Chinook

VOL. 1 NO. 1 FALL 1978

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Chinook

October 1978 Volume 1 Number 1

ARTICLES

DEPARTMENTS

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Publisher Weather Enterprises, PO Box 427, Brampton, Ontario, L6W 1W5.

ISSN 0705-4572

Printed and produced in Canada and published quarterly by Weather Enterprises. Application for second class mailing privileges pending. Subscription rates in Canada and U.S.A. for one year 6.00, for two years $11.00, and for three years $16.00. All other countries the rates are $7.50, $14.00, and $20.50 respectively.

IN THE NEXT ISSUE our regular departments

Plus:

NEWFOUNDLAND'S NEAR MISS WITH HURRICANE ELLA

TIPS ON LOCATING AN AERO-GENERATOR TO TAKE FULL ADVANTAGE OF THE WIND.

WHAT IS A CYCLO-STORMOGRAPH?

FROM THE PUBLISHER

This, the inaugural issue of *Chinook*, is a milestone in Canada's weather history. It is the first and only popular weather magazine ever published in this country. To be sure, there have been other publications dealing with the topic, for example the almanac *Storm Herald* by Ezekiel Stone Wiggins, and *Vennor's Almanac* by Henry G. Vennor, both published in the 1880's. *The Review of Literature, Science and Art* for that period commented as follows;

"Then there is a multifarious category of what is hardly literature, and some will not allow to be science, which includes the ever important subject of the weather, &c., &c., Jupiter Pluvius or Nivalis or Glacialis, is regularly called to account by such patient watchers as Mr. Vennor F.G.S., and Dr. Wiggins . . . . . The Almanack and Bulletin or Monthly Record have, at least, the advantage of interesting the majority, which cannot be said for some publications of a higher class."

Today we have the scholarly journal *Atmosphere-Ocean*, produced by the Canadian Meteorological Society, which is a vehicle for original scientific research.

Chinook however is different in design, purpose and policy from any of these.Our purpose is to bring the rich and complex topic of weather in Canada to a readership that is not necessarily expert in the field. *Chinook* will explore Canada's extensive weather history; present columns for the weather amateur; examine what satellites view in the atmosphere below them; and keep you informed of the weather highlights as they occur. Look for items of topical interest — how the weather affects industry, aviation, boating, agriculture and forestry.

Chinook's policy is to keep an open door. Letters and contributions are welcome and will be printed at the Editor's discretion. Advertisers are also welcome to use our pages since it is natural that our readers will want to know how to obtain weather related products and services. If you have weather items for sale (books, antiques, instruments, etc.,), and you are a private individual, your ad will be carried free in volume 1 if it is **short.**

Many of you will have received a complimentary introductory issue of volume 1, number 1, our Fall issue. However, economic realities dictate that we must build a paying readership. A subscription is the cheapest way to obtain each edition of this quarterly magazine, so won't you fill in the subscription order form (p. 11) as soon as possible and mail it to us.

While *Chinook* may not belong to the higher class, it does wish to emulate its early predecessors and prove to be interesting to you, the reader.

The Publisher

A SATELLITE VIEW OF THE CHINOOK

WINDOW ON WEATHER

The chinook of southern Alberta is a warm, dry, gusty wind from the mountains. In common with similar winds, known as *foehn* in other parts of the world, it is accompanied by rapid temperature changes during the winter months. Plate I, a photograph taken from space at an altitude of 1400 km by the NOAA 5 weather satellite, shows the chinook arch, a cloud formation which reveals the existence of the warm wind. Figure I depicts the features of interest — the Rocky Mountains (identifiable in the bottom left corner of the photograph by their grain and snow capped peaks), and the shaded areas A and B which represent the large white cloud masses adjacent to the mountains. These clouds are remarkable for their sharp western boundary and in other chinook situations are often joined together as one complete cloud sheet (shown by the dotted connecting lines). In this particular case the middle zone has nearly dried out, splitting the cloud into two.

The cloud is formed by the action of mountain-induced waves in the wind and remains nearly stationary. Where the chinook blows down the mountain side it dries out the air in the cloud layer and erodes it eastwards in an arch (area coloured blue). An observer in Calgary, say, would find cloud overhead, but looking towards the mountains would see a large expanse of clear sky. Plate 2 shows how the arch would be seen by an observer on the ground.

The weather satellite looks down through this "window" and photographs the ground which shows as the dark area between the mountains and the cloud stretching between A in the north and B in the south.

Arriving in Alberta warmer than it left the Pacific coast, the chinook wind has been known to raise the temperature in Pincher Creek, and other communities within its range, by as much as 32°C in half a day.

Further Reading

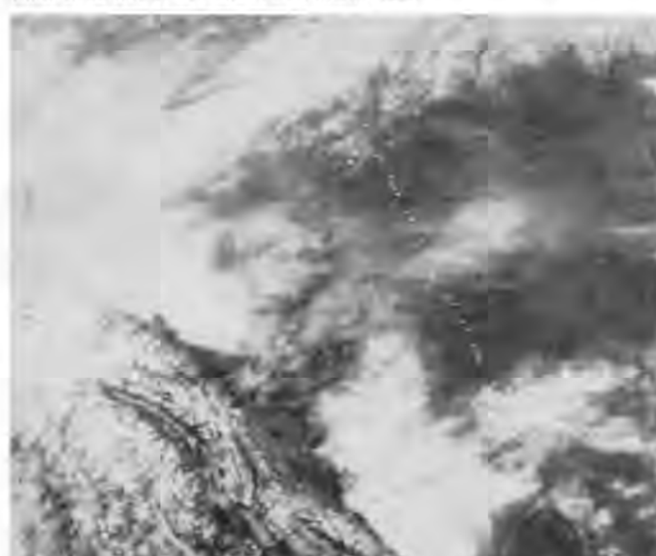
McCabe, H.J., 1961: **A new look at chinooks.** Department Communications No. 15, Canada Department of Transport, Meteorological Branch, Calgary, Alberta, 4 pp.

Lester, P.F., 1976: **Evidence of Long Lee Waves in Southern Alberta.** *Atmosphere,* Vol. 14, pp 28-36.

Thomas, T.M., 1963: **Some observations on the chinook 'arch' in western Alberta and northwestern Montana.** *Weather,* Vol. 18, pp 166-170.

FIG. I. A DIAGRAMATIC REPRESENTATION OF THE SATELLITE PHOTOGRAPH (Plate I). The blue area shows the location of the chinook wind which has evaporated the cloud A, B in an arch towards Calgary.

PLATE I. A PHOTOGRAPH TAKEN BY THE NOAA5 WEATHER SATELLITE at 1725 G.M.T. on March 29, 1978. Dark areas are the ground, white areas are either cloud tops or else snow on mountain peaks.



COURTESY AES

WIND POWER GENERATION IN ONTARIO

During the 1970's we have witnessed radical changes in the availability of non-renewable energy supplies to fuel our cars, heat or homes, and run our industries. As a result there has been considerable interest in finding alternate energy sources, preferably of the renewable variety. One such source is the atmosphere. Each and every day, nature expends considerable amounts of energy in the form of wind. Even an individual wind gust, for example, has enough energy to light up an electric bulb. Ingenious aerogenerators have been designed to harness this never-ending supply and convert it to useful power.

Given this fact, is there enough wind in Ontario to energize the aerogenerators commonly available, and for what portion of the year? Can useful amounts of power be generated? Are there any regional differences in the wind flow? These questions and others are answered in a useful publication, recently released, entitled **A Climatological Review of the Potential for Wind Power Generation in Ontario,** prepared by T. Eschle and M. Pennyfather for the Atmospheric Environment Service*. The following is an edited and condensed version of that article.

**Internal Report SSU-78-6, available from A.E.S., Ontario Region, 25 St. Clair Ave. East, Toronto, Ontario, M4T 1M2.*

WIND BEHAVIOUR

The variability of the wind over a period of time is much greater than for other weather elements such as temperature, humidity or air pressure, and the stronger the wind the greater the fluctuations in its speed. Not only does it vary with time and location, but also with height above the surface. Near the ground, frictional forces produced by terrain roughness substantially reduce wind speeds, while several hundred meters above the surface, frictional forces decrease and winds are no longer affected. Obviously, placing an aerogenerator on a tower tall enough to get it above the ground effect will increase its efficiency.

The rapid pulses in wind speed known as turbulence have an important influence on the performance of a wind-driven generator, because due to its inertia, the generator rotor is unable to respond quickly enough to utilize the turbulent energy. Severe turbulence may even shorten the life span of the machine or damage some of its more vulnerable parts.

POWER PRODUCED

The power produced by the wind is proportional to the cube of the wind speed. In other words, if the wind speed is doubled, then the power increases by 2^3 or 8 times. This relationship is important in choosing the best tower height. Because wind speeds generally increase with height (due to the decrease of friction) then the power will also increase significantly due to the cubic relationship with wind velocity. Theoretically an increase in tower height from 10 to 20 m will result in a 45% increase in available power. Although hills usually obstruct and alter wind flow, the available power is likely to be higher on the crest of the hill.

One point to remember is that the use of tables of long-term average wind speed in determining the available power at a particular locality can be misleading because the times of high winds make a much greater contribution due to the cubic relationship.

ENERGY LOSSES DUE TO HARNESSING

All aerogenerators perform the basic function of converting the kinetic energy of the wind into mechanical energy in a rotating shaft, and all are subject to energy loss during the process. Furthermore, the Betz Theorem, based on principles of aerodynamics, states that it is not theoretically possible to extract more than 59.3% of the energy contained in the wind, or in other words, for every kW possessed by the wind, a 100% efficient wind generator will only be able to extract 0.593 kW of power. In addition, aerogenerators are not 100% efficient. They lose power through propel-

PLATE 2. THE CHINOOK ARCH as seen from Gowley Airport, Alberta, February 13, 1943 at 1130 M.S.T.

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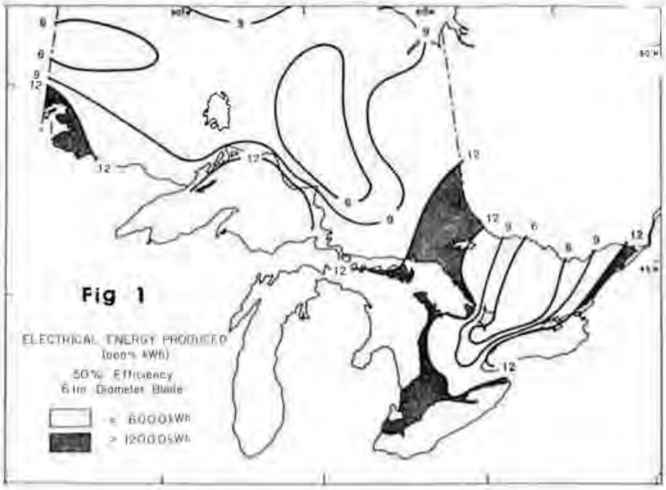

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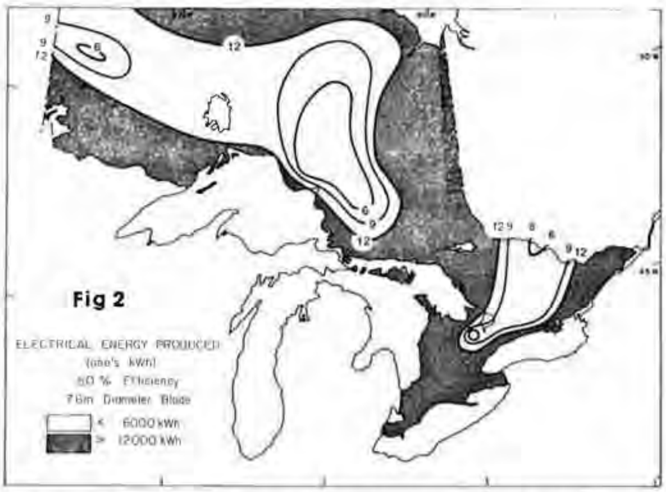

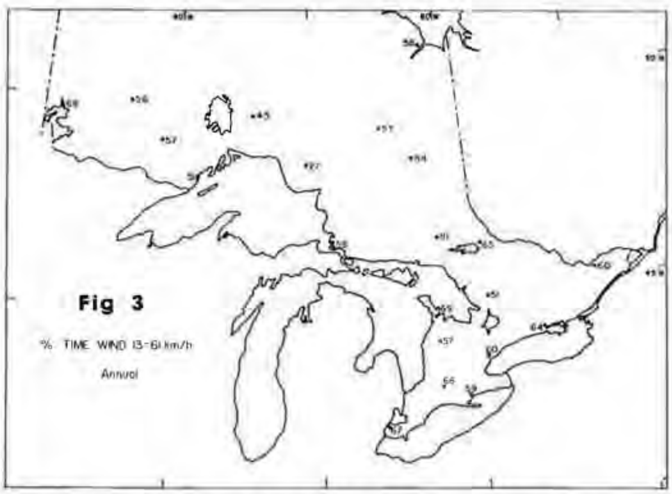

FIG 1 and FIG 2 SHOW THE ESTIMATED AMOUNT OF ELECTRICAL ENERGY per annum produced by 50% efficient (1) medium sized, and (2) large sized wind generators respectively. Energy loss in storage is not included.

FIG 3 GIVES THE PERCENTAGE OF TIME during an average year that hourly wind speed readings fall between 13 and 61 kmh. This corresponds to the range of wind speeds in which most aerogenerators produce power.

lor design, shaft friction, and generator limitations. Beyond certain critical wind speeds, damage due to overloading and stress can result, with the disadvantage of allowing much or all of the energy contained in high wind speeds to pass by without being harnessed. Once the power has been generated, there are further losses in storing and retrieving it.

THE WIND RESOURCES OF ONTARIO

In general, annual and seasonal wind speed maps reveal that the wind decreases in velocity the further inland the location from the Great Lakes, Hudson Bay and James Bay. There are two main exceptions where belts of stronger winds can be found, namely the Great Lakes — St. Lawrence lowlands, and the Nipissing — Ottawa River lowlands. To some extent there is also some wind funneling effect along the Moose River basin, and a small wind increase associated with the low lying land around Lake Nipigon. These terrain induced effects should not be confused with the earlier statement that winds generally increase with height.

Southern Ontario (south of 47°N latitude) experiences stronger winds in winter (with a January maximum), than in summer. In northern Ontario the same pattern is found, but with the strongest winds recorded in May and a Secondary maximum in October.

At any given location, the accurate estimation of wind energy is a difficult problem. Two places having the same annual average wind speed may, in fact, differ considerably in total wind energy. The site with several months of strong winds and several of light winds, would have a better annual energy potential than one with moderate wind throughout the year.

USEFUL ENERGY CAN BE GENERATED

How much energy output could be expected from an aerogenerator in Ontario? The maps (figures 1 and 2) provide estimates of the potential energy output from two theoretical wind generators, each of which has an efficiency of 50% (typical of current wind machines), and blade diameters representing the medium and large range of machines. In using these figures it must be remembered that they show only generalized regional values.

Local effects can considerably increase or reduce winds at a particular site.

The smallest unit (blade diameter - 4.6 m) is unable to fully provide for the needs of a home* with a 12,000 kWh per year demand anywhere in the province, and large sections of Ontario do not even have sufficient winds to produce minimum estimated power requirements for a residence. In the case of the medium unit (Figure 1), areas of surplus energy (12,000 kWh) appear in southwestern Ontario, the Nipissing lowlands and the Kenora area. Figure 2, representing the largest generator, shows surpluses over much of the province, and only very limited areas below the 6,000 kWh per year level. It is important to note, however, that few machines of this size (7.6 m diameter or 45 m^2 swept area) are being manufactured. Those that are available command very high prices.

OPERATING RANGE WIND SPEEDS

The range of 13 to 61 kmh was selected as being typical operating range for an aerogenerator. Figure 3 indicates the percentage of time during a year that a wind generator could be expected to be producing power. Values at most stations shown on the map exceed 50%, and seem to imply a generally favourable situation. It should be realized however, that a significant portion of this production time might be spent in generating power far lower than a household's average requirements due to only marginally productive wind speeds. The percentage time of substantial energy production will be somewhat less than the time given in the figure.

**an average single family detached dwelling with the usual gas/oil furnace, water heater and major electrical appliances.*

Further Reading

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Hamilton, R., 1975: **Can We Harness the Wind?** *National Geographic*, Vol. 148, No. 6, pp 812-829.

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WIGGINISM

In 1883 and 1884, an eccentric Canadian weather prophet named Ezekiel Stone Wiggins inspired fear in the hearts of New Englanders and Maritimers with predictions of weather disasters. At the same time he issued dire warnings to the Government of Canada, the British Admiralty and the Viceroy of India. Appearing on the scene like one of the short lived comets he was so fond of claiming as the cause of weather disturbances, his bombastic weather statements were printed by numerous newspapers from Toronto to St. Johns to New York City and inspired a critic from Pictou, Nova Scotia, to coin the term *Wigginism*.

His notoriety sprang from a series of weather prophesies in which he predicted weeks or months in advance the dates of what he supposed would be weather catastrophies. The essence of Wigginism is exemplified by this statement contained in his almanac *Storm Herald* of November 1882;

"A great storm will originate in the northern Pacific on the morning of the 9th., (of March 1883) just off the coast of California, a little south and west of San Francisco . . . . It will speed directly westwards and will reach the Rocky Mountains from the east after having passed around the world."

Following this incredible pronouncement he went on to say that the storm would be deflected eastwards off the Rockies reaching the Great Lakes on March 11, 1883. He predicted terrible calamities as a result of the storm and made the following appeal;

"As all the lowlands on the Atlantic will be submerged, I advise shipbuilders to place their prospective vessels high upon the stocks, and farmers having loose valuables, as hay, cattle etc., to remove them to a place of safety. I beg further most respectfully to appeal to the Minister of Marine that he will peremptorily order up the storm drums on all the Canadian coast not later than the 20th., of February and thus permit no vessel to leave harbour. If this is not done hundreds of lives will be lost and millions worth of property destroyed."

WARNS BRITISH ADMIRALTY TO ORDER THEIR SHIPS INTO PORT

After this and other similar predictions, newspapers kept a close eye on the evolution of events. Wiggins' pontifical statements and gratuitous advise to the Lords of the Admiralty and the Viceroy of India were frequently quoted. Reports indicated that many people heeded his warnings. Fishermen from around Gloucester, Massachusetts, were discouraged from fishing the Grand Banks off Newfoundland, and it was reported (probably tongue-in-cheek) that someone living in the Ottawa Valley built an ark on the roof of his house as a precaution against the coming flood, while in England a Mr. Emmett, an insurance underwriter, wrote the meteorological office in London concerning the subject of the alarming March weather prophecy. He received the following disdainful reply;

EZEKIEL STONE WIGGINS

"The prophecy to which you allude emanates from some man in the Finance Department of the Canadian Government. It is utter nonsense. No living man can predict the weather two days beforehand, much less six months. The idea that the Admiralty have ordered ships to be in port is also absurd."

Almost needless to say, the prophecies met with dismal failure. Undeterred, Prof., Wiggins made his excuses in the same pompous tone used for his predictions. One can almost see his mutton-chop whiskers quivering with indignity as he exclaimed, "the storm's force was in the vicinity of Australia." On one occasion the *Halifax Herald* sent him a telegram saying;

"Been delightfully mild and calm here all day. No earthquakes, no very high tides. No hurricane, no nothing except the utter failure of your prophecy . . . . what have you got to say about it?"

To this the Professor replied, "the storm is there. I see it in Neptune's glass." The Gloucester fishermen however did not agree. "The Canadian False Prophet has caused us to miss five days of good fishing. The run of fish has been exceptionally fine and large schools have been swimming calmly by." Poems were published to celebrate his failures and one of the best appeared in the *Kingston News* with the last verse as follows;

Still the dupes who were sold were prepared to behold
All creation go tumbling together,
But the sun came out warm and so Wiggin's storm
Was postponed — on account of the weather.

WEATHER PROPHET DID NOT PROFIT FROM EXPERIENCE

Strangely enough, E. Stone Wiggins did come close to success with his prediction for March 9th., to 11th., 1883. A bad storm did in fact hit the east coast of Canada on the 10th., and 11th. The schooner *Four Brothers* tore away from her moorings and struck the city wharf in Dartmouth. The tide rose and washed over the wharves sweeping away barrels of flour, meal etc. Wiggins was triumphant. He crowed in the *Toronto Globe*, "I may state what I know to be an absolute fact, that the hour at which great storms will arise at different points of the earth's surface can be predicted for any length in advance and with absolute certainty." But, as had been pointed out in a common sense *London Free Press* editorial, success was not at all likely due to Wiggin's ability to prophesy but rather to the fact that March is usually a very stormy month, and on any date chosen at random there would be a good chance of a storm. Perhaps emboldened by some grudging praise from the *Halifax Chronicle*, Wiggins embarked upon further prophecies of bad storms for the year 1884, all of which fizzled.

Ezekiel Stone Wiggins was in fact entitled to his rank as a Professor. Born in 1839 in Queens county, New Brunswick, of solid United Empire loyalist stock, he obtained B.A., and M.A., degrees at Alberta College, Belleville, and a Doctor of Medicine degree in Philadelphia. From 1871 to 1875 he was superintendant of a Brantford institution for the education of the blind. His books **The architecture of the Heavens** (Montreal 1864), and **Universalism Unfounded** (Napanee 1867), reveal a rather odd blending of philosophical and religious beliefs with the natural sciences. It may have been these studies which motivated his entry into the field as such a fervent weather prophet.

Usually at odds with the official weather service, which began in 1870, the Professor and others like him also drew the ire of the *Halifax Chronicle*. In an editorial on March 28, 1883 after recovering from their fit of generosity two weeks earlier, they wrote;

"One reason for regretting the partial fulfillment of the prophecy of Wiggins is that others, encouraged by the semi-vindication will also begin to predict the nature of the weather months ahead and cause unnecessary and mischievous alarms. Each will think himself as able a prognosticator as the Professor and fully as capable of reading the planets. Failure can bring upon them only temporary ridicule, amply paid for in advance by months of notoriety." Advocating rather harsh measures, the editorial concluded, **"We see no method of restraining imitators of Wiggins from going into business unless the law relating to rogues and vagabonds be applied to them."**

Dr. Wiggins also paid much attention to geology. In 1876 a marine monster, its head 12 feet above the water, was supposedly seen near Boston by the complement of the steamer *New York*. Dr. Wiggins at once recognized this as the far famed geologic animal the *plesiosaurus-dolichodeirus* of the Oolitic era, extinct for millions of years. He immediately published the discovery in the St. John (N.B.) *Globe*, July, 1876.

Although his death at Ottawa in 1910 brought to a close a flamboyant era in the history of weather prophecy, *Wigginism* still lives.

SEVERE STORM LOG

Few encounters with the weather are more terrifying for an individual than a confrontation with a tornado. Hailstorms, with one vicious sweep, wipe out millions of dollars worth of crops each season. Torrential cloudbursts swamp basements, wash out highways, inundate the fields. Lightning indiscriminately kills people and cattle, razes barns and their contents to the ground. But do you know anyone who has suffered in this way from one of nature's tantrums? Not likely, because fortunately these events are so localized that only a very small percentage of the population is affected — but they do occur in Canada each and every year, and to an extent which may be surprising to some. Their total impact on the economy amounts to hundreds of millions of dollars worth of damage and disruption annually.

SEVERE STORM LOG will be a regular feature in Chinook. There are of course many more storms than can be listed here, so that only the most serious will be mentioned, and because they are so localized, some will be overlooked. You can make the editor very happy by informing him of his omissions.

Statistics concerning severe summer storms are difficult to compile. Such events are usually short lived, with lifetimes measured in minutes, many of which evade detection in the sparsly inhabited regions of the country. Sometimes the tell-tale funnel of a tornado is obscured by darkness or blinding rain, thus masking the storm's true nature. In other cases, storms which gain local notoriety cause hardly a stir in newspaper columns elsewhere.

For some time the Editor, aided by research assistants Peter and Madeline Elms, and Doris Newark, has been delving through archives in search of recorded tornadoes in Canada. As a result, *Chinook* is now able to present, for the first time, a comprehensive list of the 22 most disastrous tornadoes known in Canada (p. 10). These represent less than 1% of the total number so far found, which indicates that only a very small fraction of all tornadoes fall into the severest category.

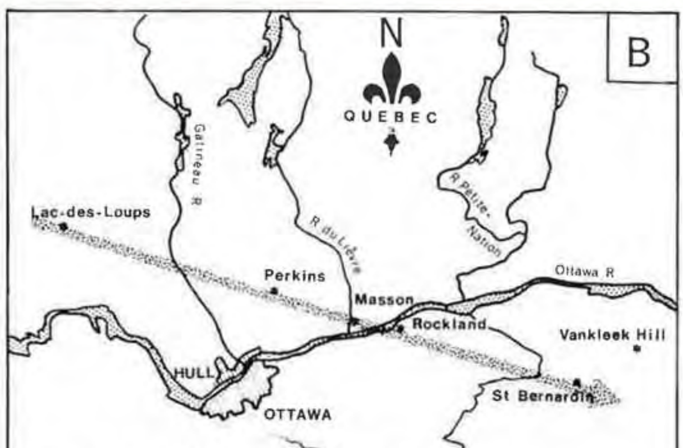
Continued p. 10

PHOTO (right). Although the worst damage of the June 27, 1978 tornado outbreak was sustained in Masson, Quebec, where houses were literally torn apart, the little village Lac-des-Loups also suffered. The house shown was lifted into the air along with its three occupants — a mother and two children — and thrown about a metre off its foundation, coming to rest amid a tangle of uprooted trees.

PHOTO (centre). Staining the sky an inky black, the Aubigny, Manitoba, tornado of June 19, 1978 bears down on the house of Leon Palud. After making sure his family had taken refuge in the basement, he took the picture of the approaching storm. It was so close that the funnel cloud almost fills the two film frames which are shown here as a composite picture. Actually it appears that there may have been two funnels — one which is in view to the left and another which is partially hidden behind the house. Seconds after taking the photo and seeking shelter himself, Mr. Palud's house was wrecked. None of the family was injured.

FIGURE 1 (below left). GEOGRAPHICAL DISTRIBUTION OF TORNADOES from the beginning of the 1978 season to the end of August. The number in parenthesis is a tornado death. A indicates the location of the "Aubigny" tornado, and B indicates the location of Box B.

BOX B (below right). THE TRACK OF THE TORNADO OF JUNE 27, 1978 through Quebec and Ontario. The path length was about 140 km long and damage width about 300-400m. As it crossed the Gatineau River, this tornado was observed to turn a foggy grey as it drew water up into the funnel about 10 or 12 m.



TORNADOES

Figure 1., shows the geographical distribution of tornadoes from the begining of the 1978 season (approximately May) to the end of August. The total amounts to 61, not all of which are confirmed due to lack of information. During this period there were two occasions which captured national attention due to the severity of the storms;

Monday June 19, 1615 — 1800 C.S.T. Ominous funnel clouds were sighted numerous times (see page 9) as a severe tornado outbreak cut across Manitoba from the vicinity of **Morris** to **Ostenfeld.** The worst damage was suffered in the villages of **Aubigny, Greenland** and **Ste. Anne.** One fatality, 23 injured, and damage estimated to be at least $2 million.

Friday, June 27, 1530 — 1700 E.S.T. A long lived tornado slashed across Quebec and Ontario (see Box B which shows the path). The worst damage was sustained in **Masson, Que.,** where 50 houses and businesses were destroyed and 36 people hospitalized. Total cost of damage estimated between $3 and $4 million.

The most northerly tornado known to have occurred during the period was on Sunday, July 30, near **Rae,** N.W.T.

LIGHTNING

August 15, Ontario. A golfer sheltering under a tree in **Guelph** was struck and killed. His two companions suffered burns.

August 16, Ontario. A boy struck and killed while in a tent near **Buckhorn.** Near **St. Jacobs,** 15 cows were killed while sheltering under a tree.

HAIL

May 25, Manitoba. Hail the size of baseballs reported in association with a tornado in **Winnipeg.**

May 30, Ontario. Hail the size of tennis balls reported in association with a tornado near **Wingham.**

July 11, Saskatchewan. A hail swath from **Yorkton** to **York Lake** contained hail the size of baseballs.

Mid-July, Manitoba. Three severe hailstorms were reported within a week in the **Morden-Carman** area. During this period, a farm at **Miami** was hit by hail for the fifth time this year. Hail came down with such force that it left pockmarks in telephone poles.

Early August, Alberta. Hail the size of baseballs fell in the vicinity of **Pincher Creek.**

TORRENTIAL DOWNPOURS

June 30, Saskatchewan. Roads and basements in **Melfort** flooded by 53 mm of rain which fell in one hour.

July 5, Saskatchewan. In **Wynyard,** apartments were flooded and rural roads washed out as 62 mm of rain fell in 90 minutes.

July 7, Saskatchewan. At **Radville,** 100 mm of rain fell in 9 hours. A record 4000 cubic feet of water per second swept through Long Creek which overflowed its banks, flooding hundreds of acres of farmland. Farmyards were isolated, while in Radville basements collapsed with the pressure of the water.

July 11, Alberta. In the occluded, or final stages of its life, a large scale Pacific storm swept across the Rocky Mountains and generated locally heavy rains and hailstorms in Alberta and Saskatchewan. **In Edmonton,** a 90 mm downpour was experienced, mostly in a 4 hour period. The city's sewer system was overwhelmed and runoff floodwater ran into the streets, basements and apartment units. The rain and floodwater forced closure of a number of roads and bridges, and caused a mudslide on Grierson Hill. The total storm damage was estimated to be between $5 and $8 million.

CANADA'S MOST DISASTROUS TORNADOES

1. **Regina "Cyclone", Sask.** June 30, 1912. 30 dead and hundreds injured. $4 millions damage.
2. **Windsor to Tecumseh, Ont.** June 17, 1946. 16 dead and hundreds injured. Damage conservatively estimated at $1.5 millions.
3. **Renfrew, Ont., to Montreal, Que.** June 14, 1892. 12 dead, 43 injured. Hundreds of homes and barns flattened.
4. **Sudbury Tornado, Ont.** August 20, 1970. 10 dead, 200 injured and $5 millions damage.
5. **Windsor, Ont.** April 3, 1974. 9 dead, 30 injured. $½ million damage.
6. **St. Zotique to Valleyfield, Que.** August 16, 1888. 9 dead, 14 injured, extensive property damage.
7. **Buctouche, New Brunswick.** August 6, 1879. 5 dead with 2 others not expected to live, 10 injured and 25 families homeless. $100,000 damage.
8. **Sarnia to Stratford, Ont.** May 21, 1953. 5 dead, 40 injured. $8 millions damage.
9. **Portage la Prairie, Man.** June 22, 1922. 5 dead, scores injured. $2 millions damage.
10. **Merritton "Cyclone", Ont.** September 6, 1898. 5 dead, many injured, at least 18 of them seriously and scores homesless. $100,000 damage.
11. **Chesterville, Ont.** July 17, 1902. 5 dead, 12 injured. $¼ million damage.
12. **Carievale, Gainsborough, Sask., to Pierson, Man.** July 1, 1909. 5 dead.
13. **Hornby to Cooksville, Ont.** June 24, 1923. 4 dead, scores injured. $2 millions damage.
14. **Cullen, Frobisher, Sask.** July 22, 1920. 4 dead, 20 injured and considerable property damage.
15. **Morley, Alta.** August 14, 1950. 4 dead, 6 injured.
16. **St. Bonadventure, Que.** July 25, 1975. 3 dead, 300 homeless. $3 millions damage.
17. **Cornwall, Ont., to Montreal, Que.** June 6, 1888. 3 dead, dozens injured. Hundreds of private dwellings and barns demolished.
18. **Rosa, Man.** July 18, 1977. 3 dead and a number of livestock killed. Between $½-$1 million damage.
19. **Montreal to Quebec City, Que.** July 11, 1888. 3 dead and considerable property damage.
20. **Whitewood to Pilot Mound, Sask.** August 28, 1900. 3 dead.
21. **Vermilion, Alta.** July 30, 1918. 3 dead.
22. **Wetaskiwin, Alta.** July 8, 1927. 3 dead.

PAST WEATHER

MARCH 1870: THE MONTH OF THE BIG SNOW

by
Scott Somerville

Ontario's Golden Horseshoe is renowned for its industrial strength and efficient inter-connecting highway system. During heavy snows, this same system is also its Achilles heel as traffic jams clog and delay the flow of transports. Fortunately this area which curves around the western end of Lake Ontario is not known for its snowstorms. A check of the snowfall for the area quickly reveals that it is a zone of lower annual amounts when compared to adjacent regions. On the average, snowfall ranges from 100 to 150 centimeters spread over five months.

The most extraordinary exception to this rule was the winter of 1869-70. During March 1870, aided by three heavy snowstorms within a two week period, total monthly snowfall in western Lake Ontario counties amounted to between 140 and 198 centimeters — record quantities which have not been exceeded, and more than an entire winter's worth. Total monthly snowfall amounts (centimeters) for available stations were as follows;

Aurora	188
Hamilton	165
Markham	165
Thornhill	198
Toronto	156
Weston	191

Even though meteorological data is somewhat sketchy, it seems that the three storms, which occurred on March 12-13, March 15-17 and March 26-28, may have been slow-moving cyclonic storms from the Ohio Valley which travelled northeastwards along the western flanks of the Appalachians. The first of the series dumped between 23 and 63 centimeters, while the second retired with an additional 45 to 63 centimeters to its credit. Reportedly though, the final storm was the grand-daddy of the series despite the fact that at some stations it began as rain, thereby reducing a potentially greater snowfall. At highter altitudes, where no rain fell, stations recorded amounts up to 90 centimeters, or as much as 50% more

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THE COVER

"My mother phoned and she said: 'My God, we've had a tornado.'
And I said: 'What happened?'
And she said: "It came through the yard, the machine shed is gone, the barn is gone, the pig barns are gone, and trees are gone."*

The tornado which struck La Riviere, Manitoba, at 7:00 p.m. C.D.T. on Saturday, July 20, 1968. The tornado funnel cloud, an awsome, frightening and roaring spectacle, moved northeastwards laden with dust and devastated all in its path. Estimated to be about 200 metres wide, it was mistaken by some motorists to be smoke from a burning farm. Driving closer to see if they could be of any help, they crossed paths with the tornado which flipped and wrecked their car. The three occupants escaped with their lives but required hospital treatment for their injuries. Fortunately, no lives were lost, but property damage was estimated at more than $1 million.
Photograph taken by the owner of the Holiday Mountain Ski Resort and given to Chinook courtesy of the *Brandon Sun.*
For more on tornadoes see SEVERE STORM LOG p 8.

*extract from **Remembering the Farm,** by Allan Anderson, published by MacMillan of Canada, 1977, Toronto.

Continued from p. 11

than at lower and slightly milder locations.

Perhaps the most peculiar feature of these storms was the lack of much human impact. Except for train disruptions, poor roads etc., reports indicate relatively few problems. One comment notes that the heavy snow was a boon to the lumbering industry since sleighs allowed easier movement of logs to the lakes. Unlike modern times, snow was a blessing because sleighing was an integral mode of winter transportation.

Speculation on the impact of a weather event such as this on the mobile society of the Golden Horseshoe is most intriguing. The fact that this event has supervened indicates the possibility of a re-occurrence some day.