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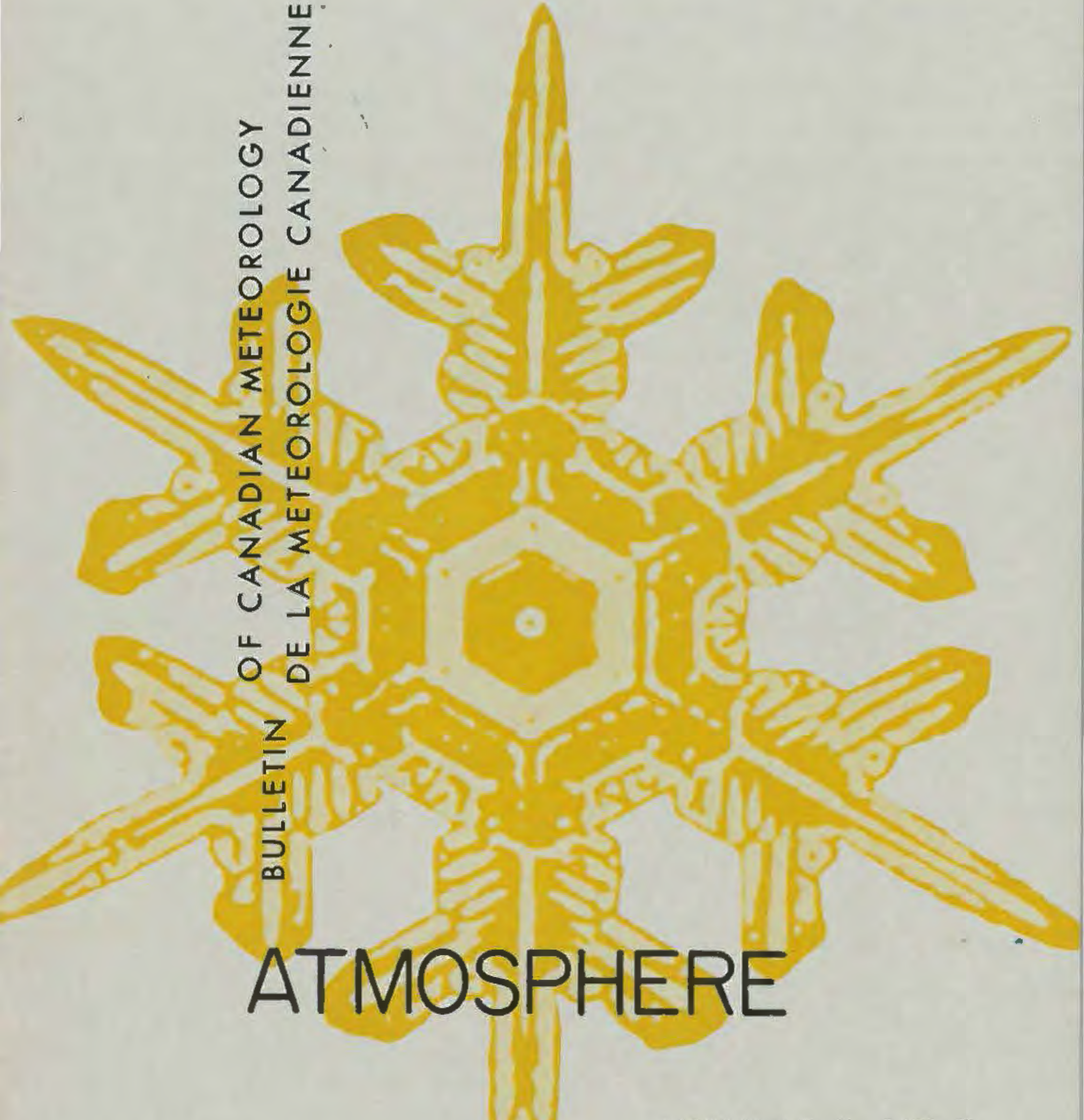

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The Canadian Branch

ROYAL METEOROLOGICAL SOCIETY

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AWARD OF THE PATTERSON MEDAL

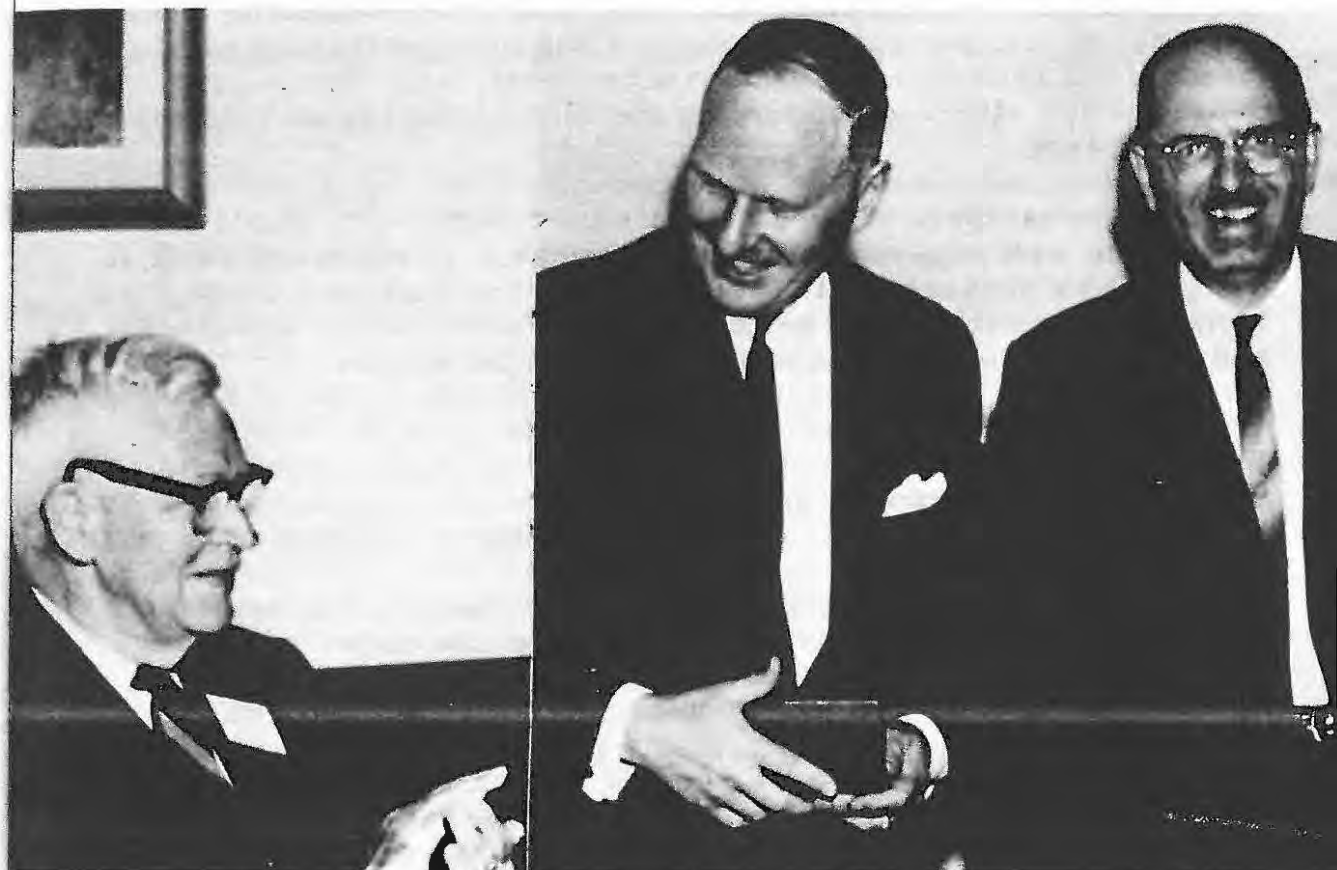
Dr. Andrew Thomson of Toronto and Dr. Patrick D. McTaggart-Cowan of Vancouver were honoured in June by the presentation of Patterson Medals, made at a luncheon of the Royal Meteorological Society (Canadian Branch) held at the Faculty Club of the University of British Columbia. The occasion was unique in that both recipients were former directors of Canada's weather service, and the presentation was made by the present director, J.R.H. Noble.

The Patterson Medal award, established in honour of the late Dr. John Patterson on the occasion of his retirement as director of the Department of Transport's Meteorological Branch in 1946, is given for sustained contributions to Canadian meteorology over a period of years, or for a single outstanding contribution by a Canadian to the advancement of the science.

Andrew Thomson, D.Sc., M.A., O.B.E., a native of Dobbington, Ontario, was director of the Meteorological Branch from 1946 to 1959. Before joining the Branch in 1932, Dr. Thomson had been associated with Thomas A. Edison in research during World War I. He played a leading role in a number of scientific expeditions, served as director of the Apia Observatory in Samoa and as aerologist in New Zealand. Dr. Thomson was made an officer of the Order of the British Empire in 1946, awarded the Gold Medal of the Professional Institute of the Public Service of Canada in 1952 and received the Honorary Degree of Doctor of Science from McGill University in 1958. The citation accompanying the Patterson Medal noted his outstanding contributions to Canadian meteorology for more than 25 years and emphasized his leadership in forging a link between the universities and the government service, and his service to international meteorology through his lengthy membership on the Executive Council of the World Meteorological Organization.

Patrick Duncan McTaggart-Cowan, D.Sc., M.B.E., a native of Scotland, came to Canada as a youth and graduated from the University of British Columbia in 1933. He attended Oxford University as a Rhodes Scholar and received an honours degree in Natural Sciences in 1936. Dr. McTaggart-Cowan joined Canada's weather service in 1936 and was appointed director in 1959. He resigned in early 1964 to accept his present position as President of Simon Fraser University at Burnaby, B.C. He was made a Member of the Order of the British Empire in 1946 and in 1959 received the Robert M. Losey Award from the Institute of Aeronautical Sciences in recognition of his outstanding contributions to the science of meteorology as applied to aeronautics. In 1961, his alma mater conferred upon him the honorary degree of Doctor of Science.

The citation accompanying the Patterson Medal awarded to Dr. McTaggart-Cowan noted his sustained contributions to Canadian meteorology and emphasized his role in the development of meteorological services for trans-Atlantic aviation and in international meteorology, his leadership in the development of meteorological services, and his encouragement of meteorological research within the government service and at Canadian universities.



Award of Patterson Medals

From left: Dr. A. Thomson, Dr. P.D. McTaggart-Cowan,

Mr. J.R.H. Noble

SIXTH NATIONAL CONGRESS OF THE CANADIAN BRANCH OF THE ROYAL METEOROLOGICAL SOCIETY

Another National Meteorological Congress has been held, for the sixth year in succession. This year the host city was Vancouver, B.C., and the site was the University of British Columbia, with its campus located in Point Grey overlooking the waters of Georgia Strait. This time the weather cooperated in every way, with beautiful sunshine and with afternoon temperatures the warmest of the year to date, reaching a high of 72° on the day of registration. A pleasant afternoon sea breeze aided by removing most of the atmospheric pollution and thus permitting plentiful views of the mountains to the north and east, with their snow capped peaks standing out against the blue of the sky and the green of the forests.

The campus, also, was at its best and Mr. S. Nikleva had everything well organized for the meetings. A representative of R.M.S. was present at the main registration desk both Sunday and Monday before the meetings to pass on information to delegates and wives and to answer questions or give directions.

Mr. Dave Strachan, Officer-in-Charge of the Pacific Weather Central and chairman of the first session, opened the meetings Tuesday morning, June 8, with a welcome to the more than sixty members of the Royal Meteorological Society and guests.

The morning session was entitled "Weather Forecasting", and eight interesting papers were presented on subjects ranging from general weather and precipitation forecasting, to aviation climatology and the measurement of sea surface temperature.

The afternoon session, guided by Dr. J. Maybank, of the Saskatchewan Research Council, saw papers on cloud and precipitation physics, and on a number of general subjects ranging from air pollution in Vancouver to "the Kernlose Winter" of the Arctic. Wednesday's sessions were chaired by Dr. R.E. Munn in the morning and by Professor A.W. Brewer in the afternoon. Topics included "Wave Motions and Atmospheric Dynamics" and "Dynamic Meteorology and Numerical Weather Predication".

The variety and quality of papers presented during the two days were outstanding, and the only real complaint was a shortage of time. A number of papers were necessarily severely condensed. A source of satisfaction, too, were the number of papers presented by members of the Meteorological Service of

Canada, suggesting that the time is fast approaching when we can form and support our own Canadian Meteorological Society.

Tuesday's luncheon and Annual Meeting of the Canadian Branch were held in the Faculty Club of the University. The head-table party included our present and two past directors, in the persons of Mr. J.R. Noble, Dr. P.D. McTaggart-Cowan and Dr. A. Thomson. Mr. Noble, chairman of the Patterson Medal Committee, named the two recipients and presented this year's medals to Dr. Thomson and Dr. McTaggart-Cowan for outstanding contributions to meteorology in Canada. Dr. B.W. Boville named Mr. John Clark of McGill University winner of the Darton Canadian Prize; Professor S. Orvig of McGill winner of the President's Prize; further, a book was presented to Mr. W.K. Sly of Edmonton as winner of the Applied Meteorology Prize.

Dr. R.E. Munn commented on the expansion of the Canadian Branch of the Society with the establishment of two new centres, in British Columbia and Halifax. Due to the shortage of time, with the meeting already running into the time allotted for the afternoon sessions, the business meeting was quite short. In view of this, it was suggested from the floor that more time be allotted for the business meeting next year.

Another highlight of the Congress was the Wednesday evening dinner at the Centennial Pavilion on the top of Burnaby Mountain, and the subsequent visit to Simon Fraser University - still under construction. The site is on the very top of the ridge at an elevation of approximately 1500 feet above Burrard Inlet. Every effort has been made to take advantage of the site, and the resulting structure shows imagination and audacity. Dr. McTaggart-Cowan is certainly to be congratulated and envied on the results, for there is no doubt that the finished product is going to be an outstanding achievement.

J.B. Wright.

MCGILL OBSERVATORY THROUGH 100 YEARS

by Nancy Bignell

(Reprinted with permission from "McGill News", Summer 1962)

Weather and time were constant sources of interest to early Montrealers, as they are today, and before 1800 scattered weather records were being kept by a variety of private citizens, sometimes farm-owners and often members of the medical profession. These early records were informal and sometimes lively, with topical notes such as "Governor set off for Quebec in a Calish", or "Six Brigs came in to Port from Europe", among the winds and temperatures. But they were sometimes open to question from a scientific viewpoint. By 1841, John S. McCord, a prominent Montrealer whose son gave his name to the McCord Museum, was deploring the "lack of system in times and manner of observations". He was a member of the Meteorological Society of London, and directed temperature readings by the military guard on St. Helen's Island for the Natural History Society of Montreal.

This active group included many prominent Victorian Montrealers connected with McGill. One was Dr. William Dawson, McGill's Principal; another was Dr. Charles Smallwood, an English-born physician with a great interest in meteorology and astronomy. The latter settled at St. Martin on Isle Jesus, about nine miles west of Montreal, and used his own resources to build an observatory there. In the intervals of his medical career he found time to design and build automatic recording instruments to measure atmospheric electricity, solar and terrestrial radiation, evaporation, rainfall and wind. His small observatory building contained a transit instrument and an accurate clock, an ozonometer, and other more usual weather instruments of the day.

"The whole of this apparatus, even to the electrometers, is the result of his own handicraft", wrote Dr. Hall, another member of the Natural History Society, "and exhibits on his part a mechanical talent of the highest order." He published a number of scientific papers as well as detailed weather summaries, which appeared from time to time in The Gazette.

Dr. Smallwood was appointed Professor of Meteorology at McGill in 1856, one of the first in the British Empire. A few years later the President of the Grand Trunk Railway proposed an observatory in Montreal, suggesting that the University might offer a site, and in 1862 Dr. Smallwood offered to move his instruments "to a small Building capable of receiving the same if such could be erected on the College property, with the ultimate hope that a Government Observatory might hereafter be established". A few months later the work was under way, and the stone tower forming the earliest part of the Observatory was built, at a cost of about $2,000.

Dr. Smallwood was now in late middle age, but he lost no time in taking advantage of his new location. By 1870 the University calendar describes a busy institution which gave "time to the City, and to the Ships in the Harbour", being connected by telegraph with a "Time Ball" at the wharf. "Connection by Electric Telegraph having also been established between the Observatory and the Government Buildings at Ottawa, mean time is furnished daily at noon, and made known there by the firing of a Cannon". The basement of the building was used for observations on terrestrial magnetism, containing a declinometer, a magnetometer and a dip-needle, and the ground storey held the various meteorological instruments. A grant was received annually from the Provincial government, and the Dominion authorities had recognized Dr. Smallwood as one of the handful of official observers in Canada, forming the early beginning of the network of Canadian weather stations as we know it today.

Students were trained as assistant observers, and in the early 1870's a young McGill engineering undergraduate named C.H. McLeod was allowed to room in the main college building (the present Arts Building) in order to take readings at the nearby observatory. He graduated in 1873 with four classmates, fully-fledged Bachelors of Applied Science in Civil and Mechanical Engineering - the first group of McGill engineers to graduate as a class. His diploma was signed by Dr. Smallwood as Professor of Meteorology. Time was running out for the older man, who died after a brief illness just before Christmas, 1873. "As a doctor he was energetic and popular," wrote The Gazette's editor, "but it is as an ardent student of meteorology that his name will live longest." His work "made valuable contributions to the important science to which he was so deeply devoted."

Dr. Dawson asked the newly-graduated engineer to take temporary charge of the Observatory, and young Mr. McLeod went to Toronto to spend a week in the observatory there under the director, Prof. Kingston. At the end of January, 1874, the first weather report was telegraphed by Mr. McLeod and his assistant under the watchful eye of a telegraph instructor, direct from the Observatory to Toronto. A new era had arrived, in which weather data could be reported at high speed to the head office of Canada's young meteorological service at Toronto. In August, 1874, McGill became a "chief station" in the new Dominion network, making eight observations daily, at three-hourly intervals. Mr. McLeod's temporary job became permanent, and the erstwhile student eventually became Prof. C.H. ("Bunty") McLeod, Ma.E., F.R.S.C., Professor of Civil Engineering, Vice-Dean of the Faculty of Applied Science, and Superintendent of the Observatory for over 40 years.

Providing accurate time was an important Observatory service, and an exact knowledge of longitude was essential for this. Many years earlier, a Captain Ashe of the Royal Navy had calculated longitude for "a station in Viger Garden in this city" by telegraphic signals to Quebec. Prof. McLeod now decided to check this old calculation by direct telegraphic connection with Harvard University Observatory, the base station for the whole continent. Expensive equipment was assembled and arrangements with Harvard made, and in 1883 a series of telegraphic exchanges of clock signals were made, with meticulous observations for determining clock error before and after each signal exchange. Prof. McLeod travelled to Cambridge to make half of the observations, while his Harvard counterpart, Prof. W.A. Rogers, observed at McGill. Harvard generously paid for half of the expense of the work. By 1885 reduction of the results was complete, and the longitude of the pier of McGill's transit instrument established as 4 hours, 54 minutes, and 18.543 seconds west of Greenwich.

McGill was now the base station for Canada, and similar observations were made to determine accurately the longitude difference between McGill and Toronto, and Cobourg, Ontario. But Prof. McLeod was not yet satisfied. Harvard's longitude was the most accurately known in America, based on three separate determinations by the Atlantic cables, but these had been made almost fifteen years earlier. Why should McGill not make an independent determination for Canada by direct connection with Greenwich? Free use of lines and cables was offered by the great telegraph companies, and Canada's Governor General obtained the cooperation of the British Government through the Astronomer Royal. The Dominion made a grant of $2,000 for the work, and experiments were made on signal transmission by specially designed automatic repeaters between land lines and cables.

"Wonderful Telegraphy", exclaimed a headline in The Gazette in 1891 over an account of signals between McGill and Waterville, Ireland to determine time required to cross the Atlantic for interchange of observations with Greenwich. Two Canadian and two English observers did the work, exchanging stations to complete the series of four observations in the summer of 1892. The final result gave a longitude for the Montreal station of 4 hours, 54 minutes and 18.670 seconds west of Greenwich, the only longitude in Canada determined "with that accuracy which meets the requirements of modern geodetic work". This was important at a time when both the U.S. Coast and Geodetic Survey and the Dominion Lands Survey were trying to close the chain of longitudes being carried across the continent, and in 1896 the U.S. agency sent two men to McGill to do longitude work from the Observatory transit pier. The longitude of Harvard itself was revised slightly on the basis of McGill's cable determination, which was verified years later as a remarkably accurate one.

Stars crossing the meridian directly above McGill's transit instrument had to be observed on almost every clear night during the year, in order to correct clock errors. At least six stars had to be timed crossing the nine spider lines of the transit; one polar and one low-south star, and four 'time' stars distributed as symmetrically as possible with reference to the zenith. The error of the sidereal clock would be computed, and then the necessary correction to the mean time clock would be determined. This was the clock used for time distribution, enclosed in a uniform temperature compartment in the basement of the Observatory.

"Few Realize the Responsibility Resting Upon Big Observatory Timepiece", declared the Montreal Witness in 1904. "Even the German Fleet in the Azores Set Their Time By It." The great railway systems of the day received and transmitted McGill time to all stations across Canada; at Canso, Nova Scotia, automatic repeaters carried it to the Azores, where the German Imperial Fleet received time signals from the land. Bermuda and Jamaica received it by manual repeater from Halifax, British naval ships used it at Halifax and Victoria, and the Australian cable carried it to various Pacific islands. "The time signals of the McGill College Observatory are, next to those of the Naval Observatory at Washington, probably the most widely distributed of any existing time service," Prof. McLeod said in 1898. A telegraph line took McGill time to Ottawa for the noon gun and tower clock, but this system encountered difficulties. "The Ottawa time service is a source of annoyance", wrote Prof. McLeod, "owing to the incompetence of the person in charge of the time gun at the Parliament Buildings." Mr. C. Kirkland McLeod (B.Sc. (Ch.Eng.) 1913), son of Prof. McLeod, recalls that the "person" was an ancient Cockney, who was heard to say that he got the McGill signal, but "it ain't right according to me watch," which he fired the gun by.

For over 60 years the 'time ball' on the Harbour Commissioners Building was dropped daily at noon during the navigation season for the benefit of shipping in the port of Montreal, operated by a switch at the Observatory. This service was important in an era long before the modern radio time signal, when captains depended on the time ball to rate their ships' chronometers; a similar system at Quebec, run by the observatory there, caused "quite a commotion in the Lower Town" when the ball failed to drop one day.

The City of Montreal also received McGill time, and all fire alarm bells were struck at noon daily. The Fire Department circuit ran through the Observatory, where it was connected to a time signal ticker and a bell; Mr. C. Kirkland McLeod recalls that the bell would ring loudly whenever a fire alarm was rung in from a street box, clearly audible to the McLeod family in their home adjoining the Observatory. A number of Montreal's "leading watch and instrument makers" received automatic clock signals over telegraph lines, and McGill class bells were run from the mean time clock. Frequent exchanges of time signals were made with the observatory at Toronto. The office had expanded, and now occupied the basement of the house adjoining the tower and two floors above it, as well as the tower itself.

From the upper floor a special clock sent automatic signals to the Grand Trunk Railway, and records of all the railway's clocks and watches were kept, for which Prof. McLeod was responsible as head of the company's time department in the early 1900's. Costly sidereal clocks were housed in the basement's insulated "clock closet", where the Riefler electric clock was kept under constant pressure inside its glass case. These timepieces were sensitive, and construction of the railway tunnel under the mountain, which started in 1912, caused difficulties which Mr. McLeod Jr. remembers well, as one of his father's undergraduate time assistants.

Meanwhile the Observatory's work was expanding in other directions. Valuable astronomical instruments were given to McGill in 1879, including a telescope and a large transit. The tower was partly rebuilt to accommodate the telescope, with a rotating dome and a heavy stone pier free from connection with the building. Some of the new instruments were used to observe the transit of the planet Venus across the sun in 1882, for which a "transit model used in the training of the English observers" was brought out to Canada and set up in the "Cupola of the College", to be observed by trainees from a station near the McGill gate. Prof. McLeod travelled to Winnipeg to observe the actual transit, which caused much interest and a certain gentle rivalry between Toronto and McGill Observatories.

As the city grew the McGill site became less suitable for astronomical work, with new buildings and smoke making observations more difficult. In 1882, after the Redpath Museum was built, the transit had to be moved to a small building directly north of the Observatory, in order to get a clear north-south view of the meridian. Sir William Dawson and Prof. McLeod went before the City Council a few years later to ask for a new observatory site on top of the mountain, on "the extreme verge of the park", but this was not forthcoming. Later, Sir William Macdonald, McGill's famous benefactor, bought a site on top of Westmount Mountain, but the city soon reached such a size that even this site was unusable, and was eventually given up to become a park.

These were years of great development at McGill, when the university's reputation was growing, and a series of famous men were coming across the Atlantic to enhance it further. In 1893 Prof. H.L. Callendar of Cambridge University came to McGill to occupy the newly-endowed Macdonald Chair of Physics. A specialist in heat measurement, he worked with Prof. McLeod in a study of soil temperatures, made on the lower campus, as the Observatory site was unsuitable with bedrock only four feet below ground. The reading apparatus was in the new Macdonald Physics Building, and eight Callendar platinum thermometers were buried at depths up to 108 inches "near the northern corner of the tennis grounds".

Prof. Callendar devised a self-recording apparatus for his electrical resistance thermometers, allowing much greater precision in temperature recording. It was decided to use this new invention to study continuous electrical records of temperature differences between two points at different altitudes - the summit of Mount Royal, and the Observatory over five hundred feet below. Two platinum resistance thermometers were placed in screens, one on the summit and the other near the Observatory, and were connected by wire to a recorder. The British Association for the Advancement of Science voted funds to erect the line in 1897, but the insulation was inadequate, and Sir William Macdonald again came to the rescue by paying for a lead-covered cable from the mountain summit to the Observatory.

With Dr. H.T. Barnes of McGill, who was later to succeed the famous Lord Rutherford as Macdonald Professor of Physics, Prof. McLeod studied the temperature records, and found that changes at the lower level were anticipated by changes from five to twenty-four hours earlier at the higher station. "In nearly all cases of a sudden change in temperature," he wrote, "we find that the high level instrument is affected several hours ahead," and emphasized the value of such records for local temperature predictions. This work was ahead of its time, detecting the passage of frontal surfaces before they were established as a meteorological concept.

Weather Observations

Regular weather observations continued, and were reported by telegraph to the Central Meteorological Office in Toronto. A wind recorder had been put up on the mountain summit on a tower near the illuminated cross, connected by Sir William Macdonald's cable to an automatic recorder in the Observatory. A sunshine recorder was acquired in 1881, and a few years later an automatic temperature recorder was installed, the ancestor of today's thermograph, with six thermometers and a clock device for tipping them over at given time intervals; the temperature readings would stay in place until the thermometers were reset by the observer.

The equipment thus improved, daily results were published in The Gazette, and monthly reports printed and sent to a variety of subscribers, from insurance agents to legal firms. These reports were much the same as today's; an occasional note, such as "date of first sleighing", shows that they belonged to old, rather than modern, Montreal.

Public demand for weather information was increasing, and Prof. McLeod was often called to Court to testify as an expert witness on weather conditions, as well as civil engineering matters. His time was also filled by administrative work as Vice-Dean of the Faculty of Applied Science, by teaching and also by work as a consulting engineer; after the fire which completely destroyed the Macdonald Engineering Building in 1907, Prof. McLeod with a colleague was in charge of construction of the new building. As Professor of Geodesy and Surveying, he was head of the summer surveying school for years, well remembered by McGill engineers who were students before the First World War, some of whom were trained at the Observatory in the use of transits, levels and astronomical equipment, and assisted with observations.

"Bunty" McLeod also found time to officiate at student athletics and took a great interest in many undergraduate activities, as well as in the Graduates' Society which he helped to found. He is referred to as "Bunty" to this day by those who remember the short, active professor crossing the campus to his office in the Engineering Building, from his home at the Observatory.

After Prof. McLeod's death in 1917, the Observatory work was continued by two young engineers who had worked under him in the Department of Surveying, James Weir and A. J. Kelly. Prof. Kelly, who directed the Observatory for over twenty years, was another memorable personality. A 1911 McGill graduate, he was in France in 1917 with the famous "Princess Pats", where he won an M.C. and bar at the front. He returned to the university to become in time Chairman of Surveying and Geodesy, and head of the surveying school as Prof. McLeod had been. This was an administrative job of no mean order, as the citizens of Ste. Anne de Bellevue did not always enjoy the surplus high spirits of the engineering students, Prof. Kelly's charges. His friends and acquaintances in Montreal were numerous, and were familiar with his work as Superintendent of the Observatory in the period between the wars, when the time service and weather observations were continued.

The volume of requests from the public and the Courts increased steadily, but importance of astronomical work to check the clocks declined with the advent of noon and 10:00 p.m. radio time signals from Arlington Observatory. Sidereal observations were still made, but not as frequently as before, and the Observatory's small transit house had to be moved to make way for expansion of the Arts Building. Time was transmitted daily to the two great railways, City Hall and the fire stations, as well as to the leading jewellers and several large office buildings, and as late as the 1930's the noon time ball was still being dropped for shipping in the harbour.

Attempt to Move

During the 30's an attempt was made by the Meteorological Service to move the Observatory to Ste. Anne de Bellevue. The site in the middle of a growing city was not ideal, but the Observatory's services were useful, and the Montreal City Council adopted a resolution against the move. A small weather station was opened at Macdonald College instead, and a few years later the exigencies of World War II created the major meteorological centre at Dorval, with the new transatlantic airport.

After 1945, Profs. G.H.T. Kimble and F. Kenneth Hare, successive Chairmen of the Geography Department, directed the work of the Observatory which was carried out by Mr. Charles Henry, Chief Observer for over twenty years until his retirement in 1958. A year later Prof. Hare was succeeded by Prof. J.S. Marshall, Macdonald Professor of Physics - the third holder of this title to be closely connected with Observatory work, as Profs. Callendar and Barnes were at the turn of the century. Prof. Marshall was Chairman of McGill's active new Department of Meteorology, founded in 1960, and the observatory work is logically associated with this department. The old building has now been torn down, and the meteorological site is on McGill's lower campus, with recorders installed in the Macdonald Physics Building nearby.

REPORTS FROM CENTRES

Toronto Centre.

February 1965:

The second meeting for 1965 and the 5th of the season of the Toronto Centre, Royal Meteorological Society, was held at 175 Bedford Road on February 25th. By an unfortunate coincidence, Toronto was having its worst snowstorm in twenty years, so the number of members who turned out to hear Mr. Paul Kutschenreuter, Deputy Director for Service Programs, United States Weather Bureau, speaking on "User Services in Meteorology" was unusually small. However, what the audience lacked in numbers they made up in enthusiasm, so that the meeting was a very successful one.

Introduced by Mr. F.W. Benum, Chief, Forecast Services, Meteorological Service of Canada, Mr. Kutschenreuter spoke on recent reorganizations within the United States Weather Bureau and of the responsibility of the Deputy Director for Service Programs for determining the what, where, when and why of user requirements for weather forecasts in the United States. Some of the recent moves by the United States Weather Bureau to make their weather forecasts more valuable to the user were discussed. Among these were concerted efforts to get the forecast in the hands of the user in a form that he can use and at a time when he wants it. Also being introduced gradually was the use of probability values in the forecasts. Examples of the improvement in service resulting were cited with regard to the agricultural program, but it was indicated that similar steps are being taken in the fire weather and marine programs as well. Improving the terminology of public weather forecasts by the application of good journalistic techniques was also cited as a step forward in making the forecasts mean what they say, thereby improving the service to the public. The concept of the one-man service office to provide specialized public weather service for all sizeable communities in the country was also propounded, and the role of the private meteorologist in the provision of meteorological service in the United States was discussed.

A lively question and answer period followed Mr. Kutschenreuter's formal presentation and attested to the interest of the members in what he had to say and in what is going on south of the border.

J.D.H.

March 1965:

World Meteorological Day, 23 March 1965, was observed by a meeting of the Toronto Centre of the Royal Meteorological Society, at which the guest speaker was Canadian Branch President, Dr. R.E. Munn. For this presidential address, Dr. Munn spoke on the topic "Meteorology and the Atomic Energy Industry in Canada".

After a brief introduction concerning the general role of the micrometeorologist, Dr. Munn outlined the organization of the atomic energy industry in Canada and then proceeded to describe the meteorological support being given to the various phases of the industry by the Meteorological Service of Canada. He concluded his address with a series of slides showing some of the atomic energy installations in Canada, the associated meteorological instrumentation, and the results of the meteorological research conducted into some of the problems of the industry.

In addition to the commercial producers of electrical power from atomic energy, there are three main government agencies in Canada with interests in this field. The Atomic Energy Control Board is a regulatory body exercising controls over the various atomic energy installations in the country. Atomic Energy of Canada Limited is a crown corporation engaged in research into the peaceful uses of atomic energy and operating two reactors, one at Chalk River, Ontario, and one at Whiteshell, Manitoba. The third agency concerned with atomic energy is the Radiation Protection Division of the Department of National Health and Welfare.

Canadian production of electrical power from atomic energy is based on the use of unpurified uranium, requiring the use of heavy water in the production process. Meteorological factors are very important in the location of production facilities, which in turn is very important in the economic equation governing operations. Extensive meteorological support is therefore provided to AECL in support of their research activities.

Meteorological advice is also required in support of operations and control in the atomic energy industry, involving both climatic information and health physics. The four areas of concern in health physics are (a) on-site safety, (b) off-site safety, (c) planned releases and (d) excursions. Dr. Munn outlined the problems involved in each of these areas and the meteorological advice and planning provided in order to take care of them. The main meteorological concern in on-site safety is strong wind downwash, while the main concern in off-site safety is strong inversions. Unusual meteorological conditions associated with inversions and sea-breeze effects are of great concern to the industry.

Dr. Munn was given a hearty vote of thanks by the audience for his stimulating and timely presentation on a subject of great general interest.

J.D.H.

April 1965:

On April 12, 1965, one hundred members and guests of the Toronto Centre, Royal Meteorological Society, met in the McLennan Laboratory, University of Toronto, for a symposium on "The Urban Effect on Climate". This meeting of the Toronto Centre was held in conjunction with the First Canadian Conference on Micrometeorology, held in Toronto April 12 to 14 and attended by micrometeorologists from all parts of Canada and from the United States.

The symposium was under the chairmanship of Mr. C.C. Boughner, Chief of the Climatology Division of the Meteorological Service of Canada. Participants were Mr. M.K. Thomas, Climatologist, Meteorological Service of Canada, Dr. P.W. Summers, Research Meteorologist, Research Council of Alberta, Mr. F.D. Thompson, Forecaster, Toronto International Airport, Mr. D.W. Boyd, Building Research Climatologist, National Research Council, and Mr. J.P. Bruce, Hydrometeorologist, Meteorological Service of Canada.

Each of the participants spoke briefly on the urban effect on climate as related to his particular field of specialization, Mr. Thomas leading off with a general survey of the urban effect on the climates of Canadian cities. It has been predicted that before many more years have passed, people living in cities will be more interested in whether the air is fit to breathe than in whether there will be rain. Since urbanization is proceeding at a very rapid rate, greater attention is required for the problems of air pollution and the other urban effects on climate. Mr. Thomas presented data and graphs for various Canadian cities showing the reduction in radiation and sunshine in the cities as compared with nearby rural areas, and the "heat island" induced by the presence of cities. He indicated that no definite effect on precipitation caused by a city has yet been confirmed for a

Canadian city. Some systematic variations in the precipitation of Toronto, particularly in snowfall, might be attributed to an urban effect. However, the complications introduced by the presence of Lake Ontario and by variations in elevation have made it so far impossible to isolate any solely urban effect.

Dr. Summers, speaking on atmospheric pollution and smoke in the climate of cities, with particular reference to Montreal, showed slides which vividly illustrated the effect of these phenomena. He presented graphs of the daily and weekly variation of air pollution and smoke at Montreal and several other cities in North America and Europe, showing the relationship of the pollution to industrial and commercial activities, particularly heating. He also showed the relationship between the concentration of air pollution in a city and the input of smoke and pollution, the wind speed, the distance downwind from the outskirts of the city and the depth to which there is mixing of the air.

Mr. F.D. Thompson discussed the allowances made for urban effects in the weather forecasts issued at the Toronto International Airport. Allowances are made for the urban effect on temperature in the forecasting of maximum and minimum temperatures. Allowance is also made in airport terminal forecasts for the reduction in visibility resulting from the drift of urban air pollution and smoke over the airport, such as occurs at Windsor, Ontario, with the drift of smoke over the airport on northerly winds blowing from Detroit. Similar effects are observed at other terminals. Urban effects are frequently combined with other influences such as lake effects and other micrometeorological effects. In general it requires very accurate synoptic forecasting in order to make it possible to superimpose the micrometeorological pattern.

Mr. D.W. Boyd spoke on the design of buildings for city climates, where it is found that other problems overshadow the city effect. In general, meteorological observations in Canada are taken at airports and the relationships between the parameters observed there and in the cities are not well developed. As a result it is generally necessary to use the values observed at airports in determining the design criteria for buildings constructed in the cities. This involves the tacit assumption that these values will be satisfactory for application in the cities, although sometimes allowances are made for known or suspected city effects, while in other cases it is known that the city effect is negligible when compared with the synoptic effect being considered in the design criteria.

Mr. J.P. Bruce, the final speaker in the symposium, discussed the ways in which cities affect the hydrologic cycle. Canadian studies in this field are only just now getting started, so his illustrations were based mainly on work done in the United States. Urbanization affects the hydrologic cycle by greatly increasing the demand for water for domestic and industrial consumption. It also introduces large problems in the pollution of streams by cities. Urbanization is found to decrease water losses by evapotranspiration, unless the transport of water to an otherwise arid area is involved. Urbanization also causes increases in the peak runoff of water from a given area, not because of an urban effect on the rainfall, but because the paving and roofing associated with urbanization produce a much more rapid runoff of the water which falls in the form of rain. Much study is required in order to provide the information for solving the legal and economic problems involved, as well as the meteorological ones.

Toronto Centre Chairman J.L. Knox brought the meeting to a close by an expression of appreciation on behalf of the Centre and guests to all the participants in a very interesting and stimulating symposium.

J.D.H.

May 1965:

A meeting of the Toronto Centre on May 26, 1965, attended by 55 members and guests, provided the forum for the first release to a scientific group of the "Results of a Cloud Seeding Test in Quebec, 1959-1963".

The speaker, Mr. J.D. Holland, of the Research Division of the Canadian Meteorological Service, has been an active participant in the experiment since its beginning in 1959. In his address Mr. Holland gave the history of the Precipitation Physics Project, indicated the methods used in prosecuting the work and presented results which had recently been determined.

The Precipitation Physics Project arose out of a request from the Canadian Pulp and Paper Association for an evaluation of the effects of cloud seeding on precipitation. The Project was coordinated and directed by the Meteorological Branch and was jointly supported by the National Research Council, the Department of Forestry and the Canadian Pulp and Paper Association. Assistance was provided by a number of other organizations including the Royal Canadian Air Force and the Canadian Army. The Project was designed to investigate the mechanisms of precipitation and to provide an evaluation of the effect of cloud seeding at the same time.

Two areas about 35 miles square and 35 miles apart along the Ontario-Quebec border near Noranda-Rouyn were selected as test areas. These areas were thoroughly instrumented with rain measuring equipment and other extensive surface and upper air observing programs including radar observations, were carried out.

Seeding with silver iodide crystals was carried out on all possible occasions during the summers of 1959 to 1963 when suitable cloud and rain conditions were expected to affect both test areas in a similar manner. The seeding aircraft was equipped with accurate navigational aids and instrumented to take meteorological observations so that the silver iodide would be dispersed into the clouds at the right temperature ($-5^{\circ}C$) and at the right location. Only one of the test areas, selected by random choice, was seeded on each occasion by the seeding aircraft flying a precise flight pattern upwind of the area to be seeded.

Mr. Holland indicated that evaluation of the results of the cloud seeding was based on a rigorous comparison of the rainfall measured in the seeded area with that in the unseeded area. Each test occasion was evaluated separately and results were then combined, with all checking and data control being carried out by an independent analyst unaware of which area had been seeded. Forty-five cloud and rain situations seeded during the course of the project were analyzed.

Evaluation showed that on the average, more rain fell in the unseeded areas than in the seeded ones. However, this difference was small and statistical analysis, because of large natural variations in rainfall, could not detect the change precisely.

Statistical evaluation gave a seeding index of minus $2\frac{1}{2}$ per cent, significant at the 0.82 level. The 95% confidence limits of this statement are plus 22 per cent and minus 22 per cent. In other words, no precise value either positive or negative could be placed on the actual effect, but the chances of it exceeding 22 per cent were very small.

The question period following Mr. Holland's presentation was a lively one, reflecting the current interest in this subject.

A. G. M.

Montreal Centre.

February 1965:

At the fifth meeting of the session on February 16th, the speaker was Dr. F.G. Shuman, Acting Director of the United States National Meteorological Centre at Washington, who had taken as his subject "a primitive equations prediction model".

About 1960, said Dr. Shuman, he had begun to test finite difference forms of the non-linear primitive equations along with various initial conditions. Instability was the problem, but quite stable forms of the equations were discovered. The two-layer model of Norman Phillips was then used, taking a 24 by 24 grid network with a rigid wall around the periphery. In the first case the initial wind was not tangential to the wall and, after 2 hours, compression and rarefaction waves were observed. After 72 hours these effects had cascaded to shorter waves resulting in an extremely rough chart. In later cases the initial wind was made tangential to the wall and the resulting meteorological systems were readily identifiable.

Dr. Shuman described his current four-level primitive equation model as employing one level for the stratosphere and three for the troposphere, a representation of the tropopause level being carried explicitly. In reprogramming for operational use on the new USWB computer an additional stratospheric level would be included for greater resolution and another additional level added to facilitate boundary layer assumptions. The current model used 10-minute time steps rather than the hour time steps of the filtered model. Because of the relative simplicity of the time step calculations this resulted in the primitive equation model being only twice as slow.

In reply to questions from the floor, the gathering numbering 69, Dr. Shuman stated that in general the advection seemed slow, due possibly to truncation error problems. Quasi-barotropic conditions were reasonably well forecast and the relative vertical phasing of systems was maintained. Initial divergence was limited to that induced by features of the terrain and the tropopause. Although the overall pattern of the vertical motion was similar to the filtered model, the magnitude appeared 50% larger. Small-scale noise in the vertical motion increased with time, but a display of the average vertical motion for 16 time steps appeared to eliminate the effects of gravity waves.

R. Strachan.

May 1965:

The sixth and final meeting of the 1964/65 season was held in the Physics Building, McGill University on May 11, 1965. With Mr. W.S. Creswick in the chair, proceedings opened with the Annual Business Meeting of the Centre. The Nominating Committee proposed a new slate of officers for the Montreal Centre for the 1965/66 season. Returned unapposed were:

Chairman: Mr. H.P. Wilson, Officer-in-Charge, High Level Centre, C.A.O.

Secretary: Mr. Gaston Paulin, McGill University.

Treasurer: Mr. I. Rutherford, High Level Centre, C.A.O.

Member of the executive: Mr. P. Merilees, McGill University.

When some confusion developed over a small item of further business, Mr. Creswick confessed that, like the butcher who sat on his meat grinder, he had got a little behind with his work.

Mr. Creswick, who remained in the chair, then introduced the guest speaker, Mr. A. Robert of the Operational Development and Evaluation Unit, Central Analysis Office. The Chairman explained that Mr. Robert was a Ph.D. candidate at McGill University, having been on educational leave from the Canadian Meteorological Service for the last two years.

Mr. Robert commenced by stating that there are two different philosophical approaches to the technical problems of Numerical Weather Prediction. The first approach has dominated nearly all of the development work in the field for the last fifteen years. It consists of using models in which the atmosphere is represented by arrays of grid-point values of the meteorological variables.

In the second approach, atmospheric configurations are described in a model by means of spectral representations in terms of series of orthogonal functions. In the function method a model deals with arrays of function coefficients instead of arrays of grid-point values. It has the advantage that the truncation error is eliminated entirely in the calculation of horizontal derivatives.

Mr. Robert then described some of the research he had been doing using the function approach. In particular, he discussed in some detail the results of his investigations into the behaviour of planetary waves in a global primitive equation model; a model based on the use of spherical harmonic functions instead of grid points. He had found that, with equatorial heating and polar cooling, the planetary waves tended to remain stationary or move very slowly. This realistic behaviour could not be linked to geography in any way, because no asymmetric effects - such as those due to topography - were included in the model. And it is in marked contrast to the poor handling of the planetary waves by a conventional barotropic model, or at least one without an empirical term to control long-wave retrogression.

Mr. Robert concluded by saying that he believed that in the future the functional approach will be of great value in general circulation studies. An interesting discussion period followed.

D. Davies.

CONFERENCE ON AGRICULTURAL METEOROLOGY

On 30, 31 August and 1 September 1966 the seventh Conference on Agricultural Meteorology of the American Meteorological Society will be held at Rutgers University, New Brunswick, New Jersey, U.S.A., in close co-operation with the International Society of Biometeorology. The latter organization is planning to hold the fourth International Biometeorological Congress at Rutgers University from 26 August to 2 September 1966.

Co-chairmen of the agricultural meteorological conference are Paul E. Waggoner (The Connecticut Agricultural Experiment Station, 123 Huntington Street, Box 1106, New Haven, Connecticut) representing the American Meteorological Society and Geo. W. Robertson (Agro-Meteorological Section, Plant Research Institute, Canada Department of Agriculture, Ottawa) representing the International Society of Biometeorology.

The chairmen would welcome volunteer contributions for this scientific conference and suggestions for programme topics.