

From telegraph to Internet – Canada's weather service since 1871



Getting the weather word out

As rain began to fall on August 25, 1873, residents of the outports and farms on Cape Breton Island secured their doors and shutters against a rising wind. Few people on this rugged island expected anything more than a late summer gale. But that night, after gathering strength for a week in the mid-Atlantic, a hurricane spiralled up the coast of the United States and smashed headlong into Cape Breton's east shore.

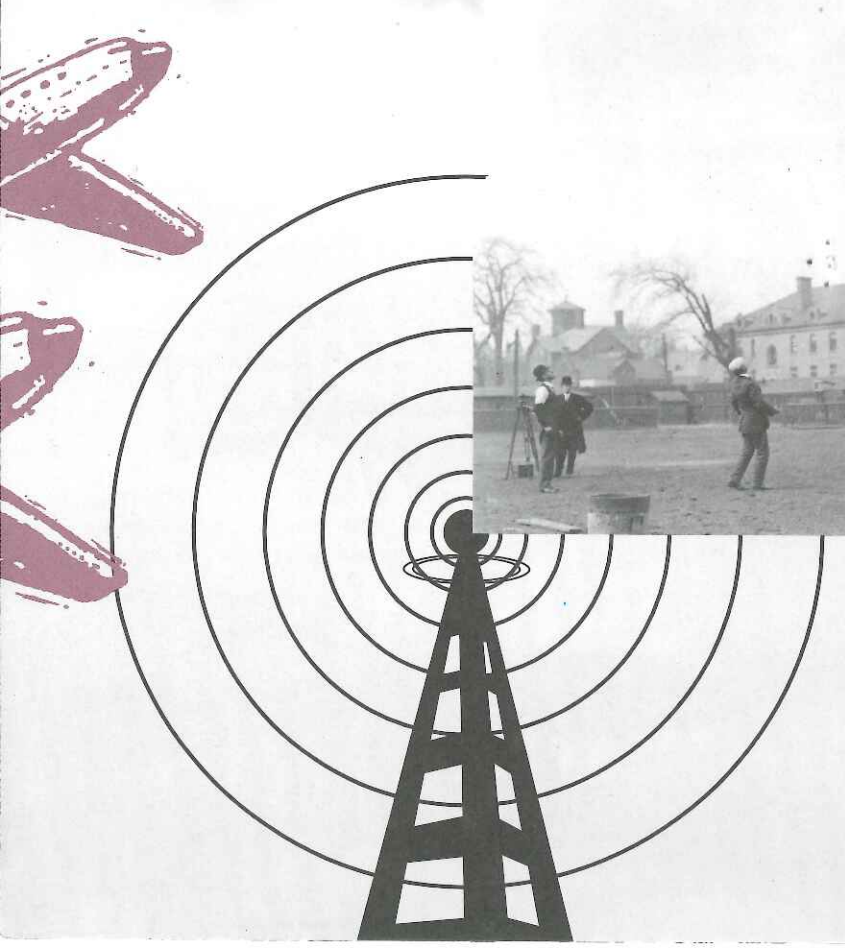
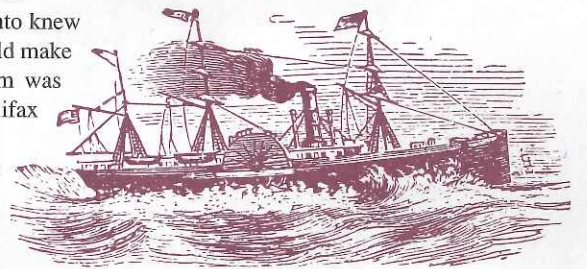
By mid-afternoon the next day, the Great Nova Scotian Cyclone had laid waste to a large swath of Cape Breton. Newspapers were filled with accounts of steamers driven aground and bridges washed away in the deluge that accompanied the high winds. The storm's final toll: almost 1,000 people dead, some 1,200 ships sunk or smashed, hundreds of homes and bridges destroyed.

Tragically, meteorologists in Toronto knew a day in advance that the hurricane would make landfall in the Maritimes, but no alarm was raised because the telegraph lines to Halifax were down.

Aside from the waterlogged farms and wind-whipped coastal towns on Cape Breton, the hurricane was felt most 1,500 kilometres to the west, in Ottawa. Politicians, prompted by the public outcry over the disaster, opened the coffers for the development of a national weather warning system. This was a major boost for Canada's fledgling weather service, which had been set up only two years earlier, in 1871.

The primary mission of a meteorological service is to get the weather word out to the public quickly. No matter how perfect the forecast, if it does not reach the public in time, it has no value. As a result, the Canadian weather service has always been one of the largest consumers of telecommunications services in Canada, creating and adapting technologies to deliver more weather information to more people more quickly.

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Environment
Canada

Environnement
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Getting the weather word out continued

In fact, telecommunications helped transform meteorology from an interesting to a practical science, and made national weather services possible. In turn, society's basic need for weather warnings has often been behind communications devices such as the telegraph, radiotelephone, and automatic telephone answering systems. Telecommunications and weather services have evolved hand-in-hand.

The formative years

Meteorology and forecasting were still in their formative years in the mid-nineteenth century. If you lived in Upper or Lower Canada, you likely divined your own weather forecast based on local conditions and accumulated weather lore – red sky at night, sailor's delight, for example.

Samuel Morse's invention of the electric telegraph in 1844 signalled a new age in meteorology. For the first time, forecasters had a tool with which to relay observations over vast distances, to warn towns in the path of a storm – if the lines were not damaged – and to inform others of sunny skies ahead.

By 1876, land lines linked all major cities in Eastern Canada. Public weather forecasts were issued from Toronto at 10 a.m., every day except Sunday and covered the following 24 hours. Compared to today's forecast, they were short and simple. For example, the forecast for the Maritimes on January 1, 1878 was, "decreasing northerly winds to westerly winds, clearing and colder weather." Distributing these forecasts, however, was anything but simple: getting the weather word out usually meant sending the latest forecast by telegraph. On receipt, the person in charge would arrange to post, for public inspection, the forecasts in a framed bulletin board outside the local telegraph office, post office, school or railway station. In the United States, besides posting daily forecasts, some communities used flag signals, steam whistles, search lights, and even sirens and bombs to advise people of approaching weather.

Most afternoon newspapers in large cities began publishing the telegraphed weather bulletins as soon as they became available.

At first they were only a recitation of the previous day's highs and lows across the country; later they offered predictions and weather maps.

For farming communities along rail lines between Windsor and Halifax, an ingenious system was developed in 1884 to get the weather word out. After receiving a morning dispatch from the central weather office in Toronto, railway agents affixed large metal discs – the shape depended on the approaching weather system – to the engine or baggage cars. To farmers working their fields, a full moon chugging by signalled sunny skies, a crescent moon meant showers and a star meant prolonged rainy periods.

Operators at 35 warning stations at ports and harbors along the Great Lakes, St. Lawrence River and Atlantic seaboard used a similar method to warn sailors of approaching gales. The system of cautionary storm signals was quite simple. The Central office in Toronto sent warnings to the signal stations. Operators at the headlands to the ports or harbors acknowledged the message by return telegraph then raised wicker baskets, cones or drums from a mast or pole representing a different weather pattern. This simple system of storm warnings proved so effective that it was not until the 1950s when the last cautionary storm station with its wicker baskets and signal drums was decommissioned.

Although useful, all these early systems were limited by the constraints of time and space. Often forecasts were old news by the time papers were published or a ship's pilot spotted the signal. And too often, workers whose job it was to update the warnings simply never did, or did it too late to make the information worthwhile. Inevitably, people began to question the reliability of the entire system. Further, as weather services began spreading across the country officials realized that forecasts were reaching only a fraction of the population. For example, southern British Columbia had a weather service in 1894, while Manitoba's service began in 1899. The service in Saskatchewan and Alberta started up in 1903 and in Newfoundland in 1910.

Wireless radio breakthrough

In the 1920s all that changed with the technological breakthrough of the wireless radio. Like the telegraph 70 years earlier, the radio revolutionized the way weather was delivered to Canadians. Information could be gathered from hundreds of remote weather stations across the country and transmitted to isolated logging camps, island communities and even ships at sea. By the mid-1930s, news and the daily national weather forecasts were a central component of radio broadcasts.

In the 1930s, weather forecasts for all of Canada except southern British Columbia were issued twice daily by a staff of four meteorologists at 9:40 a.m. and 9:40 p.m. The forecasts were based on data from about 217 stations across North America and were for the ensuing 36 to 48 hours – and occasionally for as long as 60 hours. Forecasts were distributed as

widely as possible through traditional means, the daily press and the posting of daily weather maps and bulletins on public buildings as well as by telephone, government wireless and radio broadcasting stations. In 1935, the weather service provided a daily national weather synopsis and forecast for the 10:35 p.m. eastern standard time broadcasts of the Canadian Radio Commission's Trans-Canada network – the predecessor of the CBC.

During the Second World War, Canadian and American government officials banned broadcasting and publishing public weather information over North America. Officials did permit some local weather radio broadcasts and weather maps in newspapers. But for security reasons, no mention could be made of the fog, visibility, air pressure, wind direction and cloud height. Even baseball announcers were prohibited from commenting on the weather. One announcer was reputed to have told his audience during a rain delay, "stick your head out the window if you don't understand the reason for suspension of play."

Following the war, radio, because reports could be updated so quickly throughout the day, became the natural avenue for disseminating weather information. This continues today as frequent weather broadcasts are made every day over hundreds of commercial AM or FM radio stations.

There is another type of radio we are likely to find aboard a combine on a Saskatchewan wheat farm, in a lobster boat off the coast of Nova Scotia or in the lodge of a Northern Ontario fishing camp – Weatheradio. This is Environment Canada's network of low-power VHF-FM radio stations which began transmitting a continuous stream of weather reports in 1976. The service, which is available to almost 95 per cent of the population, provides taped messages of weather watches and warnings, public and marine forecasts, and current weather forecasts. Routinely revised programs run on a cycle of five to 10 minutes in length. Weatheradio receivers are portable, inexpensive and available from most electronics stores. In addition, some receivers are equipped with a tone signal and or a flashing light to alert users to warnings of severe weather. People who are hearing impaired may tune in with special digital receivers which decode, download and print the forecasts. This is called the Weathercopy service.

Weather surfing

Televised weather casts have remained the most popular and effective way of disseminating information about the weather ever since they made their Canadian debut on September 8, 1952 on CBLT-TV in Toronto. In the early days, broadcasters used grease pencils and puppets as props. Today, most weather segments are illustrated with radar images and computer animation. In 1988, The Weather Network and its French language equivalent, MétéoMedia, became Canada's only channels dedicated to broadcasting weather news, two of just three networks to do so in the world. On average 6.5 million different viewers tune in every week. The average time they spend watching the network's programs each time they tune in has jumped from 3.5 minutes, five years ago to 8.2 minutes today.

Yet, vestiges of the old systems remain, only updated and given a modern sheen. Where telephone operators in farming communities in 1900 read morning forecasts to dozens of local residents, Canadians today call into the country's dial-a-weather-service. Using high capacity automatic telephone answering machines, the system responded to more than 50 million queries in 1994.

With the proliferation of Internet services and users, at no other time in our history has as much weather information been available to so many people. Thousands of World Wide Web sites have been launched in the past three years with the sole purpose of providing better and more convenient broadcasting products.

Environment Canada's Green Lane gives anyone in the world point and click ease access to the latest weather readings from across Canada: current forecasts, extended outlooks to five days, ultraviolet indices and ozone reports as well as smog forecasts and advisories. Some sites offer dazzling graphics and weather system maps normally reserved for television. The Internet has made virtual weather extremely popular.

With the increased speed of microprocessors, weather enthusiasts can now marshal the same specific tools as practising meteorologists. Using a laptop computer, farmers or boat captains living in Cape Breton can download the latest radar and satellite images from weather services around the world. They can watch as a hurricane is born in the mid-Atlantic and follow its progress as it spirals up the east coast of the United States. And they can make well-informed decisions about whether to hunker down and wait out the gale or pack up and dash for the safety of higher ground. ▲

By David Phillips, Senior Climatologist – Environment Canada

For further reading

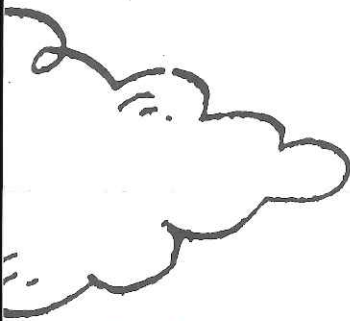
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Morley Thomas, *The Beginnings of Canadian Meteorology*. ECW Press. 1991, 308 pp.

Morley Thomas, *Forecasts for Flying*. ECW Press. Oct. 1996.



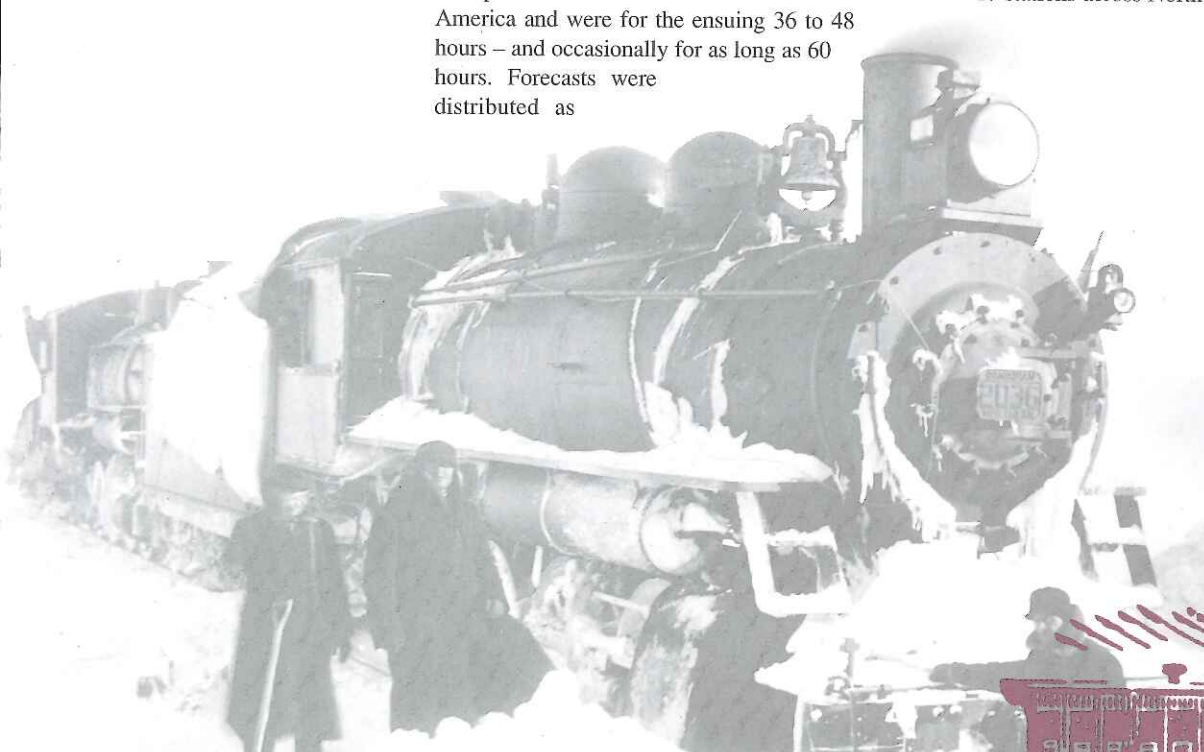
The telegraph made a national weather-warning service in Canada possible.



Weather sites on the Internet

Environment Canada's Green Lane – <http://www.on.doe.ca>

U.S. National Weather Service – <http://www.noaa.gov/>



Heavy snowfalls have long created problems for transportation in Canada



Massive





Canada has it all!

Droughts, blizzards, hurricanes, tornadoes...

Let it snow, let it snow, let it snow

Each year snow costs the Quebec economy millions of dollars. No major world city has as much snow as Montreal nor spends as much in removing it from the streets – \$45 million for 1,700 kilometres (km) of streets, not counting the costs of ploughing drive-ways and parking lots. But snow is a boon not a bane to Quebec. In fact, an insufficient snowcover can be a disaster. Each year snow returns many more millions of dollars to the province's economy through tourism and recreation.

The black summer of 1816

The year 1816 is legendary in weather history. It has been called poverty year, the year with the black summer, and the year without a summer. Between May and September, a series of cold waves chilled southern Quebec and New England, causing near-famine in some areas. From June 6 to 10, Quebec City was covered by nearly a foot of snow, with drifts reaching "to the axle trees of carriages." Freezing temperatures in June blackened crops and produced thick ice on ponds, trapping and killing large flocks of waterfowl. There were several chilly mornings in July and August. Hard frosts on September 11, 12 and 27, put an abrupt end to the already shortened growing season.

Across eastern North America, summer temperatures averaged three to five degrees Celsius below today's normal temperatures. It has been just as cold or even colder in each of these months in other years, but never consecutively. Over the years people have attributed the abnormal weather to an extraordinary increase in sunspot activity, changes in the phase of the moon, or earthquakes. Today, climatologists believe "the year without a summer" was a result of the eruption of the Tamboro volcano east of Java, which between April 7 and 12, 1815, blew more than 150 million tonnes of dust, ash and cinders into the atmosphere. The resulting global veil reflected incoming solar radiation back to space and indirectly chilled the earth.

Hurricane Hazel

Undoubtedly more words have been written about Hurricane Hazel than any other single weather event in Canadian history. After carving a path of destruction through the Caribbean, Hazel struck the American coast near Myrtle Beach on the morning of October 15, 1954. Over the next 12 hours she raced from North Carolina to southern Ontario. Weakened by the overland journey, and with peak winds of less than 115 km an hour (km/h), Hazel was technically no longer a hurricane, but after merging with a cold front west of Toronto she regained some of her lost fury.

On the evening of the 15th, Hazel struck Toronto. Eighteen hours later, she departed for Hudson Bay, but not before claiming 80 lives and causing about \$167.5 million (in 1996 dollars) of storm and flood-related damage. In her wake, Hazel left a nightmare of destruction – lost streets, washed-out bridges, and untold personal tragedy. The greatest loss of life and property damage occurred in the Humber River Valley and in the Holland Marsh just south of Lake Simcoe. Unprecedented downpours of up to 178 millimetres (mm) easily saturated well-watered soils, producing flash flooding on the rivers and creeks.

Apart from the two-day rainstorm that flooded parts of Essex County in July 1989, no other storm before or since has challenged Hazel's status as the heaviest rainstorm ever recorded in southern Ontario. And none has produced such tragic and dire memories.

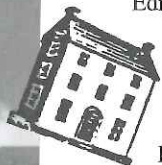
The blizzard of 1947

The most memorable blizzard in Saskatchewan's history occurred in February 1947. For 10 days all highways into Regina were blocked. Railway officials declared conditions the worst in Canadian rail history. One train was buried in a snowdrift one kilometre long and eight metres deep. Supplies of fuel, food and feed ran dangerously low. Outside Moose Jaw, a farmer cut a hole in his barn roof; it was the only way he could get in to milk his cows.



Twister

Friday, July 31, 1987 was not unlike previous days that week in Edmonton, Alberta. The morning was sunny with warm, moist, southerly winds and a hint of stormy weather in the air. As the day wore on, temperatures and humidity rose. Thunderstorms developed over the Rocky Mountain foothills and moved toward the city. At the same time, a cold front was sweeping eastward across Alberta and a line of associated thunderstorms was intensifying rapidly to the southwest of the city. From these thunderstorms developed a tornado that touched down about 3:01 p.m. just south of Edmonton. Over the next hour, the killer tornado ploughed through the eastern subdivisions of the city. Its black fury, fed by winds of up to 400 km/h cut a swath of death and destruction 40 km long and as much as one km wide. In addition to the tornado, hail as large as softballs and 40 to 50 mm of flooding rain were reported in the city.



Transmission towers were toppled and buildings obliterated. Cars and trucks were picked up and some were tossed great distances. Train cars were derailed. The final toll was 27 deaths, 253 injured, hundreds left homeless and property damage in excess of \$250 million. In terms of lives lost, it was the second worst tornado disaster in Canada, next to the Regina Cyclone. It was also Canada's worst natural disaster in 30 years, since Hurricane Hazel claimed 80 lives in 1954.

Climate records show that seven other tornadoes have hit the Alberta capital since 1889, all brief and intermittent touch-downs and none a killer, as was the Black Friday tornado that hit Edmonton on July 31, 1987.

Heat wave kills 800 people

In the 1930s, Canadians suffered through the most severe drought of the century, and endured the most intense and extensive heat wave on record. The killer heat wave of 1936 scorched the region between the Rocky Mountains and the Ottawa River, boosting temperatures as high as 44.4° Celsius, and causing nearly 800 deaths.

West coast hurricane

On October 12, 1962, Hurricane Freda struck the coast of British Columbia. At Victoria on Vancouver Island, the winds reached sustained speeds of 74 km/h with gusts up to 145 km/hr. Damage estimates were \$10 million to store windows, small boats, hydro lines and gardens. Seven deaths were attributed to the storm. ▲



Highlights of Canada's weather service

1871 – With a \$5,000 grant from the new Canadian government, George Kingston, the director of the Toronto Observatory and professor of meteorology at the University of Toronto, establishes a national meteorological office in Toronto and a network of weather observing stations. Toronto exchanges data with Washington and weather warnings are telegraphed back to Canada. Previously, people had relied on folklore about the color of the sky or the behavior of farm animals to predict the approach of a storm.

1873 – Ottawa funds a national weather warning system in the wake of the Great Nova Scotian Cyclone.

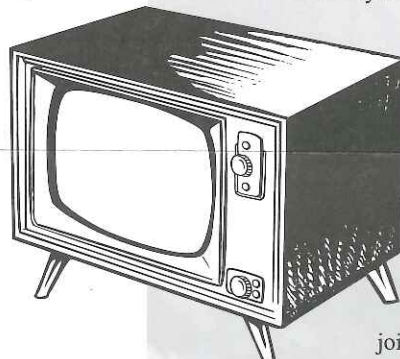
1876 – Telegraph land lines link all the major cities in Eastern Canada. The first forecasts developed in Canada are issued from Toronto at 10 a.m. every day except Sunday and are posted on public buildings.

1920 – The invention of wireless radio revolutionizes meteorology. Information can be gathered from hundreds of remote weather stations across the country and transmitted to isolated logging camps, island communities and even ships at sea.

1935 – The weather service provides a daily national weather synopsis and forecast for the Canadian Radio Commission's Trans-Canada network - the predecessor of the CBC.

1939-1945 – During the Second World War, information about the weather is a strategic military commodity, to be kept secret from the enemy and transmitted only in code to support anti-submarine patrols and ship convoys in the Atlantic and the Pacific oceans as well as the British Commonwealth Air Training Plan. The Germans try to gain an advantage by secretly setting up an automated weather station in northern Labrador; the station operates for two weeks until its radio transmissions are jammed.

1952 – Televised weather casts debut on CBLT-TV in Toronto. Percy Saltzman was the first television weather broadcaster.



1954 – Hurricane Hazel strikes southern Ontario, killing 80 people and dumping about 300 million tonnes of rain on Toronto.

1963 – The first weather satellite pictures are received in Canada.

1971 – Canada's weather service joins the new Department of the Environment. On October 29, a new headquarters building is opened in Toronto.

1976 – Canada's Weatheradio network begins transmitting continuous taped messages of weather watches and warnings, public and marine forecasts and current weather forecasts.

1982 – The probability of precipitation becomes a routine part of the forecast.

1983 – Canada's weather service acquires its first supercomputer. It is installed at the Canadian Meteorological Centre in Montreal. The supercomputer results in a great leap forward in computer modelling.

1988 – The landmark World Conference on the Changing Atmosphere brings scientists, heads of state and policy makers from the around the world together to discuss the growing problem of global warming.

1989 – Environment Canada develops the one of the first computerized models of the global climate. The model predicts an increase in the temperature around the world of 3.5° Celsius over the next 50 years. This trend is supported by the fact that 11 of the 12 warmest years have occurred since 1980.



1992 – Canada becomes the first country to develop a daily nation-wide ultraviolet (UV) index to warn Canadians about the dangers of over-exposure to the sun. Several other countries, including Australia, Germany, Great Britain and the United States, have now started their own programs. These are closely modelled on the Canadian UV index.

1996 – Everyday, Canada's weather service issues about 1,300 public weather forecasts for more than 200 regions and about 1,000 aviation forecasts for 175 airports. ▲



George Kingston – founder of Canada's weather service



George Kingston

George Kingston graduated from Cambridge University in England with a degree in mathematics. He emigrated to Canada in 1852 where he took a position as principal of a nautical college in Quebec City, and moved to Toronto in 1855 where he took up the posts of director of the Toronto Observatory and professor of meteorology at the University of Toronto.

After Confederation in 1867, Kingston promoted the need for a national weather service to co-ordinate and set standards for the collection of data and to issue weather warnings. Finally in 1871, the Dominion government granted him \$5,000 to set up the Canadian Meteorological Service. Under his guidance a national weather observing network began to take shape. By 1872, staff members at the Toronto Observatory were exchanging data with their counterparts in Washington D.C., and weather warnings were telegraphed back to Canada. The two countries have exchanged weather data almost continuously since then. In 1876 Canada's weather service began to issue its own weather warnings and forecasts.

Kingston remained director of the Toronto Observatory and head of the national weather service until he resigned in 1880. He died in 1886. ▲

Tools of the trade



The founder of Canada's national weather service, George Kingston, would probably recognize some of the instruments which are used today to gather data to produce a weather forecast. As in 1871 when he formed the national weather service, the air pressure is still measured, in many places, by a mercury barometer and the temperature outside is still recorded by a thermometer. What is more, parts of the anemometer, which measures the speed and direction of the wind, bear a strong resemblance to a weather vane. And although there are machines to do the job now, visibility is often checked by a meteorologist stepping outside for a moment and having a good look around.

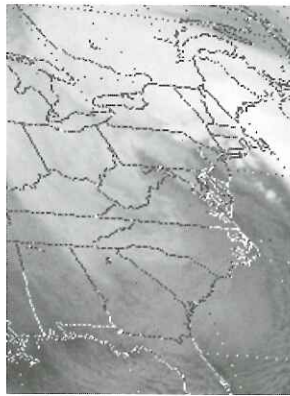
But there have been changes. Some of them have been small. Meteorologists, for instance, no longer walk out to the instrument field to read the thermometers two to four times a day. Now the information is available on a remote temperature indicator. Further, not too long ago meteorologists calculated the relative humidity with an instrument that used human hair – which absorbs and releases moisture with remarkable consistency. Today, the meteorologists use electronic instruments.

But other changes have

revolutionized how the data are collected and used. Today, measurements are taken not only at the earth's surface where people live, but also high in the atmosphere. This provides meteorologists with a three-dimensional picture and gives them the information they need to prepare forecasts.

At one end of the scale, satellites looking down through the atmosphere take snap shots of whole regions recording, among other data, temperatures, winds, snow and cloud covers. This information gives meteorologists a clear picture of the current situation as well as the ability to predict the development and direction of weather systems, changes in climate and the effects of human industry on the atmosphere. At the other end, radar provides a detailed picture of precipitation systems as they approach. Doppler radar, which is an advanced form of radar, can add important information about the wind patterns within thunderstorm systems.

Computers also have changed the job of the meteorologist. For instance, meteorologists used to draw their own weather maps and calculate, with pen and paper, the motions and development of weather systems. Today, computers do all that and more. Each day, computers in Environment Canada process no fewer than 60,000 weather observations from Canada and around the world. These are used as a starting point for atmospheric computer models and to help meteorologists produce weather forecasts and warnings. The weather service issues about 1,300 public forecasts for more than 200 regions and about 1,000 aviation forecasts for 175 airports everyday. ▲



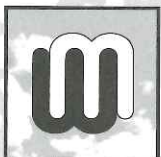
Today's meteorologists collect their data using electronic instruments and satellite images.



Weather balloon carrying instruments from the Toronto Observatory in the early part of this century.

For More Information

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Your window
on the weather

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