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Environment Canada
Atmospheric Environment Service

Environnement Canada
Service de l'environnement atmosphérique

ATMOSPHERIC ENVIRONMENT SERVICE

PROGRAM DIGEST

1980 - 1981

AES MANAGEMENT SERIES

PROGRAM DIGEST 1980-81

Atmospheric Environment Service

Department of the Environment

August 1980

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Introduction

The last of a series of AFS Budget Digests was prepared for fiscal year 1978/79 These Budget Digests were intended to present a concise overview of the AES by organization and budget In 1979/80, steps were taken to make the Program Activity Structure (PAS) the basis for most of the planning and budgeting in AFS One of the results of this change was that no Budget Digest was produced that year For 1980/81, the PAS was revised and budgets were prepared by PAS level for the first time (The current PAS is displayed in Appendix A.)

There is now sufficient information to prepare another overview of AFS displaying, this time, not only the organization and the budget but also the programs. The name of the document was changed to Program Digest to reflect this change in emphasis.

The Program Digest presents a view of AFS emphasing programs and budgets It displays the distribution of dollars and PY's by the top two levels of the PAS It is anticipated that the display of resources will be at the Activity Flement level next year

AES Responsibilities

The federal responsibility tor meteorology is discharged by the Atmospheric Environment Service of the Department of the Environment. Organization of the Meteorological Service of Canada commenced in May, 1871 and the new service became part of the Department of Marine and Fisheries. In 1936, it became the Meteorological Division (later the Meteorological Branch) of the new Department of Transport The Department of Transport retained the responsibility for meteorological services until the Department of Environment and the Atmospheric Environment Service were formed as a result of the Government Organization Act 1970 and PCO 1970-2047 Subsequently, the Government Reorganization Act of 1979 stated that

"The duties, powers and functions of the Minister of the Fnvironment extend to and include

(a) all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada relating to

(i) the preservation and enhancement of the quality of the natural environment, including water, air, and soil quality,

(ii) renewable resources,

(iii) water,

(iv) meteorology,

(v) -------- "

In addition, the Act directed that

"The Minister of the Fnvironment . shall", among other things, "initiate, recommend and undertake programs, and co-ordinate programs of the Government of Canada, that are designed

(i) to promote the establishment or adoption of . standards relating to environmental quality" and "to provide to Canadians environmental information in the public interest "

Though meteorological services are recognized as being the Federal Government's responsibility, in some specific areas AES shares the responsibility with the provinces or is involved in co-operative international programs. In addition, AFS is jointly responsible with other Services of the Department for such programs as the Long Range Transport of Airborne Pollutants

AES Objectives

AES objectives reflect both long standing and newly-assigned responsibilities compatible with Environment Canada's objectives. They are:

1 To contribute through the full application of meteorological and other environmental services, to

a) the safety and security of life and property,

b) the improvement of the national economy,

c) the enhancement of the environment, and

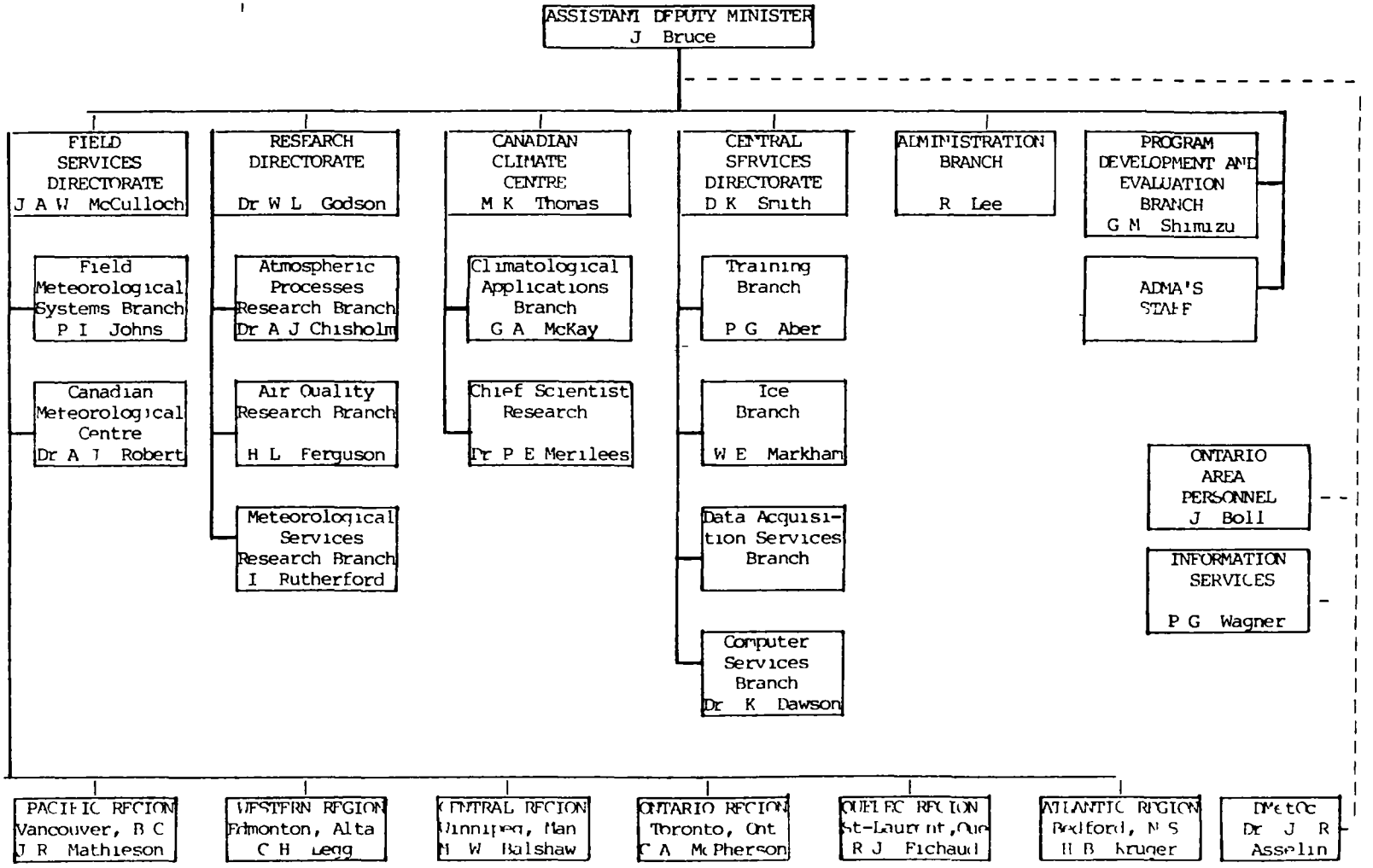
d) the raising of the quality of life of Canadians.

2 To advance knowledge and understanding of the nature and behaviour of the atmosphere, atmospheric constituents, and atmosphere/water and atmosphere/land interface relationships, in areas which will contribute to the long-term improvement of national, social, environmental and economic conditions.

3. To promote Canada's meteorological and other environmental interests in their international dimensions and the science and practice of meteorology within Canada

In addition, while working towards these objectives, the AES must respond to the general objectives of the federal government and the Department, and must promote public awareness of meteorology, other environmental disciplines and the AES.

AES ORGANIZATION CHART JULY 1980



ALS PROGRAM COMPONENTS

AES Program Components

The Department of Environment has three Main Estimates Programs Administration, Environmental Services and Parks Canada. The Environmental Services Program is divided into four Activities - Environmental Protection Service, Environmental Conservation Service, Canadian Forestry Service and Atmospheric Environment Service. The AES, in turn, is broken down into five Sub-Activities, or Program Components, which are as follows:

Weather and Sea State Services
Climate Services
Ice Services
Meteorological Research and Development and Air Quality
Management and Common Support Services

The five program components do not correspond to the organizational components. The Administration Branch is included in the Management and Common Support, the Canadian Climate Centre is in Climate Services and the Research Directorate is in Meteorological Research and Development and Air Quality. However, though most of the Field Services Directorate is within Weather and Sea State Services, portions of the Regional Scientific Services Units lie within the Climate Services Component. Similarly, the Central Services Directorate, as it supports all the other AES programs, is split between Management and Common Support, Weather and Sea State and Ice Services.

Program Component WEATHER ~~AND SEA STATE~~ SERVICES (1681 PY and $75,231.2 K)

Objective

To provide present and predicted weather and marine data and advice for the safety of Canadians, the security of their property, the support of economic activities and the protection of the environmental quality in Canada, and to acquire the basic understanding of atmospheric properties and behaviour needed to maintain and enhance such services

Description

This sub-activity encompasses the major operational component of the AES, and revolves around the commitment to provide, on a 24-hour basis, year-round real-time information services on current and predicted weather for all areas of Canada Weather Services includes

- a national data-acquisition and processing system, for both atmospheric parameters and sea- and ice-state conditions,

- providing weather and sea state forecasts, advisories and warnings for all Canada (including our adjacent waters) for the public as well as for aviation, marine, transportation, agriculture, tourism, utilities, and other interests,

- providing consultation and advice on the use of weather, climatological, and sea-ice data and information,

- interpreting and evaluating weather, sea-state information for specialized user needs,

- processing weather and sea data by computer and other electronic means,

- providing weather and sea services to Canadian Forces operating both in Canada and abroad, according to Memorandums of Understanding between the Departments of the Environment and National Defence

Data Acquisition and Processing

Surface weather observations are provided by a network of about 300 principal weather stations and supplemented by voluntary observing programs undertaken by over 200 ships operating on the Great Lakes and the Atlantic, Pacific and Arctic Oceans (see Appendix D) Weather reports are obtained from 37 automatic reporting stations An upper air

Program Component WEATHER AND SEA STATE SERVICES (Cont'd)

Data Acquisition and Processing

network of 34 stations, including Ship PAPA provides temperatures, pressures, relative humidities and wind velocities in the free atmosphere to heights of 35,000 metres Both surface and upper air observations are taken at regular intervals and made available in real-time for weather analysis and advisory purposes

A network of 231 synoptic weather stations and 2344 climatological stations provides information to define the Canadian climate, and to make a data source available for meteorological applications and climatological services work Some of the climatological stations are jointly operated through agreements with some of the provinces

In addition, special networks provide additional information to support operations and research A weather radar network, with units strategically located at 11 sites across Canada, provides information on the presence and movement of severe storms and precipitation areas Satellite readout stations at three locations provide pictorial data on North American weather systems which are distributed to operational offices

Many of the weather stations carry out special observational programs such as seasonal freeze-up and break-up of water bodies, evaporation, sunshine, and total ozone Five weather stations take seismic observations for the Department of Energy, Mines and Resources Air quality measurements are being carried out at 56 locations, and monitoring for atmospheric radioactivity is done at 25 stations for the Department of National Health and Welfare

The development, design and establishment of standards and procedures for the meteorological data acquisition systems are evaluated against international, national, and provincial requirements for data and the availability of instruments and equipment

Forecast Services

AES Forecast Services provides weather and service forecasts and advisories across Canada and adjacent waters Advanced computer techniques and sophisticated mathematical models of the atmosphere are used at the Canadian Meteorological Centre (CMC) in Montreal to generate prognoses of meteorological conditions on a synoptic scale for periods of up to 48 hours in advance, these products are a major support for all other forecast offices in the AES network. Other computers are used for special needs, such as ice movement, growth and decay.

Seven weather centres located at Vancouver, Edmonton (Arctic and Alberta), Winnipeg, Toronto, Montreal and Halifax are concerned with a more detailed study of meteorological factors in their own areas of responsibility They provide guidance information for forecast production and weather forecasts for their designated areas of responsibility. Operational development activities are carried out at these centres Two weather offices, located at Whitehorse and Gander, also provide weather forecasts

Weather forecasts, advisory and information services are provided for the general public, marine interests, aviation, agriculture, forestry and other specialized users through sixty-six weather presentation offices (see Appendix D) The services provided vary depending on the needs of the users For example, surface wind and visibility are emphasized in marine forecasts while weather conditions at airports, significant en route weather and winds and temperatures at flight levels are emphasized in the aviation weather forecasts Both marine and aviation forecasts are exchanged internationally Weather forecasts for other users such as agriculture and forestry interests serve activities such as frost prevention, crop spraying and forest fire control In addition, support is provided for air quality services and environmental assessment programs through the Presentation Offices and the Scientific Services Units.

Warnings of hazardous weather conditions are important services in the AES program They are issued, as appropriate, for the general public and for marine and other interests.

Program Component CLIMATE SERVICES (184 PY and $5,512.9 K)

Objectives

1 To provide the climate data and advice required to assist in meeting Canadian social, economic and environmental objectives

2 To increase and enhance the utility and actual application of climate knowledge in support of Canadian social, economic and environmental objectives

3 To improve the knowledge and understanding of the climate as a physical system interacting with ecosystems so as to develop the ability to anticipate and react to climate changes both natural and man made.

4 To monitor the climate system so as to provide timely advice on its present state and probable projections of its evolution on monthly seasonal and annual time scales

5 To be the Canadian focus for the scientific, organizational and educational activities related to Climate

6 To promote Canada's international climate interests

Description

The Climate Services Program consists of all activities of the Canadian Climate Centre, some activities of the Atmospheric Research and Central Services Directorates at Downsview, and specific services provided by the Regional Scientific Services Divisions. The CCC provides a central focal point for, and plays a leading role in, integrating all climate related activities in Canada. A national Canadian Climate Program is being developed that will allow for liaison and cooperation amongst DOE services, other federal government departments and with provincial governments in the provision of climate and climate related services

A Research wing is responsible for determining the extent to which climate can be predicted, the extent of mans' impact on climate, and for developing an understanding of cause and effect relationships within the climate system The Applications divisions provide expertise on the analysis and interpretation of climate data and on the understanding of man/climate interactions, apply meteorological data and theory to hydrological and marine problems, and conduct research in the field of hydrometeorology Most services in applied climatology are suplied in the Regions with the CCC acting as back up for complex, national or subject specific projects The CCC provides climate data, information and guidance along with applications services and consultations to federal government departments, to national private sector organizations, to AES regions and on referral to the general public. Finally the Centre is responsible for data management which consists of documentation, quality control and archiving of Canadian climate data

A Canadian Climate Program is being developed in conjunction with a World Climate Program Major activities fall into data, applications, impact studies, and research components. These components will be increasingly used in the planning and operation of the Climate Services Program

Program Component ICE SERVICES (49PY and $9,028.0 K)

Objective

To provide ice data and advice for the safety of Canadians, the security of their property, the support of economic activities and the protection of the environmental quality in Canada.

Description

This sub-activity includes developing and maintaining acquisition systems for ice data, provision of predictions on the formation, growth, movement and nature of ice in Canadian and adjacent waters for periods of up to one year in advance, and consultation and advice on ice data to the Canadian public and specialized users such as energy exploration and marine and fisheries interests over the 200-mile economic zone

Ice Observations

Ice observation programs are conducted from aircraft, ship and shore stations in support of shipping in the ice congested waters of Canada during the appropriate seasons Aerial ice reconnaissance is carried out every month of the year in one or more areas of the Eastern Canadian Seaboard, Canadian Inland Waterways, Hudson Bay, Hudson Strait and Canadian Arctic Waters Satellite observations are being integrated into the data acquisition system.

Ice Forecasts

From the Ice Forecast Centre in Ottawa, forecasts of the extent and characteristics of ice in the form of short-range tactical forecasts and longer-range strategic forecasts are provided for the lower St Lawrence River, Gulf of St Lawrence, coastal waters of Newfoundland and Labrador, Hudson Bay and its approaches, and the waters of the Canadian Arctic, including the Beaufort Sea

Ice Climatology

The need for ice climatology and its application to Arctic development and winter time industrial development along Canada's east coast is growing Ice climatological services are being provided and the supporting data base is being expanded

Program Component ~~METEOROLOGICAL RESEARCH AND DEVELOPMENT AND AIR QUALITY (158 PY and 6,805 0 K)~~ Air Quality Services and Research

Objectives

1. To advance knowledge and understanding of the nature and behaviour of the atmosphere and its constituents and their interactions with man, his activities and other components of the natural environment.

2 To provide information and predictions of air quality conditions for areas of Canada and adjacent waters.

3 To develop, operate, and maintain systems for acquiring data on the quality of the atmospheric environment and on the deposition from the atmosphere of contaminants, in Canada and adjacent areas

Description

The nature of the AES responsibilities, and specifically because of accelerating advances in science, technology, and automation, makes it imperative that AES have a research and development capability to advance the quality of its service. This capability includes

- theoretical and applied research to improve ~~weather, climate, and sea-ice forecasting, as well as to improve~~ our understanding of meteorological processes, atmospheric physics and chemistry, and climate forecasting;
- research on the long-range transport of air pollutants, including the cause-effect relationship between pollutants and receptors; on the impact of man's activities on the atmosphere, the air/land and air/water interface, on uptake by land, sea (water) and air of man-made and natural environmental pollutants
- research on air quality, development of air quality criteria and national ambient air quality standards
- research, development, and implementation of meteorological instrumentation not only to improve the quality and quantity of meteorological and related data, but also as a means to improve our understanding of the basic processes of meteorological physics

An Inter-Service program to study long-range transport of air pollution is now in operation. The AES, as lead agency, is co-ordinating activities with the Services, with other agencies, and with studies in the United States.

A satellite data laboratory is maintained to develop and implement techniques for the reception, analysis and utilization of data transmitted by environmental satellites, owned by the National Oceanic and Atmospheric

Program Component METEOROLOGICAL RESEARCH AND DEVELOPMENT AND AIR QUALITY (Cont'd)

Administration (NOAA) in the United States. The laboratory also is integrated with real-time forecast operations as required. In addition, there is an aeronautical meteorological facility whose program concerns the meteorological aspects of improved safety and efficiency for aviation.

The computer facilities in the Research Directorate are served by a terminal to the Control Data CYBER in Montreal as well as a number of local Hewlett-Packard mini-computers

Program Component MANAGEMENT AND COMMON SUPPORT (261 PY and $16,349.2 K)

Objectives

1 To set overall goals and objectives for the AES

2 To provide continuous policy guidance and leadership for the Service.

3 To ensure that the Service attains its goals and objectives in an effective and efficient manner

4 To provide common administrative support to the Atmospheric Environment Service in the areas of general administration including finance, library services, materiel management, and official languages

5 To co-ordinate participation in international programs in accordance with Canada's commitment to the World Meteorological Organization and as a contribution to the development of the scientific and technological base required to support the AES mandate

6 To promote and foster the science and public awareness of meteorology and other environmental disciplines in Canada in

(a) supporting organizations concerned with the advancement of meteorology and other environmental disciplines,

(b) supporting meteorological and other environmental research in Canadian universities;

(c) encouraging the development of meteorological and other environmental services in the private sector within Canada

Description

This sub-activity includes those common services which support AES in the areas of administration, personnel, facilities, library, computer services, and material and financial management. Also included is

- the management function related to the development and maintenance of overall goals and objectives for the AES, policies, and program development and evaluation

- the training of professional and technical staff

- information services

- participation in international meteorological affairs

APPENDIX A

1980-81 Budget by

Sub-Activity and Sub-Sub Activity

Atmospheric Environment Service
1980-81 Budget by Sub-Activity and Sub-Sub Activity
(Nearest $000)

Sub-Sub-Activity	PY	Capital	O&M	TOTAL
MANAGEMENT AND COMMON SUPPORT				
101 Management	35	1,104.7	2,898.3	$4,003.0
115 Common Support Services	129	330.0	7,441.1	$7,771 1
145 Information Services	12		940.3	$940 3
160 Extramural Support	2		1,035 8	$1,035.8
170 Meteorological Training	83	6 0	2,593.0	$2,599 0
100 TOTAL (SA-1)	261	1,440 7	14,908 5	$16,349.2
WEATHER AND SEA STATE SERVICES				
210 Data Acquisition	599 5	5,762.8	30,120.5	$35,883 3
270 Forecast Production	362	183 2	11,060 2	$11,243 4
300 Provision of Services	474 5	10 1	9,887.2	$9,897.3
320 Communications and Computers	61	112 0	9,229 2	$9,341 2
350 Weather and Sea State Services - General	83	218 9	4,449 1	$4,668 0
360 Special Services to D D	101		4,198 0	$4,198 0
200 TOTAL (SA-1)	1,681	6,287.0	68,944 2	$75,231 2
CLIMATIC SERVICES				
410 Data Acquisition - Climate		2 7	132 2	$134 9
420 Provision of Services	146	60 0	4,084 8	$4,144 8
440 Research & Development	20		504 0	$504 0
450 Climate Services - General	18	52.0	677.2	$729 2
400 TOTAL (SA-1)	184	114.7	5,398 2	$5,512 9
ICE SERVICES				
510 Data Acquisition	28	14.0	8,466 7	$8,480 7
520 Forecast Production	14		372.5	$372 5
530 Ice Services - General	7		174.8	$174 8
500 TOTAL (SA-1)	49	14.0	9,014.0	$9,028 0
METEOROLOGICAL RESEARCH AND DEVELOPMENT AND AIR QUALITY				
610 Meteorological Research	88	405.6	3,794.5	$4,200 1
640 Air Quality Research	58	148 0	2,011 7	$2,159 7
660 Research and Development - General	12	11.0	434.2	$445.2
600 TOTAL (SA-1)	158	564.6	6,240.4	$6,805.0
GRAND TOTAL	2,333	8,421.0	104,505.3	$112,926.3

Atmospheric Environment Service
1980-81 Budget by Sub-Activity and Sub-Sub Activity
(Nearest $000)

AES Headquarters

Directorate	AES HQ (TOTAL)			ADMA			FSD HQ (incl. CMC)			CSD		
Sub-Sub-Activity	PY	Capital	O&M	PY	Capital	O&M	PY	Capital	O&M	PY	Capital	O&M
MGMT & COMMON SUPPORT												
101 Management	23	1,103 2	1,530 3	15		636.2	3	600 0	306 8	3	503 2	491 3
115 Common Support Svs	129	330 0	7,441 1							57		1,775.2
145 Information Svs	12		940 3									
160 Extramural Support	2		1,035 8	2		52 5						
170 Met. Training	83	6.0	2,593 0							71	6 0	1,900 9
100 TOTAL (SA-1)	249	1,439.2	13,540 5	17		688 7	3	600 0	306 8	131	509 2	4,167 4
WX & SEA STATE SERVICES												
210 Data Acquisition	123	5,580.0	3,751 8				17	5,580 0	731 8	107		3,020 0
270 Forecast Production	65	179 2	1,882 1				65		1,882 1		179 2	
300 Provision of Services	8		385 3				8		385 3			
320 Commun & Computers	61	112 0	6,857.4				61	112 0	6,857 4			
350 Wx & Sea St Svs-Gen	27	12 0	637 9				24	12 0	540 2	3		97 7
360 Special Svs to DND												
200 TOTAL (SA-1)	284	5,883 2	13,514 5				175	5,704 0	10,396 8	110	179 2	3,117 7
CLIMATE SERVICES												
410 Data Acquisition												
420 Provision of Svs	92	60 0	2,785 0									
440 Research & Development	20		504.0									
450 Climate Svs - Gen	7	50.0	391 1									
400 TOTAL (SA-1)	119	110.0	3,680 1									
ICE SERVICES												
510 Data Acquisition	28	14 0	8,466 7							28	14 0	8,466 7
520 Forecast Production	14		372 5							14		372 5
530 Ice Services - Gen	7		174 8							7		174 8
500 TOTAL (SA-1)	49	14.0	9,014 0							49	14 0	9,014.0
MET R & D AND AIR QUALITY												
610 Met Research	88	405 6	3,794 5									
640 Air Quality Res	58	148 0	2,011 7									
660 R & D - General	12	11 0	434.2								2 6	32 3
600 TOTAL (SA-1)	158	564.6	6,240.4								2 6	32 3
GRAND TOTAL	859	8,011.0	45,989.5	17		688 7	178	6,304 0	10,703 6	290	705.0	16,331 4

Continued

Atmospheric Environment Service
1980-81 Budget by Sub-Activity and Sub-Sub Activity
(Nearest $000)

AES Headquarters (continued)

Directorate	ARD			CCC			AAB		
Sub-Sub-Activity	PY	Capital	O&M	PY	Capital	O&M	PY	Capital	O&M
MGMT & COMMON SUPPORT									
101 Management	2		76 5						
115 Common Support Svs							72	330.0	5,685.4
145 Information Svs							12		940 3
160 Extramural Support			77.0						906 3
170 Met. Training			54.1				12		638.0
100 TOTAL (SA-1)	2		207.6				96	330 0	8,170.0
WX & SEA STATE SERVICES									
210 Data Acquisition									
270 Forecast Production									
300 Provision of Services									
320 Commun & Computers									
350 Wx & Sea St Svs-Gen									
360 Special Svs to DND									
200 TOTAL (SA-1)									
CLIMATE SERVICES									
410 Data Acquisition									
420 Provision of Svs				91	60 0	2,785.0			
440 Research & Development				20		504.0			
450 Climate Svs - Gen.				7	50.0	391 1			
400 TOTAL (SA-1)				119	110.0	3,680.1			
ICE SERVICES									
510 Data Acquisition									
520 Forecast Production									
530 Ice Services - Gen									
500 TOTAL (SA-1)									
MET. R & D AND AIR QUALITY									
610 Met. Research	88	405.6	3,794.5						
640 Air Quality Res	58	148.0	2,011.7						
660 R & D - General	11	8.4	401.9						
600 TOTAL (SA-1)	157	562.0	6,208.1						
GRAND TOTAL	159	562.0	6,415.7	119	110.0	3,680 1	96	330.0	8,170.0

Atmospheric Environment Service
1980-81 Budget by Sub-Activity and Sub-Sub Activity
(Nearest $000)

AES Regions (Including CFWS)

Directorate / Sub-Sub-Activity	AES REGIONS (TOTAL)			ATLANTIC			QUEBEC			ONTARIO		
	PY	Capital	O&M	PY	Capital	O&M	PY	Capital	O&M	PY	Capital	O&M
MGMT & COMMON SUPPORT												
101 Management	12	1 5	1,368 0	2		60.1	2		199 9	2	1 5	60 6
115 Common Support Svs												
145 Information Svs												
160 Extramural Support												
170 Met. Training												
100 TOTAL (SA-1)	12	1 5	1,368 0	2		60 1	2		199 9	2	1 5	60 6
WX & SEA STATE SERVICES												
210 Data Acquisition	476 5	182 8	26,368 7	52 5		2,202 8	78	70 0	3,771 0	34	24 8	1,132 2
270 Forecast Production	297	4 0	9,178 1	58		1,644 0	54		1,432 0	27	4 0	915 2
300 Provision of Services	466 5	10 1	9,501 9	102 5		1,780 7	59		1,482 9	94	3 0	1,853 0
320 Commun & Computers			2,371 8			723 1			380 5			294 9
350 Wx & Sea St Svs-Gen	56	206 9	3,811 2	8	70 0	383 1	10		460 0	6		287 7
360 Special Svs to DND	101		4,198 0									
200 TOTAL (SA-1)	1,397	403 8	55,429 7	221	70 0	6,733 7	201	70 0	7,526 4	161	31 8	4,483 0
CLIMATE SERVICES												
410 Data Acquisition		2 7	132 2			25 2			28 6		2 7	29 4
420 Provision of Svs	54		1,299 8	11		322 2	4		113 8	9		203 4
440 Research & Development												
450 Climate Svs - Gen	11	2.0	286 1	2		54 1	1		37 2	2	2 0	53 7
400 TOTAL (SA-1)	65	4 7	1,718 1	13		401 5	5		179 6	11	4 7	286 5
ICE SERVICES												
510 Data Acquisition												
520 Forecast Production												
530 Ice Services - Gen												
500 TOTAL (SA-1)												
MET R & D AND AIR QUALITY												
610 Met Research												
640 Air Quality Res												
660 R & D - General												
600 TOTAL (SA-1)												
GRAND TOTAL	1,474	410 0	58,515 8	236	70.0	7,195 3	208	70 0	7,905 9	174	38.0	4,830 1

Continued

Atmospheric Environment Service
1980-81 Budget by Sub-Activity and Sub-Sub Activity
(Nearest $000)

AES Regions (Including CFWS) (continued)

Directorate / Sub-Sub-Activity	CENTRAL PY	CENTRAL Capital	CENTRAL O&M	WESTERN PY	WESTERN Capital	WESTERN O&M	PACIFIC PY	PACIFIC Capital	PACIFIC O&M	CFWS PY	CFWS Capital	CFWS O&M
MGMT & COMMON SUPPORT												
101 Management	2		59 4	2		931 9	2		56.1			
115 Common Support Svs												
145 Information Svs												
160 Extramural Support												
170 Met. Training												
100 TOTAL (SA-1)	2		59 4	2		931.9	2		56 1			
WX & SEA STATE SERVICES												
210 Data Acquisition	137		6,953 9	100	62 0	3,724.8	75	26 0	8,584 0			
270 Forecast Production	49		1,481 6	76		2,442 0	33		1,263 3			
300 Provision of Services	62		1,322 1	85	7 1	1,806 9	64		1,256 3			
320 Commun. & Computers			416.0			313.2			244 1			
350 Wx & Sea St Svs-Gen	13	95.0	1,543 0	10	20 9	733 4	9	21 0	404 0			
360 Special Svs to DND										101		4,198.0
200 TOTAL (SA-1)	261	95.0	11,716.6	271	90 0	9,020 3	181	47 0	11,751 7	101		4,198 0
CLIMATE SERVICES												
410 Data Acquisition						49 0						
420 Provision of Svs	10		263.3	7		179 0	13		218 1			
440 Research & Development												
450 Climate Svs - Gen.	2		54.2	2		56 0	2		30 9			
400 TOTAL (SA-1)	12		317.5	9		284.0	15		249 0			
ICE SERVICES												
510 Data Acquisition												
520 Forecast Production												
530 Ice Services - Gen.												
500 TOTAL (SA-1)												
MET. R & D AND AIR QUALITY												
610 Met Research												
640 Air Quality Res.												
660 R & D - General												
600 TOTAL (SA-1)												
GRAND TOTAL	275	95.0	12,093.5	282	90.0	10,236.2	198	47.0	12,056.8	101		4,198.0

APPENDIX B

1980-81 Budget by

Organizational Unit and Authority Code

AES Budget

1980-81

Displayed by Organizational Unit and Authority Code

	ADMA	AAB	FSD	ARD	CSD	CFWS	CCC	TOTAL
Salary	$427,800	$3,869,424	$38,656,900	$4,511,800	$6,764,500	$3,065,000	$2,710,800	$60,006,224
Other O & M	$260,900	$3,394,276	$26,364,500	$1,903,900	$9,566,900	$1,133,000	$969,300	$43,592,776
Capital		$330,000	$6,714,000	$562,000	$705,000		$110,000	$8,421,000
Grants & Contributions		$906,300*						$906,300
Total	$688,700	$8,500,000	$71,735,400	$6,977,700	$17,036,400	$4,198,000	$3,790,100	$112,926,300
Person Years	17	96	1,551	159	290	101	119	2,333

*This includes $563.5K contribution to the World Meteorological Organization

AES Budget

1980-81

Displayed by FSD Organizational Unit and Authority Code

	FSD HQ	CMC	ATLANTIC	QUEBEC	ONTARIO	CENTRAL	WESTERN	PACIFIC	TOTAL
Salary	$1,622,000	$2,826,700	$5,475,700	$5,385,800	$3,897,200	$7,425,000	$7,434,300	$4,590,200	$38,656,900
Other O & M	$4,851,400	$1,403,000	$1,719,100	$2,519,600	$932,400	$4,668,000	$2,801,400	$7,466,100	$26,364,500
Capital	$6,292,000	$12,000	$70,000	$70,000	$38,000	$95,000	$90,000	$47,000	$6,714,000
Grants & Contributions									
Total	$12,765,400	$4,242,200	$7,265,300	$7,975,900	$4,868,100	$12,188,500	$10,326,200	$12,103,800	$71,735,400
Person Years	66	112	236	208	174	275	282	198	1,551

AES Budget

1980-81

Displayed by CSD Organizational Unit and Authority Code

	ACID	ACTD	AIBD	ACPD	ACNC	ACDG	TOTAL
Salary	1,327,300	1,958,700	2,167,300	967,200	362,700	81,300	6,764,500
Other O&M	7,686,700	*268,600	***595,000	947,600	25,000	44,000	9,566,900
Capital	47,000	6,000	148,800			503,200	705,000
Grants & Contributions							
TOTAL	9,111,000	2,133,300	2,911,100	3,031,800	447,700	316,000	17,950,900
PY's	49	**80	94	48	16	3	290

* includes 18,600 for Official Languages Program
** includes 5 PY's for Official Languages Program
***includes 37,000 for CATA

AES Budget

1980-81

Displayed by CCC Organizational Unit and Authority Code

	CCAD	Research	Energy	CCDG	TOTAL
Salary	2,092,000	460,000		158,800	2,710,800
Other O&M	270,000	44,000	490,000	165,300	969,300
Capital	35,000	15,000	60,000		110,000
Grants & Contributions					
Total	2,397,00	519,000	550,000	324,100	3,790,100
PY's	94	20		5	119

AES Budget

1980-81

Displayed by ARD Organizational Unit and Authority Code

	ARMD (MSRB)	ARPD	ARQD	ARDG	TOTAL ARD
Salary	1,751,100	951,400	1,629,600	179,700	4,511,800
Other O&M	479,300	787,700	536,900	100,000	1,903,900
Capital	198,200	207,400	156,400		562,000
Grants & Contributions					
Total	2,428,600	1,946,500	2,322,900	279,700	6,977,700
PY's	62	31	62	4	159

AES Capital Budget

1980-81

Displayed by Organizational Unit and Program
($000)

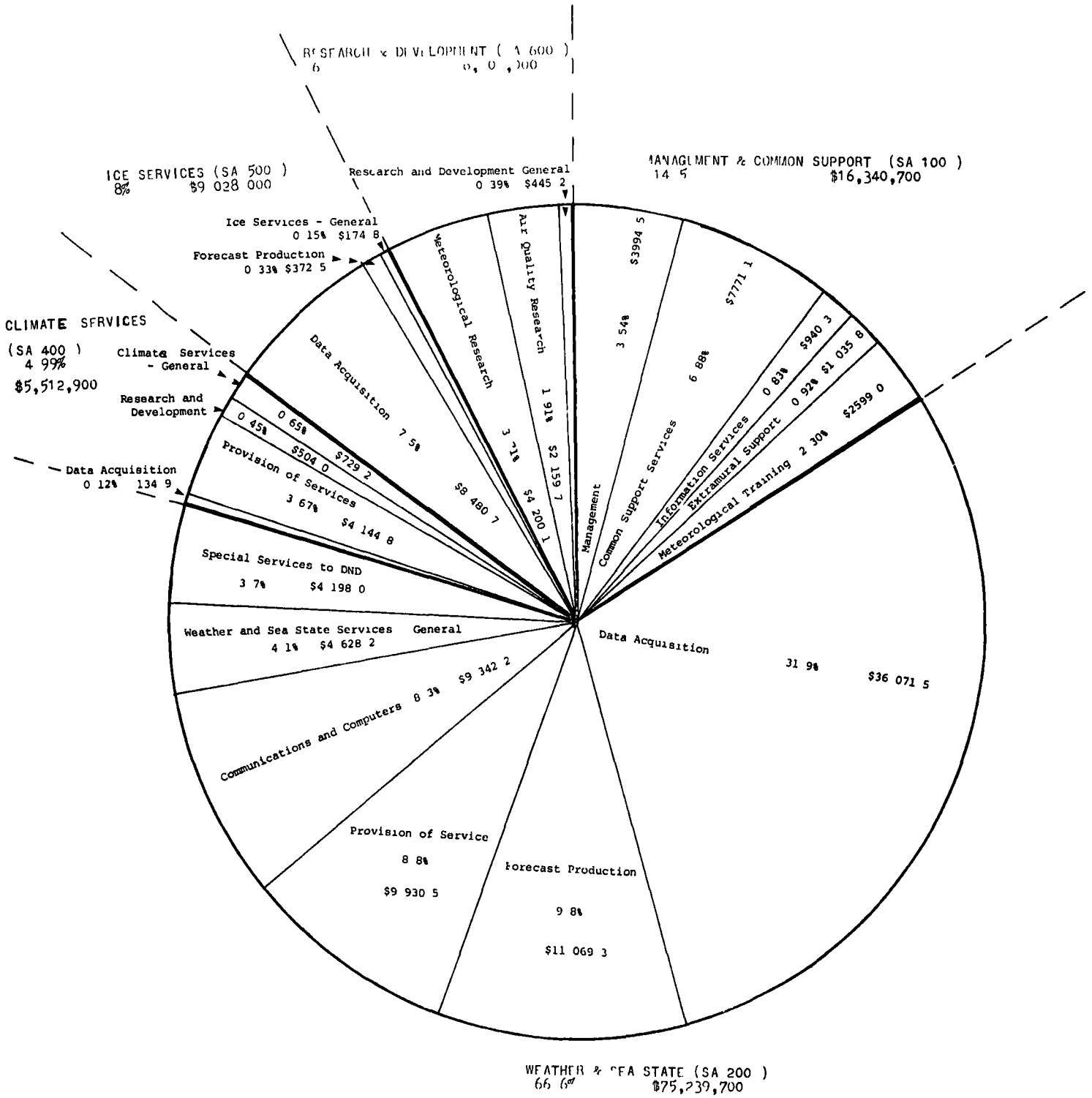
	ADMA	AAB	FSD	ARD	CSD	CFWS	CCC	TOTAL
Minor CAP		330 0	1,169.0	456 0	705 0		50 0	2,710 0
Energy				106 0			60 0	166 0
MARS II			847 0					847 0
ADRES			1,394 0					1,394 0
PAPA			3,000 0					3,000 0
Marine MARS			304 0					304 0
TOTAL		330.0	6,714 0	562 0	705 0		110 0	8,421 0*

*Not included is $1,785 0 for Major Capital Construction which is managed by the Departments' Facilities Management Branch

APPENDIX C

1980-81 Budget and Person Years

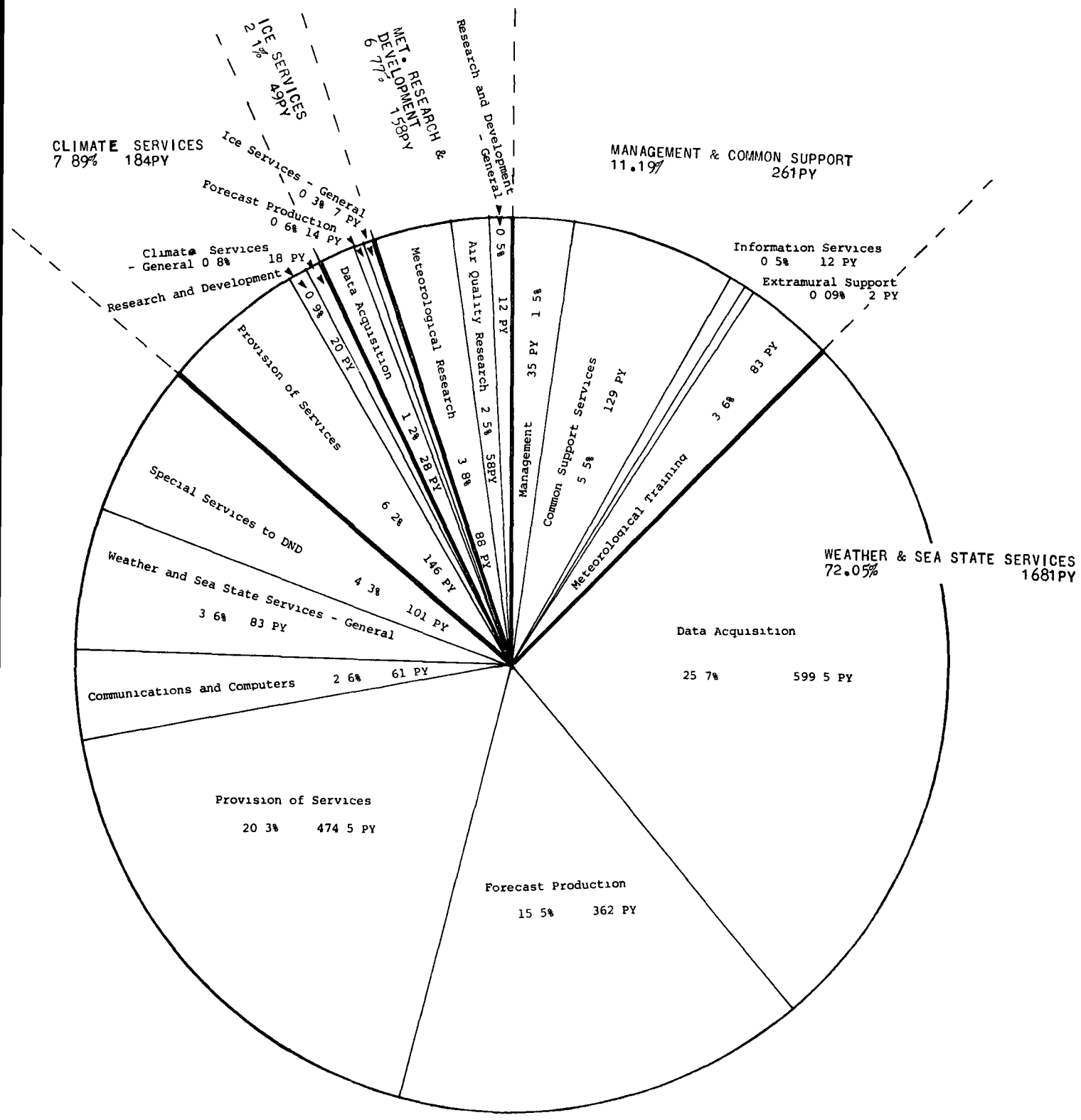
By Activity SA1 and SA2



AES 1980 – 81 BUDGET BY ACTIVITY

SA 1 and SA 2

AES TOTAL , BUDGET . $112,926 3



PERSON YEARS BY ACTIVITY

AES TOTAL , PY . 2333

APPENDIX D

AFS Service and

Data Acquisition Units

WEATHER OFFICES/WEATHER CENTRES
1980/81

REGION / TYPE	PACIFIC	WESTERN	CENTRAL	ONTARIO	QUEBEC	ATLANTIC	TOTAL
W.O 1 Forecast Office	Pacific Weather Centre	Alberta Weather Centre Arctic Weather Centre Yukon Weather Centre	Prairie Weather Centre	Ontario Weather Centre	Quebec Weather Centre	Atlantic Weather Centre Newfoundland Weather Centre	9
W O 3 Presentation Office with Professional Consultation Available	Victoria	Yellowknife	Regina Resolute Saskatoon				5
W O 4 Presentation Office	B C Forestry Castlegar Kamloops Kelowna Penticton Port Hardy Prince George Terrace Vancouver International Vancouver Aviation	Alberta Weather Centre Calgary Edmonton International Edmonton Municipal Fort Nelson Fort St. John Grande Prairie Inuvik Lethbridge (Banff - opening in 81/82)	Brandon Churchill Dauphin Prince Albert Thompson Thunder Bay Winnipeg Int'l	Hamilton Kingston London Niagara Dist North Bay Ottawa Peterborough Sarnia Sault Ste. Marie Sudbury Toronto W.O. Waterloo-Wellington Windsor	Frobisher Mirabel International Montreal Dorval Québec Sept Iles Sherbrooke St Hubert Trois Rivieres Val D'Or	Atlantic Weather Centre Charlottetown Cornerbrook Fredericton Gander Goose Bay Halifax International Moncton Saint John St. John's Sydney	61

Continued . .

WEATHER OFFICES/WEATHER CENTRES
1980/81

REGION / TYPE	PACIFIC	WESTERN	CENTRAL	ONTARIO	QUEBEC	ATLANTIC	TOTAL
Canadian Forces Weather Offices	Comox Esquimalt	Cold Lake Edmonton	Moose Jaw Portage la Prairie Winnipeg	North Bay Ottawa Trenton	Bagotville St Hubert	Chatham Gagetown Greenwood Halifax Shearwater Summerside	18
TOTAL	14	17	14	17	12	19	93

CANADIAN METEOROLOGICAL DATA ACQUISITION STATIONS
1980/81

REGION TYPE	PACIFIC	WESTERN	CENTRAL	ONTARIO	QUEBEC	ATLANTIC	TOTAL
Automatic Stations	6	6	6	9	1	9	37
Upper Air Stations	PAPA Vernon Port Hardy Prince George	Fort Smith Norman Wells Fort Nelson Whitehorse Cambridge Bay Inuvik Sachs Harbour Edmonton (Stony Plain)	Alert Eureka Hall Beach Mould Bay The Pas Trout Lake Baker Lake Coral Harbour Churchill Resolute	Moosonee	Fort Chimo Maniwaki Frobisher Bay Inoucdjouac Nitchequon Sept Iles	Sable Island Shelbourne Goose Bay St John's Stephenville	34
Synoptic Stations	83	25	33	30	26	34	231
Climate Stations	417	480	371	388	474	214	2344
Weather Radar	Abbotsford	Edmonton	Winnipeg	Carp Woodbridge Exeter Toronto *	Villeroy St Anne de Bellevue	Halifax Trepassey	11
Satellite Stations		Edmonton		Downsview		Halifax	3
Seismic Stations	Port Hardy	Frobisher Bay Inuvik Whitehorse	Churchill				5

* To be decommissioned in 1981

APPENDIX I

Network Charts

and

Regional Boundaries

CANADIAN METEOROLOGICAL DATA ACQUISITION STATIONS
1980/81

REGION / TYPE	PACIFIC	WESTERN	CENTRAL	ONTARIO	QUEBEC	ATLANTIC	TOTAL
Air Quality	Cape St James Fort Nelson Fort St John Kelowna Port Hardy Prince George Terrace Vancouver	Alert Coronation Edson Fort McMurray Fort Reliance Fort Simpson Hay River Inuvik Lethbridge Mould Bay Rocky Mountain House Whitehorse	Big Trout Lake Atikokan Bissett Churchill Cree Lake Dauphin ELA Kindersley Pickle Lake The Pas Wynard	Dorset Harrow Kapuskasing Kingston Moosonnee Mt Forest Pteervorough Simcoe	Chibougamou Form Chimo Maniwaki Nitchequon Quebec Sept Iles St Hubert	Acadia Charlo Gander Goose Bay Kejimuijik Sable Island Saint John Shelbourne Stephenville Truro	56
Radiation	Vancouver	Calgary Coral Harbour Edmonton (Stony Plain) Hay River Inuvik Resolute Whitehorse Yellowknife	Churchill Regina Saskatoon Thunder Bay Winnipeg	Moosonee Ottawa Sault Ste Marie Toronto Is Windsor	Montreal (Dorval) Quebec	Fredericton Goose Bay Shearwater St John's	25

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA
SERVICE DE L'ENVIRONNEMENT ATMOSPHÉRIQUE
ENVIRONNEMENT CANADA

CANADA

SYNOPTICS AND HOURLIES OBSERVING STATIONS

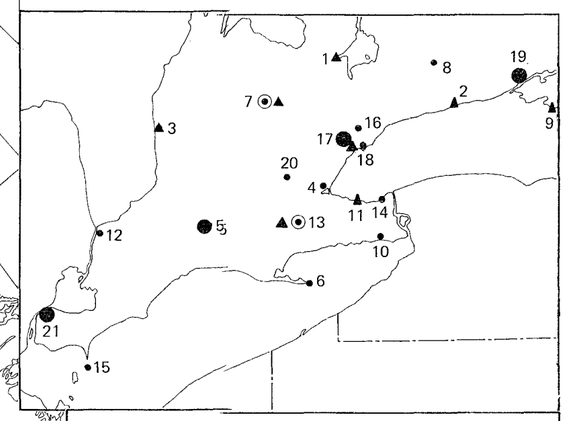
DECEMBER 1980

For Observing Programme See METSTAT

STATIONS SYNOPTIQUES ET HORAIRES

DÉCEMBRE 1980

Voir METSTAT pour le programme d'observation



1. Barrie
2. Cobourg
3. Goderich
4. Hamilton
5. London
6. Long Point
7. Mount Forest
8. Peterborough
9. Point Petre
10. Port Colborne, Light
11. Port Weller
12. Sarnia
13. Simcoe
14. St. Catharines
15. Southeast Shoal
16. Toronto Downsview
17. Toronto Int'l
18. Toronto Island
19. Trenton
20. Waterloo-Wellington
21. Windsor

LEGEND/LÉGENDE

- Hourlies Only/Observations horaires exclusivement
- Synoptic Only/Observations synoptiques exclusivement
- Synoptic and Part Hourlies/Observations synoptiques, et horaires sur une partie de la journée
- Synoptic and 24 Hourlies/Observations synoptiques, et horaires sur 24 heures
- Automatic Station/Station automatique
- Upper Air/Observations en altitude
- Upper Air Only/Observations en altitude exclusivement

SEE INSET MAP
VOIR LE CARTOUCHE

MILES/MILLES
100 50 0 100 200 300 400 500
KILOMETRES/KILOMÈTRES
100 50 0 100 200 300 400 500 600 700 800 900

CANADIAN
WEATHERFAX SYSTEM

ATMOSPHERIC ENVIRONMENT SERVICE
DEPARTMENT OF FISHERIES AND THE ENVIRONMENT – CANADA
1977

NOTES 1801

Circuit 1801 designates the entire National System, comprising all the Regional Circuits as well. When in the Circuit 1801 configuration, CMC Montreal has full control and becomes the only transmitting station. CMC, by activating a tone-switching signal, can pre-empt the entire system so that it's transmissions may simultaneously be copied at all stations shown in the diagram. At specified times CMC releases the circuit, so that it may be broken into separate regional sections. At these times each Regional transmitting station may transmit charts which will be received only at those locations within their respective regions.

CIVIL STATIONS

- Edmonton Briefing Office, Intern'l Airport
- Edmonton WO, Municipal Airport
- Calgary WO
- Ft. St. John WO
- Ft. Nelson WO
- Inuvik WO
- Lethbridge WO
- Peace River WO
- Whitehorse WO
- Yellowknife WO

OTHER USERS

- Alta. Hail Project, Penhold (May-Sept)
- Alta. Forestry, Edmonton
- Ft. Smith Lands & Forest, Ft. Smith (May-Oct)
- Yukon Lands & Forest, Whitehorse, (May-Aug)

(Relay over MOT radio station ' FE to Resolute WO, Frobisher WO, and ships in Arctic Waters).

1812 EDMONTON WC

DND STATIONS

- Edmonton (Namao) CFWO
- Suffield DND
- Cold Lake CFWO

(Note: Regional transmissions by Vancouver are received at Edmonton and can be switched to Circuit 1812)

CIVIL STATIONS

- Winnipeg Briefing Office
- Brandon WO
- Churchill WO
- Dauphin WO
- Prince Albert WO
- Regina WO
- Saskatoon WO
- Thunder Bay WO
- Thompson WO

DND STATIONS

- Winnipeg CFWO
- Winnipeg School of Met
- Moose Jaw CFWO
- Portage la Prairie CFWO

1820 WINNIPEG WC

DNDSTATIONS

- Bagotville CFWO
- Ottawa CFWO
- Petawawa CFWO
- St. Hubert MOBCOM
- Valcartier MOBCOM

CIVIL STATIONS

- Montreal WO, Dorval
- Montreal WO, Mirabel
- Ottawa WO
- Ottawa Ice Central
- Ottawa TCTI
- Quebec WO
- St. Hubert WO
- Sherbrooke WO
- Sept Iles WO
- Val d'Or WO

MONTREAL WC 1830

OTHER USERS

- Ottawa MOT Flight Dispatch
- Ottawa National Museum of Science
- Chicoutimi CEGEP
- Quebec, Ministere des Richesses Naturelles
- Noranda/Rouyn, Noranda Mines
- Montreal, Alden Electronics
- Montreal, Quebec Hydro
- Montreal, McGill Univerity
- Montreal, University of Quebec
- Montreal, Nordair
- Montreal, Execaire
- Montreal, Quebecaire

CIVIL STATIONS

- Halifax WO (Airport)
- Goose WO
- Gander WO
- Fredericton WO
- Moncton WO
- Saint John, N.B. WO
- St. John's, Nfld. WO
- Sydney WO
- Charlottetown WO

DND STATIONS

- Halifax METOC
- Chatham CFWO
- Gagetown DND
- Greenwood CFWO
- St. Margaret's (Call-up)
- Summerside CFWO
- Shearwater CFWO

OTHER USERS

- St. John's, MOT Canadian Marine Administration
- St. John's, Eastcan Exploration
- Dartmouth, Marine Aids Information Centre

HALIFAX WC 1835

MONTREAL CMC CIRCUIT 1801

VANCOUVER WC 1810

CIVIL STATIONS

- Vancouver Briefing Office
- Castlegar WO
- Kamloops WO
- Kelowna WO
- Penticton WO
- Port Hardy WO
- Prince George WO
- Terrace WO
- Victoria WO

DND STATIONS

- Comox CFWO
- Esquimalt Metoc

OTHER USERS

- B.C. Hydro, Vancouver
- B.C. Forest Service, Williams Lake, (Apr-Oct)
- B.C. Forest Service, Nelson, (Apr-Oct)
- B.C. Forest Service, Prince Rupert, (Apr-Oct.)
- B.C. Forest Service, Prince George, (Apr-Oct)

TORONTO WC 1825

CIVIL STATIONS

- Toronto Briefing Office
- Toronto AES HQ
- Hamilton WO
- Kitchener WO
- London WO
- North Bay WO
- Sarnia WO
- Sault Ste. Marie WO
- St. Catharines WO
- Sudbury WO
- Kingston WO
- Peterborough WO
- Windsor WO

DND STATIONS

- Toronto CFWO
- North Bay NNRWC
- Trenton CFWO

OTHER USERS

- Toronto, MEP Co.
- Toronto, Ontario Science Centre
- Copper Cliff, Ont. INCO
- Guelph, U. of Guelph
- Toronto Forest Fire Control
- Waterloo, U. of Waterloo

Note:
United States National Weather Service Supplies Charts to CMC on Circuit 1803 and these charts can be sent on either Circuit 1801 or 1805 by C.M.C.

LEGEND

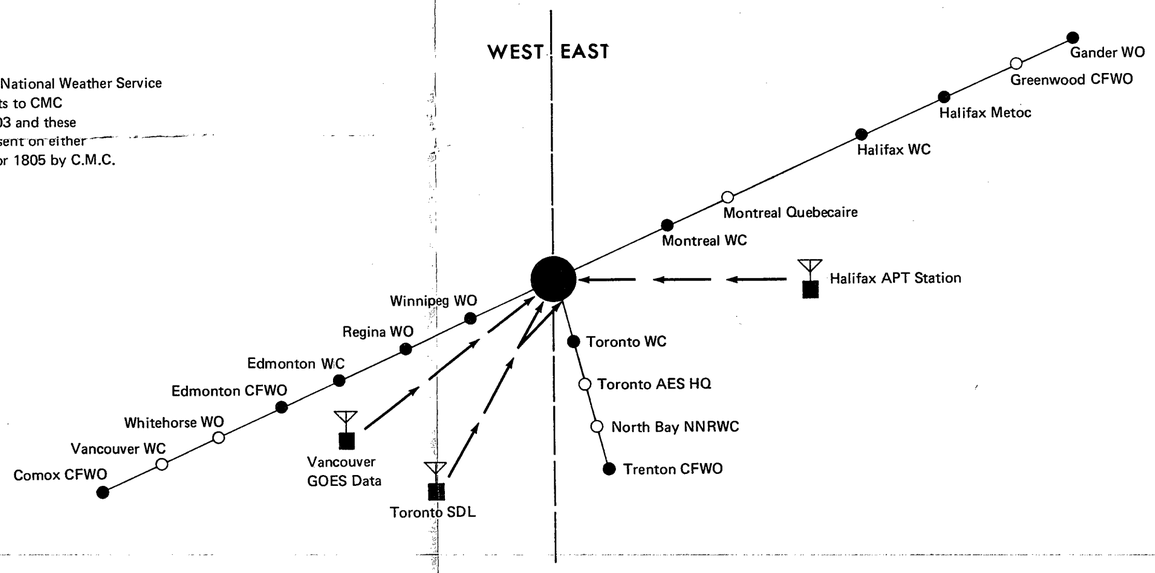
⊕ Recording and Transmitting Station.
○ Recording Station

ABBREVIATIONS

WO	Weather Office
CFWO	Canadian Forces Weather Office
WC	Weather Centre
CMC	Canadian Meteorological Centre
GMC	Canadian Meteorological Centre
METOC	Meteorological & Oceanographic Centre (DND)
MOBCOM	Mobile Command HQ (DND)
TCTI	Transport Canada Training Institute
CEGEP	College d'Enseignement Général et Professionel
NNRWC	Northern Norad Regional Weather Centre

CIRCUIT 1805

WEATHER CHARTS AND SATELLITE PICTURES



Notes 1805

1. Weather charts transmitted by CMC are received at all locations shown on the above diagram.
2. Satellite photos transmitted by Vancouver APT station are recorded at CMC and at those locations connected to the Western portion indicated with a black dot. ●
3. Satellite photos transmitted by Halifax APT station are recorded at CMC and at those locations connected to the Eastern portion indicated with a black dot. ●
4. Satellite photos transmitted by Toronto Satellite Data Lab (SDL) are recorded at CMC and at those stations on both the Western and Eastern portions indicated with a black dot. ●

0062-9390(6/77)

METEOROLOGICAL TELETYPE COLLECTION CIRCUITS

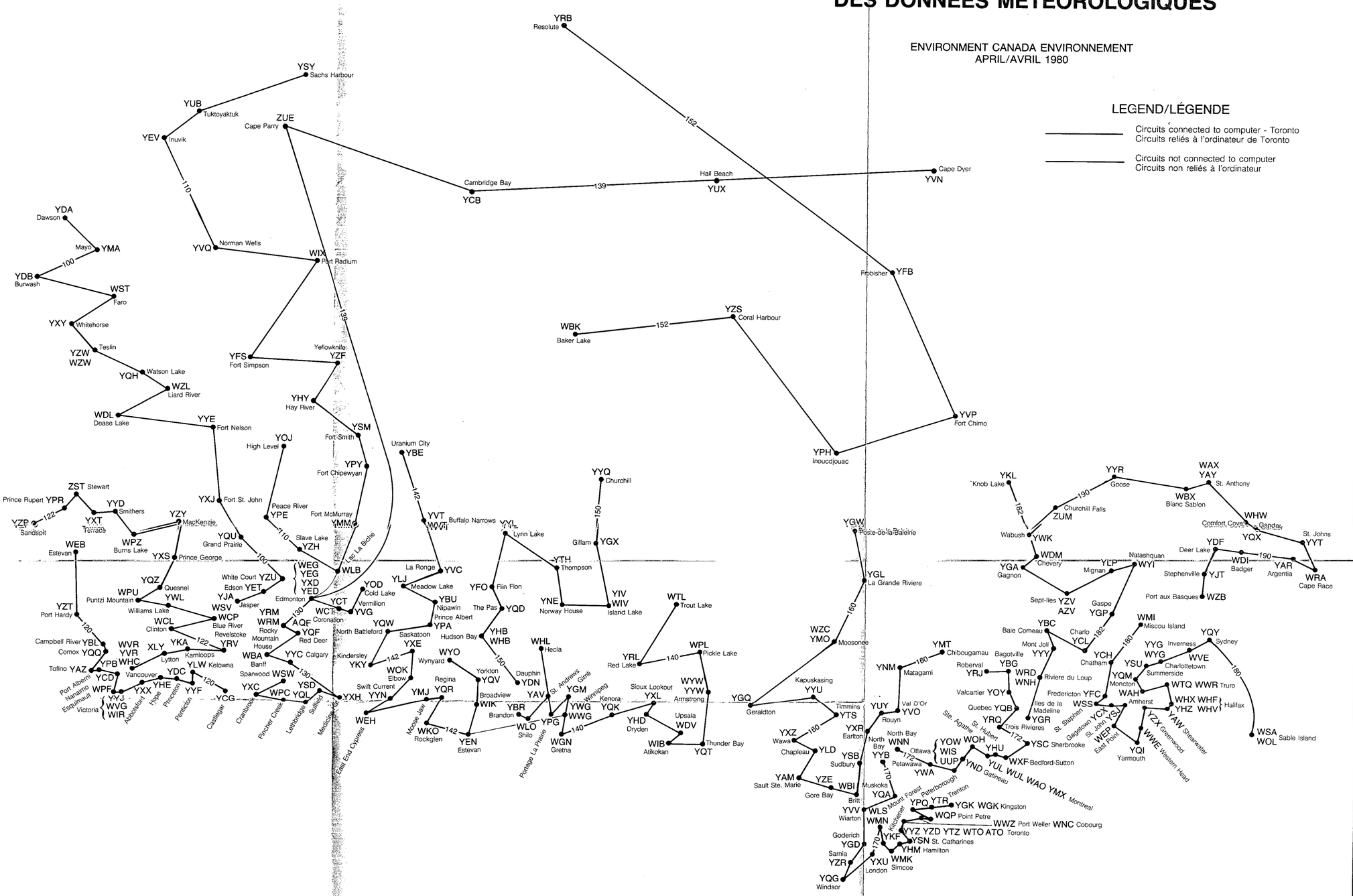
RÉSEAU DE TÉLÉIMPRIMEURS POUR LA COLLECTÉ DES DONNÉES MÉTÉOROLOGIQUES

ENVIRONMENT CANADA ENVIRONNEMENT
APRIL/AVRIL 1980

LEGEND/LÉGENDE

Circuits connected to computer - Toronto
Circuits reliés à l'ordinateur de Toronto

Circuits not connected to computer
Circuits non reliés à l'ordinateur



0062-9398

METEOROLOGICAL TELETYPE DISTRIBUTION CIRCUITS

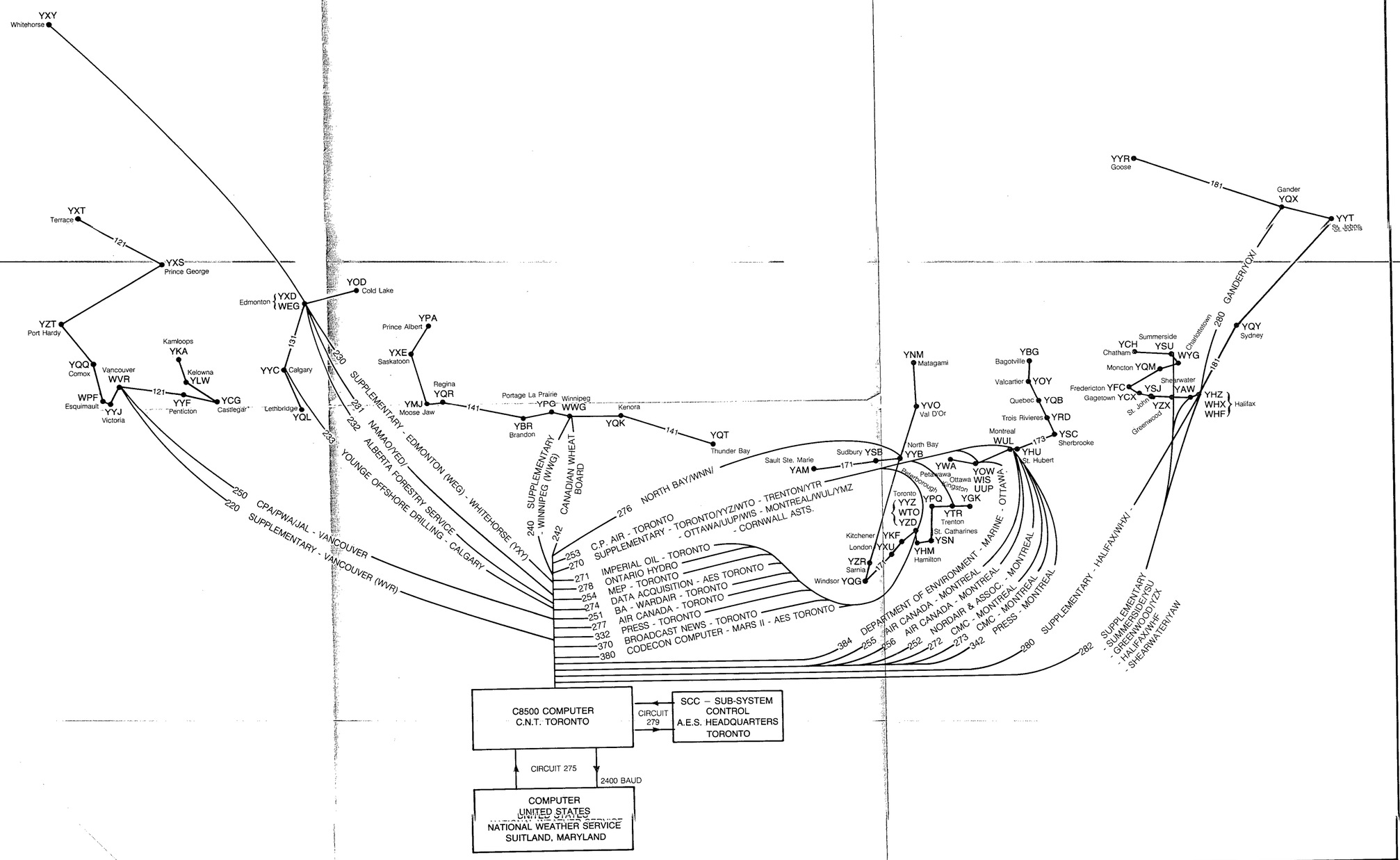
RÉSEAU DE TÉLÉIMPRIMEURS POUR LA DIFFUSION DES DONNÉES MÉTÉOROLOGIQUES

ENVIRONMENT CANADA ENVIRONNEMENT
APRIL/AVRIL 1980

LEGEND/LÉGENDE

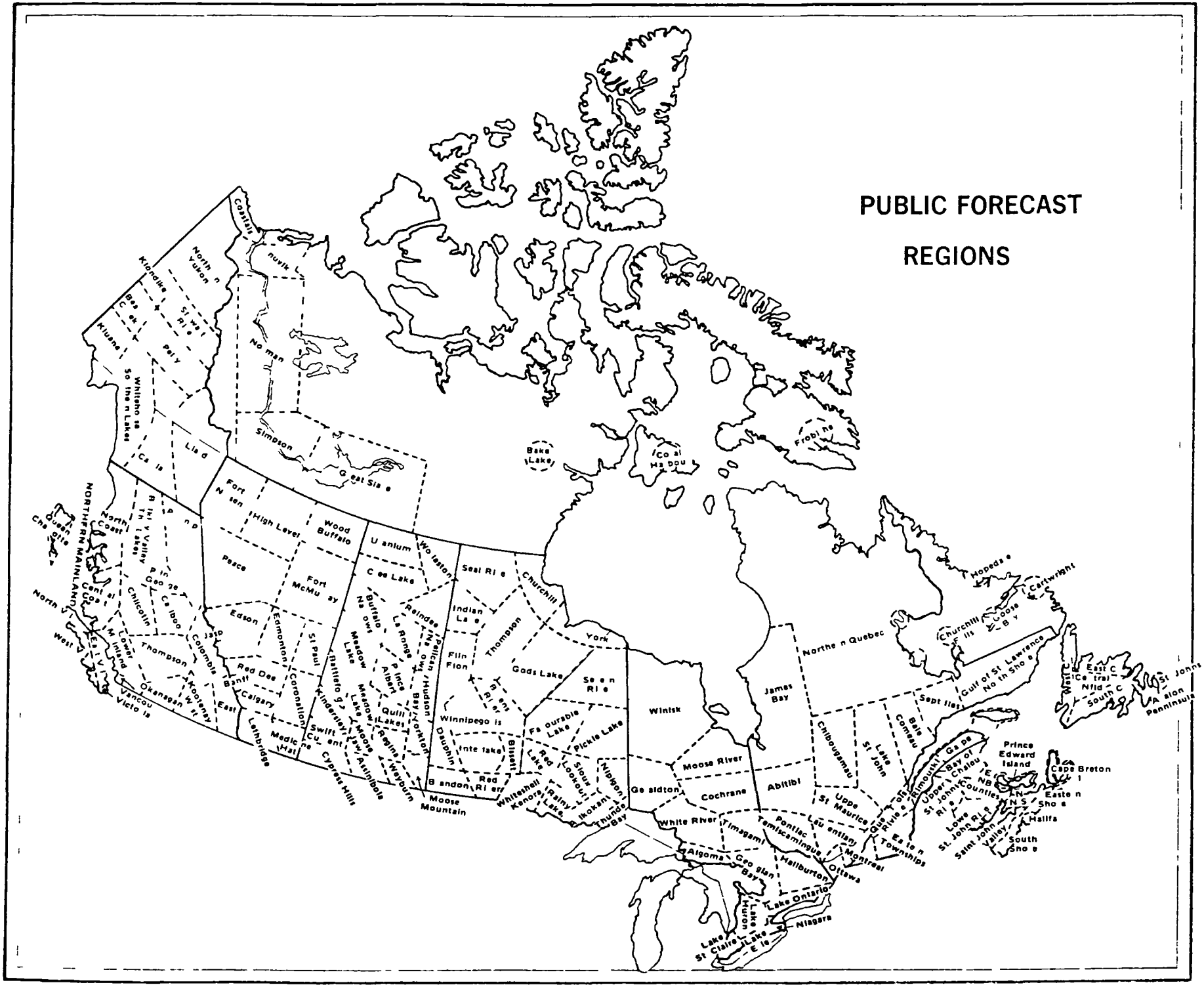
100 Series circuits
Circuits de la série 100

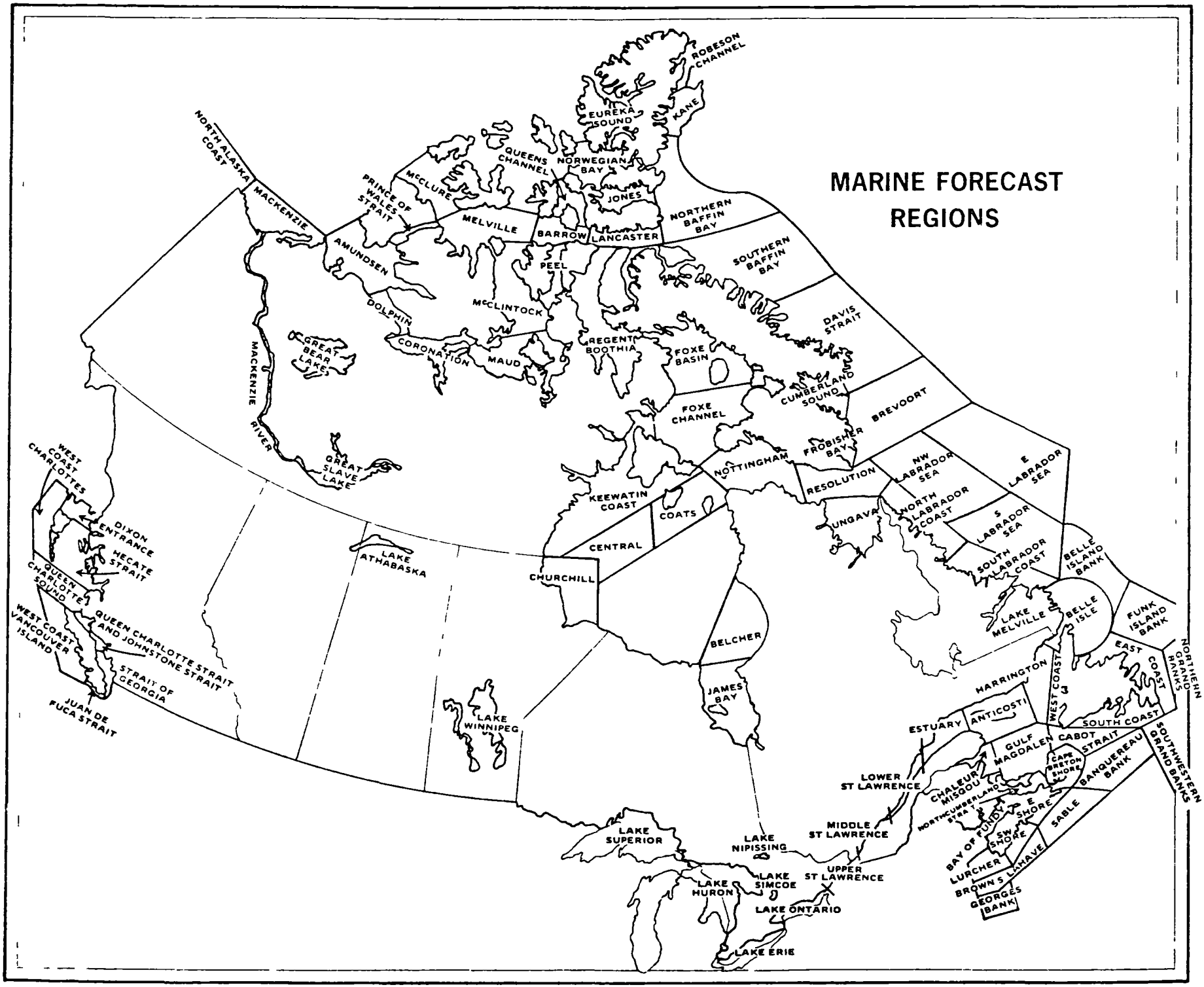
200/300 Series circuits
Circuits des séries 200 et 300

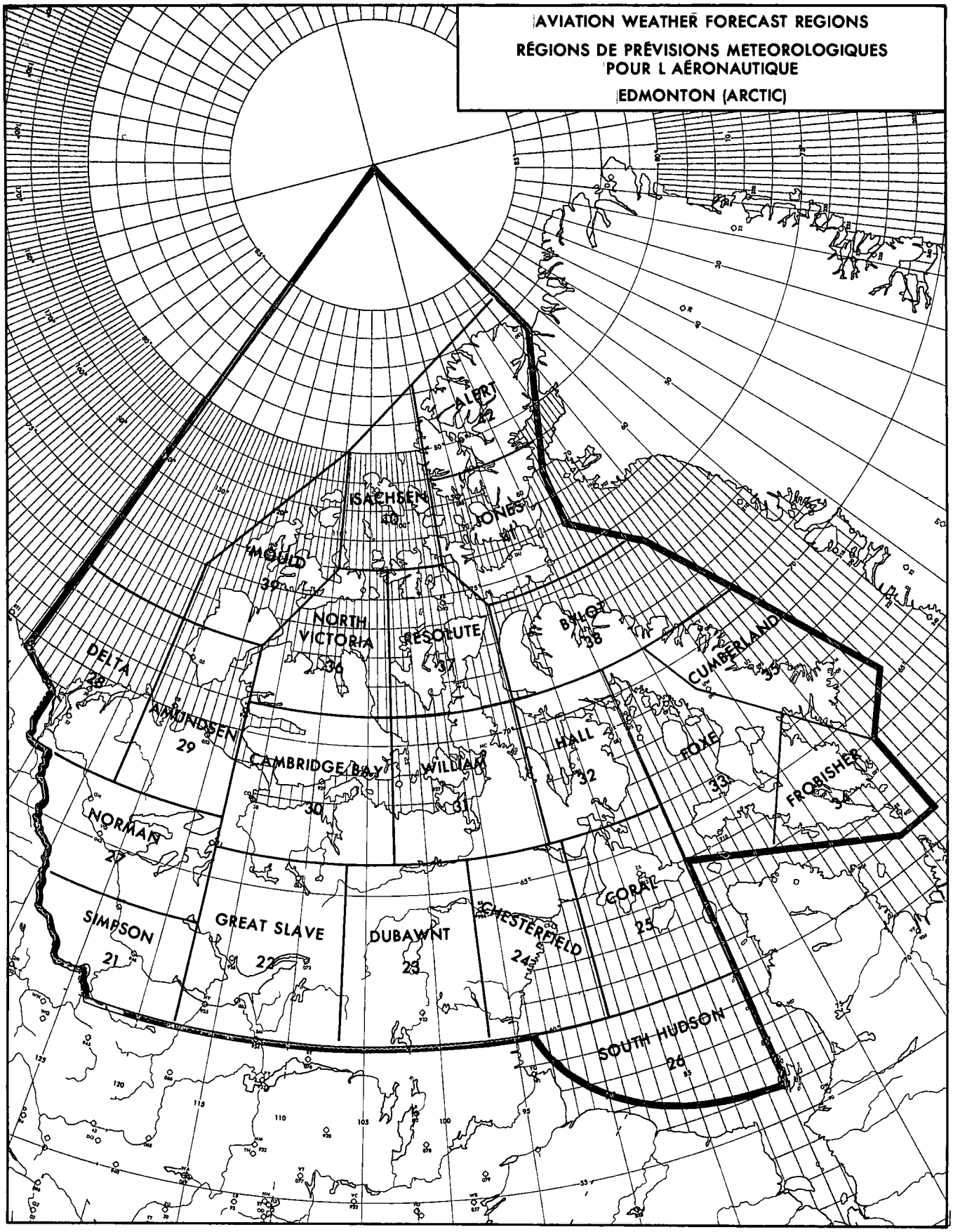


0062-9399

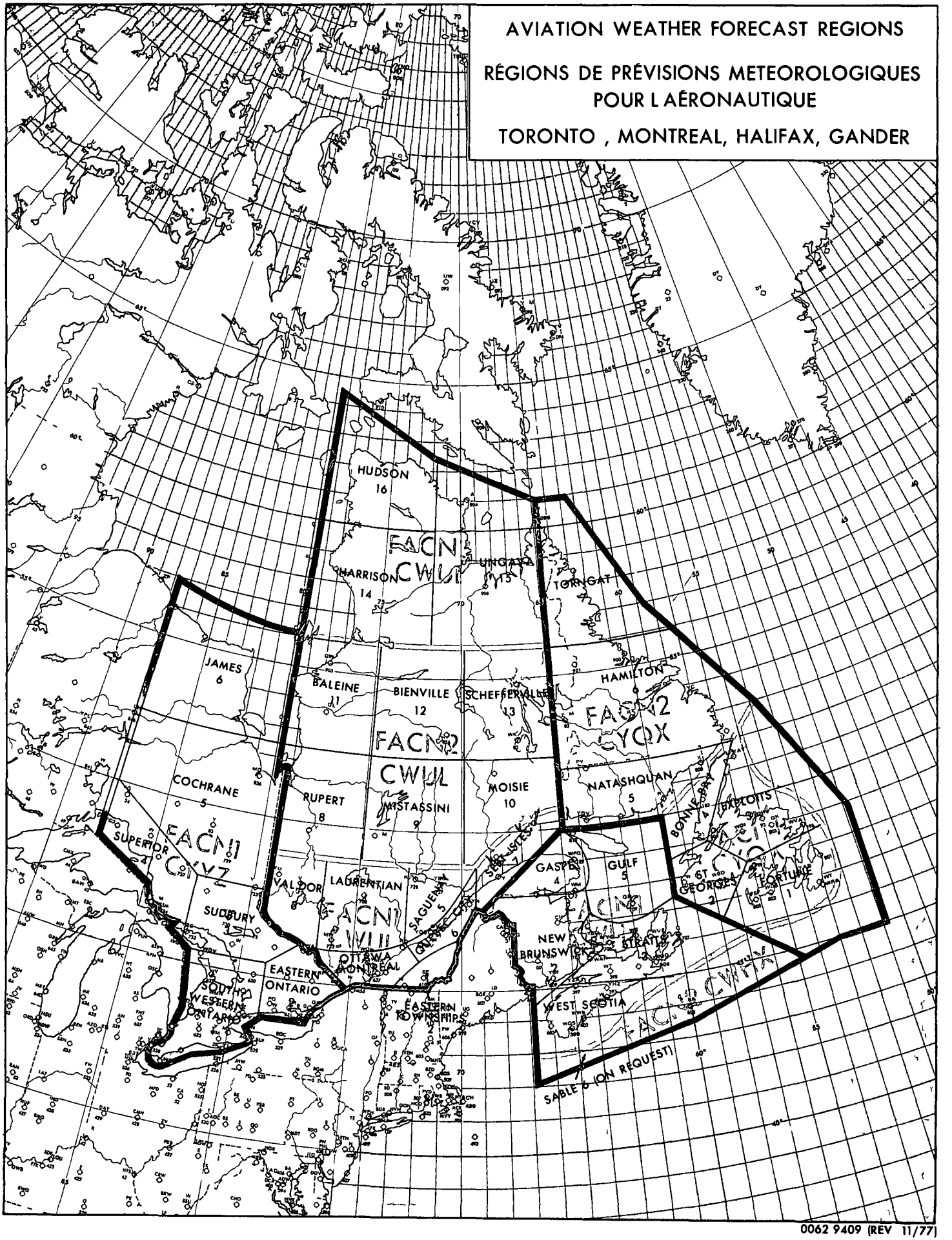

A E S
REGIONS IN CANADA
WESTERN REGION
PACIFIC REGION
CENTRAL REGION
ONTARIO REGION
QUEBEC REGION
ATLANTIC REGION


PUBLIC FORECAST
REGIONS
Coastals
Klondike
North n Yukon
nuvik
Kluane
Whitehorse
So the n Lakes
Ca ib
Lia d
No man
Simpson
G eat Sla e
Bake Lake
Co al Ha bou
Frobi he
Fort N len
High Level
Wood Buffalo
U anium
Wo laston
Seal Ri e
Churchill
Peace
Fort McMu ay
C ee Lake
Indian La e
Thompson
York
Flin Flon
Gods Lake
Se en Ri e
Winnipeg is
Inte lake
Dauphin
Bisset
Red Ri er
B andon
Moose Mountain
Whitehall
Kenora
Rainy Lake
Red Lake
Lookout
Stour
Nipigon
Ikokani
Thunder Bay
Fa ourable Lake
Pickle Lake
Winisk
James Bay
Northe n Quebec
Hopeda e
Cartwright
Churchill Falls
Goose Bay
Gulf of St. Lawrence
No th Sho e
Sept Iles
Baie Comeau
Chibougamau
Lake St John
Moose River
Ge aldton
Cochrane
Abitibi
Upper St John
Counties
Lowe St. John Ri e
Saint John Valley
South Sho e
Prince Edward Island
Cape Breton
Easte n Sho e
Halifa
N S
N B
Rimouski
Ga pe
Bay of Chalou
Upper St John Ri e
Lake St John
Ca ibou
Que Rivie e
St Maurice
Lau entian
Pontiac
Temiscamingue
Timagami
White River
Algoma
Geo gian Bay
Mailburton
Ottawa
Montreal
Easte n Townships
Lake Ontario
Niagara
Lake Huron
Lake St Clair
Lake E ie
Queen Cha lotte
NORTHERN MAINLAND
North Coast
Cent al Coa
North V
West V
Vancou
Victo ia
Lowe Mainland
Thompson
Okanagan
Kootenay
Wes
Chilcotin
Ca iboo
Ja p
Colombia
East
Banff
Calgary
Edson
Edmonton
St Paul
Red Dee
Lethbridge
Medic ne Hat
Coronation
Swift Cu ent
Cypress Hills
Rainy River
Kinde sley
Battlefo d
Meadow Lake
Lake Moose
Regina
Weyburn
Assiniboia
Quill Lakes
P ince Albert
La Ronge
Buffalo Na ows
Reindee
Lake
Wollaston
Lake
Hudson Bay/Yorkton
Pelican
Lake
Riv e Valley
Th e Lakes
P in Geo ge
Ca iboo

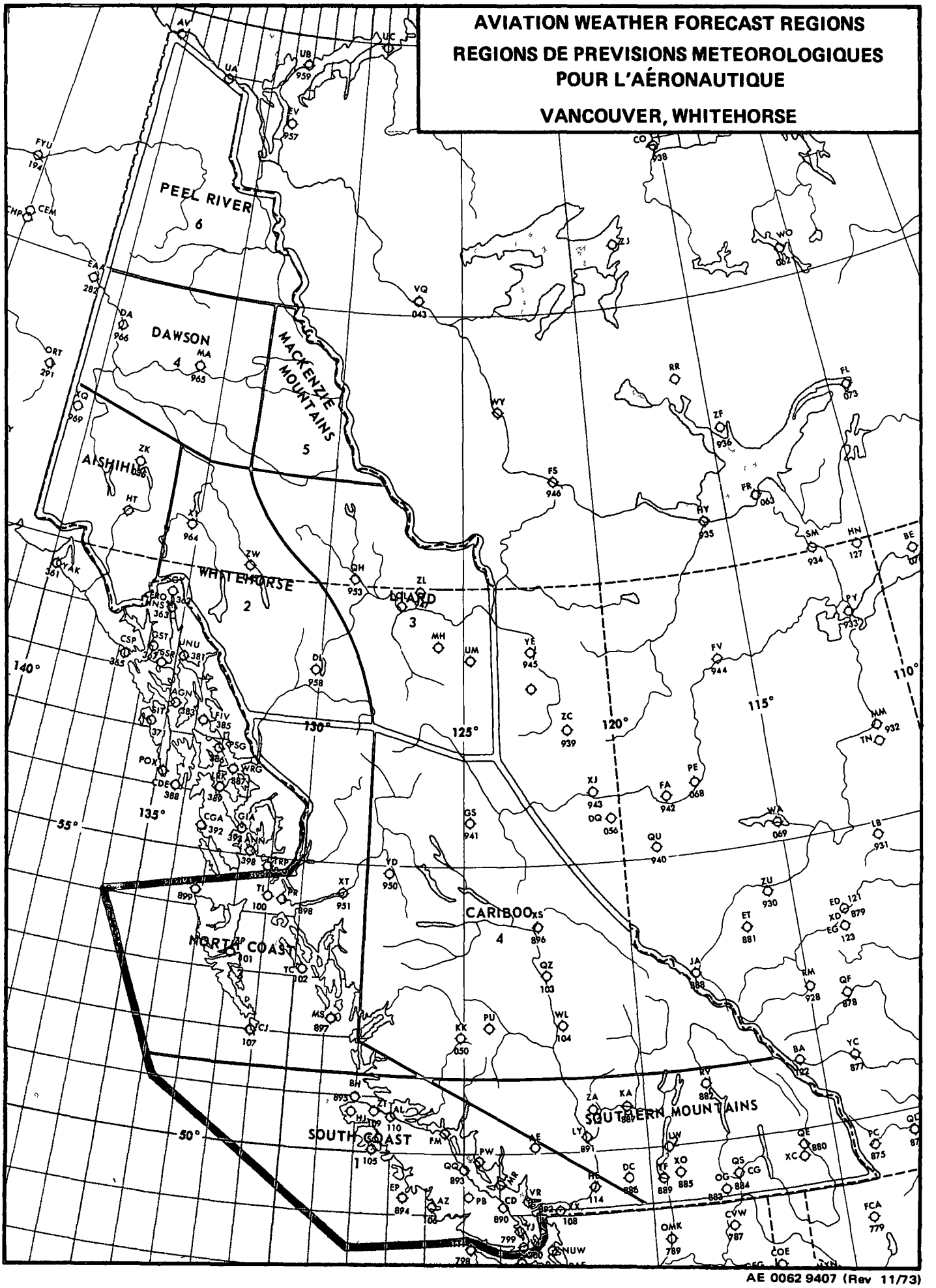

MARINE FORECAST REGIONS
NORTH ALASKA COAST
MACKENZIE
PRINCE OF WALES STRAIT
McCLURE
QUEENS CHANNEL
NORWEGIAN BAY
EUREKA SOUND
ROBESON CHANNEL
KANE
JONES
NORTHERN BAFFIN BAY
SOUTHERN BAFFIN BAY
DAVIS STRAIT
MELVILLE
BARROW
LANCASTER
PEEL
AMUNDSEN
DOLPHIN
McCLINTOCK
CORONATION
MAUD
REGENT
BOOTHIA
FOXE BASIN
CUMBERLAND SOUND
FOXE CHANNEL
BREVOORT
FROBISHER BAY
NOTTINGHAM
RESOLUTION
NW LABRADOR SEA
E LABRADOR SEA
KEEWATIN
COATS
CENTRAL
CHURCHILL
UNGAVA
NORTH LABRADOR COAST
S LABRADOR SEA
SOUTH LABRADOR COAST
BELLE ISLAND BANK
LAKE MELVILLE
BELLE ISLE
FUNK ISLAND BANK
NORTHERN GRAND BANKS
EAST COAST
HARRINGTON
WEST COAST
SOUTH COAST
ESTUARY
ANTICOSTI
GULF
MAGDALEN
CABOT STRAIT
CAPE BRETON SHORE
BANQUEREAU BANK
SOUTHWESTERN GRAND BANKS
CHALEUR
MISCOU
NORTHUMBERLAND STR
E SHORE
SW SHORE
SABLE
BAY OF FUNDY
LURCHER
BROWN'S
LAHAVE
GEORGES BANK
LOWER ST LAWRENCE
MIDDLE ST LAWRENCE
UPPER ST LAWRENCE
LAKE SUPERIOR
LAKE NIPISSING
LAKE HURON
LAKE SIMCOE
LAKE ONTARIO
LAKE ERIE
LAKE WINNIPEG
JAMES BAY
BELCHER
LAKE ATHABASKA
MACKENZIE RIVER
GREAT BEAR LAKE
GREAT SLAVE LAKE
WEST COAST CHARLOTTES
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE SOUND
QUEEN CHARLOTTE STRAIT AND JOHNSTONE STRAIT
WEST COAST VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT



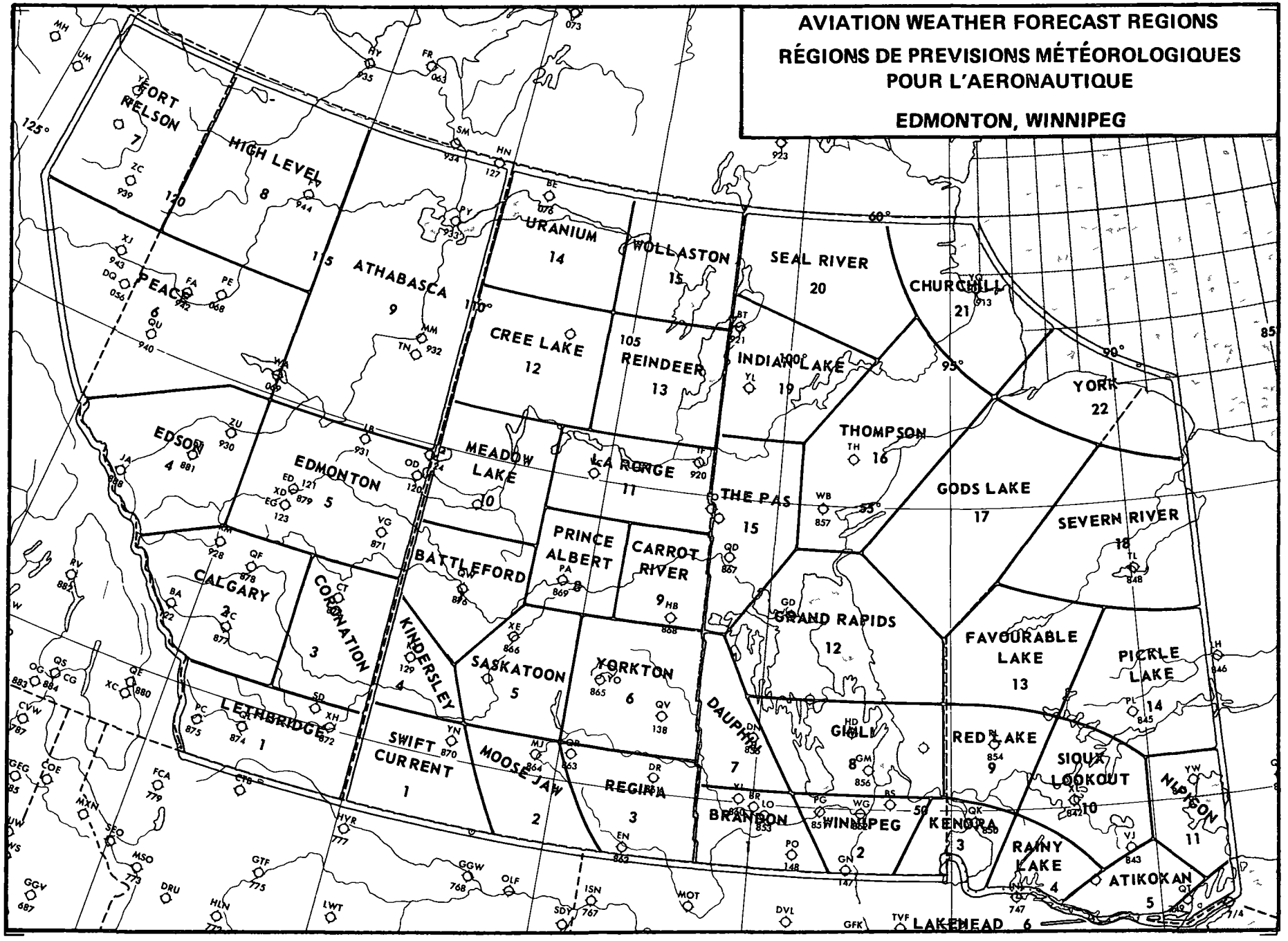
AE 0062 9410 (Rev 11/73)



0062 9409 (REV 11/77)



AE 0062 9407 (Rev 11/73)



0062 9408 (5/80)