Atmosphere

7th ANNUAL CONGRESS May 30-31 and June 1, 1973 St. Mary's University Halifax

Canadian Meteorological Society Société Météorologique du Canada

ATMOSPHERE

Volume 11 - 7th Annual Congress Issue

A PUBLICATION OF

THE CANADIAN METEOROLOGICAL SOCIETY

-- 000 ---

CONTENTS

Page

Program: 7th Annual Congress	1
Abstracts	10
Agenda for 7th Annual General Meeting	30
Annual Report	31
Nominating Committee Report	33
Treasurer's Report	34
Budget for 1974	35
Awards Committee Report	36
Editor's Report	37
Standing Committees Reports: Public Information Scientific and Professional Matters	38 40
Annual Reports from Centres	41
Membership Application Form	47

PROGRAM

SEVENTH ANNUAL CONGRESS

CANADIAN METEOROLOGICAL SOCIETY

The Seventh Annual Congress and Annual Meeting of the Canadian Meteorological Society will be held at St. Mary's University, Halifax, N.S., 30-31 May and 1 June 1973. The theme of the Congress is "The Atmosphere and the Oceans" and the technical sessions on 30 May will be devoted to invited and contributed papers on this topic. A setting for the theme will be provided by Dr. Wm. L. Ford, Director, Atlantic Oceanographic Laboratory, Bedford Institute of Oceanography. Nine additional technical sessions on a variety of meteorological subjects are included in the three-day meeting. Concurrent sessions on Remote Sensing, arranged by Dr. C. L. Mateer, including invited and contributed papers, will take place on 31 May and 1 June. Program Chairman for the Congress is R. A. Hornstein.

Delegates wishing to obtain copies of individual papers are asked to list their requests with the Reprint Committee upon registration or as early as possible during the course of the meetings. Copies of papers will be provided at cost during or immediately following the Congress.

The Halifax Centre of the CMS is host for the Congress. Chairman of the Local Arrangements Committee is Nancy B. Waller, Atmospheric Environment Service, Halifax.

SUMMARY OF SESSIONS

Wednesday, May 30

:45 a.m.	Opening Welcome
9:00 a.m.	1 The Atmosphere & The Oceans, Part I
1:30 p.m.	2 The Atmosphere & The Oceans, Part II
7:00 p.m.	Annual General Meeting of the CMS
9:30 p.m.	Wine and Cheese Party, St. Mary's University

Thursday, May 31

1

8:45 a.m.	3	Hail and Cloud Physics, Part I
0:30 a.m.	4	Remote Sensing, Part I
1:30 p.m.	5	Remote Sensing, Part II
1:30 p.m.	6	Hail and Cloud Physics, Part II
3:30 p.m.	7	Agrometeorology & Micrometeorology
5:30 p.m.	Pe	ggy's Cove Tour, Banquet and Awards,

Friday, June 1

8:30 a.m.	8	Remote Sensing, Part III
8:30 a.m.	9	Weather Forecasting Research
10:30 a.m.	10	Applied Meteorology
1:30 p.m.	11	General Meteorology

SEVENTH ANNUAL CONGRESS

WEDNESDAY MOR	NING 30 MAY 1973 8:45 a.	m noon
Opening Welcome:	Dr. Owen Carrigan, President St. Mary's University (or his representative)	5 min.
	G. A. McKay, President Canadian Meteorological Society	5 min.
SESSION 1	The Atmosphere and The Oceans - Part I	
Chairman:	R.V. Dexter	
METEOROLOGY A SCIENCES	ND OCEANOGRAPHY AS ENVIRONMENTAL	30 min.
Wm. L.	Ford, Bedford Institute of Oceanography	
DIRECT MEASURE H,C, Ma	MENTS OF ENERGY TRANSFER OVER WATER artin, Atmospheric Environment Service Toronto	20 min.
ENERGY CHANGES	S ASSOCIATED WITH WIND MIXING IN THE	20 min.
K.L. De	nman, Fisheries Research Board of Canada Dartmouth	
	Coffee (10:30 - 11:00)	
A TEST OF THE C FORECASTS IN CO MODEL	APABILITY OF VTPR DATA FOR UPGRADING ASTAL AREAS USING A REGIONAL UPDATE	20 min.
E.C. Ja	rvis, Atmospheric Environment Service Toronto	
EXPERIMENTS WI J.L. Wa	TH AN AIR-WATER BOUNDARY-LAYER MODEL Imsley, Atmospheric Environment Service Toronto	15 min.
SYNOPTIC INFLUI SABLE ISLAND OC	ENCES ON SEA-AIR INTERACTION IN THE EAN REGION	15 min.
E. Vowin	nckel and S. Orvig, McGill University	

AURIA A.A.A.A.A.		1
SESSION 2	The Atmosphere and The Oceans - Part Π	
Chairman: S	5. D. Smith	
SEA SURFACE TEMP ATLANTIC WITH PAI FRONT IN THE CANA M.R. Morg	PERATURE ANALYSIS IN THE NORTH RTICULAR REFERENCE TO THE OCEANIC ADIAN ATLANTIC (an, Atmospheric Environment Service Halifax	20 min.
IMPLICATIONS OF M ATLANTIC SUBARCT M.J. Dunba	ARINE CLIMATIC CHANGE IN THE IC (Invited Paper) ar, Atlantic Oceanographic Laboratory Dartmouth	25 min.
ARCHITECTURE, CL A. Penney,	IMATE AND THE OCEAN EDGE Nova Scotia Technical College Halifax	20 min,
	Coffee (2:55 - 3:25)	
THE MIRAGE OVER (A.B. Frase	OCEANS er, Pennsylvania State University University Park, Pa.	20 min.
SEA STATE ANALYSI CANADIAN ATLANTI M.R. Morg	ES AND FORECASTING FOR THE C an, Atmospheric Environment Service Halifax	25 min,
PREDICTION AND UP PRECIPITATION ARE D. Bellows	PDATE OF LARGE-SCALE CLOUD AND EAS AT ASYNOPTIC HOURS , Atmospheric Environment Service Toronto	15 min,
RECENT WORK ON T W.R. Smith	HE TRANSMISSOMETER n, Atmospheric Environment Service Toronto	15 min.

1:30 - 5:00 p.m.

THURSDAY MO	RNING 31 MAY 1973 8:45 a. n	n, - noon
SESSION 3	Hail and Cloud Physics - Part I	
Chairman:	R.H. Douglas	
THE GYRATION P, R.	OF SPHEROIDAL HAILSTONE MODELS Kry and R. List, University of Toronto	15 min.
THE ROSETTA- PLANNING ANI R. LI	-HAILSTONE EXPERIMENTS - PART I DEQUIPMENT st. University of Toronto	50 min.
	Coffee (10:00 - 10:30)	
THE ROSETTA- ICING ROTATE HORIZONTAL E. P. R. Li P. R. M. R.	HAILSTONE EXPERIMENTS - PART II: IG SPHEROIDS WITH THE MAJOR AXIS Lozowski, University of Alberta st, J. D. McTaggart-Cowan, Kry and P. Joe, University of Toronto de Quervain and J. von Niederhausern, Swiss Federal Snow and Avalanche Institute, Davos	15 min.
MONTE CARLO D. Ro	SIMULATIONS OF DROP GROWTH BY ACCRETION obsertson, McGill University	20 min.
THE DEVELOP AND COALESCI H. G.	MENT OF CLOUD DROPLETS BY CONDENSATION ENCE IN A STRONG UPDRAFT Leighton and R.R. Rogers, McGill University	20 min.
THE INITIAL S'	TAGES OF RADAR-DETECTABLE PRECIPITATION RM CLOUDS	20 min.

R.G. Lawford, McGill University

Program / 4

THURSDAY	MORNING :	31 MAY 1973
		the second se

SESSION 4 Remote Sensing - Part I

Chairman: E.G. Morrissey

SATELLITE SOUNDING OF THE ATMOSPHERE: VERTICAL 40 min. TEMPERATURE PROFILES BY REMOTE SENSING - PAST, PRESENT AND FUTURE Harold M. Woolf and William L. Smith, National Environmental Satellite Service, NOAA, Hillorest Heights, Md., U.S. A. 40 min. THE CANADA CENTRE FOR REMOTE SENSING (CCRS) 40 min. Joseph MacDowall, CCRS, Ottawa. 40 min. <u>THURSDAY AFTERNOON 31 MAY 1973</u> 1:30 - 5:00 p.m. SESSION 5 Remote Sensing - Part II Chairman: C, L. Mateer			
THE CANADA CENTRE FOR REMOTE SENSING (CCRS) Joseph MacDowall, CCRS, Ottawa. 40 min. THURSDAY AFTERNOON 31 MAY 1973 1:30 - 5:00 p.m. SESSION 5 Remote Sensing - Part II Chairman: C.L. Mateer CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M. Millan, Atmospheric Environment Service Toronto 20 min. DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO ₂ AND NO ₂ USING INFRARED REMOTE SENSING TECHNIQUES J. Howard Shafer and Charles Young, University of New Brunswick 20 min. LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A. L. Carswell, J. D. Houston, W.R. McNeil, York University 20 min. Coffee (3:00 - 3:30) A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO ₂ LASER AND STRATOSPHERE Charles Young, University of New Brunswick 20 min. REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A, W. Brewer and J. B. Kerr, University of Toronto 20 min.	SATELLITE SOUNDING OF THE ATMOSPHERE: VERTICAL TEMPERATURE PROFILES BY REMOTE SENSING - PAST, PRESENT AND FUTURE Harold M. Woolf and William L. Smith, National Environmental Satellite Service, NOAA, Hillcrest Heights, Md., U.S.A.	40	min.
THURSDAY AFTERNOON 31 MAY 1973 1:30 - 5:00 p.m. SESSION 5 Remote Sensing - Part II Chairman: C.L. Mateer CORRELATION SPECTROSCOPY: A CRITICAL STUDY 20 min. Millan M. Millan, Atmospheric Environment Service Toronto 20 min. DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS J. Howard Shafer and Charles Young, University of New Brunswick 20 min. LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A.I. Carswell, J.D. Houston, W.R. McNeil, York University 20 min. Coffee (3:00 - 3:30) Coffee (3:00 - 3:30) 20 min. A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO2 LASER RADIATION FOR REMOTE SENSING OF O3 IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick 20 min. REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A.W. Brewer and J. B. Kerr, University of Toronto 20 min.	THE CANADA CENTRE FOR REMOTE SENSING (CCRS) Joseph MacDowall, CCRS, Ottawa.	40	min.
SESSION 5 Remote Sensing - Part II Chairman: C.L. Mateer CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M. Millan, Atmospheric Environment Service Toronto 20 min. DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO ₂ AND NO ₂ USING INFRARED REMOTE SENSING TECHNIQUES J. Howard Shafer and Charles Young, University of New Brunswick 20 min. LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A.I. Carswell, J. D. Houston, W.R. McNeil, York University 20 min. Coffee (3:00 - 3:30) Coffee (3:00 - 3:30) 20 min. A STUDY OF THE FEASIBILITY OF USING 9. 6-µm CO ₂ LASER AND STRATOSPHERE Charles Young, University of New Brunswick 20 min. REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A, W. Brewer and J. B. Kerr, University of Toronto 20 min.	THURSDAY AFTERNOON 31 MAY 1973	1:30 - 5:00	p. m.
Chairman: C, L, Mateer CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M, Millan, Atmospheric Environment Service Toronto 20 min. DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO ₂ AND NO ₂ USING INFRARED REMOTE SENSING TECHNIQUES J. Howard Shafer and Charles Young, University of New Brunswick 20 min. LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A. I. Carswell, J. D. Houston, W.R. McNeil, York University 20 min. Coffee (3:00 - 3:30) Coffee (3:00 - 3:30) 20 min. A STUDY OF THE FEASIBILITY OF USING 9. 6-µm CO ₂ LASER RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick 20 min. REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A. W. Brewer and J. B. Kerr, University of Toronto 20 min.	SESSION 5 Remote Sensing - Part II		
CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M. Millan, Atmospheric Environment Service Toronto DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO ₂ AND NO ₂ USING INFRARED REMOTE SENSING TECHNIQUES J. Howard Shafer and Charles Young, University of New Brunswick LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A.I. Carswell, J.D. Houston, W.R. McNeil, York University Coffee (3:00 - 3:30) A STUDY OF THE FEASIBILITY OF USING 9.6-μm CO ₂ LASER RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A.W. Brewer and J.B. Kerr, University of Toronto 20 min.	Chairman: C.L. Mateer		
 DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO₂ AND NO₂ USING INFRARED REMOTE SENSING TECHNIQUES J. Howard Shafer and Charles Young, University of New Brunswick LIDAR MEASUREMENTS OF THE ATMOSPHERE S. R. Pal, A. I. Carswell, J. D. Houston, W. R. McNeil, York University Coffee (3:00 - 3:30) A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO₂ LASER AND STRATOSPHERE Charles Young, University of New Brunswick REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A, W. Brewer and J. B. Kerr, University of Toronto 20 min. 	CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M. Millan, Atmospheric Environment Service Toronto	20	min.
LIDAR MEASUREMENTS OF THE ATMOSPHERE 20 min. S.R. Pal, A. I. Carswell, J. D. Houston, W.R. McNeil, York University Coffee (3:00 - 3:30) A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO ₂ LASER 20 min. RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS 20 min. A, W. Brewer and J. B. Kerr, University of Toronto 20 min.	DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO ₂ AND NO ₂ USING INFRARED REMOTE SENSING TECHN J. Howard Shafer and Charles Young, University of New Brunswic	S 20 NQUES K	min.
Coffee (3:00 - 3:30) A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO ₂ LASER 20 min. RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS 20 min. A, W. Brewer and J. B. Kerr, University of Toronto	LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A.I. Carswell, J.D. Houston, W.R. McNeil, York University	20	min.
A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO ₂ LASER 20 min. RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young, University of New Brunswick REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS 20 min. A. W. Brewer and J. B. Kerr, University of Toronto	Coffee (3:00 - 3:30)		
REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS 20 min. A.W. Brewer and J.B. Kerr, University of Toronto	A STUDY OF THE FEASIBILITY OF USING 9.6-#m CO ₂ LASE RADIATION FOR REMOTE SENSING OF O ₃ IN THE TROPOSPI AND STRATOSPHERE Charles Young, University of New Brunswick	R 20 HERE	min.
	REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CI A. W. Brewer and J. B. Kerr, University of Toronto	LOUDS 20	min.

PROPAGATION OF 9.6- AND 10.6-µm CO₂ LASER RADIATION THROUGH THE ATMOSPHERE

R.E. Chapman and Charles Young, University of

New Brunswick

THURSDAY AFT	ERNOON 31 MAY 1973	1:30 - 5:00 p.m.
SESSION 6	Hail and Cloud Physics - Part II	
Chairman:	W. Hitschfeld	
ROLE AND IMPO PHYSICS AND D C.R.	ORTANCE OF PARTICLE KINETICS IN THE YNAMICS OF CLOUDS Girard and R. List, University of Toronto	20 min.
COLLISION AND	BREAKUP OF WATER DROPS AT TERMINAL	20 min.
J, D, 1	McTaggart-Cowan and R. List, University of Toronto	
COLLISIONS OF T.B. Univer	WATER DROPS WITH METAL CHAFF Low, R. List and J. D. McTaggart-Cowan, rsity of Toronto	15 min.
THE OBJECTIV R.G.	E ANALYSIS OF RADAR DATA Lawford, McGill University	15 min .
	Coffee (3:00 - 3:30 p.m.)	
SESSION 7	Agrometeorology and Micrometeorology	
Chairman:	R.E. Munn	
PLANT RESPON	ISE TO EXTERNAL RADIATION UNDER FROST	'Y 15 min.
N. Ba	rthakur and P.H. Schuepp, Macdonald College, Ste, Anne de Bellev	ue
A COMPARISON OVER GRASS AN R. H.	OF TEMPERATURES AT SEVERAL HEIGHTS ND IN CORN Douglas, Macdonald College, Ste. Anne de Bellevue	20 min.

DIFFUSION OF POLLUTANT FROM A MOTOR VEHICLE AS A FUNCTION OF VEHICLE MOVEMENT AND ATMOSPHERIC VARIABLES	A	20	min.
F.H. Fanaki and J. Kovalick, Atmospheric Environ Service, Toronto	ment		
PERIODIC VARIATIONS IN THE LARGE IONS AT THE METEOROLOGICAL RESEARCH STATION Bhartendu, Atmospheric Environment Service Toronto		20	min.
FRIDAY MORNING 1 JUNE 1973	8:30 - 10:	00	a. m.
SESSION 8 Remote Sensing - Part III			
Chairman: C. Young			
SURFACE CIRCULATION FEATURES AS SEEN IN ERTS IMAGERY P. Krishna Rao, National Environmental Satellite Service, NOAA, Washing D.C., U.S.A.	ton,	20	min.
REMOTE SENSING OF WIND DIRECTION E.G. Morrissey, Atmospheric Environment Service Toronto	2	10	min,
REMOTE SENSING OF SHORT-LIVED FLUCTUATIONS IN THE TOTAL OZONE J.B. Kerr, University of Toronto		20	min.
REMOTE SENSING APPLICATIONS IN ICE RECONNAISSANC: H.G. Hengeveld, Atmospheric Environment Service Toronto	E	20	min.
FRIDAY MORNING 1 JUNE 1973	8:30 a.m.	- r	noon
SESSION 9 Weather Forecasting Research			
Chairman: J.M. Leaver			
EXPERIMENTS ON THE UPDATING OF P.E. FORECASTS WITH REAL WIND AND GEOPOTENTIAL DATA I.D. Rutherford, Atmospheric Environment Service Montreal		20	min.

Program / 7

EFFECTS OF A NEW RESISTANCE LAW IN AN ATMOSPHERIC 2 MODEL	20 min.
R. Benoit, McGill University	
A PROGRAM FOR COMPUTING MIXING HEIGHTS AND TRANSPORT WINDS	20 min.
G. Piette, Atmospheric Environment Service Montreal	
PROGRESS REPORT ON THE REGIONAL UPDATE SYSTEM A.L. Bealby, Atmospheric Environment Service Toronto	15 mln.
Coffee (10:00 - 10:30)	
SESSION 10 Applied Meteorology	
Chairman: R, List	
EVENT PROBABILITIES ASSOCIATED WITH REGRESSION ESTIMATES OF PREDICTAND VALUES R.H. Robinson, Atmospheric Environment Service Montreal	15 min,
PUBLIC FORECASTS BY PATTERN RECOGNITION I.B. Findleton, Atmospheric Environment Service Montreal	15 min.
REGIONAL COMPUTING AS DEVELOPED BY THE PRAIRIE WEATHER CENTRAL S. V. A. Gordon, Atmospheric Environment Service Winnipeg	20 min.
METEOROLOGICAL CONDITIONS, TOPOGRAPHY, AND AIR QUALITY IN THE SOUTH CENTRAL PORTION OF THE SAINT JOHN RIVER VALLEY R.W. Gamble, New Brunswick Dept. of Fisheries & Environment	20 min.
P. M. Strain and G. P. Semeluk, University of New Brunswick	

FRIDAY AFTERNOON 1 JUNE 1973 1: 30 - 4:30 p.m. SESSION 11 General Meteorology Chairman: K.F. Harry METHODOLOGIES OF ENVIRONMENTAL IMPACT STUDIES 20 min. R.E. Munn, Atmospheric Environment Service Toronto STRATOSPHERIC POLLUTION AND SST'S 15 min. B, W, Boville, Atmospheric Environment Service Toronto VHF DIRECTION FINDER FOR LIGHTNING LOCATION 15 min. R.C. Murty and W.D. MacClement, University of Western Ontario A COMPUTER-CONTROLLED AERO-MET OBSERVATIONAL 15 min. FACILITY O. Koren, Atmospheric Environment Service Toronto Coffee (3:00 - 3:30 p.m.) SOME OBSERVATIONS ON CONVECTIVE PLUMES IN THE 20 min. LOWER ATMOSPHERE F. H. Fanaki, Atmospheric Environment Service Toronto INERTIAL RANGES IN THREE-DIMENSIONAL QUASI-20 min. GEOSTROPHIC TURBULENCE M. Shabbar, Atmospheric Environment Service Toronto

ABSTRACTS

SESSION 1: The Atmosphere and the Oceans - Part I

METEOROLOGY AND OCEANOGRAPHY AS ENVIRONMENTAL SCIENCES Wm. L. Ford

Abstract not available.

DIRECT MEASUREMENTS OF ENERGY TRANSFER OVER WATER H.C. Martin

Latent and sensible heat fluxes were measured during May and October 1972 using the eddy correlation technique. Using simultaneous mean values of temperature and humidity at 10 m and temperature at the surface, the transfer coefficients were calculated for 130 one-half-hour runs. The transfer coefficients are examined in terms of a stability parameter obtained with additional wind data. With the inclusion of net radiation measurements the rate of heating or cooling of the lake is estimated.

ENERGY CHANGES ASSOCIATED WITH WIND MIXING IN THE UPPER OCEAN K.L. Denman

Momentum and turbulent kinetic energy are transferred from the atmosphere to the ocean by the wind stress acting on the sea surface. This energy is partitioned into surface waves, drift currents, small-scale turbulence, and eventually much is dissipated into heat. Also, some fraction of the energy is used in working against buoyancy forces by mixing. In this talk, series of measurements of the temperature and salinity structure of the upper ocean during the passage of three "storms" at Ocean Station 'Papa' are used to calculate the fraction of the downward transfer of turbulent kinetic energy by the wind stress that is used to increase the potential energy of the water column through mixing. The values obtained are compared with those obtained from laboratory experiments of other workers. The significance of the results to large-scale ocean-atmosphere interaction is discussed.

A TEST OF THE CAPABILITY OF VTPR DATA FOR UPGRADING FORECASTS IN COASTAL AREAS USING A REGIONAL UPDATE MODEL E.C. Jarvis

Advantages to be gained by using vertical temperature profile radiometer (VTPR) data in regional modelling were examined by running two versions of a Regional Update Model over the northeast Pacific Ocean. Run 1 was a standard version of the model operating on a 1-hour forecast cycle. It utilized 1000- and 500-mb height predictions from the operational NWP model of the Canadian Meteorological Centre and current ship synoptic and aviation weather reports. Run 2 was the same as Run 1 except for an adjustment of the 1000-mb height field according to 1000 to 500-mb thicknesses obtained from VTPR data. Accuracies of the two runs were obtained by measuring 1000-mb height gradients at selected locations along the West Coast and comparing them with observed height gradients at the verifying times for various forecast periods. From the results of the experiment, inferences were made regarding the use of VTPR data in regional modelling in the Western Atlantic Ocean.

EXPERIMENTS WITH AN AIR-WATER BOUNDARY-LAYER MODEL J.L. Walmsley

A time-dependent model for coupled atmospheric and oceanic boundary layers is described. The model is one-dimensional; hence horizontal gradients of the dependent variables are specified rather than computed. Turbulent viscous and diffusive processes are incorporated by means of the eddy coefficient concept. Using a formulation which is in accord with both surface and Ekman layer observations, the vertical dependence of the eddy coefficient is specified a priorl.

Experiments with the model were performed with input conditions representative of the Gulf of St. Lawrence in autumn and winter. Results indicate the importance of oceanic negative thermal advection in lowering the water surface temperature to the freezing point.

SYNOPTIC INFLUENCES ON SEA-AIR INTERACTION IN THE SABLE ISLAND OCEAN REGION

E. Vowinckel and S. Orvig

Computer programs are used to calculate the heat budget for atmosphere and ocean, obtaining twelve hourly values for all of the elements in the heat balance. Data are used for the period 1st September 1970 until the end of the winter of 1971-72. The paper describes the variations of energy budgets with season and weather type. The synoptic effects on the ocean heat budget and resultant water temperature changes are described.

SESSION 2: The Atmosphere and The Oceans - Part II

SEA SURFACE TEMPERATURE ANALYSIS IN THE NORTH ATLANTIC WITH PARTICULAR REFERENCE TO THE OCEANIC FRONT IN THE CANADIAN ATLANTIC

M.R. Morgan

This paper examines the sea surface temperature distribution in the North Atlantic based upon 10 years of daily analysis carried out in the Canadian Forces METOC Centre, Atlantic and evidence provided by U.S. Naval Oceanographic Office.

The complexity of the thermal distribution is discussed relative to atmospheric influences but it will be shown that the bottom topography is the major controlling factor which results in certain persistent features occurring which appear highly resistant to local weather conditions. Support for this premise will be found in analogous studies in Norway and the UK with regard to oceanic fronts in the Eastern Atlantic which will be referred to briefly.

The usefulness of the sea surface temperature chart to the marine meteorologist and its strategic and tactical use to the marine operator will be indicated with reference to fog formation, storm development, icing and the propagation of sonar and radar transmissions.

The paper concludes with a hypothesis that there might be good correlation between climatic changes, or seasonal abnormalities in the Maritimes and meteorologically predictable changes in mass transport in the Gulf Stream.

IMPLICATIONS OF MARINE CLIMATIC CHANGE IN THE ATLANTIC SUBARCTIC

M.J. Dunbar

Recent marine (hydrospheric) climatic changes in the present century are briefly reviewed, and special attention is given to the effects of these changes in the Gulf of St. Lawrence and in west Greenland, with special reference to the present salmon fishery in the Davis Strait region. Some consideration is given also to man-made changes in the Gulf of St. Lawrence, and attention is directed to the need for routine monitoring of standard sections in the Atlantic Subarctic area.

ARCHITECTURE, CLIMATE AND THE OCEAN EDGE Allen Penney

Architecture has been developed to create normally an enclosure which separates the external and natural climate from the internal and artificial climate. In creating an internal climate the building influences the external climate at both large and small scale. Legislation has endeavoured to keep pace with developments to ensure the minimum of damage to property and people. Nevertheless, evolution is dynamic and new legislation itself creates new developments. At present, building law requires that climate be recognized in design, but only defensively, in that the building must not be damaged by the climate. Unfortunately, the building itself creates a new aggressive climate influence, and can damage its neighbours. Who recognizes this phenomenon, and who will do something about it? Over a short time scale climatic change may be gentle, and of little general concern. like the heat island created by an urban conurbation. If heating bills, fog and precipitation are generally reduced, we may not be too concerned, but rather pleased with ourselves. Development within the law causes the favour of lower initial cost and higher running costs for greater tax relief. The developer cares less for insulation and more for energy consumption and so by default taxation law has been accelerating the heat island effect. Other building law is generating tall buildings. When built at the ocean edge there may be unforseen developments, particularly when the climate law is only defense oriented. Buildings themselves are creating wind flutter in adjacent buildings and with higher wind speeds close to large water masses we can expect more problems. Several schemes for floating cities have been proposed. The numbers of built disasters is still relatively few, but are inexorably growing. If we can continue to build without correct recognition of the implications of climate and building we can only expect more disasters.

THE MIRAGE OVER OCEANS Allistair B. Fraser

The mirage is an ubiquitous phenomenon of the atmospheric boundary layer over oceans. Indeed, the term mirage was first coined by sailors (18th century, French). The many forms that the mirage takes over water - stooping, towering, multiple images, Fata Morgana, solar distortions and green flash - are indicative of the variable temperature profiles over the oceans. It has long been felt desirable to use the mirage (terrestrial refraction) as a means of measuring these profiles. However, due to the nature of the integral representation of ray paths, the problem of the optical inversion of lapse rate has had, up till now, only approximate solutions (or an exact solution with a very restrictive geometry).

An exact solution to this problem has now been found for a target of arbitrary geometry (even the setting sun will generate a temperature profile solution). The solution will be presented and then illustrated with slides showing all the major types of mirage that occur over water along with the temperature profiles that produced them.

SEA STATE ANALYSES AND FORECASTING FOR THE CANADIAN ATLANTIC M.R. Morgan

The introduction contains a statement of the requirement for sea state forecasts and a brief historical review of the subject with particular reference to the Canadian programme.

The techniques and nomograms used in the handling of data and preparation of the METOC Centre products are discussed; also the US National Weather Service computer programme.

Verification results are examined for the first year of operation of the programme in Canada.

The extension of the programme to inland seas such as the gulf of St. Lawrence is examined including problems involving shallow water effects.

PREDICTION AND UPDATE OF LARGE-SCALE CLOUD AND PRECIPITATION AREAS AT ASYNOPTIC HOURS

D. Bellows

Satellite photograph information on large-scale cloud systems is assembled semi-automatically and is projected forward within a predicted smoothed 500mb flow. A simulation is carried out of concurrent adjustment of the largescale CMC cloud predictions to conform with the APT observations. Extension of the method to precipitation areas and correlations with the msl pressure predictions are also discussed.

RECENT WORK ON THE TRANSMISSOMETER Wendell R. Smith

Instrumental methods of estimating visibility or visual range usually operate on either of two general schemes: optical transmission along a measured path, or amount of light backscattered by the obstruction to vision. The backscatter method has the advantage of single-ended installation and is thus suited to automatic station use. The method in most common use for aviation, however, is that of transmission (or attenuation) measurement since it yields more generally consistent results and space is not always at a premium. Conversion between transmissivity and visual range is made in terms of a standard threshold of either contrast or illumination for an average human eye. When visibility information is required exclusively for aviation purposes the concept of runway visual range is used; this embodies, in addition to transmissivity, knowledge of background lighting conditions both as to day or night and intensity settings of the runway lighting system.

The transmissometer of Douglas and Young, developed at National Bureau of Standards in Washington during the last War, is widely used on this continent. It is simple in design and has undergone very little change since its introduction to field use. More recently, however, the multiplicity of displays, the attachment of an RVR system, and signal, control, and power lines of rather doubtful quality around many airports, are forcing a re-examination of the system.

The FAA in the United States is preparing to go to industry for an evaluation and proposal for a new visibility measuring system which will be compatible with the one in present use. Staff in the Instruments Branch at AES are redesigning the present transmissometer system using integrated and discrete solid state circuitry and telemetry methods. A model has been constructed and laboratory tested. Preliminary field trials show promise.

SESSION 3: Hail and Cloud Physics - Part I

THE GYRATION OF SPHEROIDAL HAILSTONE MODELS P.R. Kry and Roland List

Angular motions are derived from the equations of motion for freely falling rotating oblate spheroids which serve as models of large hailstones. The derivation uses experimental values for the coefficients of the aerodynamic forces and torques and is based on a quasistatic approximation.

A particular motion for a spheroid spinning about its minor axis with horizontal total angular momentum causes symmetrically equivalent points to be equally exposed to the flow (thus this motion is consistent with preservation of shape symmetry during the growth of a spheroidal hailstone). The motion, called symmetric gyration, consists of the minor axis describing a cone at a frequency of the same order of magnitude as the spin rate.

A critical spin rate is defined to provide a lower limit which exclusively leads to motions with symmetry preserving growth. For most natural hailstones in a typical thundercloud the critical spin rate is in the range of 2-6 Hz, independent of height in the cloud. It increases for more oblate stones and decreases slightly with increasing hailstone size. THE ROSETTA-HAILSTONE EXPERIMENTS - PART I: PLANNING AND EQUIPMENT

Roland List

The new advances in the understanding of the aerodynamics of spheroidal hailstones, in particular the rotation around a horizontal major axis or the gyration, and the finding of air bubble size distributions and concentrations varying with liquid water content and air temperature led to the planning and execution of a series of icing experiments in the Swiss hail tunnel. They are supposed to establish the existence of a dictionary relating icing conditions to air bubble characteristics and crystallography. The cooperation between the Swiss Federal Snow and Avalanche Research Institute and the Universities of Toronto and Alberta, Edmonton, made this possible.

Four types of icing experiments were performed. In each set a different type of suspension of the original spheroidal ice models (size 2 or 3 cm, axis ratios 1: 0.67: 0.5) was applied: (i) fixed; (ii) rotation about a major axis which was kept horizontal; (iii) spinning about the minor axis, which was horizontal; and (iv) gyration, the minor axis serving as spin axis and rotating on a conical surface about a horizontal axis (the model hailstone at the cone apex).

The relative velocity was adjusted in each case to the terminal velocity, calculated on the basis of a quasistatic approximation. The liquid water content was varied from $0 - 30 \text{ g/m}^3$, the temperature from -5 to -30° C. The pressure was also varied but not independently; it was always related to the air temperature according to the average temperature-pressure relationships of Colorado hailstorms.

A movie shows different phases of the experiments and tentative results are discussed.

THE ROSETTA-HAILSTONE EXPERIMENTS - PART II: ICING ROTATING SPHEROIDS WITH THE MAJOR AXIS HORIZONTAL

E. P. Lozowski; R. List, J. D. McTaggart-Cowan, P. R. Kry and P. Joe; and M. R. de Quervain and J. von Niederhausern

Theoretical and experimental aerodynamic studies have demonstrated that free fall of oblate spheroids is possible and stable when such models rotate around a major axis, this axis being horizontal. The existence of this type of motion is not necessarily meaningful for hailstones of spheroidal shape because icing can change the shape to triaxial ellipsoids with the rotation axis ending up as an intermediate axis. If this happens, rotation would deteriorate into some kind of irregular tumbling. Experiments do indeed show that this is happening under certain icing conditions. For other situations, however, the initial rotation axis may remain the same.

MONTE CARLO SIMULATIONS OF DROP GROWTH BY ACCRETION D. Robertson

A drop, growing by the accretion of smaller cloud droplets, increases in mass by a finite amount whenever a droplet is captured. The time between captures is a random variable depending on the size of the drop and the size of the captured droplet. Telford recognized this element of variability in the growth rate in 1955 and published an analytical solution for the probability that a drop of given initial size had grown to a certain size at some later time. Telford's drops were, however, growing in a monodisperse cloud and so the variability in the size of the collected droplet is neglected. Further, his applications of the analytical solution involve some very gross assumptions which must invalidate the results.

In this study, drop growth by accretion is simulated using a Monte Carlo technique. The capture probabilities which were used employ the most reliable empirical data available for fall speeds and collision efficiencies. In addition, the drop is allowed to grow in a polydisperse cloud of realistic water content and droplet sizes. Results indicate that the continuous growth formulation of accretion underestimates the expected rate of growth and seriously underestimates the rate of growth of a few statistically "fortunate" drops.

THE DEVELOPMENT OF CLOUD DROPLETS BY CONDENSATION AND COALESCENCE IN A STRONG UPDRAFT H.G. Leighton and R.R. Rogers

A dynamically simple cloud droplet growth model has been developed that includes growth both by collision (and subsequent coalescence) and by condensation. The growth by coalescence is calculated stochastically and the growth by condensation assumes simple diffusion and adiabatic liquid water contents. The model is applied to growth in strong updrafts for different cloud conditions, updraft speeds and initial droplet distributions.

It is found that starting from a realistic droplet spectrum at cloud base, under suitable conditions, a sufficient number of droplets can grow to precipitation sizes, and that by the time the parcel of air has reached a height of 7 km above cloud base the drops are radar detectable.

Growth by condensation plays a vital role in determining the time required before the onset of rapid growth by coalescence. Consequently, for instance, increasing the number of drops in the initial distribution, leaving the mean radius and dispersion unchanged, inhibits the development of large drops. This strong coupling between condensation and coalescence is an effect that should be included in dynamically more sophisticated cloud models.

THE INITIAL STAGES OF RADAR-DETECTABLE PRECIPITATION IN CUMULOFORM CLOUDS R. G. Lawford

Over eighty echoes evolving within the range of the Alberta Hail Studies Radar on July 9, 1971 have been analyzed using both numerical techniques and heighttime profiles of maximum reflectivity. The meteorological fields, within which these echoes evolve, are examined using all available synoptic data. Then the geographical and temporal distributions of initial echoes, their heights of formation and their rates of growth after their initial appearance are discussed. The results obtained for Alberta are compared to studies made elsewhere in North America. The hypotheses and models forwarded by other investigators are briefly examined in the light of our new evidence. A descriptive model of the physical processes responsible for the evolution of radar detectable precipitation is then presented. The model accounts for the great variations found in the initial heights of echoes evolving in the same space-time domain. Variations in the development of precipitation due to the influences of other storms are also demonstrated and evaluated.

SESSION 4: Remote Sensing - Part I

SATELLITE SOUNDING OF THE ATMOSPHERE: VERTICAL TEMPERATURE PROFILES BY REMOTE SENSING - PAST, PRESENT AND FUTURE Harold M. Woolf and William L. Smith

The physical and theoretical bases for sounding the atmosphere from space are outlined. The techniques employed in inferring temperature profiles from measurements by the first-generation infrared sounders - the Satellite Infra-Red Spectrometers (SIRS) flown on Nimbus 3 and 4 - are described, and examples of the results of those experiments are given. The major part of this paper is given over to discussion of the second-generation infrared, the first-generation microwave, sounders on board NIMBUS-5. The former (ITPR - Infrared Temperature Profile Radiometer) observes the temperature distribution of the earth and atmosphere with a horizontal resolution of 15 n.mi., while the latter (NEMS - NIMBUS-E Microwave Sounder) permits observation of vertical temperature structure through and below clouds. In addition, a Selective Chopping Radiometer (SCR), developed in the United Kingdom, enables temperature profiles to be obtained up to the stratopause (approximately 50 km). The physical and mathematical techniques that have been developed to process NIMBUS-5 data so as to take maximum advantage of the unique capabilities of the various instruments, are described. Results are presented which indicate that the detailed thermal structure of the atmosphere over the entire globe can be obtained from combined infrared and microwave radiation measurements.

A brief preview is given of the next-generation infrared and microwave sounders to be flown on NIMBUS-F in 1974. Finally, some inferences are made regarding the course of development of future operational satellite vertical temperature sounding systems.

THE CANADA CENTRE FOR REMOTE SENSING (CCRS) Joseph MacDowall

The program of CCRS is executed by three divisions; Data Acquisition, Data Processing, and Applications. In addition, a modest program of sensor development is supported by means of contract to industrial and university groups. Four aircraft are operated by the Canadian Forces on behalf of the Data Acquisition Division and are equipped with a variety of advanced remote-sensing devices ranging from lasers to microwave systems. The work of the Data Processing Division is largely concerned with the processing of the Earth Resource Technology Satellite (ERTS) images. A four-waveband spectrometer in the spacecraft telemeters its data to the CCRS ground readout at Prince Albert, Saskatchewan. The data are rectified and developed in Ottawa to produce a nine-inch square photographic-like image at a scale of one in a million, in both colour and black and white. The absolute accuracy with which objects can be located is of the order of 200 m, with a resolution of about 100 m. Most roads are discerned, and areas down to the size of a 5-acre field are resolved. The Applications Division was more recently established in order to assist the interpreter by providing more numeric data products, by developing enhancement techniques, and by developing optical processing techniques. Examples of the work of the Centre will be presented. A static display showing examples of ERTS' imagery will be available at the Congress.

SESSION 5: Remote Sensing - Part II

CORRELATION SPECTROSCOPY: A CRITICAL STUDY Millan M. Millan

To anyone who has followed the development of remote sensing techniques for the detection of gaseous pollutants in the atmosphere, it must be quite obvious that many of these techniques have not fulfilled their expectations, especially those involving passive electro-optical methods. Reasons for this phenomenon are that: (a) in the haste of development, approaches far too naive have been taken; and (b) the physics of the various problems have not been properly considered.

Careful evaluation of the physical principles involved makes immediately apparent not only the drawbacks, but also the available solutions, the true range of application, and the very interesting possibilities for usage of these techniques.

The purpose of this paper is to evaluate one of these <u>wunder</u> techniques, namely correlation spectroscopy, considering its basic principles, how the laboratory technique was extrapolated to field use, making immediately apparent its limitations, and possible modifications to obtain a workable solution.

We shall discuss some recent work that has taken place to establish the range of application of this technique, as well as some of the solutions which can be used to optimize the operation under field conditions. Both dispersive and non-dispersive correlation spectroscopy will be discussed and compared.

DETERMINATION OF THE ATMOSPHERIC CONCENTRATIONS OF SO_2 AND NO_2 USING INFRARED REMOTE SENSING TECHNIQUES

J. Howard Shafer and Charles Young

 $\rm NO_2$ and $\rm SO_2$ are very important atmospheric pollutants and it would be most desirable to monitor their tropospheric concentrations on a continental and global scale using aircraft or satellite borne instrumentation. This paper will report calculations for the transmission of infrared radiation, absorbed in the various infrared bands of $\rm NO_2$ and $\rm SO_2$, as a function of pollutant concentration. The influence of H_20 and CO_2 will be taken into account. Such calculations enable the optimum spectral regions for remote sensing to be chosen and, in addition, allow the spectral resolution of the instrumentation to be specified.

Very precise values for certain molecular parameters are required if such calculations are to be accurately performed. The experimental research programme, which has been started at the University of New Brunswick for determining these parameters, will be described.

LIDAR MEASUREMENTS OF THE ATMOSPHERE S.R. Pal, A.I. Carswell, J.D. Houston and W.R. McNeil

This paper describes measurements of the properties of the backscattered signals from a ruby laser radar obtained under a variety of atmospheric conditions. The lidar system constructed for these measurements employs the fundamental (6943Å) and second harmonic (3472Å) ruby wavelengths. A Pockel's cell and polarizer in the cavity are used to provide a linearly polarized Q-switched output with energies up to 3 J at the fundamental. A KDP doubler external to the cavity provides the second harmonic. The pulse duration is approximately 15 ns and the pulse repetition rate is about 10 min⁻¹. The transmitter collimator provides an output beam 5 cm in diameter with a divergence less than one milliradian.

Four optical receivers are equipped with rotatable polarizers and retardation plates, interchangeable narrow band (10 Å) filters and photomultipliers to detect the backscatter signal. The main receiver channel is a 20-cm diameter Newtonian telescope and the other three are refractive telescopes with 7.5-cm apertures.

A measure of the depolarization, \bullet , is determined from the relation \bullet = P_r/P_l where P_r and P_l denote the backscattered power polarized perpendicular and parallel to the transmitter polarization, respectively. The variation of δ with altitude is reported for a variety of meteorological conditions.

It is found that δ for 3472Å is generally smaller than for 6943Å and this difference varies with altitude and atmospheric conditions. For "clear" (urban) air δ has been found to have a typical value of the order of 0.2 but can vary between 0.05 and 0.9 while well developed hazes have δ generally smaller than 0.1. For fog, δ values at both wavelengths are around 0.1 and higher. Snow gives values of δ of the order of unity. Clouds exhibit depolarizations ranging from 0.02 to values greater than unity and in many cases the presence of multiple scattering is clearly seen in the increase of δ with penetration depth. Cloud measurements show considerable variation of δ with altitude and evidence that it is possible to distinguish the difference between ice and water in the cloud by means of the difference in depolarization caused by the two phases.

A scheme is presented in this paper which combines the depolarization ratios for both the wavelengths, eliminates the effect of the Rayleigh scattering and works out a "depolarization fraction" of the aerosol concentrations. The advantage of this analysis lies in the fact that the instrument parameters are eliminated. The relevant analysis is discussed in detail and the altitude variation of the depolarization fraction of the aerosol concentration is examined for a number of cases.

A STUDY OF THE FEASIBILITY OF USING 9.6-µm CO₂ LASER RADIATION FOR REMOTE SENSING OF O₃ IN THE TROPOSPHERE AND STRATOSPHERE Charles Young

A number of the R-branch lines of the 9.6- μ m CO₂ band overlap the 9.6- μ m (ν_1 and ν_3) O₃ bands. It is easy to construct a tunable CO₂ laser system which can emit appreciable radiation for these R-branch CO₂ lines. The results of atmospheric transmittance calculations for the R-branch lines for varying O₃ concentrations will be presented. Such calculations enable the design parameters to be decided for a remote O₃ -sensing system using a CO₂ laser. In addition evidence that the individual rotational lines for O₃ have super-Lorentzian wings will be presented and the effect on atmospheric transmittance calculations discussed.

REMOTE SENSING OF STRATOSPHERIC OZONE THROUGH CLOUDS A. W. Brewer and J. B. Kerr

Ground-based measurements of stratospheric ozone are made by measuring the depletion of sunlight due to ozone absorption. Clouds cause serious problems and no suitable method has been found for their correction. Light emerging from the base of a cloud is a scrambled mixture of the sunlight and skylight above and is very variable due to changes in the cloud thickness. Those who measure ozone on cloudy days are left with no alternative but to measure this light from the base of a cloud. Much effort has been given to make a cloudy sky appear like a clear blue sky but these efforts have had limited success. It has been found that the effects of variable skies may be avoided by making all skies appear like thick clouds. A discussion of the techniques used will be given and results illustrating the accuracy of ozone measurements through clouds will be presented.

PROPAGATION OF 9.6- AND 10.6- μ m CO₂ LASER RADIATION THROUGH THE ATMOSPHERE

R.E. Chapman and Charles Young

The CO_2 laser is capable of producing high intensity radiation, continuous or pulsed, in the 9.6- and 10.6- μ m spectral regions. Proposals have been made for using such lasers for lidar, communications and the remote sensing of certain atmospheric pollutants such as O_3 . In order to interpret such measurements it is necessary to be able to accurately calculate atmospheric transmittances for the CO_2 laser radiation. An extensive laboratory programme has been undertaken at the University of New Brunswick, using a tunable CO_2 laser source, to measure the rotational line strengths, collisional broadened widths (for both self-and N₂-broadening) and the variation of the widths with rotational quantum number for the 9.6- and 10.6- μ m CO_2 bands. The results of these measurements are presented. In addition their implication for atmospheric transmittance calculations will be discussed. Saturated absorption effects due to the passage of high powered laser radiation through an absorbing gas and its possible atmospheric Importance will also be discussed.

SESSION 6: Hail and Cloud Physics - Part II

ROLE AND IMPORTANCE OF PARTICLE KINETICS IN THE PHYSICS AND DYNAMICS OF CLOUDS

C.R. Girard and Roland List

Cloud particle kinetics is the theory which describes the behaviour of cloud particle ensembles. The role of the theory consists of: i) selecting among the numerous physical processes known to affect cloud particles, those which are significant for their evolution and subsequent interaction with air dynamics; ii) providing a means for the appropriate identification of the particles; and iii) providing the mechanisms to calculate the formation and evolution of particle ensembles. Such a theory constitutes a logical link between the microphysics and dynamics of clouds. Provided certain conditions are met, it is possible to fully model the cloud particle spectrum evolution and particle-air interactions using but one additional independent variable, besides space and time coordinates. In other words, one internal parameter, or label, namely mass (or size) is sufficient to describe adequately a particle spectrum function in processes like nucleation, condensation, sedimentation, coalescence and breakup. The kinetic theory of cloud particles with the mass-label approximation seems to represent the simplest complete version of its kind and should be considered as a framework for communication between cloud physicists and dynamicists.

COLLISION AND BREAKUP OF WATER DROPS AT TERMINAL VELOCITY J. D. McTaggart-Cowan and Roland List

The results of the collisions of water drops falling at their terminal velocity is reported for five drop-size pairs with equivalent spherical diameters of: 4.6 and 1.8 mm; 3.6 and 1.8 mm; 3.6 and 1.0 mm; 3.6 and 1.0 mm; 3.0 and 1.0 mm. Fragment distributions by size and number following breakup are given. This information is necessary for numerical simulations of the evolution of drop spectra in rainshafts and particularly for the Langmuir "warm rain" process.

Four types of collisions are defined and illustrated: Necks, Sheets, Disks and Bags. The frequency of occurrence of each of these forms is: necks - 27%, sheets - 55%, disks - 18% and bags - 0.5%. Fragment distributions by size and number are given for each of the three most frequent types of collision.

COLLISIONS OF WATER DROPS WITH METAL CHAFF T.B. Low, R. List and J.D. McTaggart-Cowan

Investigation into the effect of rain on the trajectory of metallic radar chaff for use in cloud dynamics has been carried out. Individual water drops ~ 4.9 mm in diameter falling at 78% terminal velocity collided with single strands of chaff fibre, 25μ by 10.7 cm, which were falling freely at the time of the collisions. It has been found that the water drops carried the chaff, on the average, 4.5 cm from the point of initial contact. The actual distance of carry depended on the initial point of contact with respect to both the drop and the fibre, being greatest for centered collisions. A simple collision model has been worked out combining drag forces on the chaff both within the drop and within the air.

THE OBJECTIVE ANALYSIS OF RADAR DATA R.G. Lawford

A number of precipitation echoes evolving on a summer afternoon in Alberta have been digitized and analyzed by objective techniques. The methods and limitations of this analysis scheme are outlined. Using these techniques the life of a hailstorm is followed for $4\frac{1}{2}$ hours. Amongst the parameters computed and presented are: the horizontal distribution of vertically integrated rain (VIR), horizontally integrated rain, height-time mass profiles, trajectories of the storm's centre of mass and maximum top, and temporal variations in the total echo mass and maximum VIR. These computed parameters are compared to observed hailfall on the ground, the height-time profile of maximum reflectivity and computer-generated presentations of the three-dimensional distribution of precipitation in the storm. The distributions of, and inter-relationships between various parameters, based on all the echoes evolving during the afternoon are also discussed.

In conclusion, the most important parameters for summarizing a precipitation echo are itemized, and possible objective techniques for determining storm type and the stage of storm development are demonstrated.

SESSION 7: Agrometeorology and Micrometeorology

PLANT RESPONSE TO EXTERNAL RADIATION UNDER FROSTY CONDITIONS N. Barthakur and P. H. Schuepp

Temperatures of externally irradiated leaves were measured inside a wind tunnel as functions of surface wetness and at low ambient temperature. The effects of wettability and externally applied radiation are discussed from the point of view of frost protection of plants. The effects of forced air flow over the leaves are also evaluated.

A COMPARISON OF TEMPERATURES AT SEVERAL HEIGHTS OVER GRASS AND IN CORN

R. H. Douglas

During several summers, daily maximum and minimum temperatures were recorded at five heights above grass, as well as in a nearby corn crop. A comparison of these, level-by-level, reveals that within the corn crop, daytime maximums are a little warmer than over grass; but night-time minimums are very nearly identical. The difference in the maximum becomes detectable as the corn grows through the level of observation. In addition, continuouslyrecorded thermal patterns at eight levels, in corn and over grass, reveal significant differences in the diurnal temperature behaviour of the two environments. A comparison is also made of temperatures in two adjacent corn plots, planted at different densities.

DIFFUSION OF POLLUTANT FROM A MOTOR VEHICLE AS A FUNCTION OF VEHICLE MOVEMENT AND ATMOSPHERIC VARIABLES

F.H. Fanaki and J. Kovalick

Diffusion of motor vehicle exhaust fumes is a function of not only the type of fuel and vehicle age but also of the vehicle movement, atmospheric wind, turbulence and thermal stability.

Two methods are used to examine this effect on the diffusion of the exhaust fumes: direct probing by means of road tests using a full scale system and wind tunnel tests using a model.

Field tests have been conducted at the Meteorological Field Station at Woodbridge. The tests include a common passenger car and a stationwagon. Ten-metre and fifty-metre meteorological instrumented towers were used at the test sites. Attention was given to the flow of the exhaust fumes by observing and photographically recording their entrainment and modification by the ground, wind speed and thermal stability.

Motor vehicle aerodynamics was studied in a specially designed wind tunnel. Streamlines passing over the roof of the vehicle swept down to the ground level and then divided to form a series of vortices. These, in turn, helped to elevate the exhaust fumes to a distance depending on the vehicle size.

PERIODIC VARIATIONS IN THE LARGE IONS AT THE METEOROLOGICAL RESEARCH STATION Bhartendu

Large oscillations with periods in the range of $\frac{1}{2}$ hr to 1 hr were observed in the large-ion concentrations at the Meteorological Research Station, Woodbridge, Ontario. In general, the amplitude of these oscillations was larger for the negative ions than for the positive ions. These oscillations are found to be due to the electric heating of the building and are observed inside and outside the building. No such oscillations are observed for the small-ion concentrations. Implications of these results are discussed.

SESSION 8: Remote Sensing - Part III

SURFACE CIRCULATION FEATURES AS SEEN IN ERTS IMAGERY P. Krishna Rao

Multi-spectral scanner data obtained from Earth Resources Technology Satellite (ERTS) for 14 and 15 September, 1972, over the Bay of Bengal show interesting circulation features. Imagery from the $0.5-0.6\mu$ and $0.6-0.7\mu$ channels show some sediment transport along the relatively shallow part of the coast line. A very sharp boundary delineates an area without any clouds and very little sediment in the water. The absence of clouds can be attributed to relatively cooler water at the surface, inhibiting the growth of clouds. An intense tropical storm that crossed the coastline over this area on 11 September 1972, might have brought cooler water at the surface. Surface circulation features that can be deduced from the ERTS imagery are: a counterclockwise circulation at the head of the Bay of Bengal and a clockwise circulation on the lower west section of the Bay. This conclusion is in agreement with the mean monthly circulation

patterns published by the U.S. Naval Oceanographic Office.

REMOTE SENSING OF WIND DIRECTION E.G. Morrissey

Aerial photography is used to measure the wind direction over urban areas. The paper describes the progress in the development of the technique by the Meteorological Services Research Branch in cooperation with the Canada Centre for Remote Sensing and the plans for future development work. Several applications are identified and described.

REMOTE SENSING OF SHORT-LIVED FLUCTUATIONS IN THE TOTAL OZONE

J.B. Kerr

An extensive series of ozone measurements was taken over the period from September, 1971 to November, 1972. As a result of these measurements it was found that variations of ozone occur which usually last about half an hour and sometimes amount to 30% of the background ozone. These "ozone disturbances" are advected because the same disturbance has been observed on the direct sun and the zenith sky at different times. Results which show the general nature of these disturbances will be presented. Also, a discussion will be given which stresses the need for an automated, mesoscale ozone-measuring network, capable of measuring in all weather conditions during all daytime hours.

REMOTE SENSING APPLICATIONS IN ICE RECONNAISSANCE H. G. Hengeveld

Particulars on the objectives and nature of the ice reconnaissance remote sensing program are discussed. Application of data received from various sensors (including laser profilometer, infrared line scan system, aerial cameras, and side-looking airborne radar) includes real-time in-flight utilization for provision of ice information in navigable waters, the collection of sensor data for special studies, and the provision of sensor data for an ice climatology data bank. Several projects undertaken for evaluation of the application of sensor data in ice reconnaissance and related activities are discussed. Examples of data records are presented and the type of information available from each example is outlined.

SESSION 9: Weather Forecasting Research

EXPERIMENTS ON THE UPDATING OF P.E. FORECASTS WITH REAL WIND AND GEOPOTENTIAL DATA Ian D. Rutherford

A series of experiments is described in which hemispheric, single-level, P.E. Intecasts are updated every twelve hours for twenty cycles using various combinations of real wind and geopotential height data. The data assimilation is by "optimum" interpolation of the apparent forecast errors. The space autocorrelation functions for the wind component forecast errors are calculated from these for the geopotential by assuming geostrophy. Various simple procedures for approximately coupling the wind and geopotential analyses are tested. Gravity waves are damped by means of a time filter. The analyses and forecasts are verified against the data themselves. The importance of allowing wind data to influence the height analyses and vice versa is clearly demonstrated.

EFFECTS OF A NEW RESISTANCE LAW IN AN ATMOSPHERIC MODEL Robert Benoit

A recently developed parameterization of the surface friction is tested for its effects on short-range integrations of a large-scale model of the atmosphere. This theory, which is based on similarity arguments, leads to the so-called resistance law of the neutral barotropic planetary boundary layer.

The atmospheric simulator used is a hemispheric five-layer, sigma coordinate, primitive equations model. Comparisons are made with the friction model using the Cressman drag coefficients. The main changes introduced by the new parameterization are a locally variable drag coefficient and a computation of the cross-isobaric component of the surface stress. The differences that are thus produced in the pressure and velocity fields indicate that a stronger and more realistic friction is being modelled.

Sensitivity experiments reveal that a fairly large variation of the two empirical constants in the resistance law and a change of Z_0 by a factor of two do not affect 36-hour integrations of the PE model significantly.

A PROGRAM FOR COMPUTING MIXING HEIGHTS AND TRANSPORT WINDS Gerard Piette

In the field of research on air pollution potential a program computing mixing heights and transport winds for radiosonde sites in North America has been developed at the Canadian Meteorological Centre.

Mandatory and significant temperature levels of the radiosonde report are used as well as pibal information. Technical details on the scheme of computation are given.

An analysis of the radiosonde ascent by a meteorologist is necessary for proper interpretation of the values obtained from the program.

PROGRESS REPORT ON THE REGIONAL UPDATE SYSTEM A.L. Bealby

A brief summary of the progress in developing and testing components of the Regional Update System will be given. Verification scores on the Regional Update Model for the period December 1972 - March 1973 will be presented. A new computer, a Varian 73, has been purchased for the National Test-Bed Facility and a brief description will be presented.

SESSION 10: Applied Meteorology

EVENT PROBABILITIES ASSOCIATED WITH REGRESSION ESTIMATES OF PREDICTAND VALUES

R. H. Robinson

Forecasts of predictand values based on linear regression equations do not necessarily meet requirements of individual consumers. But such forecasts carry implications which permit their modification and/or interpretation in terms of probability, and which consequently may enhance their value.

These implications, and the possible use of an inflation factor (or constant multiplier) for modification, are explored.

PUBLIC FORECASTS BY PATTERN RECOGNITION L.B. Findleton

A pilot study of the feasibility of producing computer generated station forecasts in a restricted public format is being conducted for Montreal. The system uses a statistical-dynamic approach based on Pattern Recognition techniques applied to the output of an operational forecast model. System output consists of a worded forecast of weather conditions for 12-hour part periods over a 60-hour prediction interval. The system has been running operationally since December 1972.

REGIONAL COMPUTING AS DEVELOPED BY THE PRAIRIE WEATHER CENTRAL

S.V.A. Gordon

An outline of development of computer programs for the regional requirements of the Prairie Weather Central in Winnipeg is presented. The paper describes the original work (as completed by Mr. A. Davies in 1968) through the new programs now in operational use to those envisaged for the immediate future.

Some programs are shown but mainly the concepts connected with various types of programs are sketched.

Problems with various types of computer hardware are explained and results from the H/P 2100A now in operational use are given.

METEOROLOGICAL CONDITIONS, TOPOGRAPHY, AND AIR QUALITY IN THE SOUTH CENTRAL PORTION OF THE SAINT JOHN RIVER VALLEY R. W. Gamble, P. M. Strain and G. P. Semeluk

The operation of a pulp mill complex at Nackawic, N.B. on the Saint John River, has made noticeable the relation between topography, the frequent formation of temperature inversions in the valley, and air quality down river as far as Fredericton (40 miles) and up river as far as Florenceville (70 miles). This situation offers an investigational opportunity with an interdisciplinary base:

(1) measurement of the standard meteorological parameters at ground level and in vertical profile,

(2) measuring concentrations of "raw" atmospheric pulp mill components, and of their photochemical (solar initiated) products at various locations in the plume.

The principal features of the portable, inexpensive gas chromatographic unit which was developed to meet the analytical requirements will be briefly outlined. Preliminary results obtained in field measurements, which were begun in early November 1972, will be presented and discussed.

SESSION 11: General Meteorology

METHODOLOGIES OF ENVIRONMENTAL IMPACT STUDIES R. E. Munn

Environmental impact studies are being undertaken in many parts of the world. The objective is to provide the decision maker with an assessment of possible environmental changes if a particular large-scale modification of the earth's surface is undertaken.

Meteorology is important in most impact studies, as will be illustrated with examples from the Lorneville, N.B. and Haldimand-Norfolk investigations. However, meteorology is only one of many location factors that must be considered. An examination will be made of existing methodologies for integrating these various factors into a few alternate strategies for the decision maker.

STRATOSPHERIC POLLUTION AND SST'S B, W, Boville

Recent observations by rockets and satellites combined with numerical experiments have clarified the main features of stratospheric and mesospheric circulation. This region brackets the ozone layer which shields man and the biological environment from most of the sun's incoming solar ultra-violet radiation. Proposed supersonic fleets will operate in base of the ozone layer and concern has been expressed that their water vapour and nitrogen oxide emissions may reduce the total ozone.

VHF DIRECTION FINDER FOR LIGHTNING LOCATION R.C. Murty and W. D. MacClement

A VHF direction finder based on the technique originally proposed by Oetzel and Pierce (1969) for the detection of sferics from lightning has been field tested. Sferics in the frequency range 82-88 MHz are received by two antennae separated by a distance of 115 m and the angles of arrival are calculated from the differences in the times of arrival of sferics at the two antennae. These measurements are compared with radar observations and show good agreement. Even when the observing station was surrounded by thunderstorms in many directions, the direction finder gave accurate angles of arrival. The direction finder located storms up to a range of 60 miles and the range can be extended to about 100 miles by suitable choice of the field site.

A COMPUTER-CONTROLLED AERO-MET OBSERVATIONAL FACILITY Oscar Koren

A computer-controlled AERO-MET observational facility, located at the Canadian Meteorological Research Station near Toronto, is discussed and its capabilities are briefly outlined. The design of the facility is considered from the point of view of location and hardware involved, which are then described. Present and future plans in regard to the operation of the facility, the data handling and analysis are briefly outlined.

SOME OBSERVATIONS ON CONVECTIVE PLUMES IN THE LOWER ATMOSPHERE

F.H. Fanaki

Convective heat transfer plays an important role in the distribution of heat and water vapour throughout the atmospheric boundary layer. Although three convective models have emerged, i.e., convective Benard cells, thermals and plumes, recent investigations tend to support the plume model. Some details of this mechanism are incomplete or controversial.

This paper deals with this complex mechanism and describes in some detail the plume behaviour.

An active thermal surface usually does not generate individual well behaved plumes but rather a large number of rising convective columns which interact with each other. In the absence of wind the plume rises vertically towards a concave cap which resembles a thermal. The cap may disintegrate or may join an adjacent plume and appear to extend further aloft. Under flow conditions, the plume may bend forward with an angle dependent on the wind speed. It will be noted that the plume inclination increases with height until the upper extremity is almost horizontal and wavelike. A plume rising in the wake of an adjacent plume will have a modified behaviour, e.g., in some cases the higher part may bend backward taking the shape of a backward letter C, and the wavelike tail may contain a curl or a vortex.

The information presented in this paper was obtained from atmospheric observations and a series of experiments using a water tunnel with a controlled flow and a thermally variable underlying boundary.

INERTIAL RANGES IN THREE-DIMENSIONAL QUASI-GEOSTROPHIC TURBULENCE

M. Shabbar

A diffusion approximation is derived both for spectral energy transfer and for the transfer of spectral components of potential enstrophy in a homogeneous quasi-geostrophic flow with a random collection of potential vorticity discontinuities superimposed on the principal motions. For three-dimensional quasigeostrophic turbulence which conserves potential enstrophy as well as energy, this approximation predicts -8/3 and -4 power inertial range spectra for energy of the continuous flow. Non-linear interaction between continuous flow with wave-like properties and discontinuous flow with vortex-like properties in the atmosphere (which is really a combination of wave and vortex-like systems) plays an important role in the determination of energy flux and the flux of mean-squared potential vorticity fluctuations. Discontinuities in potential vorticity cause straining effects of turbulent-velocity and temperature fluctuations and modify (attenuate) the energy spectrum of the continuous flow.

The prediction of the theory formulated in this paper favourably corroborates the observed spectrum of energy in the atmosphere for the region of hemispheric wave number 10-16 with a -8/3 slope and for higher wave numbers with a -4 slope in the log-log energy/wave-number diagram. The transfer rates of potential enstrophy in the range $10 \le n \le 16$ and energy in the range n > 16are identically zero, while the transfer of energy in the first range is from higher to lower wave numbers and that of the potential enstrophy in the second range is from lower to higher wave numbers.

As compared with the earlier two-dimensional turbulence theory of Kraichnan and the quasi-geostrophic turbulence theory of Charney, the present theory predicts a more realistic shape of the energy spectra of atmospheric motions at scales shorter than the baroclinic excitation scales.

CANADIAN METEOROLOGICAL SOCIETY

7th Annual General Meeting, May 30, 1973 St. Mary's University, Halifax

AGENDA

The President in the Chair

- 1. Minutes of the 6th Annual General Meeting, May 31, 1972
- 2. Annual Report of the Executive Committee
 - (a) President's Report
 - (b) Treasurer's Report
 - (c) Awards Committee Report
 - (d) Editor's Report
- 3. Reports of Standing Committees
 - (a) Public Information
 - (b) Scientific and Professional Matters
- 4. Reports from Local Centres
- 5. Budget for the period 1 January 1974 to 31 December 1974
- 6. Membership Fees
- 7. Speaker's Tour
- 8. Other Business
- 9. Nominating Committee Report and Installation of Officers

Ø\$

CANADIAN METEOROLOGICAL SOCIETY

DRAFT MINUTES*

Sixth Annual General Meeting - Canadian Meteorological Society

Minutes of the Sixth Annual General Meeting of the Canadian Meteorological Society held at the University of Alberta on Wednesday, May 31, 1972 at 7:30 PM.

1. Adoption of Minutes

The minutes of the Fifth Annual General Meeting of the Canadian Meteorological Society held on May 12, 1971 at McGill University, Montreal were presented to the meeting. Moved by A. H. Campbell that the minutes be approved as read. Seconded by Dr. P. W. Summers. Carried.

- 2. Reports of the Executive Committee
 - 2.1 Annual Report The President, Mr. C. M. Penner, presented the Annual Report of the Society to the meeting.

Moved by J. D. McTaggart-Cowan that each report be discussed after it is presented. Seconded by Dr. J. Maybank. Carried.

Discussion of the Annual Report followed.

- 2.2 Treasurer's Report The Treasurer's Report was given by Mr. M. S. Webb. He especially noted that the recent order of 200 subscriptions to <u>Atmosphere</u> by the Atmospheric Environment Service required the revision of the operating budget for 1972 and the tentative budget for 1973. Mr. Webb answered questions arising then moved that the report, as published, be approved. Seconded by A. L. Bealby. Carried.
- 2.3 Nominating Committee Report The report was presented by Mr. S. V. A. Gordon. The report had been approved by the Executive and since no further nominations had been received the following were declared elected to office for 1972-73:
- * The reports referred to in these minutes were published in full in the special issue of <u>Atmosphere</u> devoted to the 6th Annual Congress, published in May 1972 and mailed to all members prior to the meeting.

Executive-President Vice-President Past President Treasurer Corresponding Secretary Recording Secretary Editor

G. A. McKay W. F. Hitschfeld C. M. Penner M. S. Webb G. A. McPherson C. B. Adamson E. J. Truhlar

Councillors-at-Large-S. J. Buckler J. F. Derome L. E. Parent

- 2.4 Editor's Report Mr. Penner touched on the highlights of the Editor's Report and noted that the Atmospheric Environment Service had placed a recent order of 200 subscriptions to <u>Atmosphere</u> to begin with Volume 10 #1. Mr. Penner answered questions regarding <u>Atmosphere</u>.
- 2.5 Report of the Awards Committee Mr. Penner presented the report which had been approved by Council. The awards were as follows:

The President's Prize- Drs. M. Kwizak and A. Robert for their work published as: "A semi-implicit scheme for grid-point atmospheric models of the primitive equations." Monthly Weather Review, Vol. 99, 1971.

The Prize in Applied Meteorology Dr. J. S. Marshall for his work published as "Peak readings and thresholding in processing weather radar data." Journal of Applied Meteorology, December, 1971.

<u>Graduate Student Prize</u> R. S. Schemenauer for his work described in his M.Sc. thesis at the University of Toronto "Measurement of the Drag Coefficients and Characteristic Motions of Snow Crystals, Graupel and Small Hail Models". It was published in the Journal of Atmospheric Science, January, 1971 by List and Schemenauer under the title "Free-Fall Behaviour of Planar Snow Crystals, Conical Graupel and Small Hail".

The Dr. Andrew Thomson Undergraduate Student Prize -Mr. Tom Low for his B.Sc. thesis at the University of Toronto in 1971 entitled "A Study of Collisions between Raindrops and Metal Chaff".

Mr. Penner presented the President's Prize to Dr. Kwizak while Prof. Hitschfeld is to arrange a presentation to Dr. Robert at the Montreal Centre.

Arrangements will also be made to present the Prize in Applied Meteorology to Dr. Marshall in Montreal. Plans will be made to present the Graduate Student Prize and the Dr. Andrew Thomson Undergraduate Student Prize to Mr. R. S. Schemenauer and Mr. Tom Low, respectively at a fall meeting of the Toronto Centre.

3. <u>Reports from Local Centres</u>

Reports from the following local Centres were presented:

British Columbia Centre	-	as published in Atmosphere
Alberta Centre	-	as published in Atmosphere
Regina Centre	-	as published in Atmosphere
Winnipeg Centre	-	as published in Atmosphere
Toronto Centre	-	as published in Atmosphere
Ottawa Centre	-	Mr. H. J. Wilson
Quebec Centre	-	M. Raymond J. A. Perrier
Halifax Centre	-	as published in Atmosphere

Mr. C. B. Adamson presented some additional information on the Toronto Centre and Dr. A. J. Chisholm proposed that the Toronto Centre host the 8th Annual Congress in 1974. Mr. Penner thanked the Toronto Centre for the invitation on behalf of the Society.

4. <u>Budget for 1973</u>

Mr. M. S. Webb presented the budget for 1973 to the meeting. Moved by Mr. Webb and seconded by Dr. J. Maybank that the budget be approved. After some discussion the motion was carried.

5. Membership Fees

It was moved by G. A. McKay that the following fee structure for 1973 be adopted: General Members \$15.00 Student Members \$7.50 Sustaining Membership \$50.00 (minimum) Seconded by S. J. Buckler.

Dr. J. Maybank moved an amendment to the motion that the Student Membership should be set at \$5.00. Seconded by Prof. J. B. Gregory.

Considerable discussion followed and the amendment carried.

6. Amendments to the Constitution and By-Laws

6.1 Moved by Mr. S. V. A. Gordon and seconded by Dr. J. Maybank that the following changes be approved:
1 lete the office of Editor from the executive in Article 4, Constitution of the Canadian Meteorological Society.
2. Change By-Law 6 Section (f) to read:

- 3 -

An Editorial Committee shall be established, elected by Council and responsible to the Executive. Each member will normally remain on the Committee for at least two years. <u>Atmosphere</u> shall be an official publication of the Society and the Editor elected by Council shall be Chairman of the Editorial Committee. The Committee shall review annually the desirability of publishing other scientific reports, proceedings or journals and shall make recommendations to Council. All publications may be in either or both of the official languages of Canada. Carried.

- 6.2 Moved by Mr. G. A. McKay and seconded by Mr. G. W. Robertson that the following changes be made:
 - 1. Delete By-Law 2(c) and 2(d).
 - 2. Add the following as By-Law 2(c): Sustaining membership is open to individuals, institutions, companies, firms and organizations who wish to support the Society in promoting met
 - eorology and its application for the benefit of Canada. A Sustaining membership will require a certain minimum annual contribution determined as indicated in By-Law 3. Carried.

7. Other Business

- 7.1 Moved by Dr. J. M. Powell that the Canadian Meteorological Society write a letter of thanks and appreciation to the Alberta Government for sponsoring the dinner for the Sixth Annual Congress on June 1, 1972. Seconded by Mr. G. A. McPherson and carried unanimously.
- 7.2 Mr. Penner advised the meeting of a proposal by Mr. M. Newark that the Society publish a high school meteorology text. The Executive will continue to investigate the suggestion in conjunction with Mr. Newark.

8. Installation of Officers

- 8.1 Mr. Penner welcomed the new members of the 1972-73 Council and turned the meeting over to Mr. G. A. McKay, the incoming President.
- 8.2 Mr. McKay expressed thanks to the outgoing executive prior to adjourning the meeting at 10 P.M.

(A. H. Campbell) Recording Secretary

А

In view of the recent order for 200 subscriptions to "Atmosphere" by the Atmospheric Environment Service starting with Volume 10(1)-1972, the operating budget for 1972 and the tentative budget for 1973 have been revised. Copies of both are attached.

A summary of the year-end financial positions of the Society for the years 1971 through 1973 inclusive is given below.

Year	Budget	Year-End Balance
1971		\$1,178.43
1972	40.00 (deficit)	\$1,138.43
1973	30.00 (surplus)	\$1,168.43

OPERATING BUDGET FOR 1972

RECEIPTS

Fees	-general	500	6 14.00			7000.00		
	-student	100	● 2.00			200.00		
Subse	riptions	100	610.00			1000,00		
							8200.00	
Susta	ining Mer	bers	hips	2	640.00		80.00	
Subse	riptions	for /	A.E.S.	200	010.00		2000.00	
TOTAL					a			\$10,280.00

EXPENDITURES

Atmosphere -handling (20% of 8200) -printing (4 issues 81700)	1640.00 6800.00		
● DA 60 50 mm 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8440.00)	
Congress Issue and Mailing	900.00)	
Prizes	100.00)	
Auditor	30.00)	
Support for Activities of Centres	300.00)	
Grants -SCITEC	50.00)	
-Youth Science Fair	50.00)	
Operating Costs of Executive	450.00		
TOTAL		\$10.320.0	0
BUDGETED DEFICIT		\$ 40.0	ю

TENTATIVE BUDGET FOR 1973

RECEIPTS

4

Fees -general 550 @14.00	7700.00	
-student 100 @ 2.00	200.00	
Subscriptions 120 010.00	1200.00	
Enventile datesta ●Cel ultimetat ulti ni	9100.00	
Corporate Memberships 2 040.00	80.00	
Subscriptions for A.E.S. 200 @10.00	2000.00	
TOTAL		\$11,180.00

EXPENDITURES

Atmosphere -handling (20% of 9100)	1820.00	
-printing (4 issues @1800)	7200.00	
	9020.00	
Congress Issue and Mailing	900.00	1200.00*
Prizes	100.00	150.00*
Auditor	30.00	
Support for Activities of Centres	400.00	1200.00*
Grants -SCITEC		500.00*
-Youth Science Fair	50.00	
Operating Costs of Executive	450.00	600.00*
Information and Educational Services	200.00	900.00*
TOTAL		\$11.150.00
		327

BUDGETED SURPLUS

\$ 30.00

*Your Executive has requested an annual grant of \$3,000.00 from the Atmospheric Environment Service in order to expand the activities of the Society. If successful, the additional funds can be allocated as shown. This increase in expenditures totals \$2,500.00.

ANNUAL REPORT

PRESIDENT'S REPORT

A FORWARD LOOK

Science has assumed a role of unprecedented importance in society. It is held accountable for indiscriminate use of knowledge. It holds the keys to many of the environmental riddles and muddles of our times. Increasingly, Science is being asked to provide guidance to government and others concerned with our way of life. Meteorology is no exception, and your Society, sensing the need and the desire of meteorologists to concern themselves with our way and quality of life as well as with scientific communication and excellence, has attempted to alter its course accordingly.

Within Canada there has been continued debate on the role of Science, a debate which introduces the question of the role of Scientific Societies. The societal role has been traditionally the advancement of the science, i.e., improving the precision with which it describes phenomena, mainly through the provision of a means of communication and debate.

There has been a reluctance to step out and express opinions on how our knowledge should be exploited. Because of this reluctance, the Societies have been subjected to significant criticism. Senator Lamontagne noted, "The evidence before our committee shows two things: first, the representatives of that community [the scientific] have been reluctant to raise and discuss broad issues of science policy; secondly, the Canadian scientific community lives in isolation and is divided in a great number of regional and scientific solitudes; to the extent that it considers the problems and priorities of our scientific effort, it speaks with many voices which are far from being always consistent".

The Science Council, in its Report #25, effectively repeats this criticism, noting that there is presently no efficient way for government to obtain clear concise views from the scientific community. Perhaps this is because Societies have never grasped their potential role.

There are pressures for change, and change is undoubtedly essential. Nevertheless, change must not be such as to destroy the very nature of the Societies, as they obviously have a fundamental role to play.

The "changers" would organize the Societies in a way to ensure interdisciplinary communication, and through groupings such as SCITEC and Engineering Institute of Canada, enable the collective scientific opinion to reach the ears of government. At the same time, the Societies are being asked to assume a more active role in the national and international aspects of their Science. This change requires much more effort, and in the case of the CMS, poses the question of "how", since we have limited resources.

Your executive has looked at change as a challenge which would give renewed vigour to the Society. The increased scientific responsibility places us much closer to the very core of our disciplinary effort. At the same time, we have accepted that the CMS should become more acquainted with the roles of other disciplines and national issues. Our actions illustrate this policy.

1972-73 IN RETROSPECT

On coming into office, the executive attempted to prepare for the changing role of the Society and also to remove some of the problems raised at the previous Congress.

Communication appeared to be the major difficulty in the internal CMS operation, and its lack had resulted in a highly heterogeneous view of our aims, as well as discontent. Steps taken to overcome this problem were a "newsletter" and the publication of the membership list. Funds did not permit full circulation of the newsletter, but this is planned for the forthcoming year. Reports to date Indicate it was highly successful.

Membership was previously identified as a problem. We adopted the stand that a renewed and more vigorous Society was the only permanent way to acquire the desired members. Two major opportunities presented themselves and were exploited. These were more active public participation stimulated by a vigorous Public Information Committee, and acceptance of the responsibilities for SOMAS, the NRC Subcommittee on Meteorology and Atmospheric Sciences, as a standing committee of the Society. Thus, two major steps were taken to involve our science in national and international affairs and, in particular, issues pertinent to our discipline. The Standing Committee on Scientific and Professional Matters has also supplied knowledgeable replies to queries from government and the public.

There has been some confusion concerning the role of Atmosphere. While Canada's only meteorological journal made great strides with respect to content and timing in 1972, Council has always stated that it would be a general publication emulating <u>Weather</u> or <u>Weatherwise</u> in content. The accelerating pace of meteorological research makes a highly professional Canadian Journal of Meteorology essential. We have proposed the creation of such a journal and taken the initial steps toward its creation.

The Centres have been recognized along with the Standing Committees as the major functioning components of the Society. They are the productive units. whereas Council has an advisory and planning role. The more effective the operation of the Centres, the more effective will be our Society. We have attempted to assist, but in a very diplomatic way as befits our organization. The newsletter has kept you up-to-date in Society affairs. You have been integrated with the national executive as never before through the activities of the Public Information Committee. We have had problems, as in handling replies on hail suppression, and in organizing the speaker's tour. However, these problems can and will be resolved. For example, the AES has agreed to our finalization of the speaker's tour for 1973 well in advance of the time you require for your scheduling. One of our major objectives has been to obtain the funds needed by Centres to bring in speakers, enable funding of travel, and carry out the other tasks of operation. Up until the present, the Centres have been most charitable recognizing that virtually no money is available for this purpose. We hope that our actions will permit us to change this situation,

Our hopes stem from submissions we have made to the AES for increased support. The AES has been an important factor in our existence down through the years. While respecting our independence, the Service has assisted our development initially by grants, and recently by the purchase of publications in quantity and in funding the speaker's tour. More recently, it has agreed to go to Treasury Board to plead our cause for support as a Society. The major reasons given in our submission were precedent, and the impossibility of maintaining a Society which can provide independent opinion to Government, as well as support SOMAS when funded by membership fees alone. Whereas the results of the submission are unknown, we are extremely hopeful that AES will be successful in its negotiations.

In brief, your executive has responded to meet the needs expressed by yourselves and those responsible for science policy. Our response is not complete; there are many major challenges which remain to be faced such as integration with other Societies, but we feel our response has been at least a major step toward a mature, vigorous Meteorological Society.

REPORT OF NOMINATING COMMITTEE

As Chairman of the Nominating Committee in accordance with By-Law 4 of the By-Laws of the Canadian Meteorological Society the following names are submitted in nomination for Council for the year 1973-74.

All nominees have been contacted and have given their consent to accept the Office if elected.

President W.F. Hitschfeld Vice-President A.J. Robert Past President G. A. McKay Treasurer L.N. Yacowar Corresponding Secretary F.J. Lemire Recording Secretary J.F. Derome Councillors-at-Large A, F. McQuarrie C.V. Wilson R. D. Easto Auditor

R. H. Silversides

J.M. Leaver Chairman, Nominating Committee

Nominating Committee Report / 33

CANADIAN METEOROLOGICAL SOCIETY STATEMENT OF RECEIPTS & EXPENDITURES FOR THE YEAR ENDED DECEMBER 31, 1972

RECEIPTS

Sales of Atmosphere 514	. 69
Dividends 31	. 80
Sustaining Membership 40	.00
Congress Surplus 185	.82
Reprints from Atmosphere 339	. 90
A.E.S. Subscription 2,000	.00

EXPENDITURES

\$1,679.07
370.75
80.02
343.24
30.00
50,00
50.00
801.72
100.00
7,997.55

\$11, 502.35

\$11, 517.56

CASH ON HAND - December 31, 197	1		
Bank Account	\$ 2,068.69		
Univ. of Toronto Press Acct.	-1,061.96		
TOTAL		1,006.73	
Plus Receipts	1	1,517,56	
Less Expenditures	1	1, 502. 35	
			1,021,94
CASH ON HAND - December 31, 197	2		
Bank Account	3,387.51		
Univ. of Toronto Press Acct.	2, 365, 57		
			1.021.94
OTHER ASSETS			
Bell Canada 12 shares @ 44.00		528.00	
Canada Savings Bonds Series #	24 (a)	950.00	
TOTAL			1,478.00

(a) Bond Interest	- 1970 - 7% of 950	66,50	
	- 1971 - 8% of 950	76.00	
	- 1972 - 8% of 950	76.00	\$ 218.50

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, 1972.

R. D. Easto, Auditor.

CANADIAN METEOROLOGICAL SOCIETY

Budget for 1974

INCOME

Dues	\$ 8,700.00
Subscriptions	3,200.00
Grant	10,000.00
	\$21,900,00

EXPENDITURES

SOMAS	\$ 3,500.00	
Support to Centres	2,700.00	
Information & Educational Services	1,400.00	
Publication of Atmosphere	8,500,00	
Support for Annual Congress	1,000.00	
Operating Costs of Executive	3,500.00	
Travel	800,00	
SCITEC	500,00	
	5	\$21,900.00

Treasurer's Report / 35

AWARDS COMMITTEE REPORT

The Awards Committee for 1972 offers the recommendations listed below, together with brief statements of the reasons for our recommendations:

President's Prize: T.R. Oke

For his important contributions to urban meteorology and in particular for the paper "Comparison of urban/rural counter and net radiation at night." <u>Boundary-Layer Meteorol.</u> 2, 290-308, co-authored by R. F. Fuggle.

Prize in Applied Meteorology: P.W. Summers

For his many important contributions to design and technological problems of weather modification experiments culminating in the airborne flare system now proven and in use in Alberta and elsewhere. The system is described in the paper "The development and testing of an airborne droppable pyrotechnic flare system for seeding Alberta hailstorms." J. of Appl. Meteorol. 11, 695-703, co-authored by G. K. Mather and D. S. Treddenick,

Graduate Student Prize: L. Ettinger

For his work on variable static stability as a factor of importance in modelling atmospheric flow. Mr. Ettinger's work is described in his M. Sc. thesis entitled "A spectral baroclinic model including variable static stability." (McGill University.)

Dr. Andrew Thomson Undergraduate Student Prize: Carole Dyck For her paper (with R, List and W, A. Murray) which made a significant contribution to the study of hailstones and their growth through icing. Her work is described in "Air Bubbles in Hailstones", <u>J. Atmos. Sci.</u> 29, 916-920, (University of Toronto.)

K.D. Hage, Chairman

EDITOR'S REPORT - ATMOSPHERE 72

During 1972 the chronic financial pressure on the Society was alleviated principally by the AES order for 200 subscriptions to <u>Atmosphere</u> (at \$10 each). In addition, more revenue was received by the sale of back issues, and amounted to \$453 mainly for 7 complete back sets and 39 RMS (Can. Branch) publications inherited by the CMS.

This increase in revenue allowed more pages and articles to be published, raising the cost per issue (including mailing and handling charges) close to \$1900. Five issues were printed: Vol. 9 No. 4, Vol. 10 Nos. 1, 2 & 3 (148 pages, 8 more than in 1971); and the Congress issue (43 pages). These contained 10 articles, 8 Book Reviews, 13 Reports, 7 Announcements, 10 notes and 4 letters as well as the program and abstracts for the 6th Annual Congress and the Society's annual reports.

Support from the members in submitting articles, especially book reviews, has been good. Some delay in publication has resulted from problems connected with reviewing articles. Also Centres have not contributed their share of reports concerning their own activities, 2 not even submitting their annual reports for publication.

Five papers received in 1972 were not published: 2 were rejected, 1 was not suitable, 1 was returned for extensive revision, and 1 was accepted but later withdrawn for addition of later results. At the end of 1972, two other papers were out for review. (For 1973, 6 articles are accepted for publication, 2 of these in principle.)

Most items are published in English; only 1 Book Review and one Report, in French. For the 1973 issues the information given on the inside front and back covers will be printed in a bilingual format.

The number of members (General and Student) has remained almost constant over the past year decreasing by only one. However, institutional subscriptions (other than AES) have increased by 36 (almost 50%) in the past year (20 USA and 8 foreign, mainly). It may now be appropriate to contact selected universities, colleges and libraries by means of complimentary issues to try to increase the list further.

The effect of raising the student fees has yet to be evaluated, although by the beginning of April 55% had renewed their memberships.

The membership address listing as prepared by the U of T Press Computer Department was distributed to all members with the Vol. 10 No. 3 issue.

The first issue of the CMS Newsletter (about 100 copies) was published in December for distribution to Centres and selected individuals giving more details about Society activities, especially as discussed by the Council or Executive. Dr. R. Treidl is Editor of the Newsletter which has received favourable comments and is certainly filling a need for communication with the members. Starting with Newsletter No. 4 distribution will be made to all members.

E.J. Truhlar

Editor's Report / 37

REPORT OF THE STANDING COMMITTEE ON PUBLIC INFORMATION

Chairman H.B. Kruger Dr. A.J. Chisholm Toronto Centre D. A. Faulkner B.C. Centre M.G. Ferland Centre Québecois H.M. Fraser Winnipeg Centre Halifax Centre A. D. Gates J.R. Hendricks **Regina** Centre A. Ouellet Montreal Centre (French Language media) Montreal Centre (English Language media) N.N. Powe D.J. Webster Ottawa Centre H. P. Wilson Alberta Centre

The members of the Committee for 1972-73 were as follows:

This was the first year that a Committee structure consisting of a national chairman plus representatives from each Centre was tried. It would be inappropriate for me to suggest whether or not this year's Committee was a success - this assessment will have to be made by the National and Centre Executives and the members-at-large. But no matter what the assessment turns out to be, I firmly believe that Centre participation is essential if the Committee is to operate effectively within its terms of reference in all parts of Canada. I would, therefore, recommend that the Committee structure adopted for 1972/73 be continued indefinitely.

The following is a brief outline of some of the more productive activities of the Committee during the year:

- A column by John Schmidt which appeared in the 5 July 1972 issue of the <u>Calgary Herald</u> carried a quotation from the portion of the 1971-72 Public Information Committee report describing its handling of an issue which had arisen in connection with Alberta hail suppression activities. A letter was written to the <u>Herald</u> to answer questions raised by Mr. Schmidt and to explain the Society's position. This letter was given feature coverage in the 28 July 1972 issue of the newspaper.
- The Committee reviewed and supported a letter-to-the-Editor written by Dr. R. Shaw and subsequently published in the <u>Halifax Chronicle-Herald</u> and the <u>Halifax Mail-Star</u> on 14 October 1972. The letter concerned the possible adverse environmental effects, especially air pollution, which could result from a proposed deep-water port at St. Margaret's Bay, N.S.
- 3. A one-man task force consisting of Mr. J.R. Hendricks was appointed to investigate how the CMS might assist the public in changing over to the metric system. The result was a formal recommendation to the AES to consider designing, and making available through Information Canada, a wallet-sized metric conversion card emphasizing meteorological aspects. Another recommendation was that CMS members be encouraged to prepare articles on the subject suitable for submission to newspapers and periodicals immediately after some official announcement dealing with the change-over. The objective should be to assist people to think in terms of the metric system without having to convert back to the old system.

- 4. A suggestion by Mr. J. R. Hendricks resulted in an official addition to the CMS program of awards. It will take the form of citations to be awarded publicly to individuals or groups in Canada who have made some outstanding contribution in helping to alleviate pollution problems or in developing environmental ethics.
- An item on the take-over by the CMS of the Subcommittee on Meteorology and Atmospheric Science (SOMAS) of NRC's Associate Committee on Geodesy and Geophysics was solicited from Dr. B. W. Boville and submitted to <u>Science Forum</u>. The item appeared in the April 1973 issue (Vol. 6 No. 2).
- 6. On 13 December 1972, the <u>Toronto Star</u> carried a column by journalist Alexander Ross in which he described the supposed feats of a woman who claimed that she could dissipate clouds with a concentrated gaze. The column ended up with the statement "There is no doubt she did it". Dr. A.J. Chisholm wrote a letter to Mr. Ross commenting on the energy requirements of cloud dissipation processes, and suggesting a method by which the lady's abilities could be verified. Mr. Ross quoted sections of Dr. Chisholm's letter in his column of 6 February 1973, and the meteorological point of view came across quite well.
- 7. Cooperative action by CMS members in Edmonton and Toronto, including Public Information Committee members A.J. Chisholm and H. P. Wilson, resulted in the naming of Dr. E. P. Lozowski as pro-tem member of the Alberta Department of Agriculture's interim Weather Modification Committee. This Committee had initially been set up with no representation from the meteorological community.
- 8. N. N. Powe has identified the "Ask Andy" syndicated column which originates in California and appears in many Canadian newspapers as being a frequent source of nonsense and scientific misinformation to children - particularly on meteorological subjects. It is proposed to bring this assessment to the attention of Editors of newspapers in Canada which carry the column, and to examine the possibilities of providing suitable alternatives.

To conclude this report, I would like to urge that the National and Centre Executives consider taking advantage of events which could serve as vehicles to bring appropriate information to public attention. A number of these happen every year, and could be planned well in advance. For example:

National Environment Week (second week of October) World Meteorological Day (March) Annual CMS Congress.

I would also like to recommend that the idea of holding a Weathercaster's conference in conjunction with the 8th annual Congress in 1974, already discussed by the National Executive, be actively pursued.

H.B. Kruger, Chairman

Standing Committees Reports / 39

REPORT OF THE STANDING COMMITTEE ON SCIENTIFIC AND PROFESSIONAL MATTERS

After the Society was advised that the National Research Council intended to terminate the Associate Committee on Geodesy and Geophysics (and its subcommittees including SOMAS) in favour of a National Committee for the IUGG and professional society responsibility for national activities, action was taken to merge SOMAS and this Committee. Among actions taken were:

- Correspondence with SCITEC and their Forum on Science Policy (D. B. Kennedy represented CMS) and on their Study on Science and Technology in the supply and Utilization of Energy in Canada.
- 2. Reviewed the A.E.S. proposed regulations, re: Weather Modification activities.
- Reviewed SOMAS recommendations on stratospheric pollution related to SST operations.
- Made recommendations on the upgrading of the Meteorological Library to a centre of excellence in the National Science Library system.
- 5. Agreed to explore cooperation with C. A. P.
- Agreed to accept recommending responsibility for the GARP Scientific Committee.
- 7. Made recommendations for the Alberta Interim Committee on Weather Modification.
- Planned a joint meeting of SOMAS and this Committee at the Halifax Congress.

Dr. B.W. Boville Chairman

ANNUAL REPORTS FROM CENTRES

ALBERTA CENTRE

Executive of the Centre during 1972-73:

Past Chairman	Mr. A.F. Ingall, Arctic Weather
	Central, AES, Edmonton
Chairman	Prof. R. W. Longley, Geography
	Department, (Meteorology Division),
Secretary Treasurer	University of Alberta
	Dr. E.P. Lozowski, Geography
	Department, (Meteorology Division),
	University of Alberta
	Mr. F. Bergwall, Research Council
	of Alberta, Edmonton
Calgary Representative	Mr. W.C. Thompson, Prairie
	Provinces Water Board, Calgary

The Centre has held seven meetings this year with the general theme of applied meteorology. The speakers and topics are listed below:

October 24, 1972	Prof. W.R. Frisken, The Atmospheric Environment of Cities.
November 15, 1972	Mr. J. P. Bruce, The role of the Canada Centre for Inland Waters in the Inter- national Field Year on the Great Lakes.
January 23, 1973	Mr. H. Wilson, A Forgotten Giant of Arctic Science - William Scoresby.
February 21, 1973	Ms. B. Barge, The Meighen Island Ice Cap - a Study in Fog.
March 8, 1973	Dr. P.W. Summers, Can Hail be Suppressed? - Progress to Date.
April 3, 1973	Dr. J. Powell and Mr. E. Stashko, Studies in Forest Climatology and Fire Weather Services in Alberta,
May, 1973	Prof. R.W. Longley, Meteorology in the Junior High Schools.

A number of Alberta Centre members have served the Society and the community at large in a meteorological capacity this year.

Prof. K. D. Hage, Mr. D. B. Fraser and Dr. P. W. Summers were members of the C. M. S. Awards Committee. Mr. H. Wilson served as the local representative on the Public Information Committee. Dr. P. W. Summers serves on the Science Advisory Committee of the Alberta Environment Conservation Authority, and Mr. D. H. Smith is serving with the same body on the Public Advisory Committee. Dr. E. P. Lozowski is acting as a pro-tem member of the Alberta Weather Modification Board.

REGINA CENTRE

The fifth year of the Regina Centre saw a continued steady support from the meteorological community in Saskatchewan. Four meetings were held at the Department of Geography, University of Saskatchewan Regina Campus, while the dinner meeting planned for Friday April 13 provides a new departure for the Centre. We hope that this will become an annual event to wind up the formal program for the year.

On October 11, 1972, Mr. George Robertson discussed some of the recent work at Swift Current on soil moisture variability in cultivated soils. He will also be paying a return visit at the dinner meeting to show slides from his stay in the Philippines.

Dr. William Frisken came to us on October 25, 1972, through the annual lecture tour sponsored by the Canadian Meteorological Society and the Atmospheric Environment Service, and spoke on processes active in the air over cities.

Dr. John Maybank completed the pre-Christmas program on November 30, 1972, when he gave us some insight into the difficulties of farm weather forecasting, drawing on the experience of the Saskatchewan Research Council in this field.

It was not until March 1, 1973 that we received a speaker from Regina, Mr. Syd Buckler, who described a project carried out during the summer of 1972 to estimate evaporation from Lake Diefenbaker, and which cast a little light on trout behaviour in the reservoir.

The Centre's officers for 1973-74 will probably be elected at the April 13 meeting. The current executive is:

Chairman

Secretary-Treasurer

Mr. Don Bernachi, Saskatoon Weather Office

Public Information Representative Prof. Alec Paul, Dept. of Geography, University of Sask. Regina Campus Mr. John Hendricks, Regina Weather Office

TORONTO CENTRE

The Toronto Centre had an active year with six meetings held before April and three more planned to complete the year. The attendance at meetings varied from about 30 up to more than 50. The support of those who attended was much appreciated by the speakers and the Centre executive. It is somewhat disappointing that more members of the Toronto Centre do not attend the meetings.

The first meeting of the year was held in late September with Prof. M. de Quervain, Swiss Federal Institute for Snow and Avalanche Research, speaking on "Weather and Avalanches". He discussed the effects of weather on avalanches and efforts being made to predict and control their occurrence.

Dr. Steven Hanna of NOAA's Atmospheric Turbulence and Diffusion Laboratory spoke on "Air pollution modelling on a regional scale" at our second meeting. He showed that a simple pollution model could give results as good as much more sophisticated ones.

"Applied meteorological services available to business, industry and research" was the topic of J.L. Wright, Superintendent of the Scientific Support Unit, Pacific Region. The wide variety of activities of the unit, the first in AES, were described.

The AES tour speaker, Prof. W. Frisken of York University, was the Centre's December speaker. His topic was the "Atmospheric Environment of Cities" and covered a wide range of topics on the environment in which many of us live.

The first speaker in 1973 was D.N. McMullen of the Ontario Ministry of Natural Resources. Mr. McMullen, a Past-President of the Society gave a well illustrated talk on his "Hydrometeorological Studies in Kabul, Afghanistan".

Prof. C.R. Phillips of the University of Toronto spoke on atmospheric chemistry at the next meeting. He discussed his group's aerometric pollution studies and postulated on the sources of the pollution. He also outlined some work on the rates of chemical reactions in the atmosphere.

Dr. B. W. Boville, of AES will speak on the "Stratospheric circulation and some implications of SST flights" and Prof. A. B. Fraser of Pennsylvania State University will give a talk entitled "The Mirage, The Green Flash, and Theological Optics" to round out our regular evening meeting schedule. The annual Toronto Centre dinner meeting will be held at the Ontario Science Centre. The guest speaker will be Prof. F.K. Hare of the University of Toronto and D. O. E. His topic will be "Air and Water".

Mainly through the efforts of Mike Newark, the Toronto Centre has accepted responsibility for the development of a meteorological reference book suitable for senior high school students.

The 1972-73 executive were:

Chairman Program Chairman Secretary Treasurer Dr. G. A. McBean Dr. R. W. Shaw M. Newark Dr. A. J. Chisholm

OTTAWA CENTRE

Officers of the Ottawa Centre in 1972-73 were:

Chairman	Mr. H.J. Wilson
	Air Pollution Control Directorate, DOE
Vice Chairman	Mr. C.J. Stead
	Directorate of Meteorology and
	Oceanography
	Canadian Forces Weather Service
Secretary-Treasurer	Mr. A. P. Beaton
and the second second	Ice Central, AES

The Ottawa Centre had a moderately active winter season during 1972-73. Three meetings were held, all on campus at Carleton University.

On November 8, 1972, LCOL E. M. Lenton, Director of Air Regulations and Traffic Services, Canadian Forces Headquarters, addressed the Centre on "Air Traffic Control Operations and Meteorology".

Professor W. Frisken, Associate Professor of Physics, York University was the guest of the Centre on December 6, 1972, and spoke on the subject of "The Atmospheric Environment of Cities". His interesting lecture discussed the modification of the city's meteorology and climate, and also dealt with the dispersion of atmospheric pollutants.

On April 3, 1972, the Centre was particularly fortunate to have Dr. F. K. Hare as its speaker. Dr. Hare spoke about the current trend in meteorological research being away from services to forecasting towards emphasis on ecosystems, air-sea and ice-air interactions, as well as pollution processes.

Attendance continues to remain relatively light at the Ottawa Centre meetings, presumably because of conflicting commitments of the membership.

CENTRE DE QUEBEC

La neuvième assemblée générale du 2 mai 1973 couronnera également la quatrième année de la Société de Météorologie de Québec en tant que Centre de Québec de la Société météorologique du Canada. Voici en résumé, le rapport des activités que ont eu lieu au cours de ce dernier exercice.

Le Conseil d'administration a tenu quatre réunions au cours desquelles ont abouti certaines réalisations dont voici les principales:

- a) A la demande de la Société météorologique du Canada, traduction de sa constitution en français.
- b) M. Michel Ferland est nommé responsable à la surveillance de la presse écrite et parlée auprès de la Société météorologique du Canada.
- c) La proposition d'un nouveau sigle par Gaétan Soucy à la Société météorologique du Canada a été favorablement accueillie.
- d) La Société de météorologie de Québec exerce présentement certaines pressions auprès de l'Université Laval afin de promouvoir l'implantation d'un cours de météo-physique par cette institution.

Dans l'ensemble au cours de cet exercice 1972-73, on a pu noter une plus étroite collaboration entre la Société météorologique du Canada et le Centre de Québec.

Cette année, six réunions d'information publique ont été presentées, dont voici les conférenciers et les sujets, dans l'ordre chronologique:

14 novembre 1972:	M. André Bentz
	"Evaporométrie dans la région de Québec".
29 novembre 1972:	Dr. W.R. Frisken
	"L'environnement atmosphérique des villes".
19 décembre 1972:	M. Jos Tremblay
	"Hydrogéologie et météorologie en Tunisie".
11 janvier 1973:	Mr. J.R.H. Noble
	"International Aspects of Meteorology",
13 février 1973:	M. Roy Lee
	"Sur la nature des concepts météorologiques".
13 mars 1973:	Dr. Ben Garnier
	"La variation topographique du rayonnement solaire et
	le bilan radiatif résultant".

Toutes ces réunions d'information ont été tenues au Département des sols de l'Université Laval et nous tenons à remercier le docteur Lawrence O'Grady pour avoir mis un local à notre disposition.

Notre société va toujours grandissante et cette année, pour l'exercice qui prend fin, ses registres comptent 61 membres-cotisants, soit le plus grand nombre depuis sa fondation en 1964. Le Conseil sortant se composait comme suit:

Président	Raymond-M. Gagnon
Vice-président	André Hufty
Secrétaire-trésorier	Gaétan Soucy
Conseillers	Robert Boudreault
	Michel Ferland
	Antoine Hone

Léandre Leblanc Guy Lemelin

HALIFAX CENTRE

On October 11th, 1972, Mr. Barry Greer presented a paper on "The Prediction of Onshore Snowfall in Nova Scotia using Eigenvectors and Multiple Linear Regression" (Greer and Anderson). At the same meeting, Miss N.B. Waller was appointed Chairman of Local Arrangements for the Seventh Annual Congress.

Dr. W.R. Frisken presented a lecture on "The Environment and the City" on November 8th, 1972. Dr. Frisken's talk was part of the Annual Lecture Tour to Local Centres. In Halifax, the meeting was jointly sponsored by the CMS, AES and the School of Architecture, Nova Scotia Technical College.

December 14th, 1972 saw the election of the following new officers: Miss N. B. Waller, Chairman; Mr. J. B. Elliott, Vice-Chairman; Mr. A. D. Gates, Treasurer; and Mr. R. F. Hopkinson, Secretary. Mr. Hornstein, Program Chairman, reviewed the current plans and preparations for the Seventh Annual Congress. Mr. E. W. Brandon spoke on the development of the FRS numerical prog update model for local use.

The first meeting in 1973 was held on March 6th, at which time Mr. J. Dublin spoke on some aspects of hail suppression, particularly as they related to the Alberta Hail Studies Program.

A request for representation on the Local Executive was received from the members at CFB Greenwood. It was suggested that the representative could strengthen communications between the members in Halifax and those at smaller centres in the Maritimes. Mr. J. E. Donegani will represent Greenwood and Mr. W. L. Ranahan, Summerside. Also under consideration is the possibility of holding one meeting a year at both Greenwood and Summerside.

Local activities are currently overshadowed by planning for the Congress. We hope the Congress will help to stimulate more meteorologists in the Halifax region to acquire membership in the CMS.

MEMBERSHIP APPLICATION FORM

(Please write in Block Letters)

General	SURNAME
or Student	GIVEN NAMES
Member	PERMANENT ADDRESS

TITLE, RANK, DECORATIONS, DEGREES OR PROFESSIONAL

QUALIFICATIONS

OCCUPATION

(for record purposes only; if student, indicate university and year studies will be completed)

Sustaining NAME OR AGENCY Member BUSINESS ADDRESS

Membership Status Required

Please enroll me as a member of the Canadian Meteoroloical Society effective January 1, 19, to receive all publications issued by the Society from that date. I attach a cheque for \$ payable to the Canadian Meteorological Society.

Signature of Applicant

Mail completed application forms to: Corresponding Secretary Canadian Meteorological Society P.O. Box 41, Willowdale, Ontario M2N 5S7. CMS dues for 1973: General Member \$15.00 Student Member \$ 5.00 Sustaining Member \$50.00 (min.)

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. At nine local centres of the Society, meetings are held on subjects of meteorological interest. Atmosphere as the official publication of the CMS is distributed free to all members. Each spring an annual congress is convened to serve as the National Meteorological Congress.

Correspondence regarding Society affairs should be directed to the Corresponding Secretary, Canadian Meteorological Society, P.O. Box 41, Willowdale, Ontario M2N 557.

There are three types of membership – Member, Student Member and Sustaining Member. For 1973 the dues are \$15.00, \$5.00 and \$50.00 (min.), respectively. The annual Institutional subscription rate for *Atmosphere* is \$10.00.

Correspondence relating to CMS membership or to institutional subscriptions should be directed to the University of Toronto Press, Journals Department, Front Campus, Toronto, Ontario, Canada M5S 1A6. Cheques should be made payable to the University of Toronto Press.

La Société météorologique du Canada a été fondée le 1er janvier 1967, en remplacement de la Division canadienne de la Société royale de météorologie, établie en 1940. Cette société existe pour le progrès de la météorologie et toute personne ou organisation qui s'intéresse à la météorologie peut en faire partie. Aux neuf centres locaux de la Société, on peut y faire des conférences sur divers sujets d'intérêt météorologique. Aimosphère, la revue officielle de la sMC, est distribuée gratuitement à tous les membres. À chaque printemps, la Société organise un congrès qui sert de Congrès national de météorologie.

Toute correspondance concernant les activités de la Société devrait être adressée au Secrétaire-correspondant, Société météorologique du Canada, C.P. 41, Willowdale, Ontario, M2N 587.

Il y a trois types de membres: Membre, Membre-étudiant, et Membre de soutien. La cotisation est, pour 1973, de \$15.00, \$5.00 et \$50.00 (min.) respectivement. Les Institutions peuvent souscrire à *Atmosphère* au coût de \$10.00 par année.

La correspondance concernant les souscriptions au SMC ou les souscriptions des institutions doit être envoyée aux Presses de l'Université de Toronto, Département des périodiques, Campus Front, Toronto, Ontario, Canada, M5S 1A6. Les chèques doivent être payables aux Presses de l'Université de Toronto.

Council/Conseil de Administration: 1972-73

President/Président

Vice-President/Vice-Président

Past President/President sortant

Corresponding Secretary/ Secrétaire-correspondant

Treasurer/Trésorier

Recording Secretary/ Secrétaire d'assemblée

Editorial Committee/ Comité de rédaction E.J. Truhlar, Editor-in-Chief/ Rédacteur-en-Chef J.A.W. McCulloch R.E. Munn

Editorial Staff/Equipe de rédaction

Sustaining Member/Membre de soutien

-G.A. McKay

- -W.F. Hitschfeld
- -C.M. Penner
- -G.A. McPherson
- M.S. Webb
- C.B. Adamson

ATMOSPHERE

Associate Editors/Rédacteurs associés

B.W. Boville C. East K.D. Hage J.V. Iribarne G.A. McPherson J.G. Potter V.R. Turner

- N. MacPhail - A.W. Smith - J. Rogalsky, Advertising/Publicité

- Air Canada

Councillors-at-large/ Conseillers

S.J. Buckler J.F. Derome L.E. Parent Chairmen of Local Centres/ Présidents des centres