

In this chapter

- Summer Severe Weather
- Tropical Storms and Hurricanes
- Winter Severe Weather
- Severe Weather Bulletins from Environment Canada
- Keeping Informed

CHAPTER 4



Severe weather is a fact of life in Canada. This country has a land area of 9,970,610 square kilometres, making Canada the second largest country in the world after Russia.

It's not surprising then that Canada also has a wide variety of severe weather — everything from ice storms to tornadoes. Canadians may joke about the country's weather, but severe weather is no joke. Bitter cold and winter storms, for example, kill more than 100 people a year.

This section describes severe weather phenomena, as well as Environment Canada's severe weather warning program. Severe weather warnings alert people to hazardous weather, which may be dangerous to lives or property.

SUMMER SEVERE WEATHER

Thunderstorms

Thunderstorms are a dramatic, somewhat noisy, but typical part of summer. They develop when warm, moist, unstable air is forced to rise into the atmosphere. This happens for many reasons. For example, some thunderstorms develop along the boundaries or transition zones between warm and cold air masses, when the colder,

heavier air undercuts the warmer air and forces it to rise. Other thunderstorms pop up when cool lake breezes from large lakes such as the Great Lakes meet hot, humid air farther inland. When this happens, the cooler air undercuts the warmer air and bumps it up into the atmosphere. Still other thunderstorms form when land, which has warmed up over the course of the day, has heated the air above, causing it to rise. Storms that form in this manner are called air mass thunderstorms.

One variation of air mass thunderstorms is the type that forms early in the day on slopes which face east, such as those on the east side of the Rocky Mountains. The slope of the ground allows the sun's rays to strike the earth at almost right angles, focusing the heat energy on a smaller area. This extra heating kicks off thunderstorms that then drift eastward during the day, carried by the prevailing westerly winds.

In all these instances when the warm air rises, it cools to its dew point temperature and the water vapour in the air condenses to form water droplets. But this does not stop the warm air from rising. It continues to push upward as long as it is warmer than the air around it, stopping only when it reaches air of the same temperature.

The rising warm air, or updrafts, and sinking cooler air, the downdrafts, in developing cumulonimbus clouds bounce the water droplets around so hard they collide with others, creating ever larger water droplets. Eventually, these water droplets become too heavy for even the strong updrafts to support and rain falls.

Activity:

- The updrafts in a really good thunderstorm may exceed 1,800 metres per minute. Ask your students to calculate what that is in kilometres per hour (Answer: 108 km/h). They could also work out how long it would take a newly formed water droplet to zip from one third of the way up to the top of a cumulonimbus cloud which was 12 kilometres high (Answer: 4.4 minutes).

Thunderstorm Hazards

Lightning

At the same time, the turbulence in the cumulonimbus clouds creates positively and negatively electrically-charged areas within the clouds. Scientists do not know why, but generally speaking the positive charge develops in the cold upper reaches of a cloud and the negative charge develops in the lower portions of a cloud. This, in turn, induces positive charges in objects on the ground below.



There is little truth to the saying that lightning never strikes the same place twice. Lightning strikes the CN Tower in Toronto about 70 times a year.

Although air is a notoriously poor conductor of electricity, the electrical charge in the cloud above grows until it overcomes the air's resistance. Interestingly, even though

Lightning Safety Tips for Kids

Every thunderstorm produces lightning. Your best defence is to apply the **30-30 rule**:

If you can count fewer than 30 seconds between seeing the lightning flash and hearing the thunder, take shelter and remain there until 30 minutes after the last flash of lightning or rumble of thunder.

Indoors:

- Stay away from windows and doors.
- Don't use the telephone or take a shower or wash dishes. Don't even touch water faucets, electrical appliances or metal items that would conduct electricity.

Outdoors:

- Unsafe places include open fields, high places, tents, picnic shelters or pavilions, baseball

dugouts, indoor (yes, indoor) swimming pools and things that could conduct electricity, like metal fences.

- If you can't find a safe shelter, make yourself as small a target as possible. Don't lie flat — instead, crouch down with only your toes touching the ground and lower your head.
- Safety also means no bike riding, skateboarding, or golfing until the storm has passed.
- If you're swimming or boating, return to shore immediately.

- In wooded areas, go deep into a stand of trees and find a low-lying area, but never seek shelter under a solitary tree.

In a vehicle:

- You're safe inside a hard-topped vehicle like a car or RV, because the outer metal body of the vehicle will divert the lightning. But keep your hands in your lap and don't touch anything metal inside the vehicle.

lightning looks like one bolt hurtling towards earth, it is not. Lightning usually occurs when the electrons holding a negative charge begin moving downward from the cloud to the earth in what is called a step leader. As they get closer to the earth, the negative force of the electrons attracts the positive charge from the earth. This flows upward in what is called a streamer. This streamer, or return stroke, flows upwards at about 96,000 kilometres a second and at temperatures of 30,000C, which is six times hotter than the sun. The same process occurs when lightning travels from one cloud to another. In fact, nine out of 10 lightning strokes flash from cloud to cloud or within the same cloud.



Lightning kills an average of seven people and injures 60 to 70 people each year in Canada. Lightning is also responsible for 42 per cent of the country's forest fires. The cost of forest fires caused by lightning has been estimated at \$14 billion annually in recent years.

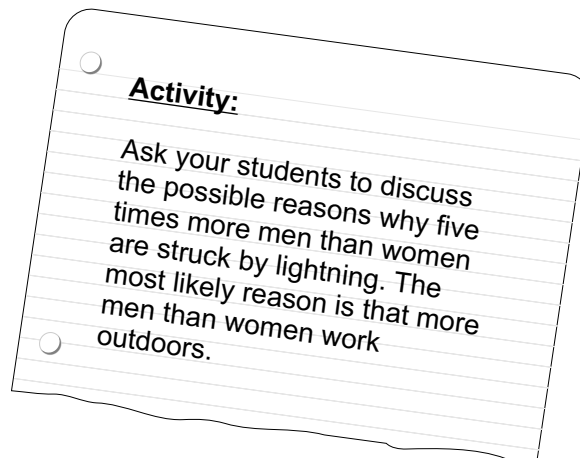
Thunder is a by-product of lightning. Thunder is the sound produced by the sudden and rapid expansion of the narrow channel of air heated by the lightning stroke. You see the lightning, and then hear the thunder, because the speed of light is about a million times faster than the speed of sound.



You can work out how many kilometres away a thunderstorm is by counting the number of seconds between the time you see the lightning and hear the thunder and dividing that by three. For example, if you count 15 seconds between the lightning flash and the crack of thunder, then the storm is about five kilometres away.

One other point about thunderstorms: they often change as they travel across the countryside. Lakes and the local terrain may affect the strength, movement and duration of storms. For example, if a thunderstorm

passes over hills and ridges, it may grow stronger as it climbs up one side and weaker as it goes down the other. A thunderstorm may grow stronger if it moves over a long stretch of flat land that has been baking in the sun all afternoon, or weaker if it passes over a large body of cool water in the late spring.



Only a small percentage of the thunderstorms that rumble across the countryside unleash enough energy to produce severe weather – high winds, heavy downpours, damaging hail or tornadoes. However, any thunderstorm can be dangerous.

Hail

Hail forms when the updrafts carry water droplets into colder reaches of a cumulonimbus cloud, where they freeze. More layers of ice are added when updrafts hurl other water droplets up and they collide with the now frozen particles. This continues until the ice particles are too heavy for the updrafts to support and the ice particles fall to the ground as hail.

Hail is one of the most destructive forms of severe weather in Canada. Hail stones can destroy crops, dent vehicles and cause millions of dollars in damage. Environment Canada issues a severe weather warning when hail stones the size of a nickel (20 mm) or larger are expected.

Hail Safety Tips for Kids

Indoors:

- Follow your lightning safety plan.
- Stay inside and away from windows that may be struck by hail.
- Make sure any pets are indoors, too.

Outdoors:

- Find something to protect your body or at least your head.
- Stay out of ditches or low areas that might suddenly fill with water.

In a vehicle:

- A car can give you reasonable protection, but be aware that extremely large hail could break windows.



The heaviest documented hailstone in Canada fell at Cedoux in Saskatchewan. The hailstone weighed 290 grams and measured 114 millimetres across.

Downbursts

Downbursts are another hazard of large thunderstorms. Downbursts are the downdrafts that usually accompany rain or hail. They plunge to the ground at speeds of up to 240 kilometres an hour – the speed of an F2 tornado. A microburst is a form of downburst that is less than four kilometres wide. Microbursts have caused aircraft to crash and capsized sailboats.

Straight-line winds or plough winds are other terms used to describe strong downdrafts that can spread out ahead of even individual thunderstorms. Derechos are more damaging and longer-lasting winds associated with lines or clusters of thunderstorms. Damaging winds of at least 90 km/h can be expected to spread damage across an area several kilometres wide and several hundred km long in a single or series of swaths.



People often confuse downbursts with tornadoes, believing that only tornadoes can generate such damaging winds. Derechos (pronounced day-RAY-cho) comes from the Spanish word “straight ahead,” while tornado comes from the Spanish word for “turn.”

Tornadoes

Tornadoes often form in the hot, humid weather of a late spring or summer afternoon. The thunderstorms that produce tornadoes frequently develop in the warm, moist air near the fronts or transition zones between warm and cold air masses. Although the cumulonimbus clouds that spawn tornadoes may be extremely dark, their bottoms often have a sickly pea green or gray colour.

Tornadoes begin as funnel clouds, violently rotating columns of air extending from the base of a thunderstorm. Some funnel clouds never quite reach the ground, disappearing instead back into the parent cloud. If a funnel cloud does touch the ground, then that is a tornado.

The bottom end of a tornado can range in width from a few metres to two kilometres. For instance, the tornado that ploughed through Edmonton on July 31, 1987 was as much as one kilometre wide. Tornadoes usually travel from the southwest to the northeast and at the speed of the parent thunderstorms, which range from 20 kilo-

Activity:

To show your students a tornado, try Activity No. 13 of the Activity Section.

metres per hour to 80 kilometres per hour. Tornadoes rarely travel in a straight line. They cut an erratic course, often appearing to bounce from spot to spot. On average, most tornadoes last about 5 to 10 minutes and travel for about six kilometres. But that is just an average. The Edmonton tornado cut a swath through Alberta's capital nearly 40 kilometres long. The tornado that raced through Grand Valley in southern Ontario, on May 31, 1985, travelled for 110 kilometres before dissipating.

Tornadoes have been reported in every province. About 80 tornadoes are reported in Canada each year. Most are too weak to cause serious damage. The Barrie and Edmonton tornadoes, however, were F4 tornadoes. There has never been a recorded occurrence of an F5 tornado in Canada, although such tornadoes do occur in the United States.

The Fujita Scale – The intensity of tornadoes is measured on the Fujita scale, which is named after Dr. Ted Fujita, a pioneer of research into tornadoes :

Scale	Wind Speed and Damage
F0	Winds of up to 116 km/h TV antennae bent, siding removed
F1	Winds of 117-180 km/h Barn roofs ripped off, summer cottages taken off their foundations
F2	Winds of 181-252 km/h Barns and silos demolished, farm wagons and other farm equipment picked up and moved. Roofs removed from homes and house trailers demolished
F3	Winds of 253-331 km/h Upper storeys of brick houses destroyed, outer walls removed from most houses
F4	Winds of 332-418 km/h Two-storey brick houses almost destroyed, cars and vans carried long distances
F5	Winds of 419-512 km/h Destroys virtually everything in its path

Tornado Safety Tips for Kids

Tornadoes most often occur in the afternoon or early evening from May to September, although they have happened at night or even in November. Play it safe if you see a funnel cloud, or if you hear that a tornado warning has been issued for your area.

Indoors:

- Stay away from windows, doors, and outside walls.
- In a house, either go to the basement or take shelter in a small ground-floor room near the center of the house, such as a bathroom, hallway, or closet. If that's not possible, shelter under a desk or sturdy table.
- In an apartment building, don't use the elevator. Move to an inner hallway or room.
- At school, don't go to the gymnasium. The gym, like arenas and auditoriums, may have a wide-span roof without

supports in the middle, making them more likely to collapse if struck by a tornado. In this type of building, move to a smaller room such as bathroom or change room.

In a vehicle:

- A vehicle is not a safe refuge when a tornado strikes. Don't get caught in a car, camper, or mobile home.
- If possible, go to the lowest level of a building with a strong foundation or basement.
- If no such building is available, then leave your vehicle, find a low-lying area. Lie down flat and protect your head.

Outdoors:

- If you cannot get to a well-constructed building, then seek shelter deep in a stand of trees in a low-lying area, lie down flat and protect your head.
- If you are in an open area, find a ditch or other low spot, lie down flat and protect your head.
- In all cases, the key is to get as close to the ground as possible and protect your head from flying debris.

Other Rotating Phenomena

Most summer severe weather events, including damaging tornadoes, are spawned by a special type of thunderstorm known as a supercell. With supercells, multiple strong updrafts continue to feed the storm, allowing it to maintain its intensity for several hours. However some tornado look-alikes can form under less developed clouds, over water surfaces, or even under sunny skies.

Dust devils

Normally harmless, dust devils are rotating updrafts or eddies that typically form on hot sunny days when strong surface heating causes the air adjacent to the ground to heat up as well. This localized pocket of hot air rises quickly in a small spinning column, and cooler air rushes in below to replace it. The resulting vortex is made visible by the dust it picks up. Dust devils seldom extend higher than 100 metres, but those that do can flip objects like lawn furniture.

Funnel clouds

As mentioned in the Thunderstorm section, every tornado was once a funnel cloud, but not every funnel cloud becomes a tornado. A spinning condensation funnel can form under large cumulus clouds or weak thunderstorms, but most lack the energy to reach the surface. They spin in mid-air without touching the ground and normally fizzle out soon after they form.

Waterspouts

Waterspouts form during periods of cool, unsettled weather from mid-July to late October over large bodies of water like Lake Winnipeg or the Great Lakes. A waterspout looks like a tornado, but is much smaller and weaker. A waterspout is a slender, graceful-looking rotating column of vapour and water extending from the base of a towering cumulus cloud to the water's surface. The diameter of a waterspout ranges from seven to 20 metres and its winds range from 40 to 80 kilometres per hour, which is strong enough to flip a boat. They pose no threat on land as they collapse as soon as they move onshore.

TROPICAL STORMS AND HURRICANES

Tropical cyclone is the name given to any low pressure system which is fueled by the heat released when moist air rises and condenses. A tropical cyclone that intensifies through the three stages described in this section will be called a hurricane if it forms over the Atlantic Ocean or a typhoon if it forms in the Northwest Pacific. The Atlantic hurricane season extends from June to November, with the peak between August and October, when the ocean surface is at its warmest.

But what causes a hurricane to develop? Here are the key ingredients:

- Hurricanes only form over ocean water that's warm enough to provide a good energy source—it must

Camping Safety Tips for Kids

Here's one more tip to add to the list. Just as your school has emergency exits to ensure that you have a safe way out of the area, you should pick out a safe refuge near your campsite in case you need to shelter from severe weather.

- In an organized campground, there may be a comfort station or shower facility nearby.
- In wilderness camping, look for a low spot in a thick stand of trees.

Identifying your “emergency exit” ahead of time will help you react quickly when summer storms appear.

be at least 26.5°C. Ocean water that warm is only found in the tropics, never off Canada's shores.

- The atmosphere above it must cool off rapidly with height, so that rising warm air will continue to rise through the cooler layers, allowing the disturbance to grow.
- Winds at all levels of the atmosphere from the ocean right up to 9000 meters must be blowing in the same direction and about the same speed. Conflicting wind velocities would hamper the storm's development.
- A hurricane seldom forms any closer than 500 km to the equator, because the Coriolis Force that makes winds spiral in these storms becomes too weak near the equator.

These ingredients don't always produce a hurricane, but a hurricane will never form without them.

Stages of a Tropical Cyclone

The initial disturbance (called a Tropical Disturbance) is just a large area of thunderstorms that persists for more than one day. If the disturbance becomes organized and the air pressure at its center decreases, strengthening winds begin to spiral and it's classified as a tropical cyclone.

There are three types of tropical cyclones:

- **Tropical Depression:** this is the first stage, when the circulation within the system has become organized enough to produce sustained winds of between 37 and 62 km/h. Some Tropical Depressions continue to intensify, while others fizzle out without developing any further.
- **Tropical Storm:** If the low pressure centre continues to deepen, with strong thunderstorms and a well-defined circulation pattern that produces sustained winds reaching 63 km/h or more, the system becomes a Tropical Storm and is given a name.

Identifying the storm by name reduces confusion when more than one storm is active.

- **Hurricane:** If the air pressure at the centre of the Tropical Storm continues to drop, the circulation around it will intensify and wind speeds will increase. When the system produces sustained winds of 119 km/h or more, it is upgraded to hurricane status. At this stage, an "eye" or calm area forms in the innermost part of the storm, with spiral bands of torrential rain rotating around it.



An alphabetical list of names is prepared well in advance for each hurricane season, using boys' and girls' names alternately. The list contains only 21 names—the letters Q, U, X, Y, and Z aren't used because few names begin with them.

All types of tropical cyclones have the potential to inflict damage, depending on where they strike and the particular hazards associated with that system.

Hurricanes begin to weaken and eventually dissipate when the ingredients that created them—particularly the warm ocean water—are no longer available.

Categories of Hurricanes

Hurricanes are classified by the strength of their winds using the Saffir-Simpson Scale. A Category 1 hurricane has the lowest winds speeds and a Category 5 the highest.

SAFFIR-SIMPSON HURRICANE SCALE	
Category	Wind Speed (km/h)
1	119-153
2	154-177
3	178-210
4	211-249
5	> 249



No Category 3, 4 or 5 hurricane has made landfall in Canada in over a century.

Hurricane Hazards

The hazards commonly associated with hurricanes include high winds, storm surges and flooding from intense rainfalls.



More than half of the hurricanes that make landfall in the United States produce at least one tornado. This seldom happens in Canada.

In general, most hurricane-related deaths are from storm surges. A storm surge is simply a swelling of water that is driven toward shore by strong winds. This surge of advancing water combines with the normal tide to create an enhanced storm surge that can increase the mean water level by five metres or more, causing serious flooding as it drives onto the shore. In Canada, however, most fatalities result from the flooding rainfalls.

Hurricane Frequency

In an average year, of the dozens of tropical depressions that form, 10 will reach tropical storm status over the Atlantic Basin. The Basin includes the Atlantic Ocean, Caribbean Sea and Gulf of Mexico. Six of them will further develop to become hurricanes and, of these, two or three will be classified as intense hurricanes, reaching Category 3 or higher. Since 1994, these averages have climbed to 15 tropical storms, eight hurricanes and four intense hurricanes.

In an average year, eastern Canada is affected by four tropical cyclones of varying strength. Depending on the storm's path and size, its effects may be felt as far west

as Quebec and Ontario or as far north as Nunavut. On the west coast, British Columbia is never affected directly by tropical cyclones. However, in October 1962, the remnants of Typhoon Freda struck the Pacific coast of British Columbia, causing seven deaths and an estimated \$10 million in damage. This storm devastated the entire northwestern coast of the U.S. and became known as the infamous "Columbus Day Storm."



Canada's best-known hurricane was Hurricane Hazel, which hit southern Ontario in October 1954, resulting in 81 deaths and more than \$100 million in damage. Most of the destruction was a result of flooding from in excess of 200 millimetres of rain in less than 24 hours.

The 2005 Hurricane Season was one for the record books. The Atlantic Basin produced 28 named storms, compelling forecasters to use the Greek alphabet to identify storms once the annual list of names was depleted. A record four hurricanes were classified as Category 5 at some point—Emily, Katrina, Rita and Wilma—although none of them came onshore at that strength. Here are a few comparisons.

Hurricane Season 2005—Atlantic Basin		
	Average	2005 Statistics
Number of named storms	10	28 (new record)
Storms to reach hurricane status	6	15 (new record)
Intense hurricanes	24	7 (record is 8, set in 1950)

Hurricane Safety Tips for Kids

- Follow your family's disaster plan for events such as tornadoes.
- If you live near the coast, know what the local tides are. High tides will significantly increase the danger from storm surges. Leave low-lying beaches.
- Go indoors and remain indoors during a hurricane. It's extremely dangerous to travel or move around outdoors during the event.
- Monitor the storm's progress through Environment Canada's bulletins on Weatheradio, the Internet, or local radio and television stations. A battery-operated radio will ensure your access during power outages.

WINTER SEVERE WEATHER

Blizzards

The word blizzard was first used to describe a snow storm in the early nineteenth century in the United States. Today, meteorologists use the word to describe one of the worst of the winter's snow storms. Blizzards combine high winds, bitter cold and blowing snow. They are dangerous on several counts. First, the snow is often powdery and fine enough for you to breath into your lungs. Second, the combination of bitter cold and high wind can cause frost bite within seconds. And third, the blowing snow and high winds often reduce visibility to almost zero. Canadian literature abounds with true stories of pioneers, farmers, ranchers and explorers who froze to death only metres away from the shelter they could not see.

In Canada, blizzards are most common in the southern Prairies, the Maritimes and the eastern Arctic. They are relatively rare in Ontario.

Freezing Rain

Freezing rain is a significant winter hazard in Canada, but can also occur in late fall or early spring. Freezing

rain glazes trees, hydro lines, roads and sidewalks with ice. Buildups of ice can bring down branches and trees as well as overhead power and telephone lines. This can disrupt power supplies and communications for days. Even a small accumulation of ice may pose a risk to both pedestrians and drivers.

Ice Storm is a term used to identify particularly severe freezing rain events. The ice storm which hit parts of eastern Ontario, Quebec and New Brunswick from January 4 to 10, 1998, was the worst in recent memory. The storm was directly or indirectly responsible for the deaths of 25 people. At its height, the storm left nearly three million people in Quebec and Ontario without electricity or heat. A week after the storm ended, nearly one million people were still without light or heat.

Activity:

Ask your students to write a story describing what it would be like to live in their homes for seven days in the winter without electricity, running water and heat from the furnaces. Ask them what supplies they might want to keep on hand to help cope with such an event.

Winter Storm Safety Tips for Kids

- Stay indoors and wait out the storm.
 - If you must go outside for a short period, dress in multiple layers of loose-fitting clothing.
 - Outer clothing should be hooded, tightly woven and water repellant.
 - Mittens are warmer than gloves.
 - Wear a hat, because most body heat is lost through the head.
 - If it's very cold, cover your mouth with a scarf to protect your lungs from the cold air.
- Never touch a power line that may have come down due to wind or ice buildup. It may still be "live" and you could be electrocuted.
- If you become stranded while traveling in a vehicle, wait for rescue:
 - Stay in the car — you won't get lost and the car will provide shelter.
 - Keep dry and warm. If you begin to sweat, remove your hat or one layer of clothing.
 - Keep fresh air in the car by opening the window one centimetre or less on the side away from the wind.
 - Exercise your arms and legs periodically to keep your hands and feet warm.
 - Keep watch for traffic or for search parties.

In some respects, that storm was typical of most freezing rain storms. For several days a low pressure area over the Texas panhandle pumped warm, moist air from the Gulf of Mexico into southern Ontario and Quebec. This air came in at about the level of low clouds, that is, less than two kilometres above the earth's surface.

At the same time, a large and stationary area of high pressure sat over Hudson's Bay and pumped cold air into the St. Lawrence and Ottawa River Valleys. As warm air is lighter than cold air, the warm, moist air from the south rose above the cold air and stayed there. This is the classic recipe for freezing rain — a layer of warm air hovering above a shallow layer of cold air.

When rain drops began to fall from the clouds in the warm layer of air, they had to fall through the cold layer where temperatures hovered either at the freezing point or just below it. Here, the rain drops cooled to the freezing point or just below it, becoming what meteorologists call super-cooled. Consequently, when these very cold rain drops hit a colder object such as a hydro wire or the branch of a tree with a temperature below freezing, they froze on contact, forming a veneer of ice.

Most ice storms last a few hours. Some continue for up to three days. The ice storm in January of 1998 went on for six long days. That was because a high pressure area

near Bermuda, which is 1,100 kilometres off the coast of North Carolina, prevented the storms formed in the Gulf of Mexico from heading out to sea in the Atlantic Ocean. Instead the high-pressure area deflected the storms north along the western flank of the Appalachian Mountains in the eastern United States and right into eastern Canada.

SEVERE WEATHER BULLETINS FROM ENVIRONMENT CANADA

Only Environment Canada can issue weather alerts to keep the Canadian public advised of weather events that could affect their safety or property. These weather alerts fall into three categories:

- **Special Weather Statements** are issued for events that are not severe enough to merit a warning, but yet might cause general inconvenience or public concern. For example, a Special Weather Statement might be issued to highlight widespread dense fog that could pose a transportation challenge, or to clarify a weather warning that may be in effect near our borders.
- **Weather Watches** provide a heads-up that conditions are favourable for severe weather to develop. A Watch might be issued as much as 12 hours in advance, when the potential for dangerous weather has been identified, but the track and strength of the

Cold Weather Safety Tips for Kids

Frost-bite and hypothermia (low body temperature) occur when more heat is lost than your body can generate. Although this happens more rapidly on a windy winter day, don't be fooled — you need to guard against frostbite on any cold winter day.

- Limit your time outdoors when the temperature is extremely cold.
- Dress appropriately and cover your head, ears and face.
- Use the “buddy” system. You and a friend can check exposed skin on each other's face for tell-tale white patches where skin is frozen. If you spot frostbite, go indoors immediately for help.
- Keep active. Physical activity generates more body heat.
- Stay dry. Wet clothing speeds up the loss of body heat. If your mitts or boots are wet, go indoors to change them.

system are still uncertain. Watches may be issued for five different severe weather events to provide more advance notice of the threat. These include a Severe Thunderstorm Watch, a Tornado Watch, a Winter Storm Watch, a Tropical Storm Watch and a Hurricane Watch.

- Weather Warnings are issued when severe weather is occurring or about to occur. Environment Canada strives for a lead time of six to 18 hours, depending on the type of event. However, thunderstorms often develop rapidly so that lead times on occasion may be less than an hour. The threshold for issuing various types of warnings will depend on the climate of an area as well as local needs.

Winter Weather Warnings

The criteria for winter severe weather warnings differ across the country because the climate itself (or what is considered "normal") also varies from place to place. These are the primary types of warnings issued by Environment Canada in the winter, although the threshold for issuing them may change across the country.

- A Snowfall Warning is issued when an unusually high amount of snow is expected to fall in a comparatively short period of time. In Vancouver, 5 cm of snow in 12 hours would be unusual whereas in Ontario, a warning is only issued if 15 cm is expected in that length of time.
- A Blizzard Warning is issued if a combination of strong winds, reduced visibilities in snow or blowing snow and cold temperatures is expected to persist for four hours or more.
- A Freezing Rain Warning is issued when it is expected to last long enough for the accumulation to create hazardous walking and driving conditions, and possibly damage to trees or overhead wires because of the ice buildup.

- A Wind Chill Warning is issued when winds of at least 15 km/h are expected to combine with very cold temperatures to produce hazardous outdoor conditions lasting more than three hours. The criteria for this type of warning vary across the country, ranging from -55 in some Arctic regions to -30 in southwestern Ontario.

In some regions, combinations of these phenomena will prompt Environment Canada to issue a broader Winter Storm Warning. Climate differences across the country cause additional types of warnings to be issued in some areas as well. Near large bodies of open water such as the Great Lakes, Snowsquall Warnings are often issued. In some places, blowing snow can reduce visibility enough to warrant a public warning. In main transportation corridors, a sudden drop in temperature from above freezing to below zero can turn a wet roadway into a sheet of ice, and a Flash Freeze Warning may be issued.

Summer Weather Warnings

Although the criteria for summer severe weather warnings may differ from region to region, Environment Canada issues four main types of summer warnings:

- A Severe Thunderstorm Warning is issued when a severe storm has developed, producing flooding rain, destructive winds with gusts of at least 90 km/h and/or hail at least 10 to 20 mm in diameter.
- A Tornado Warning is issued when one or more tornadoes or funnel clouds are observed or detected on Doppler radar.
- A Wind Warning is issued for sustained winds of at least 60 km/h or gusts of at least 90 km/h.
- A Rainfall Warning is issued when heavy or prolonged rainfall is sufficient to cause local or widespread flooding or flash floods.

Warnings for All Seasons

Some types of weather pose a threat year-round, and Environment Canada will issue appropriate warnings to alert the public of the risk.

Hurricane Warnings

There are also specific warnings that can be issued when hurricanes or tropical storms threaten Canadian territory.

- A Tropical Storm Warning is issued when an approaching tropical cyclone is expected to produce winds of 63 to 118 km/h within 24 hours.
- A Hurricane Warning is issued when an approaching tropical cyclone is expected to produce winds greater than 118 km/h within 24 hours.

KEEPING INFORMED

Environment Canada uses a variety of delivery methods to ensure that everyone, no matter what technology is available to them, can access weather information.

Weatheradio

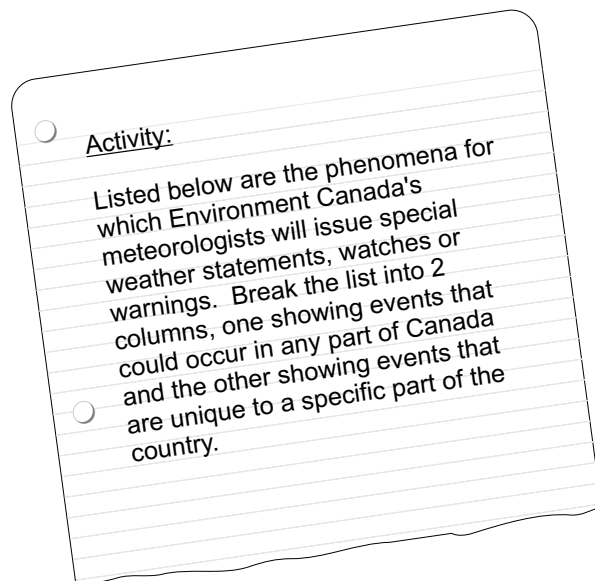
Environment Canada has its own radio network, broadcasting continuous weather information 24 hours a day. Known as Weatheradio, this network uses VHF frequencies so that specially equipped receivers will automatically activate when warnings are issued for your area. The network is expanding, so check out the Weatheradio Fact Sheet on the Publications page at <http://msc-smc.ec.gc.ca> to check the transmitter location nearest you.

Internet

Millions of people visit Environment Canada's main weather Web site at www.weatheroffice.ec.gc.ca to look at radar imagery or to check the forecast for any of the hundreds of towns available on drop-down menus.

Media

The most popular source of weather information for Canadians is still their local media outlet — radio, television, or newspaper — and Environment Canada feeds weather information to them directly through wire services and a special Web site just for media.



- Severe Thunderstorm
- Tornado
 - Twister sisters
 - Funnel Cloud
 - Cold-Core Funnel
 - Landspout
 - Waterspout
- Tropical Storm
- Hurricane
- Storm Surge
- High Heat and Humidity
- Heat Wave
- Humidex
- Rainfall
- Freezing Rain
- Freezing Drizzle
- Flash Freeze
- Wind
- Les Suêtes
- Wreckhouse Wind
- Marine Wind
- Dust Storm
- Blizzard
- Blowing Snow
- Snowfall
- Snow Squall
- Winter Storm
- Wind Chill
- Cold Wave
- Arctic Outflow
- Frost
- Weather
- Fog - Smoke
- UV
- Air Quality

For more information on Environment Canada's severe weather program, please visit http://msc-smc.ec.gc.ca/cd/brochures/warning_e.cfm