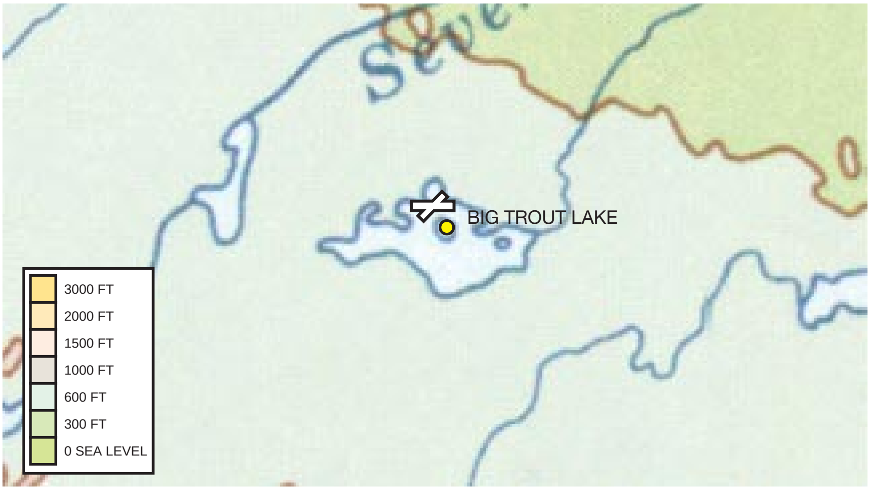
Chapter 5

Airport Climatology

Ontario and Quebec

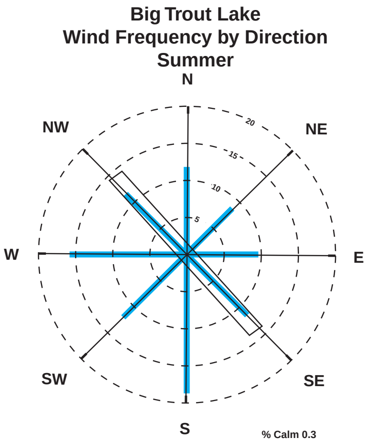
(a) Big Trout Lake

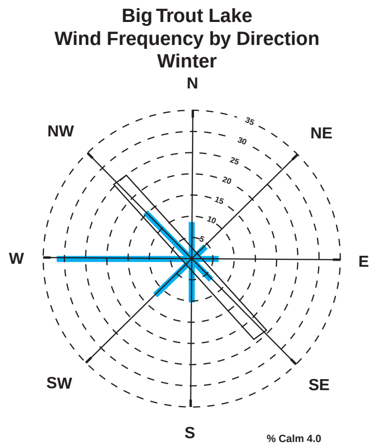


Big Trout Lake, one of the larger lakes in northwestern Ontario, is itself surrounded by numerous smaller lakes, marshes and rivers. The Severn River crosses the region 30 miles to the northwest, draining much of the region as it meanders northeastward to Hudson Bay. The community and airport at Big Trout Lake are situated on Post Island, near the northeastern lakeshore. The island is connected to the shoreline by a road built atop a narrow bridge of land. The landscape of Post Island and the area surrounding Big Trout Lake is mostly flat, forest covered and dotted with marshes. On a broader scale, the terrain to the north and northeast slopes gently down toward Hudson Bay, while the terrain of the Canadian Shield rises equally gently to the south and southwest.

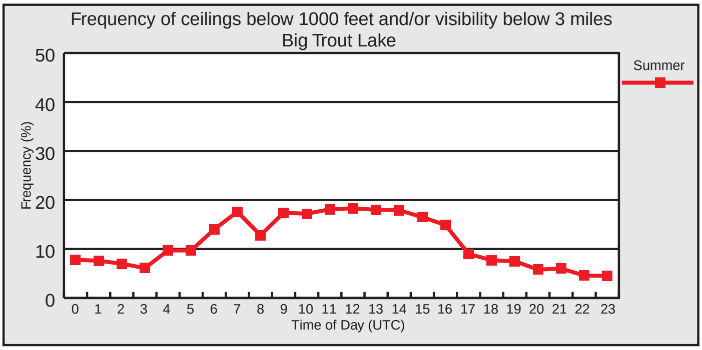
During the winter months, west winds prevail both in direction and strength, while winds from the east and northeast occur infrequently and tend to be much lighter.

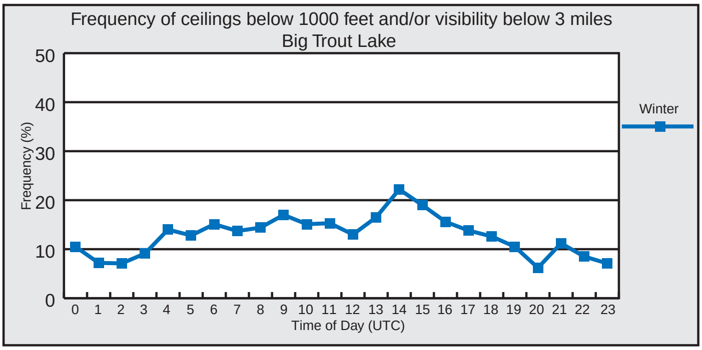
Summer wind patterns are more diverse. Winds from the northwest to south occur around 15 percent of the time and are stronger, while southeast to northeast winds only occur about 10 percent of the time and are lighter.





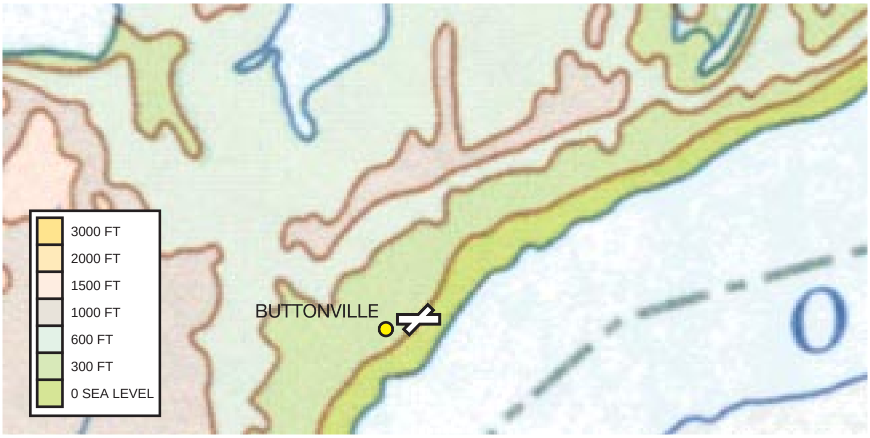
Summer provides a good deal of fair weather flying over northwestern Ontario and, in general, the frequency of IFR weather diminishes. This holds true for Big Trout Lake; however, IFR conditions occur from time to time, particularly in the early and latter part of the season. Fog tends to be one of the chief causes, forming in the early morning hours and reducing visibility, then dissipating during the early part of the day. A second contributing factor in the development of IFR conditions is upslope flow. Winds from the north and northwest are upslope across this section of the Canadian Shield and tend to result in the formation of areas of low cloud. Finally, convective clouds and showers also make their contribution to IFR weather in the summer months, usually developing in the afternoon and dissipating in the evening.





The causes of winter IFR weather have similar roots to those found in the summer. Fog is again a primary culprit, tending to occur more frequently in the early and latter part of the season when moisture is still available from open water sources. As in summer, it tends to form in the early morning hours but will often be slower to dissipate. As temperatures begin to plunge below zero, ice fog starts to develop and can be persistent, especially under calm or low wind conditions. Ice fog can form quickly at times, often triggered by aircraft exhaust or smoke from the chimneys of the nearby community. Another frequent cause of winter IFR conditions is snow or blowing snow. When low ceilings and/or visibility is associated with a rapidly moving weather system, ceilings and visibility tend to be reduced as it passes, followed by a fairly rapid clearing in its wake. Stalled lows; however, can cause periods of low ceiling and visibility to persist for more extended periods of time.

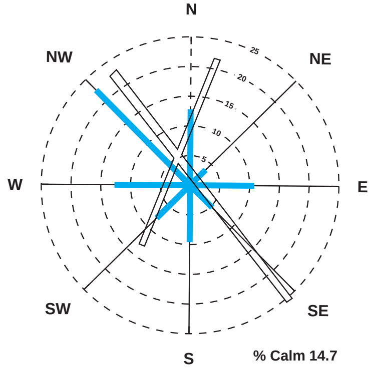
(b) Buttonville



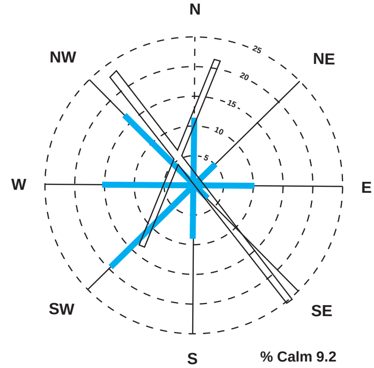
Buttonville Airport is situated in an area of urban development amongst slightly rolling terrain, 16 miles north-northwest of downtown Toronto. The airport has an elevation of 650 feet ASL. The lands to the south of the airport slope gently down to the shores of Lake Ontario. To the north, the land rises along the slopes of the Oak Ridges Moraine, reaching elevations of 1,330 feet ASL.

The predominant wind directions at Buttonville are from the southwest and northwest. Northwest winds become subsident as they flow down the south facing slopes of the Oak Ridges Moraine, toward the Buttonville airport. Southwest winds, flowing across Lake Erie and western Lake Ontario, tend to parallel the terrain along the northwest shore. Winds from the east and southeast are upslope and, though they occur with less frequency, they bring some of Buttonville's lowest ceilings and visibilities.

Buttonville
Wind Frequency by Direction
Summer

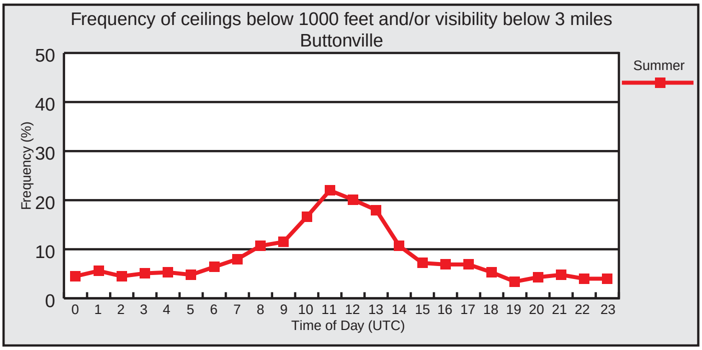


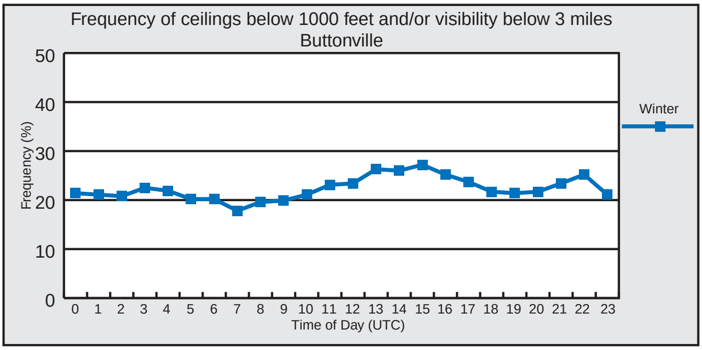
Buttonville
Wind Frequency by Direction
Winter



Good flying weather can be expected throughout the bulk of the summer. The sloping terrain surrounding the airport offers fairly good air drainage and, on average, fog only develops 2 to 3 times, mainly during late summer and early winter. Radiation fog, forming in the early morning hours, usually dissipates by mid morning and rarely lasts in to the afternoon. Haze is another common restriction to visibility in summer. It often develops in the more stagnant air mass beneath a ridge of high pressure and is made worse by conditions of high humidity. Haze will occasionally reduce visibility to near 5 miles, but rarely to less than 3 miles.

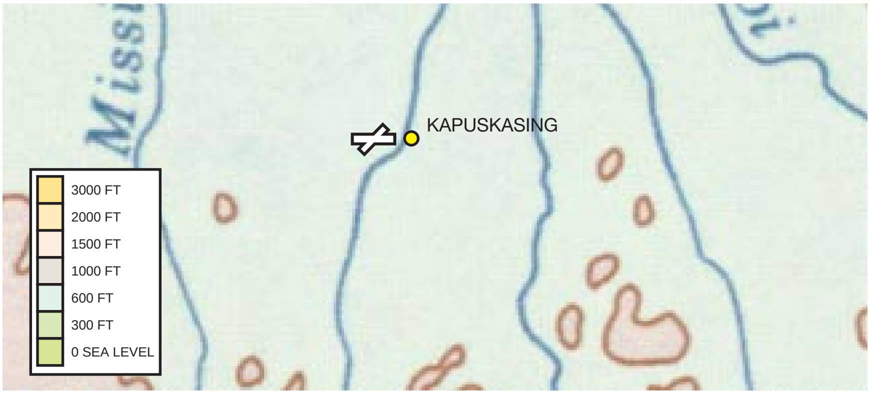
Lake breezes off Lake Ontario will frequently trigger convective cloud development along the surrounding upslope terrain during summer afternoons and, if the air mass is sufficiently unstable, will result in thunderstorms. Most thunderstorm activity tends to occur along the higher terrain to the north of the airport. Thunderstorms occur an average of 25 times per season.





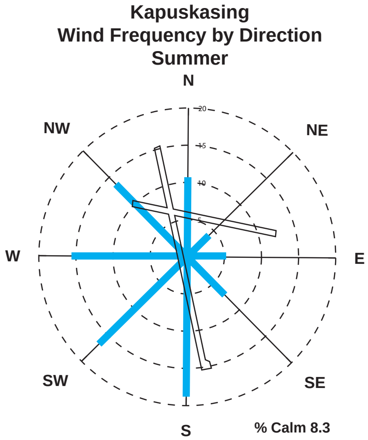
During the winter months, the prevailing winds are southwesterly. Migratory low pressure systems begin to track across the Great Lakes in greater numbers and the primary causes of winter IFR conditions tend to be low ceilings and poor visibility in snow. With the passage of a low pressure system, the rising upslope terrain and ridges to the north often see lower ceilings and poorer visibility in snow than that experienced at the airport. Under a strong northwest flow, lake effect cloud can generate significant snowfalls and IFR conditions along the upslope areas to the north of these ridges, while conditions at Buttonville Airport, on the downslope side of this terrain, will be significantly better.

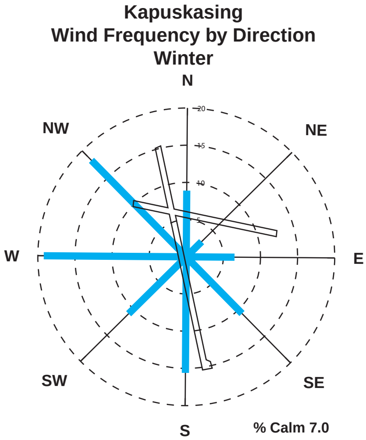
(c) Kapuskasing



Kapuskasing Airport in northeastern Ontario lies one mile west of the town centre and half a mile south of the Trans-Canada Highway. There are several smaller communities within the surrounding area including Kitigan, about 7 nautical miles to east-southeast; Lepage, 6 miles to the west-northwest; Harty, 11 miles to the west-northwest; and Val Rita, 4 miles to the northwest.

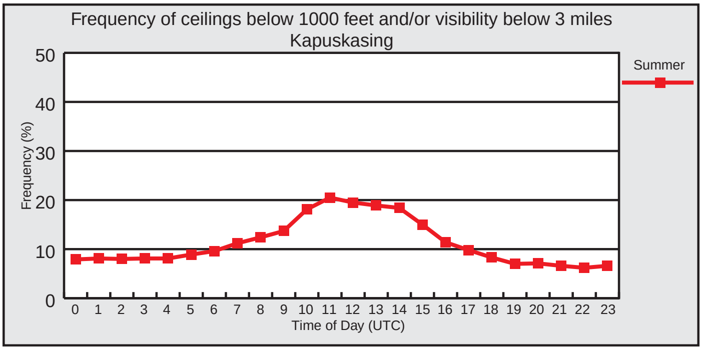
The surrounding terrain consists of low rolling forested hills. The highest of these has an elevation of 735 feet ASL and lies about 12 miles to the southwest. The Kapuskasing River passes within a little over a mile to northeast of the airport. It takes a winding path across the region, flowing northward down the gently sloping terrain toward the Hudson Bay lowlands.

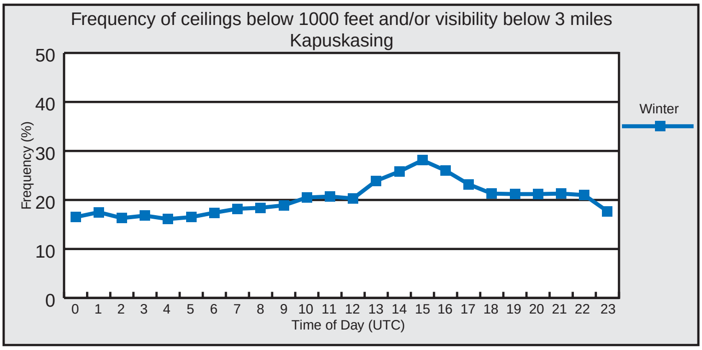




Winter brings prevailing winds out of the west or northwest at Kapuskasing. South and southwest winds are less frequent in both direction and strength throughout the winter and winds from the northeast rarely occur.

During summer, the dominant wind direction is from the south or southwest. Northwest winds diminish in strength and occur about half as often, while winds from the eastern quadrants are rare.





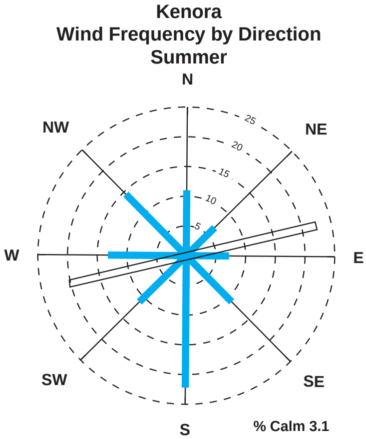
IFR weather occurs about 15 to 25 percent of the time in winter and is often associated with poor visibility in fog or snow. Fog occurs more frequently in the early and latter part of the season, before the local surface moisture sources freeze over. The fog tends to form in the early morning hours, is at its worst just after sunrise, and is slow to dissipate. Later in the season, as temperatures begin to plunge below freezing, ice fog begins to develop and can be persistent, especially under calm or low wind conditions. Ice fog can form quickly at times, often triggered by aircraft exhaust or smoke from a nearby community.

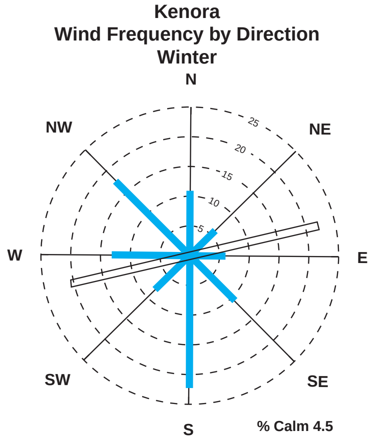
Other common causes of winter IFR conditions are system cloud, snow and blowing snow. This type of weather generally begins and ends for reasons unrelated to the time of day; therefore, there is little diurnal variation in the frequency of IFR weather in winter. Northwest winds, which are upslope for Kapuskasing, bring some of the worst flying weather. IFR conditions are more than twice as likely to occur under a northwest flow than with winds from any other direction.

Kapuskasing generally sees good flying weather throughout the summer; however, IFR conditions do occur at times, particularly in the early and latter part of the season. Fog is again the most common cause, forming in the early morning hours and reducing visibility, then dissipating during the early part of the day. Low ceilings occur less frequently, most often is association with an upslope northwesterly flow. Convective clouds and showers also make a contribution to IFR weather in the summer months, usually developing in the afternoon and dissipating in the evening. Thunderstorms occur infrequently, reaching a peak in July with an average of six per month.

(d) Kenora

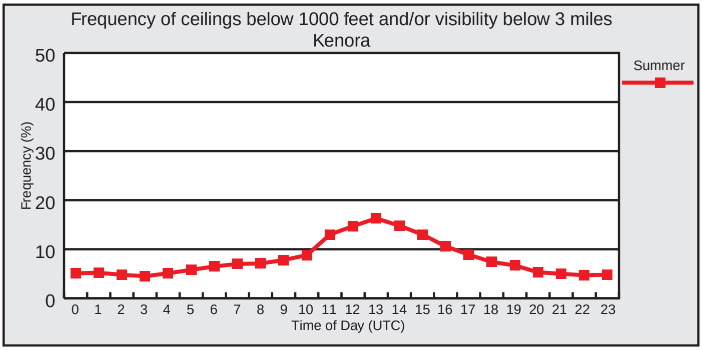
Kenora lies in northwestern Ontario, along the northern shore of Lake of the Woods. The airport is located 5 miles east-northeast of the city. Numerous smaller lakes dot the region's rocky, forest covered and rolling landscape. In general, the terrain rises to the east and falls in elevation to the west.

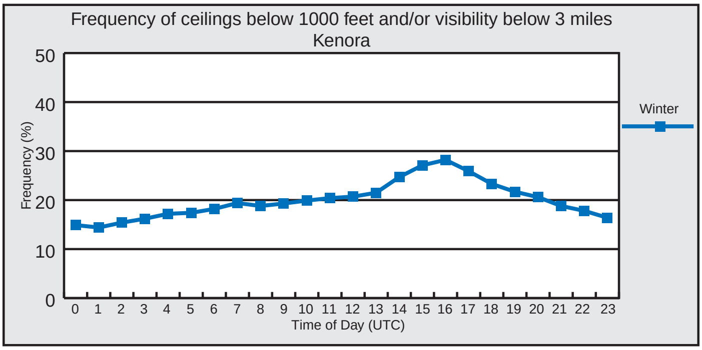




During summer, the dominant wind direction is from the south and occurs about 22 percent of the time. Northwest to southwest winds occur less often and easterly winds are more rare.

The winter wind pattern at Kenora airport is dominated by winds out of the northwest and south. Westerly winds, and those out of the southeast, occur about half as frequently and tend to be lighter. Winds out of the east or northeast occur much less often.



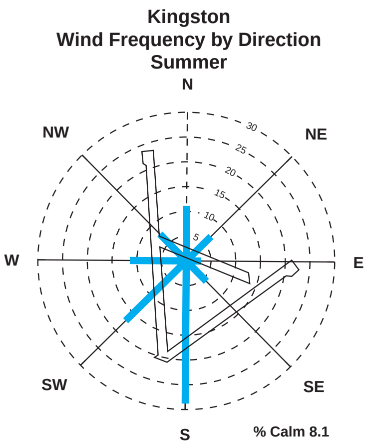


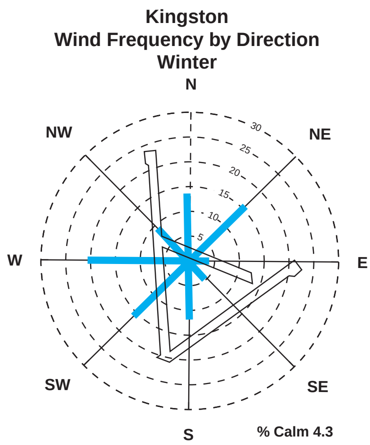
Summer generally brings fair weather flying to the Kenora area. IFR conditions develop infrequently, but occur more often in the early and latter part of the season. Fog typically forms two or three times a month, usually developing during the early morning hours, from moisture that is readily available from the many surrounding lakes. The fog usually dissipates during the early part of the day, seldom lasting beyond noon. Low ceilings are not often a problem, but tend to develop more frequently under a southerly flow off Lake of the Woods. Convective clouds and showers make a small contribution to IFR weather in the summer months, usually developing in the afternoon and dissipating in the evening. Thunderstorms tend to develop several times a month throughout the summer, peaking in July with an occurrence rate of seven per month.

Winter brings on a rise in the frequency of IFR weather as the number of migratory low pressure systems tracking across the region increases. Fog is generally not a problem to operations, but forms more often in the morning during the early and latter part of the season, before freeze up and during the spring melt. Low cloud and snow begin to develop more frequently in December and January. Low ceiling and visibility, when they do occur, are rarely persistent as most migratory systems pass within 24 hours and are often followed by fairly rapid clearing.

(e) Kingston

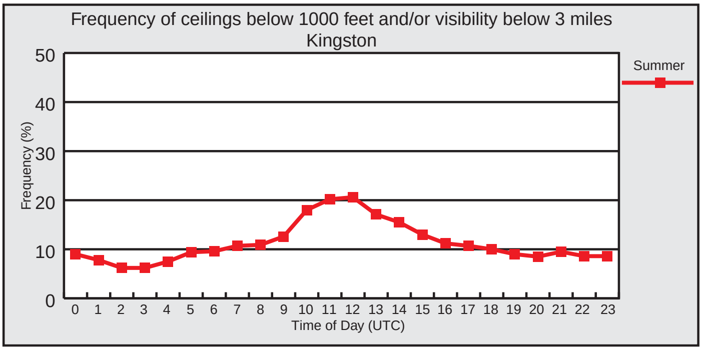
The Kingston Airport is located near the eastern end of Lake Ontario, on the northern shore, 4 nautical miles west of the city of Kingston. A fairly level landscape surrounds the airport, which has an elevation 60 feet above that of the lake. Sparsely treed, rolling farmland rises gently to the northwest through northeast and is dotted with numerous small lakes and rivers. To the southwest, lie the open waters of Lake Ontario, and to the east the headwaters of the St. Lawrence River and the Thousand Islands region.

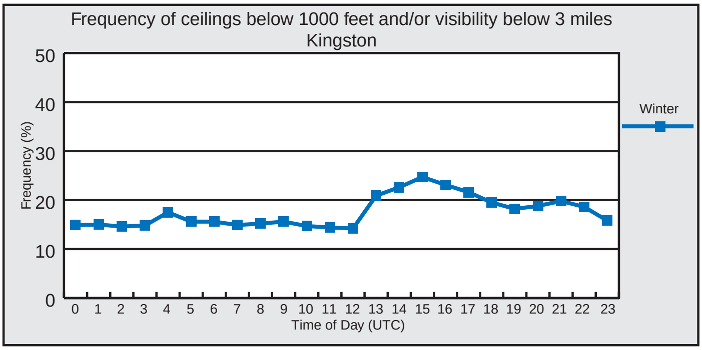




Throughout the summer, south and southwest winds off Lake Ontario dominate the wind pattern at Kingston. Winds from the northern quadrants occur with less than half the frequency, and those out of the southeast and especially the east are quite rare.

In winter, westerly winds are slightly more dominant over those out of the southwest and northeast. As in summer, east and southeast winds are fairly uncommon.



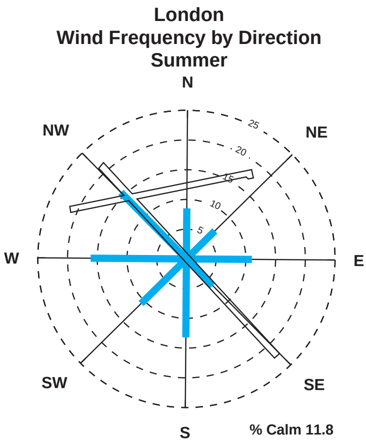


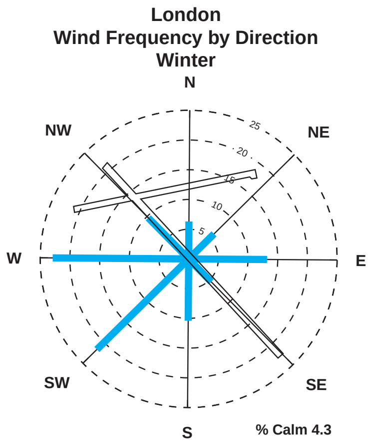
Kingston Airport sees little IFR weather during the summer. Radiation fog will sometimes develop in the early morning hours, under calm or light wind conditions, but usually dissipates within a few hours of sunrise. Low ceilings and visibility are more often seen in association with migratory low pressure systems and southerly winds which are upslope and carrying moisture off Lake Ontario. Summer convective cloud tends to develop along the warm slopes and rising terrain to the north of the airport, at times resulting in lines of thunderstorms. The cool waters of Lake Ontario serve to dampen summer convection; therefore, few thunderstorms develop or pass within the immediate vicinity of the airport

In winter, migratory low pressure systems begin to track across the Great Lakes in greater numbers and the occurrence of IFR conditions begins to rise. System cloud and reduced visibility in snow, rain and fog account for much of the increased IFR weather at Kingston. In the absence of synoptic scale weather systems, a south or southwest flow over the open waters of Lake Ontario can subject the airport to lake effect low cloud and reduced visibility in snowfall. Kingston is also prone to an average of 2 to 3 occurrences of freezing rain per month, throughout the winter, as warm frontal air masses approaching from the west or southwest encounter and override cold arctic air spilling out from the Ottawa River Valley and along the St. Lawrence.

(f) London

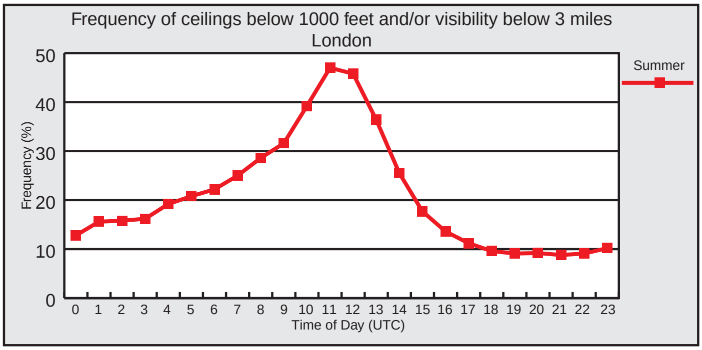
London Airport lies on a plain of gently undulating terrain that falls slowly toward the shores of Lake Erie, 23 nautical miles to the south, and Lake Huron, 32 miles to the northwest. To the northeast, the land rises across a distance of 7 miles, reaching an elevation of 1,200 feet ASL. A northern branch of the Thames River wanders across the region and passes within 1-1/2 miles of the airport, where a dam has been constructed to create Fanshawe Lake. The southern branch of the Thames River passes within 4 miles to the south of the airport and joins the northern branch at a point 6 miles to the southwest.

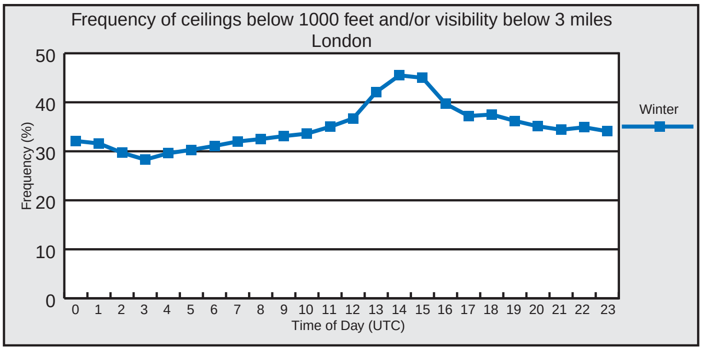




Airport climatology here is influenced to some extent by local topography but is dominated by the presence of the Great Lakes, which for the most part surround southwestern Ontario. By frequency of occurrence, west and southwest winds tend to prevail throughout the winter months, with a secondary peak from the east. Winds show more diversity in direction throughout the summer, with wind from the west and northwest being slightly more dominant over those winds out of the south.

London generally sees fairly good flying weather during the summer but that is not to say that IFR conditions do not occur. On average, fog develops 3 times per month during the early summer and six times per month in August and September. Usually resulting from radiation cooling under clear skies, the fog tends to form in the still morning air a few hours before sunrise, then gradually dissipates and seldom lasts beyond mid morning. Haze, on the other hand, is another common restriction to visibility in summer, arising from the accumulation of aerosols and particulates in the atmosphere. It often develops in the more stagnant air mass beneath a ridge of high pressure and is made worse by conditions of high humidity. Haze can be more persistent and has been known to reduce visibility at London airport to less than 3 miles. Low ceilings and poor visibility also tend to accompany migratory low pressure systems, especially in conjunction with an upslope southerly or northwesterly flow. London lies in a region of strong convective development driven by daytime heating and convergence of lake breezes off Lake Erie, to the south, and Lake Huron, to the north, resulting in an average of seven thunderstorms per month during the summer. Waterspouts are a common occurrence over nearby Lake Erie and severe convection occasionally results in tornadoes over the land.





Fog occurs an average of 3 or 4 times per month in winter and usually dissipates late in the day. However, during the winter, it is the migratory low pressure systems, with their cloud and snow, that are the primary causes of IFR conditions. In the absence of synoptic scale systems, a strong northwest to north flow over the open waters of Lake Huron can bring lake effect cloud and snowfall to London. Since the southern end of Lake Huron is fairly shallow and tends to freeze over, lake effect clouds and snowfall usually diminish in January and February.

(g) Moosonee

Moosonee Airport is located on the north bank of the Moose River, 10 nautical miles from where the river empties into James Bay. The airport has an elevation of 30 feet ASL and is surrounded by a near flat landscape of poorly drained muskeg areas, interspersed with low sandy rises covered in spruce, poplar, willow and alder trees. The town of Moosonee itself lies less than one mile to the southwest of the airport. The waters of the Moose River are fresh in this area, with strong currents throughout the summer months and tides of nearly 6 feet. Across the river, 1-1/2 miles to the southeast, lies the town of Moose Factory situated on Factory Island, one of a cluster of several islands in the Moose River, where it broadens to a width nearly 3 miles before emptying into James Bay. The river freezes over during the winter months providing a seasonal ice bridge, however, during periods of freeze-up and break-up helicopters provide transportation between these two communities.

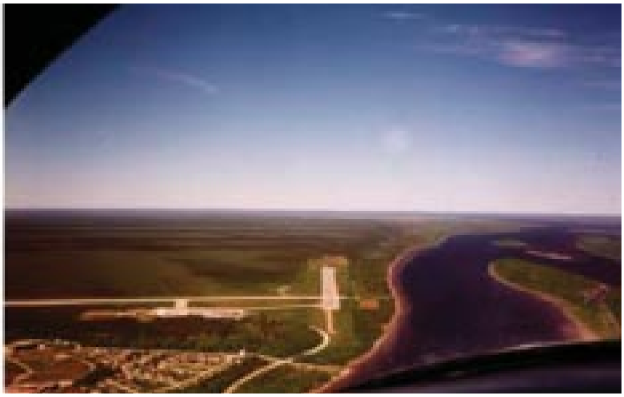
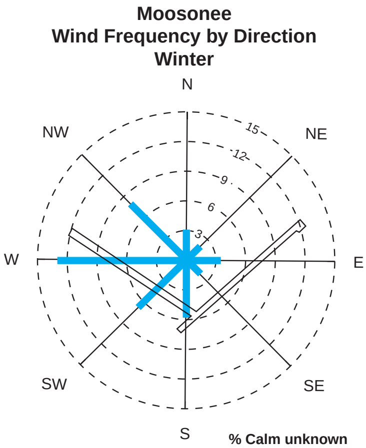
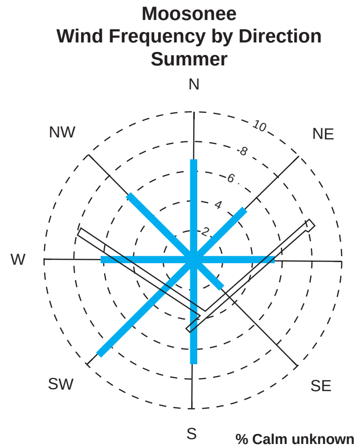
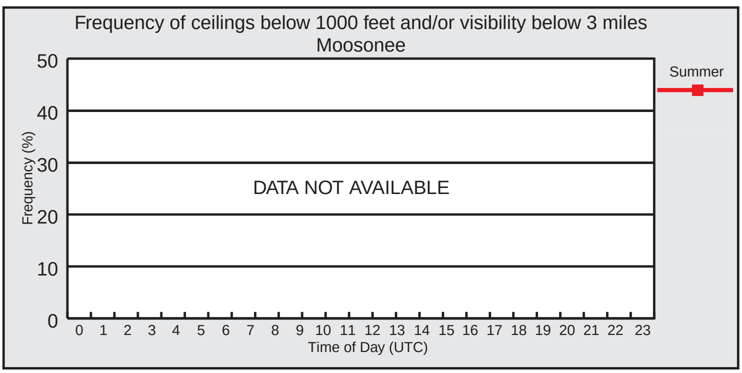


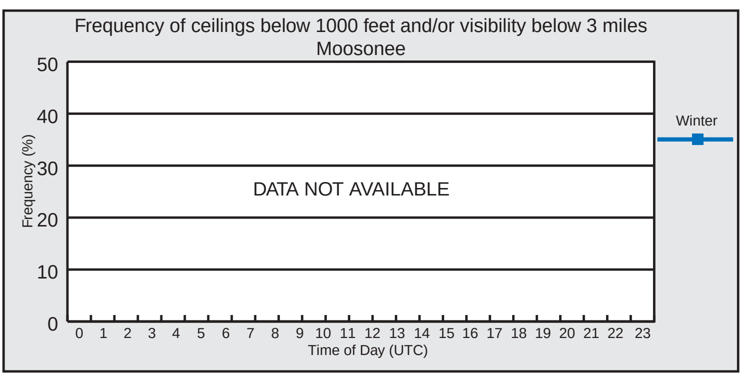
Photo 5-1 - Moosonee Airport credit: Source unknown





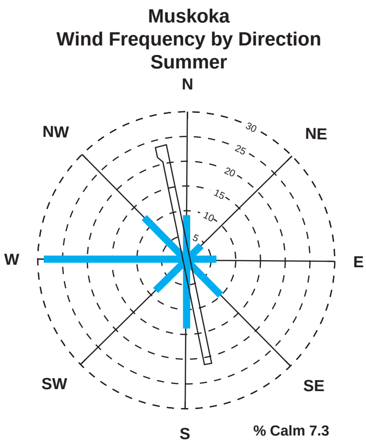
Southwest winds predominate throughout the summer months at Moosonee Airport, while westerly winds prevail during the winter months. Other wind directions are much less frequent and are usually associated with passage of low pressure systems across the region. Both the mean wind speeds and maximum gust speeds show only slight seasonal variation.

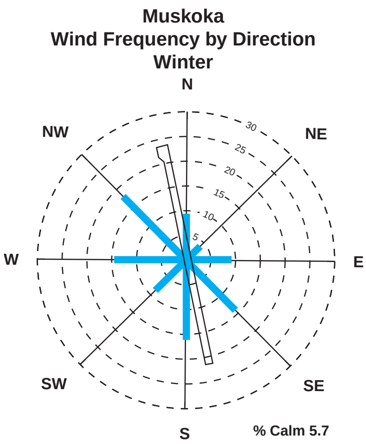




(h) Muskoka

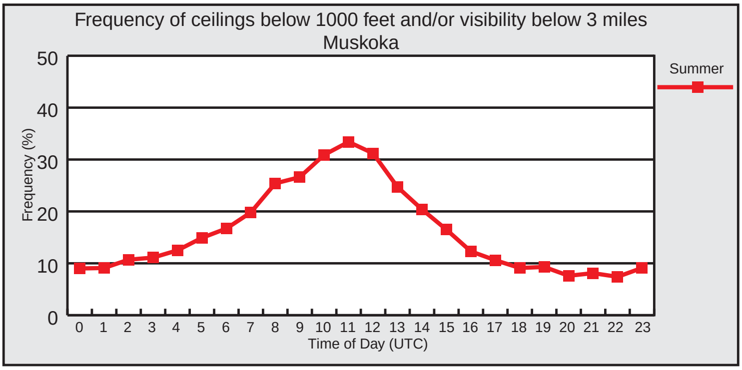
Muskoka Airport is located in central Ontario, 3 nautical miles to the east of Lake Muskoka and midway between the towns of Gravenhurst, 5 miles to the southwest and Bracebridge to the north. The smaller community of Muskoka Falls lies 2 miles to the north. This is a cottage and resort region dotted with numerous lakes, of which Lake Muskoka is the largest. The lands surrounding the airport are varied, consisting of fairly flat areas intermixed with low rolling hills covered in forest and shrubs and dotted with rocky outcroppings. The Canadian Shield gradually rises to the northeast, while the waters of Georgian Bay open up 30 miles to the west.

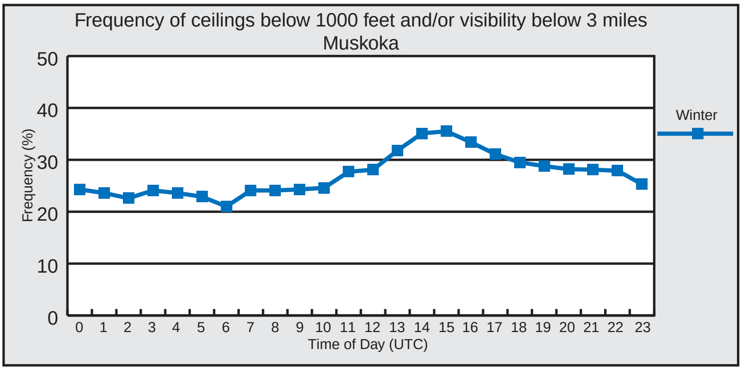




Westerly winds dominate the summer months at Muskoka, however, southerly winds frequently prevail for periods of time depending upon the pressure pattern. During the winter, as the storm track shifts northward and the frequency of low pressure systems increases, a more pronounced split develops, with winds from the northwest maintaining only a slight dominance over those from the south and southeast.

Low ceilings and/or visibility develop infrequently at Muskoka throughout the summer, usually in the early and latter months of the season. When IFR conditions do occur, it is often the result of mist, fog or low stratus which forms during the early morning hours, from moisture off the numerous surrounding lakes and rivers, and dissipates before midday.





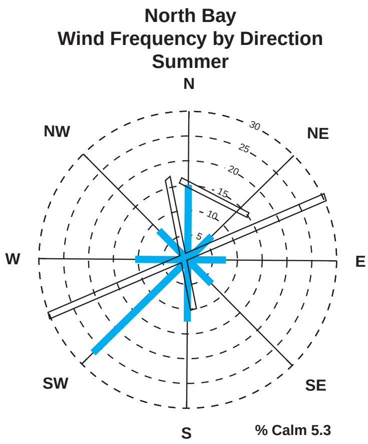
During the winter, IFR conditions are usually associated with snowstorms. Snowstorms can be "lake effect" in origin, developing under a northwest flow that carries moisture inland from Georgian Bay, or they may be linked to migratory low pressure systems, which tend to wrap moisture across the region from the south or southwest. Both can give periods of low ceiling and poor visibility in cloud and precipitation.

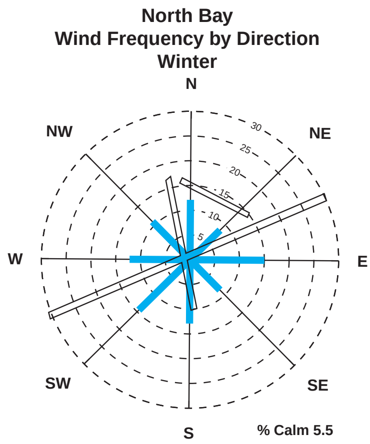
While flying weather is generally at its worst over Muskoka in the winter and best in the summer, it should be noted that the frequency of occurrence of IFR conditions peak during the early morning hours of the spring and fall.

(i) North Bay Airport

North Bay Airport lies just over 4 nautical miles northeast and approximately 500 feet above the shores of Lake Nipissing, atop a plateau of Canadian Shield granite. To the northeast of the airport, the terrain continues to rise gently in rows of low hills forested in a mix of birch, poplar and maple. To the south, the plateau falls away steeply in elevation to a lower table of land on which the city of North Bay spreads out to the lakeshore.

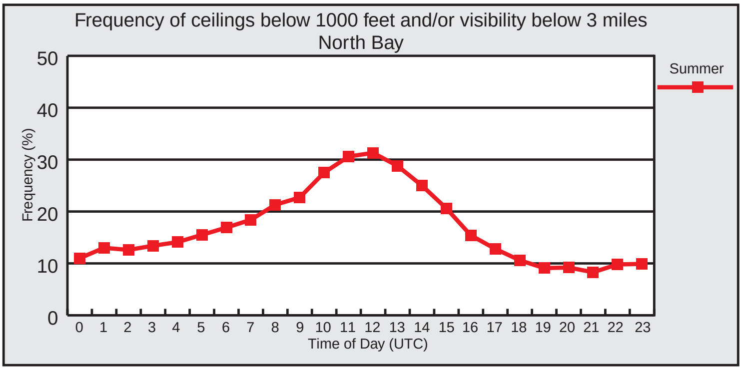
Photo 5-2 - North Bay Airport credit: Source unknown

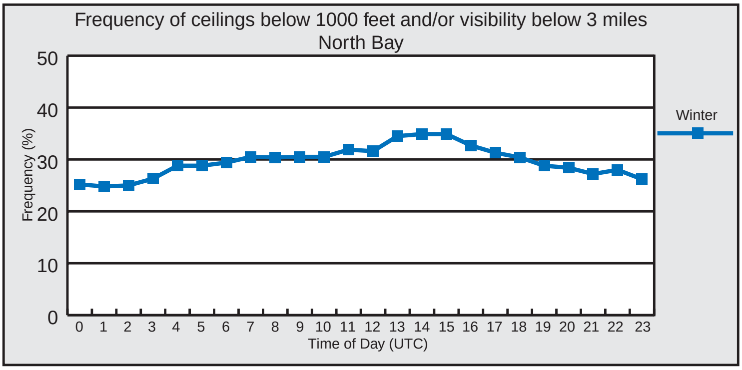




The dominant wind direction at North Bay during the summer months is southwesterly, off of Lake Nipissing. Northerly winds occur with less than half the frequency and tend to be lighter than of those out of the southwest. Winds from the remaining compass points are often weaker and even less frequent.

The winter wind regime becomes much more diverse, reflecting shifts in wind direction associated with the passage of an increasing number of low pressure systems along the winter storm tracks. Southwest winds are still dominant but their frequency of occurrence is nearly matched by winds out of the north and east.





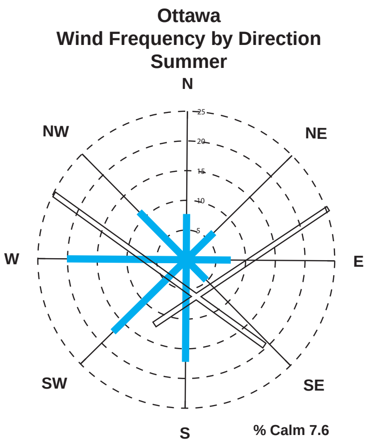
The frequency of IFR weather conditions drops to a minimum in the summer, usually occurring in the early and latter part of the season and most often in association with southwest winds. Winds from the southwest through southeast are upslope for North Bay and tend bring the worst flying weather. It is southwest winds that dominate throughout the summer months, carrying moisture off Lake Nipissing and, more distant, Georgian Bay and contributing in combination with daytime heating, to cloud and shower development along the rising slopes of the Canadian Shield. This pattern is evident in the accompanying summer chart which shows IFR conditions peaking as cloud develops from late morning to early afternoon. IFR frequency then diminishes in the late afternoon and evening as cloud begins to dissipate. North Bay Airport is not particularly susceptible to summer radiation fog.

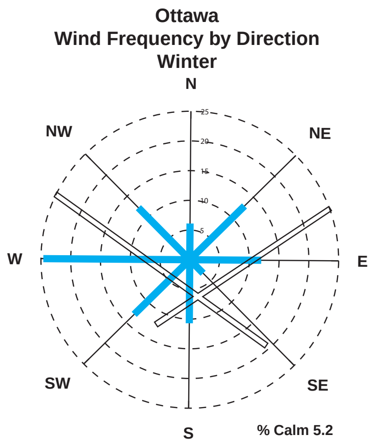
During the winter months IFR conditions develop more often and are much more evenly distributed throughout the day and night hours. This can be attributed to the fact that IFR conditions in winter tend to arise from a combination of snow, blowing snow, fog and low cloud associated with winter's increased numbers of migratory low pressure systems. It should be noted that throughout the winter, IFR weather occurs much more frequently with winds from the southwest and southeast quadrants, indicating a strong contribution from upslope flow.

(j) Ottawa

Ottawa Airport is located about 90 nautical miles northeast of Lake Ontario, near the junction of Ottawa and St. Lawrence River Valleys. It is sited on a plain of rolling farmland about 6 miles south of the city. The Rideau River, a little over a mile to the west, flows northward past the airport and through the city to join the Ottawa River about 6 miles to the north. The airport has an elevation of 375 feet ASL, about 240 feet above the level of the Ottawa River. The surrounding terrain rises to the north along a section of the Canadian Shield known as the Gatineau Hills, which reach elevations near 1,300 feet some 15 miles from the airport.

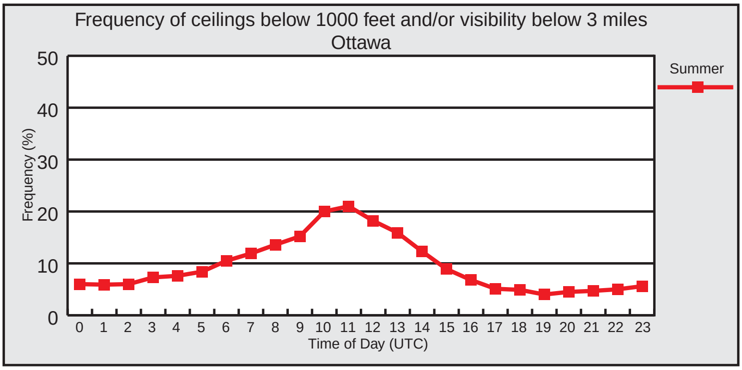
Ottawa's winds tend to be channelled by the surrounding river valleys. During the summer, south through west winds prevail both in strength and direction. Northwest winds occur less frequently and winds seldom flow out of the eastern quadrants.

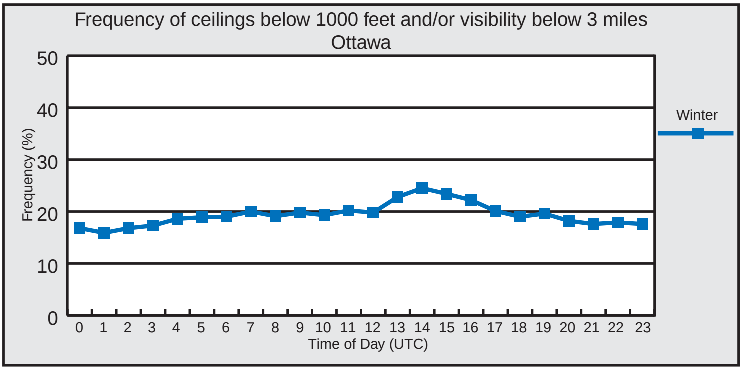




During the winter, west winds flowing out of the Ottawa Valley are dominant in both direction and speed and, to a somewhat lesser extent, winds out of the east-northeast and southwest, which are channelled along the St. Lawrence Valley. Winds seldom arise from the north or southeast as they are blocked by the Gatineau Hills and the Appalachian Mountains, located to the south of the St. Lawrence Valley.

Summer generally brings good flying conditions at Ottawa and little in the way of low ceilings or poor visibility. Radiation fog is one of the most common causes of IFR conditions, developing in the early morning hours under calm or light winds. Radiation fog usually dissipates within a few hours of sunrise and rarely last into the afternoon. On average, fog restricts visibility to less than half a mile, 2 to 4 times per month, reaching its highest frequency during the late summer and early winter. Low ceilings and visibility also tend to occur in association with the passage of migratory low pressure systems but, again, poor conditions are seldom persistent. Ottawa has an average of 24 thunderstorms per season, peaking in number during July and August and rarely developing outside of the period April through October.





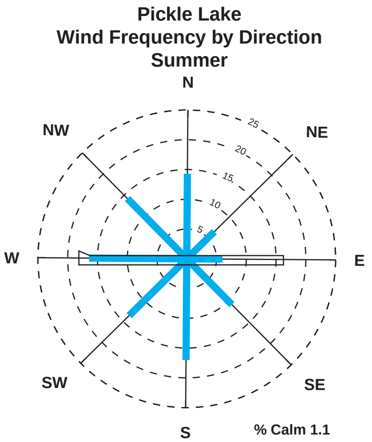
Migratory low pressure systems begin to track across southern Ontario in greater numbers in winter and the occurrence of IFR conditions arising from low ceilings and poor visibility in snow begins to rise.

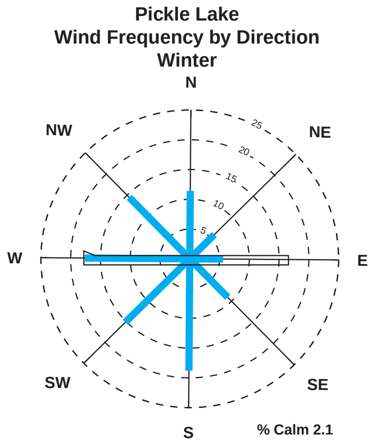
Probably the greatest risk to aviation in the Ottawa area is freezing rain. Ottawa averages 3 to 5 occurrences of freezing rain per month between November and April. Freezing rain commonly lasts an hour or less, however, freezing rain can persist for several hours at a time. One of the most prolonged periods of freezing rain ever recorded in Canada occurred January 5-10, 1998, during which time nearly 85mm of freezing rain fell in the Ottawa area.

(k) Pickle Lake

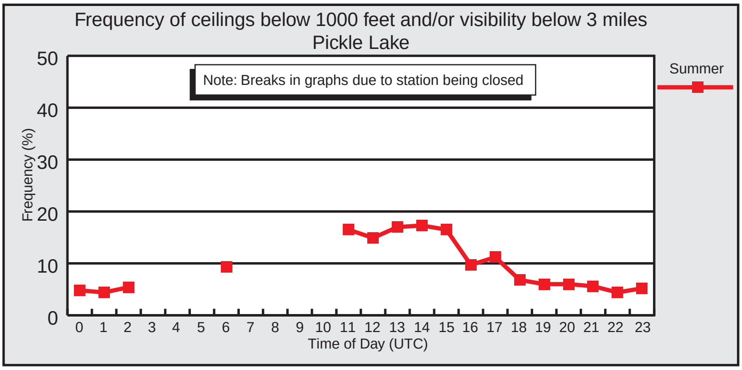
Pickle Lake Airport is located in northwestern Ontario, near the southern shore of Pickle Lake. The local community, which also bears the lake's name, is sited about 2 nautical miles to the northeast. The airport is fairly exposed and the surrounding terrain is made up of gently rolling, forested hills with rocky outcroppings interspersed with numerous small lakes.

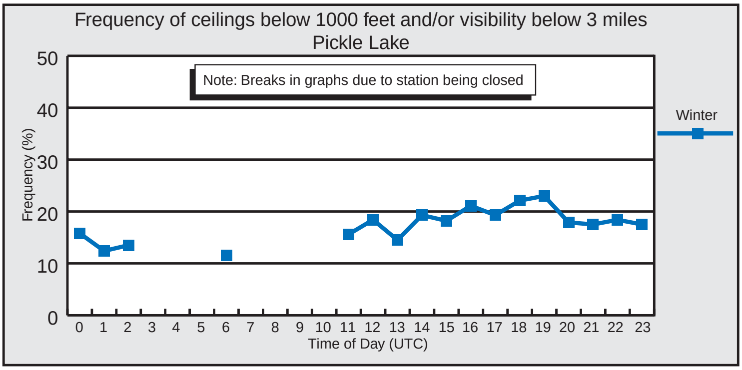
During the winter months westerly winds prevail in both strength and direction; however, winds out of the northwest, southwest and south occur almost as frequently. In summer, the prevailing wind direction becomes south or west, although winds out of the northwest occur only slightly less frequently. The least favored wind directions throughout both winter and summer are those out of the east or northeast.





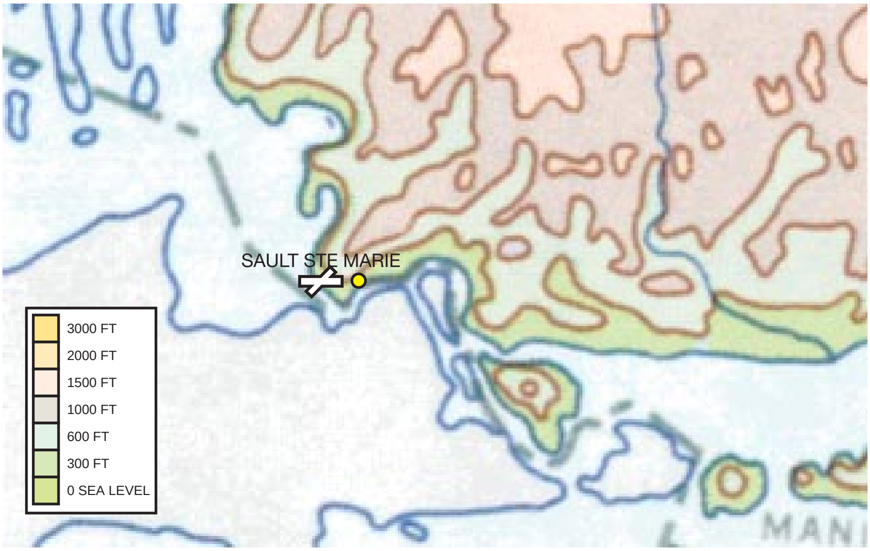
Summer usually brings good flying weather to Pickle Lake and northwestern Ontario in general, however IFR conditions sometimes occur. One of the most common causes is radiation fog, which occurs more often later in the season. Shallow fog will typically form overnight and dissipate within a few hours of sunrise. To a lesser extent, summer convection and thunderstorms can also lead to low ceilings and visibility developing in showers. This is often the case with the passage of a cold front but, on occasion, will occur in stronger storms that arise with daytime heating.



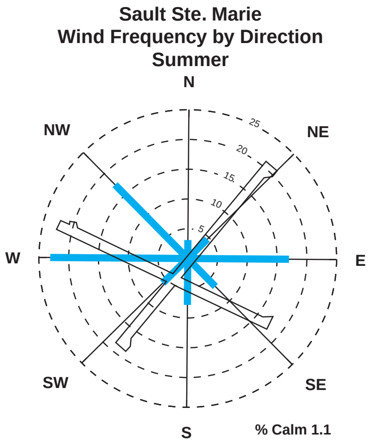


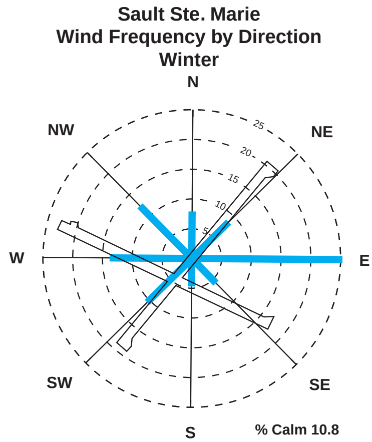
Low ceilings and visibility occur more frequently in winter. This is particularly true of the early part of the season, when open water is still present. At this time of year, fog is more prevalent, especially in the morning and it tends to linger into the day. Convection also remains somewhat of a problem until freeze up, as warm water in surrounding lakes gives rise to lake effect snowfall, which can reduce visibility at times to between half and a quarter of a mile and persist for several hours. Once local lakes freeze over, flying conditions usually improve, however, winter brings an increase in both the number and intensity of low pressure systems. These disturbances often bring low ceilings and periods of poor visibility in snow or blowing snow. Most low pressure centers or frontal systems move across the region in less than 24 hours, followed by fairly rapid clearing in their wake. Stalled lows can cause periods of low ceiling and poor visibility to persist for more extended periods of time.

(l) Sault Ste. Marie

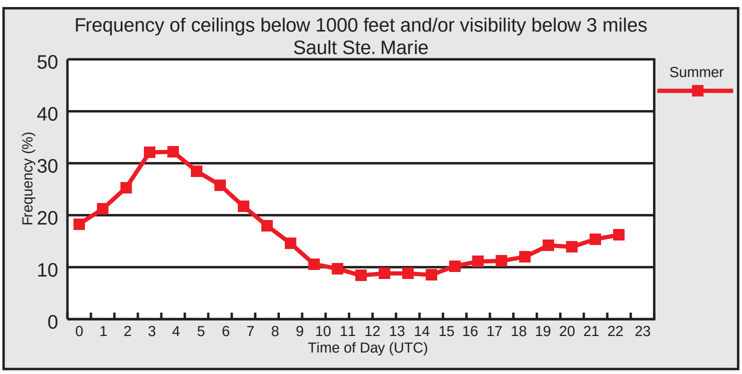


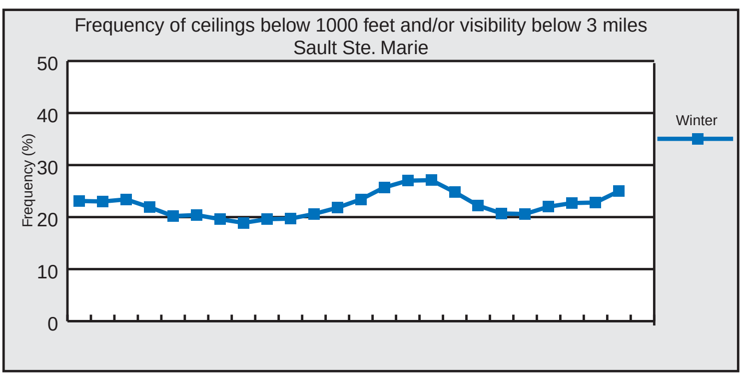
Sault Ste. Marie Airport is located on a broad, relatively flat peninsula at the south-eastern end of Lake Superior. Reaching an elevation of 672 feet ASL, only slightly higher than that of the adjacent waters of Whitefish Bay to the west and the St. Marys River to the east, the peninsula abuts the Canadian Shield approximately 3 nautical miles north of the airport. Here the terrain rises abruptly to an elevation of 899 feet. The Shield then continues to rise slowly to the north in a series of sharp, thinly forested ridges and deep, more densely forested valleys. The city of Sault Ste. Marie is situated 8 miles east-northeast of the airport on the banks of the St. Marys River. Across the river, the near flat landscape of Michigan state extends 40 miles south to the shores of Lake Huron, and southwest 42 miles to the to those of Lake Michigan.





On a year round basis the prevailing wind directions at Sault Ste. Marie are from the northwest, west and east. Winds rarely occur from the south and southeast. In large part, this is due to topography. The airport is exposed to winds off Lake Superior and Whitefish Bay, as well as winds channelled by the St. Marys River, but is sheltered by the rising slopes of the Canadian Shield to north of Lake Huron.



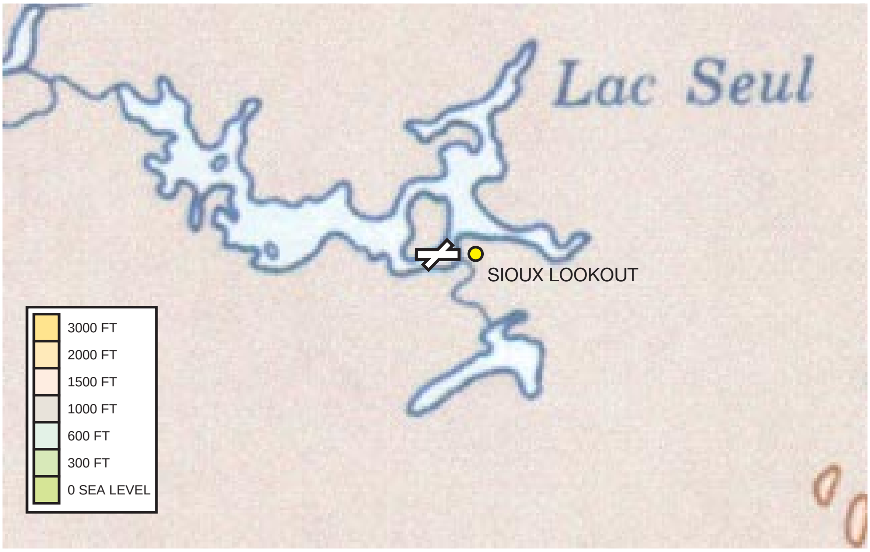


During the winter months, winds tend to flow out of the east. This direction is upslope for Sault Ste. Marie and IFR conditions are generally at their worst, occurring between 20 and 25 percent of the time. Snowstorms associated with migratory low pressure systems cause much of the IFR weather but most can be attributed to lake effect streamers. These can arise out of a southeast flow off Lake Huron but are more often associated with a strong northwest flow off of Lake Superior. Lake effect snowfalls are usually much heavier in the steeper upslope areas of the Canadian Shield, to the north and east of Sault Ste. Marie. Since the beginning and ending of this type of weather is to a large extent independent of the time of day, there is little diurnal variation in the frequency of IFR weather in winter.

During the summer months, west to northwest winds prevail in both strength and direction, enhanced by daytime heating and lake breeze effects. East winds occur less frequently and are usually lighter, tending to develop overnight.

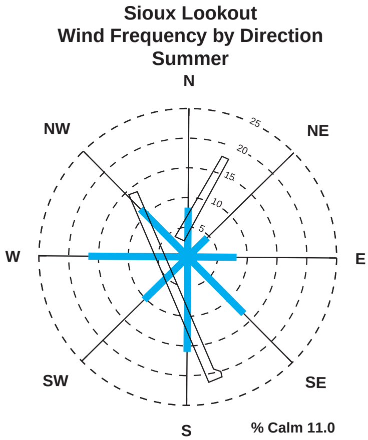
Summer brings some of the best flying weather. Fog and low stratus does occasionally form during the early morning hours but generally burns off with in a few hours of sunrise and, by mid morning, IFR weather occurs less than ten percent of the time. Thunderstorms are not uncommon, but usually develop over the upper Michigan Peninsula and track to the northeast and southeast Sault Ste. Marie Airport.

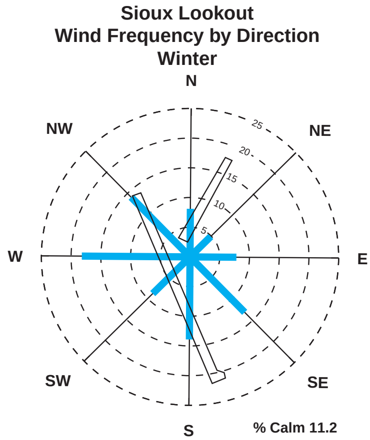
(m) Sioux Lookout



Sioux Lookout is located on the shore of Pelican Lake in northwestern Ontario. The airport is situated just to the northeast of the town centre. This is a region dotted with numerous lakes. The largest of these, Lac Seul, has a surface area of almost

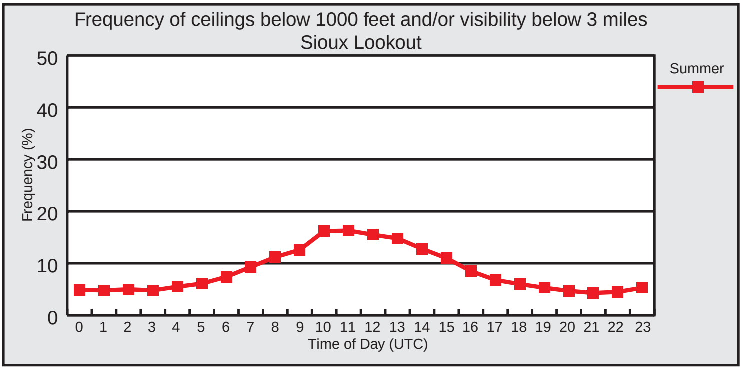
640 square miles. Its shoreline lies 15 nautical miles to the northwest of the airport. The surrounding terrain is typical of the northern Canadian Shield, consisting mostly of low, rolling, forested hills and rocky outcroppings, interspersed with areas of flat land and marshes.

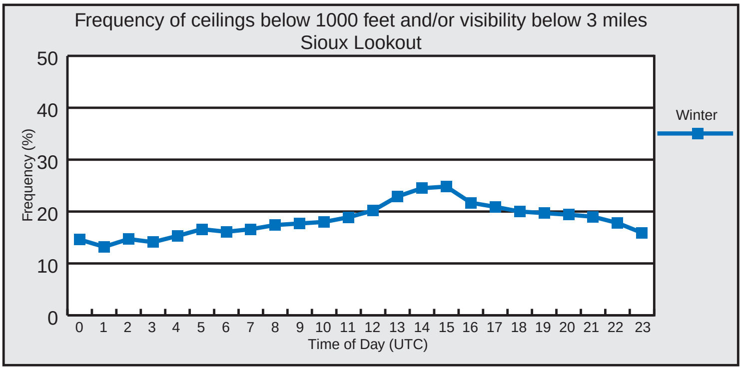




The winds at Sioux Lookout show very little variation between summer and winter. While the winds do show a preference for south or west, all other directions except north, northeast and east occur with reasonable frequency. Winds from these directions are infrequent and light.

Summer months usually offer fair weather flying over northwestern Ontario. Sioux Lookout is no exception, having little persistent fog, heavy precipitation or significant low cloud. That being said, IFR conditions do occur from time to time, particularly in the early and latter part of the season. The most common cause is radiation fog, which tends to form during the early morning hours and dissipate within a few hours of sunrise. To a lesser extent, summer IFR conditions can be attributed to convective cloud and showers, forming in the afternoon with daytime heating and dissipating near sunset. This pattern is reflected in the accompanying graph, which shows peak IFR frequency in the morning, falling to minimum values later in the day.

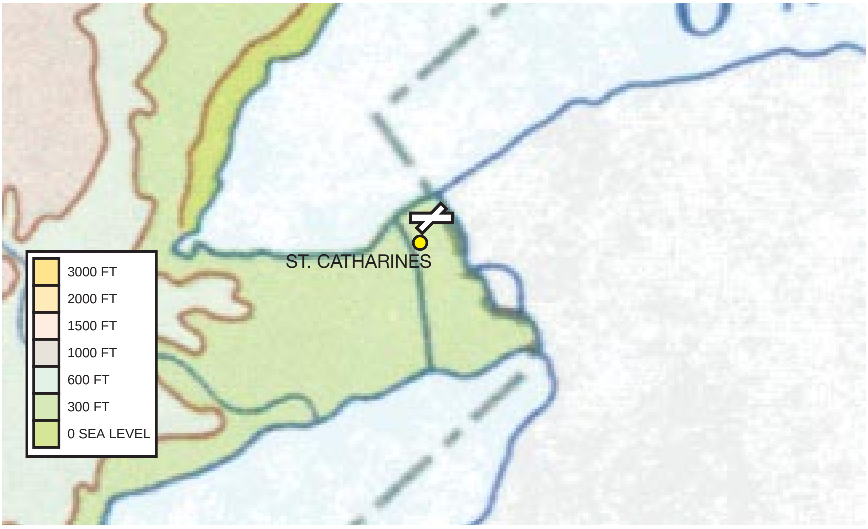




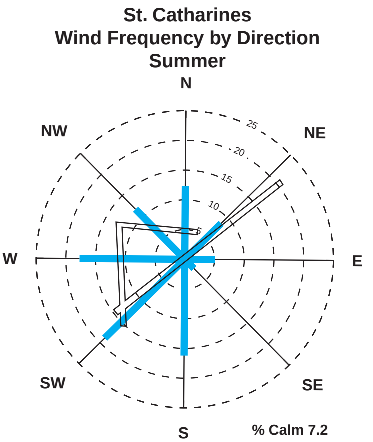
IFR weather occurs with much higher frequently during the winter months at Sioux Lookout. There are several reasons for this. Prior to freeze up in late November or early December, and during break up in March and April, open water provides moisture to fuel the formation of fog. Until the surrounding lakes freeze, fog tends to form and linger into the day. After freeze up, the air mass becomes drier and the occurrence of fog diminishes. Winter also brings an increase in both the number and intensity of low pressure systems tracking across the region. These disturbances often bring low ceilings and periods of poor visibility in snow or blowing snow. Most low pressure centres or frontal systems move across the region in less than 24 hours, followed by fairly rapid clearing in their wake. Stalled lows, however, can cause periods of low ceiling and poor visibility to persist for more extended periods of time.

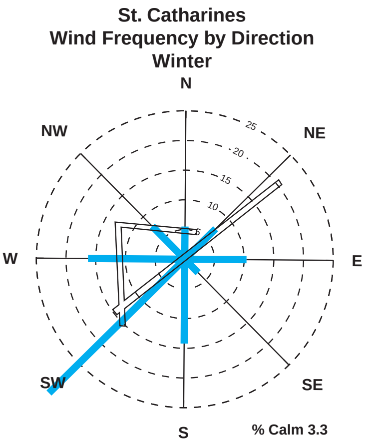
In the absence of fog and migratory low pressure systems, Sioux Lookout can at times fall subject to IFR conditions due to lake effect clouds and showers from nearby Lac Seul. This tends to occur infrequently in the fall and lasts only until the lake freezes over, since it requires a strong northwest flow of cool air across the long fetch of open water between Earl Falls and Sioux Lookout.

(n) St. Catharines

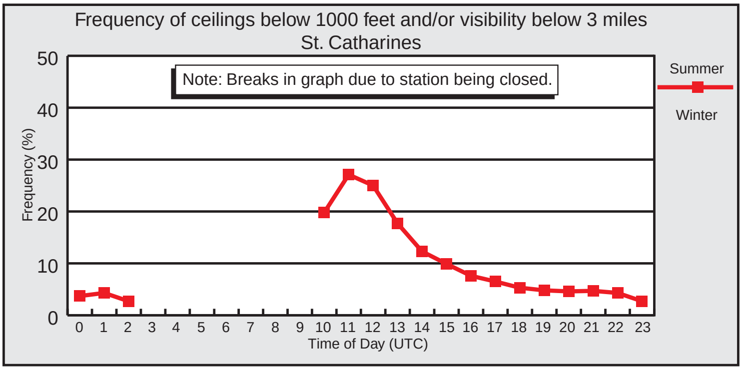


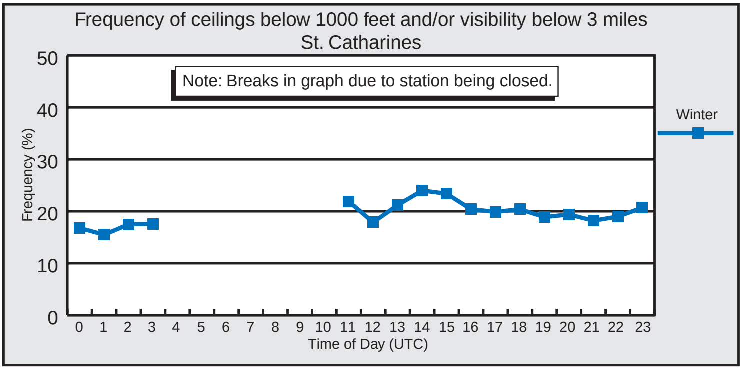
The St. Catharines Airport is located near the western end of Lake Ontario, approximately 4 nautical miles inland from the southern lakeshore. It sits on the rolling plains just below the Niagara Escarpment, which parallels the Lake Ontario shoreline from east to west. The surrounding terrain rises suddenly to the south and falls gently to the north. The Niagara River lies about 6 miles to the east and the Welland Canal, which separates the airfield from the city of St. Catharines, is about 2 miles to the west.





Winds flowing over lake Erie and across the Niagara Peninsula from the west through south tend to prevail throughout the year at St. Catharines. Winds from other directions are generally weaker, occur with less frequency and, due to rising terrain, rarely develop from the southeast.





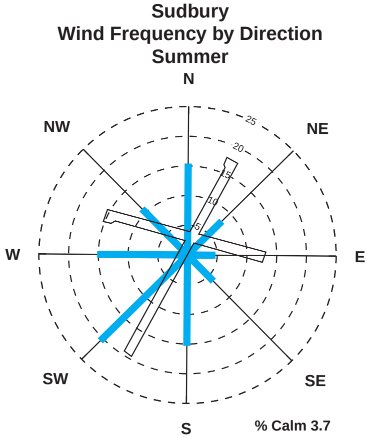
St. Catharines sees little IFR weather throughout the summer months. When it does occur, it is usually as a result of radiation fog or low stratus. Both conditions occur more frequently in the early and latter part of the season. Radiation fog tends to develop under light wind conditions, with a moist airmass and cool early morning temperatures associated with clear nigh time skies. Fog often dissipates at St. Catharines within a few hours of sunrise and seldom persists beyond mid morning. Low ceilings tend to accompany migratory low pressure systems and southwest winds which carry moisture off Lake Erie. Low stratus ceilings will also develop with northeast winds, which carry moisture off Lake Ontario and are upslope across the Niagara escarpment.

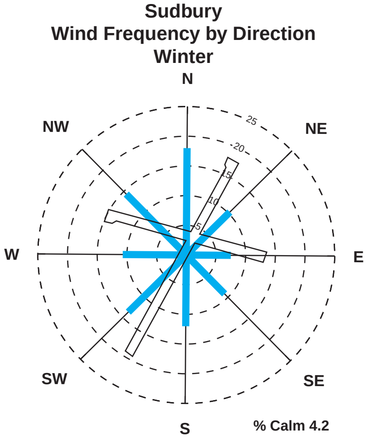
St. Catharines is not known for severe summer thunderstorms however waterspouts are common, often forming over Lake Erie and, within view of the airport, over Lake Ontario.

During the winter months, migratory low pressure systems begin to track across the Great Lakes in greater numbers and the occurrence of IFR conditions begins to rise. System cloud and reduced visibility in snow account for much of this increase. Since the beginning and ending of this type of weather is, to a large extent, independent of the time of day, there is remarkably little diurnal variation in the frequency of IFR weather in winter. Even in the absence of synoptic scale weather systems, a strong southwest flow over the open waters of Lake Erie, or northeast flow over Lake Ontario, can subject St. Catharines to lake effect cloud and snowfall.

(o) Sudbury

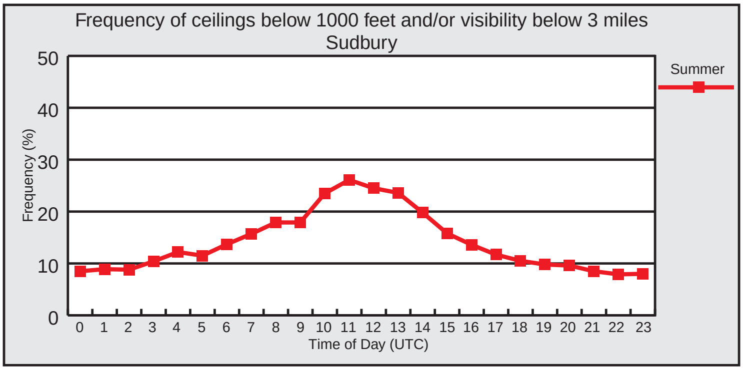
Sudbury Airport is located in northern Ontario atop a small plateau, about 11 nautical miles northeast of the city. The landscape surrounding the airport consists of low and rocky, sparsely treed hills, generally falling in elevation to the south. Sixteen miles to the north, the terrain reaches elevations of near 1,600 feet ASL. Three large smokestacks, ranging in height from 1,280 to 1,550 feet, are sited about 3 miles south of the airport. Wanapitei Lake lies about 9 miles to the north and drains southward through the Wanapitei and French Rivers into Georgian Bay, 50 miles to the south.

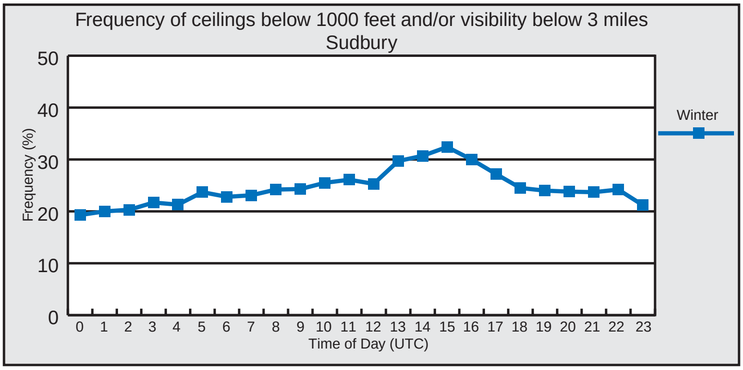




The prevailing wind direction at Sudbury during the summer months is southwesterly; however, winds from the northwest, west and south are all about equal in occurrence and happen only a few percentage points less than the southwest wind. Winds from the northeast, east and southeast are often weaker and occur much less frequently.

The winter wind pattern is much more diverse and reflects the shift in wind direction associated with the passage of the increasing number of low pressure systems along the winter storm track. Southwest winds are still dominant but their frequency of occurrence is nearly matched by winds out of the northwest and northeast.



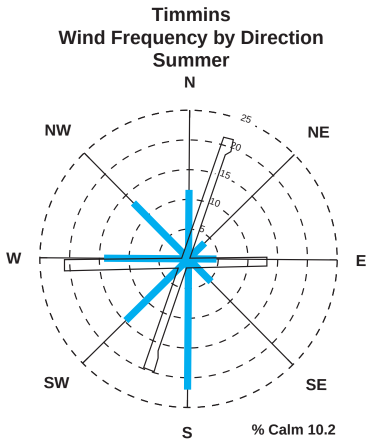


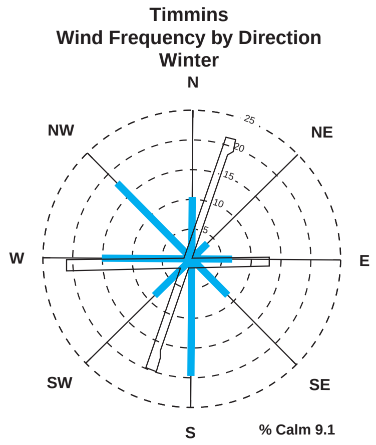
Sudbury generally enjoys good flying weather during the summer, however, several factors can contribute to the development of poor visibility and low ceilings. Fog occurs on an average of 5 or 6 times a month through mid summer and 7 or 8 times a month during the later part of the season. Radiation fog that forms overnight, then dissipates within a few hours of sunrise, rarely affects operations beyond mid morning. Low ceilings and poor visibility in precipitation on the other hand, are commonly associated with the passage of migratory low pressure systems and are often more persistent. These conditions tend to be at their worst under an upslope southwest flow. IFR conditions also arise from convective clouds and showers. On average, Sudbury has 4 or 5 thunderstorms per month throughout the summer.

During the winter months, IFR conditions develop more often and the probability of occurence is evenly distributed throughout the day and night hours. This can be attributed to the fact that IFR conditions in winter tend to arise from a combination of snow, blowing snow, fog and low cloud associated with winter's increased numbers of migratory low pressure systems. It should be noted that, throughout the winter, IFR weather occurs much more frequently with winds from the southwest and southeast quadrants, indicating a strong contribution from upslope flow.

(p) Timmins

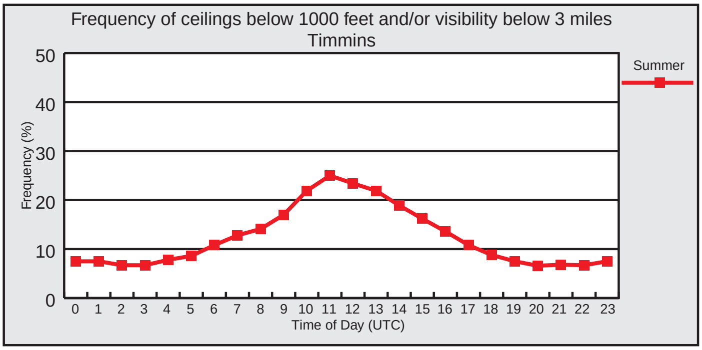
The Timmins Airport is located approximately 6 nautical miles north-northwest of the city. The landscape surrounding the airport rises gently to the south and consists of fairly flat terrain covered in forest and dotted with open marshes. The Mattagami River wanders across the region, skirting the western edge of the city, turning and coursing westward at a point 3 miles south of the airport, then turning again and flowing northward to meet with the Moose River, 55 miles southwest of Moosonee.

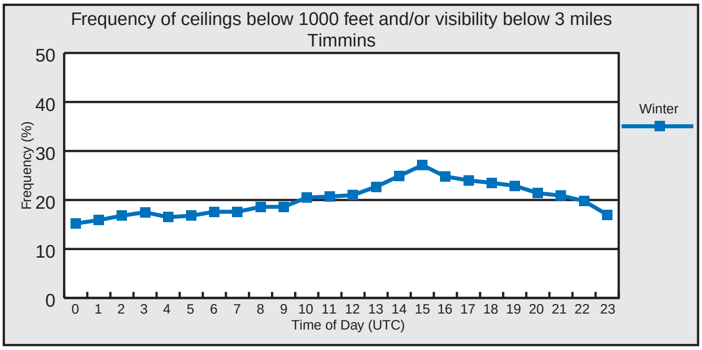




During the winter, winds out of the northwest, west and south are almost equally dominant in both direction and strength. Northeast winds are a rare occurrence at Timmins, and southeast winds develop infrequently and tend to be much lighter.

During summer, the dominant wind directions are from the south with wind from the southwest, west and northwest being a close second. Easterly winds are rare.





IFR weather occurs 15 to 20 percent of the time in winter and is often associated with poor visibility due to fog or snow. Fog occurs more frequently in the early and latter part of the season when moisture is still available from open water. As in summer, fog tends to form in the early morning hours, but in winter it will often linger until later in the day. As temperatures begin to plunge below zero, ice fog begins to develop and can be persistent, especially under calm or low wind conditions. Ice fog can form quickly at times, often triggered by aircraft exhaust or smoke from a nearby community.

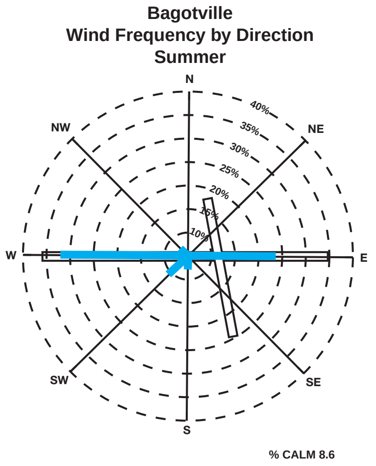
Other common causes of winter IFR conditions are system cloud, snow and blowing snow. This type of weather begins and ends independent from the time of day; therefore, there is remarkably little diurnal variation in the frequency of IFR weather in winter.

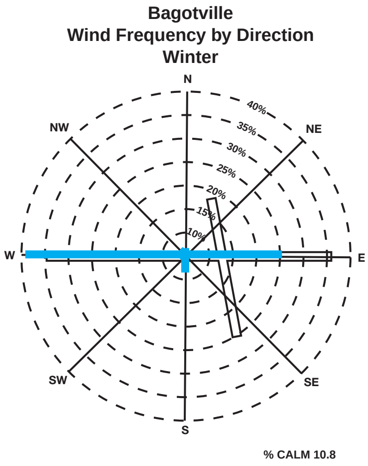
Summer generally brings fair weather flying at Timmins; however, IFR conditions do occur at times, particularly in the early and latter part of the season. Fog is most often the cause, forming in the early morning hours and reducing visibility, then dissipating during the early part of the day. Low ceilings occur less frequently but tend to develop in a north or northwest flow, which is upslope across this section of the Canadian Shield. Finally, convective clouds and showers make their contribution to IFR weather in the summer months, usually developing in the afternoon and dissipating in the evening.

Airport Climatology - Quebec

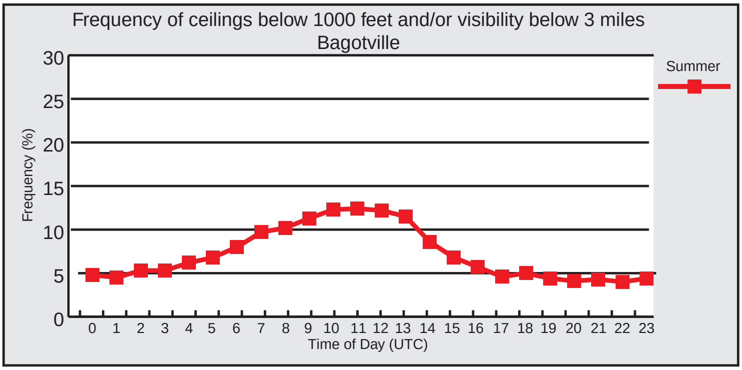
(a) Bagotville

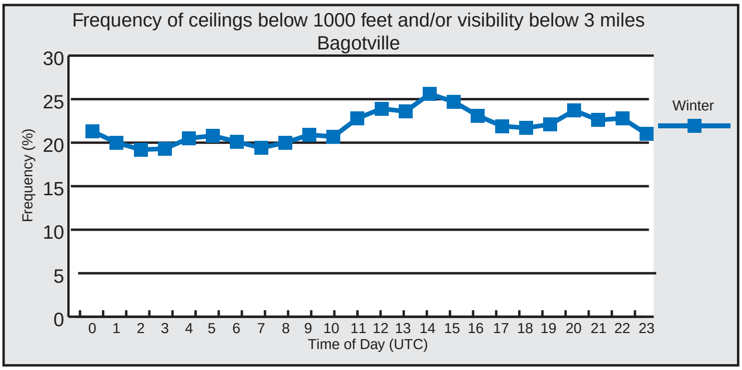
Bagotville Airport is located near the Saguenay River, some 6 miles from the town of Bagotville. The runway elevation is 522 feet ASL. Most buildings are located to the northeast of the junction of runways 11-29 and 18-36.





The Saguenay River Valley, which runs east to west in the area, has a major impact on the local winds. During the summer months the winds tend to be either westerly (32 percent of the time) or easterly (24 percent of the time). Other directions occur infrequently (less than 10 percent of the time) with the wind being calm 6 percent of the time. Wintertime shows little change in this pattern. The westerly wind is observed 39 percent of the time while the easterly wind takes place nearly 26 percent of the time. The other wind directions remain insignificant in occurrence, and the occurrence of calm winds rise to almost 11 percent.



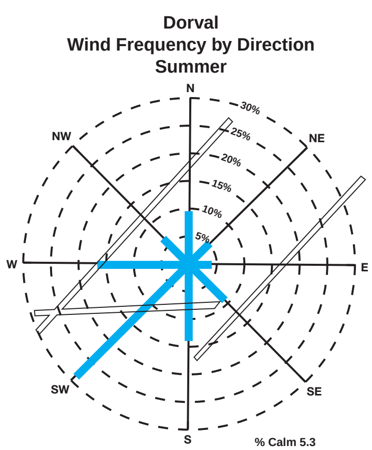


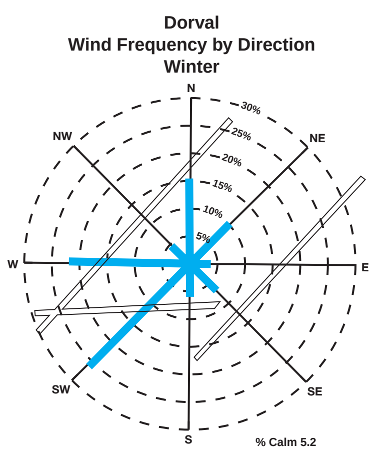
Flying conditions during the summer months tend to be good. Thunderstorms do move along the valley giving brief periods of reduced ceilings and visibility. At the same time the presence of the nearby river and small lakes do lead to periods of low cloud or fog. This tends to occur mostly overnight, reaching a peak near 11 UTC then dissipating rapidly between 15 and 17 UTC.

Winter is a different story. The valley is subject to the trapping of cold air with low level moisture. As such, low cloud and visibility do occur between 20 to 25 percent of the time at almost any hour of the day. At the same time, periods of snow or freezing precipitation can make aviation operations hazardous throughout the area.

(b) Dorval International Airport

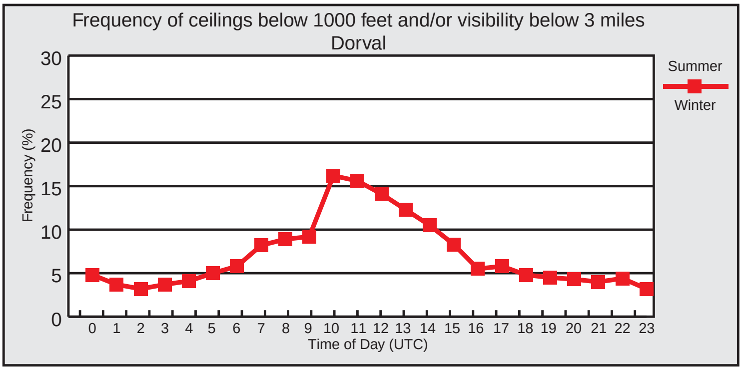
The Dorval International Airport is situated on the western half of the island of Montreal, in the midst of the city. The runway elevation is 117 feet ASL. The area surrounding the airport comprises an industrial park, bungalows, and very few high-rise buildings.

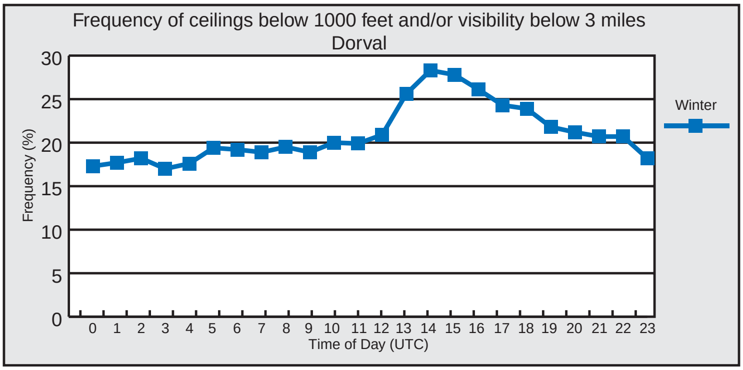




Southwest winds are predominant by far throughout the year. During the winter, the second most frequent wind direction is west with north following in third place. In the summer, west winds are slightly more frequent than northeast winds. During this same period west and south winds are half as frequent as southwest winds. As for the other directions, each occurs less than 10 percent of the time whether it is winter or summer.

Strong winds, wind shear and moderate turbulence are often observed on approach to the east-west runway, e.g. wind gusts of 30 knots behind cold front when runway 28 is in use.





The lowest ceilings and visibilities usually occur with east or northeast winds. On the other hand, ceilings and visibility are usually much better with westerly winds except in the case rain or snow showers, which are usually of short duration. The Dorval International Airport is better protected from fog than nearby aerodromes when the wind is a light southwesterly or light northwesterly. The visibility tends to go down; however, with light easterly winds. Usually, visibilities below 3 statute miles and ceilings below 1,000 feet AGL are usually observed just after sunrise, most often due to the formation of fog, and conditions tend to improve rapidly thereafter. The occurrence is usually low in the summer, around 15 per cent or less.

In late fall and winter, warm fronts tend to linger over the Saint Lawrence River, between the Dorval International Airport and the St. Hubert Airport on the South Shore, with large temperature differences between the two airports. As a result, freezing rain can be expected when there is significant warm air aloft but cold air drainage from the northeast is holding the air temperature just below the freezing mark. Ice fog is seldom observed at Dorval International Airport. In winter, ceilings below 1,000 feet and visibility below 3 statute miles are more frequent in the morning than at any other time.

Precipitation approaching from the west or generated over Lake Ontario often dissipate before reaching Dorval International Airport, when the surface wind is from the south, regardless of the time of year.

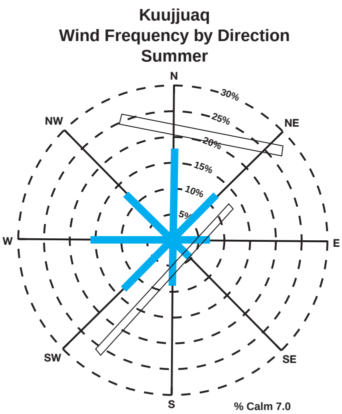
(c) Kuujjuaq

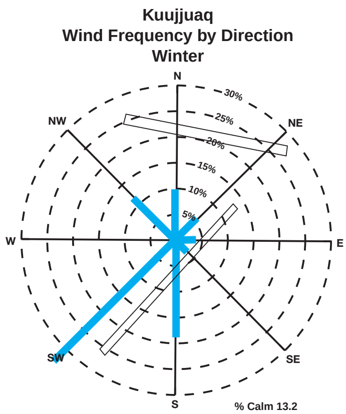
Kuujjuaq Airport is situated on the western bank of the Koksoak River, approximately 52 nautical miles from the river mouth. The runway elevation is 196 feet ASL, while the land rises gently toward the west.

Photo 5-3 - Kuujjuaq and the Koksoak River looking toward the southwest. credit; Gilles Simard, MSC

Southwesterly winds are predominant in Kuujjuaq in the ice-free season. It is the northeast winds, however, that are the most troublesome as they advect low weather conditions in from Ungava Bay. Such conditions never last long, however. Ceilings and visibilities seldom go below 200 feet and 1/2 mile visibility (10 days per year on average). In turn, northwesterly winds usually clear the poor weather when it occurs.

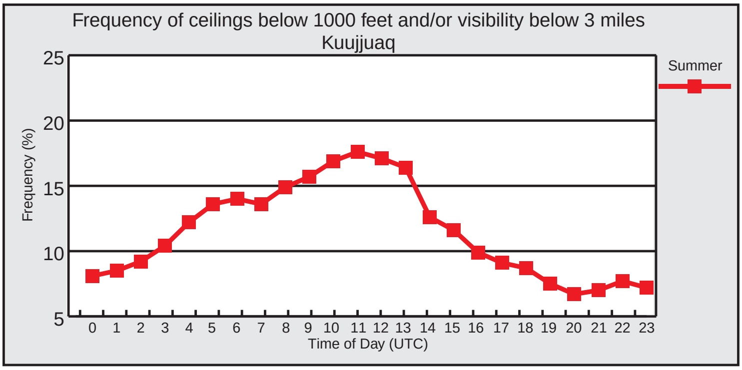
Thick fog is never far away. In late spring, it usually remains to the north over the bay during the day and it will move toward the aerodrome in early evening, pushed by the sea breeze (typically between 5 and 6 pm in early May and around 7 pm by early June). The fog tends to move out once the sea breeze dies down during the evening. During the summer months, it takes the best part of the day for the sea breeze to establish itself. In July, for example, the wind tends to shift from light westerly to strong northeasterly around 3 pm. Fog is also observed briefly in early morning but it dissipates rapidly. Winds from the south to southwest usually result in nice and warm weather. Southerly winds tend to be strong, in the 20 to 30 knot range.

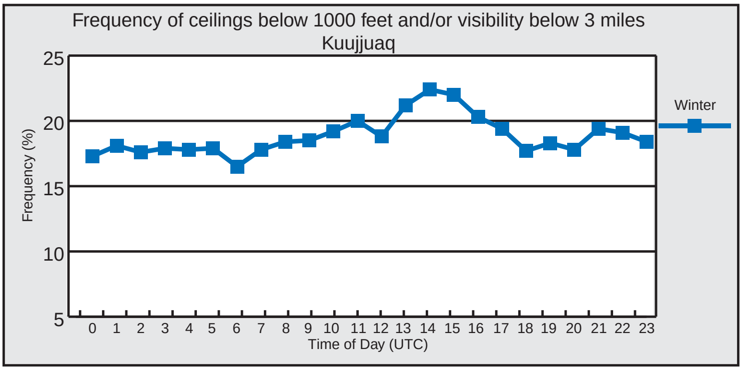




The fall is usually the worst season, especially when warm air moves over cold ground, such as in the warm sector of a synoptic low pressure system, often resulting in rain or freezing rain or wet snow. The onset of easterly winds tends to be a good precursor of precipitation. Northeasterly winds usually result in low stratus cloud and freezing drizzle, later changing to snow. North to northwest winds usually vary between 10 and 20 knots. Wind shear may occur in late summer, or fall, when strong westerly winds are occurring.

In winter, once Ungava Bay freezes over, the sky and the horizon are generally clear with ice fog often observed over the river. Whiteout conditions are common with falling snow and, on very cold days, blowing snow and ice crystals may combine to produce whiteout.

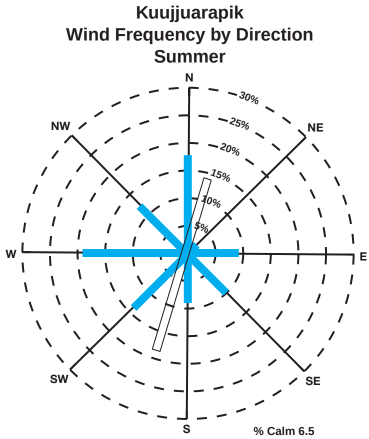


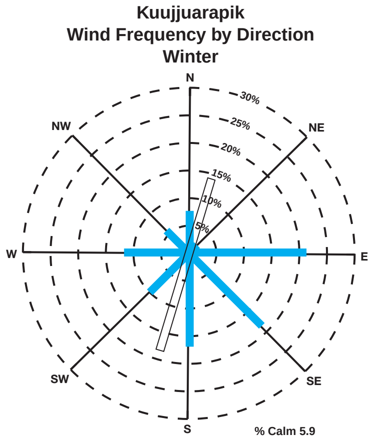


The spring weather usually offers excellent flying conditions. On occasion, there may be some foggy mornings with humidity rising from melting snow or lakes. Low level clouds are usually a rare occurrence, unless associated with falling precipitation from a well-organized weather system.

(d) Kuujjuarapik

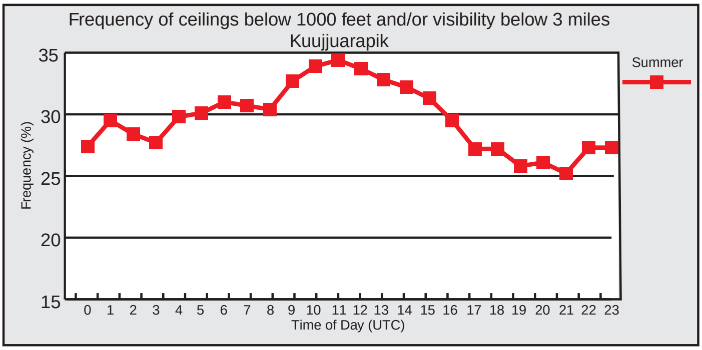
Kuujjuarapik airport is situated on Sable Point, between the shore of Hudson Bay and the mouth of "Grande Riviere de la Baleine" (loosely translated as Great Whale River). The land is generally flat with a single 1,231-foot hill situated approximately 3 nautical miles to the northeast of the aerodrome.

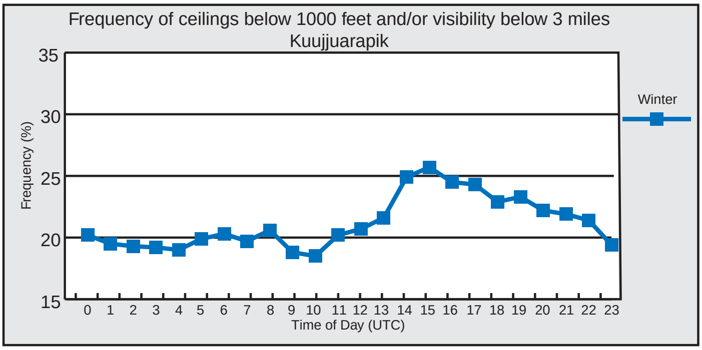




During the ice-free season, fog and very low stratus move onshore whenever the wind direction is between the southwest to north quadrants, with the worst visibilities and ceilings when the wind usually comes from the west or the northwest. July and August are usually the worst months for ceilings below 500 feet and visibilities below 1 mile. These conditions usually persist until there is a change in wind direction. Thick fog has been observed even with strong northwest winds, sometimes reaching 40 knots. There was once a 22-day period when their planes could not land in Kuujjuarapik, due to insufficient ceilings and visibilities in fog. This occurred in July, with west to northwest winds of 6 knots or less.

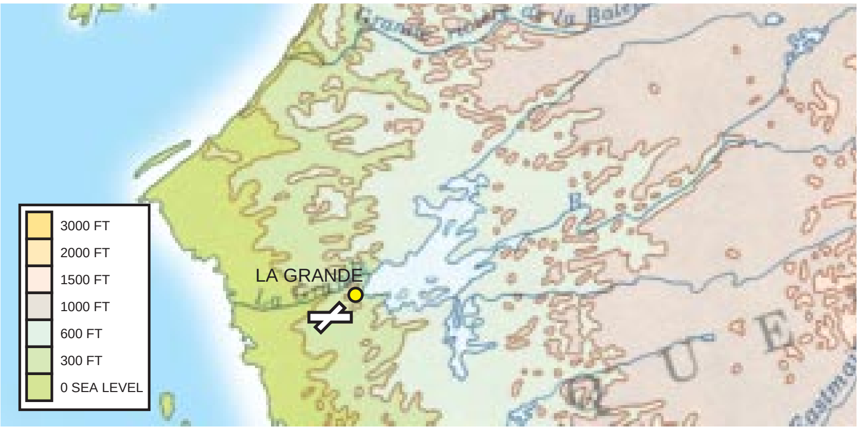
In the fall, west to northwest winds usually bring freezing drizzle and very low stratus. On the other hand, the arrival of cold arctic air usually results in zero, or near zero, ceilings and visibilities in snow squalls.



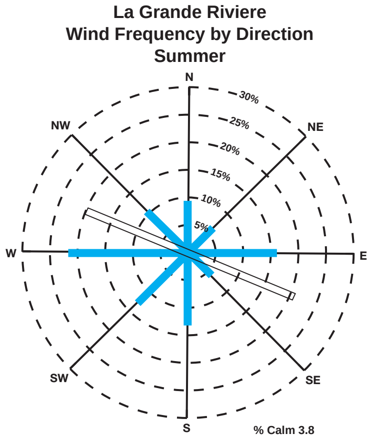


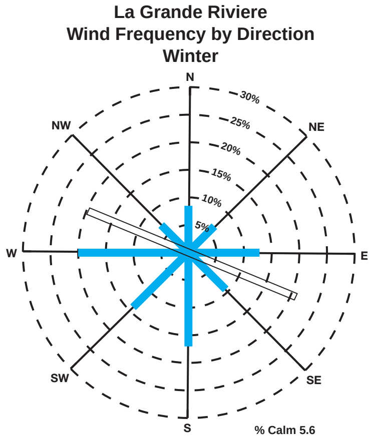
In winter, once the ice pack is well established, flying conditions are generally more favourable. Ice fog may occur when the ice pack shifts under the force of strong easterlies, exposing open water. Throughout the year, east to northeast winds are usually associated with favourable flying conditions. Strong northwesterlies are generally not aligned with the runway, and may generate difficult landing conditions.

(e) La Grande Riviere

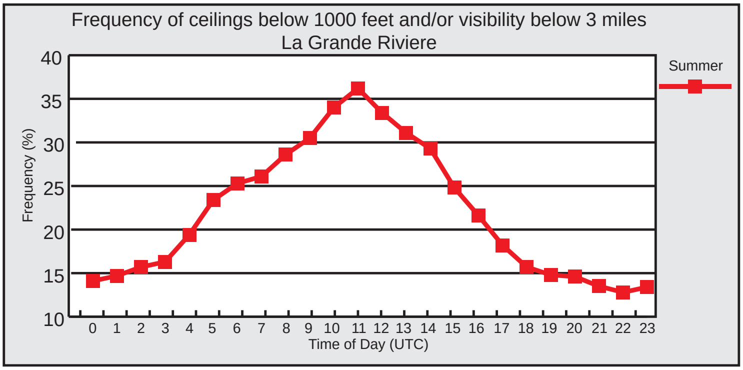


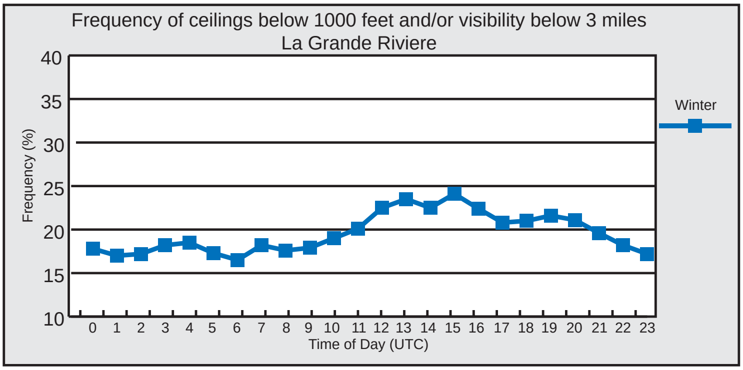
La Grande Riviere is one of a series of airports built by Hydro-Quebec to service their dams. The airport at La Grande Riviere sits in the middle of a series of power lines taking power south. The runway, oriented west-northwest to east-southeast, has an elevation of 639 feet ASL. Near the southeast end of the runway is a butte, otherwise the terrain is made up of a multitude of small hills and lakes. The soil is largely gravel with small trees and lichen. To the east of the airport is an extensive area of flooded terrain that formed behind the dams. To the west, some 90 n. miles distant, is James Bay.





The winds in the summer months can be quite variable but show a preference for the westerly quadrants. The most common wind is the westerly winds at 22 percent; however south and southwest winds occur around 13 percent of the time while northwest and north winds occur nearly 10 percent of the time. Other than the east wind, at 16 percent of the time, all other directions are infrequent. Calm winds are also infrequent occurring only 4 percent of the time. During the winter, the winds show a preference for the southwest quadrant (west -19 percent; southwest - 14 percent; south - 17 percent) and an east wind (13 percent). All other directions are infrequent. Calm winds occur 6 percent of the time. It is worth noting that throughout the year turbulence and low level wind shears are very rare due to the general flatness of the landscape.

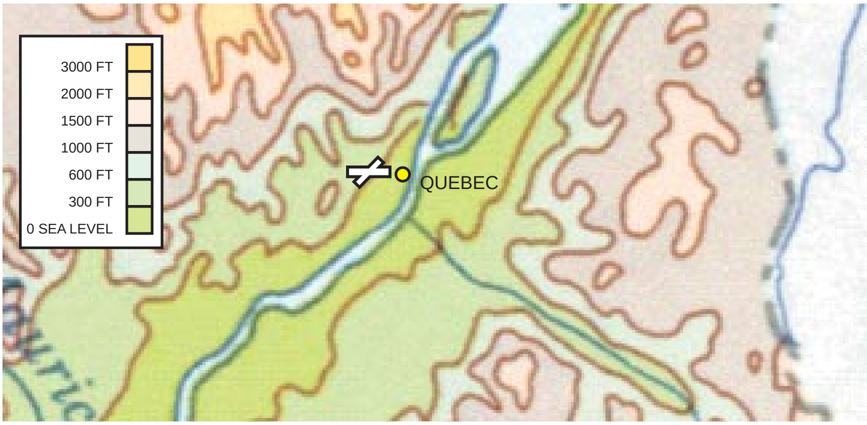




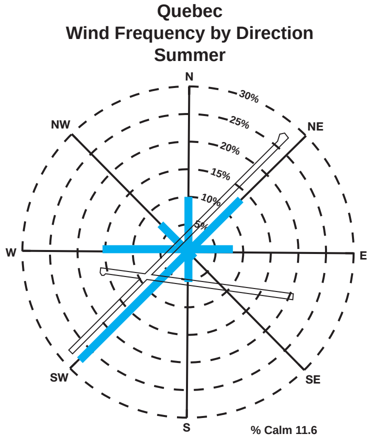
Summer flying conditions are usually benign. Clouds tend to be scattered or broken cumulus or stratocumulus over the area. Low conditions may occur when a warm front or a cold front goes through the area. Isolated thunderstorms can develop on moist and unstable days. This being said, the presence of so much water in the area causes a problem with low cloud and fog, especially during the fall. These conditions tend to form overnight, reaching a peak around 11 to 12 UTC then gradually dissipating between 12 and 18 UTC as the day warms.

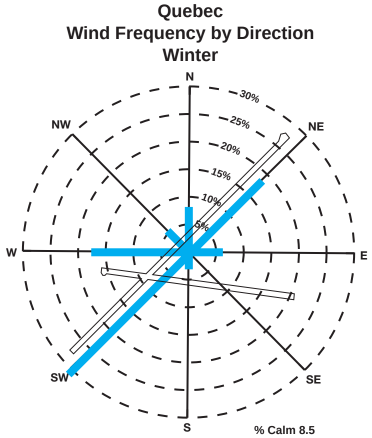
The transition from summer to winter tends to be abrupt, usually taking a short two-week period. This is due to the fast freezing of rivers and lakes during very cold nights. Once the ice has set on the lakes, reservoirs, and rivers, visibility becomes bound only by the horizon and the sky is generally cloudless. These excellent flying conditions are only interrupted when a large-scale weather system passes through the area or the occurrence of fog prior to freeze-up and during spring melt. Westerly winds from James Bay can carry very low stratus cloud, mist, fog and sometimes freezing drizzle in upslope circulation along the largest rivers up to 60 nautical miles inland. Low ceilings and visibility typically occur around 18 percent of the time, but do show a slight peak of 25 percent near dawn.

(f) Quebec



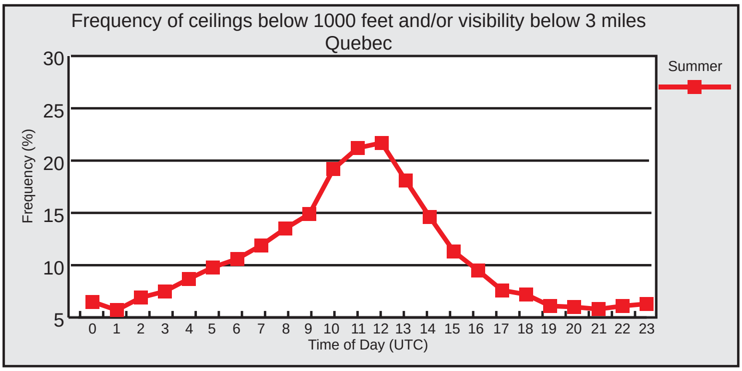
The Jean-Lesage International Airport is situated on a small plateau just to the northwest of the city. The runway elevation is 244 feet ASL. Most airport buildings are found to the south of the main runway, which is oriented in a northeast to southwest direction, and to the east of the secondary and shorter runway, which is oriented in a southeast to northwest direction. There are also some forested areas parallel to the two runways and built-up areas surrounding the airport land. There is a rapid drop in elevation close to the south of the airport, before the ground rises again to form the Ste-Foy Plateau. To the north, the land continues toward the Laurentian foothills. There is a hill to the northwest of the airport called Mont Belair.

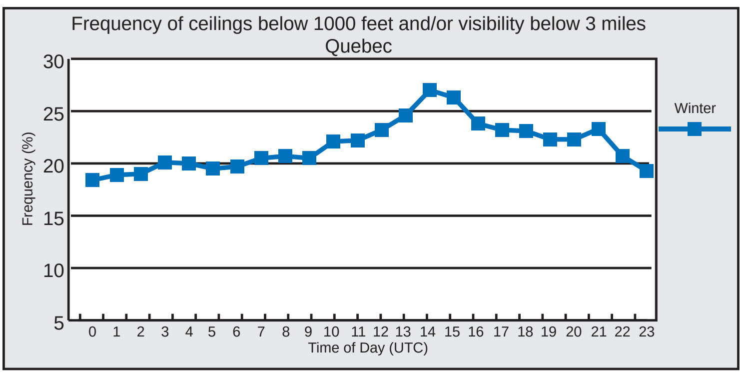




Southwest winds are predominant by far throughout the year. The second most frequent wind direction is northeast in winter, with west wind a close third. In the summer, west winds are slightly more frequent than northeast winds. As for the other directions, each occurs less than 10 percent of the time whether it is summer or winter. Southeast winds are too infrequent to even appear on the wind rose.

An experienced flight instructor reported the occasional mechanical turbulence on landing, when the wind is from 110 to 120°. The wind speed can vary greatly between the runway 24 threshold, the one for runway 30, and the official meteorological wind tower. On one occasion in October, the wind speed was 11010G15KT, 11015G20KT and 11020G30KT depending on the location in the runway complex. The presence of significant wind shear is often observed between the surface and 500 feet above the ground on final approach to runway 06, and moderate mechanical turbulence near runway 30, when a large low pressure weather system is in the area. In such instances, the general wind direction can be 120° while there might be a 30° difference at the surface.



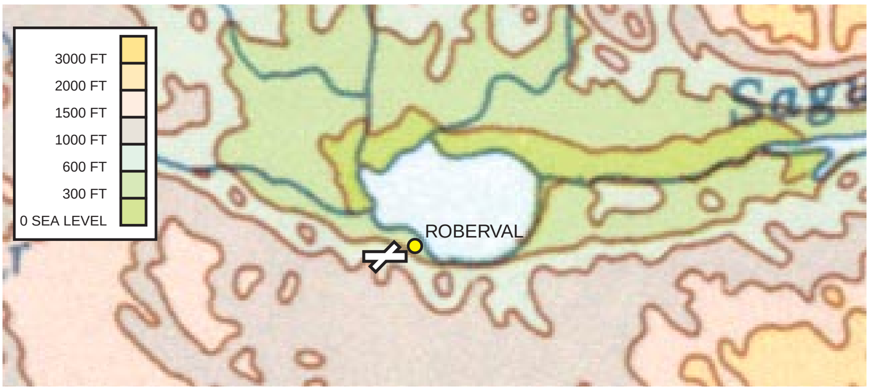


Flight conditions are generally good in the summer, except in the early morning hours when fog often reduces the visibility below 3 statute miles and the cloud base below 1,000 feet. Experienced pilots report that the fog tends to form rapidly just after sunrise, as the moisture-laden air starts to stir, reducing visibilities to 1/4 statute miles, then it tends to dissipate between 10 am and 11 am. In spring and fall, though, the fog tends to last until noon. The top of this fog layer usually lies at 200 or 300 feet above ground. It is frequent to observe the fog bank sitting over the runway complex and clear skies elsewhere. This localized fog layer appears with the thaw in the spring and is most present in the summer. It becomes less frequent in the fall.

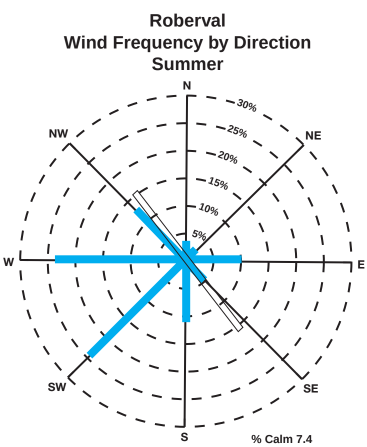
Haze, reducing the visibility to 6 statute miles in the morning, is common on hot days in July and August, when the air temperature reaches or exceeds 28° Celsius. The haze often forces pilots to fly the approach on instruments, especially when landing facing the sun. When it rains, the visibility may lower to 5 statute miles while the ceiling may lower to 1,500 to 2,000 feet ASL in the absence of mist, or even below 1,000 feet if mist forms in the rain.

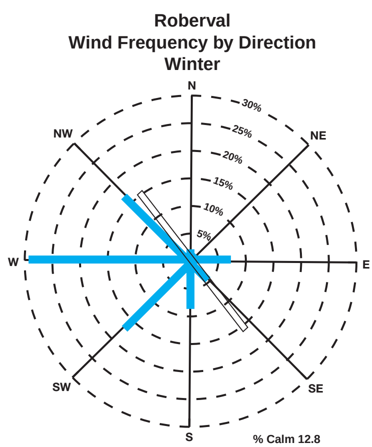
Summer thunderstorms usually move in over the airport from Mount Belair to the northwest, in late afternoon.

(g) Roberval

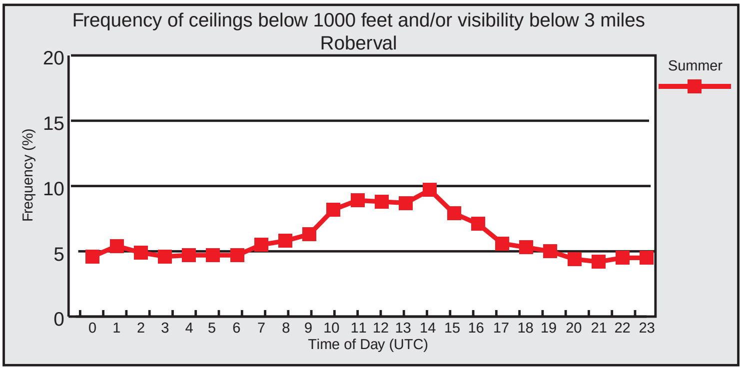


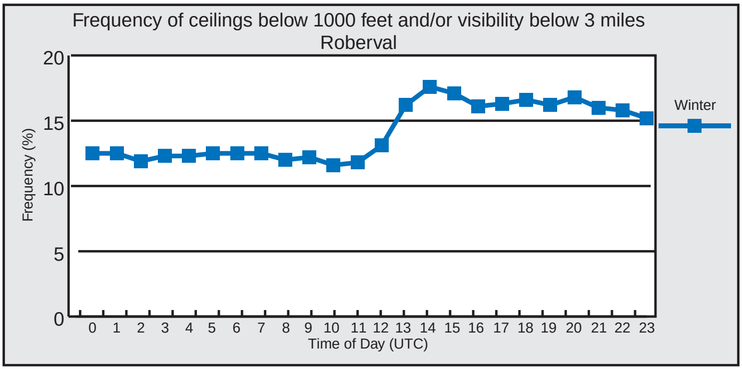
Roberval Airport is situated on a small plateau, one of many, squeezed between mountainous terrain immediately to the west and Lake St-Jean to the east. The terrain surrounding the airport is relatively flat with marshy areas. The runway elevation is 586 feet ASL and is oriented in a north-northwest to south-southeast direction, parallel to the chain of hills to the west.





Southwesterly and westerly winds are predominant in the summer while westerly are predominant in the winter with northwesterlies and southwesterlies a close second. These predominant southwest or west winds are perpendicular to the runway. As a result, wind shear and moderate mechanical turbulence are common along the runway axis as planes make their final approach. The wind shear and the turbulence are more common from late spring to late fall. The winds are usually stronger in the fall, when wind speeds of 25 to 30 knots are sometimes observed. Any winds coming off the lake often bring low clouds and low visibilities but these winds are infrequent.



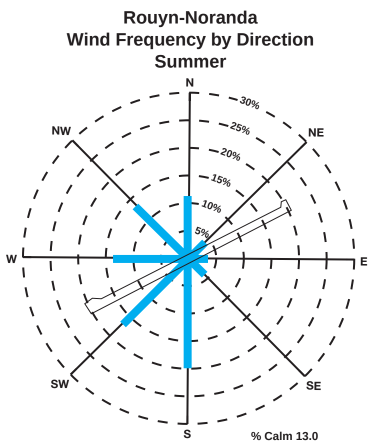


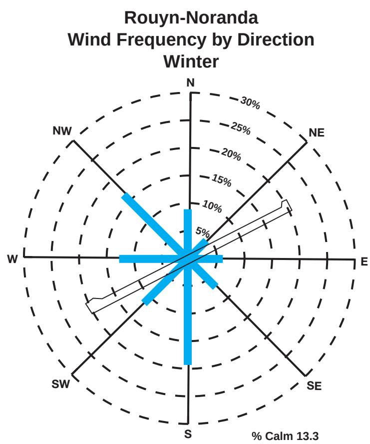
Flying conditions are usually good through out the year, although the winter morning hours tend to have the poorest weather. In winter, conditions are usually excellent except when a snowstorm affects the area. In summer, ceilings are rarely below 1,500 feet AGL. Thunderstorm activity is frequent over the land surrounding the airport in July.

(h) Rouyn-Noranda

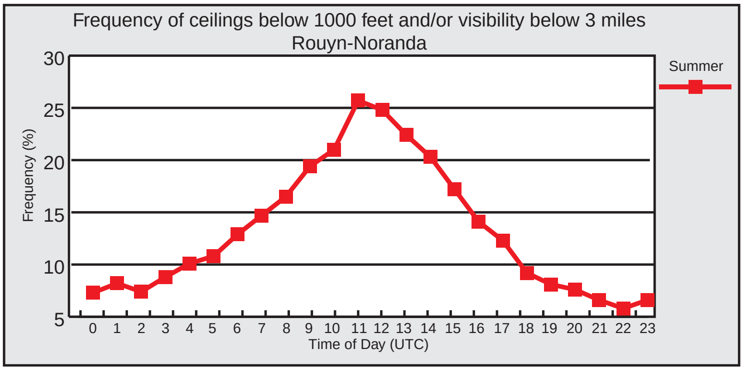
The Rouyn-Noranda Airport is situated in a forested area with the east west runway lying at an elevation of 988 feet ASL. There are some changes in elevation in the vicinity of the airport.

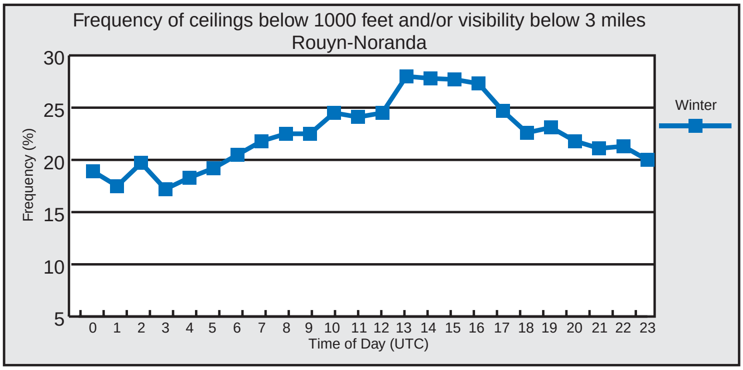
Prevalent winds are generally from the south throughout the year. Like in Val d'Or, the second most prevalent winds are either from the southwest, the northwest or the west, with the relative frequency between southwesterlies and northwesterlies changing from summer to winter.





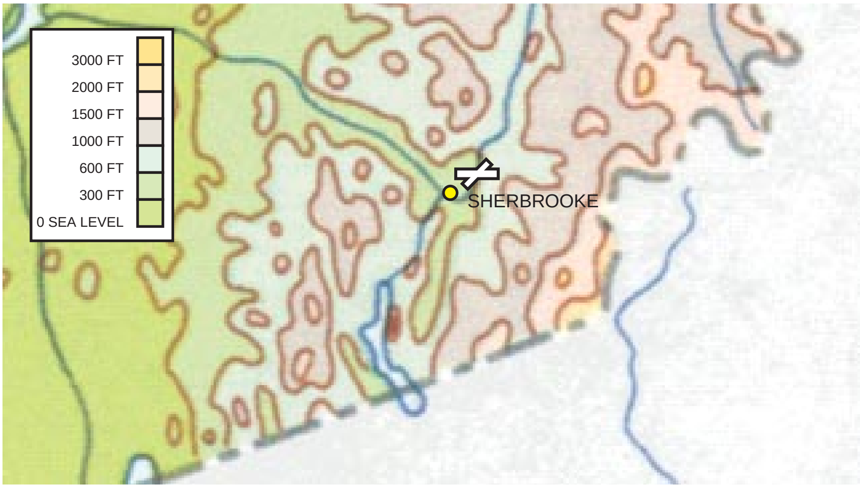
Reports from different sources indicate the existence of low-level, moderate mechanical turbulence over, and in the immediate vicinity of, the runway with northerly and northwesterly winds. Additionally, low level wind shear is reported on runway 08, with northeasterly winds, due to terrain irregularities.



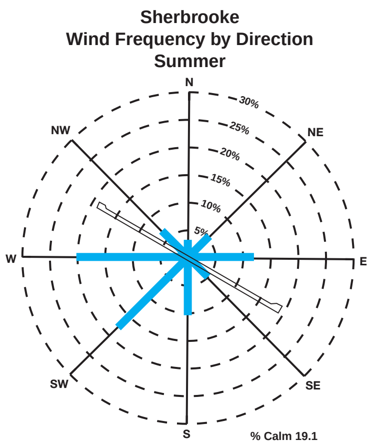


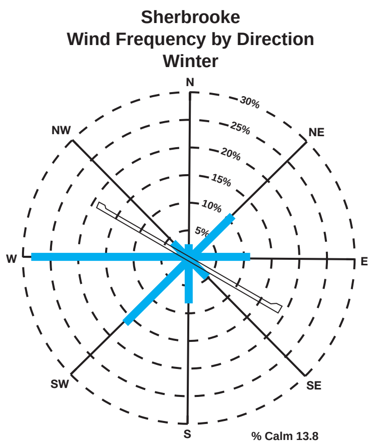
The general frequency of poor weather conditions is very similar to that at Val d'Or. Pilots, however, report that mist, fog, and low visibilities tend to occur more often in Rouyn-Noranda than in Val d'Or, in summer. They also report precipitation tends to last longer in Rouyn-Noranda than in Val d'Or.

(i) Sherbrooke

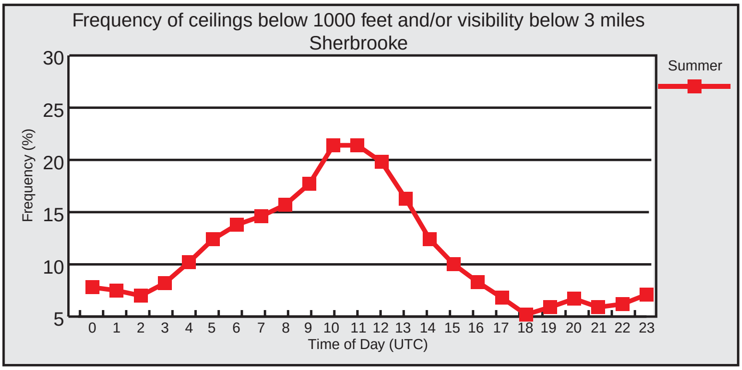


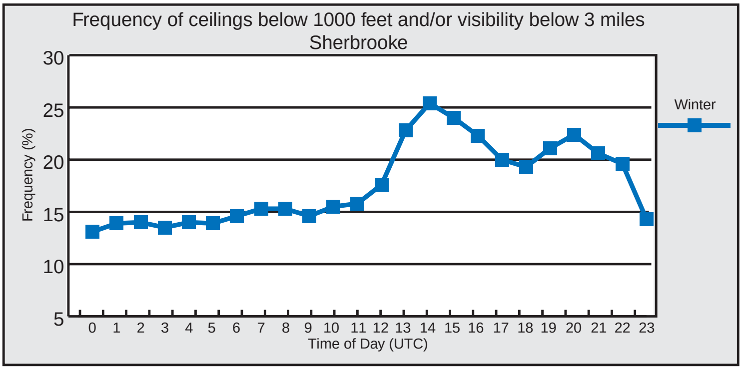
Sherbrooke Airport lies to the east of the city of Sherbrooke, across the Riviere St-Francois in a valley that runs northeast to southwest. The runway is oriented nearly northwest to southeast and has an elevation of 792 feel ASL. To the north of the airport, across the Riviere St-Francois, a series of mountains / hills rise to 1,500 to 2,200 feet ASL. To the east and south of the airport the ground is mountainous and tree-covered, rising quickly to 2,000 feet ASL and to better than 3,000 feet further southeast.





During the summer months, winds are predominantly from the west or southwest 37 percent of the time. The only two other directions of significance are a south wind 10 percent of the time and an east wind 12 percent of the time. Calm winds are observed 19 percent of the time. During the winter, this pattern does not really change except that the west and southwest wind become even more dominant, at 44 percent of the time. At the same time, the occurrence of calm winds drops to 14 percent.



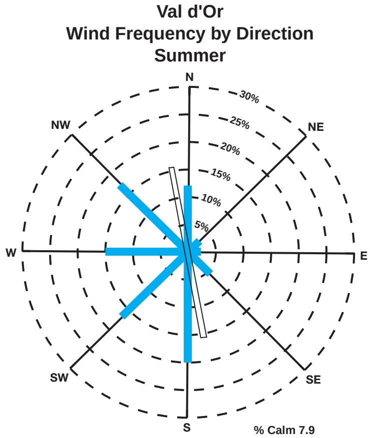


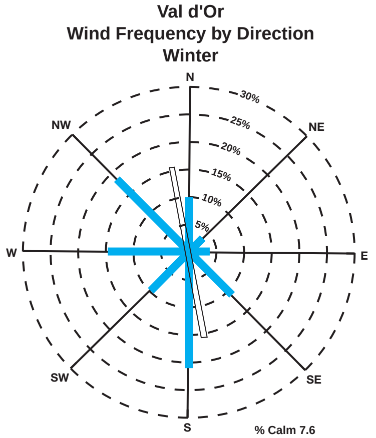
Low clouds and poorer visibilities, along with obscured higher terrain, can be expected at any time of the year. Also, mountainous terrain is conducive to the pooling of cooler air in river valleys during the night. With moisture present, fog often forms in these areas either in the evening or early morning. This fog may slowly lift into a thin stratus cloud hugging the valley summits. This pattern can be seen in the summer graph which shows a rising probability of low ceilings or visibility after 02 UTC that reaches a peak of just over 20 percent probability at 11 UTC. The probability then drops after this, during the morning hours, until it dissipates near 18 UTC.

Winter is by far the worst time of the year with poor ceilings and visibility varying between 15 and 25 percent throughout the day. The reason for this is fairly simple - all the parameters that created low cloud or fog during the summer are still in place while at the same time the sun rises later and is weaker, reducing any diurnal effect. Fall, early winter, and spring are times of the year when precipitation types can change rapidly from snow to freezing rain to rain or vice versa over short distances or with slight changes in elevation.

(j) Val d'Or

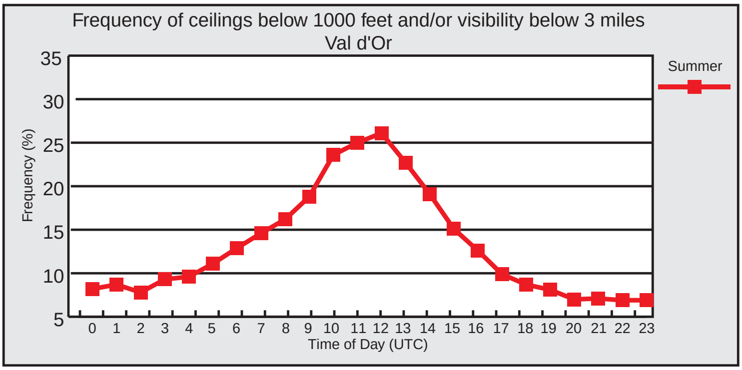
The Val d'Or Airport is situated on a small plateau just to the northwest of the city. The runway elevation is 1,107 feet ASL. Most airport buildings are found near the north end of the north south runway. The surrounding area is relatively flat and marshland can be found around the airport.

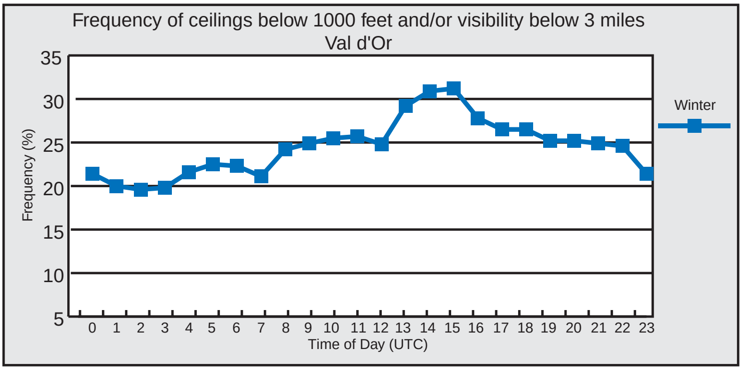




South winds are predominant, by far, throughout the year. In summer, the second rank is shared by the northwest and southwest with west winds close behind. In the winter, northwest and west winds remain as frequent as in summer, while southwest winds are half as frequent and southeast winds become more frequent. Strong wind speeds tend to be a rare occurrence in Val d'Or. Wind shear and turbulence are seldom reported in the immediate vicinity of the Val d'Or airport, except on hot convective days.

In July, thunderstorm activity is frequent over the land surrounding the airport.





Flying conditions are usually good throughout the year, although the winter morning hours tend to have the poorest weather. There is also the usual bout of fog or mist in the wee morning hours but it starts to dissipate as early as 8:30 am, during the summer and early fall. In many instances, the fog moves in over the southern half of the runway from a nearby lake. Once winter sets in and lakes freeze up, continental conditions (cold and dry arctic air) usually predominate, except for the occasional low pressure systems bringing some snow accumulations. Freezing rain is very rarely observed in Val d'Or, while freezing drizzle may occur on occasions during the fall.

Glossary of Weather Terms

anabatic wind - a local wind which blows up a slope heated by sunshine.

advection - the horizontal transportation of air or atmospheric properties.

air density - the mass density of air expressed as weight per unit volume.

air mass - an extensive body of air with uniform conditions of moisture and temperature in the horizontal.

albedo – the ratio of the amount of solar radiation reflected by a body to the amount incident on it, commonly expressed as a percentage.

anticyclone - an area of high atmospheric pressure which has a closed circulation that is anticyclonic (clockwise) in the Northern Hemisphere.

blizzard - a winter storm with winds exceeding 40 km/h, with visibility reduced by falling or blowing snow to less than one kilometre, with high windchill values and lasting for at least three hours. All regional definitions contain the same wind speed and visibility criteria but differ in the required duration and temperature criterion.

cat's paw – a cat paw-like, ripple signature on water given by strong downdrafts or outflow winds. A good indication of turbulence and wind shear.

ceiling - either (a) the height above the surface of the base of the lowest layer of clouds or obscuring phenomena (i.e. smoke) that hides more than half of the sky; (b) the vertical visibility into an obstruction to vision (i.e. fog).

chinook - a warm dry wind blowing down the slopes of the Rocky Mountains and over the adjacent plains.

clear air turbulence (CAT) - turbulence in the free atmosphere not related to convective activity. It can occur in cloud and is caused by wind shear.

clear icing - the formation of a layer or mass of ice which is relatively transparent because of its homogeneous structure and smaller number and size of air spaces; synonymous with glaze.

climate - the statistical collection of long-term (usually decades) weather conditions at a point; may be expressed in a variety of ways.

cold front - the leading edge of an advancing cold air mass.

convection - atmospheric motions that are predominately vertical, resulting in the vertical transport and mixing of atmospheric properties.

convergence - a condition that exists when the distribution of winds in a given area is such that there is a net horizontal inflow of air into the area; the effect is to create lift.

cumuliform - a term descriptive of all convective clouds exhibiting vertical development.

cyclone - an area of low atmospheric pressure which has a circulation that is cyclonic (counterclockwise) in the Northern Hemisphere.

deepening - a decrease in the central pressure of a pressure system; usually applied to a low. Indicates a development of the low.

deformation zone - an area in the atmosphere where winds converge along one axis and diverge along another. Where the winds converge, the air is forced upward and it is in these areas where deformation zones (or axes of deformation as they are sometimes referred to) can produce clouds and precipitation.

disturbance - applied loosely: (a) any small-sized low pressure system; (b) an area where the weather, wind, and air pressure show signs of cyclonic development; (c) any deviation in flow or pressure that is associated with a disturbed state in the weather; and (d) any individual circulatory system within the primary circulation of the atmosphere.

divergence - a condition that exists when the distribution of winds in a given area is such that there is a net horizontal outflow of air from the area.

downdraft - a small scale downward current of air; observed on the lee side of large objects that restrict the smooth flow of air or in or near precipitation areas associated with cumuliform clouds.

downburst - an exceptionally strong downdraft beneath a thunderstorm usually accompanied by a deluge of precipitation.

filling - an increase in the central pressure of a pressure system; applied to a low.

Föhn wind (foehn wind)- a warm dry wind on the lee side of a mountain range, whose temperature is increased as the wind descends down the slope. It is created when air flows downhill from a high elevation, raising the temperature by adiabatic compression.

front - a surface, interface or transition zone of discontinuity between two adjacent air masses of different densities.

Fujita Scale – a scale used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure (see Table 1).

Table 1 - The Fujita Scale

F-Scale Number	Intensity Phrase	Wind Speed (kts)	Type of Damage Done
F0	**Weak** Tornado	35-62	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	**Moderate** Tornado	63-97	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	**Strong** Tornado	98-136	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	**Severe** Tornado	137-179	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	**Devastating** Tornado	180-226	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large-object missiles generated.
F5	**Incredible** Tornado	227-285	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-inforced concrete structures badly damaged.

funnel cloud - a tornado cloud or vortex cloud extending downward from the parent cloud but not reaching the ground.

gust - a sudden, rapid and brief increase in wind speed. In Canada, gusts are reported when the highest peak speed is at least 5 knots higher than the average wind and the highest peak speed is at least 15 knots.

gust front - the leading edge of the downdraft outflow ahead of a thunderstorm.

high - an area of high barometric pressure; a high pressure system.

hurricane – an intense tropical weather system with a well defined circulation and maximum sustained winds of 64 knots or higher. In the western Pacific, hurricanes are called "typhoons," and similar storms in the Indian Ocean are called "cyclones" (see Table 2 for hurricane intensitites).

Table 2 - Saffir-Simpson Hurricane Scale

Category #	Sustained Winds (kts)	Damage
1	64-82	Minimal
2	83-95	Moderate
3	96-113	Extensive
4	114-135	Extreme
5	>155	Catastrophic

icing - any deposit of ice forming on an object.

instability - a state of the atmosphere where the vertical distribution of temperature is such that a parcel displaced from its initial position will continue to ascend.

inversion - an increase of temperature with height - a reversal of the normal decrease of temperature with height.

isothermal layer - equal or constant temperature with height.

jet stream - a quasi-horizontal stream of wind concentrated within a narrow band; generally located just below the tropopause.

katabatic wind - downslope gravitational flow of colder, denser air beneath the warmer, lighter air. Also known as “drainage wind” or “mountain breeze”. Strength can vary from gentle to extremely violent winds.

knot - a unit of speed equal to one nautical mile per hour.

lapse rate - the rate of change of an atmospheric variable (usually temperature) with height.

lee wave - any stationary wave disturbance caused by a barrier in a fluid flow; also called mountain wave or standing wave.

lightning - any and all forms of visible electrical discharge produced by a thunderstorm.

low - an area of low barometric pressure; a low pressure system.

meridional flow – airflow in the direction of the geographic meridians, i.e. south-north or north-south flow.

meteorology - the science of the atmosphere.

mixed icing - the formation of a white or milky and opaque layer of ice that demonstrates an appearance that is a composite of rime and clear icing.

occluded front - a front that is no longer in contact with the surface.

orographic - of, pertaining to, or caused by forced uplift of air over high ground.

outflow - a condition where air is flowing from the interior land area through mountain passes, valleys and inlets onto the coastal areas; used most commonly in winter when cold Arctic air spreads onto the coastal area and adjoining sea.

overrunning - a condition when warm air overtakes or is lifted by colder denser air.

parcel - a small volume of air, small enough to contain uniform distribution of meteorological properties, and large enough to remain relatively self-contained and respond to all meteorological processes.

plow wind - usually associated with the spreading out of a downburst from a thunderstorm; a strong, straight-line wind in advance of a thunderstorm that often results in severe damage.

precipitation - any and all forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the surface.

quasi-stationary front - a front that is stationary or nearly so; commonly called stationary front.

ridge - an elongated area of relatively high atmospheric pressure; also called ridge line.

rime icing - the formation of a white or milky and opaque granular deposit of ice formed by the rapid freezing of supercooled water droplets.

saturation - the condition in the atmosphere where actual water vapour present is the maximum possible at the existing temperature.

shower - precipitation from cumuliform cloud; characterized by suddenness of beginning and ending, by rapid changes in intensity, and usually by rapid changes in the appearance of the sky.

squall - essentially gusts of longer duration. In Canada, a squall is reported when the wind increases by at least 15 knots over the average speed for a duration of at least 2 minutes and the wind reaches a speed of at least 20 knots.

squall line - a non-frontal line or narrow band of active thunderstorms.

stability - a state of the atmosphere where the vertical distribution of temperature is such that a parcel will resist displacement from its initial position.

stratiform - term descriptive of clouds of extensive horizontal development; flat, lacking definition.

stratosphere - the atmospheric layer above the tropopause; characterized by slight increase in temperature from base to top, very stable, low moisture content and absence of cloud.

subsidence - the downward motion of air over a large area resulting in dynamic heating.

supercooled water - liquid water at temperatures below freezing.

thunderstorm - a local storm invariably produced by a cumulonimbus cloud, and always accompanied by lightning and thunder.

tornado - a violently rotating column of air, shaped from a cumulonimbus cloud, and nearly always observed as "funnel-shaped;" other names are cyclone and twister.

tropopause - the transition zone between the troposphere and the stratosphere; characterized by an abrupt change in lapse rate.

troposphere - the portion of the earth's atmosphere from the surface to the tropopause; characterized by decreasing temperature with height and appreciable water vapour. Often referred to as the weather layer.

trough - an elongated area of relatively low atmospheric pressure; also called trough line.

trowal - a trough of warm air aloft; related to occluded front.

turbulence - any irregular or disturbed flow in the atmosphere.

updraft - a localized upward current of air.

upper front - any frontal zone which is not manifested at the surface.

virga - water or ice particles falling from a cloud, usually in wisps or streaks, and evaporating completely before reaching the ground.

warm front - the trailing edge of retreating cold air.

weather - the instantaneous conditions or short term changes of atmospheric conditions at a point; as opposed to climate.

wind - air in motion relative to the earth's surface; normally horizontal motion.

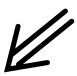
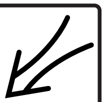
wind direction - the direction from which the wind is blowing.

wind speed - rate of wind movement expressed as distance per unit time.

wind shear - the rate of change of wind direction and/or speed per unit distance; conventionally expressed as vertical and horizontal wind shear.

zonal wind - a west wind; conventionally used to describe large-scale flow that is neither cyclonic or anticyclonic; also called zonal flow.

Table 3: Symbols Used in this Manual

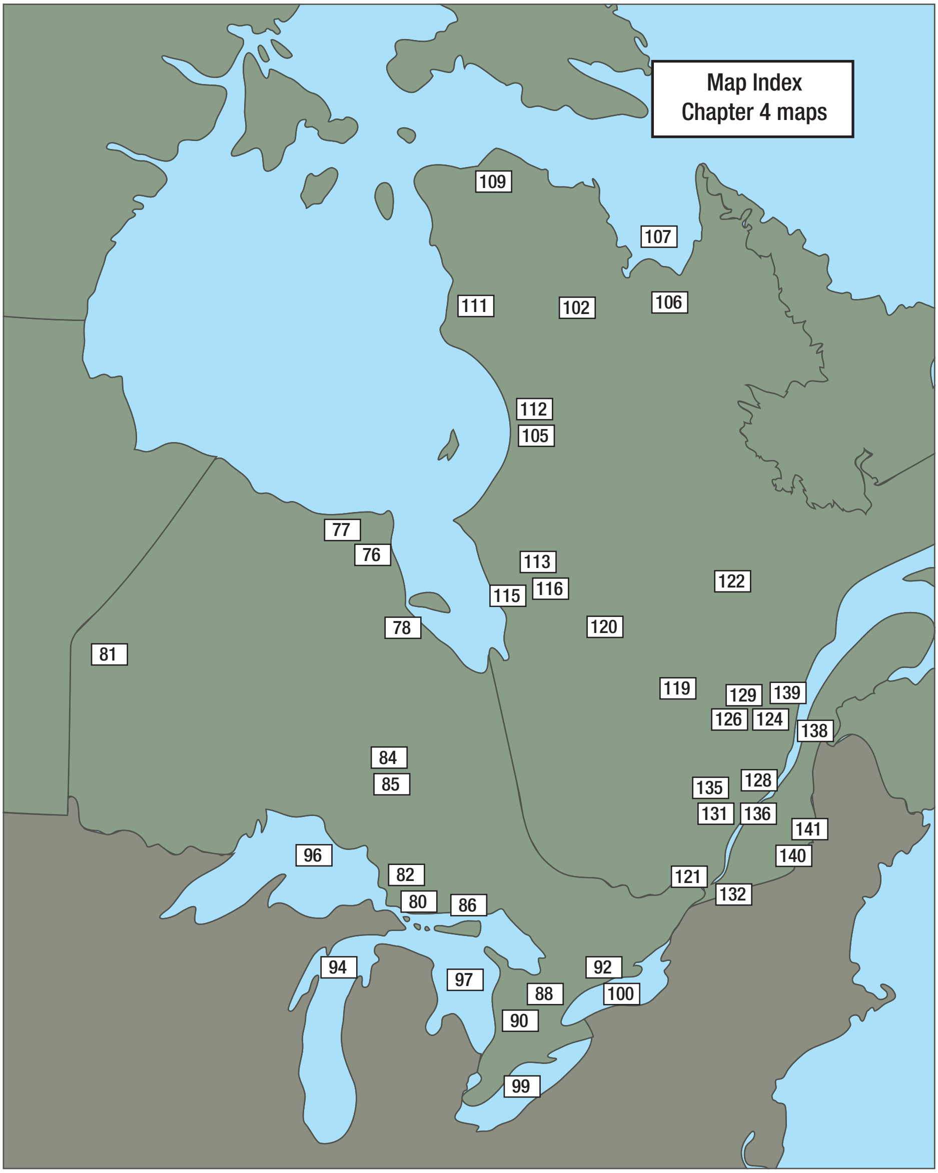
	**Fog Symbol (3 horizontal lines)** This standard symbol for fog indicates areas where fog is frequently observed.
	**Cloud areas and cloud edges** Hatched lines show areas where low cloud (preventing VFR flying) is known to occur frequently. In many cases, this hazard may not be detected at any nearby airports.
	**Icing symbol (2 vertical lines through a half circle)** This standard symbol for icing indicate areas where significant icing is relatively common.
	**Choppy water symbol (symbol with two wavelike points)** For floatplane operation, this symbol is used to denote areas where winds and significant waves can make floatplane operation dangerous or impossible.
	**Turbulence symbol** This standard symbol for turbulence is also used to indicate areas known for significant windshear as well as potentially hazardous downdrafts.
	**Strong wind symbol (straight arrow)** 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, etc.), turbulence, although not always indicated, can be expected.
	**Funneling / Channeling symbol (narrowing arrow)** 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.
	**Snow symbol (asterisk)** This standard symbol for snow shows areas prone to very heavy snowfall.
	**Thunderstorm symbol (half circle with anvil top)** This standard symbol for cumulonimbus (CB) cloud is used to denote areas prone to thunderstorm activity.
	**Mill symbol (smokestack)** 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.
	**Mountain pass symbol (side-by-side arcs)** 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.

Appendix


BELCHER
ISLAND
Sanikiluaq
Fontanges
Kuujjuarapik
Fort Severn
La Grande IV
Peawanuck
JAMES
BAY
La Grande Riviere
QUÉBEC
Big Trout Lake
Attawapiskat
Eastmain
Nemiscau
Sandy Lake
Lansdowne House
Moosonee
Chibougama
Pickle Lake
Matagami
Red Lake
ONTARIO
Armstrong
Hearst
Kapuskasing
Parent
Geraldton
Sioux Lookout
L. NIPIGON
Timmins
Val-d'Or
Kenora
L. of the
WOODS
Terrace Bay
Earlton
Thunder Bay
Wawa
Chapleau
Maniwaki
Atikokan
LAKE SUPERIOR
Sudbury
Petawawa
North Bay
Ottawa
Sault Ste Marie
Muskoka
LAKE
HURON
Trenton
Wiarton
Kincardine
L. ONTARIO
Toronto
LAKE MICHIGAN
London
Sarnia
Windsor
L. ERIE


Killinek
Kangiqsujuaq
Salluit
Ivujivik
Quaqtaq
PÉNINSULE
D'UNGAVA
Kangirsuk
UNGAVA BAY
LABRADOR SEA
Puvirnituq
Kuujjuaq
Inukjuak
Schefferville
Sanikiluaq
BELCHER ISLAND
Fontanges
Wabush
Lac Eon
Chevery
Kuujjuarapik
La Grande IV
Natashquan
anuck
JAMES BAY
La Grande Riviere
QUÉBEC
Port-Menier
Sept-Iles
Manicouagan
Attawapiskat
Eastmain
Nemiscau
Gaspe
Baie-Comeau
House
Mont-Joli
Moosonee
Chibougamau
Matagami
Roberval
Riviere-du-Loup
Hearst
Kapuskasing
Parent
ldton
Timmins
Val-d'Or
Quebec
ace Bay
Earlton
Trois-Rivieres
Wawa
Chapleau
Maniwaki
Sherbrooke
RIOR
Sudbury
Petawawa
Montreal
North Bay
Ottawa
Sault Ste Marie

Notes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NAV CANADA

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