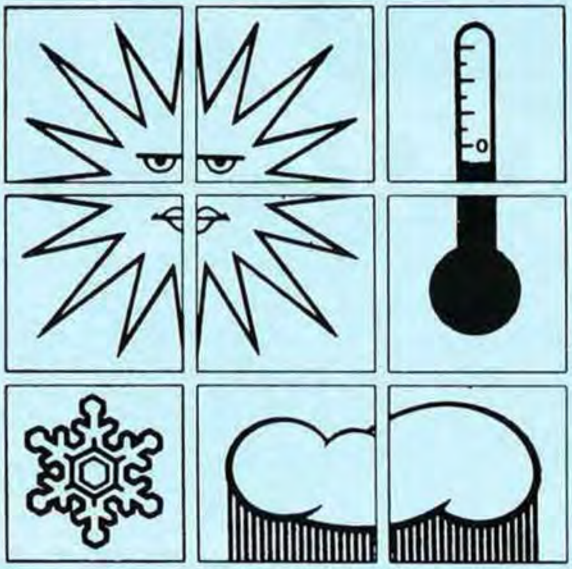
Chinook

THE CANADIAN MAGAZINE OF WEATHER AND OCEANS

LA REVUE CANADIENNE DE LA MÉTÉO ET DES OCÉANS

VOL. 8 NO. 3 SUMMER/ÉTÉ 1986



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COVER

Cool air behind a cold front has resulted in the development of fair weather cumulus clouds whose vertical growth is restricted by a subsidence inversion. Because of the strong northwesterly flow the cloud elements are aligned and form a pattern of lines that are often referred to as cloud streets. The photograph was taken during the early fall near the Frenchman's Bay area on Lake Ontario, east of Toronto, at about two o'clock in the afternoon.

COUVERTURE

L'air frais à l'arrière d'un front froid entraîne la formation de Cumulus de beau temps dont le développement vertical est restreint par une inversion de subsidence. Les forts vents du nord-ouest causent l'alignement des nuages; cette configuration en lignes est souvent appelée « rue de nuages ». La photo fut prise tôt à l'automne, à l'est de Toronto, près de Frenchman's Bay vers 14 h.

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KEEPING ON TOP OF THE WEATHER

by Philip Chadwick

A picture is worth "a thousand words" and it's a good thing! This article has room for two excellent satellite images and about 900 words. Simple addition gives a total of nearly 3000 words. This should be sufficient to highlight the interesting meteorology as viewed by the satellite during the late afternoon of November 20, 1985.

The images in question were observed by a polar-orbiting satellite and are centred over the Great Lakes. At the relatively low altitude of 850 km, the satellite orbits from pole to pole while scanning the underlying atmosphere and terrain. Images exhibiting excellent detail and clarity are produced.

On this particular November day, a vigorous cold front swept across the Great Lakes to lie just south of Lake Ontario by image time. A cold and relatively dry Arctic air mass flooded across the lakes in the wake of the front. Daytime temperatures ranged from −10 to −15°C which was about 15°C below seasonable normals. In addition the Arctic air mass was relatively stable with light winds near the surface. The wind speed increased rapidly above the surface to west-southwesterly winds of 40 to 50 knots between 900 and 1500 metres above sea-level. These physical characteristics of the situation created a very striking cloud pattern as shown in the imagery.

The satellite imagery reveals a large swath of stratocumulus forming over Lake Michigan. The southern and northern edges of the cloud align perfectly with the mean wind direction through the cloud layer. The edges are very sharp and may be traced upwind to the southern and northern extremities of Lake Michigan. The convergence of these cloud edges reveals convergence in the strong west-southwesterly flow. This fact is confirmed in the appropriate analysis of winds at the upper levels.

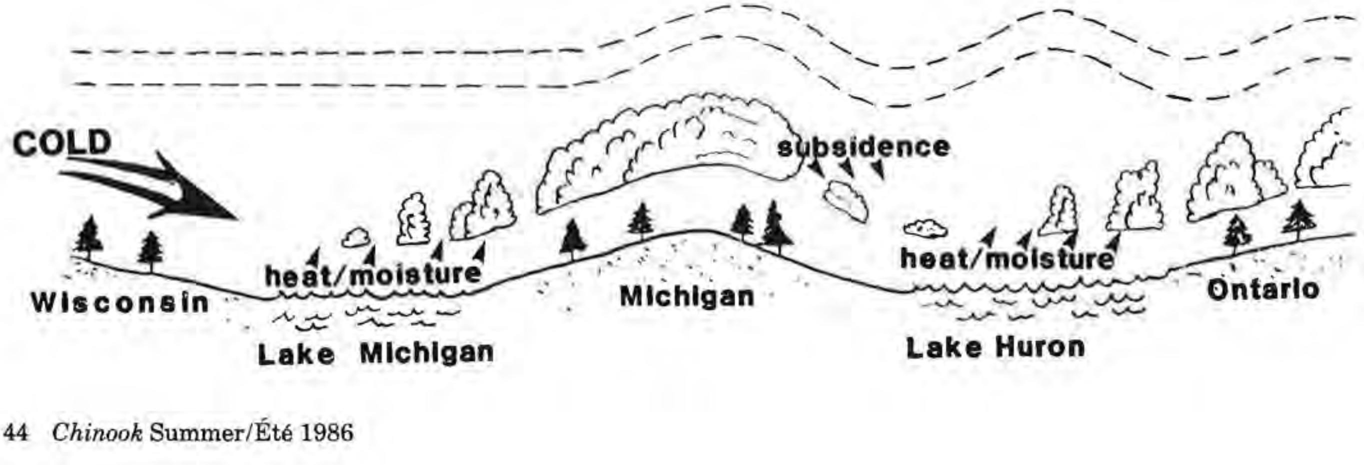
The leading edge of the cloud swath begins over Lake Michigan, the ultimate culprit! The cold relatively dry air as seen over Wisconsin passes over the warm water surface with temperatures ranging from 6 to 8°C. Immediately, the Arctic air draws heat and moisture into its lowest levels. More than one half of the total modification that results occurs within the first 10 minutes over the water surface. After the modification process is complete, the temperature of the air has climbed approximately 6 degrees and the relative humidity has increased from 50–60% to more than 75%. The result is that warm, moist parcels of air rise buoyantly in the cold Arctic air to form cloud which is confined to the lowest levels of the atmosphere. This cloud is sculpted by the wind field in the layer.

The internal cloud structure is as interesting as the large-scale cloud shape. As the clouds build vertically, they are aligned into cloud streets parallel to the wind direction. The vertical velocity field about one cloud street interacts with the adjacent streets. The net result is an array of parallel cloud streets that are most evident in the NIR image over Michigan and northern Wisconsin.

A second internal feature of interest is the banding of the cloud tops that is roughly perpendicular to the cloud streets identified. This banding results from the stable atmospheric lid put on the low-level instability generated by Lake Michigan. The atmosphere is very stable at this "lid". The strong winds in the layer below the lid are forced into vertical oscillations upon reaching hilly terrain. These vertical oscillations force the height of the stable atmospheric lid into a wave pattern that is analogous to water waves. The height of the clouds as determined by the height of the stable layer exhibits this wave structure. In the NIR satellite image, the wave structure of the cloud is made apparent through shadows and differing cloud thickness. Note that this wave banding is apparent only over and downstream from rough terrain. It is not visible over Lake Michigan.

A final point that bears mentioning about the internal structure of the cloud swath is the thinning of the cloud over northeastern Michigan. This is a result of the air mass subsiding down the eastern slopes of Michigan approaching Lake Huron and Saginaw Bay. As the air subsides, it warms owing to compression, and without the addition of more moisture the relative humidity of the air decreases. The decrease is sufficient so that the clouds become widely scattered over this region in the NIR image. The strength of this effect increases as the amount of downslope and the wind speed increases.

This "bird's-eye view" from space has allowed meteorologists to examine the atmosphere from a different perspective. Cloud patterns and physical processes that were previously only theorized are now revealed in black and white.



Near-infrared (NIR) satellite image taken at 3 p.m. EST. The shade of grey varies mainly with the reflectivity of the surface. The non-reflective lake is black and the reflective clouds are white.

The 11-micrometre satellite image taken at 7 p.m. EST. The shade of grey of the image varies directly with temperature. The warm water of Lake Michigan is black while the cold cloud tops are white.

The application of satellite imagery ranges from everyday operational forecast decisions to weighty theoretical studies of the atmosphere. With this much at stake, some people might think a picture is worth much more than a thousand words.

Philip Chadwick is an instructor in the Professional Training Section at the Atmospheric Environment Service Headquarters in Downsview, Ontario.

FATALITIES DUE TO A TORNADIC WATERSPOUT

by Michael J. Newark

Waterspouts are frequently observed over Canadian lakes and adjacent ocean waters. The *Canadian Geographic* magazine of June/July 1985 contains an excellent photograph of one that formed over Lake Winnipeg on August 8, 1984.

They are very close cousins of the tornado. In fact, visually, the two phenomena cannot be distinguished from each other because each is a rapidly rotating vortex of air (which usually is made visible by condensed moisture) in the shape of a funnel or cone. However, they form in completely different meteorological circumstances, which strongly influence their behaviour and potential for damage. The waterspout requires a sustaining marine environment and an atmosphere destabilized by cold air aloft. If one or the other of these ingredients is removed (either by the waterspout moving onshore, or by the cold air moving elsewhere) the waterspout dissipates. On the other hand, tornadoes are usually more energetic (and hence potentially more damaging) because they typically form in regions of the atmosphere where warm air converges towards the storm at levels near the earth's surface while at the same time strong winds (or jet streams) occur at higher levels. Since tornadoes form in more dynamic situations they tend to move more quickly than waterspouts, expend more energy, and persist over land.

Waterspouts are generally slow moving and long-lived, making them easy for mariners to spot and fairly easy to avoid (in power craft). As a result, over the years no proven cases of a fatal interaction between sailors and waterspouts have occurred in Canadian waters. However, they have been known to cause damage to the superstructure of boats, in one case partially lifting a vessel out of the water, and in several others causing minor structural damage as they made landfall.

MARINE FATALITIES

Obviously, tornadoes do move from the land across bodies of water, or form directly over water. These are sometimes called tornadic waterspouts. On November 10, 1983, what is believed to be a tornadic waterspout caused a fatal marine accident in Millar Channel,

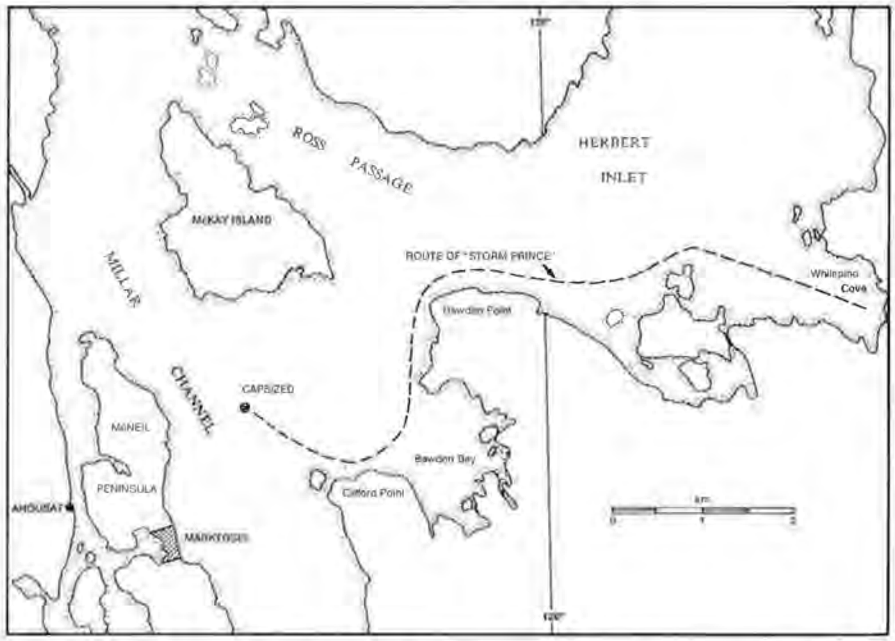


Figure 1 The location in Millar Channel, B.C. where the *Storm Prince* capsized after being struck by a tornado.

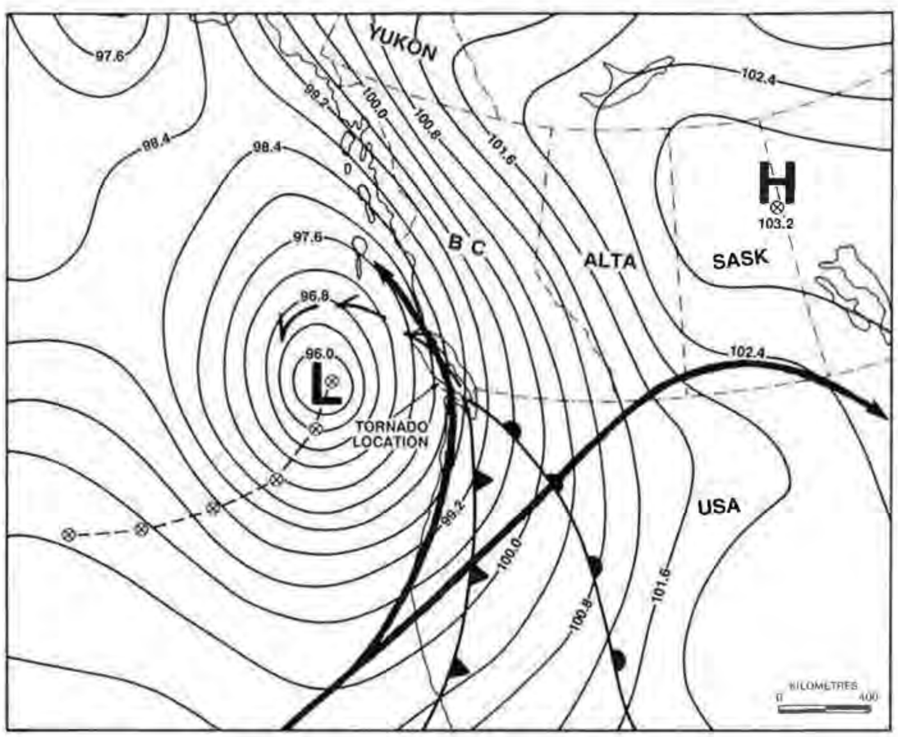
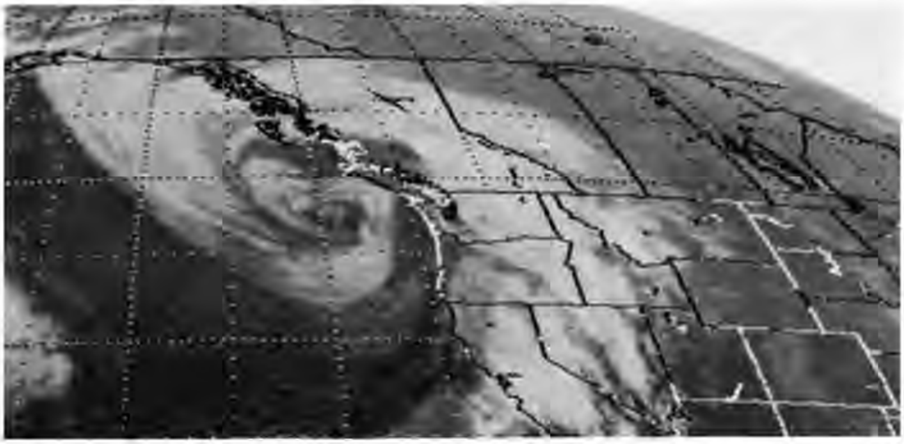


Figure 2 The synoptic surface weather map for 1600 PST, November 10, 1983. The isobars are labelled in kPa and the storm track is shown at 6-hourly intervals. The high-level jet axes are indicated by the arrowed lines.



This image of North America obtained by the GOES West weather satellite at 1600 PST November 10, 1983, shows an intense storm off Canada's West Coast. The tornado appears to have been associated with the leading (eastern) edge of the second spiral arm.

(which divides Flores Island from the west coast of Vancouver Island). At approximately 1535 PST, the 11.6-metre wooden fishing boat, ironically named *Storm Prince*, encountered the phenomenon and capsized with the loss of two lives out of a complement of 10 people.

The *Storm Prince* was ferrying forestry workers from Whitepine Cove to Ahousat (see Figure 1) and was towing a herring skiff. Because of choppy water it was decided to cease towing and three forestry workers took the skiff safely to Ahousat through 0.6 to 0.9 metre waves and winds of 25 to 35 km/h.

After hoving to at Clifford Point for a few minutes to appraise the wind and sea conditions, the operator of the *Storm Prince* started across Millar Channel in sea conditions similar to those encountered by the skiff, but with somewhat stronger winds from the south at 45 to 55 km/h. Seven of the remaining passengers were playing cards in the cabin abaft the wheel-house, while another two were in the wheel-house with the operator.

At about 1535 PST when the vessel was close to mid-channel, one of the workers went outside the wheel-house but returned almost immediately to report that the surface of the water astern was churning and a waterspout was approaching. From then on, events happened very quickly. The wind and waves veered the vessel to port; it would not repond to the helm, but broached and then capsized to starboard. Reportedly, the waves rapidly grew in height to between 2.4 and 3 metres, and the wind blew at least 110 km/h. Everyone was able to scramble outside the boat, but none had time to grab and put on a life-jacket. Subsequently, two were washed away from the capsized boat and were presumed to have drowned. The other eight were rescued by small boats from the village of Marktosis where residents had witnessed the tragedy.

NOVEMBER 10, 1983 WEATHER

It is interesting to look at the weather situation of Thursday, November 10, 1983 (Figure 2). During the day an intense Pacific storm swept northeastwards towards Vancouver Island, but curved towards the north during the afternoon. By 1600 PST it had deepened to about 95.6 kPa and was centred about 650 km west-southwest of Victoria. Weather satellite images (see photograph) show that the storm was in a very mature stage of its life cycle, with $2\frac{1}{2}$ spirals of warm air wrapped into the storm centre. It appears that the tornadic waterspout occurred in association with convective cloud embedded in the second arm of the spiral cloud band. It was also located beneath the left exit of a velocity maximum in the jet stream, a favoured position for severe thunderstorm development. The axes of the high-level jet streams are shown in Figure 2.

Data and statistics concerning tornadoes over land are relatively plentiful, but over ocean areas there is very little information, so that the characteristics of marine tornadoes are not well known. The west coast of Vancouver Island may seem to be an unusual location and November an unusual month for a tornado occurrence. However, in the United Kingdom (which experiences Atlantic storms in much the some way that Vancouver Island experiences Pacific storms) tornadoes are frequent and their maximum number from 1960 to 1982 occurred in November. In fact, on November 23, 1981 a super-outbreak of 102 tornadoes formed in association with a vigorous storm (low pressure, 98.6 kPa) centred near the Faeroe Islands (Elsom and Meaden, 1984).

Given the paucity of meteorological reports off Canada's West Coast, and the sparse population along most of that coast, it is possible that tornadoes are more common there than is generally thought to be the case.

FURTHER READING

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Michael Newark is the founder-editor of *Chinook* (1979–1984). He was for many years a forecaster in the Ontario Weather Centre and the Centre's Summer Severe Weather Meteorologist. He is currently head of the Climate Monitoring and Prediction Section of the Canadian Climate Centre.

RÉSUMÉ *Au point de vue visuel, les trombes marines ressemblent aux tornades mais elles résultent de conditions météorologiques bien différentes. Les tornades se forment lors de situations atmosphériques plus dynamiques que les trombes marines; elles se déplacent aussi plus rapidement et dégagent plus d'énergie, et elles persistent sur terre tandis que les trombes marines, en général, se dissipent lorsqu'elles atteignent la côte. Il arrive parfois qu'une tornade se forme au-dessus de l'eau ou qu'elle parcourre des masses d'eau après s'être formée sur terre. Voilà ce qui se serait produit le 10 novembre 1983 quand, apparemment, une tornade causa un accident maritime mortel dans le canal Millar (qui sépare l'île Flores de la côte ouest de l'île Vancouver, en Colombie-Britannique). Vers 1535 HNP, un bateau de pêche en bois, de 11,6 m, portant ironiquement le nom de « Storm Prince », chavirait sous l'effet de ce phénomène en enlevant la vie à 2 des 10 personnes à bord. Bien que la côte ouest de l'île Vancouver semble peu propice à la formation de tornades, et que ce phénomène soit rare en novembre, on observe que les conditions météorologiques prédominantes sont analogues à celles du Royaume-Uni qui connaît un climat maritime où c'est en novembre que les tornades se manifestent en plus grand nombre. Étant donné la population clairsemée de la côte ouest du Canada, il est possible, contrairement à l'avis général, que les tornades soient en ces endroits, des phénomènes fréquents.*

WEATHER AND THE CONTROL OF PLANT DISEASES

by William J. Blackburn, Andrew Bootsma and Terry J. Gillespie

The use of weather information is playing an ever increasing role in agricultural decisions. For example, we know that radiation and temperature characteristics are important in influencing the rate at which plants transpire water and take in carbon dioxide from the air, and the rate of crop development. Therefore, this weather information is valuable not only to the meteorologist, and other scientists, but also to the farmer. Important advances in using these and other data, including moisture (rainfall, dew duration), relative humidity, and heat units have been made in agriculture.

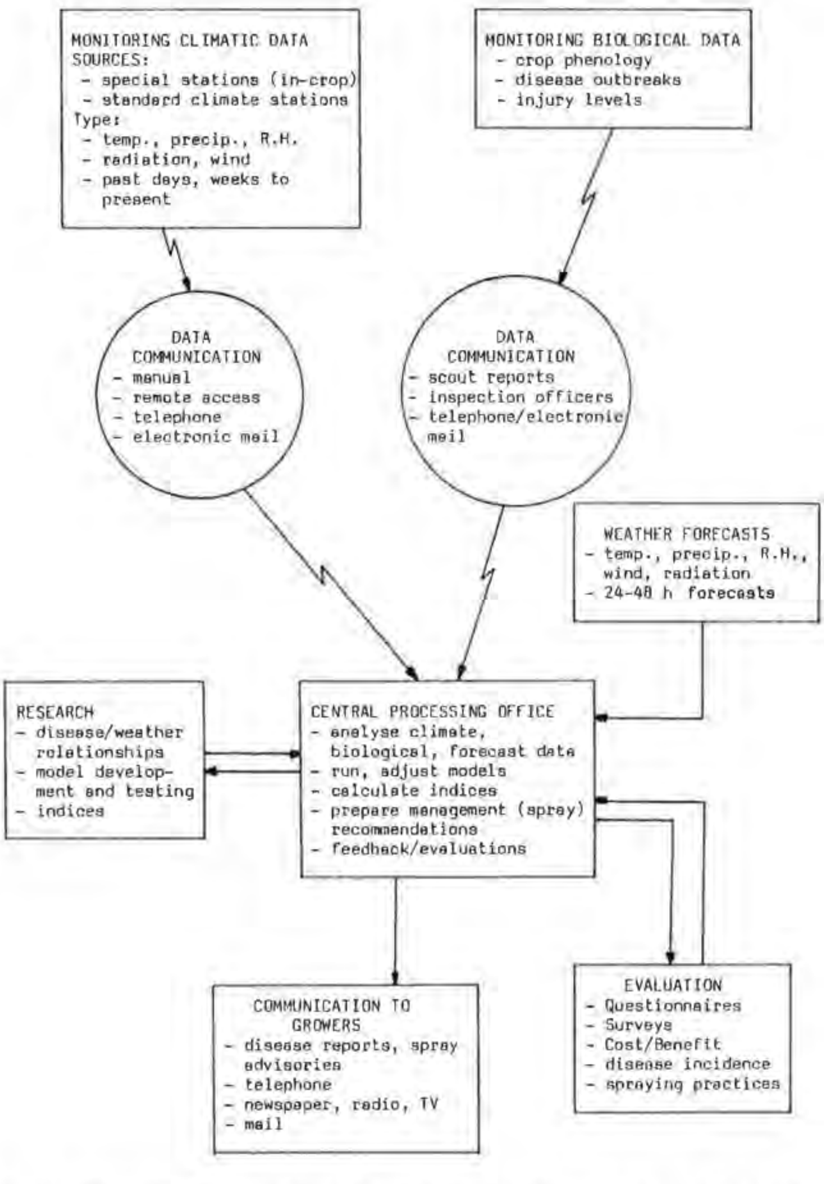

Figure 1 Schematic diagram of typical procedures and interactions involved in implementing weather-based disease management programs.

Weather data are becoming more essential for disease control in fruit and vegetable crops, and have proven highly useful in developing weather-based schemes for the timely application of fungicides. Most fungal crop diseases result from interactions between the plant (host), the disease (pathogen) and the environment. Hence, data describing the climate within the crop can be merged with biological data to help predict the level of disease in the field. Therefore, disease outbreaks can often be related to specific ranges of temperature and moisture. The use of weather data is continuing to be developed for effective disease control and contributes to the increased adoption of "Integrated Pest Management (IPM)" schemes that have developed in the Canadian horticultural sector over the past few years.

Approaches in IPM are numerous for horticultural crops. In this article three examples have been selected so as to represent efforts that have been made in this direction; namely, weather-based schemes for apple scab, potato late blight, and carrot blight. All of these schemes aim to improve the timing and number of fungicide sprays used to control these diseases. In many cases these schemes will achieve better disease control at less cost since the number of spray applications that are needed can often be reduced.

While most weather-based schemes for disease control have slightly different requirements from each other, the general procedures for implementing such programs are very similar for many diseases. Figure 1 summarizes the procedures usually involved in forecasting the outbreak of diseases and advising growers when to apply sprays.

APPLE SCAB INFECTION

Apple scab is a major disease in apple-growing areas of Canada. This disease overwinters in the leaf litter on the orchard floor. In the spring, tiny spores (called ascospores) are released and carried by the wind to infect new foliage on the trees. Studies in Ontario have shown that the release of ascospores in spring is closely related to the total number of heat units (degree-days above 0°C) that have occurred in a given year.

In these studies, data on the formation of ascospores and their release into the air were taken from "McIntosh" apple leaf samples collected from orchard litter and analysed along with weather data for various Ontario apple-growing districts. It was found that some phases of ascospore maturity and discharge were related to some stages of development of the apple tree and others were not.

Apple growers are most concerned about the first time that ascospores are released from the orchard litter in the spring since they are attempting to keep the fruit completely free from disease. Therefore, in order to determine the most appropriate date to start accumulating heat units, it is desirable to select the development stage of the apple tree that corresponds best with the time the first ascospores are released. Silver tip (when the buds are swollen and bud scales are separated at the tip to expose some light grey tissue) was selected since data showed that first discharge usually occurs after this stage.

Examination of 13 years of data revealed that the number of days between silver tip and estimated first ascospore discharge was closely related to the cumulative degree-days over the same time period. Degree-days were calculated from the average of daily maximum and minimum temperatures. This relationship assumes that once the required number of degree-days is obtained, a rain event of greater than 2.0 mm must follow silver tip to initiate ascospore discharge.

This relationship can be used to help decide when to begin spraying fungicides to control apple scab. Sprays are needed when the sum of the degree-days computed using temperatures measured on-site or at a nearby weather station equals or exceeds the required threshold. Use can also be made of weather forecasts. For example, the forecast temperatures for the next 3 to 5 days may be used to calculate the degree-days, which can be compared to the threshold value.

Horizontal boom sprayer in a carrot field in the Holland Marsh, Ontario.

Flat plate used to measure duration of wetness on apple leaves.

POTATO LATE BLIGHT

In areas of Canada where potatoes are grown in humid climates, fungal diseases may cause serious economic losses unless proper control measures are undertaken to prevent the spread of disease. Late blight of potatoes is one such disease that requires periods of high relative humidity (wet foliage) for the disease to spread and infect new plant tissue. A weather-based control scheme has been used effectively in Prince Edward Island and is similar to those used successfully in other parts of the Atlantic region of Canada and in the northeastern United States.

Forecasts of the initial occurrence and subsequent spread of late blight are based on measurements of relative humidity (RH), temperature and rainfall taken within the crop. From these data the following values are computed for each day: the number of continuous hours with RH greater than 90%, the average temperature during the period of RH greater than 90%, the maximum and minimum temperatures, and the total 24-hour rainfall amount. A daily index is computed to describe the severity of the weather for blight development. This index (called blight severity index (BSI)) ranges from a value of 1 to 4 depending on the average temperature and the hours of RH above 90%.

When the RH is high for long periods the BSI is high (closer to 4), indicating that conditions are conducive to development of late blight. During warm, wet weather, the blight develops more rapidly so that fewer hours of high RH are needed to produce high BSI values.

Values of the BSI are accumulated for the preceding 7-day period and combined with rainfall data to determine the risk of blight outbreak (i.e., "very low" to "extreme"). The most suitable spray schedule may require the spray interval to be as short as 5 to 7 days or as long as 14 days or more depending largely on the 7-day accumulation of the BSI.

Left Carrot blight showing typical symptoms of dying tissue on the leaf margins. *Right* Typical lesions caused by the late blight fungus on potato leaves (From: Busch, L.V., 1979: Late Blight of Potato. Ontario Ministry of Agriculture and Food Factsheet 79-043).

CARROT BLIGHT CONTROL

Alternaria leaf blight is a disease that commonly occurs in carrot crops. Just as for apple scab and potato late blight, its spread is also related to weather factors.

A predictive scheme was developed to improve the efficiency of fungicide use in controlling alternaria leaf blight in carrots. Spray scheduling can be timed according to blight-favourable weather. This scheme has controlled blight effectively. Frequently, one to five fewer sprays are required than in a traditional spray program after blight symptoms are observed on 1 to 2% of the foliage in the field.

Studies show that fungicides need only be applied when forecast weather for the forthcoming 36 hours is favourable for infection of carrot leaves by the fungus. This forecast uses data on temperature and leaf wetness duration. Temperatures are based on regional forecasts, and wetness duration on the occurrence of rain and regional forecasts of cloud cover and surface wind speeds.

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William J. Blackburn is an Agrometeorologist with the Resources and Environment Section, Regional Development Branch, Agriculture Canada, Ottawa. His work has focussed on environmental factors and technology related to crop yield and production trends, practices, efficiences and potentials. He is also a member of Canada's expert Committee on Agrometeorology.

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RÉSUMÉ *On discute de l'application des données météorologiques aux scénarios de contrôle des maladies dans trois cultures horticoles. L'utilisation de telles données permet d'établir un rapport quantitatif entre les conditions météorologiques et les facteurs de maladies dans les cultures, en vue de planifier la pulvérisation de fongicides. Étant donné que la température et l'humidité dans les cultures diffèrent souvent et considérablement de celles enregistrées aux stations météorologiques avoisinantes, il est habituellement nécessaire d'y placer des instruments météorologiques afin de rendre effectifs les scénarios de prévisions des maladies. Grâce à des recherches plus poussées sur ces différences, il sera de plus en plus possible d'utiliser les données provenant plutôt de stations météorologiques standard. Les scénarios basés sur les données météorologiques permettent fréquemment aux exploitants agricoles de mieux choisir le moment idéal de pulvérisation et de réduire le nombre de pulvérisations nécessaires; il en résulte d'importantes économies, une amélioration du contrôle des maladies et une réduction de la contamination environnementale.*

PROFESSOR KINGSTON'S SCHEME FOUNDING THE METEOROLOGICAL SERVICE

by Morley Thomas

On November 3, 1870 William Smith, Deputy Minister of Marine and Fisheries, wrote Professor Kingston of the Toronto Observatory, to inform him "that the Minister approves the scheme proposed by you". The part of Kingston's "scheme" approved at that moment was simply to have certain lighthouse keepers take meteorological observations. It was this simple acceptance of a proposal to have federal government employees take weather observations that opened the door for the founding of the Meteorological Service of Canada.

The first systematic, scientific weather observations had been taken in Quebec City from 1742 to 1756. Official, or government, meteorology began in 1839–40 when Her Majesty's Magnetic and Meteorological Observatory was established in Toronto. A detachment of the Royal Artillery manned the observatory until 1853 when the Imperial Government withdrew its support. The Canadian Legislature then undertook to maintain the observatory and placed it under the supervision of the University of Toronto.

George Templeman Kingston arrived in Toronto in August 1855 to become professor of meteorology and director of the observatory. A Cambridge graduate, Kingston was abreast of the developing theories of meteorology and of the steps that were being taken in Europe, Britain and the United States to develop "weather telegraphy" – the use of the new telegraph system to collect and distribute weather information from which, it was hoped, "a knowledge of the laws that govern the progress of storms" would be gained and storm warnings attempted.

OBSERVATIONS

In Canada the Legislature had passed a bill calling for a program of meteorological observations at the senior county grammar schools. Delayed for lack of equipment, since American manufactured instruments had proved to be unsatisfactory, the program had not yet started in 1855. Kingston became involved and wrote the instructions for use in the schools but his view of the future for meteorological observing was wider than the grammar school program. Early in 1856 the Canadian Institute established a Meteorological Committee to consider "rendering the [observing] system complete". Kingston was named chairman and reported to the Institute early in 1858. In it he suggested that, since the grammar school system was now in place, the Institute should recruit and support additional observers and place them in communication with the Toronto Observatory. The Institute took little or no action on the recommendations. Kingston's first reports to the U of T's Board of Visitors, written in December 1855 and October 1856, had optimistically referred to additional work to be undertaken at the observatory to receive, process and perhaps publish climate data from the grammar schools and private observers. But it is likely that Kingston was sharply criticized for planning to undertake this extraneous work since it was not mentioned in his later annual observatory reports.

Professor G.T. Kingston (1816–1886), Director of the Observatory from 1855 to 1880 and Founder of the Meteorological Service (Photograph: *Journal of the Royal Astronomical Society*, 1940).

WEATHER FORECASTS

The challenge of weather forecasting was "in the air" in the 1850s. Following discussion in the Canadian Institute about the need for a system of simultaneous meteorological observations in British North America, Kingston presented a paper in 1857 on the employment of the electric telegraph for predicting storms. The Institute endorsed Kingston's plan and copies were sent to several Boards of Trade, insurance companies and the government. There is no evidence that any action resulted but Kingston now had the basis of his "scheme", which consisted of a Central Office, different classes of observing stations and, in time, a weather forecasting service.

The second Toronto Observatory, built in 1855, where the Meteorological Service was organized and administered from 1871 to 1908 (Photograph: *Journal of the Royal Astronomical Society*, 1940).

Dr. Charles Smallwood (1812–1873), Founder of the McGill Observatory in 1863 (Notman Photographic Archives No. 73424-B1, McCord Museum, Montréal).

Meanwhile Kingston was establishing contacts with others interested in meteorology in British North America. With the advent of Confederation, he became concerned over the "anomaly involved in this observatory being the property of the Dominion and under the supervision of a local university", and wrote suggesting that the Québec, McGill and Queen's observatories be supported, that observatories be set up in Nova Scotia and New Brunswick and that all report to the Toronto Observatory. He wrote to several officials, such as Sandford Fleming, urging the establishment of a network for rain gauge stations to provide a "service to engineering", and to several politicians promoting an observatory in the Red River Settlement. He also corresponded with officials of the Northern Railroad, a fruit-growers association, the Crown Lands Department and universities regarding weather observations.

In Europe there had been a remarkable surge of interest in the science of meteorology in the two to three decades prior to 1870. Several scientists had published on the theory and "philosophy" of storms, and the first International Meteorological Conference was held in Brussels in 1853. Several western European countries set up meteorological institutes, observatories or services during the early and mid-1850s and began the national collection of meteorological data. Weather telegraphy followed in most European countries by 1870 and several services and institutes began to issue storm warnings and general forecasts during the next decade.

In the United States, meteorological science was also being developed and the politicians had become aware of a public demand for storm warnings. The result was the passing by Congress on February 9, 1870 of a joint resolution that authorized the Secretary of War "to provide for taking meteorological observations at the military stations and at other points in the interior of the continent, and for giving notice on the northern lakes and seaboard of the approach and force of storms". The Signal Office was charged with developing and supervising the service and on November 1, 1870 "systematic synchronous meteoric reports" from 24 stations were "placed upon the telegraph for transmission". Storm warnings were first issued a few days later and "weather probabilities" were published twice daily beginning in 1871.

CANADA 1867–1870

An Act establishing the Canadian Department of Marine and Fisheries was assented to on May 22, 1868. There was nothing in the Act regarding meteorology but the department was made responsible for "such matters as refer to the marine and navigation of Canada". As it happened these years were "extremely boisterous and stormy" and considerable loss of life and property was reported from both the seaboard and the inland lakes. In July 1870, Kingston visited the Deputy Minister of Marine and Fisheries to discuss his scheme to collect data which they both hoped would be useful in discovering the laws governing storms so that a system of storm signals to warn mariners and fishermen might soon be set up.

Kingston continued to approach other federal politicians, writing to the Secretary of State, the Minister of Public Works, the Minister of Agriculture, and the new Lieutenant Governor of Manitoba. But when he received the Deputy Minister's letter of November 5 advising him that the Minister had approved his scheme he dropped his other contacts and moved quickly to propose guidelines for the program. After receiving advice "that $5,000 had been placed in the estimates for meteorological observations" he sent off detailed expenditure plans and a request for "authority" for himself. On May 1, 1871 the Governor General approved the proposed expenditure and Kingston began to plan for launching the lighthouse observing program.

Built in the early 1870s, this house served as the residence and telegraphic reporting station for Manuel Payne, the Port Stanley observer from 1873 to 1908.

CHIEF STATIONS

During the summer of 1871, equipment and supplies were forwarded to 37 lighthouses and Kingston moved quickly to have superintendents named for the Chief Stations he had included in his proposed organization. Frederick Allison of Halifax, Gilbert Murdoch of Saint John and Dr. Charles Smallwood of Montréal were appointed superintendents on July 1, 1871, at $400 a year, the first paid personnel of the Meteorological Office. Kingston himself continued to work gratuitously; it was 1873–74 before he was paid an additional $1,000 a year for his Service work.

In addition, Kingston was given authority to negotiate with Professor W.B. Jack of the University of New Brunswick, and with the Bishop of Rupert's Land for two stations, one at Winnipeg and another at Spence's Bridge, B.C. By March 1872, Chief Stations were operating at seven locations. The concept of Chief Stations had been basic in Professor Kingston's scheme but their importance began to fade almost immediately as the rapid introduction of self-registering instruments alleviated the need for several observations each day.

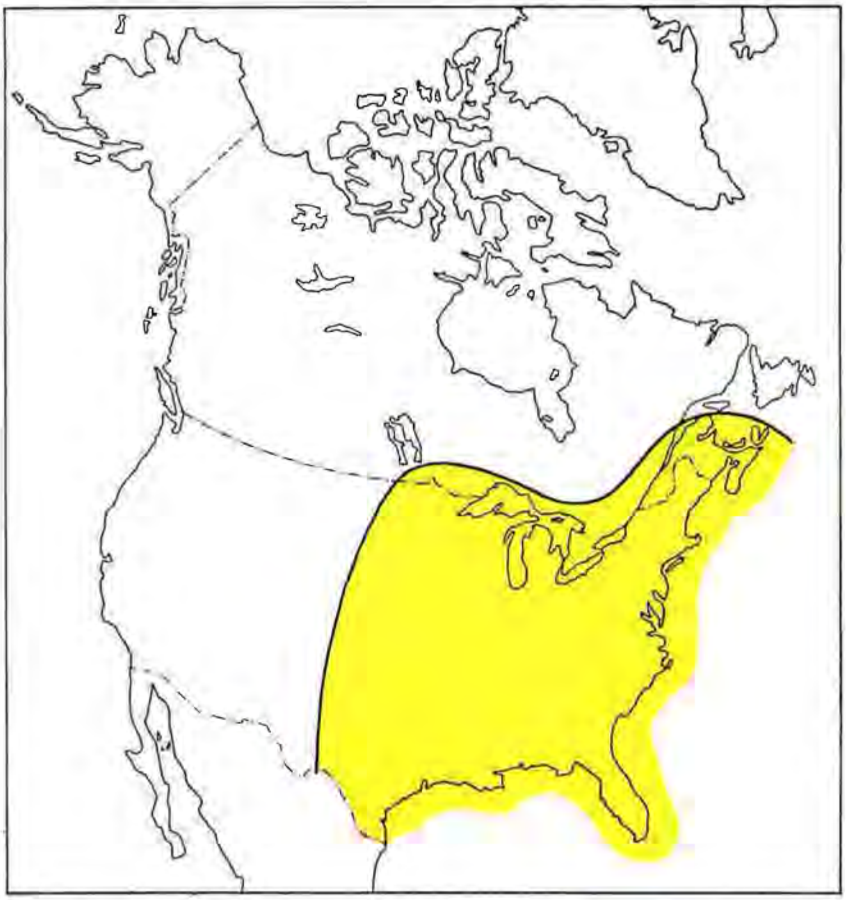
TELEGRAPH STATIONS

When Professor Kingston wrote to the Chief Signal Officer of the U.S. Army in June 1871, as authorized by the Minister of Marine and Fisheries, to inquire about the possibility of a "systematic interchange, by telegraph, of meteorological information between Canada and Washington" he was advised that "such an interchange will be cheerfully made". Kingston, however, was in no position to move rapidly into weather telegraphy since he had no resources. He advised the Deputy Minister that "it would be wise policy for Canada to allow time for the further development of the System before becoming committed to any costly telegraphing arrangements". Meanwhile the U.S. Chief Signal Officer had another contact in Canada whom he used to speed Canadian participation. Earlier, in March 1871, Dr. Smallwood of the Montréal McGill Observatory had written to the Americans requesting an interchange of meteorological observations by telegraphy. The response was enthusiastic; Lieutenant Howgate, Acting Signal Officer, went so far as to suggest the posting of U.S. Army observers to Canadian stations if "permission can be obtained from the Colonial Government". Despite being told by Kingston that he had been given governmental authority, the Americans continued to press Smallwood for observations from other Canadian locations during the summer and fall of 1871.

Early in October 1871 Kingston advised the Chief Signal Officer that he had made arrangements with his meteorological agents in Halifax and Saint John to telegraph weather reports to Washington and that he could arrange for seven additional stations to start within a year. To Kingston's dismay the Chief Signal Officer responded by asking for telegraphic weather reports from five locations on the Great Lakes and advising that reports from Quebec and the Maritimes were "not of special value to our service at present". In subsequent correspondence over the next two weeks, stations at Port Dover, Port Stanley, Kingston and Saugeen/Southampton were agreed to and for the remainder of 1871 Professor Kingston was exceedingly busy finding observers and sending instructions and equipment to the new stations. Negotiations were begun with the Montreal Telegraph Company, and the international exchange of data with the Americans began on January 2, 1872.

Kingston's development of his meteorological system during the late months of 1871 was most remarkable. In negotiating with the new telegraph station observers he gambled that the service would soon be funded. He told each observer that he had recommended payment of $18 a month and that he, Kingston, would personally guarantee payment of $15 for the month of January 1872. Soon after the New Year he reported his progress to the Department in Ottawa, stating that "my action so far has been at my own risk" and submitted estimates amounting to an additional $4,000 for the remainder of the fiscal year, which ended on June 30, 1872.

No help came from Ottawa. On February 14, 1872 Kingston was forced to write to his new observers and to the office of the Chief Signal Officer in Washington to advise that weather telegrams from the four out-stations were suspended "till Parliament has voted the necessary supplies". Optimistically Kingston continued to pursue his contacts for additional Chief and Telegraph Stations and prepared estimates totalling $25,000 for the next fiscal year.



Southeastern North America – the limited area covered by the Canadian daily weather maps in the late 1870s.

However, the potential value of storm warnings and weather forecasts was being recognized by the bureaucrats and the politicians. Questions were raised in Parliament regarding the government's intention to establish a meteorological bureau and several Members spoke in support of a Canadian meteorological system, but apparently no attempt was made to introduce a meteorology bill to formally establish a Service and charge it with specific responsibilities. Because of the American interference, however, a return of "all correspondence with the Government of the United States and persons in the Dominion on the subject of Meteorological observations and weather reports" was requested by a Member and tabled in the House.

Kingston received an additional $5,000 and on July 1, 1872 the thrice-daily exchange of data with the Americans was resumed, an exchange that has continued daily ever since. Québec was added to the telegraphic list in July and Fort Garry (Winnipeg) and Halifax later in the year. Thus by the fall of 1872 Kingston had seen his "scheme" become an operational system.

ORDINARY STATIONS

The rest of the scheme had not been forgotten either: In addition to the Chief and Telegraph Stations, Kingston in the course of a few years built up an additional network of about 100 "ordinary" stations, all of them operated by volunteer observers. Expansion into the West began a year or two later with assistance from the North-West Mounted Police who took observations at several of their stations in what is now Saskatchewan and Alberta, and from officers of the Church of England who arranged for instruments to be set up at several missions in Manitoba and the Northwest Territories.

Kingston had hoped to receive support from the Superintendents at the Chief Stations in supervising the ordinary stations. In 1872 he appointed Frederick Allison of Halifax to be Chief Meteorological Agent for Nova Scotia.

METEOROLOGICAL SERVICE OF THE DOMINION OF CANADA.

WEATHER BULLETIN,

ISSUED BY THE CENTRAL OFFICE, TORONTO, AT 10 A.M., *January 1st, 1878.*

Received by Telegraph at *Halifax* *at 11.45 a.m.,* *F. Allison* *Agent.*

PROBABILITIES FOR THE NEXT 24 HOURS.

* FOR THE LOWER LAKE REGION :—

Moderate to fresh south-westerly to north-westerly winds; clear to fair weather.

FOR THE ST. LAWRENCE :—

Moderate to fresh south-westerly to north-westerly winds; clear to fair weather; stationary or rising temperature.

FOR THE MARITIME PROVINCES :—

Decreasing northerly to westerly winds; clearing and colder weather.

These probabilities are issued at 10 a.m. Toronto time, and are for the 24 hours following.

LOWER LAKE REGION includes the Peninsula of Ontario, and east as far as Kingston.

ST. LAWRENCE includes the St. Lawrence River and adjacent territory.

MARITIME PROVINCES includes Nova Scotia and New Brunswick and Prince Edward Island.

The ordering up of the Cautionary Storm Signals (which constitutes a storm warning), is intended to warn those connected with shipping that a storm will probably occur, either at the place at which the signal is displayed, or within such a distance that ships leaving port might be affected by it.

* The probabilities for each district (with a few exceptions) are sent only to those stations situated in that district.

An example of a weather forecast displayed in Halifax, N.S., in 1878.

METEOROLOGICAL SERVICE OF THE DOMINION OF CANADA.

STORM WARNING.

Issued by the Central Office, Toronto, at 7.10 p.m., 21st December 1878.

Received by Telegraph at *St. John at 9.05 p.m. local time* *J. Murdoch Agent.*

CAUTIONARY STORM SIGNALS ARE ORDERED UP AT

Gaspé,	*Chatham,*	*Glace Bay.*	*Liverpool,*
Percé.	*Point du Chêne.*	*Cow Bay.*	*Digby,*
Dalhousie,	*Charlottetown,*	*Louisburg,*	*St. John,*
Bathurst.	*Pictou,*	*Port Hastings.*	*St. Andrews.*
	Sydney,	*Halifax.*	

G. T. KINGSTON, *Superintendent.*

The ordering up of the Cautionary Storm Signal is intended to warn those connected with shipping that a storm will probably occur, either at the place at which the signal is displayed, or within such a distance that ships leaving port might be affected by it.

An example of a storm warning displayed in Saint John, N.B., in 1878.

Through Allison's efforts additional stations were obtained but soon confusion arose regarding the extent of his authority. Later J. Murray of Spence's Bridge, B.C. was successful in obtaining 20 or so precipitation observers in that province. The officers of St. John's College in Winnipeg, the Chief Station established by the Bishop of Rupert's Land, was successful in setting up a few volunteer stations in Manitoba. However, Kingston was unable to use the Chief Station Superintendents to any extent to lighten the administrative and supervisory tasks at the Central Office – mostly because he seemed unwilling to delegate authority and to share "control" of his new system with his subordinates across the country. Until late 1872 Kingston had only the help of his three observers in Toronto. Over the next few months he was permitted to hire a few assistants for the new Service including Charles Carpmael, another Cambridge MA, who eventually succeeded him as director.

THE OPERATIONAL SYSTEM

At the reporting Telegraph Stations, observers were responsible for 3 observations a day at 7:25 a.m., 4:25 p.m. and 10:40 p.m. Toronto Mean Time. After examination the Canadian telegraphed reports were sent on to Washington and in exchange the daily reports from a few U.S. stations were sent from Buffalo to Toronto. Maps were prepared at the Toronto Central Office and from them deductions were made regarding expected weather and whether or not storm warnings should be issued. For the first few years Kingston and his assistants relied on warnings sent from Washington, but beginning in September 1876 all decisions on storm warnings were made independently of Washington.

Both Britain and the United States had begun storm signal programs where cautionary drums, baskets or lights were hoisted on masts overlooking ports and harbours whenever stormy weather was expected. With the objective of reducing storm losses, Kingston was able to move quickly to organize a similar system. Spurred by the loss of 600 lives and 1,100 vessels in Atlantic Canada from the passage of a hurricane in August 1873, there were 36 storm signal stations operating within two or three years. In addition, by 1878, Toronto prepared daily "probabilities" for the ensuing 24 hours that were issued daily at 10 a.m., Sundays excepted, for newspapers. The "probabilities" were also posted at telegraph and post offices and by 1878 were received in over 100 places in Ontario, Quebec and the Maritimes.

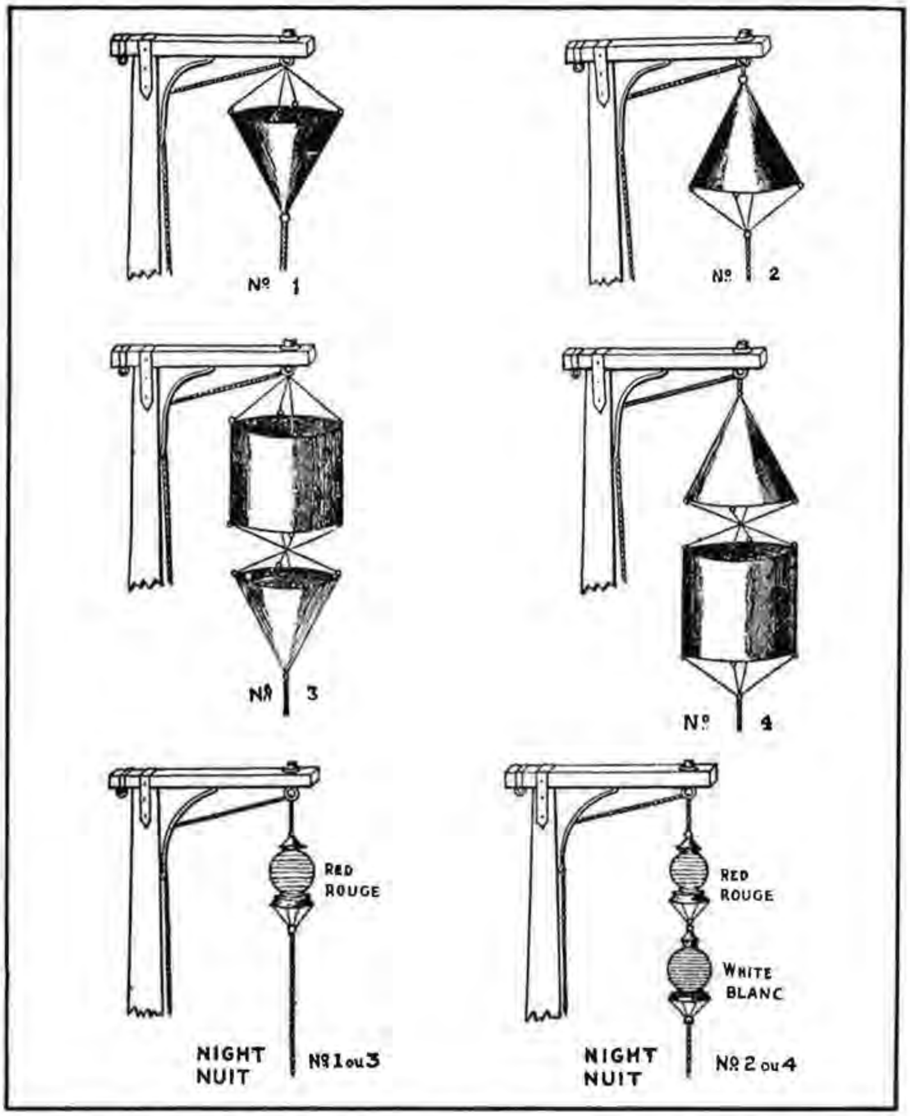
CONCLUSIONS

Undoubtedly because of Empire connections and his own background, Kingston looked to Britain for guidance and support in developing his scheme for a meteorological system in Canada. For example, in the late 1860s he began ordering meteorological instruments from English firms through the British Meteorological Office. In the 1870–72 period Kingston gave every indication that he wished only to gather and analyse climate data before getting into weather telegraphy, following the policy laid down by the Royal Society's Meteorological Committee. He was, however, forced to move much more quickly, mainly on account of the Americans.

As might be expected Canada's meteorological relations with the United States were, and are, unique. Mention has already been made of Canada's rapid move into weather telegraphy because of the advantages to be gained from the U.S.'s "very liberal and extensive scheme ... which in other circumstances would have been better postponed". Politically there was undoubtedly the realization that the Americans needed, and were going to get in some manner, daily weather observations from Canada. However, the Canada/U.S. cooperation begun by Kingston and his U.S. national weather service counterparts has flourished and continued without interruption.

George Templeman Kingston was truly the founder of the Canadian meteorological service. Under his supervision a unique civilian Canadian system was developed, borrowing from both the Americans and the British whenever this would be advantageous. He was firm in his belief that his should be the only authority in the Service and he battled the Department for more and more resources with moderate success.

Kingston was never a robust healthy man. Early in his life a career in the Royal Navy had to be given up on account of poor health. Frequently complaining of exhaustion and absent through illness during the latter half of 1879 he was forced to retire on January 31, 1880 and died in Toronto on January 21, 1886 in his 70th year.



The signals indicate the probable occurrence of : 1 (2) – a gale *at first* from an easterly (westerly) direction; 3 (4) – a HEAVY gale *at first* from an easterly (westerly) direction. The night signal corresponding to No. 1 or 3 is a red light, and to No. 2 or 4 is a red light above a white light.

FURTHER READING

Newark, M.J., 1983–4: The Pre-Confederation Weather Network. *Chinook*, Vol. 5/6, 42–45.

Sommerville, S., 1981: Dr. Charles Smallwood: A Meteorological Pioneer. *Chinook*, Vol. 3, 56–57.

Morley Thomas has had a long and distinguished career with the Atmospheric Environment Service and the World Meteorological Organization. He is a former Director General of the AES Canadian Climate Centre and is currently Archivist for the Canadian Meteorological and Oceanographic Society.

RÉSUMÉ *En 1855, on nommait George T. Kingston professeur de météorologie et directeur de l'observatoire de magnétisme et de météorologie à l'Université de Toronto. Les quelques années suivantes, il a travaillé, de concert avec le ministère de l'Éducation, à recruter des observateurs bénévoles et à mettre en oeuvre un système d'observations météorologiques dans les collèges du Haut-Canada. Comme suite à ses propositions au Gouvernement fédéral, le ministre de la Marine et des Pêches acceptait en 1870, que les gardiens de phares relèvent des observations. Plus tard dans l'année, les États-Unis lançaient un service opérationnel d'observations et de prévisions météorologiques qui nécessitait de mettre sur pied au Canada, des stations de transmission télégraphique d'observations. C'était là une chance à ne pas manquer et, en 1871, Kingston commença à participer à l'installation d'un réseau provincial de stations d'observations et de stations climatologiques principales et ordinaires. C'est en 1869 que les premières données climatologiques furent recueillies; 1872 marqua le début de l'échange, aux fins d'exploitation, des données transmises par télégraphe entre les États-Unis et le Canada; et en 1876, le bureau central de Toronto émit les premiers avis de tempêtes et les premières prévisions météorologiques générales.*

THE WINTER OF 1985–86

by Andy Radomski

Mean temperatures were consistently above normal in the Yukon, Northwest Territories and extreme northern Quebec for each of the three winter months. The contrary was true in northern Ontario and central Quebec. In the Prairies, where winter temperatures averaged well above normal, only February was relatively cold. January at many B.C. and Prairie locations was the warmest ever. Weather systems moving across the Great Lakes and up the St. Lawrence Valley gave typically changeable conditions for this time of year. Heaviest snowfalls occurred to the lee of the Great Lakes in December, and in the Gulf of St. Lawrence in January. Snowfalls were above normal across the North, especially in northern Quebec and Baffin Island, where some were almost double the normal. Except in February, southern Alberta was very dry. By mid-January, the snow pack was almost depleted in central Alberta, and non-existent in the south. Owing to the lack of moisture and snow on the western prairies, strong winds caused some soil erosion, while the lack of snow to the east allowed farmers to complete their fall harvest. Although eastern Canada received its fair share of Atlantic storms, the winter began and ended dry and sunny – The precipitation was excessive only during January. A cold December caused ice to develop rapidly in the Gulf of St. Lawrence, where by mid-winter, the ice was extensive and thick. Strong northwesterly winds congested the ice-pack, and made this one of the more difficult ice seasons for the Coast Guard.

DECEMBER

The record cold weather that covered western Canada during November was slowly replaced by much milder air. Weather systems affecting the west coast regularly produced cloudy skies, but only light precipitation. After the middle of the month, a strong high pressure built northwards across western Canada. A southerly flow of very mild air from the U.S.A. overran the cold air trapped in B.C. valleys. As a result thick fog developed during the Christmas period and disrupted transportation. Many high temperature records were broken in northern B.C. and the Yukon, but the warm weather was also accompanied by freezing rain. Even under above normal temperatures, all lakes and rivers were frozen by mid-month across the North. Blowing snow and blizzards were common in the central and eastern Arctic.

In Alberta, where skies were mainly sunny, temperatures soared into the teens during the holiday period, breaking many records. When the mild weather reached the eastern prairies, temperatures eventually climbed above freezing. With a few exceptions, snowfalls were below normal, and in Alberta and Saskatchewan, agricultural districts lost most of their snow cover.

On December 1 and 2, a fierce storm from the U.S. Midwest hit Ontario, with heavy rains in the south, snow in the north, and gale-force winds. Southwesterly winds up to 100 km/h forced the lake level in eastern Lake Erie to rise two metres. Waves pounded the shoreline and caused extensive flooding, destroying houses and cottages. Damage was estimated to exceed $15 million. The storm swept across Quebec on December 3 and 4 with gale-force winds to 100 km/h, and forced a barge aground, spilling fuel oil in the St. Lawrence River. By mid-month, an Arctic air mass encompassed most of eastern Canada, and triggered heavy snow squalls to the lee of the Great Lakes. To the delight of ski resort operators in the snowbelt, snow fell every day from December 13, right through the holiday period. In Muskoka and near the shores of Georgian Bay, some places received more than 300 cm of fresh snow by month's end, and several new snowfall records were set with amounts ranging between 100 and 200 cm.

Weather disturbances tracking across Quebec, after the middle of the month, gave substantial snowfalls to the south. During December, the Laurentians received almost 100 cm of snow, while the north had above normal falls of 50 cm.

Cold, but frequently sunny weather was encountered in the Maritimes, while cloud plagued Newfoundland. Several places enjoyed record amounts of sunshine, while others recorded the lowest total precipitation in three decades. Storms brought heavy snow to Cape Breton Island and Labrador, and strong winds and blowing and drifting snow to Atlantic Canada. At Moncton on December 2, a record wind speed of 126 km/h was observed while at Port-aux-Basques, on December 19, winds hit 157 km/h, producing whiteouts and drifts and paralysing transportation.

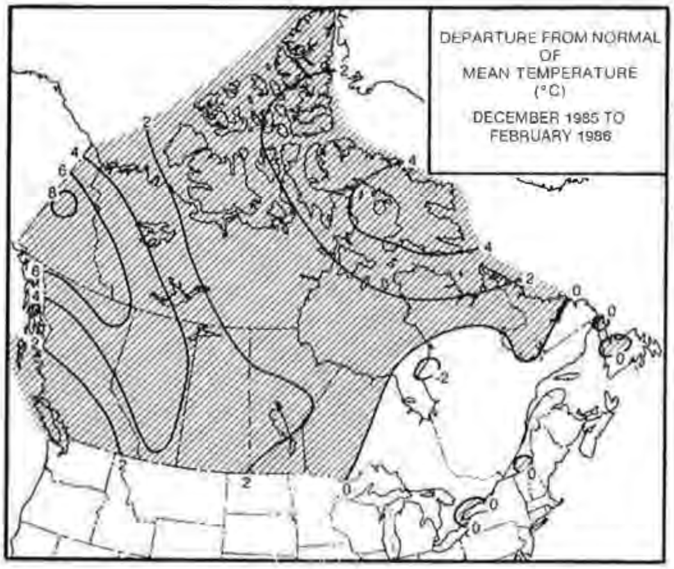
JANUARY

Unseasonably mild Pacific air crossed the Rockies, establishing this as one of the warmest Januaries on record in western Canada. In British Columbia, where daytime temperatures climbed to the mid to high teens, six monthly maximum temperature records were set. Onshore winds produced cloudy skies and heavy rainfalls along the west coast; some places received twice their normal precipitation. McInnes Island set a January record of 395 mm. Cold air trapped in Yukon mountain valleys caused low stratus and fog to form. The unseasonably mild Prairie weather virtually depleted the protective snow cover in the southwest, and valuable topsoil was blown away. In some areas dust reduced visibilities significantly.

The Great Lakes weather was uneventful with temperatures moderating somewhat, especially in the northwest. Heavy snowfalls in Ontario were rare. Occasional Arctic outbreaks triggered snow squalls to the lee of the Great Lakes. By month's end, some snowbelt communities had accumulated several metres of snow. In contrast, falls in the southwest were well below normal.

Heavy snow from several east coast storms fell in Quebec. On January 27, the worst snowstorm of the winter dumped 30–50 cm of snow on the St. Lawrence Valley, and 25 cm of snow on eastern Ontario. In the Eastern Townships, heavy rain and mild temperatures caused some rivers to rise alarmingly. Highways in both provinces had to be closed because of heavy blowing snow. Snowfalls were above normal in eastern Quebec, breaking several monthly precipitation records. Blanc Sablon was buried under 182 cm of snow. Snowfalls in northern Quebec were also substantial, ranging up to 75 cm.

In Atlantic Canada several storms produced wintry weather conditions: very high winds, (60 km/h or more), blowing snow and well above normal precipitation amounts. Snowfalls varied considerably from area to area. On January 4, Moncton set a new 24-hour snowfall record of 66 cm, while winds of 160 km/h caused whiteouts on Prince Edward Island. On January 14, winds gusted to 148 km/h at Daniel's Harbour, Nfld. On January 20, heavy rains in excess of 40 mm fell on Nova Scotia,



while southern Newfoundland was inundated with a 24-hour record 75-mm rainfall. There was heavy flooding along the Salmon River in central Nova Scotia. Frequently Labrador blizzards resulted in snow depths of nearly 200 cm. Total snowfall at St. Anthony, Nfld., was 161 cm.

Temperatures fluctuated and both daily and monthly records were broken. There were several mild spells, but the warmest temperatures occurred towards the end of the month, climbing into the teens.

On January 27 and 28, new monthly high temperature records were established in Prince Edward Island, Nova Scotia and Newfoundland. Ice conditions in the Gulf of St. Lawrence were severe. Persistent northwesterly winds pushed heavy pack-ice through the Cabot Strait, and many ships were unable to make headway through the ice. On the east coast of Newfoundland, ice developed later than in the previous two years and ships needed little navigational assistance.

FEBRUARY

While cold Arctic air invaded western Canada, temperatures moderated sharply in the Arctic, breaking many daily high temperature records. At the same time, blizzards, blowing snow and winds gusting to 100 km/h were frequent. Watson Lake in the Yukon set an all-time high monthly maximum temperature of 9.4°C on February 23. Pacific weather systems gave periods of heavy precipitation to southern British Columbia and Alberta. Temperatures fluctuated markedly as Arctic and Pacific air masses alternated. Heavy snowfalls, blizzards and whiteouts in the interior closed the Trans-Canada Highway on a number of occasions. At Vancouver Harbour a new monthly low temperature record was set, -6.7°C, while at Vancouver, the mercury reached 18.4°C, setting a monthly high temperature record. At Victoria Gonzales, 17.4°C was the warmest February temperature since 1898. During the last week the warm weather triggered many avalanches, and caused considerable flooding on the lower mainland.

Record cold and snowy weather hit the western prairies during mid-month; the Pincher Creek area of Alberta received more than 70 cm of snow. It was a very dry month in central Saskatchewan; The Pas, Manitoba, received only 2.8 mm of precipitation. The final week was very warm and windy. In southern Alberta 54 cm of snow on the ground disappeared in less than a week. The heavy runoff caused flash floods in many low-lying areas. By the end of the month most of the snow had disappeared in farming areas, again giving rise to increased incidents of blowing dust. Sunshine was plentiful in western Canada, except in southern Manitoba, where it was one of the cloudiest months on record.

In northwestern and southwestern Ontario snowfalls were heavier than normal. Windsor received 67 cm of snow, almost three times the normal. Two major snowstorms crossed southern Ontario, each leaving behind 15 to 20 cm of snow. Widespread fog and freezing precipitation, which eventually made its way into southern Quebec, covered a large portion of Ontario after mid-month, disrupting transportation.

Relatively fine, but cold weather prevailed in Quebec during the first part of the month. Gaspé set two February records: lowest precipitation of 15.4 mm, less than half the previous record; lowest total snowfall of 21.6 cm. Elsewhere snowfalls generally exceeded 40 cm, and ranged as high as 72 cm at Blanc Sablon.

In the Maritimes, it was the sunniest February since 1972, but snowfalls were substantial in most areas, including Newfoundland. Sydney, N.S., received 152 cm of snow, more than double the normal, while Greenwood had 99 cm, the heaviest snowfall since 1972. Snowfalls on the Burin Peninsula in Newfoundland exceeded 100 cm, more than twice the normal. On February 22 and 23, Cape Breton was paralysed by the largest two-day snow fall, 75 cm, since records began in 1870. St. John's, Nfld., received more than 100 mm of rain, even experiencing a thunderstorm earlier in the month. Strong winds buffeted the East Coast, frequently reaching nearly 100 km/h, causing blowing snow and whiteouts. At Twillingate, Nfld., on February 16, winds gusted to 145 km/h in a snowstorm, which dumped 45 cm of snow on parts of Newfoundland; meanwhile heavy rains caused flooding on the Avalon Peninsula. The below normal temperatures and strong winds resulted in one of the worst ice situations in years in the Gulf of St. Lawrence. Four Canadian ice-breakers were busy trying to keep the shipping routes open through the heavy pack-ice congesting Cabot Strait. Off the east coast of Newfoundland, the Labrador ice-pack extended farther south than usual, forcing drilling rigs to leave the Hibernia oil fields. However an open water lead allowed ships to sail as far north as Bonavista without assistance.

Andy Radomski is engaged in climate modelling and prediction studies in the Canadian Climate Centre and is Editor of the AES periodical *Climatic Perspectives*.

CRITIQUE

GUIDE DE LA MÉTÉOROLOGIE. Par G.D. Roth et A. Gillot-Petré. Delachaux et Niestlé, 1984 (1979 pour l'édition allemande), 14 chapitres, 248 p., 19,95 $.

Ce *Guide de la météorologie* est un volume très attirant; en effet, il contient une grande variété de photos couleurs, de belles illustrations et plusieurs cartes météorologiques. Le profane, à qui ce livre est destiné, voudra sûrement se le procurer, surtout qu'il est à un prix raisonnable.

L'édition originale de ce livre a été publiée en Allemagne en 1979 et sa version française ne souffre pas des défauts relatifs à la traduction que l'on retrouve dans d'autres ouvrages.

Dans sa préface, A. Gillot-Petré s'adresse à ses compatriotes français de façon assez crue afin de secouer leurs vieilles conceptions en météorologie. Cet auteur et homme public en France a aussi rédigé le premier chapitre, où il présente, sur un ton un peu plus sérieux, mais dans un langage simple et clair, une information intéressante sur les satellites météorologiques.

Dans le second chapitre, l'auteur (G.D. Roth) aborde les questions touchant la composition et la structure de l'atmosphère, le rayonnement, la continentalité, etc. et leurs liens avec le temps qu'il fait. Le troisième chapitre discute de nombreux phénomènes météorologiques de façon très originale et que je n'ai retrouvé dans aucun volume récent. L'auteur présente 32 phénomènes accompagnés d'une photo couleur pleine page (pour la plupart) et qui sont traités selon les quatre thèmes suivants : observation du phénomène, physique du phénomène, météorologie, prévisions que l'on peut en tirer. Les sujets dont on parle vont du clair de lune à la neige en passant par les halos, les éclairs, le brouillard, etc. et le ciel bleu. Les photos que l'auteur a choisies sont toutes très belles et certaines sont même spectaculaires. Les photos classiques des 10 genres de nuages ne figurent pas dans ce chapitre; elles sont vers à la fin du livre et en noir et blanc plutôt qu'en couleur. Il aurait peut-être été plus approprié de décrire les nuages dans ce chapitre puisque l'on y fait référence assez souvent. La description de ces phénomènes demande aussi une certaine connaissance des notions qui ne sont traitées que plus loin dans le livre. Ainsi, il est fort probable qu'une re-lecture s'imposera au lecteur non familier avec la météorologie.

Le chapitre suivant traite des éléments de la météorologie; on y discute de la pression, de la température, de l'humidité, des variations diurne et saisonnière, des vents et on y donne une explication sommaire de l'équilibre géostrophique mais sans aborder les systèmes météorologiques. Vient ensuite l'explication des cartes du temps où on présente les symboles de pointage puis le chapitre suivant analyse les grandes situations météorologiques d'Europe. On présente 18 situations avec cartes en surface et à 500 mb que l'on traite selon les thèmes suivants : circulation, location, évolution du temps, fréquences et situations apparentées. Ces analyses sont très intéressantes pour le lecteur qui pourra se familiariser davantage avec les cartes et les situations météorologiques. Cependant, notons que les concepts de fronts et masses d'air ne sont présentés qu'au chapitre suivant qui se veut un approfondissement de la météorologie. Ce dernier véritable chapitre donnera peut-être au lecteur une impression de répétition, ce qui n'est peut-être pas une mauvaise chose pour celui qui n'a aucune connaissance préalable.

Le livre s'achève par de courtes sections qui présentent sommairement les services météo, les 10 genres de nuages, l'état de la mer en fonction du vent, la carte du temps marin et l'observation du temps. Un court lexique, quelques adresses et un index terminent l'ouvrage. Il n'y a pas de bibliographie.

Ce volume a un caractère très européen et, par conséquent, il n'est pas nécessairement approprié pour le lecteur nord-américain. Néanmoins, et malgré quelques défauts, ce livre plaira au lecteur intéressé grâce à des présentations originales et à un montage (photos, graphiques) très réussi.

Richard Leduc

PRÉSENTATION D'ARTICLES POUR LE *CHINOOK* À L'INTENTION DES AUTEURS

1. Contenu de l'article, langue et lecteurs
On vous invite à présenter des articles d'ordre général, rédigés soit en anglais, soit en français, dans le domaine de la météorologie et de l'océanographie, et qui conviennent à des lecteurs du niveau scolaire secondaire. Les opinions exprimées dans le texte reflètent celles de l'auteur.

2. Longueur et format
La longueur suggérée d'un article est de 1500 à 3000 mots, avec deux à quatre figures (et légendes). La présentation de photographies et d'illustrations nettes est particulièrement encouragée. Les auteurs sont priés de fournir un résumé de 100 à 200 mots, de préférence dans l'autre langue officielle. Au besoin, les résumés seront traduits et publiés dans l'autre langue.

3. Références
Les citations littéraires dans le texte même sont à éviter. On suggère plutôt d'y indiquer le nom des auteurs ou de l'organisme à qui le mérite est attribué et d'ajouter, à la fin de l'article, les références sous forme d'une liste brève de « lectures recommandées ». Toute référence à un article de revue doit comporter le nom et les initiales du ou des auteurs, l'année de publication, le titre de l'article en entier, le nom de la revue, le numéro du volume et le numéro des pages concernées. La mention d'un livre doit arborer le nom et les initiales du ou des auteurs, l'année de publication, le titre du livre, et le nom et l'adresse de la maison d'édition. Toutes les références doivent être présentées dans l'ordre alphabétique selon le nom de famille de l'auteur principal.

4. Mode de présentation des articles
Le manuscrit doit être dactylographié à double interligne et soumis en deux exemplaires à : Rédacteur du *Chinook*, a/s de la Société canadienne de météorologie et d'océanographie, 151, rue Slater, suite 805, Ottawa (Ontario), Canada, K1P 5H3. Les épreuves finales des figures tracées et les photographies en noir et blanc de bonne qualité (l'original et deux photocopies de chacune) doivent accompagner le manuscrit. Nous faisons bon accueil aux illustrations ou photographies en couleurs qui pourraient paraître en page couverture du numéro. Les auteurs son priés de fournir une brève description (50 mots environ) de leur affiliation professionnelle (le cas échéant) et de leur intérêt en météorologie et en océanographie; ils devraient de plus indiquer si leur article a déjà été publié ailleurs ou le sera plus tard.

5. Politique de rédaction
Le rédacteur en chef décidera de la pertinence des articles à publier en consultation avec au moins un autre membre du conseil de rédaction. On prêtera une attention toute particulière à la lisibilité des articles par des profanes.

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On ne pourra pas faire réimprimer les articles. L'auteur principal recevra quatre tirés à part du numéro de parution de l'article. Des exemplaires additionnels seront fournis au frais de l'auteur pourvu que la demande soit faite avant l'impression.

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