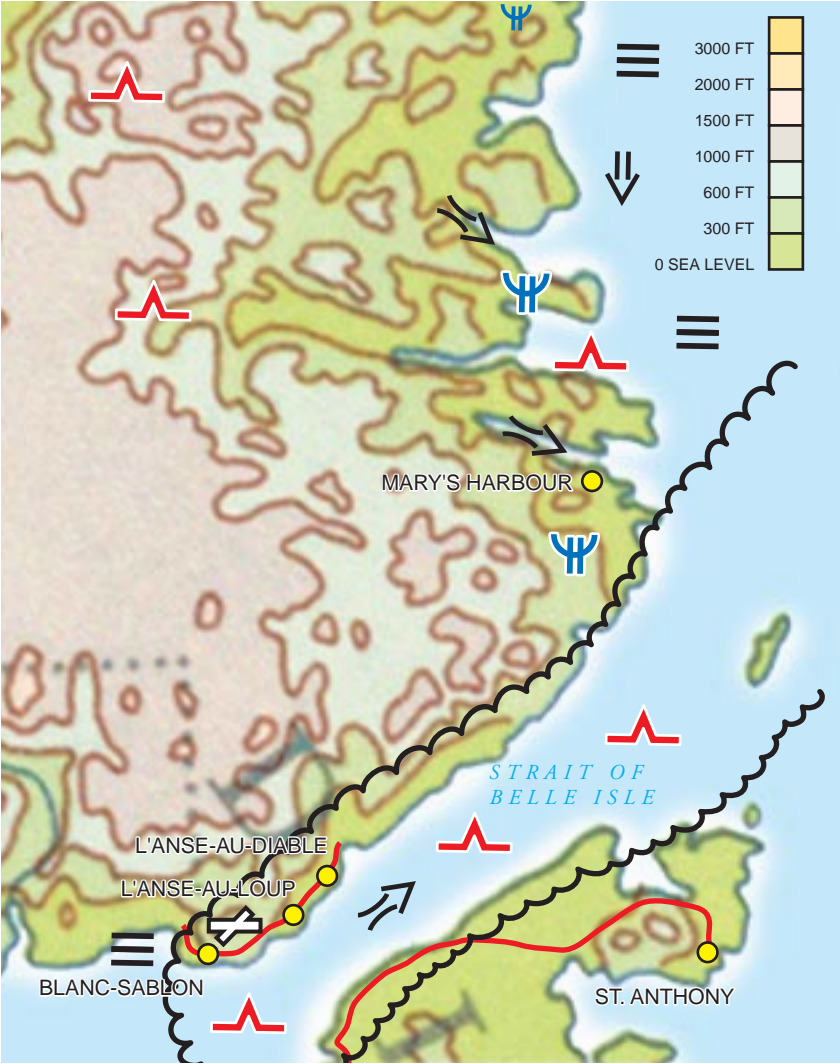
A common route in southeastern Labrador is from Goose Bay to Cartwright. The preferred route is to go direct, however, it is often necessary to fly around the Mealy Mountains. Cloud will often develop over these mountains in north or northwest winds, especially when Lake Melville is free of ice. Upslope cloud can also develop when the winds are out of the south or southeast. Furthermore, shower activity is common in and around the Mealy Mountains when the air is sufficiently moist. Conditions are usually better on the leeward side of the mountains although it should be kept in mind that in strong southerly or southeasterly winds, significant turbulence can be expected on the north side of the mountains.

When it is not possible to make the Goose Bay-Cartwright route direct, one frequently used route is to follow the Kenamu River Valley until south of the Mealy Mountains, proceeding eastward to the Eagle River and then following it directly to Sandwich Bay and into Cartwright. Another option is to head northeast from Goose Bay along the south shore of Lake Melville to Frenchman Point, following the English River to the North River, which can then be tracked right to the coast. These two routes are frequently used since cloud is often present around the Mealy Mountains. When conditions are too low to use these routes, helicopter pilots will generally follow Lake Melville, head through The Narrows out to the coast, and then proceed to Cartwright. One location along this route where problems may occur is in The Narrows where low cloud is often encountered.

While south or southwest winds will generally give ceilings and visibilities above 2,500 feet and 6 miles respectively in any season, northeast to north-northwest winds will yield the lowest conditions at Cartwright from the fall through to spring. One of the major hazards at Cartwright, and all along the coast for that matter, is icing due to freezing drizzle when winds are from the east to northeast in the winter and spring.

The weather observations for Cartwright are taken off-site, about one n. mile north of the runway.

Blanc-Sablon to Mary's Harbour/Strait of Belle Isle



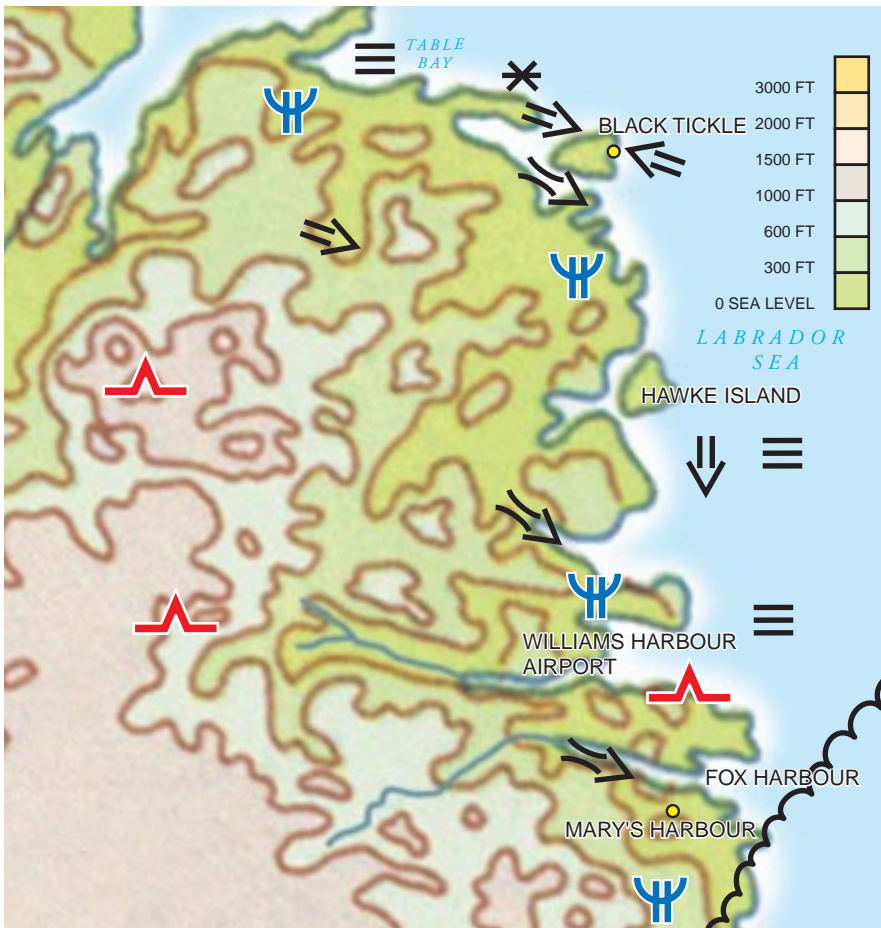
Map 4-34 - Blanc-Sablon to Mary's Harbour

The Strait of Belle Isle is well known for its gap winds. In southwesterly or north to northeasterly flow, air is funnelled through the strait producing strong gap winds, especially between L'Anse-au-Loup and Blanc-Sablon. For example, light southwest winds in the Gulf of St. Lawrence can easily increase to 30 to 40 knots between these two locations. Similarly, northeasterly winds will increase substantially between these two locations. Turbulence can also develop in this area due to funnelled and channelled winds forcing the air upwards over the strait. Pilots report that the turbulence is usually worse on the Labrador side to about half way across the strait. Strong updrafts and downdrafts are also reported and extend as high as 5,000 feet.

In warm and moist southwesterly flow, fog will either form in this area or will be advected up into the Strait of Belle Isle from the Gulf of St. Lawrence and often persist for several days. Since Blanc-Sablon Airport is directly in the path of west or southwesterly winds, fog is usually more prevalent here than at L'Anse-au-Loup and points eastward. This fog generally does not extend more than two or three miles inland. It usually takes several hours after the passage of a front for conditions to improve since low cloud tends to linger in the strait.

Katabatic winds at L'Anse-au-Diable produce strong northerly gusts and can extend up to 1 1/2 miles from the coast. A valley to the north channels the airflow southward until it reaches the steep cliffs at the coast. Frictional effects along the cliffs can cause whirlwinds and significant turbulence in this area.

Mary's Harbour to Black Tickle



Map 4-35 - Mary's Harbour to Black Tickle

In the summer, a warm southwesterly flow will give good flying conditions although dense fog usually sits offshore over the cold water. Sea breezes are also common along the coast and may advect the fog or sea stratus onshore. Some of the more experienced pilots indicate that when flying into the coastal stations in the afternoon, the presence of haze will most likely mean that these same coastal stations will be below minimums in fog or stratus by evening. These conditions will usually be observed only four or five miles inland but can extend further inland with a strong onshore wind.

Southeast to northeast winds will almost guarantee low ceilings and visibility along this stretch of coastline. Drizzle is also very common but usually poses no hazard to aviation. Freezing drizzle, however, becomes a significant problem in the spring and winter months. The low ceilings and visibility combined with the severe icing conditions in freezing drizzle can render coastal areas extremely dangerous in these situations.

Although not entirely weather related, Fox Harbour has a problem with seagull activity in the vicinity of the airport, made worse in a southerly wind. A fish plant near the airport tends to attract these seagulls, especially when winds are out of the south, and local pilots must take great care when coming in from the north.

Williams Harbour Airport, whose runway is oriented southeast to northwest, is built up and lies on a plateau where there tends to be a lot of eddy activity due to the configuration of the airport. Pilots will often report significant downdrafts on approach to either runway.

Westerly winds tend to blow stronger north of Hawke Island because the land near the coast is low and barren. Without any barriers to slow the wind down, the wind is free to increase as it blows across the barrens. Northwest winds are particularly strong at Black Tickle. Pilots say a 10 to 20 knot wind at Cartwright will always mean a 25 to 35 knot wind at Black Tickle. This effect is also observed in a southeast wind. Another hazard at Black Tickle occurs as northeast winds tend to be enhanced by cornering from the eastern end of Spotted Island. The runway is oriented northwest to southeast, therefore strong crosswinds will accompany the low ceilings and visibility.

Black Tickle to West Bay



Map 4-36 - Black Tickle to West Bay

This particular stretch of coastline is oriented northwest to southeast and is fully exposed to northeasterly winds, hence, very low ceilings and visibility are commonplace in such conditions. In winter and spring, severe icing due to freezing drizzle can be expected when the winds are onshore.

Between North River and West Bay, northwest winds experience coastal convergence that causes a band of stronger winds to develop along the coast. Low-level turbulence can also be expected just south of Woody Point where the local terrain that rises to almost 1,200 feet creates mountain waves. Another effect that occurs here during fall, or winter when the ice pack is pushed just offshore, is for scattered flurries to develop near the coast.

Fog and stratus tend to linger in Table Bay and Sandwich Bay, especially during spring and fall. It is not uncommon to see the fog or stratus drift in over the airport at Cartwright.

Groswater Bay to Hamilton Inlet



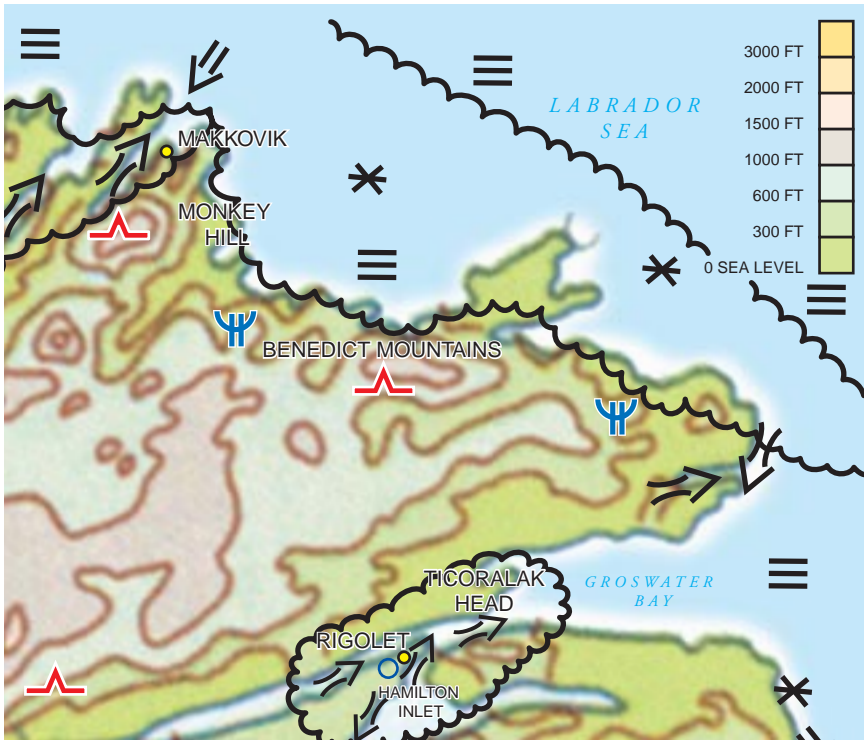
4-37 - Groswater Bay to Hamilton Inlet

Groswater Bay is wide and open towards the east and susceptible to very low ceilings and visibility in drizzle and fog when winds are from the southeast or northeast, in any season. Of these, the worst conditions occur in northeast winds. Freezing drizzle becomes a problem in the spring and winter. Funnelling and channelling occur at the mouth of the bay and into Hamilton Inlet due to numerous small islands and The Narrows. In the fall and winter, storms bring very strong winds and heavy precipitation to this area.

At the head of Groswater Bay, northeast and southwest winds tend to be funnelled at Tioralak Head and cause winds to increase as much as 15 knots.

Strong tidal currents in The Narrows generally prevent winter freeze-up thus providing a good source of moisture for cloud to develop. This cloud is usually based around 1,500 feet and may cause problems getting into Rigolet due to steep, hilly terrain in the vicinity. Fog is often a problem here in the spring.

Groswater Bay to Makkovic and Vicinity



Map 4-38 - Groswater Bay to Makkovic

Although somewhat more rugged than farther south, this coastline is also oriented northwest to southeast and is fully exposed to northeasterly winds. Local pilots keep a close eye on the forecast wind direction since conditions deteriorate very rapidly after the onset of onshore northeasterlies in any season. During spring, these northeast winds can be quite persistent and usually shut down operations with below minimum ceilings and visibilities. During winter, snowfall tends to be heavier here due to the enhancement from the Atlantic Ocean. Coupled with very strong winds that occur here in winter (up to 80 knots at times), blizzard conditions are not uncommon and can persist for days as strong low-pressure systems stall off the coast. Severe icing in freezing drizzle is also a major problem in both spring and winter, although this becomes less of a threat further inland.

Turbulence is often encountered over and to the lee of the Benedict Mountains and tends to be worse in either southwest or northeast winds. Turbulence is also a problem at Makkovic and near Monkey Hill in south or southwest winds. Pilots going into Makkovic airport report lots of mechanical turbulence and downdrafts off the hills to the south of the field when winds are from the south or southwest. Makkovic's winds are often stronger than those at nearby airports but only about half the strength

of the wind at the top of Monkey Hill. A typical combination would see Makkovic's winds at 20 to 25 knots, Postville at about 10 to 15 knots while 50 to 60 knots are blowing at the top of Monkey Hill. In winter, local pilots will often look at the drifting snow on the top of the hill as an indication of the severity of the turbulence and downdrafts they can expect on approach to Makkovic.

In late spring, fog becomes a problem as soon as the ice begins to break up and, by summer, extensive fog banks generally sit just offshore. Southwest winds generally keep the fog and sea stratus offshore but onshore winds will advect the fog inland. Sea breezes are common here and often push the fog onshore. Pilots often find, however, that conditions at Makkovic airport are not particularly representative of the main conditions along the coast and that many locations are not as bad.

Northwest winds here will generally bring improving conditions as far as precipitation, ceilings and visibilities are concerned. Ceilings and visibilities will improve rapidly during winter but may take somewhat longer in other seasons

Makkovic to Nain and Vicinity



Map 4-39 - Makkovic to Nain

West or southwest winds bring good flying weather along this part of the coast although these winds will be funnelled and channelled along the southwest to north-

east axis of the inlets. Localized areas of strong gap winds occur at the mouth of these inlets. Winds from the southwest to northwest quadrants, however, tend to be fairly turbulent.

During winter, similar problems exist here as do over southern coastal sections, with enhanced snowfall and severe icing conditions in onshore flow. Blizzard conditions with near zero visibility are also fairly common in winter when deep low-pressure systems lie to the southeast. That being said, however, occurrences of freezing drizzle tend to diminish somewhat as you head north.

Several long, narrow bays bordered by steep, hilly terrain and oriented southwest to northeast exist along the coast. Funnelling, channelling and coastal convergence cause strong winds along the length of the bays. Where the bays are narrow, such as in Kaipokok Bay, strong gap winds occur. Between Postville and Post Hill, whirlwinds and significant low-level turbulence can accompany these winds. With the very cold Labrador Current just offshore, strong temperature contrasts exist between the land and water during the daytime. Even moderate offshore winds in the morning can give way to a cold, 10 to 15 knot northeasterly sea breezes in the afternoon. As these sea breezes enter the bays and inlets, funnelling causes these winds to increase further, turning a 10 to 15 knot wind outside the bay to a 25 knot wind just inside the bay. Fog may also be advected inland with these winds.

It should be noted here that this effect occurs not only from Makkovic to Nain but all the way up the coast.

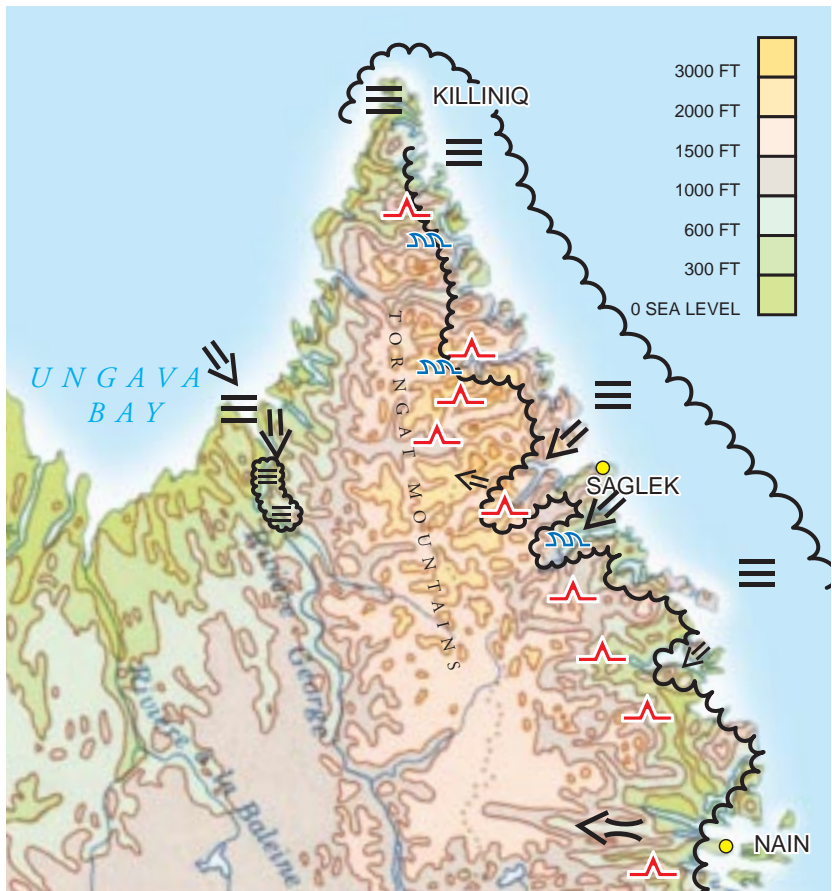
From spring to fall, low cloud pushed far inland by onshore winds between Makkovic and Davis Inlet will have a tendency to linger in the lower terrain between these two sites. Cloud may linger as far southwest as Nipishish Lake depending on the winds. Quite often this area will be covered by cloud but the coastal stations will be better.

Makkovic airport will often be lower than other locations along the coast. As far as ceilings and visibility are concerned, Nain will usually be the best station along this part of the North Labrador Coast when winds are onshore, as the numerous islands to the east of the airport tend to have a sheltering effect. On the other hand, Makkovic will generally have the lowest conditions, with Hopedale and Davis Inlet lying somewhere in between. Typical conditions will be an 800 foot ceiling at Nain, while Davis Inlet and Hopedale will be at 400 feet and Makkovic at 300 feet.

Although ceilings tend to be better at Nain, the mountainous terrain in the vicinity gives rise to very turbulent conditions at the airport. Many pilots regard Nain as the worst airport for turbulence along this stretch of coastline. West to northwest winds will be funnelled down Nain Bay and the Tikkoatakak River Valley and are enhanced further by cornering around the hills west of the field. Pilots will often

encounter strong tailwinds on approach from the north or northeast and will also encounter strong downdrafts near the end of either runway. Pilots say that there are two windsocks near the end of each runway and they will often both point in opposite directions. Similar, but less severe, conditions exist at Davis Inlet where downdrafts are often encountered at the end of runway 32 in southwest winds.

Nain To Killiniq Island/Northern Torngats



Map 4-40 - Nain to Killiniq

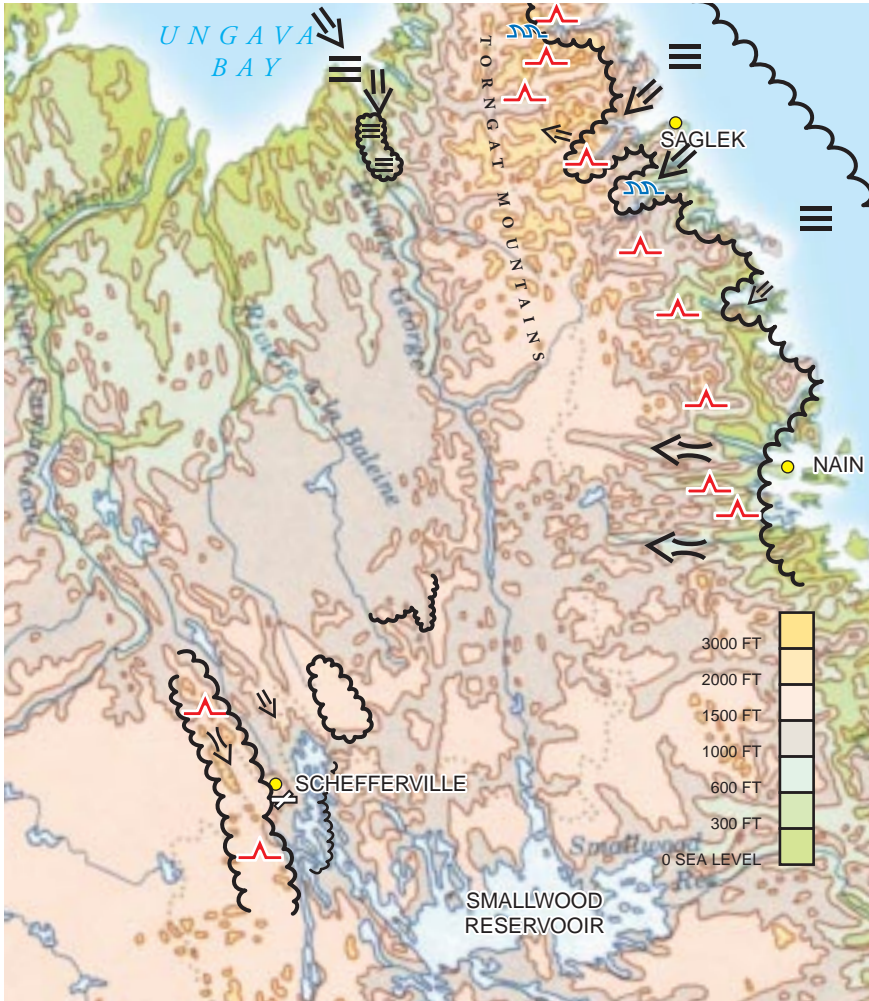
Although this may be the most exciting and most scenic place to fly in the GFACN34 domain, it is without a doubt one of the most dangerous and unforgiving places to fly into as well. More and more pilots are discovering the hidden treasures of the Torngat Mountains, as evidenced by the marked increase in traffic in this area over the past few years. Very limited data exists for this area and pilots are urged to be extremely cautious when flying here. Pilots new to the area should talk to the more experienced local area pilots regarding specific hazards.

The Torngat Mountains north of Nain are usually quite windy even in relatively light pressure gradients. Saglek for example, is a particularly bad location. Gusts spreads here are often quite high, causing problems for helicopter operations in the area.

With stronger winds, turbulence becomes a major problem, especially over the Torngats due to the rugged terrain. Numerous mountains and fjord-like valleys cause an array of local effects such as funnelling, channelling and cornering. Severe updrafts and downdrafts are also encountered in the deep valleys and fjords. Local pilots indicate that it is also preferable to fly the mountain passages and fjords at mid height to remain clear of the worst turbulence.

From Nain to Killiniq, which is Innu for "land's end", southeast to northeast winds will generally give low ceilings and poor visibility conditions and will often penetrate deep into the valleys and fjords, depending on the wind. The lowest conditions generally occur in the spring and early summer. Freezing drizzle in onshore flow is somewhat of a problem as well but is worse in spring rather than winter. Low-level flight over the water is not an option here due to the presence of numerous icebergs that protrude out of the water. Also, the greater the ice cover and number of icebergs in this area, the greater the incidences of fog and low stratus, especially north of Nachvak Fjord. One of the most difficult areas to fly through is Killiniq due to the frequent fog and low cloud in the vicinity.

Ungava Bay Area to Schefferville



Map 4-41 - Eastern Ungava Bay Area to Schefferville

During summer, ice in Ungava Bay begins to melt in June and is usually gone by late summer. This is likely the worst time for low stratus or fog. Westerly winds are particularly prone to spreading upslope cloud along the coast. Low stratus may even penetrate deep into the northern valleys. If temperatures at higher elevations are at or below freezing, considerable rime or even clear icing in cloud may be encountered. This can occur during any season.

Heading south from Ungava Bay, the terrain is generally flat, although it does rise slowly from west to east, until you reach the foot of the Torngats where it rises much more abruptly. From summer to late fall, winds from the west to northwest will pick

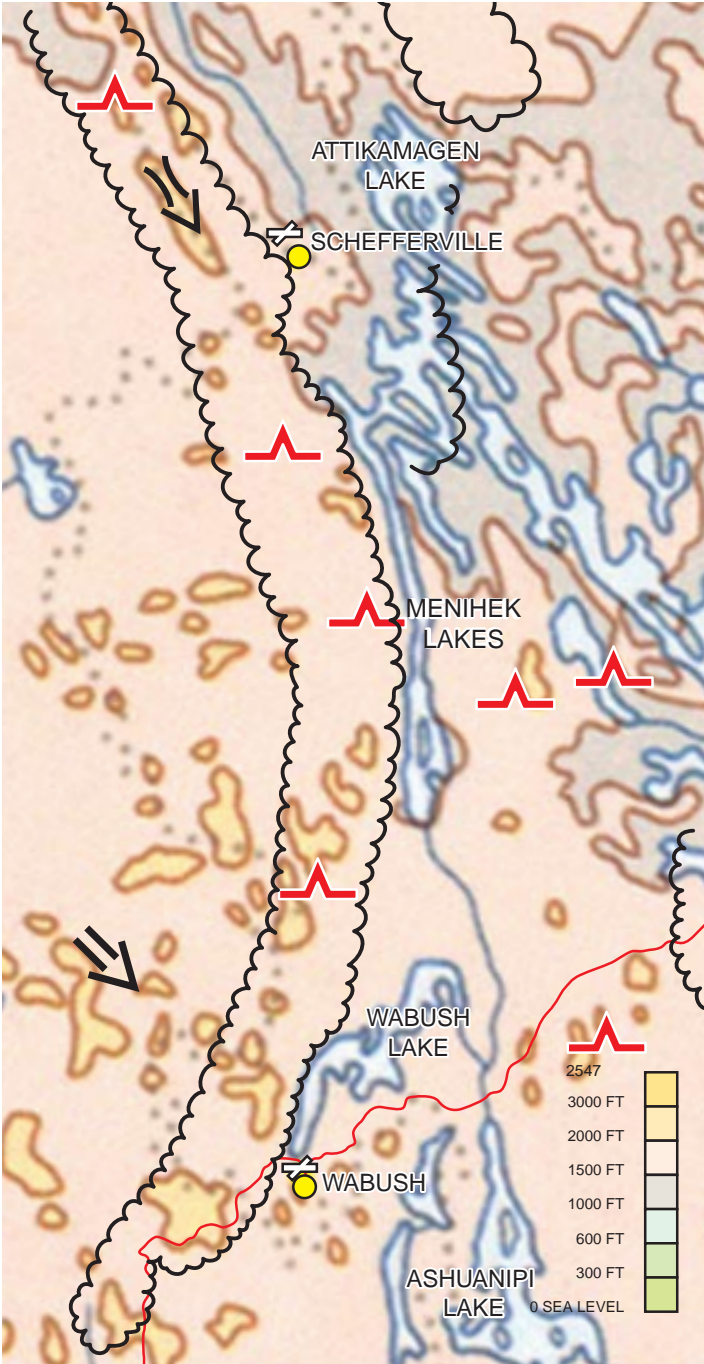
up moisture from the lakes and give widespread upslope cloud in this area. Ceilings are typically in the 2,000 to 3,000-foot range although there are usually local areas of low stratus cloud. If fog or low stratus ceilings inland do not improve significantly between 10 a.m. and 2 p.m., local pilots generally won't fly because the ceilings will usually start to come down again by 3 p.m. local time. Pools of warmer water also exist along the Ungava coast due to drainage from the numerous rivers into the bay. This gives rise to highly variable conditions and patches of very dense fog along the coast.

Winds from the east or northeast will be a downslope flow off the Torngats and will tend to produce better conditions than similar winds elsewhere in Labrador. It should be noted that persistent rain can, however, produce widespread low ceilings in this area.

Water landings on Ungava Bay are usually not an option due to the high tidal ranges in the bay (up to 40 to 50 feet in some areas). These high tides also cause the weather to change quite rapidly as well.

When departing from Kangiqsualujjuaq or Barnoin Camp on the Barnoin River, pilots sometimes observe lenticular clouds over the mountains. When these lenticular clouds are visible, pilots will not fly the Torngats since severe turbulence will always be associated with them. The updrafts and downdrafts associated with these features can easily cause a rise of 500 feet followed by a 500-foot drop within a few seconds. Occasionally rotor clouds can be seen particularly near the mountain tops.

Schefferville to Wabush



Map 4-42 - Schefferville to Wabush

The Schefferville-Wabush route is another common route. The best flying conditions occur in southwesterly flow in any season. Even when precipitation is present, ceilings will generally be quite good. Once the winds go to west or northwesterly after a winter storm, cloud usually clears out quite rapidly as cold, dry, arctic air floods southward. Schefferville is usually one of the first stations to indicate a wind shift and subsequent clearing trend after a storm.

Northeast to southeast winds will generally give the lowest conditions over this route. Ceilings will be marginal, at best, when no precipitation is falling but will quickly deteriorate after the onset of rain. Snow will have more of an effect, causing poor visibility, rather than low ceilings. South to southeast winds accompanied by rain will always give low ceilings and poor visibility along this route.

In westerly flow, upslope cloud will develop along the hills to the west of the route from Schefferville to Wabush. Quite often this cloud will extend right up alongside the airport at Schefferville.

Northwest winds are always stronger at Schefferville than Wabush. Local pilots report that you can always add 15 to 20 knots to the Wabush wind in a northwest flow to get an idea of the winds near Schefferville.