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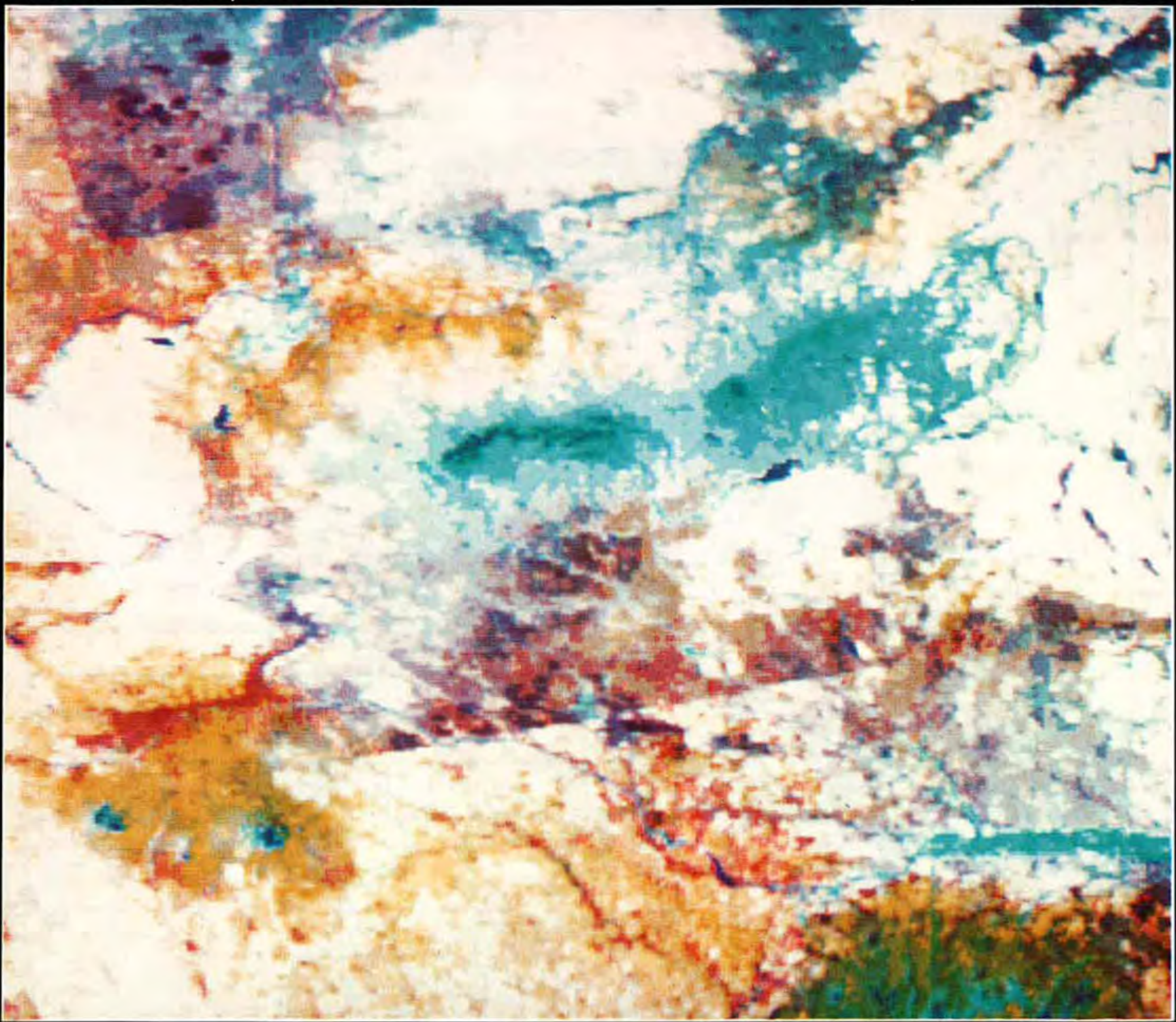

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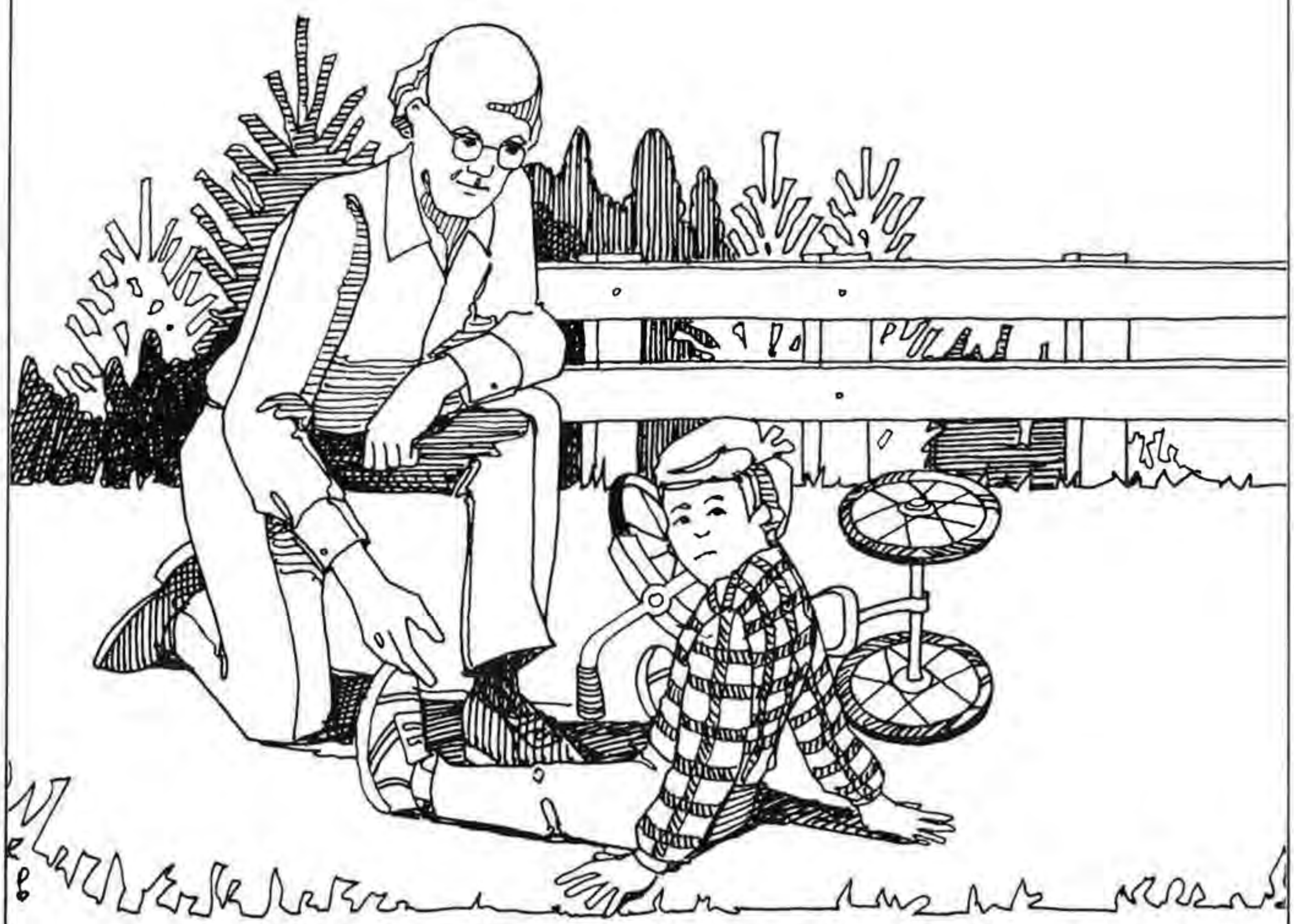

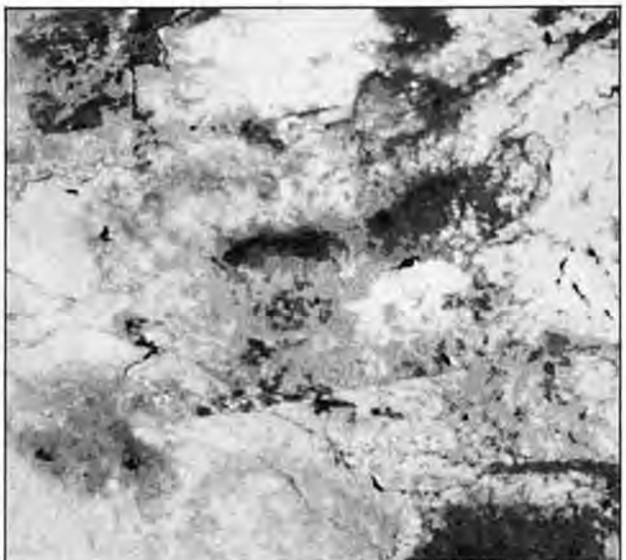

THE COVER. In this infra-red picture taken by the NOAA 7 weather satellite on September 22, 1983 the international border separating Alberta from Montana shows as a remarkably clear straight line. Land-use practice varies across the border and is picked up in this false colour image. The city of Calgary is visible in the top left hand corner of the picture. Photo courtesy of Environment Canada.

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ARTICLES

DEPARTMENTS

Fall 1983/Winter 1984 • Volume 5 no 3, volume 6 no 1

The parents of Vika Ignatyeva work as meteorologists at the arctic meteorological station on the Cape of Harasaway.

Novosti Photo 78-11858

WEATHER FORECASTING IN THE SOVIET NORTH

by Vladimir Fyodorov

Yakutia, an autonomous republic located in the northeastern part of the Soviet Union, is within the Arctic Circle. Its weather fluctuates widely during a year with winter temperatures falling to -67.7°C in Verkhoyansk and Oimyakin, and summer temperatures reaching +34.6°C in Verkhoyansk and +32.1°C in Oimyakin. For a long time these extreme weather conditions have attracted the attention of scientists. In fact the first weather studies in Yakutsk were carried out in 1736, and permanent observations began in 1888. In 1981, Yakut weather researchers marked the 60th anniversary of their hydrometeorological service. When the service first began in 1921, Yakutia, which occupies more than 3,000,000 sq km (or roughly the size of Canada's Northwest Territory), had only four meteorological stations and six posts. At present there are 150 stations and 280 posts. About 40 of the stations are located in remote places where natural resources are being developed and there is a need to obtain more precise weather forecasts.

More than 30 automatic stations have been installed in remote mountainous, forest, and tundra areas. Every three hours they print out data on the temperature, the pressure, and the wind. These stations are equipped with long-range automatic visibility recorders, pulse ceilometers, wind speed and direction indicators, remote meteorological and hydrometric installations, new Meteorite and Titanium atmospheric sounding devices, and special locators. With the introduction of the automatic stations there has been a decrease in manned observing sites which is an important step forward in Yakutia with its long winters, severe frosts and snow storms. High-speed communication methods promptly collect information from all parts of Yakutia and neighboring areas.

"Since 1972," observes Yuri Proshin, Chief of the Yakutsk Hydrometeorological Centre, "we have been receiving and using data supplied by weather satellites. Two or three times a day we receive photos from the Soviet *Meteor* and American *NOAA* satellites. In the latter case, we mainly use the infrared wavelength images because they make it possible to penetrate the dark polar nights in winter and our constant fogs. The use of orbital information has helped us gain a better understanding of atmospheric processes and has also helped to bring the reliability of our forecasts up to 85-90 per cent.

"Weather forecasting is impossible without broad exchanges of information. Once a day, we receive weather maps of the northern hemisphere, and more frequently, weather maps of the USSR and neighboring countries as well as Japan, China, the United States,

PREVIOUS PAGE, Top. *The computer room at the Khabarovsk regional meteorological centre which provides information to the entire area of Yakutia. It also keeps in touch with the regional meteorological posts and weather satellites.* Bottom Left, *a radiosonde is launched at one of the aerological stations of the Murmansk department of hydrometeorological services.* Bottom Right, *an aerological station control room.* THIS PAGE, Top. *An arctic meteorological station on the Cape of Harasaway.* Bottom, *measuring solar radiation at a meteorological site on Wrangel Island, the Soviet Union.*

and Canada. Through our station in Khabarovsk, we in turn supply data eight times a day to the world meteorological centers at Moscow, Washington, and Melbourne. From there it is redistributed all around the world."

Yakut weather researchers issue special forecasts for reindeer breeders, drivers, river-transport workers, miners, power engineers, and builders of the South Yakut territorial production complex in the Baikal-Amur Railroad zone. Accurate weather forecasts are also necessary for aviation, the number one all-season method of transport in Yakutia. The weather station at Yakutsk airport maintains steady communication with 100 stations. Every hour forecasts are made for Yakutsk itself and its surrounding air routes, which are supplied to air traffic controllers and pilots en route.

Weather forecasts have been a constant benefit to agriculture. On several occasions, sudden frosts were successfully forecast in Yakutsk at the height of summer. Smoking, sprinkling, and other protective measures were then initiated to save cucumber and tomato plantations. Timely warnings about ice crust formation on the snow helped save 26,000 horses in one of the republic's districts.

Last spring a cold snap occurred over the tributaries of the Vilyui River in whose upper reaches a hydro-electric power station and a water storage basin are located. Weather forecasters of the hydrometeorological service concluded that delayed melt of the snowpack would conserve water. Furthermore, they reasoned that a gradual release of the water into the river would maintain sufficient levels required for navigation. A successful decision was then made to use the stored water to generate an addtional 1 million rubles' worth of electricity rather than diverting the water to the needs of the shipping industry. Another example of the use of weather services can be found in the experience of the logging industry who receive special forecasts twice daily. Lumbermen who raft wood down Yakut rivers can now prepare for storms, fog, changes in the level of water, etc., and help prevent losses of this valuable product.

Yakutia's second weather forecasting center, the Tiksi hydrometeorological and environmental control board, covers the republic's Arctic coast, nearby islands and the Northern Sea route. Specialists work at 50 polar stations around the clock. The most distant of these is located on Zhokhov Island, 500 km from the coast.

Hydrometeorological services in Yakutia are also responsible for environmental control. They monitor the content of dust and gas in the air, and the extent of water pollution by oil products and other harmful substances. This work is performed at both stationary and mobile stations, during field expeditions, and also with the help of aerial observation. All Yakut industrial enterprises

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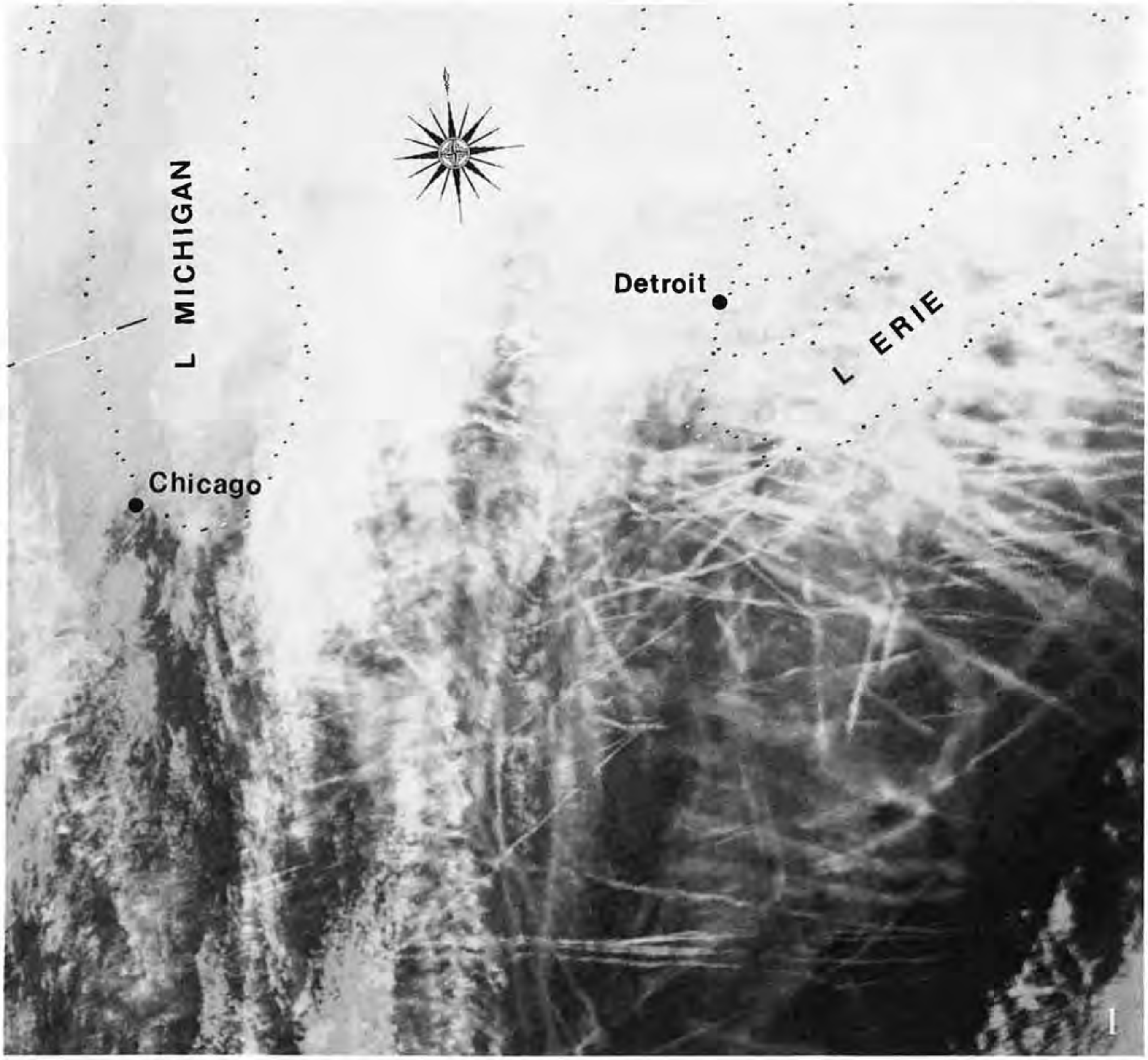
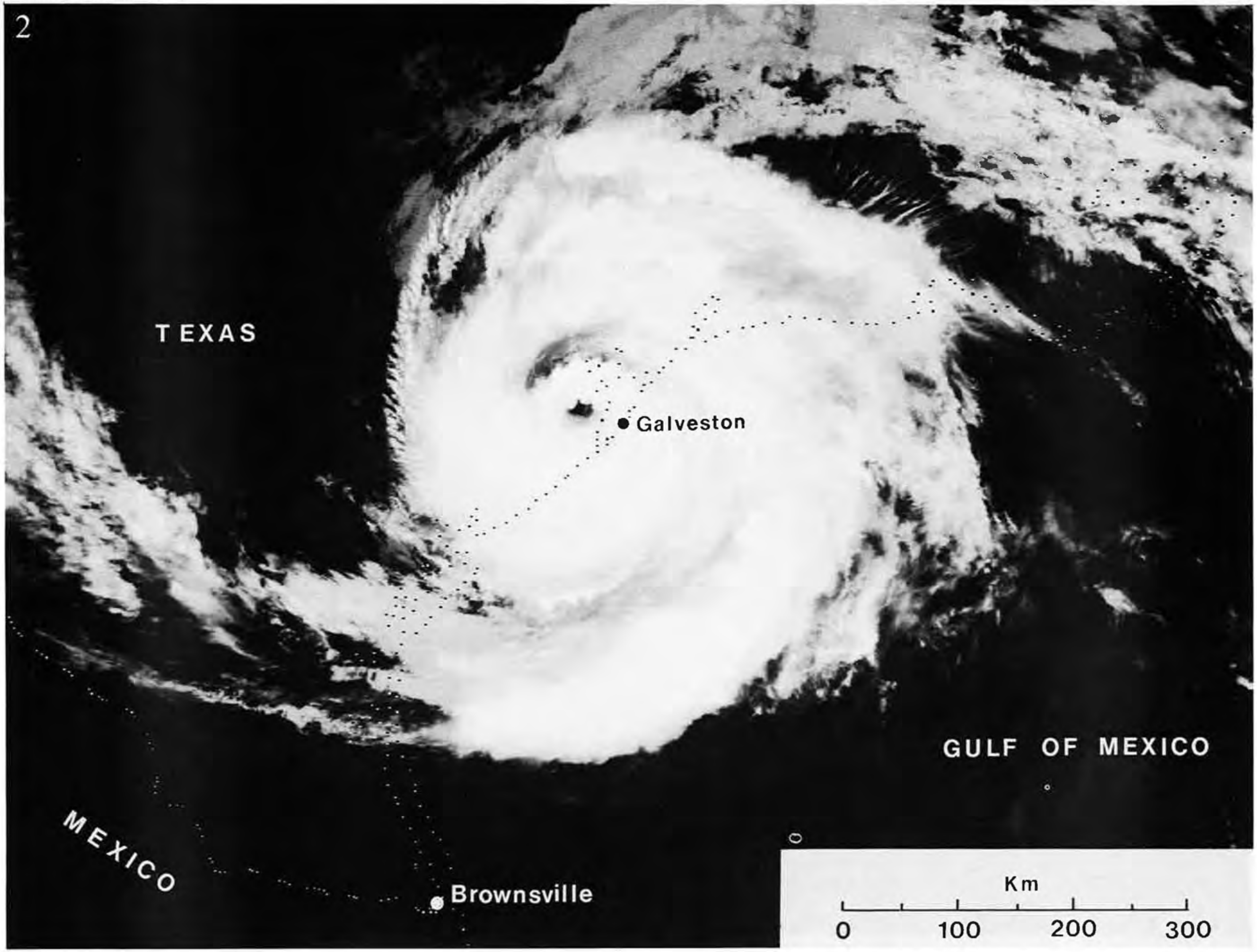


Courtesy Environment Canada

SATELLITE PHOTOS—THE BEST OF 1983

The cover photograph, as well as the three pictures shown here, were all taken by the NOAA 7 weather satellite from an altitude of about 850 kilometres above the earth. Photo number 1 (this page) taken November 9, 1983 is an enlargement of the area of southwestern Ontario and the states of Michigan, Ohio, Indiana and Illinois. The white patterns are clouds and the dark patches are regions of clear skies. Most remarkable is the clear evidence of man's activities in the form of scores of jet plane contrails that can be seen criss-crossing the air routes south and southwest of Lake Erie. Photo number 2 (page 40) shows hurricane Alicia crossing the Texas coast near Galveston at 4 am EDT on August 18, 1983. The eye of the storm lies about mid-way between Galveston and Houston. Photo number 3 (page 41) was taken on June 24, 1983 and shows the waters of the Atlantic Ocean off the northeast coast of the USA and south of Nova Scotia. A few streaks of white clouds can be seen but otherwise skies were clear allowing the satellite's infra-red sensor to pick up the temperature variations of the water surface. The warm waters of the Gulf Stream stretch as a dark sinuous band from Cape Hatteras to about 40°N 60°W. Swirls of colder water from the north Atlantic, indicated by the various lighter shades of grey, probe and loop southwards.

Courtesy Environment Canada



Courtesy Environment Canada

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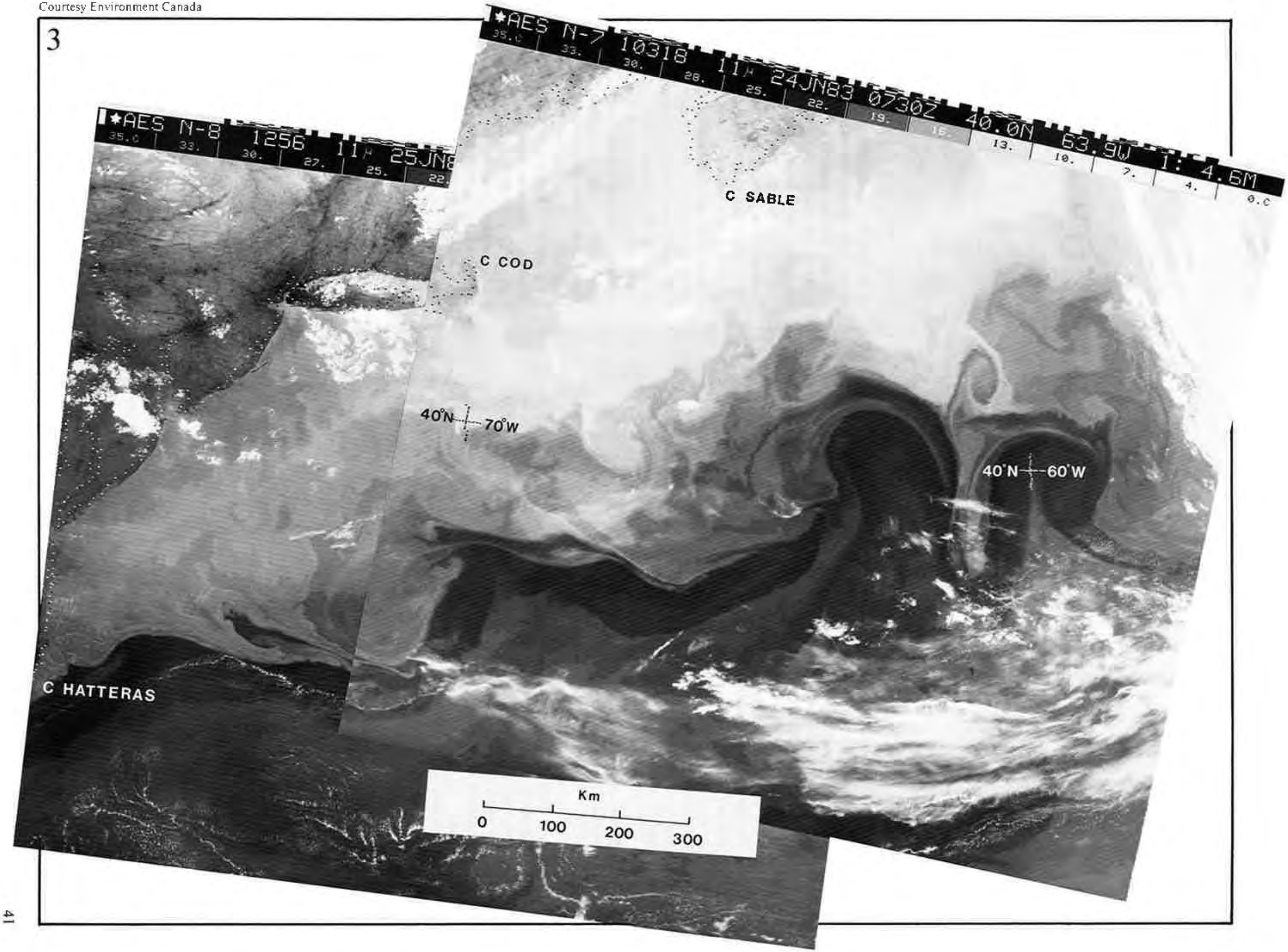


THE PRE-CONFEDERATION WEATHER NETWORK

by Michael J. Newark

If, in 1797, the Moravian missionaries located near present day Thamesville, Ontario had been able to compare notes with Peter Fidler a Hudson Bay Company employee in what is now Manitoba, they would have discovered that the winter in both parts of the country could be equally long and arduous. As we now know, Canada at that time was in the grip of the little ice-age and winter arrived early and relinquished its grip late. In talking about the 1796-1797 winter season, Fidler said "this has been the most backward spring and cold winter ever known by any person in these parts." The Moravians found themselves knee deep in snow on November 24, 1796, and suffered through temperatures as low as 12 below zero Fahrenheit.

Although their occupations and locations were far apart, HBC employees and the Moravians had one thing in common, namely an interest in the weather and making observations of it. It seems to have been the practice of the Moravian missionaries to take such observations wherever they settled. During the latter half of the nineteenth century they took a long series at their missions on the coast of Greenland and Labrador. Their observations at Fairfield, Upper Canada (just east of Thamesville) began in 1792 and continued until 1813 when their station was destroyed by the invading Americans.

In the late 18th century, a number of HBC employees besides Fidler were engaged in measuring the temperature, wind and atmospheric pressure. At Fort York in 1771, Mr. Thomas Hutchins noted in his record of October 2nd, "this day some Indian children accidentally cracked the tube of the barometer. I made two ligatures on it and did not perceive any air had gained admittance." However, his patchwork failed and although he finally obtained a replacement from England, it didn't last long because the post surgeon found himself in urgent need of quicksilver and borrowed some mercury from the barometer.

A lively interest was also taken in the weather at York (the precursor of Toronto). In January 1801, the *Upper Canada Gazette* began publishing meteorological observations of the temperature and weather. "We are much indebted," the paper declared, "to an ingenious Gentleman of this Town (for the observations) ... we hope they may prove agreeable to our Readers as the are the first of the kind ever published in this Province." Apparently the thermometer was originally installed with a southerly exposure, but this mistake was quickly discovered and it was moved to a north-facing location.

Egerton Ryerson at 33 years of age (from a portrait by the noted English artist, William Gush). He was the moving force behind the establishment of meteorological stations at Grammar schools in Upper Canada during the middle of the 19th. century. This was the first real observing network ever organized in Canada.

It was not so easy for the ingenious Gentleman to live down a bungled attempt to explain the word 'meteorological' as it applies to taking weather observations. Several newspaper readers responded with humorous letters to the editor which are perhaps the first published examples of the public poking fun at the weatherman. One reader wrote "meteorological relates to the doctrine of meteors (a statement made by the ingenious Gentleman) ... what are we to infer from this? That the weather, or the weatherglass are transitory bodies appearing in the air ... 'tis the practice with a number of rational gentleman to fortify the vacuum of their brains with a strong solution of Irish whisky until their optics are not so keen, but may mistake earthly objects for dancing meteors ... ." The ingenious Gentleman responded to this jibe with the statement "the motives I had in handing meteorological observations to the printers was to remove, as much as possible, the prejudices entertained in almost every other country against Canada, from the severity of the winter. But the question I put was to satisfy myself as to the propriety of classing meteors with the effects air has upon mercury. ..."

Clearly, around the time of the 18th century there was a considerable interest in systematically observing the weather. Along with the Hudson Bay Company and Moravians can be counted surveyors, explorers, and individual diarists who also kept weather records. However, this activity although widespread in practice was uncoordinated and fragmented in space and time. It is unlikely that any of these people knew of the efforts of others and it was not possible to draw the information together into a coherent picture of Canada's weather and climate.

True enough, knowledge of local climates began to emerge from this work. The Hudson Bay Company for example learned to cease its fruitless attempts to locally grow enough food to become self-sufficient at its barren northern outposts. Peter Fidler discovered that Holland gin froze at 17°F below zero, English brandy froze solid at 25°F below, and rum froze at 31°F below. But it is in the remarks of the ingenious Gentleman that we find a clue to one of the first forces that would begin to lead to more organization in the collection of weather data. This force was immigration. British North America needed people to open up the vast wilderness and to reinforce Britain's desire to defend its possessions against the expansionist Americans. Climatic summaries became a standard part of the literature produced by politicians and land development companies for the purpose of wooing potential immigrants to a country perceived as being cold and inhospitable.

If a review of the book *Statistical Sketches of Upper Canada for the Use of Immigrants* published in 1832 is anything to go by, perhaps such discourses on the climate achieved the very opposite of what the authors were trying to portray. Authored by a satirical friend of Dr. Samuel Johnson, the review summed up the climate of Canada as follows; "for two months of spring, and two months of autumn, you are up to your middle in mud; for four months of summer your are broiled by the heat, choked with the dust, and devoured by the mosquitoes; and for the remaining four months, if you get your nose above the snow, it is to have it bit off by the frost."

In 1839, a powerful new force emerged that would eventually focus the efforts of the growing meteorological community into the formation of an official government network of weather stations. This force was the need of the British Royal Navy for a system of simultaneous worldwide magnetic observations. As part of such a system, an observatory was established in Toronto in 1839 by Lieutenant Charles Riddell, R.A. As well as observations of the earth's magnetic field, the observatory also made meteorological observations. Amateur but highly competant weather observatories followed, such as that built by the meteorological pioneer Dr. Charles Smallwood (*Chinook*, Summer 1981) at Isle Jesus near Montreal in 1841, and another in Halifax by F.A. Allison, Esq.

When Lieut. Riddell was forced by illness to return to England in 1841, he was replaced by Captain (later General Sir) Henry Lefroy. Captain Lefroy was an enthusiastic observer who quickly moved to place a book in each of the military guard rooms in Canada for the purpose of recording wind and temperature data and in formation concerning aurora and unusual atmospheric phenomena. He attended the meetings of scientific societies in Washington and Harvard and there learned of the system of meteorological observations in the superior schools of New York and other states. He attempted to have this system introduced into the grammar schools of Canada but was recalled to London before this could be accomplished.

More players in the field of personalities who led the way to the establishment of meteorology as a science in Upper Canada. Top left, *Lt. C.J.B. Riddell, R.A.*; top right, *Capt. J.H. Lefroy, R.A.*; lower left, *Prof. J.B. Cherriman, M.A.*; lower right, *Prof. G.T. Kingston, M.A. (From Journal of the Royal Astronomical Society of Canada, 1940).*

Simultaneous observations of the atmosphere are fundamental to a weather forecasting system and the collection of climatological data, and Lefroy's zeal in pursuing such an observation network was not wasted. Others had also seen the need and took over. One such individual was Major R. Lachlan, President of the Natural History Society who seemed anxious to receive credit for originating the idea. On March 18th, 1854, he formally presented a suggestion to the Canadian Institute to establish a system of simultaneous meteorological observations and lake level measurements.

Lachlan's proposal was to standardize record keeping and measure temperature and pressure four times a day at 6 a.m., 9 a.m., 2 p.m., and 9 p.m.; wind direction morning and afternoon; rainfall; and to make notes on the prevailing weather. This system would be integrated with the U.S. system of 50 stations then already in operation. With regard to measuring the variation of pressure, he noted "I fear this would not be so easily accomplished from there being so few barometers in this country." Concerning lake levels, his proposal was designed to gather data "to set at rest not only the disputed existence of the traditional septennial flux ... of their waters, but also the extent of the better known annual variations in their level."

For support of the meteorological system, he had turned to Captain Lefroy who offered the advice "that there should be a station at least every 100 miles from east to west and from north to south on the line of Ottawa." Furthermore he considered that £10 per station would be sufficient, exclusive of publications, to furnish a barometer, wet and dry thermometers, rain gauge and wind vane. Captain Lefroy also offered his opinion that it would take a considerable time to acquire the instruments and compare their accuracy.

Lachlan foresaw the usefulness of telegraph lines in conveying information and providing storm warnings. Because the results of the meteorological system would be "of a useful and beneficial public character" he reasoned, (a) that Government funding should cover the cost of instruments; (b) that public servants such as harbour-masters, lighthouse keepers and customs collectors should act as local observers; (c) medical officers in military hospitals should furnish a copy of the meteorological record transmitted by them periodically to the medical Department of the Army in London; (d) the cooperation of the Governor of the Hudson Bay Territory should be sought; (e) invitation should be made to seek the cooperation of every university, college and other educational institutions and learned societies in soliciting volunteer observers.

In terms of public benefits Lachlan used as an example the results obtained from the set of U.S. meteorological data measured from 1825 to 1850 by the Regents of the University of New York. These were the determination of the "extent and progress of storms and the various atmospheric vicissitudes ... and establishing the laws of climate, the mean temperature, depth of rain and general character of the weather etc." This, he reasoned would allow the limits of vegetation to be found and the areas of climate adapted to the cereals; the parallels within which wheat, Indian corn etc may be profitably cultivated; the effects of moisture and evaporation upon drought; the health and comfort of man; the improvement of rivers and the means of avoiding and controlling floods and freshets; the system of winds prevailing in different parts; the application of using atmospheric pressure in determining the height of land features and mapping topography; the direction of the motion; frequency and intensity of thunderstorms.

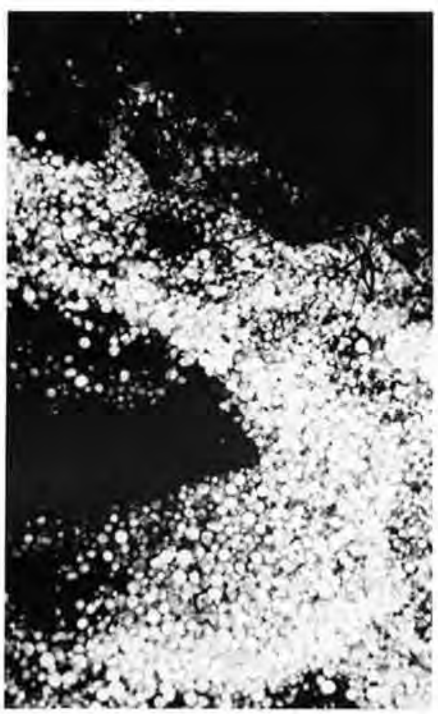
Lachlan did not act upon his proposal but asked the Institute to set up a special committee to investigate and report on his project. The Institute moved very slowly if at all as it did not want the burden of abstracting, reducing and preparing for publication the great mass of information produced by Lachlan's proposed 26 observing stations in the Province of Canada (between Gaspe and western extremity of Lake Superior). Such a grand scheme was beyond the resources of the time and it was not until the Confederation of Canada that Lachlan's measures were instituted by the Department of Marine and Fisheries in response to the need for storm warnings. Impressed by the growing importance of meteorology, in 1871 the Dominion Government gave a grant of $5000 to Professor G.T. Kingston who became the first Director of the Meteorological Service of Canada as well as Director of the Toronto Magnetic Observatory.

But we are getting ahead of ourselves. The Reverend Dr. Egerton Ryerson, Chief Superintendent of Education for Upper Canada entered the scene. He was a remarkable man. Stern-looking with a shock of white hair in his later years, he seemed to possess boundless energy. Not only did he found the Ontario public school system while maintaining his position as the foremost Methodist of his time, he also founded the Christian Guardian and later obtained a charter for the Upper Canada Academy (later Victoria University) in Cobourg and was appointed its first principal. In later years he was elected President of the Methodist Church. In 1854, when Grammar schools came under his control, Ryerson enthusiastically forged ahead with establishing that part of Lachlan's proposal dealing with the recruitment of volunteer weather observers in schools. Legislation enabling this action had been passed in 1853 by the Provincial government and Ryerson began travelling to London, England to obtain instruments. He envisaged a total of 73 stations, with the Headmaster to assume the duty of taking meteorological observations. For this, a special allowance at the rate of $200 per annum was to be paid over and above the regular salary (which ranged from about $1000 to $1300 a year). In practice, however, problems were encountered. The added chore of taking the observations was not popular, and the acquisition of instruments was slow. In his 1862 report, the Rev. Dr. Ormiston, a school inspector, noted that at some schools the instruments had not been procured, and in others where they had been, they were not used. "Only in a few places" he wrote, "are the observations made regularly and accurately recorded. This state of things," he continued, "is doubtless to be accounted for by the fact that no remuneration is given for the performances of this duty, a fact of which I was not unfrequently reminded, and of which the teachers justly complain ... ." By the end of 1862, a total of 19 schools were taking observations. Their work was "graded" as well prepared, indifferently prepared, and badly prepared. At Chatham, the program had been in operation for 5 years but only 15 months of observations were taken and all of these were rated as being indifferent or badly prepared. Cornwall on the other hand had taken 42 months of observations in the same period and all were noted as well prepared. C.J. MacGregor, the headmaster of the Stratford Grammar School obviously enjoyed this work because he authored a paper entitled "On the Climatology of Stratford, Ontario" a scholarly work which was published in the Canadian Journal in 1868.

Top, *a view of Old Fort York from the east. The Magnetic and Meteorological Observatory first established by Lt. Riddell was temporarily located in one of the unused Bathurst Street barracks of the fort during December 1939.* Bottom, *the Observatory was moved to specially constructed log buildings on the grounds of the University of King's College (now the University of Toronto) during September 1840. (From the Journal of the Royal Astronomical Society of Canada, 1940).*

In his annual reports, Ryerson spoke in glowing (but unjustified) terms about the weather program. In 1867 he wrote "our stations are still deficient in anemometers for ascertaining the velocity of the wind, and the observers are therefore obliged to estimate its force. With this exception, for which it is hoped a remedy will be found, our meteorological system is working admirably, and I doubt if anywhere so valuable a collection of facts is systematically made at so little public expense." In actual fact the program continued to stagger along with the Headmasters still looking for their non-existent special allowance until 1874, just after sweeping changes were made in the general regulations governing high schools. These provided for fixed work terms, regulated hours of work, defined holidays and vacations and as such sounded the death knell for the meteorological program which required the Headmaster to take observations at 7 a.m., 1 p.m. and 9 p.m. all year round.

Deficient as this school network may have been, it still represents the first truly organized attempt to measure and understand the weather and climate of Canada. It represented a considerable advance over the individual efforts which preceded it and paved the way for the full fledged national network which was established shortly after Confederation by the government of Canada.



ARCH PUZZLE No 19

It has been a while since this department was last seen in *CHINOOK.* It enjoyed a certain amount of popularity, particularly when prizes were offered. We just happen to be in the happy situation of discovering some puzzling pictures at the same time as having a copy of *The Weather Book* to give away, so here is challenge number 19. Can you identify what the two pictures on this page represent? Send your answers to the Editor, Chinook, c/o CMOS Suite 805, 151 Slater St., Ottawa, Ontario K1P 5H3 and the first entrant who correctly identifies both pictures will be declared the winner.

Continued from page 38

must take pollution control measures and as a result, the pollution of rivers and the air has been reduced.

Most Yakut weather forecasters are graduates of the Leningrad and Odessa hydrometeorological institutes as well as of Moscow, Vladivostok, Irkutsk, Novosibirck, and Sverdlovsk technical schools. Among them are quite a few members of local ethnic groups such as Yakuts, Evens, and Evenks.

Alexei Zabolotsky, a Yakut, one of the oldest meteorologists in the republic, recently celebrated his 70th birthday. In 1937 Zabolotsky started working at an island station in the Laptev Sea.

Yuri Proshin, a Russian, graduated from the Odessa Institute and has been working in Yakutia for 25 years. He says that within this time no major changes in climate have taken place in the republic. He has however observed a trend in recent years of increasing humidity in summer, while droughts have decreased.

Weather researchers throughout the world have tried to artificially influence atmospheric processes. In this respect, the weather of Yakutia is particularly difficult to modify. For example, in the low temperatures of the republic, fog exists in the form of ice crystals, and not water drops. The reagents such as silver iodide or dry ice which are often used to seed and successfully dissipate water droplet fog are not suitable for ice fogs. But more success has been achieved in experiments to extinguish forest fires with artificial rain, and such a method can, in principle, be used in summer throughout Yakutia.

NEWS AND NOTES

BETTER SCREENING METHOD FOR TOXIC CHEMICALS

An environmental toxicologist at the **University of Waterloo** is developing faster, more cost-effective methods to measure toxicity in fresh-water fish populations. Prof. **George Dixon** has long been concerned about the time and expense involved in identifying man-made chemical toxicants—often by-products of petroleum or other industrial processes—in our lakes and rivers.

Dixon estimates there are approximately 40,000 toxic chemicals present in the North American environment in significant quantities (five tonnes or more). He further estimates there are 2,000 more potentially harmful chemicals released each year, each of which should be fully screened by toxicologists so their approximate effects on the environment can be determined.

"If we could merely single out the most harmful chemicals quickly, it would be a help," says Dixon. "Then we could do more detailed testing where we note a potential problem. "Proper testing of just one chemical takes three years," says Dixon, "and these tests can cost from $1 to $2 million."

With a limited number of toxicology research units in North America, scientists must have faster screening methods so they can quickly identify chemicals that should be tested thoroughly before being released into the environment.

Dixon is developing unique methods for screening toxic chemicals in rivers and lakes in co-operation with the **Ministry of the Environment's** Department of Fisheries and Oceans.

One method, called QSAR (Quantitative Structure Activity Relationships), numerically relates a chemical's structure with the degree of reaction in fish exposed to it.

Dr. Dixon is using QSAR to identify toxicants based on two types of chemicals—benzenes and phenols. These chemicals are widely used industrially and are commonly found in contaminated fish tissue in both fresh and salt water.

Benzene and phenol based compounds have identifiable chemical structures, so Dixon can compare the degree of toxicity in fish to a given structure with a computer program prepared for this purpose. Once a correlation is established between a compound's structure and its toxicity, the measure can be entered into a database and quickly accessed for future reference. Then, when a new chemical compound needs to be screened its chemical structure can be checked against the database. A matching structure would be spotted by the computer and the approximate toxicity of the compound would be estimated.

To note the effects of benzene and phenol based toxicants in aquatic life, Prof. Dixon has developed a number of experimental innovations that improve classical fisheries techniques. "The typical way to do this," says Dixon, is to introduce the toxic substance into the fish tank, and maintain a lethal concentration (L.C.). To do this you need constant monitering and expensive pumps, gauges and so on. "What we are doing is administering a toxic dose directly into the fish with a hypodermic needle, thus eliminating much of the expensive monitoring apparatus."

After the toxic dose has been administered Dixon examines the fish's blood for an enzyme called Sorbital Dehydrogenase (SDH) which is released by the liver in response to toxic contaminants. The enzyme is released into the bloodstream as the liver cells are broken down.

"Therefore," he says, "the more liver damage, the more SDH enzyme in the blood. We use this measurement as the 'degree of reaction' in the QSAR equation, and come up with the numerical relationship between chemical structure and toxic reaction to the chemical in fish."

Dixon asserts with his experimental innovations, many more toxic chemicals can be screened.

"We can identify toxic chemicals much more quickly than we could using ordinary methods," he says.

A PORTABLE POWER STATION

Soviet specialists have designed a unique air-hydrogen electrochemical generator, named the Malakhit-6. It can replace conventional cells and storage batteries for feeding meteorological stations, beacons and radio equipment. This reliable and compact generator has no analogue in the world.

Electrochemical generators have been known about for some time. In the early 19th century the British physicist **W.R. Grove** advanced an idea of a fuel element, the basic element of the device. As a result of a reaction between fuel and an oxidant, for instance hydrogen and the air, chemical energy was converted into an electrical one. It took, however, more than 100 years to implement the idea. Complex structure and high cost of fuel elements prohibited their mass-scale production.

The first prototypes of those elements were developed in the sixties. Generators made on this basis are lighter and more reliable than galvanic cells used in instruments. They have a greater efficiency. The efficiency of airhydrogen electrochemical generators, for example, exceeds 60 percent. This makes them highly promising for use in battery-driven cars. Specialists maintain that in the future these generators will provide a cheap, efficient and non-polluting source of energy.

Staffers of the **Kvant Research and Production Association** have developed the unique Malakhit-6 electrochemical generator. An efficient and very simple device, it weighs less than five kilograms.

The device is a miniature power station which generates 12 V current for various instruments and apparatus. It will be indispensable in remote mountain regions, in deserts and in the tundra, where the construction of power supply networks is economically unjustified. It will replace bulky and short-lived storage batteries, broadly used by deer breeders, geologists and polar researchers.

The new generator consists of an ion-exchanging membrane, a reactor and current leads. It converts a chemical reaction between hydrogen and oxygen into electrical energy. Hydrogen is produced in a small reactor, which contain 30-40 grams of a special chemical agent and water. Their reaction yields hydrogen in the quantity sufficient for 12 hours of continuous operation.

In its characteristics and power-per-weight ratio the new generator is five times more efficient than conventional batteries. Its broad-scale use promises numerous economic advantages. A month-long operation of the new generator instead of conventional mercury-zinc batteries will give a saving of 35 kilograms of mercury oxide, 10 kilograms of zinc and 40 kilograms of construction materials.

The Malakhit-6 generator was on display at the Electro-82 international exhibition in Moscow.

PROFESSIONAL AND BUSINESS DIRECTORY

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