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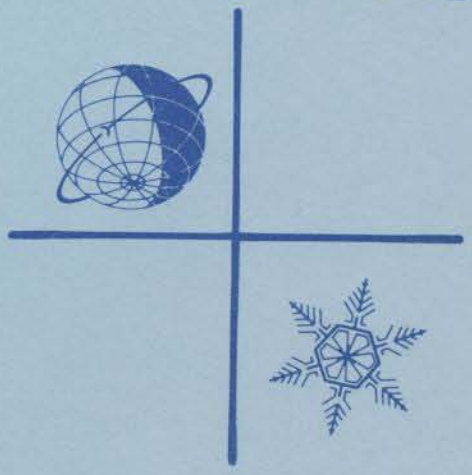
REPORT GD-15

GLACIOLOGICAL DATA

WORKSHOP ON ANTARCTIC CLIMATE DATA

World Data Center A
for
Glaciology
[Snow and Ice]



April 1984

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2101 Constitution Avenue, NW
Washington, D.C. 20418 USA

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[Telephone: (303) 497-6487]

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GLACIOLOGICAL DATA

REPORT GD-15

WORKSHOP ON ANTARCTIC CLIMATE DATA

Edited by
R.G. Barry

Sponsored by
Scientific Committee on Antarctic Research
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April 1984

DESCRIPTION OF WORLD DATA CENTERS[1]

WDC-A: Glaciology (Snow and Ice) is one of three international data centers serving the field of glaciology under the guidance of the International Council of Scientific Unions Panel of World Data Centers. It is part of the World Data Center System created by the scientific community in order to promote worldwide exchange and dissemination of geophysical information and data. WDC-A endeavors to be promptly responsive to inquiries from the scientific community, and to provide data and bibliographic services in exchange for copies of publications or data by the participating scientists.

1. The addresses of the the three WDCs for Glaciology and of a related Permanent Service are:

World Data Center A
University of Colorado
Campus Box 449
Boulder, Colorado, 80309 U.S.A.

World Data Center B
Molodezhnaya 3
Moscow 117 296, USSR

World Data Centre C
Scott Polar Research Institute
Lensfield Road
Cambridge, CB2 1ER, England

Permanent Service on the Fluctuations of Glaciers
Swiss Federal Institute of Technology
CH-8092 Zurich, Switzerland

2. Subject Matter

WDCs will collect, store, and disseminate information and data on Glaciology as follows:

Studies of snow and ice, including seasonal snow; glaciers; sea, river, or lake ice; seasonal or perennial ice in the ground; extraterrestrial ice and frost.

Material dealing with the occurrence, properties, processes, and effects of snow and ice, and techniques of observing and analyzing these occurrences, processes, properties, and effects, and ice physics.

Material concerning the effects of present day and snow and ice should be limited to those in which the information on ice itself, or the effect of snow and ice on the physical environment, make up an appreciable portion of the material.

Treatment of snow and ice masses of the historic or geologic past, or paleoclimatic chronologies will be limited to those containing data or techniques which are applicable to existing snow and ice.

3. Description and Form of Data Presentation

3.1 General. WDCs collect, store and are prepared to disseminate raw[+], analyzed, and published data, including photographs. WDCs can advise researchers and institutions on preferred formats for such data submissions. Data dealing with any subject matter listed in (2) above will be accepted. Researchers should be aware that the WDCs are prepared to organize and store data which may be too detailed or bulky for inclusion in published works. It is understood that such data which are submitted to the WDCs will be made available according to guidelines set down by the ICSU Panel on WDCs in this Guide to International Data Exchange. Such material will be available to researchers as copies from the WDC at cost, or if it is not practicable to copy the material, it can be consulted at the WDC. In all cases the person receiving the data will be expected to respect the usual rights, including acknowledgement, of the original investigator.

---

[1] International Council of Scientific Unions. Panel on World Data Centers. (1979) Guide to International Data Exchange Through the World Data Centres. 4th ed. Washington, D.C. 113 p.

[+] The lowest level of data useful to other prospective users.

This Guide for Glaciology was prepared by the International Commission on Snow and Ice (ICSI) and was approved by the International Association of Hydrological Sciences (IAHS) in 1978.

3.2 Fluctuations of Glaciers. The Permanent Service is responsible for receiving data on the fluctuations of glaciers. The types of data which should be sent to the Permanent Service are detailed in UNESCO/IASH (1969)*. These data should be sent through National Correspondents in time to be included in the regular reports of the Permanent Service every four years (1964-68, 1968-72, etc.). Publications of the Permanent Service are also available through the WDCs.

3.3. Inventory of Perennial Snow and Ice Masses. A Temporary Technical Secretariat (TTS) was recently established for the completion of this IHD project at the Swiss Federal Institute of Technology in Zurich. Relevant data, preferably in the desired format**, can be sent directly to the TTS or to the World Data Centers for forwarding to the TTS.

3.4. Other International Programs. The World Data Centers are equipped to expedite the exchange of data for ongoing projects such as those of the International Hydrological Project (especially the studies of combined heat, ice and water balances at selected glacier basins***), the International Antarctic Glaciological Project (IAGP), and Greenland Ice Sheet Project (GISP), etc., and for other developing projects in the field of snow and ice.

4. Transmission of Data to the Centers

In order that the WDCs may serve as data and information centers, researchers and institutions are encouraged:

4.1. To send WDCs raw+ or analyzed data in the form of tables, computer tapes, photographs, etc., and reprints of all published papers and public reports which contain glaciological data or data analysis as described under heading (2); one copy should be sent to each WDC or, alternatively, three copies to one WDC for distribution to the other WDCs.

4.2 To notify WDCs of changes in operations involving international glaciological projects, including termination of previously existing stations or major experiments, commencement of new experiments, and important changes in mode of operation.

*UNESCO/IASH (1969) Variations of Existing Glaciers. A Guide to International Practices for their Measurement.

**UNESCO/IASH (1970a) Perennial Ice and Snow Masses. A Guide for Compilation and Assemblage of Data for a World Inventory; and

Temporary Technical Secretariat for World Glacier Inventory. Instructions for Compilation and Assemblage of Data for a World Glacier Inventory.

***UNESCO/IASH (1970b) Combined Heat, Ice and Water Balances at Selected Glacier Basins. A Guide for Compilation and Assemblage of Data for Glacier Mass Balance Measurements; and

UNESCO/IASH (1973) Combined Heat, Ice and Water Balances at Selected Glacier Basins. Part II, Specifications, Standards and Data Exchange.

+The lowest level of data useful to other prospective users.

FOREWORD

This issue contains the report of a workshop on Antarctic climate data sponsored by the Scientific Committee on Antarctic Research (SCAR) and convened by WDC-A for Glaciology during the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, FRG, in August 1983. A small group of invited participants representing the disciplines of glaciology, meteorology, and oceanography met together with data managers to review the status of information relating to the climate system in the Antarctic region. The collection, archiving, dissemination, and availability of data were discussed and a series of recommendations formulated. Subsequent to the workshop, preliminary inventories of some identified data categories were prepared by the participants and WDC-A for Glaciology staff. Comments on these inventories and corrections or additions will be welcomed.

We gratefully acknowledge the support of SCAR in this activity and the participants for their generous assistance. Special thanks are due to G.E. Hemmen, Executive Secretary of SCAR; also to A.M. Brennan for her careful editing and to M. Strauch and C. Pedigo for typing.

R.G. Barry
Director
WDC-A for Glaciology (Snow and Ice) and
National Snow and Ice Data Center

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WORKSHOP ON ANTARCTIC CLIMATE DATA
HAMBURG, FRG, 14-15 AUGUST 1983

SUMMARY

The Group of Specialists on Antarctic Climate Research, which was established by the Scientific Committee for Antarctic Research (SCAR), among others, to plan and coordinate an Antarctic contribution to the World Climate Research Programme, identified the need for a comprehensive plan for the management of Antarctic climate data as a high priority item for new research activity. In view of the overwhelming climatic significance of snow- and ice-phenomena in the Antarctic, the World Data Center-A for Glaciology [Snow and Ice] proposed to SCAR that it organize and convene a specialist workshop to address the problems of Antarctic climate-related data. This report presents the findings and recommendations of the invited participants to that workshop.

The workshop participants examined the status of data in the areas of synoptic meteorology, climatology (standard and non-standard expedition-type reports), oceanography, glaciology, and satellite remote sensing. Existing data transfer and archival mechanisms were reviewed and the major problems addressed.

The group concluded that a data management strategy and plan were essential and that SCAR should take a lead role in ensuring the implementation of a data management strategy for Antarctic climate data in coordination with other appropriate organizations (WMO-WCDP, IOC and WDCs). In view of the diverse problems identified in the various data types, however, it was recognized that a new data system dedicated only to Antarctic climate-related data is not feasible nor is it necessary.

Present data archiving mechanisms can be greatly improved and an urgent first step is the preparation of a detailed catalog (or catalogs) of Antarctic climate data, building on the inventory work undertaken for this workshop report. SCAR should seek to arrange funding for such an activity, possibly through WMO, and/or coordinate it through its national correspondents. Problems with existing data archives arise principally through the delays in releasing Antarctic data promptly via established archiving channels. In addition, existing archives are held in many disparate formats and in several locations. The status of national holdings needs to be assessed and it is recommended that the attention of the World Meteorological Organization/International Council of Scientific Unions Joint Scientific Committee (or/and the WMO Executive Committee Working Group on Antarctic Meteorology) be drawn to the urgent need for the preparation, under the World Climate Data Programme, of standardized, readily accessible digital sets of the substantial meteorological data for the Antarctic region.

Several national agencies and groups involved in Antarctic programs currently produce annual data summaries and it is recommended that SCAR encourage and coordinate the preparation of a standardized annual synopsis of Antarctic climate data.

DISCUSSION AND RECOMMENDATIONS

I. INTRODUCTION.

A. Background.

A report prepared by the SCAR Group of Specialists on Antarctic Climate Research (Allison, 1983), concerning the implementation of an Antarctic contribution to the World Climate Research Programme (WCRP), identifies the lack of a comprehensive plan for the management of an Antarctic climate data base as an important deficiency. The report specifically recommends "development of a comprehensive Antarctic data management plan based on the World Data Centres wherever possible. The aim is to construct a single detailed inter-disciplinary set of all the data needed for Antarctic climate research."

A workshop to address these proposals was organized by World Data Center-A for Glaciology [Snow and Ice] (WDC-A) and sponsored by SCAR, in conjunction with the XVIII General Assembly of the International Union of Geodesy and Geophysics, at Hamburg on 14-15 August 1983. Twelve participants and six observers (Appendix A), representing the major disciplinary fields of Antarctic climate research and specialists in data management, took part. This report provides a summary of the workshop discussions and recommendations. It also presents a preliminary inventory of Antarctic climate data sets, based on materials submitted by the workshop participants and subsequently reworked by WDC-A for Glaciology staff.

The recommendations are specifically directed to SCAR, but they are also being forwarded to the World Meteorological Organization Executive Committee (WMO EC) Working Group on Antarctic Meteorology, the WMO World Climate Data Programme, and the relevant World Data Centres.

B. Antarctic Data Management Issues.

The workshop was organized to try and formulate responses to a series of questions bearing upon the recommendations of the SCAR Group of Specialists. The objectives were:

1. to determine what is, or should be, an "appropriate climate data set" (based on WMO-World Climate Programme (WCP) reports, etc.), including determination of space and time scales of coverage, and the parameters to be included.

2. to suggest how such a data set is best organized:

    a. do data sets already exist in acceptable form in various national or international data centers?

    b. what data need to be assembled, where, and by whom?

    c. what overall structure would be best to achieve this (e.g. newsletter, one data center to provide a lead role)?

3. to define a minimal climate data set for central archiving, with definition of mechanisms for exchanging such data and formats.

4. to determine mechanisms for encouraging and facilitating prompt publication of data reports by researchers and agencies in certain basic formats (e.g. the monthly climate summaries published in the Antarctic Journal of the United States).

5. to recommend means of funding various national and/or international data management activities.

The participants meeting in Hamburg agreed to concentrate discussion on existing data. Questions of potential future data requirements for the WCRP have been addressed in several recent studies (Jenne, 1982; World Climate Data Programme, 1981) and the group saw no need to re-evaluate those reports.

C. Antarctica and the World Climate Research Programme.

The World Climate Research Programme (WMO/ICSU Joint Scientific Committee, 1983) has the following objectives:

1. establishing a physical basis for the long-range prediction of weather anomalies over periods of several weeks to a season;

2. predicting the interannual variability of the global atmospheric climate and the tropical oceans over periods from one to several years;

3. understanding long-term variations and the response of the global climate to natural or man-made forcing factors over periods of several decades.

The Antarctic continent and the Southern Ocean, approximately south of 55°S, are principal heat sinks of the global climate system. Antarctica has an area of 12 million km^2, 98 percent of which is covered by ice. This ice, averaging about 1.5 km thick, comprises 70 percent of the world's fresh water and has a volume equivalent to 73 m of world sea level. Antarctic sea ice cover varies in area between about 4 million and 18 million km^2 during the annual cycle. Atmospheric and sea ice processes, and the formation of Antarctic bottom water masses are important on seasonal to decadal, as well as longer, time scales, while changes in mass budget of the Antarctic ice sheet are important on centuries to millenia time scales. Meteorological problems in the Antarctic of relevance to the WCRP include such issues as cloudiness, aerosols, and surface radiation balance, cryosphere-climate interactions, and long-term trends in atmospheric constituents as revealed by ice core studies. Hence, a wide range of data types are relevant to questions of Antarctic climate data. There are a number of distinctive problems with these different data types, elaborated below, but there is a clear overall need for a guide to existing data, their location, and availability. It is appropriate to begin by reviewing the status of existing data.

II. STATUS OF EXISTING ANTARCTIC DATA.

The workshop participants individually surveyed the data types and existing archiving mechanisms in their disciplines or special areas of interest. An overview of this information and other sources, such as the annual reports to SCAR

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Table 1. Stations and Observational Programmes Comprising the Basic Synoptic Network in the Antarctic (World Meteorological Organization, 1982).

Index Number	Name of the Station*	Surface**				Radiowind/ Radiovent		Radio-Sonde	
	1	2				3		4	
		00	06	12	18	00	12	00	12
85984	Centro Met. Antarctico Pdte. Eduardo Frei***	X	X	X	X				
85986	B.A. Arturo Prat	X	X	X	X				
85988	B.A. Bernardo O'Higgins	X	X	X	X				
88925	Signy Island	X	X	X	X				
88952	Faraday (Argentine Island)	X	X	X	X	X	X	X	X
88962	Fossil Bluff	X	X	X	X				
89022	Halley	X	X	X	X	X	X	X	X
89062	Rothera Point	X	X	X	X				
88963	Esperanza B.E.	X	X	X	X				
88968	Islas Orcadas D.N. (Observatorio Meteorologico)	X	X	X	X	X	X	X	X
88970	Teniente B. Matienzo B.A.	X	X	X	X				
88971	Almirante Brown E.C.	X	X	X	X				
89034	General Belgrano II B.E.	X	X	X	X				
89045	General Belgrano III B.E.	X	X	X	X				

* The names of stations are considered to be as geographical designators and are not indicative of functions.

** Where possible when other requirements make it desirable, observations should also be made at some or all of the four intermediate standard times of observation, i.e. 0300, 0900, 1500 and 2100 GMT.

*** Stations carrying out data-processing and meteorological service functions.

Table 1. (continued).

Index Number	Name of the Station*	Surface**								Radiowind/ Radiovent				Radio-Sonde	
	1	2								3				4	
		00	03	06	09	12	15	18	21	00	06	12	18	00	12
89055	Vicecomodoro Marambio B.A. Centro Meteorologico Antartico***	X		X		X		X		X		X		X	X
89066	General San Martin B.E.	X		X		X		X							
89001	S.A.N.A.E. Station	X		X		X		X		X		X		X	X
89002	Georg von Neumayer	X		X		X		X							
89009	Amundsen-Scott	X		X		X		X		X				X	
89664	McMurdo	X		X		X		X		X				X	
89050	Bellingshausen	X		X		X		X		X		X		X	X
89132	Russkaya	X		X		X		X							
89512	Novolazarevskaja	X		X		X		X		X		X		X	X
89542	Molodeznaja***	X		X		X		X		X		X		X	X
89592	Mirnyj	X		X		X		X		X		X		X	X
89606	Vostok	X		X		X		X		X		X		X	X
89657	Leningradskaja	X		X		X		X		X		X		X	X
89532	Syowa	X		X		X		X		X		X		X	X
89571	Davis	X		X		X		X		X		X		X	X
89611	Casey	X		X		X		X		X		X		X	X
94986	Mawson***	X		X		X		X		X		X		X	X
95502	Dumont D'Urville	X		X		X		X		X		X		X	X

* The names of stations are considered to be as geographical designators and are not indicative of functions.

** Where possible when other requirements make it desirable, observations should also be made at some or all of the four intermediate standard times of observation, i.e. 0300, 0900, 1500 and 2100 GMT.

*** Stations carrying out data-processing and meteorological service functions.

EXISTING LINKS FOR THE DAILY INTERNATIONAL EXCHANGE OF METEOROLOGICAL DATA WITHIN THE ANTARCTIC (June 1983)

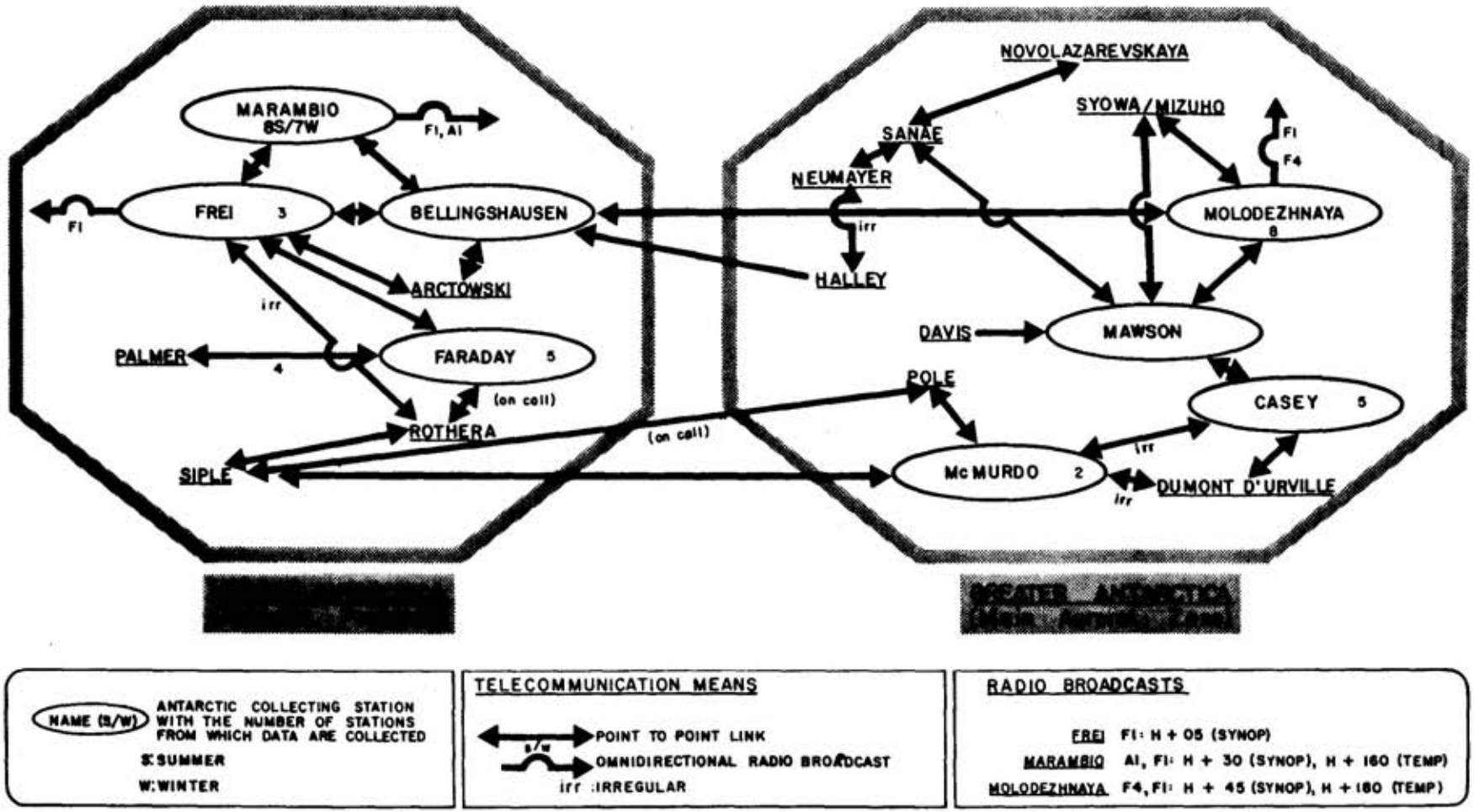

Figure 1. Existing links for the daily international exchange of meteorological data within the Antarctic, June 1983. (From WMO, 1983a).

PRINCIPAL ROUTES BY WHICH ANTARCTIC METEOROLOGICAL DATA ENTERS THE GTS

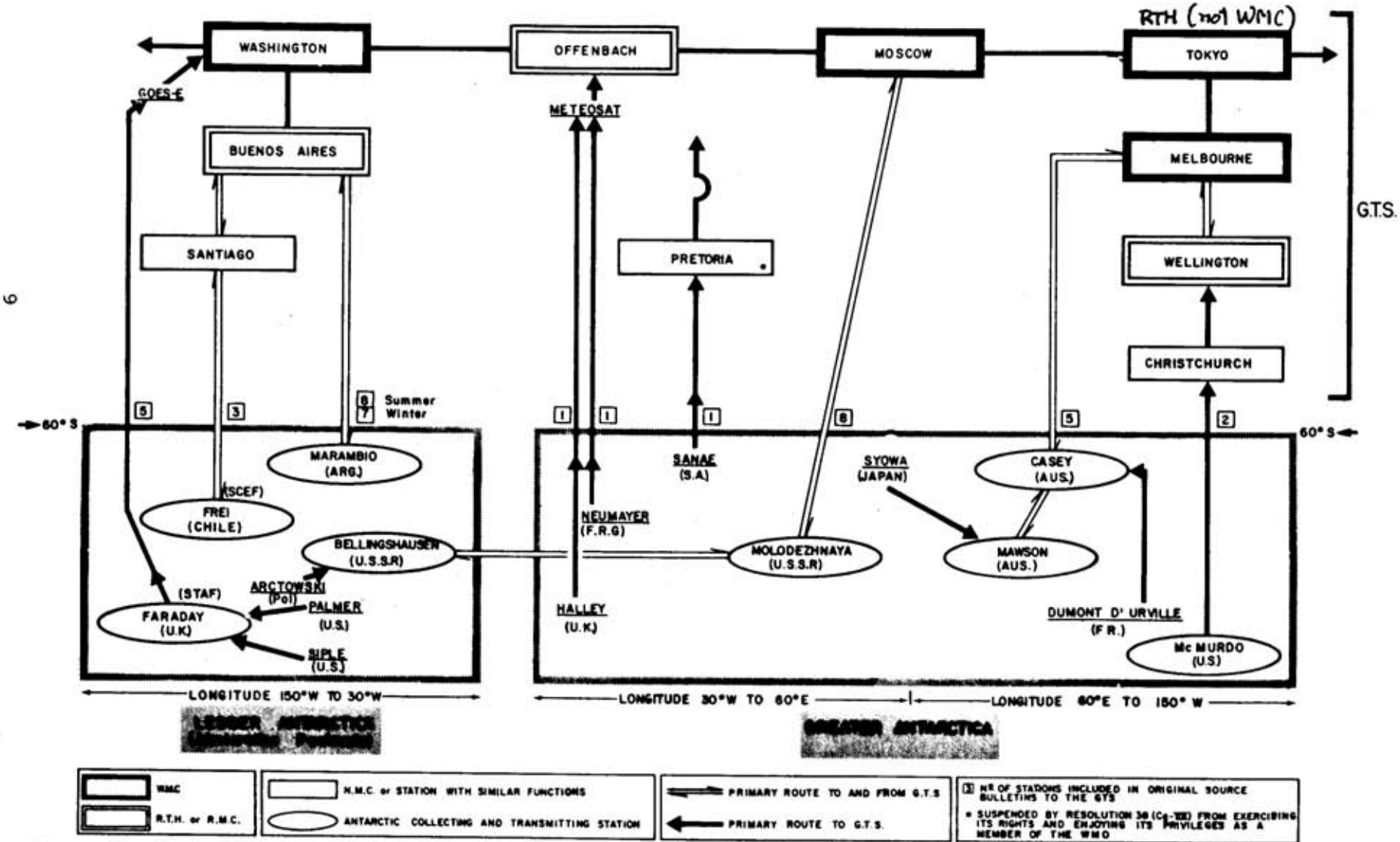

Figure 2. Principal routes by which Antarctic meteorological data enters the GTS. (From WMO, 1983a).

Table 2. Network of CLIMAT and CLIMAT TEMP Reporting Stations in the Antarctic (World Meteorological Organization, 1982)

Index Number	Name of Station	CLIMAT	CLIMAT TEMP
85984	Centro met. antarctico Pdte. Eduardo Frei	X	
85986	B.A. Arturo Prat	X	
85988	B.A. Bernardo O'Higgins	X	
88952	Faraday (Argentine Island)	X	X
89022	Halley	X	X
89062	Rothera Point	X	
88963	Esperanza B.E.	X	
88968	Islas Orcadas D.N. (Observatorio Meteorologico)	X	X
88971	Almirante Brown E.C.	X	
89034	General Belgrano II B.E.	X	
89055	Vicecomodoro Marambio B.A. Centro Meteorologico Antartico	X	X
89066	General San Martin B.E.	X	
89001	S.A.N.A.E. Station	X	
89009	Amundsen-Scott	X	X
89664	McMurdo	X	X
89050	Bellingshausen	X	X
89132	Russkaya	X	
89512	Novolazarevskaja	X	X
89542	Molodeznaja	X	X
89592	Mirnyj	X	X
89606	Vostok	X	

Table 2. (continued).

Index Number	Name of Station	CLIMAT	CLIMAT TEMP
89657	Leningradskaja	X	
89571	Davis	X	X
89611	Casey	X	X
94986	Mawson	X	X
95502	Dumont D'Urville	X	

B. Climatology.

Conventional climatological variables derived from the synoptic station reports are available in the CLIMAT format. Several SCAR nations also prepare monthly summaries, although not all of these are published. Monthly surface data for Antarctica from the World Weather Records are published through 1970 and available data are archived on tape through 1981 (Jenne, 1982, p. 118). Digital tape archives exist for varying periods. Partial listings, based on available information, are given in Appendix C.

Non-standard climatic data present a much greater problem, although the data volume is relatively small. (See Appendix B.2.) Incoming solar radiation is measured routinely at approximately 8 stations; these data are archived at the World Radiation Centre (WRC) in Leningrad. Measurements of radiation balance components and sunshine duration are reported mainly to national weather services, making these data much harder to obtain. Sets of these measurements could usefully be assembled by the WRC; a recently published report on the activities of this center recommends that the WRC should collect data on additional radiation variables (World Climate Data Programme, 1983). Energy balance measurements have been made at some 19 coastal and 10 inland locations, mainly on an expedition basis. Most of these data have been published, at least in summary form.

More specialized measurements of atmospheric properties are made through a variety of special observational or monitoring programs. Atmospheric composition and chemistry data are coordinated via the Background Air Pollution Monitoring (BAPMoN) program. Total ozone measurements (3-5 times daily at six stations) are reported to the World Ozone Data Center (WODC), Downsview, Ontario, Canada. Carbon dioxide is measured at South Pole by U.S. National Oceanic and Atmospheric Administration-Environmental Research Laboratories. Micrometeorological data have been archived from a number of special programs at South Pole Station, Plateau Station, and Mizuho Station. Surface synoptic weather observational data are also collected at Mizuho Station by the National Institute of Polar Research (Japan). These data are published in the JARE Data Report Meteorology series by the National Institute of Polar Research, Tokyo.

In an entirely different category, there are daily and averaged grid point analysis data for the Southern Hemisphere from national meteorological services in Australia, New Zealand, and South Africa, as well as global grids prepared by National Meteorological Center (NMC), Washington, the U.S. Navy, and the European Centre for Medium Range Weather Forecasting (ECMWF) (see Appendix C.10).

C. Oceanography.

Oceanographic variables needed by the World Climate Research Programme have been identified and the exchange mechanisms for data are well established. Appendix B.3 identifies data categories and observing systems for oceanographic data of relevance to Antarctic climate research. Each cruise files a Report of Observations/Samples Collected by Oceanographic Programs (ROSCOP) on its completion and, subsequently, investigators send data in standard formats to National Oceanographic Data Centers (NODCs) which in turn provide data sets of designated international interest to the World Data Centers A and B for Oceanography in Washington, D.C., and Moscow. Additionally, certain centers are

designated as Responsible National Oceanographic Data Centers (RNODCs) by the Intergovernmental Oceanographic Commission (IOC) for specific types of data (e.g. wave data), regions or projects (e.g. the WMO-IOC Integrated Global Ocean Station System (IGOSS). The establishment of an RNODC for physical and chemical data from the Southern Ocean is under discussion by IOC.

The WDCs produce data catalogs and a more general Marine Environmental Data and Information Referral System (MEDI) is maintained by the IOC and FAO. Guidelines for data exchange are formulated by the IOC Working Committee on International Oceanographic Data Exchange (IODE) and an oceanic component of the World Climate Research Programme is being developed by the SCOR/IOC Committee on Climatic Changes and the Oceans (CCCO).

A standard exchange format for digital oceanographic data (GF-3) has been developed by the Working Committee on IODE from the meteorological GATE (GARP Atlantic Tropical Experiment) data format (see UNESCO, 1973, Annex I, Parts I-III). It is suitable for the exchange of multidisciplinary data, but it is not designed as a processing or archival format. In many cases it is desirable to exchange data in the archival format to eliminate subsequent reprocessing.

D. Glaciology.

Glaciological and related geophysical data are the most heterogeneous in type, time and space coverage, and media of archiving (see Appendix B.4). Ice sheet data are collected mainly by research institutes and variables or parameters of climatic significance usually involve substantial interpretation procedures. Examples of these data types include: ice sheet elevation which may be determined by ground survey and by aircraft or satellite altimetry; accumulation determined by surface observations or satellite microwave data; ice temperatures determined at the surface by satellite infrared radiometers and at depth by shallow or deep holes. These data are needed in a synthesized form (levels 2 or 3) and in several instances (e.g. elevation) only at decadal, or longer, time intervals. Some of this information is now available in Antarctica: Glaciological and Geophysical Folio (Drewry, 1983). An inventory of ice core data has been published by World Data Center-A for Glaciology (1980) which also archives a small number of ice core data sets and radio-echo sounding film for Antarctica. In the case of ice sheet data, time series are of particular importance. Parameters of interest include the gas content (especially CO_2), microparticle content, and electrical conductivity (as a measure of H_2SO_4) in ice cores, in addition to the inferred temperatures (from ^{18}O data), and accumulation rates (from the annual stratigraphy). The data volumes involved are not large, although a major task of data assembly and digitization is necessary.

In the case of sea ice, routine mapping of ice extent by satellite has been possible since the early 1970s. Limited historical records for summer exist from the 1930s in a few sectors. Microwave data are now providing all-weather coverage, although ice concentration information is still subject to uncertainty. The U.S. Navy weekly ice charts from the early 1970s are currently being digitized and tape archives exist of ice concentration inferred from ESMR data for 1973-76 (Zwally et al., 1983).

E. Satellite Remote Sensing.

Satellite data range from high-resolution Landsat images being used to compile a satellite mosaic of Antarctica, to research and development programs of NASA collecting microwave imagery, to operational NOAA satellites routinely providing sea surface temperature data and vertical temperature profiles. In most cases Antarctic data are contained in large global data files, commonly ordered by orbit, making their extraction cumbersome and costly. For example, the Antarctic subset of Vertical Temperature Profiling Radiometer (VTPR) temperature soundings (1200 tapes) could be held on about 10 high density tapes. Operational NOAA AVHRR data (5 channels) are available in reduced (sampled) resolution on tape from NOAA-NESDIS. Experimental research data sets (microwave, radar altimetry) are typically held in NASA research centers until algorithms and orbit parameters are finalized; the orbital data are distributed by the National Space Science Data Center (NSSDC), Greenbelt, Maryland. Antarctic ice extent and concentration derived from the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR) data for 1973-76 and Nimbus 7 Scanning Multifrequency Microwave Radiometer (SMMR) data for 1979-80 are also archived at WDC-A for Glaciology.

III. THE STATUS OF EXISTING DATA MANAGEMENT MECHANISMS AND ASSOCIATED PROBLEMS.

The types of problems that scientific users of data encounter fall under seven general headings.

A. Data sets differ among disciplines and among national practices within a given discipline as to the type of measurement or observation, the time and space sampling, the data level that is archived, and the media on which the data are stored;

B. the existence or location of certain data is unknown due to the lack of a comprehensive inventory/referral system and data catalogs;

C. standard data types are collected by national observing networks but are retained in many individual national centers and recorded in varying media;

D. digital files or other records are incomplete as a result of deficiencies in the data transfer mechanisms. The missing data need to be retrieved from national centers and the files updated;

E. data that are most useful in digital form, particularly older observations, may not have been digitized;

F. digital data that are needed may be part of a global data set of very high data volume and thus costly and difficult to access;

G. research project data, of continuing interest, may depend on the health, interest, and funding of a single researcher.

Each of these problems is encountered in some degree for Antarctic climate data, although the type of problem differs on a discipline-specific basis. A broad characterization can be made for each of the discipline headings used in Section II.

Synoptic meteorology. The GTS reporting network and the World Meteorological Center (WMC) archiving system are well established and controlled. One major problem is incomplete data collection via the present communication links. This problem is being addressed by the WMO Executive Committee Working Group on Antarctic Meteorology. Large data volumes are characteristic in these global files and accessing them is commonly costly.

The collection of Antarctic CLIMAT data in the delayed transmission mode is also subject to the general communications problem.

Climatology. Climatological data are heterogeneous in type and in the case of measurements relating to surface energy balance, for example, usually short-term and/or at a small number of stations. Data volumes are small and some data sets are published in extenso, but there is a clear need for an inventory and catalogs of these data. Except for specific data types (ozone, radiation) there are no mechanisms for international data transfer and archiving.

Oceanography. The data exchange mechanisms of the IODE are well established for standard observations. Non-standard data are generally retained by originating countries. However, the Guide to International Data Exchange (ICSU, 1979) notes that specialized meteorological data (such as solar radiation) recorded in conjunction with oceanographic observations should be sent to meteorological centers with a copy to WDCs for Oceanography.

There is no RNODC for the Southern Ocean. Limited catalogs of Antarctic oceanographic data have been prepared by the NODC in Washington, DC. The distributions of selected data types are shown in the NOAA publication Environmental Inventories. Antarctic Area (1978).

In the case of oceanographic data there is a particular need to create time series for variables such as temperature, ocean currents, and sea level.

Glaciology. Snow and ice data types are very heterogeneous. Ice sheet data are mostly short-term specialized measurements whereas sea ice cover is mapped by satellite sensors. Archiving and exchange mechanisms exist through the WDCs for Glaciology and data volumes are modest, but many data sets reside with research scientists. Further inventory and catalog preparation is necessary, as well as encouragement to scientists to provide data reports and summaries to WDCs. The data deriving from the ice dynamics and ice core projects identified in the report of the SCAR Group of Specialists on Antarctic Climate Research (Allison, 1983, pp. 17-23) would be appropriately handled via WDC-A for Glaciology. Ice from cores collected under major United States National Science Foundation programs are stored at the Ice Core Facility at the State University of New York at Buffalo.

Remote Sensing. Continued growth in satellite data archives can be expected over the next one to two decades. Antarctic subsets of various global meteorological data files are required so that researchers can access such data in a cost-effective and timely manner.

IV. PROPOSED SOLUTIONS.

A. Data Management Strategy.

The recommendation of the SCAR Group of Specialists on Antarctic Climate Research for development of a comprehensive data management plan was discussed. The group agreed that a data management strategy and plan were essential but considered that an attempt to formulate a special Antarctic climate data system was unnecessary and might be counter-productive. The problems of Antarctic climate data are diverse because the data types are much more varied and the observational networks more heterogeneous than those in short-term, intensive meteorological or oceanographic experiments where specific data management plans are typically required. The workshop participants identified several areas where improvements could be made in the existing mechanisms for climate data archiving that involve the WMO, IOC, and the WDCs, particularly WDC-A for Glaciology.

RECOMMENDATION:

The Scientific Committee on Antarctic Research should take a lead role in ensuring the implementation of a data management strategy for Antarctic climate data in coordination with the World Meteorological Organization/World Climate Data Programme, the Intergovernmental Oceanographic Commission and the World Data Centres.

B. Data Inventory and Catalogs.

A new data system dedicated only to Antarctic climate data does not seem to be necessary or feasible. However, the present data archiving mechanisms do not provide for all the types of data that climate researchers require and the concept of a "distributed data archive" that can be accessed via a central referral point, is therefore not yet feasible. As a first step, there is an urgent and overriding need for an inventory of Antarctic climate data, identifying data types and their archiving. The materials prepared by the workshop participants, and included in Appendix C of this report, provide an interim product which it is hoped can quickly be corrected, supplemented, and updated. This revised inventory can then be more widely distributed and elements of it incorporated into the WCDP Infoclima referral system (see World Climate Data Programme, 1981a). Based on this inventory, more detailed data catalogs need to be prepared; for example, these would detail stations, time periods and variables measured, and the space/time coverage of gridded products.

As an essential contribution to preparing data catalogs, SCAR might contact the nations involved with Antarctic research and request that each develop a brief history of their research efforts, with emphasis on the time periods for which given types of observations were taken (for Antarctica, sub-Antarctic islands, and tips of the southern continents). This national information should also indicate what data are available in digital files.

Selected centers should be asked to inventory the data available for the Antarctic regions. A possible breakdown of responsibilities might be as follows:

- Meteorological data available from GTS - NCAR

- Surface and upper air meteorological data (observations and monthly means) at WDCs - WDCs for Meteorology

- Surface marine ship data (and summary statistics) - WDCs for Meteorology, NCAR, CIRES Climate Dynamics group

- Surface radiation and sunshine data - WRC Leningrad

- Satellite radiation budget data - NCAR, NASA

- Synchronous satellite data (radiation, cloud, winds) - NCDC (satellite data), NCAR

- Ozone data - WDC (Ozone)

- Satellite microwave data - WDC-A for Glaciology

- Ocean station data - WDC-A for Oceanography

- Time series of coastal measurements (SST, salinity, etc.) - NODC and individual countries

- Meteorological and oceanographic grid point analyses - NCAR

- Tide data (daily and monthly) - Permanent Service for Mean Sea Level (UK)

- Drifting buoy data - NCAR

- Current meter data - Joint Oceanographic Institute, Washington, D.C.

- Ice and snow data - WDC-A for Glaciology

After the additional inventory information has been gathered, it should be reviewed and assembled for publication. At this point it will be more apparent what further steps of data gathering, processing, and digitizing are necessary to make Antarctic data easier to obtain and to use. A data plan should then be written that considers each type of data, and indicates what further action is needed, if any.

RECOMMENDATION:

A catalog (or catalogs) of Antarctic climate data should be prepared, building on the inventory work carried out for this workshop report. SCAR should seek to arrange funding for such an activity, possibly through WMO, and/or coordinate it through its national correspondents.

C. Data Transfer Mechanisms.

The existing mechanisms for data transfer to archiving centers are summarized in Table 3. Certain deficiencies can be identified. For example, whereas oceanographic cruise data are transferred in a delayed mode via the WDC system in accordance with IODE procedures, there is no corresponding provision in

Table 3. Existing methods for data transfer to archiving center. (From World Climate Data Programme, 1982, p.33).

Data Category	Archiving Systems		
	National	Specialized or Regional	Global or International
Synoptic Meteorology (surface, upper-air)	NMC NMC	RMC	WMC
Surface Climate	National Services		-
Oceanography	NOC NODC/DNA	SOC RNODC	WDC for Oceanography
Marine Meteorology		RMC Responsible Members (8)	WMC Members (Voluntary)
Surface Radiation	National Services Others	-	WMO Centre
Snow and Ice	National and sub-National Agencies, Research Institutes	-	WDCs for Glaciology, FAGS, UNESCO
Atmospheric Composition, Chemistry, etc.	BAPMoN	-	BAPMoN
Hydrology	Sub-national and National Agencies	-	-
Agriculture-Meteorology	Sub-national and National Agencies	-	-
Agriculture-Agronomy	Sub-national and National Agencies	Agricultural Organization	-
Satellite	National Agencies Research Institutes	-	-
Proxy	Research Institutes	Specialized Data Banks	-
Solar and Extraterrestrial Radiation	National Services	Specialized Institutes	WDCs for Solar Terrestrial Physics
Meteorological Research Experiments	National Services Research Institutes	Specialized Centres	WDC for Meteorology
Other Geophysical data types	National Services	Specialized Institutes	WDCs Centres, Permanent Services

the WMC system for meteorological data collected on Antarctic "expeditions." There is similarly no provision for non-standard surface climate data, such as energy budget measurements made by research projects. In the case of WMO-GARP-designated experiments, such as MONEX and ALPEX, the data are organized and held together in a designated national or other center. This approach could be adopted for Antarctic meteorological projects such as the katabatic wind and automatic weather station programs. Tapes of such data should include header information referring to relevant publications.

RECOMMENDATION:

The WMO EC Working Group on Antarctic Meteorology should assess the problems of non-standard and expedition-type meteorological and climatological data and determine whether existing archiving mechanisms can be expected to provide for these low volume, but important records.

D. Existing Archives.

A variety of problems have been identified with several existing types of data archive. First, certain climate data collected at Antarctic stations are not released in a timely manner. These records are commonly archived in national centers but the responsible agency and its principal responsibilities differ widely among countries. The data formats and archiving media used by these centers are also variable and are not always known.

RECOMMENDATION:

SCAR should call upon all national organizations to release Antarctic data promptly via existing archiving channels. As a first step, full catalogs of these data should be published.

A second problem concerns existing archives of global meteorological, oceanographic, or remote sensing data that are of very large volume. Antarctic climate researchers may require level 3 archives in addition to the existing (generally level 1) data sets and they may also require Antarctic subsets to reduce data access and handling problems. In some cases, data may be archived in a data base management system such that they are readily extracted in a choice of grid formats. In other cases, where retrieval of specific geographical subsets or time intervals is costly and inconvenient, it may be worthwhile considering a one-time effort to prepare selected subsets of data for Antarctica. However, the problem of updating such sets periodically then needs to be addressed. Such data extraction could possibly be undertaken for selected data at the National Center for Atmospheric Research, Boulder, Colorado, if a clearly defined and strongly supported research need was established.

Data types which already exist in comprehensive data sets in a primary data center include ocean station data, marine ship observations, ozone observations, and many meteorological analysis products. In these instances there is no reason to transfer or copy such files to a special Antarctic center unless that center needs them for its own research activities, or that center has become a general computational center for Antarctic climate research.

Certain data types that are fully accommodated within existing data archiving systems may have deficiencies in the data sets with respect to older records. In the case of ship log-book observations, for example, many early reports have not been digitized. Rescue operations to safeguard important data sets of this kind may be required.

A common concern of the workshop participants was the fact that data that are known to exist may not be readily available because they are held in many disparate formats and in several locations. The following conventional meteorological data should be made readily accessible for Antarctica, Southern Ocean Islands, and southern extremities of the continents from the beginning of records:

1. individual land synoptic observations;

2. observations from ocean buoys and automatic land stations;

3. daily maximum and minimum temperature and precipitation (gage and stake observations);

4. individual rawinsonde soundings;

5. sunshine and radiation observations;

6. station history information;

7. yearly/monthly means of the above should also be available.

Since many of these data are already held in digital form in national archives, the first step should be to determine the status of the national holdings. Then the national holdings need to be put into a common format. If some of the older data have not been digitized, a plan will need to be developed to accomplish this for necessary selected stations.

To reduce costs, it is suggested that these tasks might be undertaken over an extended period, up to four years. Data from the real-time GTS can be used to supply many of the needs for current data even though data receipt may be less than adequate. Existing WMCs decode the GTS data. It is then archived at such centres as WDC-A for Meteorology, NCAR, and the Australian Bureau of Meteorology. Statistics on the receipt of GTS data should be prepared, based on the decoding of data at one or two NMCs.

RECOMMENDATION:

SCAR should request that the WMO/ICSU Joint Scientific Committee (JSC), or/and the WMO EC Working Group on Antarctic Meteorology, draw attention to the urgent need for the preparation, under the World Climate Data Programme, of standardized readily accessible digital sets of meteorological data for the Antarctic region.

With regard to surface radiation budget data in Antarctica, these should be routinely reported to the appropriate data center with a time delay of less than three months or according to the schedule of expeditions. The data formats

and time resolutions adopted by the World Radiation Centre (WRC) in Leningrad could be used. There is a vital need for all operational radiation instruments and those used for local research projects to be intercompared. Reports on instrument performance and maintenance should be included in the data documentation published by the WRC. There is a need also to develop algorithms to derive surface radiation estimates from operational satellite data and to calibrate these against network data.

RECOMMENDATION:

SCAR should take all possible measures to ensure that all national programmes promptly report the radiation data obtained at all their stations or by their expeditions, in digital and analog format, to the World Radiation Centre in Leningrad.

E. A Minimal Set of Antarctic Climate Data.

The workshop participants discussed the feasibility of defining a minimal set of Antarctic climate data for archiving at one, or a small number of designated disciplinary center(s). This question is linked with the problem that existing data may not be available to scientists for any of the various reasons discussed on p. 14. No definitive agreement was reached, although the meteorological data listed on p. 20 and the annual climate data synopsis discussed below would represent essential components of a common basic set of Antarctic climate data. Additional inventory information would need to be obtained, however, before a series of processing steps could be formulated to create such a data set.

RECOMMENDATION:

After the recommendations of this report have been considered, and implemented where appropriate and feasible, SCAR in conjuction with the concerned World Data Centres and WMO-WCDP, should reconsider whether a need exists for the creation of a basic set of Antarctic climate data appropriate for archiving at one, or a few, data centers.

F. Annual Synopsis of Antarctic Climate Data.

A number of national agencies and groups involved in Antarctic programs produce regular annual data summaries. Standard climate data for U.S. Antarctic stations, for example, are published in the Antarctic Journal of the United States, see Table 4. Similar reports are prepared by the British Antarctic Survey, the Australian National Research Expedition (ANARE) using Australian Bureau of Meteorology data, and other agencies. The workshop participants considered that an annual compilation of such reports would be valuable and suggested that volunteers to undertake this task should be sought. Past data should also be consolidated into similar synopses, if resources for this task can be identified. A suggested format and outline of the contents of such an annual synopsis is given in Appendix E. Items 1, 2, and 3 of this format might be published in the National Reports to SCAR.

Table 4. Sample of standard climate data for U.S. Antarctic stations as published in the Antarctic Journal of the United States.

Weather at U.S. stations

Feature	February 1983				March 1983				April 1983			
	McMurdo	Palmer	Siple	South Pole	McMurdo	Palmer	Siple	South Pole	McMurdo	Palmer	Siple	South Pole
Average temperature (°C)	-12.6	1.2	-17.3	-42.6	-17.1	0.0	-25	-54.9	-16.4	- 1.2	-25.5	-56.1
Temperature maximum (°C) (date)	- 0.5 (11)	6.8 (10)	- 6.2 (16)	-31.1 (3)	- 6.1 (5)	6.7 (31)	-13.4 (30)	-34.8 (7)	- 4.8 (30)	6.4 (1)	- 6.0 (20)	-39.2 (19)
Temperature minimum (°C) (date)	-22.2 (28)	- 4.4 (10)	-36.5 (26)	-53.3 (26)	-32.9 (27)	- 4.9 (17)	-41.9 (19)	-71.0 (25)	-30.6 (7)	- 6.9 (12)	-40.5 (10)	-68.7 (6)
Average station pressure (mb)	995.8	986.2	864.7	686.8	986.6	983.9	864.0	682.9	981.3	999.2	865.4	683.2
Pressure maximum (mb) (date)	1008.5 (7)	1002.6 (10)	881.2 (9)	699.5 (2)	1001.5 (27)	1010.7 (26)	875.0 (29)	698.4 (7)	998.1 (4)	1014.6 (19)	883.8 (12)	692.3 (14)
Pressure minimum (mb) (date)	983.5 (12)	968.0 (24)	844.9 (13)	676.4 (18)	973.1 (20)	965.5 (5)	856.5 (31)	671.0 (26)	961.2 (13)	974.0 (7)	846.8 (8)	673.7 (6)
Snowfall (mm)	236.2	76.2	38.1	Trace	104.7	401.3	25.4	Trace	246.4	262.9	55.9	Trace
Prevailing wind direction	045°	345°	150°	070°	080°	245°	190°	045°	075°	025°	190°	045°
Average wind (m/sec)	4.1	2.8	5.2	3.7	4.5	3.8	3.5	3.8	6.2	3.9	4.3	3.7
Fastest wind (m/sec) (date)	17.4 040° (6)	22.4 260° (15)	12.8 130° (14)	14.4 360° (27)	29.9 170° (29)	25.9 030° (20)	16.5 240° (28)	15.4 360° (6)	31.3 120° (20)	26.4 025° (1)	25.2 290° (20)	15.9 360° (10)
Average sky cover	6.5	7.0/10	7.3	6.1	6.5	8.9/10	5.5	5.4	7.2	7.7/10	6.4	4.9
Number clear days	3	2.4	5.0	10.6	4	0	8.25	13.0	2.0	3.4	7.0	14.0
Number partly cloudy days	13	14.3	2.0	2.8	14	11.4	7.5	6.4	14.0	12.8	4.5	5.5
Number cloudy days	12	11.3	21.0	14.6	13	19.6	15.25	11.6	14.0	13.9	18.5	10.5
Number days with visibility less than 0.4 km.	0	---	8.5	11.4	0.7	---	3.5	3.8	1.3	---	7.25	2.0

Prepared from information received by teletype from the stations. Locations: McMurdo 77°51'S 166°40'E, Palmer 64°46'S 64°3'W, Siple 75°55'S 83°55'W, Amundsen-Scott South Pole 90°S. Elevations: McMurdo sea level, Palmer sea level, Siple 1054 meters, Amundsen-Scott South Pole 2835 meters. For prior data and daily logs, contact National Climate Center, Asheville, North Carolina 28801.

RECOMMENDATION:

SCAR should encourage and coordinate the preparation and publication of a standardized annual synopsis of Antarctic climate data.

G. Improvement of Field Observations.

Many climate-related data from polar regions are of limited use to researchers because methods of acquiring the data are either not standardized or not specified. For instance, estimates of snow accumulation rate, 10 m temperatures, and even strain rates are strongly dependent on measurement techniques. A brief handbook could be of considerable value to those polar researchers who have little previous experience of Antarctic conditions. A distillation of the practical knowledge of more experienced workers would be especially useful to these people.

Suggested techniques for inclusion in such a manual include:

- measurement of snow accumulation by stake;
- collection and preservation of 10 m cores;
- measurement of strain rates;
- measurement of air temperature and surface melt;
- measurement of 10 m temperature;
- establishing "geocenter" fixes and installing a long-lived marker.

The preparation of such a field observers handbook might be considered by polar science institutes, the NSF Division of Polar Programs, and SCAR, based on any existing manuals of this kind available to national agencies.

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NCDC - National Climatic Data Center (Asheville, N.C., U.S.A.)

NESDIS - National Environmental Satellite, Data, and Information Service

NMC - National Meteorological Center

NOAA - National Oceanic and Atmospheric Administration

NODC - National Oceanographic Data Center

NSF - National Science Foundation

NSSDC - National Space Science Data Center (Goddard, MD)

PSMSL - Permanent Service for Mean Sea Level, U.K.

RNODC - Responsible National Oceanographic Data Center

ROSCOP - Report of Observations/Samples Collected by Oceanographic Programs

RTH - Regional Telecommunication Hut

SCAR - Scientific Committee for Antarctic Research

SCOR - Scientific Committee on Oceanic Research

SMMR - Scanning Multifrequency Microwave Radiometer

SST - Sea Surface Temperature

VTPR - Vertical Temperature Profiling Radiometer

WCDP - World Climate Data Programme

WCP - World Climate Programme

WCRP - World Climate Research Programme

WDC-A - World Data Center A for Glaciology (Snow and Ice)

WDC-O - World Data Centre (Oceanography)

WMC - World Meteorological Center

WMO - World Meterological Organization

WMO-JSC - World Meteorological Organization - Joint Scientific Committee

WMOEC - World Meteorological Organization Executive Committee

WODC - World Ozone Data Centre

WRC - World Radiation Centre (Leningrad)

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WMO-JSC - World Meteorological Organization - Joint Scientific Committee

WMOEC - World Meteorological Organization Executive Committee

WODC - World Ozone Data Centre

WRC - World Radiation Centre (Leningrad)

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Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.

1. METEOROLOGICAL DATA.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
A. Surface Land Data			Existing Network from 100 km to >1000 km		World Meteorological Centres (Washington, Melbourne, Moscow) or Research Organizations	Mixed: Archive manuscripts, Microfiche, Magnetic Tape/Disc
1. Instrumental						
a. Temperature		0.2°C/1°C	Desired: 150 km land; 300 km sea; minimum: 500 km			
b. Dew Point or		0.2°C/1°C				
c. Relative Humidity or		5%/20%				
d. Vapor Pressure	Synoptic Meteorological Observations and Synoptic Climatological Reports	0.1 mb/0.5 mb		every 3 or 6 hours		
e. Pressure		0.1 mb/0.5 mb				
f. Wind Speed		0.5 ms^{-1}/2 ms^{-1}				
g. Wind Direction		10°/45°			WDC-A, B for Meteorology*	Magnetic Tape
h. Sunshine Duration		0.1 hr/1 hr		Daily		
i. Rainfall/Snow water equivalent		1 mm/5 mm		2 Daily/ Daily	Principally 1) a, d, e, h, i as Synoptic Reports	
j. Snow depth		0.5 cm/ 1 cm		Monthly		
2. Observed			Existing Network from 100 km to >1000 km		World Meteorological Centres (Washington, Melbourne, Moscow) or Research Organizations	Mixed: Archive manuscripts, Microfiche, Magnetic Tape Disc
a. Weather Type and Intensity	Synoptic Meteorological Observations		Desired: 150 km land; 300 km sea; minimum: 500 km			
b. Cloud Amount		± 1 okta				
c. Cloud Type						
d. Cloud Height		10% / 25% of height		every 3 or 6 hours		
e. Visibility		10% / 25% of range				
B. Ship Reports						
As A.1. a. - g. A.2. a. - e. plus Sea Surface Temperature	Synoptic Reports	0.2°C/1°C		6 hours; 6 hours	National Meteorological Services and United Kingdom Meteorological Office, Marine Branch, Dutch Marine Branch	Punched Card or Magnetic Tape plus Original Log Books
Sea Ice: Distribution Type		1/10 / 3/10		6 hours	U.S. Navy-NOAA Joint Ice Center	
Iceberg Frequency		± 20%		6 hours		

*Only for research experiment data (e.g. GARP).

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
1. METEOROLOGICAL DATA, continued.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
C. Radiation						
Short Wave Global	Solarimeters		>1000 km	Hourly	National Meteorological Services	Analog Charts Digital Tape
Short Wave	Solarimeters		>1000 km	Hourly	WRC Leningrad	
Long Wave Net	Radiometers		>1000 km	Hourly		
Turbidity	Pyrheliometer/ Photometers		>1000 km	Clear days only	Expeditions, Universities	Hard Copy
D. Upper Atmosphere		500 Km/1000 Km				
Temperature	Radio-remote and Radar Wind Soundings	$\pm$ 1°C	500 km for 4 tropospheric levels	1 or 2 Daily	As for Synoptic Reports	As for Synoptic Reports
Pressure	Radio-remote and Radar Wind Soundings	1mb/3mb	500 km troposphere only	1 or 2 Daily		
Wind	Radio-remote and Radar Wind Soundings	$\pm$ 3 ms^{-1}				
Relative Humidity	Radio-remote and Radar Wind Soundings	$\pm$ 30%	500 km troposphere only			

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
2. CLIMATOLOGY: RADIATION, ENERGY BALANCE, AND ATMOSPHERIC CONSTITUENTS.*

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Sunshine Duration	Campbell-Stokes heliograph	± 0.1 hrs.	26 stations (including islands)	Continuous	All held by respective weather services	Burn Charts (strips)
Solar radiation (Global or direct and diffuse)	Solarimeters (Kipp, Eppley, etc.)	± 5%	8 stations	Hourly or on strip charts (continuous)	All held by respective weather services	Strip Charts or Digital
Complete radiation balance	Solarimeters, radiometers	± 10%	10 Stations (not including 8 above)	As above	All held by respective weather services	Ship Charts or Digital
Total energy balance:	No observations listed, but in the past there have been energy balance measurements at 19 inland and 10 coastal stations. Data only available after and through publication of papers.					
Total ozone	Dobson		6 stations	5 x daily	Research Institutions	Log Books/Hard Copy
Vertical profiles of ozone	Dobson (Umkehr)		2-3 stations	Occasionally	Research Institutions	Log Books/Hard Copy
CO_2	Flask samples		3 stations	2 x monthly	Research Institutions	Log Books/Hard Copy
NO_2	Flask samples		2 stations	2 x monthly	Research Institutions	Log Books/Hard Copy
Halocarbons	Flask samples		2 stations	2 x monthly	Research Institutions	Log Books/Hard Copy
Turbidity	Photometers		2-3 stations	Occasionally	Research Institutions	Log Books/Hard Copy
Other trace gases	Samples			Occasionally	Research Institutions	Hard Copy
Condensation and Aitken's nuclei	Samples			Occasionally	Research Institutions	Hard Copy
Other parameters (C-14, radioactivity, Kr-85, Na_2 etc,)			Occasionally	Ocassionally	Research Institutions	Hard Copy

*Source of information, SCAR National Reports for 1982.

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
2. CLIMATOLOGY: RADIATION BUDGET DATA.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Planetary Radiation Budget	Satellites (U.S. Satellites)	Albedo 0.02/0.05 Fluxes 10-25 Wm^{-2}	250 x 250 km^2	1-4/day	NOAA/NESDIS Archive, C.S.U., Univ. of Wisc., WDC-A for	Magnetic Tapes
	Earth Radiation Budget Experiment (ERB) 1984 - 1988				Meteorology should be available from NASA/Langley	Magnetic Tapes
(Summary: See articles by Stephens, G.L., et al., 1981; Kandel, R. 1983.)						
Radiation Budget at Surface						
Global Solar	Stations/Sat.	10-25 Wm^{-2}	?/250 x 250 km^2	Daily and Hourly	M 60-Leningrad* (3 stations)	Hard Copy
Albedo	Stations/Sat.	0.02/0.05	?/250 x 250 km^2			
Surface Temperature	Satellite/ Station	1-2°K	?/250 x 250 km^2		Individual	Hard Copy
Atmospheric Radiation	Stations	10-25 Wm^{-2}	?/250 x 250 km^2		Countries	Magnetic Tapes
Clouds						
Sky Cover	Visual (Station)	3 / 15%		2-4/day	Research Institutions	?
	Satellites			2-4/day		Tape
Top Temperature	Satellites	2 / 4K		2-4/day	NOAA-NESDIS	Tape
Albedo	Satellites	0.2/0.4		2-4/day	NOAA-NESDIS	Tape
Total Liquid Water Content	Satellites	10 / 50 mg cm^{-2}		2-4/day	NOAA-NESDIS	Tape
Water/Ice Phase	Satellites	Water vs. ice		2-4/day	NOAA-NESDIS	Tape

Status: 1. Measurements are made with NOAA-AVHRR. In the solar wavelengths these are poorly calibrated but very stable instruments.
2. Only a few (3-5) research projects are concerned with developing algorithms to extract cloud properties from AVHRR data. The possibility exists to determine:

Cloud Cover
Top altitude/temperature (except haze)
Water/Ice phase
Albedo (if cloud is optically thick)

*The World Radiation Centre, Leningrad has received, for publication, Antarctic radiation data from the following countries: France, 1973-June 1982; Great Britain, 1964-1968; Netherlands, 1964-1965; USSR, 1964-1980.

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Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
3. OCEANOGRAPHIC VARIABLES.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY based on 16)	SPATIAL NETWORK	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Sea-surface temperature	Ship and in-situ measurements, satellites	0.2°C/1°C	30-150km	3 days	NODCs, WDCs-Oceanography, Meteorological Offices	Magnetic Tape
Evaporation		10%(mo) or 2mm(wk)/25%	250km	weekly (5-10 days)	Research Institutes	
Near-surface currents	Buoys, ship's drift, tide gauges	2/10 cm/sec	Variable/critical areas	30 days	WDCs-Oceanography, Meteorological Offices	Magnetic Tape, Some hard copy
Surface sensible heat flux		10/25 W/m^2	250km	weekly (5-10 days)	Research Institutes	Magnetic Tape (?)
Wind stress	Scatterometer, ships	0.1/0.3 $Dyne/cm^2$	200km	weekly (5-10 days)	Research Institutes	Magnetic Tape (?)
Sea level (to determine currents)	Altimetry, tide gauges	1/10 cm	20-200km	weekly (5-10 days)	PSMSL, Hydrogr. Services	Magnetic Tape, Hard Copy
Upper-ocean heat content (200 m)	XBT data, C/STD data, towed undulating thermistors	1/3 $Kcal/cm^2$	500km	monthly	NODCs, WDCs-Oceanography, Research Institutes	Magnetic Tape
Near-surface salinity	C/STD, salinograph	not defined			NODCs, WDCs-Oceanography	Magnetic Tape
Deep ocean circulation	SOFAR floats, moored current meters	0.1/0.5 cm/sec	1000 km and/or variable	5 years	Research Institutes	Magnetic Tape, Hard Copy
Ocean heat transport	XBT, C/STD, drifting buoys, ship's drift, cm profiler	not defined			NODCs, WDCs-Oceanography, Research Institutes	Magnetic Tape
Temperature profile	XBT, C/STD, towed undulating thermistors	0.2/1.0°C	Variable	monthly	NODCs, WDCs-Oceanography	Magnetic Tape
Velocity profile	Current meter profiler	2/10 cm/sec			Research Institutes	Magnetic Tape, Hard Copy

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
4. GLACIOLOGY: ICE SHEET PARAMETERS.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Surface Elevation	Satellite Altimetry	$\pm$ 0.5/$\pm$ 5m	N of 72°S	Once in 1978	NASA	Hard Copy, Maps, Tape
COMMENTS: Future satellites will extend coverage and provide repeat data.						
Ice Velocity	Repeated Satellite position measurements	$\pm$ 1/10m yr^{-1}	Representative points	At least twice, 1-5 yrs. apart	U.S.G.S.	Hard Copy
	Radar fading patterns	$<\pm$1m yr^{-1}	Representative points	At least twice, 1 month to 2 years apart	Research Institutions	Film
COMMENTS: Potential for accuracies of 0.1m yr^{-1}.						
Strain	Microwave distance measurements on stake networks	5×10^{-6} / 5×10^{-5}	Representative networks	At least twice, 1-5 yrs. apart	Research Institutions	Hard Copy
COMMENTS: Potential for high accuracy over large areas using satellite laser ranging.						
Accumulation	Pit studies	$\pm$10% / $\pm$50%	Along traverse routes	Once	Research Institutions	Hard Copy
	Stake measurements	$\pm$5% / $\pm$ 20%	Representative networks	At least twice, 1-5 yrs. apart	Research Institutions	Hard Copy
	Radioactive-horizons - from 10-m cores	$< \pm$1 cm yr^{-1}	Representative networks and traverse routes	Once	Research Institutions	Hard Copy
	Microwave brightness temperatures	To be determined	Global	Continuous since 1973	NASA - GSFC	Digital Tape and images
COMMENTS: Still a research project.						
Chemical and Isotope studies	Pits, cores	Various	Sparse	Once	Research Institutions	Hard Copy, Tape
COMMENTS: Some data in WDC-A for Glaciology.						
Snow and Ice Temperatures	Deep Holes Satellite estimates of T_s		Representative Stations	Once	Research Institutions	Hard Copy
Surface	Satellite IR	$\pm$ 1°C	Global	Continuous	NASA	Tape, Images
10m	Drill holes	$\pm$ 0.1°C	Representative Stations	Once	Research Institutions	Hard Copy
Deep	Deep holes	$\pm$ 0.1°C	Sparse	Once	NASA	Hard Copy
COMMENTS: Still a research project.						

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
4. GLACIOLOGY: ICE SHEET PARAMETERS, continued.

CATEGORY	OBSERVATION SOURCE	EXISTING ACCURACY AND PURPOSE*	SPATIAL NETWORK (existing)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Elastic wave velocities in the firn and ice	Seismic refraction shooting	+0.1% - 10% (1. Gives density depth profiles. 2. Marginal. 3a,3b. No)	50 along traverse routes ice shelves; near coastal stations	Once	Research Institutions U.S., USSR, Japan	Film/Hard Copy
	Seismic wide-angle reflection shooting	1% (1. Gives measure of anisotropy for ice fabrics--needed for ice dynamics. 2. Secondary. 3a., 3b. No)	20 sites along U.S. and USSR traverses; Dome C	Once	Research Institutions U.S., USSR	Film/Hard Copy
	Comparison, radar and seismic reflections	1% (1. Gives measure of anisotropy for ice fabrics--needed for ice dynamics. 2. Secondary. 3a.,3b. No)	Several hundred along traverse routes and on ice shelves	Once	Research Institutions U.S., USSR, FRG	Film/Hard Copy
Ice thickness	Radar reflections	1% (1. Mapping of basic ice-sheet configuration. 2. Secondary. 3a.Yes, 3b. No**)	About half Antarctica, 100km grid coverage	Once	Research Institutions U.K., U.S., USSR, FRG, Australia, Japan, South Africa, Belgium	Film
	Seismic reflections	1% (1. Also water depth beneath ice shelves. 2. As for radar. 3a. Yes, including copies of seismograms, 3b. No)	Several hundred stations along traverse routes and on ice shelves	Once	Research Institutions Many countries	Film/Hard Copy
Electrical Permittivity	Radar wide-angle reflections	0.1% #(1. Conversion of reflection times to ice thickness. Search for anisotropy. 2. Secondary 3a, 3b. No)	Representative Stations	Once	Research Institutions	Film/Hard Copy
	Logging in drill holes	0.1%	A few sites	Once	Research Institutions	Hard Copy
	Reflection sounding next to drill holes	0.1%	At all deep drill sites	Once	Research Institutuions	Hard Copy

*1. Purpose.
2. Importance to Climate.
3. Central Archive: a. glaciological.
b. climate.

**Radar records are not needed in central climate archive unless internal layering is visible. In most cases the ice bottom shows also.

#For all sources in the Electrical Permittivity category.

Appendix B. SUMMARY OF DATA CATEGORIES, CHARACTERISTICS, AND AVAILABILITY.
4. GLACIOLOGY: ICE SHEET PARAMETERS, continued.

CATEGORY	OBSERVATION SOURCE	EXISTING ACCURACY AND PURPOSE*	SPATIAL NETWORK (existing)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
Electrical Permittivity, cont.	Comparison between radar and seismic reflections	1%	Representative Stations	Once	Research Institutions	Hard Copy
	Direct propagation between drill holes	0.1%	A few sites	Once	Research Institutions	Hard Copy
	Radar polarization studies	30°	Representative Stations	Once	Research Institutions	Film/Hard Copy
	Radar absorption studies	To be determined	Representative Stations	Once	Research Institutions	Hard Copy
Internal discontinuities	Radar reflection	1% (in depth) (1. Paleoclimatic marker horizons. 2. Secondary. 3a,3b. Yes**. 1. Glacial flow lines for ice dynamics. 2. Secondary. 3a,3b. Yes**	Throughout sounding grid	Once	Research Institutions U.S., U.K., USSR, Aus, FRG	Film
Electrical Resistivity	Resistivity profiling	±10% (1. Englacial temperarures; Pleistocene/ Holocene boundary. 2. Marginal 3a,3b. No.)	A dozen or so stations mostly on Ross Ice Shelf	Once	Research Institutions U.S.	Hard Copy
Gravity	Gravimeter measurements	1-10 m/gal (1. Determination of glacio-isostatic imbalance--glacial history. 2. Marginal. 3a. Yes; 3b. No)	Several thousand measurements, mostly along traverse routes and on ice shelves	Once	Research Institutions Many countries, Central collection in USSR	Hard Copy

*1. Purpose.
2. Importance to Climate.
3. Central Archive: a. glaciological.
b. climate.

**Radar records are not needed in central climate archive unless internal layering is visible. In most cases the ice bottom shows also.

#For all sources in the Electrical Permittivity category.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
1. AUSTRALIA. ANTARCTIC DIVISION DATA.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
A. Meteorological Data						
4m, 2m, 1m Surface Temperatures	Automatic Weather Station	±0.02°C	68°S 112°E (Oct 1980 - Apr 1981)	Dependent on satellite passes Approx. hourly	Glaciology Section, Antarctic Division	Digital. 1200 BPI, ASCII-coded data tapes. Unedited. One file per month.
Snow Temperature		±0.02°C				
Wind Speed		0.1 m/s	68°40'S, 60°33'E (Jan 1981 -->)			
Wind Direction		2°				
Surface Pressure		0.2 mb				
4m, 2m, 1m Temperatures	Planned	0.02°C	Planned Oct 1984	Dependent on satellite passes. Approx. hourly	Glaciology Section, Antarctic Division	Digital. 1200 BPI, ASCII-coded data tapes. Unedited. One file per month.
4m, 2m, 1m Wind speed	Automatic Weather Stations	0.1 m/s	75°S 110°E			
Wind Direction		6°	71°S 110°E			
Snow Temperature		0.02°C	68°S 110°E			
Surface Pressure		0.2 mb				
Global Radiation						
Sea Surface Temperature	2 Drifting Data Buoys	0.1°C	February - April 1981 65°S 63°E 65°S 75°E) (drifting)	Dependent on satellite passes. Approx. 2-hourly	Glaciology Section, Antarctic Division	Digital. 1200 BPI, ASCII-coded data tapes. Unedited. One file per month.
Surface Pressure		0.2 mb				
Sea Surface Temperature	3 planned Data Buoys	0.1°C	Planned Feb. 1984 onwards 60 to 65°S 70 to 80°E	Dependent on satellite passes. Approx. 2-hourly	Glaciology Section, Antarctic Division	Digital. 1200 BPI, ASCII-coded data tapes. Unedited. One file per month.
Surface Pressure		0.2 mb				
B. Climatic Data						
Surface Temperatures	Synoptic network	0.2°C	All Antarctic and Southern Ocean Stations	Monthly means	Glaciology Section Antarctic Division	Digital
C. Energy Budget Data						
Complete annual energy budgets: Radiation Turbulent Fluxes Ground Flux	Profiling Mast (4m)		Mawson ablation zone Mawson sea ice	1965, 1967 1965 1969 1976* 1977* 1978* 1980* 1965, 1967 daily fluxes; 1969 3-hrly fluxes; 1976-80 1/2 hrly fluxes.	Glaciology Section Antarctic Division	Hard Copy Some digital files

COMMENTS: Data incompletely analyzed.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
1. AUSTRALIA. ANTARCTIC DIVISION DATA, continued.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
D. Glaciological Data						
Surface Elevation Ice Thickness Ice Surface Velocity Snow Accumulation	ANARE Traverses		Casey-Vostok flowline 2000m contour 50°E - 60°E 100°E - 130°E	2-3 traverses along each route	Glaciology Section Antarctic Division	Hard Copy Data Reports
Surface ^{18}O Samples 10m Firn Temperatures			Law Dome Lambert Glacier Basin			
Ice Core Studies - Law Dome Boreholes						
^{18}O Profiles	All boreholes		See Table 1 Summary on p. 43	N.A.	Glaciology Section, Antarctic Division	Most ^{18}O digital, others hard copy
Cation impurities Na^+, K^+, Ca^{++}, Mg^{++}	Boreholes D,Q and F					
Total Gas Content	Boreholes J, D, B, P, F, A, Q					
Anions - Cl^-	Borehole F					
Electrical Conductivity	Preliminary, borehole D					
Borehole Logging						
Ice Deformation Temperatures	Most Law Dome Boreholes		See Table 1 Summary on p. 43	N.A.	Glaciology Section, Antarctic Division	Hard copy. BHC1, and BHC2, digital data
Aerial Radio-echo Sounding	100 MHz radar		Approx. 50 km grid in: 1. Enderby Land 2. Lambert Glacier Basin 3. Inland of Davis Station 4. Vanderford Glacier		1, 2, 4 Glaciology Section, Antarctic Division 1 and 3 Bureau of Mineral	Hard copy, some digital. Digital

Appendix C. ARCHIVES OF ANTARCTIC DATA.
1. AUSTRALIA. ANTARCTIC DIVISION DATA, continued.

Table 1. SUMMARY OF BOREHOLES/CORES - LAW DOME.

BOREHOLE SITE	YEAR OF DRILLING	DEPTH OF BOREHOLE	DEPTH OF ICE	(Range where rough bedrock)
*SGD	1969	380 m	1010 m	
SGD (BHO) (1 km north of SGD)	1977	475 m	1010 m	
SGQ (BHQ)	1977	420 m	810 m	
SGB (78 km from SGD)	1972	73 m	850 m	(775 m-895 m)
SGP (90 km from SGD)	1972	115 m	685 m	
SGF (104 km from SGD)	1974	344 m	390 m	
SGA (107 km from SGD)	1969	320 m	360 m	
BHC1 (350 m at 308° T from SGA)	1981-82	301 m	305 m	
BHC2 (700 m at 308° T from SGA)	1981-82	345 m	350 m	
SGJ (90 km from SGD)	1972	112 m	514 m	(440 m-550 m)
S1	1972	50 m	(?)	

* SGD is Law Dome Summit
SGA is near southwest coast (Cape Folger).
SGJ is near southeast coast (Cape Poinsett).
All other holes are on line between SGD and SGA.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
1. AUSTRALIA. ANTARCTIC DIVISION DATA, continued.

CATEGORY	OBSERVATION SOURCE	DESIRED/MINIMUM USEFUL ACCURACY (based on 1 sigma)	SPATIAL NETWORK (existing and/or planned)	OBSERVING FREQUENCY	DISPOSITION OF CURRENT DATA	DATA MEDIA
E. Oceanographic Data						
Salinity and Temperature profiles	Antarctic Divsion CTD Casts. Fibex and 1982/83 cruises	$0.01^0/_{00}$	60°S to Coast 60°E to 90°E	120+ Single casts mostly to bottom or 2000m	Antarctic Division	Digital
Temperature profiles and sea surface temperatures	XBT casts and bucket measurements 1977 -->		60°S to Coast 60°E to 90°E	Single Casts	10c/RNODC	Digital
Sea ice extent every 10° longitude, 1973-present	Joint Ice Center Charts (U.S. Navy/ NOAA)	± 25 nm	Greater than 55°S	Monthly	Glaciology Section, Antarctic Division	Digital
Sea ice thickness and snow cover thickness	Manual Observations	0.01m	Coastal Antarctic, locations near: Mawson (1954 –>) Davis (1957,58 80–>) and Casey (1979 –>)	Weekly or more frequently	Glaciology Section, Antarctic Division	Digital
Iceberg characteristics and distribution	Manual Observations		55°S to Coast 60°E to 90°E	During resupply voyages	Glaciology Section, Antarctic Division	Hard copy
Salinity and temperature profiles	CTD	0.02°C $0.02^0/_{00}$	Near Mawson Station (67°S 62°E)	2-weekly casts beneath annual sea ice cover	Glaciology Section, Antarctic Division	Digital
Surface currents Sea Surface Temperatures	2 Drifting Buoys 3 planned drifting buoys	0.1°C	Feb-April 1981 65°S 63°E 65°S 75°E Planned Feb 1984 60 to 65°S 70 to 80°E	Approx. 2 hourly	Glaciology Section, Antarctic Division	Digital tapes
Mixed layer temperatures (10 levels, 0-100m)	3 planned drifting buoys		Feb-April 1981 65°S 63°E 65°S 75°E Planned Feb 1984 60 to 65°S 70 to 80°E	Approx. 2 hourly	Glaciology Section, Antarctic Division	Digital

Appendix C. ARCHIVES OF ANTARCTIC DATA.

2. AUSTRALIA. BUREAU OF METEOROLOGY. PRELIMINARY CATALOGUE OF ANTARCTIC METEOROLOGICAL DATA.

The growing interest in Antarctica and Antarctic meteorology has focused increasing attention on the availability of meteorological data from the region. This catalogue summarises the Antarctic meteorological data that is held by the Bureau of Meteorology either in document or in computer storage media.

The catalogue is ordered according to data types, using the following headings:

1. Upper Wind Data
2. Radiosonde Data
3. Ozone Data
4. Surface Climate Data
5. Radiation Data
6. Autographic Chart Records
7. Ship Observations
8. Analyses: Weather Charts
9. Operational Meteorological Observations

Stations, referred to in the catalogue, which are currently operating are listed in Table 1..

Table 2 gives details of stations from which data are no longer being received.

The concluding section describes present and proposed data services by the Bureau of Meteorology.

Table 1. Australian Meteorological Stations Currently Operating in Antarctica

Station	Macquarie Island	Davis	Mawson	Casey/ Wilkes	Heard Island
Latitude	54° 30'S	68° 35'S	67° 36'S	66° 15'S	67° 27'S
Longitude	158° 57'E	77° 58'E	62° 53'E	110° 32'E	60° 52'E
Height Above MSL (m)	6.1	12.2	8.2	11.0	3.0
Commencement of Record	1948	1957*	1954	1957	1948*

*Record intermittent

Table 2. Short Term Australian Observation Sites in Antarctica.

	Moore Pyramid	Mt. Cresswell	Taylor	Mt. King	Knuckey Peaks	Amery Ice Shelf	237 Depot (Mawson)	Commonwealth Bay
Latitude	70° 18'S	72° 44'S	67° 27'E	67° 06'S	67° 48'S			
Longitude	65° 06'E	64° 23'E	60° 52'E	52° 51'E	53° 30'E			
Height Above MSL (m)	1460	1161	3	1125	1600			
Period of Record	1971-1974	1971-1974	1957/58	1975-1977 1979/80	1974/75	1962	1968/69	1912

Appendix C. ARCHIVES OF ANTARCTIC DATA.
2. AUSTRALIA. BUREAU OF METEOROLOGY. PRELIMINARY CATALOGUE OF ANTARCTIC METEOROLOGICAL DATA, continued.

1. Upper Wind Data

Station	Archived Working Forms	Archived Coded Messages Forms	Computer Archived Standard Level Data
Mawson	1954 - 1975 1977 -	1953 -	1954 -
Davis	1957 - 1964 1969 -	1957 - 1964 1969 -	1957 - 1964 1969 -
Casey/Wilkes	1960, 1969 - 1971 1973 -	1959 -	1959 -
Heard Island	1948 - 1951 1953 - 1954	1953 - 1954	1948 - 1952
Macquarie Island	1952 - 1974 1977 -	1953 -	1948 -
Moore Pyramid	Summers 1971 - 1974	1970 - 1974	1970 - 1974
Mt. Cresswell	Summers 1971 - 1974	1971 - 1974	1973/74
Mt. King	Summers 1975 - 1977 1979/80	1975 - 1977 1979/80	1975 - 1977 1979/80
Taylor	1957/58	1957/58	-
Amery Ice Shelf	1962	1962	-
237 Depot (Mawson)	1968/69	-	-

2. Radiosonde Data

Station	Archived Working Charts	Archived Aerological Diagrams	Computer Archives of Standard Level Data
Mawson	1962 -	1955 -	1955 -
Davis	1962 - 1964 1969 -	1959 - 1964 1969 -	1959 - 1964 1969 -
Casey/Wilkes	1962 -	1959 -	1959 -
Heard Island	-	1948 - 1954	1948 - 1959
Macquarie Island	1962	1948 -	1948 -

Appendix C. ARCHIVES OF ANTARCTIC DATA.
2. AUSTRALIA. BUREAU OF METEOROLOGY. PRELIMINARY CATALOGUE OF ANTARCTIC METEOROLOGICAL DATA, continued.

3. Ozone Data

Station	Archived Documents	Computer Archives
Macquarie Island	1956 -	In preparation

4. Surface Climate Data

Station	Archived Field Books	Computer Archived	Special Observations
Mawson	1955 -	1968 -	
Davis	1959 - 1964 1969 -	1957 - 1964 1969 -	Snow Gauge
Casey/Wilkes	1959 -	1968 -	Rainfall Obs. Dec., Jan. only Snow Gauge
Heard Island	1948 - 1954	1948 - 1954 1981 - (AWS)	
Macquarie Island	1948 -	1968 -	
	Summers		
Moore Pyramid	1971 - 1974		
Mt. Cresswell	1971 - 1974		
Mt. King	1976 - 1980		
Taylor	1957/58		
Amery Ice Shelf	1962 (All year)		
237 Depot (Mawson)	1968/69		
Knuckey Peaks	1974/75		
Commonwealth Bay	1912 (All year)		
Field Trips			
Casey Mobile	1975		
Casey S 2	1973		
Wilkes south of S 2	1960		
Casey Range Mawson	1956		
Prince Charles Mts.	1958/59		
Bretangen Mawson	1955		
"to Mawson"	?		
Amundsen Bay	1958		
Lambert Glacier	1958		
Beaver Lake			
"to 100 miles south of Mawson"	1961		
"southern journey"	1955		
"seismic near ranges"	?		

5. Solar Radiation Data

Station		Document/ Computer Archived Data
Casey/Wilkes		
	1/2 hr. totals Global Radiation	1974 - 1977
	1/2 hr. totals Diffuse Radiation	1974 - 1977
	Downward Effective	1974 - 1977
	Duration of Bright Sunshine	1960 - 1964
Mawson		
	1/2 hr. totals Global Radiation	1974 - 1977
	Daily totals Global Radiation	1956 - 1962
		1965 - 1972
		1974 - 1975
	1/2 hr. totals Diffuse Radiation	1975 - 1976
	Daily totals Diffuse Radiation	1965 - 1972
		1974 - 1975
		1975 - 1977
	Downward Effective	1975 - 1977
	Net Radiation	1965 - 1975
	Duration of Bright Sunshine	1955 -
Macquarie Island		
	1/2 hr. totals Global Radiation	1968 -
	1/2 hr. totals Diffuse Radiation	1971 -
	Duration of Bright Sushine	1948 - 1953
		1964 -
Davis	Duration of Bright Sunshine	1957 - 1963
Heard Island	Duration of Bright Sunshine	1948 - 1954

6. Autographic Chart Records

Sunshine cards; thermograph charts; anemograph charts or rolls; barograph charts; hygrograph charts:

Casey	1959 - 1982
Davis	1957 - 1964, 1969 - 1982
Heard Island	1948 - 1954
Macquarie Island	1948 - 1982
Mawson	1954 - 1982

Pluviograph charts:

Heard Island	1948 - 1952
Macquarie Island	1948 - 1982

Hydrograph charts:

Fisher Nunatak	1962

Barograph charts:

Vestfold Hills	1961 - 1962
Taylor	1958
Fisher Nunatak	1962
Kista Dan	1954 - 1956
Nella Dan	1961 - 1965
Thala Dan	1958 - 1967
Magga Dan	1960

Thermograph charts:

Thala Dan	1961
Mawson Mobile	1966 - 1968
Fisher Nunatak	1962
Moore Pyramid	1971 - 1972
Mt. Cresswell	1971 - 1972
Vestfold Hills	1961 - 1962
Wilkes Mobil	1960 - 1961
Knuckey Peaks	1974 - 1975

7. Ship Observations

Date available for voyages of the:

Nella Dan	Patenela
Thala Dan	River Norman
Magga Dan	LST 3501
Kista Dan	Cheynes II

Ship data from fishing fleets are plotted on Southern Ocean or hemispheric charts.

8. Analysed Weather Charts

Charts	Charts Archived	Charts Microfilmed	Counter Archived
Southern Hemisphere MSL, 700 mb, 500 mb, 300 mb	1959 -	1959 -	1973 -
Time Cross Sections	1959 - 1976		

9. Operational Meteorological Observations

All Antarctic Observations, (Satellite, surface, upper air, ship, drifting buoy) that reach Melbourne Regional Meteorological Centre. Data are stored in coded message format.	1971 -

Data Services Provided By The Bureau of Meteorology (Australia)

Original returns are stored in Commonwealth Archives in Melbourne or other state capitals. Original returns can be made available for scrutiny. However, such returns cannot be passed out of the custody of either the Bureau or the Commonwealth Archives. Anyone wishing to examine such data must do so at a Bureau Office.

The Bureau has developed a large number of reporting and analysis programs which draw on data stored in the computer-based archives. These programs meet the needs of most requests for data or climatological information.

Computer-generated reports cover cyclone data, solar radiation data, upper atmosphere observations, rainfall data, ship data, surface climate data, sea surface temperatures, and operational observations. However, the Bureau's summary of data held in computer-compatible form is currently out of print.

Over the years a number of computer programs have been developed which present or process meteorological data in special ways. Examples include:

1. Two way frequency analyses, mostly applied to wind speed and direction but capable of use with any two elements;
2. Listing of extremes;
3. Runs and durations of events;
4. Provision of data on magnetic tapes with 800 bpi, 1600 bpi packing density.

All of the analyses that can be produced as printed reports can also be made available on microfiche. Some 270 pages of printout can be placed on one microfiche. The advantages are obvious. Some climatological data are routinely available on microfiche.

Much of the general climatic information is published annually in the Australian and State year books. The Bureau also publishes a number of routine and special reports. These are listed in the Bureau's catalogue of publications.

Requests for data or climatological information are handled by the Bureau's meteorological information services section. Postal address:

Bureau of Meteorology,
G.P.O. Box 1289K,
Melbourne, Victoria, 3001
Australia

The office is located on the fourth floor of 150 Lonsdale Street, Melbourne. Phones: (03) 669-4084, 669-4083, 669-4082, 669-4075.

The professional and technical staff of this section would be pleased to discuss your information needs. Not all requests can be met with our standard data processing packages. Special computer programs can be designed but our ability to do this work has always been constrained by our limited resources. However, recently developed high level computer languages show promise for providing quick and flexible data reporting and analysis systems. One such package newly introduced in the Bureau has a considerable capability for statistical analysis and has already been used to advantage for several non-standard customer requests.

There is a charge for our data services. Requests are individually costed on the basis of man-hours and computer resources used. Most requests for data using our standard systems come to less than $100. Quotes are given once requirements are clearly defined. Purchase orders for information are preferred.

Looking ahead, it is the Bureau's intention to give greater emphasis to climate studies and climate services. Planning has commenced for a National Climate Centre which will be the Bureau's focal point for all climate and climate related matters. The provision of a more flexible and comprehensive data service will be part of the new centre's charter.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
3. BRITISH ANTARCTIC SURVEY. PRELIMINARY CATALOGUE OF DATA AVAILABLE.

Table 1. Meteorological Stations For Which Data Are Held.

Station	Meteoro-logical Number	Latitude	Longitude	Zone Time
Grytviken South Georgia	88903	54°16'S	36°30'W	GMT-2
Signy Island	88925	60°43'S	45°36'W	GMT-3
Admiralty Bay, King George Island	88934	62°03'S	58°24'W	GMT-4
Deception Island	88938	62°34'W	60°34'W	GMT-4
Hope Bay	88940	63°24'S	56°59'W	GMT-4
Port Lockroy	88949	64°50'S	63°31'W	GMT-4
Argentine Islands	88952	65°15'S	64°16'W	GMT-4
Loubet Coast	88956	66°54'S	66°48'W	GMT-4
Adelaide Island	88958	67°46'S	66°55'W	GMT-5
Horseshoe Island	88959	67°48'S	67°19'W	GMT-4
Fossil Bluff	88962	71°20'S	68°17'W	GMT-5
Halley Bay	89022	75°31'S	26°40'W*	GMT-2
Orcadas, Laurie Island	88968	60°44'S	46°44'W	GMT-3
Shackleton		77°59'S	37°10'W	GMT-2
South Ice		81°57'S	28°50'W	GMT-2
Rothera (Adelaide Island)	89062	67°34'S	68°08'W	GMT-5

*Mean position; varies from 26°35' to 26°50'W

Appendix C. ARCHIVES OF ANTARCTIC DATA.
3. BRITISH ANTARCTIC SURVEY. PRELIMINARY CATALOGUE OF DATA AVAILABLE.

Table 2. Surface Meteorological Data.

Synoptic and Climatological Data. Dates include pressure, temperature, dew point, wind speed and direction, sunshine, rainfall where possible, weather, cloud and visibility (normally 4 or 8 times daily).

Station	Period	Manuscript Summaries	Synoptic reports, Climatological Data Sheets or Registers	Autographic Records	Computer Data Sets
Grytviken	1905-1981	X	1950-1981 only	1950-1981 only	1956-1981 only
Signy	From 1947	X	X	X	1956-1969 only
Admiralty Bay	1948-1960	X	X	X	
Deception Island	1949-1967	X	X	X	
Hope Bay	1945-1959	X	X	X	
Port Lockroy	1944-1947	X	X	X	
Faraday (Argentine Islands)	From 1947	X	X	X	1956-1983 only
Loubet Coast	1956-1958	X	X	X	
Adelaide Island	1962-1974	X	X	X	1962-1974
Rothera	From 1976	X	X	X	1976-1982
Marguerite Bay	1946-1950	X	X	X	
Fossil Bluff	From 1961		(x)	(x)	
Halley	From 1956	X	X	X	1956-1983
Orcades	From 1903	X			
Shackleton	1956-1957	X Trans-Antarctic Expedition Report	X		
South Ice	1957	X Trans-Antarctic Expedition Report	X		
BAS ship reports	1947-1983	X	X Met. Office		X Met. Office

(x) intermittent data

Table 3. Snow Accumulation Data Series.

Daily snow depth measurements are made whenever possible, otherwise weekly or monthly changes are measured. A geodetic grid of ten snow stakes is the normal method used at most locations.

Where there is an underlying rock or earth surface which is uncoverd in summer the depth is unambiguous. At ice shelf or ice cap locations the depth is relative to a January 1 datum of that year.

Density measurements of new snow are made using 250 cm^3 samplers. Verification accumulation pits are dug at yearly intervals whenever possible. Estimates of gross and net accumulation are made.

Station	Surface	Daily	Monthly	Density	Annual Pit
Grytviken	Rock and Soil	1974-1981	X	(x)	
Faraday	Ice cap	1973-1983	X	X	
Adelaide Island	Ice cap	1972-1974	X	X	
Rothera	Glacier	1976-1983	X	X	Occasional
Halley	Ice Shelf	1957-1959 1972-1983	1956, 1960-1971	X	Occasional
Signy Island	Glacier	-	1972-1974 intermittent		

Table 4. Sea Ice Reports.

Station	Location	Period & Frequency	Remarks
BAS Ships	10°W-80°W	Summers from 1962	Sea ice distribution
BAS Stations	All (see table 1)	At weekly to monthly intervals when station in use	Local ice distribution charts
BAS Stations	All	Annually when station in use	Annual Diary

Appendix C. ARCHIVES OF ANTARCTIC DATA.
3. BRITISH ANTARCTIC SURVEY. PRELIMINARY CATALOGUE OF DATA AVAILABLE, continued.

Table 5. Upper Air Data.

Normally only one sounding a day was made at 1200 GMT from Faraday (Argentine Islands) 88952 and Halley 89022. During the IGY soundings were made at 0000 GMT and 1200 GMT.

Some other meteorological stations made optical pilot balloon soundings.

Key: RS = radiosondes (pressure, temperature, humidity, height)
RW = radar wind
P = optical pilot winds

Station	Period	Manuscript Summaries	Climatological Data Sheets	Raw Data and Computation Sheets	Computer Data Set
Faraday	1955-1982	X	RS,RW,P	RS,RW 1969-82 P 1965-1966	RS 1956-82 RW 1967-82
Halley	From 1956	X	RS,RW	RS,RW 1969-82	RS,RW 1957-1982
Adelaide Island	1965-1974 (intermittent)			P 1965-1966 1970-1974	
Grytviken	1950-1981 (intermittent)			P 1965-1966 1969-1970	
Deception Island	1949-1967 (intermittent)			P 1956-1957	
Fossil Bluff	From 1961 (intermittent)			P 1968 1972-1973	

Appendix C. ARCHIVES OF ANTARCTIC DATA.

4. JAPAN. ANTARCTIC METEOROLOGICAL DATA AT SYOWA STATION, (69°00'S, 30°35'E).*

Volume	Contents	Period	Remarks
2	Surface Meteorological Data at the Syowa Base	1957 - 1961	3 times per day (06, 12, 18 GMT) in 1957 No data in 1958 8 times per day, 3-hrly (00 to 21 GMT) in 1959 4 times per day, 6-hrly (00 to 18 GMY) in 1960 8 times per day. 3-hrly (00 to 21 GMY) in 1961
3	Aerological Data at the Syowa Base	1961	Once per day at 12 GMT No data 1962 through 1965
4	Total Radiation (Sun and Sky) on a Horizontal Surface and Duration of Sunshine	1959 - 1961	
7	Meteorological Data at the Syowa Base in 1966	1966	Surface Observations: 6 times per day, 3-hrly, 00 - 18 GMT Upper Air Observation: Once per day at 12 GMT
8 - 20	Meteorological Data at the Syowa Base in 1967 - 1979	1967 - 1979	Surface Observation: 6 times per day, 3-hrly (00 to 18 GMT) in 1966-1973 8 times per day, 3-hrly (00 to 21 GMT) Upper Air Observation: Rawinsonde Once per day at 12 GMT in 1966-1967 Once per day at 00 GMT in 1968-1973 Twice per day at 00, 12 GMT in 1974-1979
Special No. 1	Atmospheric Ozone Atmospheric Electricity Long Wave Radiation	1966 - 1970 1967 - 1970 1966 - 1970	Ozonesonde Observation Electricity Radiosonde Observation Radiation Radiosonde Observation
Special No. 2	Atmospheric Ozone Atmospheric Electricity Long Wave Radiation Total Amount of Ozone	1971 - 1975 1971 - 1972 1971 - 1975 1961 - 1975	Ozonesonde Observation Electricity Radiosonde Observation Radiation Radiosonde Observation Dobson Spectrophotometer Observation. (Total ozone amount only)
Special No. 3	Atmospheric Ozone Long Wave Radiation Total Amount of Ozone	1977 - 1980 1979 - 1980 1976 - 1980	Ozonesonde Observation Radiation Radiosonde Observation Dobson Spectrophotometer Observation
20 and 21	Meteorological Data at the Syowa Station	1980 - 1981	Surface Data; Aerological Data; Global Solar Radiation Data; Atmospheric Turbidity Data (1979 data included)
1, 5 and 6	Marine Meteorological Data	1956 - 1967	Surface and upper air data onboard expedition ships on the way to and from Syowa Station every December to March from 1956 to 1967 [?] except 1962 to 1965).

*The Japan Meteorological Agency, 1-3-4 Ote-machi, Chiyoda-Ku, Tokyo 100, is responsible for observation, reporting, and publishing.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
5. JAPAN. JARE (JAPANESE ANTARCTIC RESEARCH EXPEDITION) DATA REPORTS.*

Contents	Period	Remarks	Data Report No.
A. Meteorology			
Meteorological data at Mizuho Station (Camp), Antarctica	Sept. 1971 - Jan. 1972 May 1972 - Jan. 1973 Mar. 1974 - Jan. 1975 May 1976 - present	Surface Synoptic Observation 8 times per day, 3-hourly (00 to 21 GMT)	25, 30, 40, 47, 52, 57, 65, 77, 86
POLEX-South data Radiation data at Mizuho Station, Antarctica	1979, 1980	Spectral measurements of direct, global and reflected solar radiation, downward and upward longwave radiation at 1.5m and 30m height. Hourly.	61, 73
POLEX-South data Micrometeorological data at Mizuho Station, Antarctica	1979 - 1981	Vertical profile of wind direction, wind speed and temperature by 30m-tower. Vertical profile of snow temperature from the surface to 10m-depth. Hourly.	62, 79, 85
B. Glaciology			
Glaciological research program in Mizuho Plateau-West Enderby Land	1969 - 1975	Observations of accumulation, surface morphology, snow temperature, flow line, ice sheet thickness, drifting snow and stratigraphy of 10m ice cores. Surface meterological, gravimetric, and geomagnetic data.	17, 27, 28, 36
Glaciological survey in 1976-1977	1976 - 1977	Observation of accumulation, surface snow density in Mizuho Plateau. Snow temperatures and thermal cracks in snow cover at Mizuho Camp. Surface meteorological data in Mizuho Plateau.	44
Glaciological research at Mizuho Station, Antarctica in 1977	1977	Observation of accumulation, surface morphology, snow temperature, and driftin snow at Mizuho Station. Surface meteorological data in Mizuho Plateau.	48
Glaciological data collected by the Japanese Antarctic Research Expedition	1979 - 1981	Observation of accumulation, surface morphology, and drifting snow at Mizuho Station and in Mizuho Plateau. Radio echo sounding. Sea ice thickness. Surface meteorological data in Mizuho Plateau.	63, 71, 82

*National Institute of Polar Research, 9-10, Kaga 1-Chome, Itabashi-ku, Tokyo 173, Japan, is responsible for observation, reporting, and publishing of meteorological data at Mizuho Station (70°41'S, 44°19'E, elevation 2,230m) and oversnow traverses.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
6. NEW ZEALAND METEOROLOGICAL SERVICE.*

SCOTT BASE DATA			
TYPE	PERIOD	MEDIA HELD	REMARKS
Synoptic, 6-hourly	Dec 1956-Jan 1959	Tabulations	IGY
Climatological, Daily	1959-present	Tabulations and Magnetic tape	0900 except midday 1959-1964
Solar Radiation (Total)	1957-present	Tabulations	Pyranometer, Hourly
Solar Radiation (Diffuse)	1976-present	Tabulations	Pyranometer/shade ring
Net Flux Radiation	1957-1958	Tabulations	IGY, Hourly
Windspeed/Direction	1968-present	Tabulations and Magnetic tape	Hourly values
LAKE VANDA DATA**			
Synoptic, 6-hourly#	1969-present	Tabulations	See footnote
Climatological, Daily	1969-present	Tabulations and magnetic tape	0900 NZST
Solar Radiation	1969-present	Tablulations	Pyranometer, Hourly
Net Flux Radiation	1969-1974	Tabulations	Hourly
Windspeed/Direction	1969-present	Tabulations and Magnetic tape	Hourly values

* New Zealand Meterological Service, Ministry of Transport, P.O. Box 722, Wellington, New Zealand.

**All data are for summer season only (November-January inclusive), except for the years 1969, 1970, and 1974, when observations were made through the year.

Some synoptic data are also available for 3-hourly intervals.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
7. NORSK POLARINSTITUTT.*

CATEGORY	OBSERVATION SOURCE	PERIOD	MEDIA
Standard surface observations	Whaling ships	1932/33 - 1938/39; 1949/50 - 1967/68	Punched Cards
Surface observations Radiosonde**	Maudheim (71°03'S, 10°56'W)	1 March 1950 31 January 1952	Magnetic Tape
Surface observations Radiosonde**	Norway Station (70°03'S, 02°32'W)	1 April 1957- 31 December 1959	Magnetic Tape
Surface observations Radiosonde**	Bouvetoya (54°24'S, 03°17'E)	Jan/Feb 1979	
Pressure, temperature wind	Bouvetoya - automatic station	February 1977 - January 1978; March 1979 - January 1982; January 1983 - present	Magnetic Tape
Pressure, temperature	Drifting stations	Various periods, especially FGGE	Magnetic Tape

* Norsk Polarinstitutt, Rolftangveien 12, 1330 Oslo Lufthavn, Norway.

**Radiosonde observations are available for slightly shorter time periods than those given for surface observations.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
8. POLAND. INSTYTUT METEOROLOGII I GOSPODARKI WODNEJ.*

ARCTOWSKI STATION, King George Island, South Shetland Islands (62°10'S 58°28'W).

Data	Period	Media	Remarks
Standard synoptic data	1978 - 1981	Magnetic Tape	8 observations daily
Daily and Monthly means and summaries	1978 - 1981	Yearbooks	
	1978 - 1981 Jan - Feb 1982	Logbooks	8 observations daily
	March - Dec 1982; Jan - Feb 1983	Logbooks	3-4 observations daily
Thermograph, hydrograph, barograph and heliograph reports	1979 - 1982	Recording tapes	
Ship reports	1977 - 1982	Magnetic Tape	

*Instytut Meteorologii i Gospodarki Wodnej, ul. Podlesna 67, Warsaw, Poland 00-967.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
9. U.S. INTERIM CLIMATE DATA INVENTORY*

TITLE: Analysis Of Spatial And Temporal Variations Of The Ice In The Antarctic (December 1972 to June 1975).
PARAMETERS: Ice cover, satellite imagery
PERIOD OF OBSERVATION: 3 years

Start: December 1972
End: June 1975

GEOGRAPHICAL AREA: Antarctica and surrounding sea
DATA TYPE: Derived Data

Organization: Grid

MEDIA: Charts/Maps, Magnetic Tape, Digital Standard 1/2 inch
VOLUME: 2 volumes
REMARKS: Chief data source: Nimbus 5, 15.5 mm band radiation brightness temperature.
HOLDING CENTER:
National Space Science Data Center
U.S. National Aeronautics and Space Administration

TITLE: Analysis Of Spatial And Temporal Variations Of The Ice In The Antarctic (December 1972 to June 1975).
PARAMETERS: Brightness, satellite imagery
PERIOD OF OBSERVATION: 3 years

Start: December 1972
End: June 1975

GEOGRAPHICAL AREA: Antarctica and surrounding sea
DATA TYPE: Derived Data

Organization: Grid

MEDIA: Charts/Maps, Magnetic Tape, Digital Standard 1/2 inch
VOLUME: Unknown
REMARKS: Chief data source: Nimbus 5, 15.5 mm band radiometer.
HOLDING CENTER:
National Space Science Data Center
U.S. National Aeronautics and Space Administration

TITLE: Global Solar Radiation Data In 5 Spectral Bands At The Geophysical Monitoring For Climatic Change (GMCC) South Pole Observatory (1976-1977).
PARAMETERS: Incident radiation, global radiation
PERIOD OF OBSERVATION: 2 years

Start: January 1976
End: December 1977

GEOGRAPHICAL AREA: South Pole, 90S, 2847 m.
DATA TYPE: Observed Data

Organization: Point

MEDIA: Magnetic Tape, Digital Standard 1/2 inch
VOLUME: 1 tape
REMARKS: None
HOLDING CENTER:
National Climatic Center
Environmental Data and Information Service
National Ocean and Atmospheric Administration

TITLE: Satellite 5-Day Composite Ice Minimum Brightness, Northern And Southern Hemispheres (1968 to 1972).
PARAMETERS: Brightness, satellite imagery
PERIOD OF OBSERVATION: 4 years

Start: November 1968
End: November 1972

GEOGRAPHICAL AREA: Northern and Southern Hemisphere
DATA TYPE: Derived Data

Organization: Composite

MEDIA: Film-negatives
VOLUME: 1 neg/5 days (10 neg replaced 35 mm neg 3 February 70)
REMARKS: None
HOLDING CENTER:
Satellite Data Service Division D56
U.S. National Climatic Center
National Oceanic and Atmospheric Administration

TITLE: Temperature And Wind Speed Profile Data, Surface To 8 Meters, Little America V, Antarctica (1957-1958).
PARAMETERS: Temperature, wind speed
PERIOD OF OBSERVATION: 2 years

Start: January 1957
End: December 1958

GEOGRAPHICAL AREA: Little America V, Antarctica 78-12S, 162-11W
DATA TYPE: Observed Data

Organization: Point

MEDIA: Publication, Magnetic Tape, Digital Standard 1/2 inch.
VOLUME: Unknown
REMARKS: Temp at SFC, 3, 6, 12, 25, 50, 100, 200, 400, 800 cm. Wind speed at top 6 levels.
HOLDING CENTER:
U.S. Army Engineers Topographic Laboratories
Ft. Belvoir, VA 22060

TITLE: 3-Day Average Maps Of Satellite Microwave Brightness Temperatures, Antarctic Region (1973 to 1977).
PARAMETERS: Brightness, ice cover, satellite imagery
PERIOD OF OBSERVATION: 4 years

Start: January 1973
End: June 1977

GEOGRAPHICAL AREA: Antarctic Region, 50S to South Pole
DATA TYPE: Derived Data

Organization: Grid

MEDIA: Photographic prints or copies, Magnetic Tape, Digital Standard 1/2 inch, Film-slides
VOLUME: Unknown
REMARKS: Data processed on 293 x 293 grid, 30 km resolution, some gaps in record, numerous references.
HOLDING CENTERS:
World Data Center A: Rockets and Satellites
Goddard Space Flight Center

World Data Center A: Glaciology (Snow and Ice)

Appendix C. ARCHIVES OF ANTARCTIC DATA.
9. U.S. INTERIM CLIMATE DATA INVENTORY, continued.*

TITLE: Tower Temperature And Wind Profile Data And Radiation At Plateau Station, Antarctica (1966-1968).
PARAMETERS: Ice temperature, atmosphere temperature, wind speed, wind direction, standard surface meteorology, global solar radiation, global IR radiation, direct solar radiation, reflected solar radiation, emitted radiation, solar radiation, UV radiation
PERIOD OF OBSERVATION: 3 years

Start: January 1966
End: December 1968

GEOGRAPHICAL AREA: Plateau Station, Antarctica, 79-15S, 40-30E, 3625M.
DATA TYPE: Observed data

Organization: Point

MEDIA: Publication, Magnetic Tape, Digital Standard 1/2 inch
VOLUME: Unknown
REMARKS: Temp at -10, -2, -1, -.5, -.25, -.125, 0, .5, 1, 2, 4, 8, 12, 16, 20, 24, and 32m. Wind from .5m to 32m. data analysis published in Antarctic Research Series, Vol.25, "Meteorological Studies at Plateau Station, Antarctica", American Geophysical Union, Washington, D.C. 1977.
HOLDING CENTER:
U.S. Army Engineers Topgraphic Laboratories
Ft. Belvoir, VA 22060

TITLE: Weekly Northern Ice Limit, Anarctic (1973 to present).
PARAMETERS: Ice cover
PERIOD OF OBSERVATION: 8 years

Start: January 1973
End: Continuous

GEOGRAPHICAL AREA: Antarctic
DATA TYPE: Observed Data

Organization: Field

MEDIA: Charts/Maps
VOLUME: Unknown
REMARKS: Satellite data supplemented by ship, aircraft and surface observations.
HOLDING CENTER:
National Technical Information Service
U.S. Department of Commerce

World Data Center-A: Glaciology (Snow and Ice)

TITLE: Weekly Northern Ice Limit, Antarctic Ocean (1973 to Present).
PARAMETERS: Ice/Age, ice cover, ice type, ice thickness, ice/concentration, ice/floe size, ice/surface character
PERIOD OF OBSERVATION: 8 years

Start: January 1973
End: Continuous

GEOGRAPHICAL AREA: Antarctica and surrounding seas.
DATA TYPE: Derived Data

Organization: Composite

MEDIA: Charts/Maps, Microfiche
VOLUME: Unknown
REMARKS: None
HOLDING CENTER:
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

*From: Ropelewski, C.F.; Predoehl, M.C.; Platto, M. (1980) Interim Climate Data Inventory: A Quick Reference to Selected Climate Data. U.S. National Oceanic and Atmospheric Administration, Center for Environmental Assessment Services, 176p.

Appendix C. ARCHIVES OF ANTARCTIC DATA.
10. U.S. METEOROLOGICAL GRIDDED DATA, SOUNDINGS, AND SATELLITE PRODUCTS.*

Daily Grid Point Analysis Data (Usually 2 per day)

1. NMC global 2.5 degrees. 1 July 1976 - 31 December 1982. SLP, sfc T, U, V, T, H 1000-50 mb; humidity 1000-300 mb. SLP starts 8 December 1977, sfc P starts 21 September 1978, SST starts 16 May 1979, Boundary layer starts 6. June 1980. 165 tapes.[1]

2. Australian. Analyses for whole Southern Hemisphere H, T, U, V 1000-100 mb. Mixing ratio 1000-500 mb. 47 x 47 grid; 2x/day, 24 April 1972 - 28 February 1981. 21 tapes.

3. South African. Analyses for whole Southern Hemisphere 63 X 63 grid; 2x/day, August 1977 thru March 1981. SST, sfc P, H, T 1000-50 mb; winds 925-100 mb. 29 tapes.

4. New Zealand SLP 16 x 16 regional grid 1957-1978, Southern Hemisphere 500 mb August 1968 - June 1977 from Australia.

Year-Month Grids

1. Australian South Hemisphere analyses. H, T, U, V, R. 1 tape. 1000-100 mb, May 1972 - November 1980.

FGGE Data[1]

1. ECMWF 1.875° x 1.875° grids. H, T, U, V, RH, 1 December 1978 - 30 November 1979, 82 tapes.

2. 3.75° x 3.75° version of 1 above. Derived at NCAR by selecting every other grid point from every other row, 18 tapes.

3. GFDL 1.875° grids. 1 December 1978 - 30 November 1979.

Stratospheric Data (Primary Sets at NCAR)

DS 67: Daily strato grids, Southern Hemisphere, 70 - .4 mb, June 1981 - December 1982. Z, T from NMC (4 tapes, Southern Hemisphere) (NCAR will have these from October 1978).

DS 107: Southern Hemisphere, grids from South Africa. 63 X 63 grids 1000 - 50 mb.
August 1977 - March 1981, 29 tapes.

Also: Ozone data, satellite soundings, grid sets surface to 100 mb. Tropopause analyses.

Other Selected Data at NCAR

DS 200	Southern Hemisphere Climatology. Sfc - 100 mb. (1 tape)
DS 670	Daily Satellite Brightness. 1967 - 1972. (1 tape)
DS 676	Daily Brightness and IR. 150 km resolution. June 1974 - March 1978, January 1979 - August 1982. NESS. (12 tapes)
DS 720	GOES Satellite Wind. October 1974 - April 1980. NESS. (3 tapes)
DS XXX	Sets of Drifting Balloon Data. EOLE August 1971 - December 1972. TWERLE. FGGE.
DS 750-780	Sfc Elevation and Depth Data. (1 tape each set) (1 degree, 10 minutes global, 1 km elevation USA, 5 min global depth)
DS 861	Earth insolation for 1.1 million years, from Berger, 1 tape.

*Shows selected data available from National Center for Atmospheric Research (NCAR), Data Support Section, P.O. Box 3000, Boulder, CO 80307. Data available as of January 1984.

[1] The NMC and FGGE analyses are also available from NCDC, the primary archive for FGGE data.

Appendix D. COMPARISON OF RECENT SEA ICE AREA STUDIES OF THE ANTARCTIC.*

DATA TYPE		TECHNIQUES OF ANALYSIS				
SOURCE	PERIOD	GRID SIZE	CONC.>[d]	TIME SCALE	MEASUREMENT	POLYNYA ALLOWED FOR
Navy-NOAA	Jan 1973-Feb 1979	5° long/10° long.[a]	5/8	Monthly (all weeks?)[e]	Lat. of ice edge	No?[k]
Navy-NOAA	Dec 1972-Nov 1977	10° long.	1/8 (12%)	Monthly (one week)[f]	Lat. of ice edge	No
Navy-NOAA	1973-1980	2° lat. x 2° long. 2° lat. x 4° long.[b]	1/8 (12%)	Weekly	Area of ice	No
Navy-NOAA	1973-1982	5° lat. x 10° long.	10-12%	Weekly	Area of ice	Yes
Navy-NOAA	1973-1982	10° long.	10-12%	Monthly (one week)[g], except Aug., Sept., Oct.[h]	Lat. of ice edge/area of ice	No
Navy-NOAA	1973-1982	1° lat. x 2.5° long. 1° lat. x 10°long.[c]	10-12%	Monthly (one week)[i]	Area of ice	Yes
ESMR	1973-1976	30 x 30 km	15%	Monthly (all weeks)	Area of ice	Yes
Navy-NOAA	1973-1981	6mm	10-12%	Monthly (all weeks)[j]	Area of ice	Yes
Kukla & Gavin (1981)	1973-1980	6mm	1/8 (12%)	Weekly	Area of ice	No

a. A 5° longitude grid was used for data analysis, while a 10° longitude grid was used for "the actual analysis".

b. A 2° latitude by 2° longitude grid was used equatorward of 70°S, with a 2° latitude and 4° longitude grid poleward of 70°S.

c. A 1° latitude by 2.5° longitude grid was used to obtain estimates of sea-ice concentration, and grid boxes containing at least 50% ice were summed in 1° latitude by 10° longitude slices to compute areas.

d. Ice edge defined where concentration is greater than the value given.

e. Not clearly stated.

f. Used chart containing first day of month.

*Prepared by A.P. Sturman, Visiting Fellow, CIRES and M.R. Anderson, CIRES.

Appendix D. COMPARISON OF RECENT SEA ICE AREA STUDIES OF THE ANTARCTIC continued.*

RESULTS			REFERENCES
TREND OVER PERIOD GIVEN	MEAN ANNUAL ICE AREA ($10^6 km^2$)	MEAN ANNUAL EXTREME ICE AREAS (10^6 km^2)	
Decline in sea ice area	11.1	September: 18.1[l] February: 3.1[l]	Lemke, et al (1980)
Decline in sea ice area	12.0[l] (av. lat.=64.0°S)[l]	Maximum: 18.3[l] Minimum: 3.4[l] (av. max. lat.=68.3°S, March) (av. min. lat.=60.9°S, Sept/Oct.)	Streten & Pike (1980)
Decline in sea ice area	11.9[l]	September: 18.5 February: 4	Kukla & Gavin (1981)
Decline in sea ice area 1973 to 1980, increase 1980 to 1982.	13.1[l]	September (second week): 20[l] February (second week): 5[l]	Chiu (1983 a & b)
Decline in maximum sea ice extent 1973 to 1977, increase 1977 to 1981.	11.7[l]	September: 18.7 February: 3.3[l]	Jacka (1983)
Minimum sea ice extent-low in 1980, high in 1973. Maximum sea ice extent-low in 1977, high 1974.	11.8[l]	August: 18.4 February: 3.8	Ropelewski (1983)
Decline in sea ice area 1973 to 1977, increase 1977 to 1979, decline 1979 to 1980, increase 1980 to 1981.	11.8	Winter: 17.4 (Navy-NOAA data) Summer: 4.6 (Navy-NOAA data) September: 18.4[m] (Navy-NOAA data) February: 3.6[m] (Navy-NOAA data)	Zwally, et al (1983)

g. Used chart for middle of month.

h. Jacka states that he uses all weekly charts for August, September, and October, but his data tables indicate otherwise.

i. Used chart for end of month.

j. Used chart for middle of each month.

k. Not stated, presumed not.

l. Calculated from their published data.

m. From data provided by authors.

Appendix D. COMPARISON OF RECENT SEA ICE AREA STUDIES OF THE ANTARCTIC, continued.

References

Chiu, L.S. (1983a) Antarctic sea ice variations 1973-1980. (In: Street-Perrott, F.A.; Baran, M.; Ratcliffe, R.A.S., eds. Variations in the Global Water Budget, D. Reidel, p.301-311.)

Chiu, L.S. (1983b) Variation of Antarctic sea ice: an update. Monthly Weather Review, v.111, p.578-780.

Jacka, T.H. (1983) A computer data base for Antarctic sea ice extent. ANARE Research Notes, No.13, Kingston, Australia, 54p.

Kukla, G.; Gavin, J. (1981) Summer ice and carbon dioxide. Science, v.214, p.497-503.

Lemke, P.; Trinkl, E.W.; Hasselmann, K. (1980) Stochastic dynamic analysis of polar sea ice variability. Journal of Physical Oceonography, v.10. p.2100-2120.

Ropelewski, C.F. (1983) Spatial and temporal variations in Antarctic sea-ice (1973-82). Journal of Climate and Applied Meteorology, v.22, p.470-473.

Streten, N.A.; Pike, D.J. (1980) Characteristics of the broadscale Antarctic sea ice extent and the associated atmospheric circulation, 1972-1977. Archiv fur Meteorologie, Geophysik, und Bioklimatologie, A 29, p.279-299.

Zwally, H.J.; Parkinson, C.L.; Comiso, J.C. (1983) Variability of Antarctic sea ice and changes in carbon dioxide. Science, v.220, p.1005-1012.

Appendix E. ANNUAL SYNOPSIS OF ANTARCTIC CLIMATE DATA.

Suggested Format:

1. Brief review of changes during past year in the complement of contributing stations - including a list of all stations, identifying those from which data have been used to compile synopsis; plus a routine request to other nations to facilitate availability of their data.

2. Brief review of relevant "expeditionary work" during past year, listing scientific aims and identifying Principal Investigator (P.I.).

3. Bibliography listing sources of current synopsis, references that provide more detailed information, and publications of relevant material during past year resulting from earlier field work (i.e. follows up to 2).

4. Data synopsis comparing (probably) monthly averages (etc.) of data that can be readily obtained from member nations.

Suggested Contents of Synopsis: (Station Data, including automatic station)

Average (monthly)	Auxiliary Data
Surface temperature	Standard deviation (+ number of observations) Maximum, minimum No. of degree days above 0° C
Scalar wind	Frequency/direction (and speed) statistics No. of "precipitation days" No. of "cloud days" Total sunshine
Total area within ice limits; by ice	Standard deviation? IMAGE Standard deviation?
South Pole CO_2	Total snow accumulation during month (from stake farm) with standard deviation and number of stakes

Additional Data:

Non-station data could be included on a selective basis. Possible candidates include:

- 10 m temperatures - date of measurement - comments (technique, etc.);
- snow accumulation from stakes and bomb layers;
- locations of "geoceiver" measurements;
- ice velocities published during last year (from geoceiver measurement);
- locations of drill holes and intended core studies.
- a location map of Antarctica showing disposition of permanent stations and major measurements;

In each case, P.I.s and relevant publications should be identified.

NOTE

Barry, R. G., ed. (1984) Snow and Ice. Chapter 9, CODATA Directory of Data Sources for Science and Technology, E.F. Westrum, ed. New York, Pergamon Press. (CODATA Bulletin, no. 53, 87p.).

This chapter provides an overview of the principal agencies and institutions involved in glaciological data collection. It covers information relating to all forms of terrestrial snow and ice - snow cover, freshwater and sea ice, glaciers, ice sheets, and ground ice. The principal listing is by country, and subject and name indexes are provided.

The information was compiled from a survey distributed by the World Data Center A for Glaciology (Snow and Ice) to addresses of centers, agencies, and institutions available through the mailing lists of the WDC-A and the International Glaciological Society.

"Snow and Ice" is Chapter 9 of the CODATA Directory of Data Sources for Science and Technology. This series represents an international and interdisciplinary effort to make reliable scientific data more readily accessible to users throughout the world.

Individual copies of "Snow and Ice" are available for $10.00(US) from: Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, NY 10523 U.S.A.; Outside North America, inquiries or orders should be addressed to Pergamon Press, Ltd., Headington Hill Hall, Oxford OX3 OBW U.K.

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GLACIOLOGICAL DATA SERIES

Glaciological Data, which supercedes Glaciological Notes, is published by the World Data Center-A for Glaciology (Snow and Ice) several times per year. It contains bibliographies, inventories, and survey reports relating to snow and ice data, specially prepared by the Center, as well as invited articles and brief, unsolicited statements on data sets, data collection and storage, methodology, and terminology in glaciology. Contributions are edited, but not refereed or copyrighted. There is a $5 shelf stock charge for back copies.

Scientific Editor: Roger G. Barry
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GD- 4, Parts 1 and 2, Glaciological Field Stations, 1979 - Out of Print

GD- 5, Workshop on Snow Cover and Sea Ice Data, 1979

GD- 6, Snow Cover, 1979

GD- 7, Inventory of Snow Cover and Sea Ice Data, 1979

GD- 8, Ice Cores, 1980 - Out of Print

GD- 9, Great Lakes Ice, 1980 - Out of Print

GD-10, Glaciology in China, 1981

GD-11 Snow Watch 1980, 1981

GD-12 Glacial Hydrology, May 1982

GD-13 Workshop Proceedings: Radio Glaciology; Ice Sheet Modeling - August 1982

GD-14 Permafrost Bibliography, 1978-1982 - July 1983

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