ATMOSPHERE

4th ANNUAL CONGRESS

June 17 to 19, 1970

Winnipeg, Manitoba

A T M O S P H E R E

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THE CANADIAN METEOROLOGICAL SOCIETY

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CANADIAN METEOROLOGICAL SOCIETY
4th Annual Congress

June 17-19, 1970
University of Manitoba
Winnipeg, Manitoba

PROGRAM
Wednesday, June 17

9:00 a.m.		Opening Remarks	M.K. Thomas, President, C.M.S.
SESSION 1:		Education in meteorology - professional aspects Chairman - J.B. Gregory	
9:20-Noon			Room 240 University College
Time	Paper		
9:20	1.1	University programs in meteorology	B. Boville McGill University
9:50	1.2	Conversion of a physicist into a meteorologist?	A.W. Brewer University of Toronto
10:20		Coffee	
10:50	1.3	Professional education of the operational meteorologist	C.M. Penner Meteorological Branch, Toronto
11:20	1.4	Meteorology serving the university and the community	R.W. Longley University of Alberta
11:50		Summing up by the chairman	

SESSION 2: Education in meteorology - technician training and general education

Chairman - D.B. Kennedy

1:30 p.m.-5:00 p.m.

Room 240 University College

Time	Paper		
1:30	2.1	Performance-oriented meteorological training for Canadian Armed Forces technicians	J.R. Lauder Training Command, H.Q. Westwin, Manitoba
1:50	2.2	Meteorological Branch technician training	M.F. Dolan Meteorological Branch, Toronto
2:10	2.3	Education in agricultural meteorology	K.M. King University of Guelph
2:30	2.4	Education in meteorology at the undergraduate level	B. Prasad University of Washington Seattle
2:50	2.5	Meteorological teaching in school programs	L.K. McGlening Meteorological Branch, Toronto
3:10		Coffee	
3:30		Panel discussion: Present problems and future developments in meteorological education	

Moderator: D.B. Kennedy

Panelists: J.S. Marshall
J.B. Gregory
G.L. Pincock
G.A. McKay

RECEPTION AND MEETING

5:00 Reception hosted by the President of the University of Manitoba on the Plaza and in the foyer of University College.

8:00 Annual General Meeting of the CMS

Thursday, June 18

SESSION 3: Winds. Chairman - S.J. Buckler

8:30 a.m.-Noon

Room 240 University College

Time	Paper		
8:30	3.1	Forest winds	H.C. Martin Meteorological Branch, Toronto
8:55	3.2	Wind profile and tower shadow measurements near Stonewall, Manitoba	H.M. Fraser and P. Bellan Prairie Weather Central Winnipeg
9:20	3.3	An approximate method for calculating critical gust statistics for STOL operations	E.G. Morrissey Meteorological Branch, Toronto
9:45	3.4	On the mechanism of formation of zones of strong gradients in dynamical variables and their coupling with the large-scale atmospheric motions	M. Shabbar Meteorological Branch, Toronto
10:10		Coffee	
10:45	3.5	On the variation of the 500 mb wind and its effect on the release of instability	E.R. Reinelt University of Alberta
11:10	3.6	Diurnal variations in upper winds in Alberta	N.H. Thyer Notre Dame University Nelson
11:35	3.7	Atmospheric winds from balloon levels up to 100 km	J.B. Gregory and D.K. Rees University of Saskatchewan

SESSION 4: Precipitation. Chairman - G.A. McKay

1:30-4:30 p.m.

Room 240 University College

Time	Paper		
1:30	4.1	Precipitable water over Canada: computation and distribution	J.E. Hay University of British Columbia
1:55	4.2	Probability forecasts of precipitation	D.E. McClellan, D.E. Page, R.H. Robinson and N. Yacowar Central Analysis Office Montreal
2:20	4.3	Rainfall extreme value statistics applied to microwave attenuation climatology	J.H.S. Bradley McGill University
2:45	4.4	The spatial distribution of thunderstorms over Alberta forests	R.G. Lawford University of Alberta
3:10		Coffee	
3:40	4.5	The influence of upper winds on hailfall patterns in central Alberta	W. Thompson Meteorological Branch, Edmonton and P.W. Summers Research Council of Alberta
4:05	4.6	Hailfall characteristics and crop damage in Alberta	P.W. Summers and L. Wojtiw Research Council of Alberta

BANQUET AND RIVERBOAT CRUISE

5:00 Leave University by chartered bus

6:00 Banquet and cruise on a Red River paddle wheel boat
Special address - Dr. P.D. McTaggart-Cowan

Award of Patterson Medal

10:00 Return by bus to University

Friday, June 19

SESSION 5: Climatology and physical meteorology
Chairman - R.W. Longley

8:30 a.m.-Noon

Room 240 University College

Time	Paper		
8:30	5.1	The application of climatological records to the analysis of meso-scale weather	F.D. Thompson Meteorological Branch, Toronto
8:55	5.2	Instant experience: the use of climatological data as an aid in forecasting	N.N. Powe Montreal Weather Office
9:20	5.3	A study of heat flow in the lower troposphere by a laboratory model	F. Fanaki Meteorological Branch, Toronto
9:45	5.4	Numerical models of heat island circulations	Y. Delage and P.A. Taylor University of Toronto
10:10		Coffee	
10:45	5.5	A spectral convection model	R. Daley McGill University
11:10	5.6	Statistical significance of empirical orthogonal functions arising from meteorological fields	F.B. Muller Meteorological Branch, Toronto
11:35	5.7	An experimental test of the Smith-Hay model for the expansion of clusters of particles in the atmosphere	O. Johnson, B.R. Larson J.A. McCallum and W.D. Simpson Defence Research Establishment Suffield

SESSION 6: Electrification and cloud microphysics
Chairman - J.S. Marshall

1:30 p.m.-5.00 p.m.

Room 237 University College

Time	Paper		
1:30	6.1	Atmospheric electricity measurements at Toronto	Bhartendu Meteorological Branch, Toronto
1:55	6.2	Electrical measurements of the turbulent diffusion of splash droplets in heavy rain	D.R. Lane-Smith University of Western Ontario
2:20	6.3	Electrification associated with drop splashing	S.R. Shewchuk and J.V. Iribarne University of Toronto
2:45	6.4	General survey of the coagulation equation	R.L. Drake NCAR Boulder, Colorado
3:10		Coffee	
3:45	6.5	Preliminary study of collisions and break-up of raindrops	J.D. McTaggart-Cowan C.F. MacNeill and R. List University of Toronto
4:10	6.6	Measurements of drag coefficients and characteristic motions of snow crystal, graupel and small hail models	R.S. Schemenauer and R. List University of Toronto
4:35	6.7	The water budget of a summer storm	C.D. Holtz Meteorological Branch, Toronto

SESSION 7: Forecasting and synoptic meteorology
Chairman - J.J. Labelle

1:30 p.m.-5.00 p.m.

Room 240 University College

Time	Paper		
1:30	7.1	Middle cloud forecasts by a statistical-numerical technique	C.D. Henry Prairie Weather Central Winnipeg
1:55	7.2	Fine mesh limited-area forecasting	G. Paulin Central Analysis Office Montreal
2:20	7.3	The interpretation of diagnostic fields using surface observations, and some applications to short-range weather forecasting	E.C. Jarvis Meteorological Branch,Toronto
2:45	7.4	Comparison of the barotropic, Phillips and Mintz-Arakawa numerical circulation models	A.K. MacPherson and G.V. Price University of Manitoba
3:10		Coffee	
3:45	7.5	Meteorological experiments carried on simultaneously with operational programs	A.F. Davies Prairie Weather Central Winnipeg
4:10	7.6	Significance of upper atmospheric temperatures	F.R.C. Ezemenari Meteorological Branch,Toronto
4:35	7.7	Synoptic heat budgets at three polar stations	E. Vowinckel and S. Orvig McGill University

ABSTRACTS

1.1 UNIVERSITY PROGRAMS IN METEOROLOGY

B. Boville

The aim of university education is to provide an environment within which the student can learn to think for himself and to work on his own. Although rote learning is of some importance at all levels, it must not be confused with the main aims or methods--else preparation is for yesterday's, not tomorrow's world.

At McGill formal lectures in meteorology have been reduced to a minimum and the student is challenged by a comprehensive set of material and projects which, of necessity, require more effort and participation on his part.

Student reaction leads to the modern paradox--they clamour for more freedom and say in their own programmes, yet surveys usually show a desire for better lecturers and more classical lectures. What is the proper balance between lectures and participation, between courses and research--is this a function of the individual or the discipline?

1.2 CONVERSION OF A PHYSICIST INTO A METEOROLOGIST?

A.W. Brewer

In converting the physicist into a meteorologist one might argue that this is unnecessary; but at the University of Toronto we find a lot of work is needed to achieve this metamorphosis. The divergence of outlook is compared, and problems of this conversion discussed.

1.3 PROFESSIONAL EDUCATION OF THE OPERATIONAL METEOROLOGIST

C.M. Penner

The professional education needs and level required for operational practice of Meteorology will be outlined and a critical analysis of how universities have been meeting these needs or should be meeting these needs in the future, will be given. The role of the employer and of the professional himself in providing job-training and in updating academic training will be discussed.

1.4 METEOROLOGY SERVING THE UNIVERSITY AND THE COMMUNITY

Richmond W. Longley

At the University of Alberta, there are three professional meteorologists on staff. The involvement of these three men illustrates the extent to which meteorology serves many different disciplines within the university and also in the business world. The talk will describe some of the requests that come to these men and the work that these men do because of their background and position.

2.1 PERFORMANCE-ORIENTED METEOROLOGICAL TRAINING FOR CANADIAN ARMED FORCES TECHNICIANS

J.R. Lauder

Performance-oriented training, its objectives and methods as used by the Canadian Armed Forces is briefly discussed. Experience in the administration and application of this type of training for meteorological technicians at the School of Meteorology at Trenton is outlined. The weaknesses and strengths of the system are summarized.

2.2 METEOROLOGICAL BRANCH TECHNICIAN TRAINING

M.F. Dolan

Meteorological Branch technical support is described, emphasizing significant changes in the program over the past 10 years. The Air Services Training School program is discussed, and compared with WMO standards. Present policy on the training of non-Departmental Meteorological personnel will be outlined.

2.3 EDUCATION IN AGRICULTURAL METEOROLOGY

K.M. King

The educational requirements for an "agrometeorologist" include intensive study of the processes underway in the atmosphere and in biological systems. The training needs in the field of agricultural meteorology for meteorologists, agriculturalists and others involved with environmental problems are discussed. Forecasts are made of the future opportunities in the field.

2.4 EDUCATION IN METEOROLOGY AT THE UNDERGRADUATE LEVEL

B. Prasad

An increasing awareness of the public in environmental problems is noticeable in recent times. Although education in the environmental sciences has been mostly limited to graduate study till now, multi-disciplinary programs at the undergraduate level have been set up in the last few years among several campuses across the country. A survey into the Earth and Space Science programs, with special reference to meteorology, available in schools within Washington State is discussed. The results of the study and future plans are summarized.

2.5 METEOROLOGICAL TEACHING IN SCHOOL PROGRAMS

L.K. McGlening

The Meteorological Branch has for some 25 years provided reference material on meteorological topics to assist secondary school students and teachers in the study of weather. Changes in the nature and content of this material have, to a significant degree, reflected changes in the meteorological curricula across Canada. Some of these changes are discussed together with comments on the differences in school programs from province to province. Ideas are presented as to how the teaching of meteorology in secondary schools might be improved.

3.1 FOREST WINDS

H.C. Martin

Wind speeds were measured for three weeks at nine levels up to 61 m in and above a mature pine forest with canopy top at approximately 20 m. The winds were treated as hourly averages. Profiles normalized to one level were averaged by time of day and direction providing information on stability and topographic effects. Flow under the canopy indicated the effect of stability on exchange through the canopy. The logarithmic profile fit was examined as well as the influence of the tower.

3.2 WIND PROFILE AND TOWER SHADOW MEASUREMENTS NEAR STONEWALL, MANITOBA

H.M. Fraser and P. Bellan

Tower wind data covering several summer months are used to determine the coefficient P in the equation

$$\frac{V_2}{V_1} = \left(\frac{h_2}{h_1}\right)^P .$$

The relationship between P and the hour of day and mean wind speed is represented by a cosine curve. In the second part of this paper, towers are estimated to reduce wind flow over a distance 50 to 100 times the diameter of the tower downstream.

3.3 AN APPROXIMATE METHOD FOR CALCULATING CRITICAL GUST STATISTICS FOR STOL OPERATIONS

E.G. Morrissey

The probability of a STOL aircraft encountering a gust that exceeds a critical level during the landing stage is calculated from a model spectrum and climatological data. The method uses an approximate aircraft/pilot response function to define the spectral aspects of the gusts. The gust spectra are generated using this function and Davenport's model gust spectrum for various average wind speeds. The probability of a gust exceedence is computed as well as the probability of a given average wind speed. These probabilities are combined to obtain the required gust statistics.

3.4 ON THE MECHANISM OF FORMATION OF ZONES OF STRONG GRADIENTS IN DYNAMICAL VARIABLES AND THEIR COUPLING WITH THE LARGE-SCALE ATMOSPHERIC MOTIONS

M. Shabbar

A method of attack by which the behaviour of the planetary scale motions of the atmosphere may be deduced in terms of asymptotic series solutions on a long-time scale is discussed. It is hypothesised that effects of the Reynolds stresses and eddy conduction of heat in the atmosphere give rise to bands of non-uniform planetary waves which vary slowly in space and time. A simple example of a simplified physical model possessing the essential properties of large-scale atmospheric motions is investigated by generalizing the concept of a discrete resonating system to a system consisting of non-uniform wavetrains whose amplitudes are slowly varying functions of time as well as of space.The possibility that the "sideband" resonances in planetary waves are important is investigated. Equations are derived describing long-time behaviour of a resonantly interacting Rossby wave packet and a mean zonal flow with weak shear. It is shown that the side-band resonance can cause energy to be gained or lost by the mean zonal flow. In fact, vorticity of the mean zonal flow is excited on a longer time scale.

An important application of this theory is toward resolving long-standing difficulties in understanding the mechanism of formation of zones of strong gradients in dynamical variables and their coupling with the large-scale motions.

3.5 ON THE VARIATION OF THE 500 MB WIND AND ITS EFFECT ON THE RELEASE OF INSTABILITY

E.R. Reinelt

Time and space variations of the 500 mb geostrophic wind component normal to the Continental Divide are correlated with thunderstorm activity in the lee of the Alberta Rockies. Time sections of the normal wind component in spring and summer show relative maxima and minima which are closely related to the passage of short-wave troughs. Pronounced wind maxima are often present on days with major hail,but it is not yet clear whether they are in fact necessary for the release of such instability in Western Alberta.

3.6 DIURNAL VARIATIONS IN UPPER WINDS IN ALBERTA

N.H. Thyer

Studies have been made in the past, e.g., by Longley, on diurnal variations of surface winds at places east of the Rocky Mountains, and their similarities to mountain-valley winds and sea-breezes. An analysis has now been made of diurnal variations in upper winds and wind shears for Calgary and Edmonton in the summer months, and results are to be presented.

3.7 ATMOSPHERIC WINDS FROM BALLOON LEVELS UP TO 100 KM

J.B. Gregory and D.K. Rees

A technique for the measurement of atmospheric winds between 60 and 100 km using radio waves is described and its advantages and disadvantages as a synoptic tool for the measurement of winds are discussed. Some preliminary results for 1969 at 53°N are presented and discussed.

4.1 PRECIPITABLE WATER OVER CANADA: COMPUTATION AND DISTRIBUTION

John E. Hay

A model, based on the linear correlation between monthly mean values of screen-height vapour pressure and the total atmospheric precipitable water, is introduced as a means of increasing the spatial sampling density for the computation of the precipitable water field for an individual month.

The spatial and temporal variations in the mean monthly precipitable water fields over Canada, computed using the previously described model, are discussed with attention being paid to such features as the extremely dry air above most of the country in winter and the high values of precipitable water over the continental interior in summer with an associated strong gradient to the north corresponding to the mean position of the Arctic front.

4.2 PROBABILITY FORECASTS OF PRECIPITATION

D.E. McClellan, D.E. Page
R.H. Robinson and N. Yacowar

An operational model for producing objective probability forecasts of precipitation is being developed based upon statistical techniques. Regression equations are developed using the 'perfect prog' concept and can be applied to the output of the dynamic models to give the probability forecasts.

The techniques suggested by Lund (1955) and developed by the Travelers Research Center in their REEP project are incorporated in this model. This allows use of predictors which may have applicability in certain ranges only.

4.3 RAINFALL EXTREME VALUE STATISTICS APPLIED TO MICROWAVE ATTENUATION CLIMATOLOGY

James H.S. Bradley

Increasing traffic is forcing communications satellites and other microwave links into frequencies above 8 GHz, where attenuation by heavy rain becomes a crucial design problem. Rainfall extreme value statistics and a physical working hypothesis are used to estimate monthly and diurnal attenuation climatologies, and to extrapolate McGill radar studies to other non-orographic areas. The widely different information needed for various classes of traffic and link requires close collaboration between meteorologists and engineers in the design of data collection experiments.

4.4 THE SPATIAL DISTRIBUTION OF THUNDERSTORMS OVER ALBERTA FORESTS

R.G. Lawford

This paper includes a series of climatic maps based on Alberta Forest Service Storm records assimilated over a seven-year period (1962-1968 incl.). The maps, including analyses of hourly cumulative frequencies of storm development, mean storm onset times, mean thunderstorm approach angles,the frequency and intensity of cloud-to-ground lightning discharges, median dates for storm development and the empirical probabilities that a day during a given summer month will be a thunderstorm day, will be discussed. An emphasis is placed on the role of topography and other geographical features in the development of these storm patterns. The implications of correlations between various parameters of storm development are briefly reviewed.

4.5 THE INFLUENCE OF UPPER WINDS ON HAILFALL PATTERNS IN CENTRAL ALBERTA

W. Thompson and P.W. Summers

The spatial distribution of hailfall associated with Alberta storms is strongly influenced by the speed and direction of the upper winds. Hail in long, well-organized swaths occurs most frequently with a reversal of direction about 3000 ft above the ground and strong westerly winds at 300 mb. Poorly organized swaths or scattered hail is associated with lighter winds aloft.

North of Red Deer most long swaths are orientated from SW to NE; further south the orientations tend to lie from NW to SE. In both cases the swath orientation tends to be 20 to 30° to the right of the mid-tropospheric winds.

4.6 HAILFALL CHARACTERISTICS AND CROP DAMAGE IN ALBERTA

P.W. Summers and L. Wojtiw

Hail damage estimates made by several thousand farmers on Alberta Hail Studies report cards are related to three parameters. The larger the hail size,the greater the probability of heavy damage. Damage tends to be less when soft hail occurs. The best predictor of damage is the impact energy per unit area derived from the size and total mass of hail that falls. A given impact energy causes more damage as the growing season progresses.

5.1 THE APPLICATION OF CLIMATOLOGICAL RECORDS TO THE ANALYSIS OF MESO-SCALE WEATHER

Frank D. Thompson

The practising forecaster becomes familiar with synoptic scale weather patterns through observing their day-to-day progression. This opportunity does not exist with regard to meso-scale features since their details are not described adequately by the reporting network. Case history studies of the meso-scale characteristics may be undertaken by using reports from the climatological network. These are not available in real time for forecasting but post mortems should enable regional forecasters to study the meso-scale climatology of their area of responsibility. Weather patterns which may be diagnosed in this way include convective snowfall to the lee of open bodies of water, orographic rainfall and local floods, and local variations in temperature extremes. Examples of such analyses are reviewed.

5.2 INSTANT EXPERIENCE: THE USE OF CLIMATOLOGICAL DATA AS AN AID IN FORECASTING

N.N. Powe

A realistic description of the parameters to be expected at a terminal is an essential ingredient of a good terminal forecast. Each terminal has its own weather characteristics. To produce a realistic forecast it follows that these characteristics must be recognized and understood. The paper will describe climatological studies of airports in the Quebec Forecast Region showing how such studies can aid in preparing forecasts by current forecast techniques and provide a basis for the development of objective techniques for producing terminal forecasts.

5.3 A STUDY OF HEAT FLOW IN THE LOWER TROPOSPHERE BY A LABORATORY MODEL

F.H. Fanaki

The results from a study of a laboratory model of the lowest kilometer of the troposphere are presented. The model simulates wind (horizontal flow) and insolation (heated aluminum plates). Fine structures of temperature and velocity are measured, and the fluid isotherms are photographed in natural and free convection conditions. The vertical transfer of warm air is along cylindrical columns, which in natural convection carry heat aloft into caps, or which may merge with neighbouring columns to continue upwards. In free convection,the columns are inclined downwind, with their upper extremities extending almost horizontally;the cap is absent. If an elevated temperature-inversion layer is present, these convective columns perturb it and initiate horizontally travelling waves.

5.4 NUMERICAL MODELS OF HEAT ISLAND CIRCULATIONS

Y. Delage and P.A. Taylor

A two-dimensional model has been set up to investigate the circulation induced by an urban heat island in the absence of synoptic winds. The boundary conditions need to be formulated carefully and due to difficulties arising here attention is restricted to cases of initially stable thermal stratification. Heat island circulations are allowed to develop from rest and prior to the appearance of the final symmetric double cell pattern a transitional multi-cell pattern is observed. The basic stages of development are not critically dependent on the parameters used for such quantities as eddy diffusivity.

5.5 A SPECTRAL CONVECTION MODEL

Roger Daley

A numerical model of bubble convection has been constructed using the spectral technique.

The anelastic (sound filtered) equations for shallow convection have been expanded in terms of orthogonal functions and integrated with respect to time from specified initial conditions.

Kinetic energy and temperature variance spectra have been obtained and the transfers involved in the non-linear terms have been studied. Results have been compared with those obtained by similarity theory.

5.6 STATISTICAL SIGNIFICANCE OF EMPIRICAL ORTHOGONAL FUNCTIONS ARISING FROM METEOROLOGICAL FIELDS

F.B. Muller

Dominance and specificity are advanced as attributes of worth for empirical orthogonal functions determined from meteorological type fields. Measures of these attributes are defined and evaluated in a particular example. The principles are examined for an empirical computer procedure to assess their significance and the results for the particular example are discussed.

5.7 AN EXPERIMENTAL TEST OF THE SMITH-HAY MODEL FOR THE EXPANSION OF CLUSTERS OF PARTICLES IN THE ATMOSPHERE

O. Johnson, B.R. Larson,
J.A. McCallum and W.D. Simpson

Smith and Hay have developed a prediction equation for the expansion of a cluster of particles in the atmosphere. The equation includes an Eulerian spectral function which modifies the full spectrum of turbulence to a form effective in determining the rate of expansion. By numerical integration, it is possible to apply their equation directly. The theoretical rate of lateral expansion is compared with results from eight experiments with instantaneous elevated point sources of glass beads.

6.1 ATMOSPHERIC ELECTRICITY MEASUREMENTS AT TORONTO

Bhartendu

Atmospheric electric field, air-earth current density, and polar conductivities are being measured at the Meteorological Research Station, Toronto. Diurnal variations of these parameters are studied. The practice of calculating either one of the three quantities from knowledge of the remaining two is found to be incorrect and the application of Ohm's law does not appear to be valid in this case. Reasons for this anomaly are discussed.

6.2 ELECTRICAL MEASUREMENTS OF THE TURBULENT DIFFUSION OF SPLASH DROPLETS IN HEAVY RAIN

D.R. Lane-Smith

Field mill measurements of electric field and wide-angle shielded receiver measurements of precipitation current made during heavy thunderstorms in the tropics are presented. The response of the precipitation current to step changes in field due to lightning is analysed and found to be due to the turbulent diffusion of splash droplets formed some distance up-wind of the receiver.

The magnitude of the response and more particularly, the time constant, provide new insight into the splashing process and the subsequent history of the splash droplets.

6.3 ELECTRIFICATION ASSOCIATED WITH DROP SPLASHING

S.R. Shewchuk and J.V. Iribarne

The charge separation associated with the splash of drops of water and aqueous solutions on rotating spheres was investigated, both at room temperature and below $0^{o}C$, on ice surfaces. Flash photographs and observations provided a descriptive study of the splashing process. The influence of different factors on the electrification was studied. It was found that the data can be interpreted as resulting from a shearing of the electrical double layer at the solid-liquid interface.

6.4 GENERAL SURVEY OF THE COAGULATION EQUATION

By Ronald L. Drake

This paper is concerned with a general survey of a scalar transport equation which arises in the study of aerosols and cloud droplet coalescence. The mathematical system being investigated is an integro-differential equation which contains terms accounting for coagulation or coalescence of particles, particle break-up, sedimentation of particles and the production of particles due to condensation. This survey includes the theoretical developments of Melzak, McLeod and Morgenstern, the exact solutions of Golovin, Martynov, Bakanov and Scott, and the numerical results of Warshaw, Berry, Friedlander, Wang, and many others. Also included in this survey are new results by the present author concerning the upper and lower bounds of the power moments of the particle distribution function and how these results affect the choice of the kernel, collision frequency factor, of the integrodifferential equation. Finally,some results are given from the author's numerical studies which could be termed "solution by perturbing the kernel".

6.5 PRELIMINARY STUDY OF COLLISIONS AND BREAK-UP OF RAINDROPS

J.D. McTaggart-Cowan, C.F. MacNeill and R. List

Calculations demonstrate the high probability for collisions of raindrops with diameters of 1-5 mm in medium rainfalls. Since experimental results show that break-ups occur quite often after collision, this process may lead to a drop size limitation in rain. Data on the number of fragments and their size distribution which would allow numerical growth simulation are also presented.

6.6 MEASUREMENTS OF DRAG COEFFICIENTS AND CHARACTERISTIC MOTIONS OF SNOW CRYSTAL, GRAUPEL AND SMALL HAIL MODELS

R.S. Schemenauer and R. List

From water tank experiments, drag coefficients of six plane snow crystal models (plates and dendrites) were determined for

$$10^{-1} < Re < 2x\ 10^{2},$$

and of four conical graupel and small hail models in "apex up" and "apex down" orientations, for

$$10 < Re < 2x\ 10^{3}.$$

Best numbers ($Be = C_D Re^2$) as function of Reynolds number were then

plotted, enabling fall velocities to be calculated from atmospheric and particle parameters.

The drag coefficients of the models were found to depend strongly on the types of motions they underwent as they fell.

6.7 THE WATER BUDGET OF A SUMMER STORM

Clifford D. Holtz

Radar observations have been used to indicate quantitatively the time-variation of the water budget of a thunderstorm. Throughout the storm's life cycle, the total masses of air and water substance within the storm and the partitioning of the latter among vapour, cloud and precipitation-sized particles have been calculated.

Empirical relationships have then been used to formulate a time-dependent model to simulate the water budget.

7.1 MIDDLE CLOUD FORECASTS BY A STATISTICAL-NUMERICAL TECHNIQUE

C.D. Henry

Multiple regression analysis is used to formulate an equation relating middle cloud amounts to various meteorological parameters, actual and forecast. The analysis is done on a current basis, in order to incorporate the immediate past performance of the USWB Primitive Equations Model forecast fields. The regression equation is then used to predict middle cloud amounts over the Canadian prairies. A discussion of the performance of the technique is given.

7.2 FINE MESH LIMITED-AREA FORECASTING

Gaston Paulin

The development of a filtered baroclinic model with a variable grid length and time-dependent boundary conditions will be described. The forecast area covered decreases with the decreasing mesh size. The grid size is decreased by a step of one half the previous value. Three passes have been tried, i.e., full mesh size (381 km), half and quarter size.

The model has been tested on an Alberta storm during July 1968. The initial data used consisted of interpolated stream functions for the proper telescoped area. The earth topography and friction have been recomputed for the denser grid point arrays. Improvements have been found in the motion and depth of the Alberta storm.

7.3 THE INTERPRETATION OF DIAGNOSTIC FIELDS USING SURFACE OBSERVATIONS, AND SOME APPLICATIONS TO SHORT RANGE WEATHER FORECASTING

E. Clive Jarvis

Using small grid distances, smoothed terrain heights were incorporated with derivatives of the wind, temperature and moisture fields obtained from surface observations for the purpose of diagnosing active physical processes in the planetary boundary layer. Some applications of these diagnostic fields to short range weather forecasting are discussed using suitable cases.

7.4 COMPARISON OF THE BAROTROPIC, PHILLIPS AND MINTZ-ARAKAWA NUMERICAL CIRCULATION MODELS

A.K. MacPherson and G.V. Price

The effect of the physical assumptions made in the barotropic, Phillips and the fairly general Mintz-Arakawa numerical models is discussed. The same initial data have been used in all three cases so that the resultant patterns can be compared and the impact of the various parameters examined. These three models cover approximately the available techniques presently used, although the Phillips model has been greatly modified in recent work.

7.5 METEOROLOGICAL EXPERIMENTS CARRIED ON SIMULTANEOUSLY WITH OPERATIONAL PROGRAMS

A.F. Davies

A program for the rapid production of operational working charts from early radiosonde data has been used as a vehicle to carry out several meteorological experiments.

These include:

Air Mass Analysis
Typical Air Mass Maximum Temperatures and afternoon Dewpoints
1000 to 850 mb thickness
Extrapolated 400, 300, 200 mb and Tropopause charts
Forecasts by computer of
Slydex, Lifted Index, CB bases, CB tops, hail size, wind gusts, downrush temperature, and available convective energy

Results for a winter and summer situation, with their verification or comparison relative to hand-produced analyses will be given.

7.6 SIGNIFICANCE OF UPPER ATMOSPHERIC TEMPERATURES

F.R.C. Ezemenari

Temperature is a very difficult parameter to measure,so that it may have real meaning meteorologically, particularly at stratospheric and higher altitudes. Atmospheric temperature profiles from thermistor measurements (the routine method of measuring upper air temperatures) are compared and contrasted with those derived from such other techniques as grenade explosions and pitot-static tube soundings in an attempt to ascertain what any particular temperature sounding represents.

7.7 SYNOPTIC HEAT BUDGETS AT THREE POLAR STATIONS

E. Vowinckel and S. Orvig

Surface and atmospheric heat budgets will be presented for two Antarctic Stations (Wilkes and Byrd) and one Arctic Station (Sachs Harbour). The individual terms in the energy exchange between surface and atmosphere are calculated for each day throughout a year using synoptic observations. Thus, the seasonal and annual march of the radiational and turbulent exchange terms can be studied at each station and compared between different stations. The water budget, i.e., evaporation and precipitation, will also be illustrated.

CANADIAN METEOROLOGICAL SOCIETY

4th Annual General Meeting, June 17, 1970,
University of Manitoba.

AGENDA

The President in the Chair

1. Minutes of 3rd Annual General Meeting, Toronto, May 27, 1969

2. Reports of the Executive Committee

    (a) Annual Report of C.M.S.
    (b) Treasurer's Report
    (c) Nominating Committee Report
    (d) Editor's Report
    (e) Prize Committee Report

3. Reports from Local Centres

4. Budget for period 1 Jan. 1971 to 31 Dec. 1971

5. Amendments to Society's By-laws

6. Future of the Society

7. SCITEC

8. 1971 Congress

9. Other Business

10. Installation of Officers

DRAFT MINUTES

CANADIAN METEOROLOGICAL SOCIETY

Minutes of the Third Annual General Meeting of the Canadian Meteorological Society held at University of Toronto, Toronto, Ontario, Tuesday, May 27, 1969, at 7:00 p.m.

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1. Minutes of the 2nd Annual General Meeting of the Canadian Meteorological Society held June 3, 1968, at University of Calgary, Calgary, Alberta.

Mr. H. Cameron moved that the minutes of the 2nd Annual General Meeting be approved. Seconded by Dr. W.L. Godson. Carried.

2. Reports of the Executive Committee

(a) Mr. J.D. Holland moved that the Report as published be approved. Seconded by Mr. K.T. McLeod. Carried.

(b) Treasurer's Report

Mr. L. Shenfeld moved that the Report as published be approved. Seconded by Dr. D.P. McIntyre. Carried.

It was suggested, in the discussion, that the new Executive investigate the possibility of liquidating the low interest rate bonds presently held by the Society and reinvesting the proceeds in securities with a higher yield.

(c) Nominating Committee's Report

Mr. H. Cameron, Chairman of the Nominating Committee, moved that the following be considered for office during 1969-70 :

Executive

President	M.K. Thomas
Vice President	D.N. McMullen
Treasurer	L. Shenfeld
Corresponding Secretary	J.D. Holland
Recording Secretary	G.L. Pincock
Editor	E.J. Truhlar

Councillors at Large

Prof. K.D. Hage
Mr. J.L. Knox
Rev. Father C. East

Auditor

R.D. Easto

No nominations were received from members at large. The President declared the nominees elected.

.... 2/-

(d) Editor's Report

Mr. J.A.W. McCulloch moved that the Report as published be approved. Seconded by Dr. J. Maybank. Carried.

Mr. McCulloch also moved that the practice of providing fifty free reprints to authors be cancelled. Seconded by Prof. A.W. Brewer. Carried.

(e) Prize Committee Report

Prof. R. List, a member of the Prize Committee, reported that the following awards were recommended :

i) President's Prize - Prof. A.W. Brewer

"The regions of formation of atmospheric ozone", published in Quarterly Journal of the Royal Meteorological Society, Vol. 94, 249-264, July 1968.

ii) Prize in Applied Meteorology - Mr. D. Davies

"Three-layer numerical forecasts of precipitation amounts", published as Canadian Meteorological Memoir No. 25, plus his report with M. Olson, "Operational Forecasts of 24-hour precipitation amount from the Central Analysis Office Computer", published as Canadian Met. Branch TEC 670, April 1968.

iii) Graduate Student Prize - No recommendation.

iv) Dr. A. Thomson Undergraduate Student Prize - Mr. I.R. Graham

"An Analysis of Turbulence Statistics at Fort Wayne, Indiana", published in the Journal of Applied Meteorology, Vol. 7, 90-93, 1968.

3. Reports from the Local Centres

Reports from the following Local Centres were presented.

British Columbia Centre	-	J.R. Henderson
Alberta Centre	-	Dr. E.R. Reinelt
Regina Centre	-	J.D. Holland
Winnipeg Centre	-	H.M. Fraser
Toronto Centre	-	R. Lee
Ottawa Centre	-	D.J. Wright
Montreal Centre	-	Prof. B.W. Boville
Quebec Centre	-	Dr. O. Villeneuve
Halifax Centre	-	J.D. Holland

.... 3/-

4. Budget for Period 1st Jan. 1970 to 31st Dec. 1970.

The Budget was reviewed by Mr. L. Shenfeld.

Mr. Shenfeld moved that the fee structure be changed to Undergraduate Student Members $ 1.00, Graduate Student Members $ 4.00, Members $ 7.50, Corporate Members $ 25.00 per annum. Seconded by Mr. G.A. McKay. Prof. B.W. Boville moved an amendment that the fee structure be Undergraduate Student Members $ 1.00, Graduate Student Members $ 2.00, Members $ 8.00, Corporate Members $ 25.00. Seconded by Dr. J. Maybank. Motion carried as amended.

Mr. Shenfeld then moved that the budget as presented and amended by the change in fee structure be accepted. Seconded by Mr. H.M. Fraser. Carried.

5. Amendments to the By-Laws

Prof. A.W. Brewer moved amendments to the By-Laws as follows :

BY-LAW 2 Membership

(a) Applications for membership are accepted by Council or by the Executive on behalf of Council. Council has the power to remove members for non-payment of dues or for other reasons.

(b) Student membership is open to bona fide full-time students.

(c) Corporate membership is open to institutions, companies, firms and organizations.

Appendix to By-Laws

(c) Graduate Student Prize

When a contribution of special merit by a graduate student comes to the notice of the Awards Committee, a special graduate student prize may be awarded.

(d) The Dr. Andrew Thomson Undergraduate Student Prize.

A prize known as the Dr. Andrew Thomson Undergraduate Student Prize may be awarded in any year for a contribution of special merit by an undergraduate student coming to the attention of the Awards Committee.

Seconded by Mr. J.A.W. McCulloch. Carried.

6. Future of the Society

The President stated that further growth of the Society was necessary in order to obtain the funds required for paid assistance to the Executive. There were several ways this could be done - increasing the number of

.... 4/-

Corporate Members; a drive to obtain more members from the professional employees of the Meteorological Branch; broadening the base of membership as originally conceived when the Society was formed; charging higher rates to University and School libraries for subscriptions to Atmosphere.

The President also asked for authority from the meeting to appoint a Society Development Committee, consisting of about six members representative of the Meteorological Branch, the Universities and Private Industry. This committee would provide progress reports to Council and complete its final report by February, 1970, so that it could receive consideration at the 1970 Annual Meeting.

It was moved by Prof. B.W. Boville that Council be directed to form a Society Development Committee. Seconded by Mr. J.A.W. McCulloch. Carried.

7. 1970 Congress

The President reported on an invitation from the Winnipeg Centre to hold the 1970 Congress at the University of Manitoba in conjunction with the Conference of Learned Societies. He also advised that some consideration had been given to holding the 1970 Congress at MacDonald College along with the Second Canadian Conference on Micrometeorology and that the Montreal Centre had already indicated its willingness to act as host. He expected that a final decision would be made in July, but it now seemed likely that the 1970 Congress would be held in Winnipeg, the 1971 Congress in Montreal.

8. Other Business

Dr. R.E. Munn moved a vote of thanks to outgoing members of the Executive, Messrs : J.P. Bruce and J.A.W. McCulloch. Seconded by Mr. H. Cameron. Carried.

9. Installation of New Officers.

The President welcomed the incoming Council.

10. Adjournment

The Meeting was adjourned at 9:20 p.m. It was followed by a reception in the faculty room of the New Physics Building, University of Toronto.

M.K. Thomas, President

G.L. Pincock, Recording Secretary

ANNUAL REPORT

CANADIAN METEOROLOGICAL SOCIETY

MEMBERSHIP

Membership in the Canadian Meteorological Society continued to rise in 1969 and by April 1, 1970 stood at 593 including 83 student members, as compared with 554 including 73 students a year before. This was in spite of the fact that 72 names were removed from the rolls in December 1969 for non-payment of dues. A number of these have since been reinstated. A membership drive is currently being conducted through the Centres and is beginning to show some results.

THIRD ANNUAL CONGRESS

The Third Annual Congress of the Society was held at the University of Toronto, May 27 to 29, 1969. Using "Applied Meteorology" as a theme, Program Chairman Gordon McKay put together an excellent and stimulating program consisting of 41 papers presented in eleven sessions, including a number of concurrent sessions.

The keynote speaker at the opening session of the Congress was Dr. P.D. McTaggart-Cowan, Executive Director of the Science Council of Canada, speaking on "The Role of Meteorology in the National Economy". The first day of the Congress was devoted to "The Atmosphere as a Resource", while subsequent sessions were devoted to "Turbulence and the Boundary Layer", "Observations and Forecasting", "Human Aspects", "Pollution","Dynamic Meteorology","Climatological Analyses" and "General Meteorology". The Congress concluded with a panel discussion on the future of applied meteorology. Approximately 200 people were in attendance during the three days of the Congress, which provided, in addition to the scientific sessions, an opportunity to visit the meteorological facilities in the new McLennan Physics Laboratories at the University of Toronto and a visit to the McLaughlin Planetarium. Local arrangements for the Congress were ably handled by a local arrangements committee under the chairmanship of Walter Lawrynuik.

THIRD ANNUAL GENERAL MEETING

The Third Annual General Meeting of the Society was held at the University of Toronto, at 7 p.m. on May 27, 1969. Following reports by

the Executive, the report of the Nominating Committee was read, and the following were declared elected as officers of the Society for 1969-70:

President	:	M.K. Thomas
Vice-President	:	D.N. McMullen
Treasurer	:	L. Shenfeld
Corresponding Secretary	:	J.D. Holland
Recording Secretary	:	G.L. Pincock
Editor	:	E.J. Truhlar
Councillors-at-large	:	Prof. K.D. Hage
		Mr. J.L. Knox
		Rev. Father C. East
Auditor	:	R.D. Easto

Professor A.W. Brewer continued as Past President.

The report of the Prize Committee was presented, recommending the presentation of the following prizes for 1969:

President's Prize	:	Prof. A.W. Brewer
Prize in Applied Meteorology	:	Mr. D. Davies
Graduate Student Prize	:	No recommendation
Dr. Andrew Thomson Undergraduate Student Prize	:	Mr. I.R. Graham

It was voted to change the fee structure for 1970 to the following: Undergraduate Student Members $1.00, Graduate Student Members $2.00, Members $8.00, Corporate Members $25.00.

At the close of the business meeting the members adjourned to the Faculty Lounge of the McLennan Physics Laboratories for a wine and cheese party.

ANNUAL DINNER

The Annual Dinner of the Society was held in the Great Hall at Hart House on Wednesday, May 28 preceded by an open-air reception in the Quadrangle. Guest speaker at the dinner was Dr. F.K. Hare, who had recently joined the Geography Department at the University of Toronto. At the annual dinner, the Patterson Medal was presented to Dr. Warren L. Godson, Superintendent of the Atmospheric Research Section of the Meteorological Branch,with Dr. D.P. McIntyre making the presentation on behalf of the Director of the Branch. The President of the Society presented the Society's Awards for 1969: The President's Prize to Professor A.W. Brewer, the Prize in Applied Meteorology to Mr. D. Davies, and the Dr. Andrew Thomson Undergraduate Student Prize to Mr. I.R. Graham.

OTHER ACTIVITIES

Among other activities in which the Society participated in 1969 was the Canada-wide National Science Fair. The 1969 fair was held at the Regina campus of the University of Saskatchewan, May 8-10, 1969. Michael Lynch of Sarnia won the prize presented by the Society for the exhibit best demonstrating proficiency in Meteorology. The 1970 Science Fair is being held at McMaster University, Hamilton, Ontario, May 12-16, 1970, and is being given similar support by the Society.

Our President attended the meetings in Ottawa on January 17, 1970 at which the new national organization, SCITEC, representing the entire Canadian scientific,engineering and technological community,was founded. Our President's recommendation is that the Canadian Meteorological Society consider affiliation with SCITEC when complete information on the requirements become available. Discussion of SCITEC is also an item for discussion on the Agenda of the 1970 Annual Meeting.

Another activity of the Society during 1969-70 was to help arrange for the national tour of Dr. Tim Oke who visited Centres of the Society during the winter of 1969-70 in a speaking tour sponsored by the Meteorological Branch.

The future of the Society is a subject which continued to hold the attention of the Executive and Council for a great deal of time during the past year. A Society Development Committee was formed to consider this subject and to make recommendations to Council. The Committee has prepared a very fine and comprehensive report which will form the basis for discussion on the future of the Society at the Annual Meeting.

CANADIAN METEOROLOGICAL SOCIETY
STATEMENT OF RECEIPTS AND EXPENDITURES
FOR THE YEAR ENDED DECEMBER 31, 1969

RECEIPTS		
1967 Fees	$ 1.00	
1968 "	163.20	
1969 "	3,391.48	
1970 "	122.95	$3,678.63
OTHER INCOME		
Bond Interest	$ 25.50	
Bank Interest	38.53	
Dividends - Bell Telephone	30.00	
Subscriptions to Atmosphere	183.45	
Refund from 1968 Congress	153.57	
Refund from 1969 Congress	162.53	
Sales tax refund - ATMOSPHERE	116.74	
Grant - Meteorological Branch	1,500.00	$2,210.32
		$5,888.95
Proceeds from sales of bonds;		
Gov't. of Canada 3¾% - 1978		
Gov't. of Canada 4½% - 1983		977.90
TOTAL RECEIPTS:		$6,866.85
EXPENDITURES		
Centres - expenses	$ 186.97	
Prizes	37.61	
Audit expense - 1968 and 1969	60.00	
Stationery and Printing	708.79	
Congress Expenses	545.18	
Bank Charges	43.32	
Postage	138.45	
ATMOSPHERE - printing and mailing	3,293.56	$5,013.88
Purchase - 1969 Gov't. of Canada Savings Bonds		950.00
TOTAL EXPENDITURES:		$5,963.88
Bank Balance - January 1, 1969		$ 956.47
Plus receipts 1969		6,866.85
Less expenditures 1969		5,963.88
		$1,859.44
Balance - Bank of Montreal - December 31, 1969		$ 793.10
Canadian Imperial Bank of Commerce - December 31, 1969		1,066.34
		$1,859.44

CANADIAN METEOROLOGICAL SOCIETY
BALANCE SHEET AS AT DECEMBER 31, 1969

ASSETS

Bank	- Balance, December 31, 1969	$1,859.44	
Bonds	- 1969 Canada Savings Bonds (1 Nov 1978 - average 8%) (a)	950.00	
Bell Telephone	- market value December 31/69 $44.00 x 12 shares	528.00	$3,337.44

LIABILITIES

Surplus - December 31, 1968	$2,385.97	
Surplus for year 1969	951.47	$3,337.44

Note (a) - interest rate on bonds

first year	7 %
second and third years	8 %
fourth to the ninth years inclusive	8¼%

AUDITOR'S REPORT

I have examined the records of the Canadian Meteorological Society and am satisfied that the Treasurer's Report presents a proper statement of the financial position as at December 31, 1969.

R.D. Easto,
Auditor

CANADIAN METEOROLOGICAL SOCIETY

STATEMENT OF ACCOUNTS FOR "ATMOSPHERE"
YEAR ENDED 31ST DECEMBER, 1969

INCOME		EXPENDITURE	
Subscriptions	$ 123.05	Postage	$ 228.47
Reprints and back issues	247.69	Addressograph work	42.50
CMS subsidy	1,900.00	Printing	1,766.29
Advertising revenue	100.00	Stationery	18.89
Bank Credit	.10	Office supplies	1.79
Bank exchange undeducted	.30	Typing	235.95
	$2,371.14	Bank exchange charges, additional	.33
		Bank Service Charges	7.00
			$2,316.22
Current account 1 January, 1969	84.17	Current account 31 December, 1969	139.09
	$2,455.31		$2,455.31

Anthony W. Smith
12 January, 1970

REPORT OF NOMINATING COMMITTEE

The following have been nominated for the Canadian Meteorological Society Council for 1970-71, and all have agreed to serve, if elected:

President	:	Mr. D.N. McMullen
Vice-President	:	Mr. C.M. Penner
Treasurer	:	Mr. M.S. Webb
Corresponding Secretary	:	Mr. G.A. McPherson
Recording Secretary	:	Mr. G.L. Pincock
Councillors-at-large	:	Mr. J.L. Knox Dr. K.D. Hage Dr. C. East
Editor	:	Mr. E.J. Truhlar
Auditor	:	Mr. R.D. Easto

Mr. M.K. Thomas automatically becomes Past President.

A.W. Brewer,
Chairman,
Nominating Committee

ATMOSPHERE ANNUAL REPORT 1969

During 1969, four issues of ATMOSPHERE were printed and distributed: number 4 of Volume 6, numbers 1 and 2 of Volume 7 and the special Annual Congress issue. At the end of 1969, number 3 of Volume 7 was printed and was ready for distribution. The regular issues contained 19 articles and papers,2 book reviews, 18 reports or notices about meetings and a number of other notes. The publication is about two months behind schedule.

The style and format of ATMOSPHERE was changed with Volume 7 to improve readability and the pagination arrangement. The type style is regular Elite with Gothic for emphasis and variety (especially in headings and references). Authors of articles have not received free reprints after the Vol. 7 No. 1 issue so that each article is printed continuously without breaks.

A more integrated mailing and distribution arrangement has been set up, with the printer providing this additional service. New envelopes were also printed for mailing each issue.

Both the Federal and Provincial Governments have granted sales tax exemption for the printing of ATMOSPHERE as a professional publication issued quarterly. A tax refund in the amount of $116.74 was received from the Ideal Printing Company which printed ATMOSPHERE prior to May 1968. The present printing company, AMG Lithographers, has agreed to refund taxes paid during the period from September 1968 to September 1969, and has not invoiced sales taxes starting with the last quarter of 1969.

An initial attempt to solicit advertising on a modest scale was made towards the end of 1969, but there was only one response,leading to a possible future contact.

Many members who otherwise support the Society have not actively exerted their responsibility further by contributing articles for publication. As a result some publication deadline deferments have arisen,and consideration has been given to reducing the size of each issue from 40 pages (when necessary) to meet the uncertain schedule of contributions without diluting quality of content.

I appreciate the assistance and aid of many others who have enabled ATMOSPHERE to appear in print: Jim McCulloch, for his encouragement and suggestions; the Editorial Committee, for their advice;and the editorial staff for their constant and effective efforts.

E.J. Truhlar

PRIZE COMMITTEE REPORT

The Awards Committee, after due deliberation, wishes to recommend the following candidates for awards of the Society for the year 1969:

Professor G.T. Csanady, University of Waterloo -
The President's Prize for his paper "Diffusion in an Ekman Layer", J. Atm. Sc., 26, 414-426, 1969, and which was presented at the 2nd Annual Congress of the Canadian Meteorological Society.

M.K. Thomas, Meteorological Branch, Toronto -
The Prize in Applied Meteorology, in view of his extensive contributions which include work relating to people and construction, the preparation of national and international atlases, and continued enthusiastic promotion of all aspects of applied meteorology, which culminated in 1969 when the Society, of which he is president, held the first Canadian Congress on Applied Meteorology.

T. Warren, graduate student in Meteorology, McGill University -
The Graduate Student Prize, for his M.Sc. Thesis "Initialization Problems of a Primitive Equations Model of the Atmosphere" which is considered to warrant special merit. The thesis was rated excellent and very good by the two examiners.

T. Agnew, undergraduate student in mathematics and physics, University of Toronto -
The Dr. Andrew Thompson Undergraduate Student Prize, for his report "Terrain induced vertical velocities obtained using a direct method of stream-function computation" which was published as a Meteorological Branch Technical Memorandum,TEC-721, September 15, 1969,and who has collaborated on a "Note on the computation of terrain and frictionally induced vertical velocities" which has been submitted to the Journal of Applied Meteorology.

G.A. McKay, Chairman,
C.M.S. Awards Committee.

ANNUAL REPORTS FROM CENTRES

B.C. CENTRE - VANCOUVER

Three meetings were held in 1969; that all were hosted by The University of British Columbia reflected the continuing development of interest and support in the Society by Faculty and students in the areas of Oceanography, Geography and Agriculture.

On 20th January, Dr. K.M. King of Guelph spoke on "Micrometeorology in Agriculture" to 22 enthusiasts who had braved the rigours of a typically harsh B.C. winter! The audience were well rewarded by a fine and lively talk, in which the inter-relationship between two sciences was impressively demonstrated. Dr. King stressed the need of the agriculturalist for increased knowledge of the meteorology of the lower layers.

Dr. F.K. Hare addressed his "Reflections on the Stratosphere" to 42 members and guests on 25th February. He lucidly discussed the dynamics of the stratospheric circulation with special reference to his own work in that field. Dr. Hare contrasted the traditional assumptions of a benign, unruffled stratosphere with the actuality of turbulence and of preferred areas of turbulent motion.

On 29th October, E.I. Mukammal, Head of the Bioclimatological Section of the Meteorological Branch, addressed an audience of 30 on "The Problems and Applications of Micro-Climatology to Forestry and Agriculture." The speaker drew on a wealth of experience,gained during studies near Toronto and at Petawawa, to give a stimulating talk. In the course of his profusely illustrated lecture, Mr. Mukammal emphasised that many basic problems in micrometeorology are far from being solved.

Vigorous question and discussion sessions followed each of the talks heard during the 1969 season.

The 1970 season started well with three meetings in the period January-March addressed by W.L. Gordon, T. Oke and J.L. Knox. At least three further meetings with guest speakers, and a special meeting to consider the Development Committee report, are tentatively scheduled.

The executives for the 1968-69 year and for the current year are given below:

1968-69		1969-70
J.B. Wright	Chairman	K. Harry
W.H. Mackie	Vice-Chairman	D. Faulkner
L.E. Parent	Secretary-Treasurer	R.B. Sagar
	Program Chairman	T.D. Black

ALBERTA CENTRE

Executive of the Centre

Chairman	-	H.P. Wilson
Secretary	-	A.S. Mann
Treasurer	-	W.C. Thompson
Calgary Member	-	R.K. Holbrook

Meetings of the Season

Nov. 12, 1969	Dr. B. Haurwitz, National Centre for Atmospheric Research, Boulder, Colorado	"Unsolved Problems in Noctilucent Cloud Research"
Jan. 27, 1970	Dr. T.R. Oke, Geography Department, McGill University	"Urban Climatology and Air Pollution"
Feb. 27, 1970	Dr. W.C. Swinbank, National Centre for Atmospheric Research, Boulder, Colorado	"New Theory for the Ekman Layer"
Mid-April, 1970 (tentative)	Dr. L. Rogers, Research Council of Alberta, Edmonton, Alberta	"Electric Charge Generation in Thunderstorms"

Three of the meetings were held in the Henry Marshall Tory Building on the Campus of the University of Alberta at the invitation of the Geography Department.

The meeting tentatively set for mid-April is proposed for Red Deer to reduce the travelling time required for attendance of members in Calgary, Suffield and Lethbridge.

REGINA CENTRE

1969 was the first full year of operation of the Regina Centre. The executive for the year consisted of S.J. Buckler, Chairman, and L.S. Meeres, Secretary.

Four scientific meetings were held in 1969 as follows:

Jan. 23 - Professor K.M. King, University of Guelph, gave an interesting talk on "Applications of Micrometeorology in Agriculture."

April 30 - S.J. Buckler, O.I.C. of the Prairie Hydrometeorological Office in Regina reported on the Western Snow Conference at Salt Lake City, April 15-17, 1969.

May 26 - Mr. S.R. Blackwell of the Saskatchewan Water Resources Commission described the work carried on by the SWRC Hydrology Division and their meteorological requirements.

November 3 - L.S. Meeres reported on the American Meteorological Society's Third Conference on Weather Analysis and Forecasting.

Mr. L.S. Meeres of the Regina Centre was appointed as judge for the CMS prize to be awarded at the Eighth Canada-Wide Science Fair, held at the University of Saskatchewan Regina Campus, May 8, 9,10, 1969. Mr. S.J. Buckler, Chairman of the centre, presented the prize at the closing banquet on May 10th to Michael Lynch of Sarnia, Ontario, for his air pollution project demonstrating the experimental determination of sulphur dioxide levels in Sarnia, using lead peroxide "candles."

MEETINGS in 1970:

Jan. 29 - Dr. T. Oke of the Geography Department, McGill University, gave an illustrated lecture on "Urban Climatology and Air Pollution."

March 23 - Mr. E. Einarsson from the Prairie Weather Central reported on work he has done in connection with "Wind Tides on Some Prairie Lakes".

TORONTO CENTRE

Officers of the Toronto Centre for 1969-70

Chairman	- T.L. Wiacek
Programme Secretary	- D.K.A. Gillies
Treasurer	- T. Galler
Secretary	- M.S. Webb

Meetings

October 7, 1969 -	"Why Bother With Research" Dr. D.V. Anderson, Dept. of Mathematics, University of Toronto.
November 10, 1969 -	"Carbon Dioxide and All That" Dr. F.K. Hare, Dept. of Geography, University of Toronto.
December 9, 1969 -	Tour of Nuclear Power Generating Station, Pickering, Ontario.
January 20, 1970 -	"Ice, Weather and the Manhattan" Mr. E. Stasyshyn, Ice Reconnaissance Unit, Meteorological Service of Canada, Toronto
February 10, 1970 -	"NIMBUS D Ozone Experiment" Dr. C.L. Mateer, Supervisor of Physical Research Unit, Meteorological Service of Canada, Toronto
April 9, 1970 -	"Urban Climate and Air Pollution" Dr. T.R. Oke, Dept. of Geography. McGill University, Montreal.
May 1, 1970 -	Dinner/Business Meeting at Ontario Science Centre followed by a tour.

MONTREAL CENTRE

Executive:	Chairman	-	Dr. K.L.S. Gunn
	Secretary	-	R.W. Shaw
	Treasurer	-	B. Barge
	Member-of-the-Executive	-	Dr. P.E. Merilees

30 Sept. 69: Dr. Fred Bushby, Meteorological Office, Bracknell, England, spoke on "Recent Results with a ten-level model suitable for detailed weather prediction". The model, which included moisture and precipitation,used a 50 km grid. This model is currently being evaluated by the British Meteorological Office.

21 Oct. 69: Dr. B. Machenauer, University of Copenhagen, spoke on the theory of planetary fluctuations based on spherical harmonics. His most significant result was that moderately fast moving planetary waves can be explained by the gravity-inertial oscillations of a homogeneous incompressible fluid on a sphere.

2 Dec. 69: Mr. A.J. Chisholm of McGill University described the operational aspects of the Alberta Hail Studies project and his own research into the structure of severe hailstorms, including the microphysics of precipitation within them.

27 Jan. 70: The Centre held a special gala night to which wives and friends were invited. Dr. Victor E.F. Salman of the Canadian Wildlife Service gave an interesting talk on the meteorological aspects of forecasting the migration of birds. He also discussed the problem of bird strikes on aircraft and showed examples of the resulting structural damage. Movies of migrating birds as detected by radar were shown.

10 Mar. 70: Dr. T.R. Oke of McGill University spoke on "Urban Climate and Air Pollution". He outlined the meteorological factors in the lowest layers that affect the unique climate of a city;in particular, the pollution content of the air. He stressed the need for careful planning of cities to avoid high pollution levels.

CANADIAN METEOROLOGICAL SOCIETY

PROPOSED BUDGET FOR 1971

RECEIPTS			
Dividends and Interest		...	$ 100.00
Meteorological Branch Grant		...	500.00
FEES			
General members	- 500 @ $ 8.00	...	$4,000.00
Corporate member	- 1 @ $25.00	...	25.00
Graduate student members	- 85 @ $ 2.00	...	170.00
Undergraduate student members	- 5 @ $ 1.00	...	5.00
			$4,800.00
EXPENDITURES			
Net "Atmosphere" cost		...	$2,800.00
Annual Congress			
Typing	- $ 40.00		
Mailing	- 60.00		
Printing	- 600.00	...	700.00
Awards and Prizes		...	100.00
Auditor honorarium		...	30.00
Grants to Centres		...	300.00
Executive Costs of Operation			
Bank charges	- $ 40.00		
Postage	- 300.00		
Stationery	- 100.00		
Printing	- 100.00		
Clerical assistance	- 100.00	...	640.00
			$4,570.00
Budgeted Surplus		...	$ 230.00

PROPOSED AMENDMENTS TO BY-LAWS AFFECTING MEMBERSHIP

1. Delete present By-law 2 c) and substitute therefor:

> "c) Corporate membership is open to consulting meteorologists."

2. Add new By-law 2 d):

> "d) Sustaining membership is open to institutions, companies, firms and organizations."

The purpose of these proposed amendments is to make provision for a new class of membership to be known as Sustaining Membership, open to institutions, companies, firms and organizations interested in providing financial support to the Canadian Meteorological Society and thereby to meteorology in Canada. The amendments at the same time make provision for retaining the present corporate membership classification for those who have so far seen fit to take advantage of it, namely, consulting meteorologists.

PROPOSED AMENDMENTS

TO BY-LAWS AFFECTING SOCIETY'S AWARDS

1. Amend By-Law 14(d) by adding the following:

   "..... The Corresponding Secretary will pass this information, together with a list of papers and authors from national Canadian Meteorological Society or Canadian Meteorological Society sponsored meetings during the year, to the Awards Committee for their consideration".

2. Add New Clause 14(e):

   "(e) Nominations for the Society's Awards from members and Centres will be called for by the Corresponding Secretary in an appropriate issue of ATMOSPHERE each year, with March 1 as the deadline for receipt of nominations. Nominations received by this date will be forwarded to the Awards Committee for their consideration".

The purpose of these proposed amendments is:

(a) to assist the Awards Committee in their deliberations by making it mandatory for the Corresponding Secretary to provide them with the additional information specified in proposed amendment 1; and

(b) to encourage greater participation in the Society's affairs by the Centres and the members at large by calling for them to make nominations for the Society's awards, as specified in proposed amendment 2.

THE CMS DEVELOPMENT COMMITTEE

The National Executive decided in 1969 to set up a committee to report on the future development and goals of the Canadian Meteorological Society. The committee consisted of representatives from universities, including students, from Meteorological Branch Headquarters divisions, Forecasting Services and outside agencies. All committee members submitted working papers and participated actively in several interesting meetings. The following brief account will attempt to summarize the discussions and the highlights of the report but most of the details and organizational matters will be omitted.

There is a strong feeling in the world today that scientific and technological problems can no longer be considered separately from social problems and that scientists must accept social responsibilities for their activities. The committee felt that the CMS could and should be the leader in communication and provision of advice on meteorological problems where these are concerned with the social welfare of the community. The CMS should prepare itself to lead independently in professional meteorology in Canada. To this end, the report urges the frequent use of standing committees to report on policy, on scientific and professional matters, on education and on matters pertaining to the importance and application of meteorology to society.

The report points out that for the CMS to play its proper role in this regard and in order to develop adequate publications, the executive should keep under active consideration the setting up of a permanent secretariat. Realizing that such a goal is at least five years away and would require almost complete support of the Society by all Canadian meteorologists at a considerable fee increase, the committee also recommends further promotion of membership, not only among meteorologists but from among all those interested in the environmental and related sciences. The committee, however, recommends that the essential nature of the society as a "Learned Society" with a strong core of professional membership be retained.

Local centres are of vital concern to the growth and stature of the CMS and must play an increasing role in the Society's activities.

The most difficult problem the CMS has to face is the development of its publications. The committee suggested two alternative courses of action.

1. Continue the development and improvement of "Atmosphere" along present lines.

2. Develop "Atmosphere" as a prestige annual publication until the budget permits expansion and develop a second publication

to be distributed bi-monthly or oftener. This second publication would be designed as a concise newsletter to communicate rapidly on news items,society business,important meteorological matters of interest to the membership at large. Input to this second publication would require active cooperation and participation by local centres and the membership at large. The publication, possibly named "The Canadian Meteorologist" would also be a convenient vehicle for statements prepared by Standing Committees mentioned previously, or by the Executive or for "Press Releases", etc. It would be, because of budgeting restrictions, produced in the most inexpensive manner possible.

The majority of the committee felt that some change in the publications policy was necessary to provide for better communication among members and better leadership on professional matters.

C.M. Penner
Chairman

RECOMMENDATION FOR STANDING COMMITTEES

In the report of the Society's Development Committee (Feb. 1970), the following recommendation was put forward:

> "The Development Committee recommends the frequent use of standing committees on policy, on scientific and professional matters,on education of the general public, on matters pertaining to the importance and application of meteorology in society by the National Executive. These committees would be appointed by each National Executive and would have tenure only during the tenure of that Executive".

Members of the 1969-70 Executive view the recommendation with favour and urge the incoming Council to seriously consider establishing standing committees as soon as possible in 1970 on (a) scientific and professional matters, and on (b) public information.

If appointed by Council in the fall of 1970, the proposed standing committees would expire on the occasion of the 1971 Annual General Meeting. No action would be expected from a standing committee unless Council, or the Executive acting for it, passed a request for opinion to it. Fairly rapid response in the order of one or two weeks in the form of a report to the Executive would then be expected from the pertinent standing committee upon receipt. The Council or Executive would decide whether or not to use the "opinion" on behalf of the Society. In other words, the standing committee's function would be purely advisory and Council, or the Executive acting for it, would not be bound to make public the opinion expressed by the standing committee at any time. Neither secrecy nor undue publicity would be given to the composition of the standing committees and all announcements or pronouncements would be issued by the Executive of the Society.

The outgoing Executive recommends the establishment of standing committees on scientific and professional matters and public information as soon as possible in 1970. Perhaps individual members would like to express their opinions on this subject at the Winnipeg Annual General Meeting.

M.K. Thomas
D.N. McMullen
for: 1969-70 Executive

April 1/70

PROPOSALS FOR ATMOSPHERE

The Society's Development Committee in its report declared: "The most difficult problem that the CMS has to face is the development of its publications. The Committee recognized the valuable contributions and advances made by the development of ATMOSPHERE. Produced by volunteer effort, with inadequate budgets, and supported by an apathetic, although sometimes critical membership, ATMOSPHERE has grown in stature during its short life. Nevertheless, the discussions of the Committee indicate that every effort should be made to improve the publication".

The report of the Committee also included a general discussion regarding the goals and objectives of ATMOSPHERE, with the conclusion that in particular since these objectives are not being met by the present publication that two possible approaches could be made to achieve them:

1) "Continue the development and improvement of ATMOSPHERE along present lines ..... with the available resources".

2) "Develop ATMOSPHERE as a prestige publication to be printed annually ..... and develop a second publication distributed bi-monthly or oftener".

Your Executive discussed at length the two approaches mentioned above and finally made a decision to pursue the development and improvement of the present ATMOSPHERE without consideration of a second publication at this time. Early this spring the Editor and President met with the University of Toronto Press representatives, and in April a set of estimates were received from that organization regarding possible services that could be provided for our Society.

SERVICES OFFERED BY THE UNIVERSITY OF TORONTO PRESS

a) Design - The Press suggested a 6 x 9¼" page size compared to the present 8 x 10" size. The number of pages and the number of lines per page would be approximately the same as in the present ATMOSPHERE. A glossy cover has been rough-designed to figuratively represent the atmosphere: light blue at the bottom of the cover with "Canadian Meteorological Society" overprinted in black, deepening to a darker blue at the top with "ATMOSPHERE" overprinted. The one-time cost would be $263.

b) Copy editing - For about $150 an issue the Press will take full responsibility for copy editing,instructions to the printer,handling of proofs and general production supervision,relieving the editor of all such details.

c) Printing - The quotation for 1000 copies of a 32-page booklet is $1,220, and for each 100 additional copies $19.40. Ten to 25% should be added to the Printer's estimates to cover contingencies.

d) Promotion - An initial promotional campaign to advertise and provide North American universities, colleges, libraries, etc., with sample copies would be desirable and would cost about $1,000. In the Press' experience we might expect at least 600 new subscribers or members in return.

e) Mailing service - For $1.00 a member per year, the Press would envelope, stamp and mail out four copies of ATMOSPHERE, but would not be responsible for keeping and updating the mailing list. The Society would have to provide this for the distribution of each issue.

f) Complete distributing and billing service - For $3.00 a year per member the Press would bill and collect for subscriptions and memberships, maintain an address list (which would be amended quarterly just before each distribution), and would periodically supply the Executive with a mailing list to be used for other purposes, and would carry out and pay for the mailing as described in (e).

ITEMS NOT CONSIDERED ELSEWHERE IN THESE PROPOSALS

a) Advertising - The sale of advertising may become feasible but at present it is not practical for "amateurs". Salesman commissions cost 25%, printing costs can balloon and extensive and expensive "follow-up" and maintenance are required to hold advertising contracts.

b) Payment for contributions - No

c) Honorarium for editors - No

d) Subsidies - The Press advises that most learned journals require subsidization on a continuing basis. Subsidies have not been considered in the proposals that follow.

PROPOSALS

The accompanying table is labelled "Trial Financial Estimates for 1972" and shows statistics and data for each of three proposals.

a) Proposal #1 - Should the Society decide to make no change in ATMOSPHERE policy or format, annual dues can be kept near $8 a year. It is forecast that membership would slowly grow to 600 full members, and 100 student members. By 1972 there will be no grant money from

the Meteorological Branch, but the Editor has managed to free ATMOSPHERE from payment of federal and provincial taxes. Under this proposal, however, the Society will not be doing anything to improve the format of ATMOSPHERE; and the Editor,Treasurer and Corresponding Secretary will still be confronted with considerable clerical work - keeping the address lists up-to-date,billing members and subscribers, writing receipts, arranging for typing of manuscripts, badgering the printer to meet publication schedules,checking out the distribution, etc. On the other hand, the Society dues would remain fairly steady and we would retain our investments valued at $1,500.

b) Proposal #2 - It might be suggested that we should arrange to have ATMOSPHERE printed by the University of Toronto Press as cheaply as possible without subscribing to any extra services. To do this we would have to pay design charges of approximately $263, but could forego promotion,copy editing and any assistance in the distribution of the publication. In other words, the Editor would have the same duties as he now has, but ATMOSPHERE would be printed in a new format. Individual membership dues would have to be increased, and we would doubtless lose some members because of this. It is estimated that one-third of the membership would be lost if rates or dues went as high as $14. On this basis, however, we would have a much better looking publication,but neither the Editor,the Secretary nor the Treasurer would be relieved of any of their duties, except those diminished by a decreasing membership.

c) Proposal #3 - If the Society were to take full advantage of the University of Toronto Press services, i.e. designing services and a promotional campaign at a cost of about $1,300, and by subscribing to copy editing, printing, distributing and billing services, the result might hopefully be only a little more expensive than now. Pessimistically the change would be quite a bit more expensive to the individual member. If the University of Toronto Press estimate is valid and we could increase the paid circulation of ATMOSPHERE by about 600,it should be possible to set full membership dues at about $9. On the other hand, if the promotion effort did not bring members and if about one-third of the members decided to withdraw from the Society because of a possible increase in fees, these certainly would, and might increase to about $15.00 per member in order to finance ATMOSPHERE and all services. The important thing about proposal #3 is, however, that the editor would be free to edit and manage ATMOSPHERE without typing,printing and distributing problems. The Treasurer would be free to watch Society finances without writing hundreds of receipts, handling bank deposits and chasing delinquent members, while the Secretary would be no longer charged with keeping mailing lists up-to-date and watching for changes of address. The ultimate and oft desired paid secretariat would not be necessary since the clerical and time-consuming jobs would be done by the Press.

WHITHER?

The Canadian Meteorological Society is now at its first crossroads. Do we continue in the present manner with an ATMOSPHERE we would all like to see improved and with little to offer prospective members, or do we opt to attempt to publish a first-class handsome quarterly periodical which would attract several hundred more subscribers and members? To do this we would be gambling our assets of $1,300 and taking a chance on much higher dues for at least one or two years. If memberships and subscriptions did not increase markedly during the first year or 18 months the Society would undoubtedly be faced with retrenchment and ATMOSPHERE would have to be cut back to the 1970 type periodical. On the other hand, we do have an opportunity to use our Society in the promotion of meteorology!

E.J. Truhlar
M.K. Thomas
for the 1969-70 Executive

May 8, 1970

TRIAL FINANCIAL ESTIMATES FOR 1972

	Proposal #1	Proposal #2	Proposal #3	
	No change in policy, continue present ATMOSPHERE	University of Toronto Press print ATMOSPHERE only - No promotion	Full University of Toronto Press Service plus Promotion Best Result	Worst Result
	$	$	$	$
Paid up Membership - Full	600 @ 8.00	400 @ 14.00	700 @ 9.00	400 @ 15.00
Students	100 " 2.00	100 " 2.00	150 " 2.00	100 " 2.00
Corporations	2 " 25.00	2 " 25.00	4 " 25.00	2 " 25.00
ATMOSPHERE Subscriptions	25 " 2.50	50 " 14.00	450 " 9.00	150 " 15.00
Assets (Bonds)	1,500.00	1,200.00	200.00	200.00
Income: Annual Fees	5,050.00	5,850.00	6,700.00	6,250.00
ATMOSPHERE Subscript.	62.50	700.00	4,050.00	2,250.00
Grants	0.00	0.00	0.00	0.00
Interest	50.00	40.00	0.00	0.00
Miscellaneous	100.00	100.00	100.00	100.00
Total Income	5,262.50	6,690.00	10,850.00	8,600.00
Costs: Executive Admin.	700.00	600.00	300.00	300.00
Congress Materials	800.00	800.00	800.00	800.00
Grants to Centres	300.00	300.00	300.00	300.00
Miscellaneous	200.00	200.00	200.00	200.00
ATMOSPHERE: Type	150.00	100.00	0.00	0.00
Copy Edit	0.00	0.00	600.00	600.00
Print	2,200.00	4,000.00	4,720.00	4,220.00
Distribution & Bill	520.00	425.00	3,900.00	2,180.00
Total Cost	4,870.00	6,425.00	10,820.00	8,600.00
Balance	$ 392.50	$ 265.00	$ 30.00	$ 0.00

THE CANADIAN METEOROLOGICAL SOCIETY
La Société Météorologique du Canada

The Canadian Meteorological Society came into being on January 1, 1967, replacing the Canadian Branch of the Royal Meteorological Society, which had been established in 1940. The Society exists for the advancement of Meteorology and membership is open to persons and organizations having an interest in Meteorology. There are local centres of the Society in several of the larger cities of Canada where papers are read and discussions held on subjects of meteorological interest. Atmosphere is the official publication of the Society. Since its founding, the Society has continued the custom begun by the Canadian Branch of the RMS of holding an annual congress each spring, which serves as a National Meteorological Congress.

For further information regarding membership, please write to the Corresponding Secretary, Canadian Meteorological Society, P. O. Box 851, Adelaide Street Post Office, Toronto 210, Ontario.

There are four types of membership – Member, Corporate Member, Graduate Student Member and Undergraduate Student Member. For 1970, the dues are $8.00, $25.00, $2.00 and $1.00, respectively. Atmosphere is distributed free to all types of member. Applications for membership should be accompanied by a cheque made payable to The Canadian Meteorological Society, with exchange added for non-Toronto Banks.