

## Major Tornadoes

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### Abstract

Tornadoes are columns of air that spin at a high rate of speed. They are small in scale but can be very violent. The area affected by a tornado's passage is between about 40 and 400 metres in width and between 1.7 and 36 kilometres in length. During a tornado the damage is due to wind as well as an extremely sudden drop in pressure. Tornadoes vary in intensity, measured on the Fujita or F scale, graduated from 0 to 5 based on the level of damage. The main season for tornadoes is from April to October, and every province is subject to the risk of tornadoes.

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Tornadoes are columns of air which spin at a high rate of speed, which are small in scale but can be very violent. They strike quickly, randomly and often without warning. The winds they generate can reach speeds of 100 metres per second (360 kilometres per hour).



Tornado, July 5, 1973, Kelvington, Saskatchewan

**Source:** Mrs. Bauder, Courtesy of Environment Canada Library, Downsview, Ontario.

A tornado is recognized visually by the presence of a cloud in the form of a funnel coming out of thunderstorm clouds. Tornadoes are often preceded by thunderstorms and are associated with a dark sky, strong winds, lightning, thunder and heavy rain or hail.



Tornado, July 8, 1983, Blackfoot, Alberta

**Source:** Wilf Kenyon, Courtesy of Environment Canada library, Downsview Ontario.

As tornadoes whirl around, they move laterally over the ground at speeds of up to 70 kilometres per hour. They can also remain stationary for short periods. In general, tornadoes do not follow a straight line. They usually travel eastward or northeastward.

Depending on the strength of a tornado, it is estimated that the area affected by its passage is between about 40 and 400 metres in width and between 1.7 and 36 kilometres in length. The area of destruction is clearly demarcated next to the undamaged area. Also, tornadoes do not always remain on the ground, so the amount of damage is sometimes irregular along their paths.

During a tornado, damage is not only due to the wind, but also to the sharp, extremely sudden drop in pressure, which causes, among other things, the explosion of windows in buildings. The pressure inside the funnel can be as much as 90% lower than normal atmospheric pressure. This creates a suction effect within a tornado which can lift heavy objects into the air.

## Wind Strength of Tornadoes

Tornadoes vary in intensity. They are measured on the Fujita or F scale. This scale is graduated from 0 to 5 and is based on the level of damage caused by a tornado's passage. The various categories are as follows (Table 1):

**Table 1.** Fujita Scale

F-scale	Wind-speed (kilometres per hour)	Damage
Fujita Scale	Wind speed (kilometres per hour)	Damages

F0	64 to 116	little
F1	117 to 180	moderate
F2	181 to 253	considerable
F3	254 to 331	severe
F4	332 to 418	site devastated
F5	419 to 512	unbelievable

**Source:** Emergency Preparedness Canada

It should be noted that the damage caused by a tornado is not necessarily related to wind speed. One critical factor is the route followed by the tornado. In 1987, for example, in Edmonton, the bulk of the damage occurred when the tornado was weakest (in its F1 to F2 phase). However, that was when it struck a mobile home park. At its strongest, this tornado had a strength of F4.

Canada has yet to experience an F5 tornado, and only 1% of our tornadoes are of F4 strength.

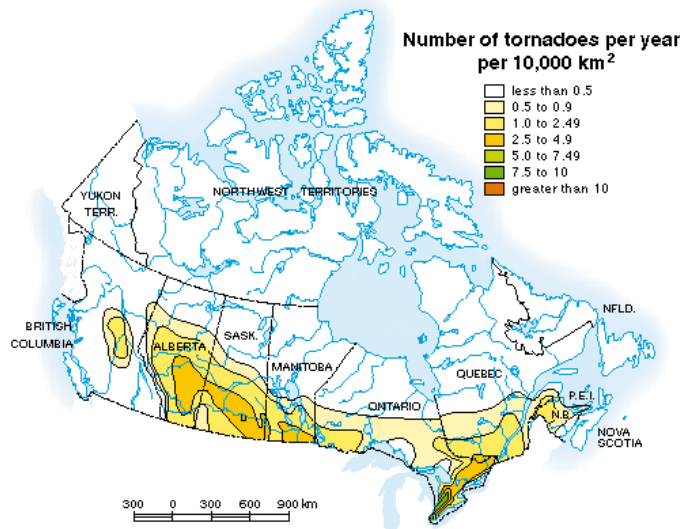
### **Tornado Occurrences in Canada: When do they occur?**

Only the United States receives more tornadoes than Canada. Prior to the 1970s, tornadoes were thought to be rare events in Canada, but various studies have since revealed that they are much more common than previously thought. Tornadoes can strike anytime during the year, but the main season is from April to October, particularly in June and July.

### **Where do tornadoes strike?**

In Canada, more than 70 tornadoes a year strike the populated regions. Fortunately, most are too weak to cause damage. In Canada, every province is subject to the risk of tornadoes (Figure 1).





**Figure 1.** Map of the Annual Number of Tornadoes in Canada

**Source:** Natural Resources Canada

The risk of tornadoes is highest in southern Ontario. The extreme southern part of the Prairies receives the second largest number. The tornado risk is high in south central Alberta, southern Saskatchewan and Manitoba, northeastern Ontario, and western Quebec.

Overall, a third of the tornadoes occur in Ontario, and most of these are in the extreme southern part of the province. This region is also more likely to receive tornadoes of high intensity. In fact, of nine tornadoes of F4 strength recorded in Canada, seven were in southern Ontario and two were in western Canada. (However, these last two tornadoes were the worst Canada has ever known).

In Manitoba, at least one tornado a year causes property damage. However, because of the low population density, tornadoes rarely cause loss of life. In southern Saskatchewan, another region frequently affected, tornadoes are not very destructive but strike repeatedly.

Finally, in the rest of Canada - British Columbia, northern regions, northwestern Ontario, the St. Lawrence valley in Quebec, and the Atlantic provinces - tornadoes are rarely experienced.

Descriptions for each of the major tornadoes shown on the map are found below.

### **Buctouche-1879**

Damage of \$100 000 and 25 families homeless

Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Lancaster, Ontario to Saint-Zotique, Quebec-1888**

Extensive property damage

Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Sainte-Rose-1892**

Six dead and 26 injured

Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Regina-1912**

Regina, Saskatchewan; 28 dead, hundreds injured, 2500 homeless, damage in excess of \$4 million; more than 400 of the finest buildings in the city were destroyed.

Source: Environment Canada. The Climates of Canada. by D. Phillips, Supply and Services Canada Publishing Centre, Cat. No. EN56-1/1990E.

**Portage La Prairie-1922**

Portage La Prairie, Manitoba; a tornado resulted in five dead, scores injured, \$2 million in damage.

Source: Emergency Preparedness Canada. Significant Disasters in Canada, September, 1995.

**Windsor to Tecumseh-1946**

Windsor to Tecumseh, Ontario; 17 dead, hundreds injured; damage to property conservatively estimated at \$0.5 to \$1.5 million.

Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Regina-1950**

Regina, Saskatchewan, November 1950.

Source: Insurance Companies

**Sarnia -1953**

Sarnia, Ontario; seven dead, 40 injured, and 500 left homeless.

Source: Emergency Planning Ontario

**White Point Beach-1954**

White Point Beach (near Liverpool), Nova Scotia; a tornado producing hail and lightning hit the coast of Nova Scotia near Liverpool.

Source: Environment Canada. The Climates of Canada. by D. Phillips, Supply and Services Canada Publishing Centre, Cat. No. EN56-1/1990E.

**Amaranth-1958**

Amaranth, Manitoba, May, 1958.

Source: Emergency Preparedness Canada, National and Regional Offices.

**Huron/Perth-1967**

Huron/Perth, Ontario; \$1 million in damage.  
Source: Emergency Preparedness Canada.

**Sudbury-1970**

Sudbury, Ontario; six dead, 200 injured; damage of \$10 million or more.  
Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Windsor-1974**

Windsor, Ontario; nine dead, 30 injured; damage of \$500 000.  
Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Saint-Bonaventure-1975**

Saint Bonaventure, Quebec; 40 injured, 300 homeless, \$2.5 to \$3 million in damage  
Source: Emergency Preparedness Canada. Significant Disasters in Canada, September, 1995.

**Woodstock-1979**

Woodstock, Ontario; two dead, an estimated \$7 million in damages.  
Source: Emergency Planning Ontario

**Montréal-1982**

Montréal (Sainte-Rose), Quebec; five fatalities, 26 injured, and extensive damage; hundreds of homes and barns flattened.  
Source: Environment Canada. The Climates of Canada. by D. Phillips, Supply and Services Canada Publishing Centre, Cat. No. EN56-1/1990E.

**Reeces Corners-1983**

Reeces Corners, Ontario; millions of dollars in damage.  
Source: Emergency Planning Ontario

**London-1984**

London, Ontario; 30 injured.  
Source: International Decade for Natural Disaster Reduction, Canadian National Report. Royal Society of Canada and the Canadian Academy of Engineering, 1994.

**Hopeville to Barrie-1985**

Hopeville to Barrie, Ontario; 12 dead, hundreds injured; 800 homeless, more than 100 buildings were damaged at a cost of over \$100 million, destruction of 300 houses.  
Source: Emergency Preparedness Canada and National Atlas of Canada. Natural Hazards Poster Map, 1996.

**Southern Winnipeg-1987**

Southern Winnipeg, Manitoba; a thunderstorm caused at least two tornadoes in Winnipeg; strong winds and 40 millimetres of rain in two and a half hours caused flash flooding and resulted in considerable property damage.

Source: Environment Canada. The Climates of Canada. by D. Phillips, Supply and Services Canada Publishing Centre, Cat. No. EN56-1/1990E.

### **Montréal-1987**

Montréal, Quebec; a tornado caused by a severe thunderstorm dropped 100 millimetres of rain in an hour which resulted in severe flooding across the city; the storm also caused intense winds which uprooted large trees and toppled hydro lines. Source: Environment Canada. Flood Events in Canada, 1983 to 1987. Water Planning and Management Branch, Inland Waters Directorate. October, 1988.

### **Edmonton-1987**

Edmonton, Alberta; 27 dead, 600 injured, 1700 homeless; damage of \$300 million; widespread heavy rainfall from a powerful tornado hit Edmonton on Friday, July 31, 1987; 300 millimetres of rain fell in three days; the Smoky, Wapiti, Simonette, and Kakwa Rivers rose by up to 7 to 8 metres in some areas; the tornado touched down in Edmonton and moved northeast; hailstorms were reported during the tornado; much of the damage was caused by hailstorms accompanying the tornado. Source: Charlton, R.B., B.M. Kachman, and L. Wojtiw. "Urban Hailstorms, A View from Alberta." Natural Hazards 12 (1995): 29 to 75.

### **Medicine Hat-1988**

Medicine Hat, Alberta; tornado caused an estimated \$50 million in damage. Source: Press.

### **Southern Ontario-1990**

Southern Ontario; tornadoes, high winds and thunderstorms caused crop damage and the destruction of several buildings in the communities of Lobo, Komoka, Frome, Port Stanley and Kendall; six minor injuries were reported. Source: Emergency Preparedness Canada, Operations Coordination Centre, Ottawa.

### **Sarnia-1991**

Sarnia, Ontario; tornado caused an estimated \$25 million in damage. Source: Press

### **St. Lawrence River-1991**

St. Lawrence River, Quebec; the tornado affected the village of Maskinongé; the tornado crossed the St. Lawrence River and touched down in Notre-Dame-de-Pierreville where a few summer cottages were destroyed and some minor injuries occurred; it also touched down in Saint-Wenceslas where minor damage was reported; there were no deaths, 15 people injured, only one seriously; 60% of all buildings in the village of Maskinongé were damaged, the power lines were down and telephone service stopped; no drinking water was available; estimated \$13 million in damage.

Source: Emergency Preparedness Canada, Operations Coordination Centre, Ottawa.

### **Grey, Wellington and Dufferin counties, Ontario, 1996**

Two F3 class tornadoes touched down in Grey County (Holland Centre), Wellington County and Dufferin County. Significant property damage occurred; nine people were injured by the two tornadoes.

Source: Emergency Preparedness Canada, Operations Coordination Centre, Ottawa.

### **Pine Lake, Alberta-2000**

Eleven people died as a result of a tornado that touched down on the west side of Pine Lake near the Green Acres campground sometime after 7 pm. It then skipped across the lake to the east side, causing additional damage. The F3 class tornado, with winds up to 300 kilometres per hour, was on the ground for about half-an-hour and cut a swath of destruction 20 kilometres long by about one kilometre wide.

Approximately 400 camping sites were destroyed and dozens of mobile homes were tossed into the lake. Preliminary insurance claims total \$15 million.

Source: Emergency Preparedness Canada.

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## **Map Sources**

### **Major Tornadoes in Canada**

Disaster Database, Emergency Preparedness Canada, 1999.

## **References**

National Geographic Society. 1993. Exploring your World, the Adventure of Geography. Prepared by the Society's Special Publications Division. Washington, D.C.

Phillips, David. 1990. The Climates of Canada. Cat. No. En56-1/1990E. Ottawa: Environment Canada.

Phillips, David. 1993. The Day Niagara Falls Ran Dry ! : Canadian weather facts and trivia. Toronto: Key Porter.

## **Related Web sites (1999 – 2009)**

### **Federal Government**

Environment Canada. Meteorological Service of Canada. Severe Weather Watcher Handbook. Tornadoes and Funnel Clouds

[http://www.msc.ec.gc.ca/education/severe\\_weather/page33\\_e.cfm](http://www.msc.ec.gc.ca/education/severe_weather/page33_e.cfm)

Volunteer weather watchers' reports of severe weather are sometimes the only information available concerning local weather events. For interested volunteers, this



Handbook provides the knowledge to report weather information effectively and accurately.

Government of Canada. Public Safety

<http://www.safecanada.ca/>

The Public Safety Portal is your one-window entry to all public safety information from the Government of Canada.

Radio-Canada Nouvelles. Une tornade frappe le Québec (available in French only)

<http://www.radio-canada.ca/nouvelles/28/28124.htm>

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## Other

Institute for Catastrophic Loss Reduction

<http://www.iclr.org/>

Canada's property and casualty insurers founded the Institute in 1998. ICLR is a coordinated effort to reduce disaster losses involving member insurance companies, The University of Western Ontario and other partners.

United States Government. Department of Commerce. National Oceanic and Atmospheric Administration. National Severe Storms Laboratory

<http://www.nssl.noaa.gov/>

The mission of the National Severe Storms Laboratory (NSSL) is to enhance the National Oceanic and Atmospheric Administration's (NOAA) capabilities to provide accurate and timely forecasts and warnings of hazardous weather events (such as blizzards, ice storms, flash floods, tornadoes, lightning.)