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World Data Center-A for Glaciology
[Snow and Ice]

National Snow and Ice Data Center

Annual Report

1985

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World Data Center
A Glaciology

Published by:

WORLD DATA CENTER FOR GLACIOLOGY
[SNOW AND ICE]

Cooperative Institute for Research in Environmental Sciences
University of Colorado
Boulder, Colorado 80309 U.S.A.

Operated for:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Boulder, Colorado 80303 U.S.A.

WDC/NSIDC ANNUAL REPORT FY 1985

I. Introduction and Historical Overview

World Data Center A for Glaciology [Snow and Ice] (WDC) is one of three international data centers serving glaciology. The other two are WDC-B in Moscow, USSR and WDC-C in Cambridge, England. The centers, established during the International Geophysical Year, serve to facilitate the international exchange of data on all forms of snow and ice (avalanches, freshwater ice, glaciers, ground ice and permafrost, ice sheets, paleoglaciology, sea ice, and snow cover).

In 1976, the National Academy of Sciences, Geophysics Research Board proposed that WDC-A be transferred from the U.S. Geological Survey in Tacoma, Washington to Boulder, Colorado, where it would be operated under a joint arrangement between U.S. National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado. This transfer was implemented in November 1976 and WDC-A was formally included among the WDC responsibilities then exercised by the Environmental Data Service of NOAA represented by the National Geophysical and Solar-Terrestrial Data Center (NGSDC).

The WDC continues to operate under a contractual agreement between the University of Colorado, Cooperative Institute for Research in Environmental Sciences (CIRES) and the National Environmental Satellite, Data, and Information Service (NESDIS) of NOAA. Colocated with WDC is the National Snow and Ice Data Center (NSIDC) established by NOAA in 1982. This center functions as a national information and referral center for the snow and ice community. Many of the data sets held are common to both WDC and NSIDC although some are only available within the latter organizational framework for practical as well as policy reasons.

This fiscal year was a landmark year in the WDC/NSIDC's operation by the University of Colorado. It marked the first year when annual expenditures passed $500,000 and when non-NOAA funding provided more than one-half of the total monies. The source of these changes and the largest incremental jump in spending since 1976 (see figures 1 and 2) were accounted for by two grants. Funding for the Cryospheric Data Management System by NASA, Polar Ocean Program, and the Image Analysis and Display System, DOD Research Instrumentation, contributed approximately $350K of the total $723K expenditure.

Despite the significance of the FY85 budget achievements, the Center faces potentially serious budget problems over the next three years because these increases were primarily for equipment purchases. Only a small proportion went towards basic operating expenses and staff salaries. Moreover, the NOAA base support (NESDIS, NGDC, NCDC), which pays for a majority of the Data Center staff, declined by 5 percent in FY85.

II. Current Programs

A. NOAA/NESDIS/NGDC funded programs

1. Basic operations

The Information Center and the publications program are two of the principal functions of WDC/NSIDC. Under the ICSU Guidelines, WDC's are to "collect, store, and disseminate information and data on Glaciology".[1] WDC/NSIDC maintains an active ongoing program to acquire published material in all areas of snow and ice research and serves as an archive for

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

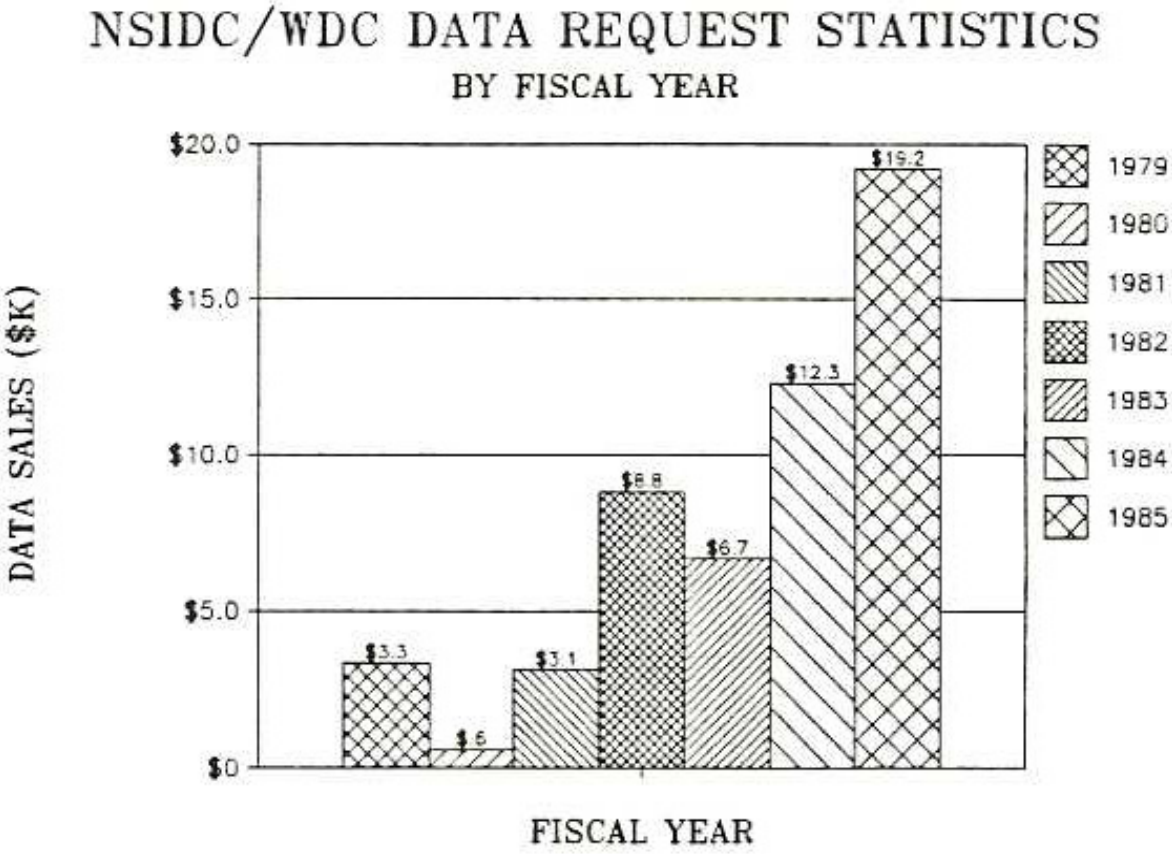

Figure 1.

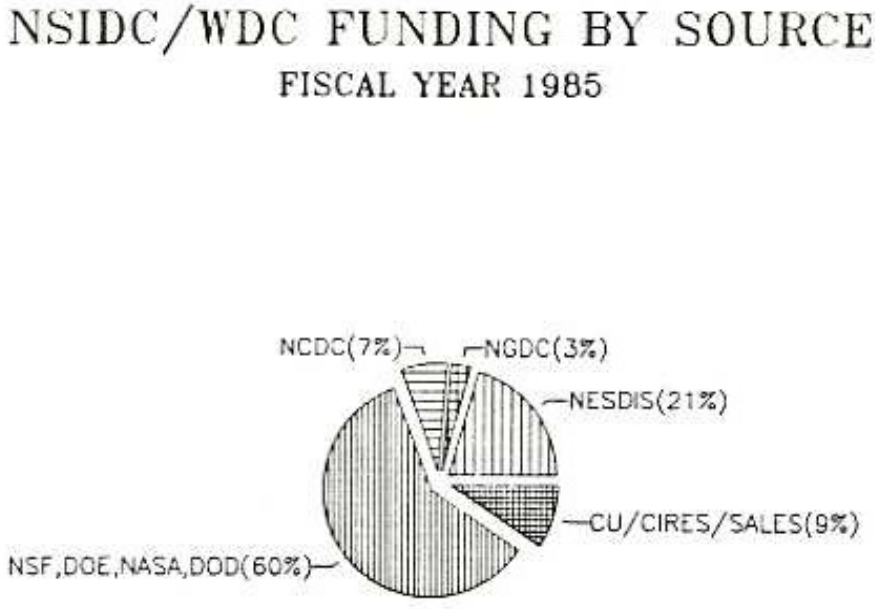

Figure 2.

both published and unpublished data and information. Currently, the Information Center contains 4000 monographs and technical reports, 8000 reprints; 70 serials are regularly received. During FY85, approximately 1500 items were added to the collection. All materials received are catalogued and assigned subject and geographic descriptors. Primary access to the collection is provided by CITATION, the in house online catalog. As of 1 September 1985, there are almost 18,000 records in the data base. The file is updated quarterly and 400-500 records are added each time. Online searches of the collection are performed for researchers on request. Microfiche indexes also offer user access to the collection. Author, title, subject, and geographic indexes are available for material received and catalogued through June 1985. The purchase of a second Micom work station has significantly accelerated the cataloguing process.

Two series, New Accessions List and Glaciological Data, are published by WDC/NSIDC. New Accessions List is a product of the CITATION data base. It is a quarterly list of documents, categorized by subject, received and catalogued during a given period. This publication which fills much of the information exchange role stipulated by World Data Center System guidelines is mailed worldwide to about 350 scientists, research institutions, and libraries. During 1985, four New Accessions Lists were printed and mailed.

Glaciological Data (GD) is published on an irregular basis, approximately twice each year. Issues focus on a single topic and include specialized bibliographies, inventories, and survey reports relating to snow and ice data prepared by WDC/NSIDC staff, as well as invited or contributed articles on data sets, data collection and storage,

methodology, and terminology in glaciology. Current circulation for GD is approximately 950 copies, 50 percent of which are mailed to addresses outside the United States. Two issues were published in FY85.

GD-16, Soviet Avalanche Research; Avalanche Bibliography Update, 1977-1983 includes eight translations of Soviet research on avalanche dynamics conducted at the Problem Laboratory of Snow Avalanches, Moscow State University and a paper by CIRES scientists evaluating the Soviet work. Financial support for the translations was provided by the Rocky Mountain Forest and Range Experiment Station of the USDA Forest Service. Also included in GD-16 is a 450 citation avalanche bibliography updating the one published in GD-1 in 1977.

The Marginal Ice Zone Bibliography was published as GD-17. This issue provides a major bibliography on sea ice, meteorology, and oceanography in the marginal ice zone, an area of critical importance to our understanding of the mechanisms of sea ice growth and decay and the focus of a major DOD (ONR)-sponsored research program. There are approximately 900 citations in the bibliography with both author and subject access.

The next scheduled issue in the series will be the proceedings of "Snow Watch 85." It will report the results of a WMO/DOE/NSF/NOAA sponsored workshop reviewing the available information on the potential role of seasonal snow cover in CO_2-induced climatic change.

2. Data Set Administration

WDC/NSIDC has digital archives on various areas of snow and ice research. The majority of data sets held are of snow cover and sea ice, but there are also data relating to glacial geophysics, Great Lakes ice-related environmental studies, and satellite microwave research.

a. Snow Cover

Airborne Gamma Radiation Snow Survey Program snow water equivalent data were received from the National Weather Service, Airborne Snow Survey Program, Minneapolis, MN. These data, contained on one IBM-PC diskette, comprise survey data for March 4, 1980-April 7, 1985, from 818 flight lines over 14 states and three Canadian provinces: Illinois, Indiana, Iowa, Maine, Michigan, Minnesota, Montana, Nebraska, New York, North Dakota, Ohio, Pennsylvania, Vermont, Wisconsin, Ontario, Quebec and Saskatchewan. The files contain flight line number, latitude, longitude, percent snow cover, snow water equivalent, percent soil moisture in the upper 20 centimeters, and normalized over-snow radiation. There are 1,748 airborne measurements recorded for these five years. Updates to the file are anticipated in the late spring of each year.

An update to the data set, "NOAA/NESS Northern Hemisphere Digitized Snow and Ice Cover Data Base", was received from NOAA/NESDIS Interactive Processing Branch. The update covers 1981-1983, and was provided as a new copy of the entire 1966-1983 data base on one 6250 bpi magnetic tape. This data set is a digitization of weekly satellite snow and ice cover charts drawn at a scale of 1:50,000,000 on a polar-stereographic projection. At the same time, 35mm microfilm of some data analyses were provided to NSIDC. Plots of snow cover frequency, extent, and anomalies for December 1981-January 1985 were produced from the data set. An additional 2-3 rolls of film are anticipated after the frames are spliced onto rolls for the earlier years of data.

b. Sea Ice

U.S. Navy/NOAA Joint Ice Center (JIC) Northern Hemisphere sea ice charts have been digitized for 1972-1982 by NOAA/NESDIS/NCC. During FY85 NSIDC has received copies of two 6250 bpi magnetic tapes containing these data for the eastern and western Arctic (boundary is 90°E, 90°W). The data are stored in the SIGRID (sea ice grid) format, developed for the World Meteorological Organization to facilitate storage and exchange of digital sea ice data. The weekly gridded data have a resolution of 20-40 km on an azimuthal equidistant projection with tangency at the poles. The JIC data now held at NSIDC also include Antarctic data for 1973-1982. Digitizing is in progress at NESDIS/NCC for the 1983-1984 data; these years should be available for distribution late in 1985. Data Announcement 83-GLA-54 was revised and distributed to NSIDC's list of sea ice requestors, and to the JIC for distribution via its mailing list.

NOAA/ERL Pacific Marine Environmental Laboratory provided a copy of data from the Bering Air-Sea-Ice Study (BASICS) 1981, BASICS II in 1982, and MIZEX-West in 1983, on one 1600 bpi magnetic tape. The data, from ARGOS buoys deployed by ship or helicopter in the Bering ice pack, include buoy position, bottom depth and air temperature. The 1981 and 1983 studies were near the ice edge in winter; the 1982 study extended into the Chukchi Sea during winter and spring.

Historical iceberg data for the North Atlantic were received from the U.S. Coast Guard International Ice Patrol. Observations of bergs from 1960-1982 include date, latitude/longitude, berg

size class, resight/new sighting flag, source of sighting information and number of bergs per record. The file, containing approximately 58,000 records, supplements the current annual files received each September by NSIDC. The annual files, which begin in 1981, contain more precise berg position data, as well as predicted positions for active bergs.

A new International Ice Patrol (IIP) data set was received this year: TIROS Arctic drifting buoy data from transmitters attached to three icebergs in the Grand Banks area off Newfoundland. The transmitters were tracked for up to three months during March-June 1983, and provided current data and drift characteristics for comparison with the IIP iceberg drift model, called IBERG. The Data Announcement 83-GLA-53 "International Ice Patrol Iceberg Data" was revised extensively to include information on the new IIP data sets.

Arctic drifting station data spanning 1893-1973 were received from the Polar Science Center, University of Washington. These data, on one magnetic tape, include date, geographic coordinates, and interpolated ice velocity from 34 drifting station tracks in the Arctic Ocean. The stations include ice islands, drifting ships and drifting buoys, of U.S., Soviet, British, and Norwegian origin.

Arctic Ocean ice drift for 1983, from the University of Washington, Polar Science Center network of buoys first deployed during FGGE (First GARP Global Experiment), were received early in FY85. These two magnetic tapes extend the current data set from 1979-1983. The 1984 data are expected to arrive in November

1985. The Arctic Ocean ice drift data include daily pressure and temperature, daily buoy positions, and interpolated ice velocity for a network averaging 15 operational buoys.

A data announcement was prepared for Arctic Ice Dynamics Joint Experiment (AIDJEX) data sets held at NSIDC. Announcement 85-GLA-58 describes Beaufort Sea ice profile data in April 1976, and wind, current, and position data from four AIDJEX manned camps on ice floes in the Arctic Ocean during summer 1975.

c. Freshwater Ice

A program of daily data collection at Great Lakes shore locations, begun in 1955 by the Army Corps of Engineers Lake Survey Center, was continued by NSIDC for the fifth ice season. Daily observations of ice conditions at NOAA/National Ocean Survey water level gage sites around the Great Lakes are reported by weekly postcards to NSIDC. These data are then tabulated by NSIDC and entered in a file on the Data General M600 minicomputer. The backlog of data from 1955-58 and 1962 to the present is now in machine-readable form; 1959-61 data will be completed during FY86. After proofing is complete, these data will be avilable in ASCII files on one magnetic tape, with annual updates. The data collection program is carried out with the cooperation of the NOS Water Levels Branch, which coordinates/supports the network of cooperative observers. NSIDC prints postcard reporting forms, mails packets to the 39 observers, and tabulates the observations. Between 1973 and 1979, these data were collected for and tabulated by the Great Lakes Environmental Research Laboratory, NOAA/ERL.

National Weather Service Great Lakes ice charts for 1983/84 were deposited at NSIDC by the NWS Forecast Office in Ann Arbor, Michigan. This annual update extends Great Lakes ice chart holdings to 11 years: 1973/74-1983/84.

Seven U.S. Coast Guard stations at Great Lakes locations deposited ice observation logs at NSIDC, and daily teletype ice reports were received from Coast Guard ships operating on the Great Lakes. These materials will be microfilmed and added to the archive which now contains these data from 1970/71 to the present.

d. Data dictionary

NSIDC completed 37 entries (12 analog and 25 digital) for the NESDIS NEDRES Data Dictionary. All catalogued data sets at WDC/NSIDC are now in the system, and new entries will be completed as data sets are received. A corollary benefit of the project is complete documentation for the catalogued data sets.

3. Western Snow Conference

NSIDC was one of the host agencies for the 1985 Western Snow Conference held in Boulder, April 16-18. Richard Armstrong served on the Technical Program Committee. This was the 53rd annual meeting of the conference and the focus of this year's program was forecasting snowmelt/runoff extreme events, remote sensing of snow cover, and snow cover chemistry.[2]

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[2]The proceedings of the Boulder meeting have been published and are available from the Secretary of the Western Snow Conference, P.O. Box 14884, Spokane, WA 99214.

B. Contractually supported data sets

1. Defense Meteorological Satellite Program (DMSP) data.

NSIDC has served as national archive for data from the U.S. Air Force Defense Meteorological Satellite Program (DMSP) since March 1983. Imagery, archived in Boulder under contract to NOAA/NESDIS/NCDC/Satellite Data Services Division, consists of approximately 1 million pieces of positive transparency film providing global coverage since 1973. Data from the visual (0.4-1.1 μm) and thermal infrared (10.5-12.5 μm) spectral bands are archived. One of the film products archived (from direct readout data) has the highest resolution (0.6 km) of any meteorological satellite imagery.

Some 241 data and information requests (for $13,932 in income) were processed in FY85. Implementation of TRAK, NSIDC's data request tracking system, greatly assisted in the processing of these requests.

The microfilming of an estimated 90,000 DMSP computer ephemeris sheets was completed in FY85, saving some 250 cu. ft. of storage space. Additionally, discarding some older and degraded duplicate imagery allowed reorganization and consolidation of the archive, eliminating the need for the purchase of 26 new map cabinets (a savings of approximately $11,000).

An estimated 73,000 new entries were made into the DMSP data base which assists in searches for data requests. A new data base manual describing all aspects of the system was prepared.

Funding for operation of the archive was renewed this year with options for two additional years without going out on bid, following NSIDC's successful response to NCDC's RFP.

The primary source of personnel to staff the archive is the University of Colorado, but participation in two federally funded programs helps reduce overall costs. Nineteen students were employed through the work/study program, which pays 80% of salaries. The Boulder County Private Industry Partnership pays 100% of qualifying high school student salaries. Five high school students were employed full-time for twelve weeks this summer.

A new photographic service was established through a well-known local commercial photographer. Overall quality and service have improved as a result. Data Announcement 83-GLA-11 has been updated and reprinted to reflect these changes.

DMSP data are used in many publications. Most notable are a new National Geographic Atlas of North America, the Western Snow Conference brochure cover, and an article on city lights and fires visible from DMSP at night in Co-evolution Quarterly. Examples were included in the NOAA Satellite Data Briefings Book, the NESDIS Briefings Book, and the NGDC Annual Report. DMSP was also used in film documentaries produced by the Boulder County Private Industry Partnership and by the Asahi Broadcasting Television Station of Tokyo, Japan.

2. Data Management for the Marginal Ice Zone Experiment (MIZEX)

The Marginal Ice Zone Experiment (MIZEX) is a multi-national, (11 nations), interdisciplinary research project located in the East Greenland Sea. Its goal is a better understanding of the atmospheric and ocean processes near the sea ice margin. A long-term monitoring and modelling program, comprising field experiments, involved more than a dozen ships and aircraft and approximately 200 researchers and

staff during the summers of 1983 and 1984. A winter experiment is planned for 1987.

NSIDC has the responsiblity for the managment of all MIZEX data. The data management plan is designed to provide both a centralized access point for the data as it becomes available, and a system for long term data archival and storage. The plan is an example of the effort to address the task of data management at an early stage in a large research project and therefore has furnished the opportunity to establish and coordinate data exchange standards and develop the appropriate data accession and archival program. Additional management responsibilities include coordination of data flow among principal investigators as well as other data centers. As of September, 1985, the total data listing includes more than 130 data sets ranging from data reports to magnetic tapes and technical reports. At present, requests for data from outside the MIZEX research group must first receive approval from the relevant scientist except in those cases where documents are clearly specified to have unlimited distribution.

C. Data requests/sales

1. Administration

Beginning with extensive design team efforts late in FY84, the TRAK project, a PC-based data request tracking system for NSIDC, became operational on 1 January 1985. The system provides menu-driven, screen-based data entry and search capability for tracking data and information requests received by NSIDC. It is written in dBase III, and includes a set of eight reports that can be produced for any date interval.

TRAK has reduced the amount of paperwork involved in monitoring data requests by consolidating all relevant information in one place. The next level of development will be the addition of a hard disk to permit a larger cumulative data base. At present, one diskette holds six months of data. Further efficiency in the data request operation could be realized if TRAK were available as a multi-user system.

2. Statistics

The volume of users climbed steadily this year to a new high of 479 (figure 3). Half of these requests were for DMSP imagery, with Glaciological Data single copy and information requests a distant second (table I). Tables II-IV offer various data and information request statistics for FY85.

Data sales income increased significantly in FY85 (figure 4). DMSP provided the largest proportion of sales income, as it has for three years. FY85 income was spread over more requests and was not from one or two very large data sales which was the case in the previous years.

The total labor commitment to filling data requests totals .5 FTE (both staff and student time). This includes both paid, unpaid and/or exchange data requests.

The data sales/information services component of the WDC/NSIDC is evidently maturing and moving towards stability. The TRAK system has automated the way data requests are filled, thus saving valuable staff time. Sales were up slightly in FY85, and we think that the increased awareness of the DMSP, sea ice, and snow cover data sets,

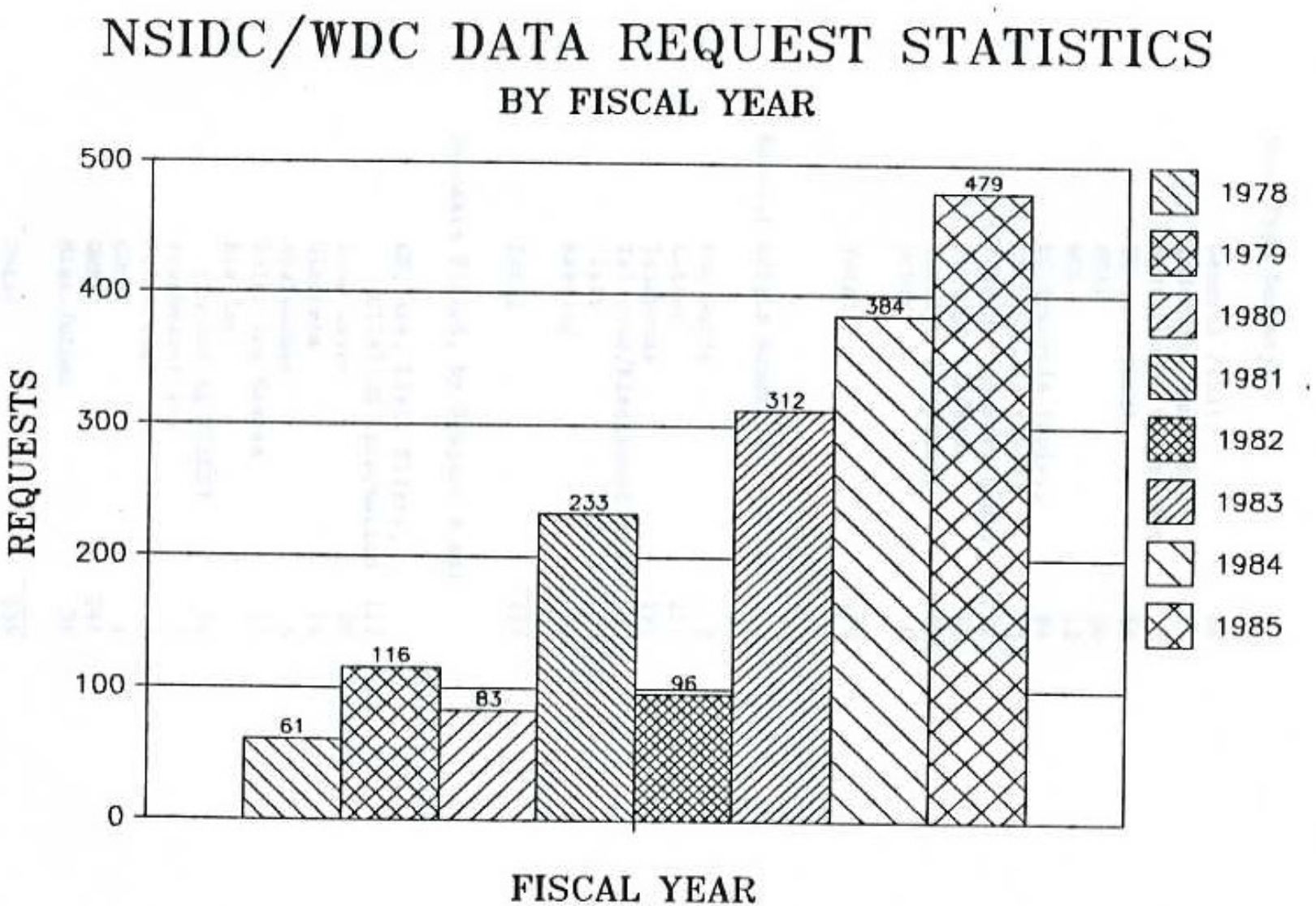
NSIDC/WDC DATA REQUEST STATISTICS
BY FISCAL YEAR
REQUESTS
500
400
300
200
100
0
61
116
83
233
96
312
384
479
1978
1979
1980
1981
1982
1983
1984
1985
FISCAL YEAR

Figure 3.

Table I

Data and Information Request Statistics, FY85
1 October 1984 - 30 September 1985

User Type Summary:

General Public	68
Industry/Commercial	104
State/Local Government	3
US Government	86
NOAA	20
WDC	12
US Academia (Univ.)	84
US Academic (K-12)	3
Foreign Industry/Comm.	22
Foreign Academia	45
Foreign Government	32
Other	0
Total	479

Request Origin Summary:

WDC Guide	2
Letter	217
Telephone	196
Telegram/Electronic Mail	5
Visit	53
Meeting	6
Total	479

Requests Filled, by Subject Area:

GD, Acc. List, Fliers, CITATION Information	117
Snow Cover	20
Glaciers	19
Avalanches	6
Polar Ice Masses	11
Sea Ice (including MIZEX)	76
Freshwater Ice	7
Permafrost	1
CDMS	1
DMSP	241
Misc./Other	36
Total	535

*NOTE: Many requests included more than one subdiscipline or subject area, so total is greater than 479.

Table II

Data and Information Request Statistics, FY85
1 October 1984 - 30 September 1985
NSIDC TRAK Data Request System

Payments Received, by Subject Area:

GD, Acc. List, Fliers, CITATION Information	$ 878.47
Snow Cover	342.30
Glaciers	187.53
Avalanches	3.90
Polar Ice Masses	19.60
Sea Ice (including MIZEX)	2995.40
Freshwater Ice	818.00
Permafrost	0.00
CDMS	0.00
DMSP	13932.41
Misc./Other	31.00
Total	$19208.61

Report completed 85/10/24

Table III
Data and Information Requests Statistics, FY85
1 October 1984 - 30 September 1985

Payments Received, by Subdiscipline:

Single GD's	113.47
CITATION indexes	765.00
Snow Cover Digital	340.00
Glacier Photos + PHOTO	187.53
RadioEcho + ARDS	6.10
Arctic Ocean Buoys	1120.00
Icebergs	376.50
JIC Digital	1132.00
Other Digital Sea Ice	100.00
MIZEX	10.20
GLERL	818.00
DMSP	13932.41

INFORMATION CENTER

Snow Cover	2.30
Avalanches	3.90
Polar Ice Masses	13.50
Sea Ice	256.70
Misc./Other	31.00
Total	$19208.61

Report completed 85/10/24

Table IV

Data and Information Request Statistics, FY85
1 January 1985 - 30 September 1985
NSIDC TRAK Data Request System

Labor Analysis: Hours to fill data and information requests, January-September 1985 only

	Information	Data		Subtotals
		Charge	No Charge	
Staff Hours	38.95	77.95	49.45	166.35
Student Hours	18.75	688.88	52.50	740.13
Totals	57.70	746.83	101.95	906.48

Materials Analysis: No. items shipped per output code

Charts/Maps	0
Computer Graphics	0
Computer Listings	404
Photocopy	5408
Letters	46
Magnetic Tapes	49
Microfilm	0
Microfiche	1335
Photographs/Negatives	492
Publications	116
Punched Cards	0
Reference Materials	15
Telephone (Verbal)	62
Loans (Original Data)	1988
Fliers/Marketing Materials	737
Computer Output Microfiche	0
Samples	0
Bibliographic Search (Comm.)	0
Bibliographic Search (CITATION)	14
Special Study	0
Inventory Search	2

Report completed 85/10/24

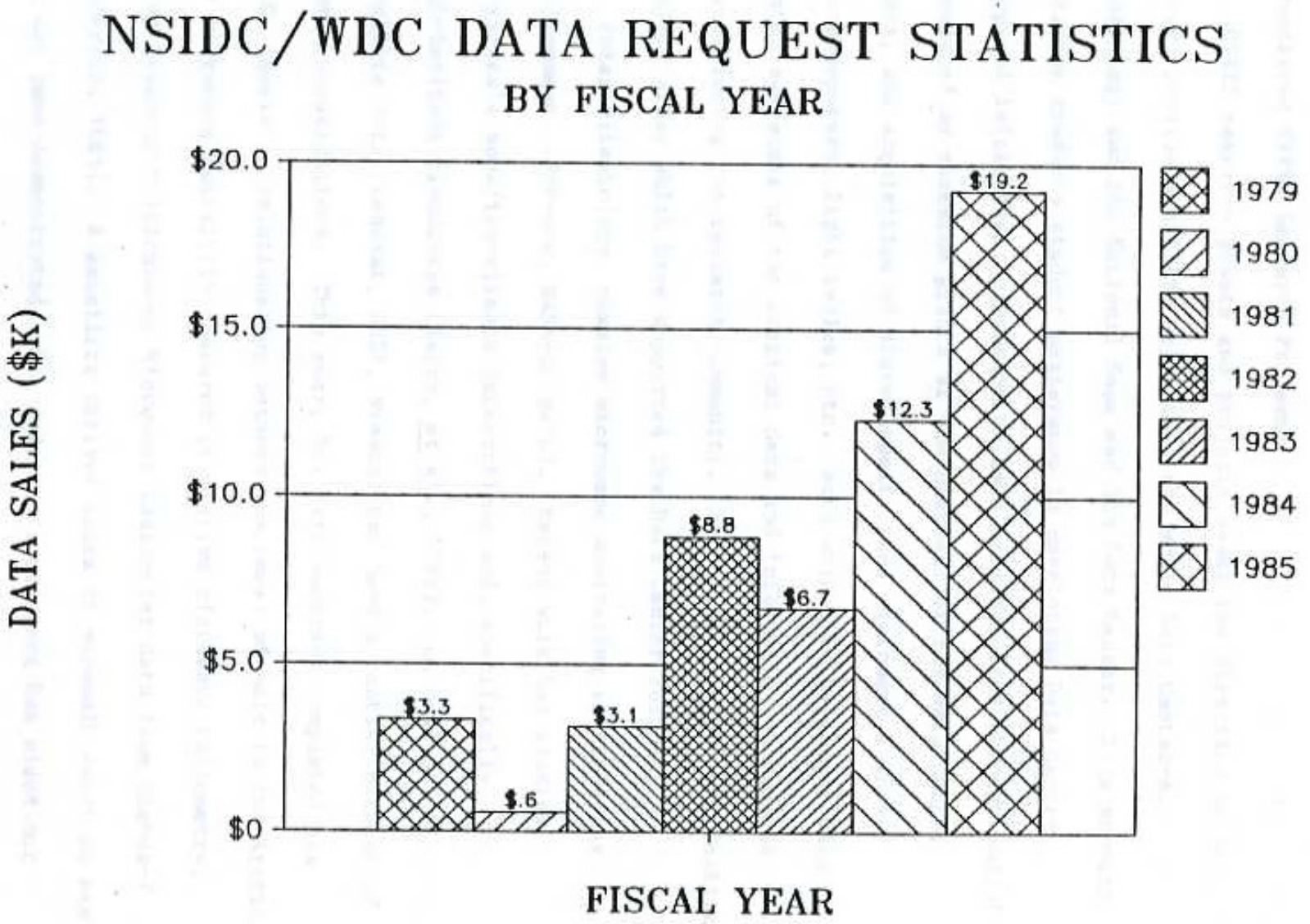
NSIDC/WDC DATA REQUEST STATISTICS
BY FISCAL YEAR
DATA SALES ($K)
$20.0
$15.0
$10.0
$5.0
$0
$3.3
$.6
$3.1
$8.8
$6.7
$12.3
$19.2
1979
1980
1981
1982
1983
1984
1985
FISCAL YEAR

Figure 4

as evidenced by the larger number of user contacts, will continue to increase cost recovery in the coming years.

D. Associated CIRES Research Projects

CIRES research grants and projects under the direction of Dr. Barry, provide ancillary support to the World Data Center-A: Glaciology and the National Snow and Ice Data Center. This support includes graduate student assistance in developing Data Center proposed initiatives, placement of data sets acquired through and/or generated by research grants at the disposal of the Data Center users, and acquisition of shared specialized equipment such as microcomputers, light tables, etc. Such work also heightens Data Center awareness of the critical data and information management issues facing the research community. Brief descriptions of specific project areas which have supported the Data Center follow.

Polar climatology, passive microwave monitoring of the polar environment (NSF-DPP, NASA-Climate). Recent work has studied large-scale snow/ice-climate interactions and, specifically, high-latitude cloudiness (Barry, et al., 1984). An analysis of satellite data (Landsat, DMSP, Nimbus) has been a central element of these investigations. This year, Dr. Mark Anderson completed his Ph.D. thesis on relationships between the onset of melt in the Arctic and microwave emissivity measured by passive microwave radiometry, using Scanning Multichannel Microwave Radiometer data from Nimbus-7 (Anderson, 1985). A satellite-derived index of snowmelt onset on sea ice has been demonstrated. Dr. Anderson's presence has aided our efforts to assess the issues involved with SSM/I data processing and management.

Department undergraduate intern worked on production of contour maps of randomly spaced snow cover depth and water equivalent point data. The software package used was SURFACE II on the University of Colorado CYBER. Data sources were the Soil Conservation Service and the National Weather Service. The SURFACE II package was set up to create an outline map of the study area, locate measurement site coordinates, allow entry of individual sets of measured data, and finally to merge these parameters in order to produce a coutour map. The test area was western Colorado and one map was produced for total snow depth on the ground for March 1, 1983. It was concluded from this prototype that SURFACE II provided an adequate and efficient means to produce small-scale snow cover maps. NSIDC is currently seeking research support in the area of snow cover data archiving and analysis. Until such time as this support becomes available, it is not anticipated that any further development will be carried out on this project.

B. Proposals submitted for FY86.

1. Analysis of snow cover conditions in Northern and Central Europe. National Science Foundation. Proposed duration two years. (R.G. Barry and R.A. Armstrong.)

Published snow cover records for Europe are only available as average values. For many purposes, data on daily snow conditions for individual years are required. It is proposed to compile, from diverse national archives, a standardized, gridded set of 10-20 years of daily snow cover depth and water content for central-northern Europe and to analyze its statistical characteristics. The region to

Snow melt on Arctic sea ice (NSF-Atmospheric Sciences through Lamont-Doherty Geological Observatory). Mr. Greg Scharfen, the DMSP Satellite Collection Manager, and student assistants are mapping snow cover on sea ice using high resolution DMSP imagery. This is part of a study of the long term climatic variations in Arctic sea ice and associated snow cover conditions, being conducted in collaboration with Dr. George Kukla at Lamont-Doherty. The project supports Scharfen half-time.

Lake ice freeze-up/break-up in high latitudes (DOE). For several years graduate student research assistants have been analyzing long term trends in lake freeze-up and break-up dates to assess their usefulness as a proxy indicator of CO_2-induced climatic warming. A strong statistical relationship between fall/spring temperatures and these dates has been established for lakes in Canada and Finland. The WDC has benefitted from the acquisition of related data sets and literature. Mr. J. Maslanik, a new graduate research assistant on this grant, is an experienced user of image analysis systems, and has played a key role in maintaining and using the DIPIX image analysis system.

III. CDMS/Image Analysis System

A. Cryospheric Data Management System

1. Purpose

The Cryospheric Data Management System (CDMS) is primarily designed to provide an archive of cryospheric data extracted from the Special Sensor Microwave/Imager (SSM/I) which will be launched in mid-1986 as part of the Defense Meteorological Satellite Program. Besides maintaining an archive of SSM/I data, CDMS will provide other functions: create gridded data sets; provide an interactive data

catalog of CDMS data sets, including information on the availibility and location of other types of data; distribute data and any data products created by the CDMS to the user community; and, incorporate non-SSM/I data sets into the CDMS archive.

2. Operations

Hardware for the CDMS project was installed in FY85. The major components are a Digital Equipment Corporation VAX-11/750 with four MBytes physical memory, and two disk drives comprising a total of almost 650 MBytes of disk space. Two tri-density tape transports were purchased from System Industries. An Emulex CS21/F Communications Multiplexer was installed on the VAX-11/750 to permit an additional 16 lines to connect to the VAX for a total of 24 available ports. A Printronix P-600 is currently being utilized as the sole spooled print device. The VAX 11/750 uses the VMS operating system.

Several DI-3000 graphic packages were acquired from Precision Visual Incorporated. The packages include DI-3000 Extended, the Contouring System, the Metafile System, and the VT125 Device Driver. These packages have recently been installed and software evaluation is in progress.

The Map Overlay and Statistical System (MOSS) was installed on the VAX-11/750. MOSS is an analysis and display system for map and other geographical information. MOSS is currently being utilized solely by SED's Terrestrial Geophysics Branch.

B. Image Analyis System

An image analysis system was acquired through a Department of Defense Research Instrumentation grant to CIRES. The DIPIX Aires II workstation

includes: a Digital Equipment Corporation PDP-11/73, CPU, an AMPEX disk drive used for both the operating system and the image display files, a DY-4 Systems VGT-100 video graphics terminal, an Integral Data Systems dot matrix printer to log operations performed on the system, a 19" Hitachi color monitor with a resolution of 960 x 720 pixel, a digitizing tablet for command input, and a color matrix camera/recorder for slide production.

DIPIX completed installation of the RSX-11 operating system and ARIES-II software onto the PDP-11/73 in early September. A version of the ARIES-II software (ie., Vstream) was installed on the VAX-11/750, permitting co-processing on the larger CPU.

C. Highlights

An overview of the Cryospheric Data Management System was presented to NOAA (local) and CU administrators during an open house held 4 June 1985. The image display system capabilities were demonstrated, including display and manipulation of selected Landsat, NOAA AVHRR, Nimbus 7, SMMR, Viking Orbiter and Lander, and Voyager data. The open house served to demonstrate the improved capabilities of CIRES/Glaciology computer systems for research and to generate awareness within the NOAA and University communities of the image analysis display system.

Vince Troisi spent three weeks at NASA's Jet Propulsion Lab Pilot Ocean Data System (JPL/PODS) to learn the installation and operational procedures of the SSM/I Data Archiving and Processing System, and to become acquainted with the operations and development staff.

IV. New initiatives

A. Snow cover mapping test

During fall semester 1984 and spring semester 1985, a Geography

be covered has high inter-annual variability in snow cover extent so that the data set will have application for future hydrologic/climatological studies. The period to be analyzed will include the years 1979-80 for which Scanning Mulifrequency Microwave Radiometer (SMMR) data are available from Nimbus 7. Test sets of surface snow cover data will be prepared for assessment of the validity and accuracy of the SMMR-derived estimates of snow cover.

2. Development of passive microwave snow cover products based on the special sensor microwave imager. National Aeronautics and Space Administration. Proposed duration 21 months. (R.G. Barry.)

Large changes in surface albedo and energy budgets over periods of days to months result from variations in snow and ice cover. Data sets available to study such changes are few. Satellite observations, however, afford the best method to view these changes on a hemsipheric basis.

We propose to develop gridded snow cover products based on the special sensor microwave (SSM/I) passive microwave sensor to be flown on the Defense Meteorological Satellite Program (DMSP) satellites starting in 1986. This project will: (1) incorporate a grid for northern hemisphere land areas with seasonal snow cover into the JPL PODS software provided for NSIDC's CDMS; (2) develop and test software for routine data processing using snow parameter algorithms; and (3) provide an algorithm validation capability for experimental snow cover products.

3. An analysis of spatial patterns of water exchange in areas of extreme local relief. National Science Foundation (Earth Sciences). Proposed duration two years. (R.G. Barry and D. Alford.)

It is the purpose of the research proposed here to evaluate variations in the three-dimensional spatial patterns of water exchange among major mountain ranges and individual basins within those mountain ranges in the western United States. This study will be conducted at two scales: a macroscale, related to the dimensions of mountain ranges and a mesoscale, related to the dimensions of the individual basin or altitudinal zone within a mountain range.

References

Anderson, M.R., 1985: Sea Ice Conditions and Surface Melt in the Arctic for Spring 1979 and 1980 from SMMR Data. Ph.D. thesis, Geography Department, University of Colorado.

Anderson, M.R., Crane, R.G., and Barry, R.G. (in press): Arctic atmosphere-ice interaction studies using Nimbus-7 SMMR. Conference on Satellite/Remote Sensing and Applications, June 25-29, American Meteorological Society.

Barry, R.G., Shine, K.P., and Anderson-Sellers, A., 1984: Cyrosphere-cloud interactions near the snow/ice limit. CIRES, University of Colorado, Boulder, and Department of Geography, University of Liverpool, 239 pp.

Barry, R.G., Crane, R.G., Anderson, M.R., Carleton, A.M. and Scharfen, G., 1984: Cyrosphere-cloud interactions near the snow/ice limit, Part A: Empirical analysis of cryosphere-cloud interactions. CIRES, University of Colorado, Boulder, 1-75.

Meetings Attended

The following meetings were attended by WDC/NSIDC staff.

International Great Lakes - St. Lawrence Ice Information Working Group, 13 Annual Meeting - Toronto, 31 October - C. Hanson.

MIZEX 84 Publications and Science Group Meeting - Monterey, 28 November to 1 December - R. Armstrong.

Polar Research Board, Committee on Glaciology, 6-7 December, San Francisco - R. G. Barry

American Geophysical Union - Ocean Sciences Remote Sensing Working Group - 6-7 December, San Francisco - R. G. Barry.

Planning Meeting for U.S.-Canadian-European Applications of Radar Data from ERS-1, Columbia University, 21-23 January - R. G. Barry.

MIZEX Remote Sensing Workshop, NOAA-ERL, Boulder, 25-27 February - R. Armstrong and R. Weaver.

Western Snow Conference, Boulder, 16-17 April - R. Weaver, R. Armstrong and G. Scharfen.

ICSI Working Group on Seasonal Snow Cover - met in conjunction with Western Snow Conference - R. G. Barry.

Invitational Workshop on Northern and Offshore Information Resources, Calgary, Alberta, 1-2 May - A. Brennan.

RADARSAT/ERS-1 meeting, Fairbanks, 14 May - Greg Scharfen.

NORDA Arctic Oceanography Workshop, Bay St. Louis, MS, 12-14 June - R. Weaver.

NRC, Marine Board, Committee on Arctic Integration Ocean Information Systems, U. of California, Berkeley, 10-11 June - R.G. Barry.

IAMAP/IAPSO Joint Assembly, Honolulu, 12-16 August - R.G. Barry.

Royal Swedish Academy Symposium on Research in Arctic Life and Earth Science, Abisko, Sweden, 4-6 September - R.G. Barry.

NRC, Marine Board, Committee on Arctic Integrated Ocean Information Systems, U. of Colorado, Boulder, CO, 12-13 September - R.G. Barry.

Papers Submitted

The following papers were submitted by WDC/NSIDC staff with credit given to NOAA:

"Cryospheric Data Management System for Special Sensor Microwave Imager DMSP Data," by R.L. Weaver and R.G. Barry, submitted to OCEANS '85 Conference, November 12-15, 1985.

"World Data Center-A for Glaciology [Snow and Ice]; An Overview of Activities and Services," by R.G. Barry and A.M. Brennan, submitted to Inter-Nord.

"World Data Center-A for Glaciology antarctic-related activities, 1983-1984," by R.G. Barry and A.M. Brennan, Antarctic Journal of the United States, V. 19(5), p. 245-246.