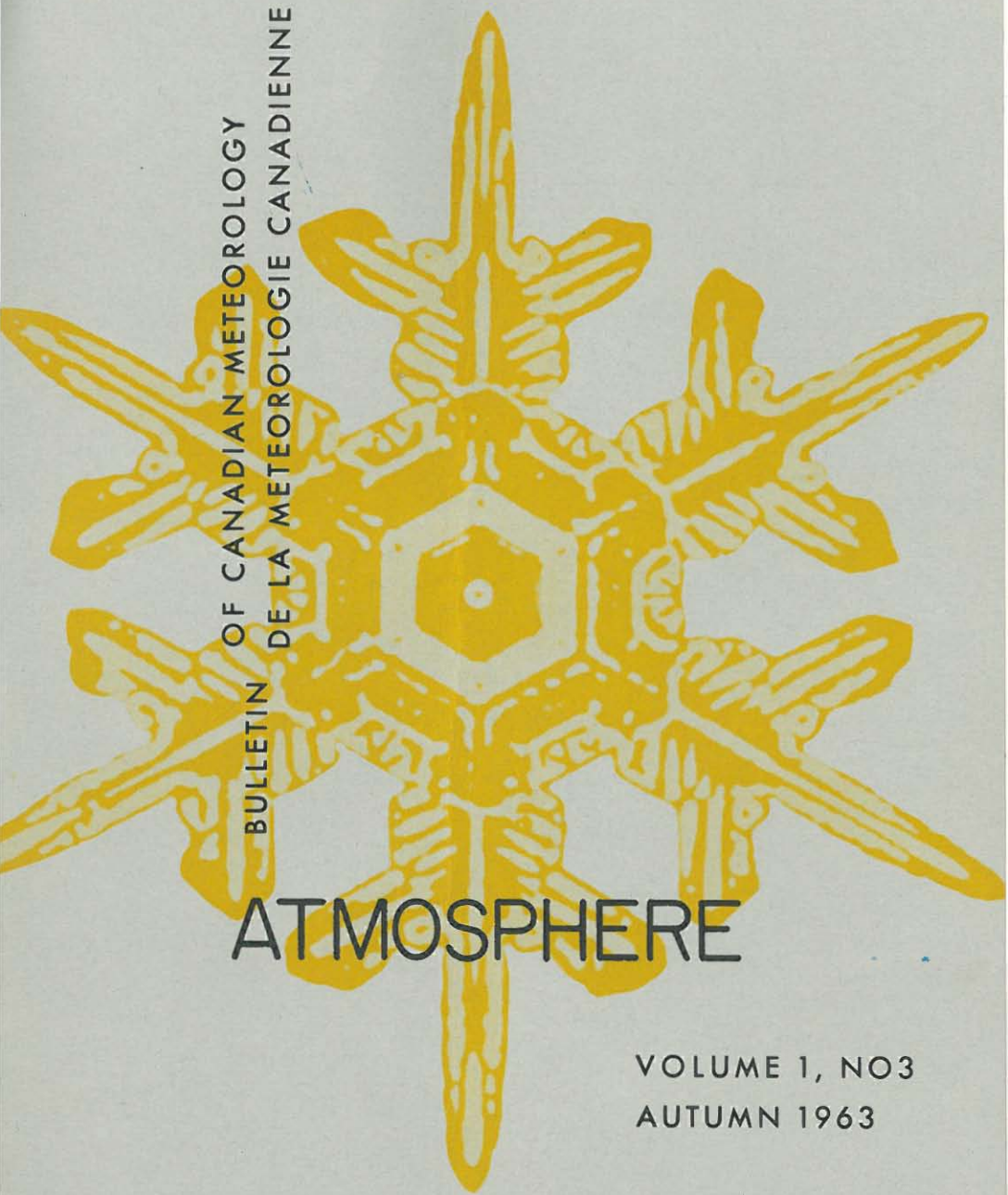
E. Truhlar



BULLETIN OF CANADIAN METEOROLOGY
DE LA METEOROLOGIE CANADIENNE

ATMOSPHERE

VOLUME 1, NO3
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ATMOSPHERE

a publication of the Canadian Branch

Royal Meteorological Society

3 rd Issue : October 1963

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An Editorial

This is the third issue of ATMOSPHERE and we are now looking for reactions from members of the Canadian Branch. These reactions may be in almost any form, good, bad, but please - not indifferent! Write a note and say that we should not attempt the impossible and it is not worth the effort even if it is possible (if that is the way you feel about it) - or write and suggest how we may improve it - and/or submit suitable material.

We are still experimenting. Our publication is new and flexible and can easily be changed. Let us know if it is desirable to do so. By-the-way, the photograph of a snow crystal used for the cover is from Bentley and Humphreys' "Snow Crystals", 1931. Permission was granted by the McGraw-Hill Book Co., Inc. for its use.

A Message

Laval, 1963, forms another milestone in Canadian Meteorology. The membership was well represented both numerically and geographically, due partly to D. O. T. travel support, and the attendance was far above our original estimate. Congratulations are extended to the organizers and authors for the high calibre of the scientific papers, although some sessions suffered from the current trend of too many papers in too little time.

General support for the Executive's actions was given at the Annual Meeting. The budget for current operating and publishing costs is satisfactory due to the 1961 increase in fees and the continued slow rise in membership, (five percent in five years).

Previous reports have indicated the revival of organizational proposals considered by a number of former executives. Possible changes were discussed with regional representatives at the Annual Meeting and, more recently, with several members of the parent society, including the President, Dr. Penman. Briefly, it is proposed that the name should be changed to "The Canadian Meteorological Society" and that our Society should be affiliated with, rather than a Branch of, the Royal Meteorological Society. In other respects, and particularly as regards journal publication, our strong association with the R. M. S. would change very little. Subsequent to such a change, and without prejudice to our R.M.S. association, we would attempt to promote some form of affiliate status with the American Meteorological Society, having in mind those of our members who are also participating in the A. M. S. That is the essence of the current "Executive line". We await your comments.

B. W. Boville,
President, Canadian Branch
Royal Meteorological Society.

Editorial

Voici le troisième numero d'ATMOSPHERE et nous sommes en quête de réactions de la part des membres de la branche canadienne de la Société Royale de Météorologie. Ces réactions peuvent être favorables ou défavorables mais, s'il-vous-plait, non indifférentes. Si le coeur vous en dit, écrivez-nous un mot disant que nous ne devrions pas essayer de réussir l'impossible et que nous perdons notre temps de toute facon (si c'est la votre opinion), ou bien suggérez-nous une manière d'améliorer votre revue ou encore soumettez-nous un article approprié.

Nous sommes encore en période expérimentale. Notre publication est jeune et flexible et ainsi peut facilement être changée. Dites-nous s'il serait souhaitable de le faire. Incidemment, la photographie du cristal de neige qui apparaît sur la couverture a été tirée du livre de Bentley et Humphreys intitulé "Snow Crystals", 1931. La compagnie McGraw Hill Book Co., Inc. nous a accordé la permission de l'employer.

Un Mot du President

Laval, 1963 marque une nouvelle étape pour la météorologie canadienne. Les membres étaient bien représentés numériquement et géographiquement, grâce à l'aide financiere du Département des Transports et l'assistance dépassa de beaucoup nos prévisions les plus optimistes. Félicitations aux organisateurs et aux auteurs pour le haut calibre des communications, même si certaines séances furent quelque peu surchargées.

Lors de l'assemblée annuelle un appui général fut accordé aux initiatives du conseil exécutif. Le dernier budget relatif aux dépenses d'administration et de publication est satisfaisant en raison de la majoration des cotisations annuelles en 1961 et d'un plus grand nombre de membres (cinq pour cent d'augmentation en cinq ans).

Des rapports précédents ont redonné vie à des propositions qui furent déja etudiées par certains conseils exécutifs. Les représentants regionaux discutèrent quelques changements durant l'assemblée annuelle et plus récemment, en compagnie de plusieurs membres de la société mère, notamment le président, Dr. Penman. En résumé, il est proposé que le nom " La Société Canadienne de Météorologie" devrait être adopté et que notre société devrait être affiliée à la Société Royale de Météorologie plutôt que d'être une branche de cette dernière. Sous tous les rapports, et surtout en ce qui concerne la publication de revues, notre solide association avec la Société Royale de Météorologie ne changerait que très peu. Consécutif à ce changement, et sans nuire à notre association à la Société Royale de Météorologie, nous nous efforcerions d'obtenir une affiliation quelconque avec la Société Americaine de Météorologie. Cela résume assez bien les derniers échos de votre conseil exécutif. Nous attendons vos commentaires.

B. W. Boville
Président, Branche Canadienne
Société Royale de Météorologie

MODERN RUSSIAN TECHNIQUES IN SYNOPTIC ANALYSIS

by

J. L. Galloway

Central Analysis Office
Canadian Meteorological Service

The recent (1962) translation into English under the auspices of the World Meteorological Organization of a Russian monograph entitled "Synoptic Processes of Central Asia" (1957)* has afforded a rare insight into the methods of synoptic analysis in use in one at least (Uzbekistan) of the republics constituting the Soviet Union. To Canadian meteorologists , who employ a four airmass, three-front model, the three airmass , two-front model herein described , is of particular interest, as is also the Russian handling of mountain meteorology.

The reproduction of an English translation of this Russian book was undertaken by WMO at the request of the Government of Iran as part of the technical assistance programme for that country.

The book opens with an introductory chapter in which its basic underlying principles are given as follows :

(i) the conception of a planetary upper frontal zone (PUFZ) as a prime element in the atmosphere.
(ii) the use of qualitative conclusions from modern hydrodynamic theory of pressure changes
(iii) the use of a rational classification of synoptic processes for distinguishing the fundamental types of circulation.
(iv) the influence of orography
(v) a statistical probability approach to the study of dynamic climatology.

A review of synoptic studies follows , in which four periods are distinguished:

(i) 1921-30 (isobars only)
(ii) 1930-38 (airmasses and fronts)
(iii) 1939-46 (introduction of upper air observations)
(iv) 1947-55 (introduction of statistics and probability theory, quantitative hydrodynamic analysis and the development of frontogenesis theory).

Ten chapters are then devoted to recognisable synoptic types, viz : the South Caspian, Murgab and UpperAmu-Darya depressions, large-scale transport of warm air, north-westerly and northerly cold invasions, wave activity, quasi-stationary depressions, anticyclones, westerly invasions and thermal depressions. Chapters on synoptic conditions for bad weather, dynamic climatology and the circulation conclude the book. In the last there is a section on the relation of runoff to weather : one point made is that the greater the contribution of glacial waters, the later is the maximum discharge in flood.

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* "Synoptic Processes of Central Asia ", by V.A. Bugaev,** V.A. Dzordzio, E, M. Kozik, M.A. Petrosjanc, A.Ja. Psenicyni, N.N. Romanov, O.N. Cernyseva. Tashkent: Academy of Sciences of the Uzbek S.S.R. 1957. Geneva: World Meteorological Organization (English) transl. 1962. Mimeograph: 645 plus XXIV pp. 161 tables, 170 diagrams (offset), bibliography of 296 items. Unpriced.

** Director of the Central Forecast Institute , Hydrometeorological Service of the U.S.S.R. (1962).

Of the 296 references, 167 are local, 80 national and 43 not identifiable on a local or national basis. Only 6 are foreign (U.S.A. 2, Austria, India, Sweden and West Germany 1 each).

The translation , which was undertaken in London, is not idiomatic in terms of meteorological usage, and is much below the standard of a normal WMO product. The book is supplemented by an " Atlas of typical synoptical processes in Central Asia", not provided by WMO, and unobtainable through the normal channel of supply in London.

The three airmass, two-front model is employed with a dynamical approach similar to that of the West. Further, a strong upper flow is the recognized prerequisite for significant cyclogenesis. However, wet-bulb potential temperature is not taken as an airmass identifier and although it is claimed elsewhere in Russian literature (1) that "the axis of a jet stream associated with a cold front is always situated in the rear of the surface position of the cold front: of that associated with a warm front - ahead of the surface position of the corresponding warm front" this is not borne out by the diagrams, where it is apparent that jet streams associated with particular fronts are located to the right of the fronts and not above the 500 mb position as in Canadian practice. Development is consequent on the phasing of recognizable flow and thermal patterns and short waves have no place in the technique .

Air Masses

The Bugaev-Dzordzio (1940) classification of air masses entering or forming in Central Asia is employed. Three main air masses are recognized, with variants, as follows :

Arctic	- from the Siberian sector of the Arctic	$-A_S$
	- from the Greenland sector of the Arctic	$-A_G$
Temperate	- from the Atlantic	$-T_A$
	- forming over Russia in Europe	$-T_{Sov}$
	- forming over western Siberia and eastern Kazakhstan	$-T_S$
	- from the Mediterranean and the Balkans	$-T_s$
	- forming over the Turan lowland	$-T_{Tur}$
Tropical	- from the Mediterranean and North Africa	$-Tr_{Med}$
	- forming in Iran	$-Tr_I$
	- forming over the Turan lowland	$-Tr_T$

It is evident that the airmasses may be divided into maritime and continental : maritime - A_G, T_A, T_s and Tr_{Med}, continental - A_S, T_{Sov}, T_S, T_{Tur}, Tr_I and Tr_T. Wet-bulb potential temperatures are not given and only in the case of A_S , T_{Sov} and Tr_I (all continental) are systematic upper air temperatures and specific humidities available . From these the figures in the Table have been obtained graphically. C.A. O. values of wet-bulb potential temperature appropriate to maritime Arctic air (mA), maritime Polar air (mP) and maritime Tropical air (mTrop), in Canadian classification, (Harley, 1962) aregiven for comparison. It is apparent that the annual variation of wet-bulb potential temperature for the continental A_S and $T_{S\,ov}$ is much greater than that for any of the maritime Canadian airmasses. Both are at mA values in winter, A_S rising to mP values and T_{Sov} to mTrop values in summer. The Tr_I is quite close to mTrop, but in winter the wet-bulb potential temperature values of an individual tropical airmass may range from as low as 6-8 at 900 mb to no higher than 12 at 400 mb . The fall in values at lower levels is attributed by the Russians to the transit of snow-covered mountains , and

in this case the airmass after modification is still being classified according to its characteristics at its source.

Fronts

Between the three airmasses two fronts are identified, the "middle latitude" front (F_1) and the "Arctic " front (F_2). However, more than two fronts may appear on surface maps, due to processes of degeneration and formation, higher suffixes being assigned for identification. Frontal contours are drawn, the notation F_1 , F_1^9 , F_1^7, F_1^5 , signifying front F_1 at the surface and 900, 700 and 500 mb respectively : a similar notation would refer to front F_2 , etc. The fronts are not linked with tropopauses and the associated jets are carried to the right of the vertical projection of the 500 mb position of the front, not above or close to it as in Canadian practice. The colder front transforms into the warmer front on moving into lower latitudes. Use is made of airmass type in qualitative estimates of precipitation.

Analytical method

The flow is often given on a 700 mb map with the total thickness 1000-500 mb superimposed. In a case where a surface frontal analysis is also included, it was noted that the 'occlusion' lagged behind the crest of the thickness lines. The 700 mb flow is preferred as features are said to be more marked at this than at higher levels. Jet cores are not indicated, but isotachs are drawn: the term"jet stream" is used, but "planetary upper frontal zone" is the normal expression and the letters "PUFZ" dominate the entire discussion. Despite the implication that short wave amplitude decreases with height, wave theory does not appear in the text : one reference to Rossby in the bibliography is concerned with the choice of an aerological diagram, the emagram being selected for reasons unstated. The reformation of a low in the lee of mountains is denied and in this connection the synoptic meteorologist is warned against getting history confused. It is possibly this denial of reformation which leads to abnormally high speeds of movement of the surface features: whereas over the year the average speed of anticyclones is 49 kmh, 60% in excess of that of depressions, maximum speeds averaged out at 130 kmh, double that of depressions. It is maintained that a "thermal low" cannot form under a jet as in this situation the added heat would be abstracted too quickly: nevertheless, it is recognized that a fall of pressure cannot be brought about by heating alone: for this the formation of an appropriate flow and thickness pattern is a necessary condition. A forecast of the development of a thermal low in Central Asia is essentially a forecast of a warm upper ridge in the region.

Prognostic method

Development is associated entirely with the upper flow and is forecast to take place in a preferred location forward of the troughs in the PUFZ, with appropriate orientation of the contours and with an isotach maximum in rear of the trough. The results of theoretical investigations of the relation of surface pressure changes to upper flow patterns are similar to those formulated by Sutcliffe (1947) and are attributed to Bugaev (1952). The absence of a short wave technique involves a matching of vorticity advection with increase of baroclinicity, the latter often being associated with orography. Of paramount importance for development downstream is digging over Russia in Europe and the location of cyclogenesis in Central Asia depends entirely on the degree of penetration of a cold outbreak into the Balkans or the eastern Mediterranean . The point is made that between latitudes 30 and 40 dg North airmasses are constantly undergoing warming : hence cyclogenesis requires cold advection. A thermal depression can acquire fronts only through cold advection in its rear. Four stages are observed in a cold outbreak : the preparatory stage, then the threatening stage, occupying two to three days: next the passage of the cold front over Central Asia, taking one to

two days with the precipitation mostly postfrontal and finally the sequence of secondary cold fronts, anticyclogenesis and the transition to a new situation. Wave activity in Central Asia requires shallow cold air with a strong westerly or southwesterly warm current aloft. Once digging is established, a forecast of wave activity for 3 to 5 days ahead is easy, but due to the speed of the waves detailed forecasts 24 hours ahead are more difficult.

Table

Wet-bulb potential temperatures(dg. Celsius) for Central Asia airmasses for which data are available and for Canadian airmasses(after Harley)

	A_S	T_{Sov}	Tr_I	mA	mP	mTrop
January	-4	1	12-13	1-4	8-11	13-14
February	0	4-5	13-15	0-4	8-11	13-14
March	-	4-7	13-15	1-5	8-11	14
April	4-5	7-9	14-15	2-4	9-12	14-15
May	5-8	9-11	16-17	4-6	10-13	15-16
June	11-12	16-17	-	(6)	12-14	16-17
July	12-13	15-17	-	(10)	14-15	17-18
August	14-15	17	-	9-10	14-15	17-18
September	8-9	12-13	-	7-9	14-15	17-18
October	7-9	12-14	15-17	6-9	12-14	16-17
November	2-4	8-11	14-15	4-6	11-13	15-16
December	3-5	6-7	12-13	1-5	9-12	14-15

References.

1. U.S.S.R. 1958 : Techniques for High Level Analysis and Forecasting (issued on a provisional basis by WMO but withdrawn)
2. Harley, W.S. 1962 : Canadian Meteorological Service CIR-3622 TEC -400.

THE NATIONAL METEOROLOGICAL CONGRESS

June 5 -6, 1963

The choice of Quebec City as the site of a conference never causes regret. Built high on top of rocky Cap Diamant, on the north shore of the St. Lawrence river , surrounded by walls and other fortifications and dominated by the Chateau Frontenac, the Old City fascinates the North American tourist. Post war expansion produced a modern section with large shopping centres, exotic restaurants, hotels, motels and other facilities required to accommodate visitors in large numbers.

Laval University started construction about 15 years ago on a new site located in this rapidly expanding section of Quebec City. The new campus is a vast complex of huge multi-million dollar buildings and provides each faculty with much more space than required at present. The completion in spring of an 800 room students residence made Laval the perfect host for the Conference of Learned Societies.

About 3,000 scientists from various parts of Canada attended the Conference. Our own National Meteorological Congress was organized within the framework of this conference. The meeting successfully gathered together 103 members of the Meteorological profession including representatives from as far as Vancouver. The four sessions were held in the Pure Science Building.

On the first day, at noon, a luncheon was held at the Grand Boulevard restaurant. The Annual Meeting of the Canadian Branch, Royal Meteorological Society, was held at the same time. Awards were presented to Mr. G. Gilbert, to Mr. W.L. Gutzman and to Mr. K.Hardy as announced in the spring issue of "Atmosphere". Various reports were presented by the executive and approved by the members. Finally, a new executive was elected.

The Conference of Learned Societies will be held in Charlottetown next year and then in Vancouver the year after. Since our National Meteorological Congress could dissociate from the Conference of Learned Societies, at least for the next two years, a lengthy discussion was raised among the members at the meeting on this subject. Dr. McIntyre asked the members to consider the attendance in Quebec City (91 persons were present at the luncheon). He expressed the opinion that the success of the present Congress could be used to predict the success of a Congress in Charlottetown. He assured the members that the Meteorological Branch would make an effort to send as many representatives as possible. The various points of view were discussed and then a motion suggesting that a decision be taken at a later date was presented and accepted.

Another event of importance on the first day of the Congress was the Symposium on Space Physics. Held in the evening, it was possible for meteorologists to attend and participate in the discussions. The second talk, given by Dr. J.H. Chapman on the Canadian satellite " Alouette" was most interesting. A short film was presented, followed by a tape recording of some of the signals received from the satellite and finally some measurements were shown, compiled in the form of graphs and curves. The general impression was that the satellite experiment has been most rewarding and should be renewed.

The first session of our Congress was held jointly with the Royal Society of Canada. A few interesting points were brought up in the first paper presented by Dr.A.W. Brewer. Ozone forms mainly at low latitudes but the high concentrations are found at high latitudes. A possible transport mechanism was suggested and discussed.

Too much space would be required to report on every paper presented at the Congress. The present writer was particularly impressed by two of the papers presented on the second day of the meeting. Personal

comments will be restricted to these two presentations. The first, by A. Eddy discussed the evaluation of divergence directly from the wind observations. The Bellamy triangle method was used in this project and evidence indicated that the computations of divergence contained enough noise to contaminate the results completely. The space auto-correlation curve of divergence was examined giving an estimate of the noise level. The same curve also indicated that the remaining part had approximately the same wave length as synoptic systems.

The density of upper air observations over North America is high enough to provide a sufficient number of divergence values, which are then analysed by an objective method. A special filter is designed to eliminate the random noise without affecting the synoptic divergence patterns. Charts of the divergence field and the derived vertical motion field were shown and correlated with precipitation and storm development. The results indicated that this technique could immediately find some synoptic application.

The seond paper of interest was presented by Mr. P.M. Hamilton and dealt with radar observations. The signals received by the McGill weather radar are electronically transformed into constant-level precipitation patterns. Compared against seven shades of gray the intensity of precipitation at a given level may be evaluated at the points of a grid superimposed on the scope or on the photograph. At each level, the values are averaged and then a vertical profile is drawn up. The vertical interval used was 5,000 ft. Charts of intensity and growth rate were shown for a certain number of cases. Profiles of this type would certainly be useful in operational meteorology since the method described here seems to be reliable and trustworthy.

Altogether, 23 papers were presented at the four sessions. A total of eight papers were presented at the last session. In general, speakers found that they were not given much time to present their subject and the audience was not given much time for discussion. It seems that this difficulty could be overcome if concurrent sessions were held or if the Congress were extended to three days.

The National Meteorological Congress is an excellent means of exchanging and discussing ideas. It has always achieved this objective with great success. It is hoped that every member of our profession will contribute to make this event even more successful in the coming years.

André Robert

STANSTEAD SEMINAR
1963

The fifth of McGill University's biennial series of seminars, sponsored by the Arctic Meteorology Research Group, was held at Stanstead College, July 7 - 19.

The stratosphere and mesosphere formed the main subject matter of the seminar, but sessions were also devoted to polar meteorology with the collaboration of the Committee on Polar Meteorology, American Geophysical Union.

An attendance of over sixty meteorologists from institutions in Canada and the United States made this the largest seminar so far. Sessions were held both in the morning and afternoon, and some were run concurrently in order to accommodate the large number of speakers.

The seminar ranged over a wide variety of topics which may be briefly summarized in a few broad categories. Dynamical and physical problems of the stratosphere and mesosphere, together with inter-layer coupling formed one of the major subjects. Energy and momentum studies were presented by Dr. A. Wiin-Nielsen and Dr. A. Barnes, while topics such as atmospheric tides, gravity waves and 26-month oscillations were discussed by Drs. B. Haurwitz, C. Hines and W.L. Godson. The large number of meteorologists currently involved in automatic data processing and computer applications to numerical weather prediction were represented by such speakers as Dr. G. Cressman of the U.S.W.B. and Dr. R.T. Duquet from Pennsylvania State University.

Atmospheric ozone problems occasioned discussion which involved not only the members of the "ozone club" but all those interested in the more general aspects of stratospheric circulation. Dr. J. London and Dr. A.W. Brewer presented the theoretical aspects of ozone distribution and transport. The observational aspect was covered by Dr. W.S. Hering who reported on the recently established network of ozonesonde measurements carried out by the Air Force Cambridge Research Laboratories. Atmospheric chemistry, a subject often neglected by meteorologists, was discussed by Dr. H. Schiff who described recent research at McGill University on chemical reactions in the upper atmosphere.

Polar meteorology was the only seminar topic which dealt with low-level phenomena. Some sessions were held jointly with the stratospheric group while others were run concurrently. Many aspects of the I.G.Y. and subsequent studies of the Antarctic were described by several speakers including M.J. Rubin , W.S. Weyant and P. Dalrymple. Arctic micro-meteorology was dealt with by Dr. H. Lettau who discussed the correspondence between theoretical models and actual observations. Arctic heat budget studies were discussed by Drs. E. Vowinckel and S. Orvig.

For some participants the seminar was an opportunity to acquaint themselves with the most recent work of colleagues in their field of specialization, while for others it was more useful as an opportunity to gain an insight into other fields, but for all it was a rewarding experience.

Violet MacDonald

CORRECTION

A few errors appeared in a summary paper entitled " A Simple Derived Height for 300 mb " published in Atmosphere Vol. 1, No. 2. The first paragraph under the sub-heading "Description" should read ,

"let V_5, V_5 and ζ_5 be the geostrophic speed , velocity and relative vorticity, respectively, obtained from the 500 mb height forecast, and $\vec{k}$ the unit vertical vector. It is assumed in general agreement ..... etc. "

Equation (1) on page 23 should read ,

$$V_3 = V_5 + K(\vec{k} \times \vec{V}_5 \cdot \nabla \zeta_5).$$

Equation (2) on page 23 should read,

$$\nabla^2 Z_3 = f/g \, \zeta_5$$

REPORTS FROM CENTRES

Report of the Toronto Centre

March 21, 1963 :

The Annual dinner of the Toronto Centre was held on Thursday evening , March 21st. A large group attended and enjoyed a social hour prior to the dinner.

In his introductory remarks the Chairman, Dr. J. Clodman pointed out the particular significance of the date which nearly coincided with World Meteorological Day (March 23). Dr. Clodman modestly disclaimed any credit for the opportune selection of the date by WMO.

The speaker for the evening , Dr. P.D. McTaggart-Cowan, Director of the Canadian Weather Service was introduced by Professor A. W. Brewer of the University of Toronto. Professor Brewer indicated that his task was relatively easy and perhaps even superfluous in view of the national and international prominence of the guest speaker.

Dr. McTaggart-Cowan chose as his topic " Education and Science" and his remarks were both stimulating and provocative. He asked the audience to consider a few of the problems in this area which Canadians face today; the shortage of scientists, the educational problems of underdeveloped countries, and the urgent need for revisions in our educational system. Dr. McTaggart-Cowan deplored the blind adherence to the IQ as a criterion for selecting the so-called gifted child and expressed grave doubts as to its success in singling out the brilliant and non-conformist mind. The speaker also had some scathing remarks to impart concerning the use of examination percentages as the basis for admitting students into University and especially into science disciplines.

In concluding his remarks Dr. McTaggart-Cowan admitted that his speech had been intentionally provocative in the hope that the talk would not be dismissed immediately as just another after dinner speech. It was his hope that members and guests would be spurred to think and talk about the problems in other company and other places since the Canadian educational system is fortunately geared to be responsive to public thought and desire.

Mr. K. T. McLeod reflected the feeling of those present when he thanked the speaker for his thought-provoking speech and assured Dr. McTaggart-Cowan that there would be considerable discussion on the philosophy expressed by him in the days to follow.

April 25, 1963 :

For the meeting of April 25th, held in the Bedford Road Classroom, the Toronto Centre had as guest speaker Dr. D.R. Hay, Associate Professor of Physics, University of Western Ontario, London. The audience was augmented by guests from the Meteorological Officers' Refresher Course and those attending the Assistant Inspector's Conference.

Dr. Hay spoke on " Measurements of the Turbulent Transfer of Water Vapour near the Ground" describing an investigation programme under his direction wherein an ingenious combination of interferometer and radar instrumentation was employed to measure changes in refractive index which could be related to changes in moisture content near the ground.

Although the present results left many unanswered questions, Dr. Hay indicated areas in which further measurements would be calculated using more elaborate equipment in a field site.

By means of excellent slides and an extremely lucid explanation Dr. Hay impressed his audience with the complexity of the problem he was investigating and the original approach he was making to the solution. During the question period members particularly concerned with atmospheric turbulence and air pollution carried on a lively discussion on the merits of the

instrumentation and results of the project. Mr. Paul Johns expressed the appreciation of those present for Dr. Hay's address.

May 22, 1963

For the final meeting of the 1962-63 season the Toronto Centre members were invited to be the guests of the Institute of Aerophysics, University of Toronto. Dr. S.N. Patterson, Director of the Institute, welcomed the group and briefly outlined the work carried out under his direction. The members were then taken on a conducted tour of the establishement , with various demonstrations described by staff personnel who generously explained the projects in lucid language. At the conclusion of the tour the hosts provided refreshments which were most appreciated.

At the Annual General Meeting of the Toronto Centre, held on May 22nd, the following Executive was elected for the year 1963-1964 : Chairman : Dr. R.E. Munn, Secretary : Mr. F.B. Muller, Program Secretary : Mr. T.L. Richards, Treasurer : Mr. G.W. Gee.

K. McGlening

Report of the Montreal Centre

May 14, 1963 :

Dr. J.S. Turner of the Commonwealth Scientific and Industrial Research Organisation , Australia, presently Rossby Fellow at Woods Hole, was the speaker at the fifth and concluding meeting of the 1962-63 session , held in the Physics Building at McGill University under the chairmanship of Professor Walter Hitschfeld. He chose convection as his subject, under the title " Plumes , bubbles or both ? " .

Dr. Turner explained that the classical picture of convective precipitation as arising from the ascent of a parcel of air until saturation supervened could not provide the quantities of liquid water found by measurement to be present in precipitating clouds. Entrainment of air was necessary into the ascending mass. There were at present two theories in vogue, the 'plume' and the 'bubble .

In the former, due to Stommel, the cloud was regarded as a kind of buoyant jet and the flux across a layer was studied : in the latter (Scorer and Ludlam) the change of an element in time was the basic idea. It was possible to simulate the natural occurrences in the laboratory and he had been doing this. By making assumptions of linearity in regard to the expansion of the plume and the bubble a promising measure of agreement had been obtained between theory and observation. In the case of the plume it had been established that both expansion or contraction were a function of the relative density of the cloud and the environment and that the interface between the areas of turbulence and nonturbulence was sharp. By the study of bubbles released through the action of hydrochloric acid on sodium bicarbonate an entrainment rate 3 - 4 times greater than that possible with plumes had been obtained and this was in better agreement with available cloud liquid water content data.

No firm picture had yet been derived as to conditions governing the shapes of clouds - tall and thin, short and fat : or to the degree of mixing at the sides or top. Plumes and bubbles probably both contributed something He had not been concerned with the electrical aspects of the work.

Annual General Meeting

At the Annual General Meeting of the Montreal Centre, held in the Physics Building at McGill University , on May 14, 1963 under the chairmanship of Mr. R.A. Parry, the following Executive was elected for the year 1963 -64 : Chairman : Professor Walter Hitschfeld, McGill University ; Co-Chairman : Mr. W.S. Creswick, Central Analysis Office, Meteorological Branch, Department of Transport ; Secretary : Mr. B. O'Reilly, Department of Meteorology, McGill University; Treasurer : Mr. P.E. Carlson, Central Analysis Office.

J.L.G.

Report of the Winnipeg Centre

The following Executive has been elected for the year 1963 - 64 : Honorary Chairman : Mr. D.M. Robertson, Chairman : Mr. D. McGeary, Vice-Chairman : Mr. F.J. Sebastian, Secretary-Treasurer : Mr. W.D. Gilmour.

A DAY WITH THE CANADIAN ASSOCIATION OF PHYSICISTS

On Friday June 7, 1963 the Earth Physics Division of the Canadian Association of Physicists (formed in 1962 largely through the efforts of Professor B.W. Currie) held its first session, during the Quebec Congress, under the Chairmanship of Professor W.N. English. Much of the subject matter was of interest to meteorologists.

Dr. John Chapman led off with an invited paper on the Canadian satellite " Alouette", which had been"unbelievably successful". However, Dr. Chapman pointed out right away in an epic metaphor that with a bill of $\$10^4$ per lb of payload to be met the satellite honeymoon was over and that the stage of family planning had been reached - this did not necessarily mean of course that things would turn out as intended. There was no likelihood of a launching vehicle being set up in Canada, but launching facilities would be available from the Americans who were welcoming ideas for satellite programmes (OGO). A period of three years would normally be forecast to elapse from the occurrence of the idea through its testing by rocket to its being flown in a satellite. Canada had expressed interest in "international satellite ionospheric studies" (ISIS) and during 1965-69 in the ascending curve of the sunspot cycle, four launchings were contemplated, the satellites, to be built by contract, to be placed into orbit at differing levels for the comparative measurement of energetic particles. Three papers followed from the "Alouette" and two from the N.R.C. Algonquin Radio Observatory.

The second invited paper was by Professor R.J. Uffen who had been investigating the possible effect of radiation on evolution. This had not been a promising study before the discovery of the Van Allen layers: but it had now been seen to be possible that changes in the Earth's magnetic field might admit powerful radiations to the surface with marked effects on the mutation rate of living organisms. Why, for example, had the dinosaurs disappeared ? To Professor Uffen the thermal history of the Earth was of great interest and its magnetic field might already have been reversed 10-20 times. He was contributing the word "palaeoaeronomy " to science.

Dr. Anne Stevens contributed a paper on earthquake mechanism and was followed by Professor E. Pounder who reported the latest results of his ice studies. Ice between one and two years old had surprisingly exhibited a tensile strength greater than polar ice, but there was no appreciable difference in elastic properties.

Dr. L. W. Gold discussed earth temperatures taken to a depth of 6.1 metres at Ottawa. These were applicable to civil engineering operations in permafrost and Dr. Gold showed slides illustrating subsidence which had occurred in permafrost after removal of the topsoil. Over a five-year period at his test site the gradient of average earth temperature indicated a net heat flow into the soil.

In the afternoon Professor Volkoff, the retiring President of the Canadian Association of Physicists, broke with tradition in taking as the subject of his presidential address the philosophical aspects of science , drawing heavily on Bronowski (the humanising effects of science) and Polanyi (the influence of the international cooperation of scientists on the development of free institutions). Later, at the Annual Dinner, Professor Larkin Kerwin was equally original in showing the assembled company of 400 a series of slides on Quebec, with particular reference to the seven gates in its old defensive wall. It remains to be seen whether the proliferation of public speaking in French which broke out in all sorts of unexpected places and people will survive the removal of the Congress to Halifax in 1964.

J. L. Galloway

The R. M. S. President Visits Canada

It is rare for a President of the Society to visit Canada, but in September, Dr. H. L. Penman, F. R. S., was able to address both the Toronto and Montreal Centres and at the same time inaugurate their new winter session. The last occasion on which Canadian Fellows were able to hear a President-in-office was in 1953 when Sir Charles Normand was in Toronto for the joint meeting of the Society with the American Meteorological Society. The Montreal Centre has never previously been so honoured.

Dr. Penman is internationally known for his contributions to soil science and agricultural meteorology as Director of the Rothamsted Experimental Station, Hertfordshire, England.

Toronto - 17 September, Dr. R. E. Munn, Chairman.

Dr. Penman spoke to the 63 participants along the lines of his presidential address (Q. J. R. Met. Soc., 1962, 88 p. 209), endeavouring to get meteorologists to look at the state of meteorological practice and emphasis from the point of view of sister disciplines and other users. Lively discussion following Dr. Penman's presentation indicated his success in drawing attention to several controversial areas. First was the relation of mathematics and physics to meteorology, with Dr. Penman's view that the physics should be doing more of the "cart-drawing". Second was the need for the use of less technical and more general terms and concepts in presentations by meteorologists to non-meteorologists, so that communication with fellow scientists in sister disciplines could be improved. Third was Dr. Penman's hope that both in tests and development meteorology could proceed more from observation to theory. A fourth point was the danger of wastefulness in vast meteorological observing programmes, particularly in the high atmosphere, where it might be considered possible to make progress more rapidly by observational programs directed more toward the testing of specific hypotheses.

F. B. M.

Montreal - 19 September, Prof. Walter Hitschfeld, Chairman.

The title of Dr. Penman's address was "Micro-meteorology without Mathematics" - a title which did not prevent him from covering all available black-board space with equations and geometrical sketches. Those members of the audience who are "x, y, z" meteorologists, to use Chapman's term, were probably more at home than the synopticians.

Measurements of profiles of temperature, humidity, and wind within a growing crop have frequently been made. It was Dr. Penman's purpose to extract from such measurements as much information as possible on the meteorological conditions critical for plant growth. Starting from the hygrometric equation and the usual equation for a logarithmic wind shear, Dr. Penman developed some of the geometric consequences of the equations, assumptions as to the constants having to be made as usual. However, the speaker showed that if the assumptions were valid in any given case then a plot of any of the quantities, temperature, vapour pressure, wind, against any other of them, would result in a straight line. A number of examples of such plots for growing wheat were shown, (Penman, H.L. and Long, I.F., 'Weather in Wheat', Q.J.R. Met. Soc., 1960, 86 p. 16). By the use of these u-e and u-T plots it is possible to get a good picture of the energy and moisture budgets within the crop, with reading from only four heights being required. It is Dr. Penman's belief that it is by such studies of energy- (or moisture-) budgets that meteorology can most effectively help agriculture.

He mentioned a number of practical results derivable from the calculations. For instance, the suggestion sometimes made to supplement rainfall by dew catch in dry climates would not likely be effective, as the total night-time deposit of dew would be re-evaporated within an hour of sunrise.

The meeting closed with a lively discussion period which continued informally during a coffee period which followed. The most far-reaching of the suggestions made during the discussion, was that of Dr. F.K. Hare of McGill who would like to extend these micro-meteorological methods to the macro-scale.

The vote of thanks was proposed by Professor B.W. Boville, President of the Canadian Branch.

J.A. MacC.