

**NATIONAL SNOW AND ICE
DATA CENTER**

**WORLD DATA CENTER-A FOR
GLACIOLOGY**



ANNUAL _____ 1996
REPORT

Cover: Arctic Sea Ice Trends from SMMR and SSM/I

Spatial distribution of trends in Arctic sea ice concentration derived from SMMR and SSM/I data. The color range represents the slope of a least squares fit to the monthly mean ice concentrations at each ocean grid cell for January 1979 - September 1995. Blue areas indicate little or no change over the period (i.e., always open ocean or always sea ice). Pink through white colors indicate decreasing ice concentration over time. Aqua through green show areas where ice concentration has tended to increase. These sea ice trends correspond in general to observed trends in surface air temperatures (J. Maslanik, unpublished data).

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1996

*National Snow and Ice Data Center
World Data Center-A for Glaciology*

NSIDC/WDC ANNUAL REPORT - FY 1996

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NATIONAL SNOW AND ICE DATA CENTER/ WORLD DATA CENTER-A FOR GLACIOLOGY

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INTRODUCTION

The National Snow and Ice Data Center (NSIDC)/World Data Center A for Glaciology (WDC) is operated under a cooperative 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. Within CIRES, NSIDC/WDC is a part of the Cryospheric and Polar Processes division. NSIDC/WDC is completing its twentieth year of service to the snow and ice research community from its Boulder location.

NSIDC/WDC is committed to make fundamental contributions to cryospheric science and to excel in managing data and disseminating information to advance understanding of the Earth system. The role of the NSIDC/WDC is to acquire, archive and disseminate data relating to all forms of snow and ice, within the context of the ICSU guidelines for international data exchange (ICSU, 1987) and NOAA's mission. Complementing these data management activities, NSIDC, through affiliated scientists within CIRES, carries on an active research program. Scientists are involved in both data management and application of the data to research endeavors.

NSIDC/WDC is funded by various federal agencies, including the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF). Some of the data management and administrative functions are supported by NOAA, with major project support from all the above mentioned agencies.

This report presents NSIDC/WDC highlights for FY1996. A complete report will be published in June 1997; June will then become the regular publication date for the Annual Report.

International Council of Scientific Unions, Panel on World Data Centres.
(1987) Guide to the World Data Center System. Part 1. *The World Data Centers*. Boulder, CO, 91p.

NEW PRODUCTS

NEW CD-ROM: RUSSIAN ARCTIC OCEAN DRIFT STATION DATA

NSIDC, in collaboration with the Polar Science Center (PSC), University of Washington, has released a new CD-ROM containing snow, meteorological, and solar radiation data from the Soviet North Pole drifting stations. *Arctic Ocean Snow and Meteorological Observations from Drifting Stations, 1937, 1950-1991*, Version 1.0, contains: snow depth, snow surface temperature, snow density, snow water equivalent; meteorological data (air temperature, relative humidity, surface pressure, wind speed and direction, U-V components of wind, total and low cloud amounts, precipitation type and amounts); and solar radiation data (diffuse, direct, global, reflected, and net radiation, and albedo.) North Pole (NP)-1 operated from 22 May 1937 through 19 February 1938. NP-2 began on 22 April 1950, and at least one station, sometimes two, operated from that date until the end of NP-31 on 31 March 1991.

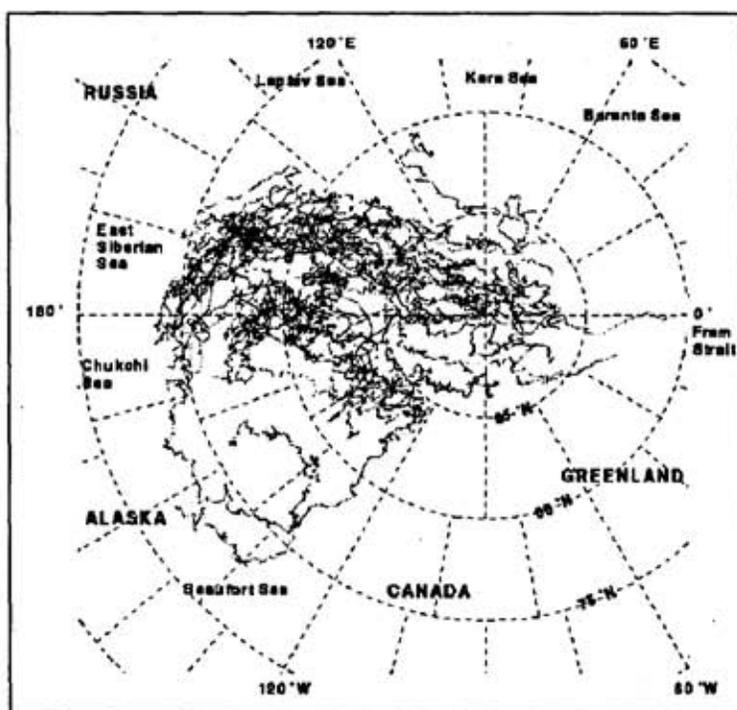


Figure 1. Daily positions of the Soviet North Pole Stations 3 through 31 which were manned continuously from 1954 - 1991. Figure courtesy of I. Rigor, Polar Science Center, University of Washington.

Data on the CD-ROM are daily averages, or 3-hourly measured values; spatial resolution is dependent on the movement of the ice floes on which the stations were located. Both original data, as digitized from station logbooks at the Arctic and Antarctic Research Institute (AARI), St. Petersburg, Russia, and daily averaged data are included. Position data were linearly interpolated from the original irregular position observations.

Meteorological instrument descriptions, including technical specifications regarding accuracy at low temperatures, are included in the documentation, which is provided on the CD-ROM. All the data are in ASCII files and are readable on any type of computer platform.

Rescue and organization of the meteorological data at AARI and PSC/University of Washington, and the CD-ROM development portion of this project, were funded by the U.S. National Oceanic and Atmospheric Administration (NOAA) as a part of the NOAA National Environmental Satellite, Data and Information Service (NESDIS) Environmental Science Data and Information Management (ESDIM) Program. Additional funding for snow data rescue and preparation was provided by the U.S. National Aeronautics and Space Administration (NASA). Funding for the rescue, publication and access to the solar radiation data included on this CD-ROM was provided by the U.S. National Science Foundation, Division of Atmospheric Sciences. This CD-ROM is an Arctic Climate System (ACSYS) contribution.

NORTHERN HEMISPHERE WEEKLY SNOW COVER AND SEA ICE EXTENT 1978-1995

NSIDC has developed a northern hemisphere cryospheric product which for the first time combines snow cover and sea ice extent at weekly intervals for the period 1978 to 1995. See Figure 2. The data set also includes monthly climatologies describing snow and sea ice extent in terms of average conditions, probability of occurrence, and variance. The data set is produced in an azimuthal equal area (25 km) projection (NSIDC EASE-Grid). The snow cover extent is based on the digital NOAA-NESDIS weekly northern hemisphere snow charts, revised by D. Robinson (Rutgers University) and re-gridded to the EASE-Grid. The original NOAA-NESDIS weekly snow charts are derived from the manual interpretation of AVHRR, GOES and other visible-band satellite data. The sea ice extent is based on the existing NSIDC, polar stereographic, sea ice concentration grids. The NSIDC sea ice concentrations are derived from the SMMR and SSM/I passive microwave brightness temperature data. Funding for this project has been provided by the NOAA Climate and Global Change Program and the NASA Pathfinder Program.

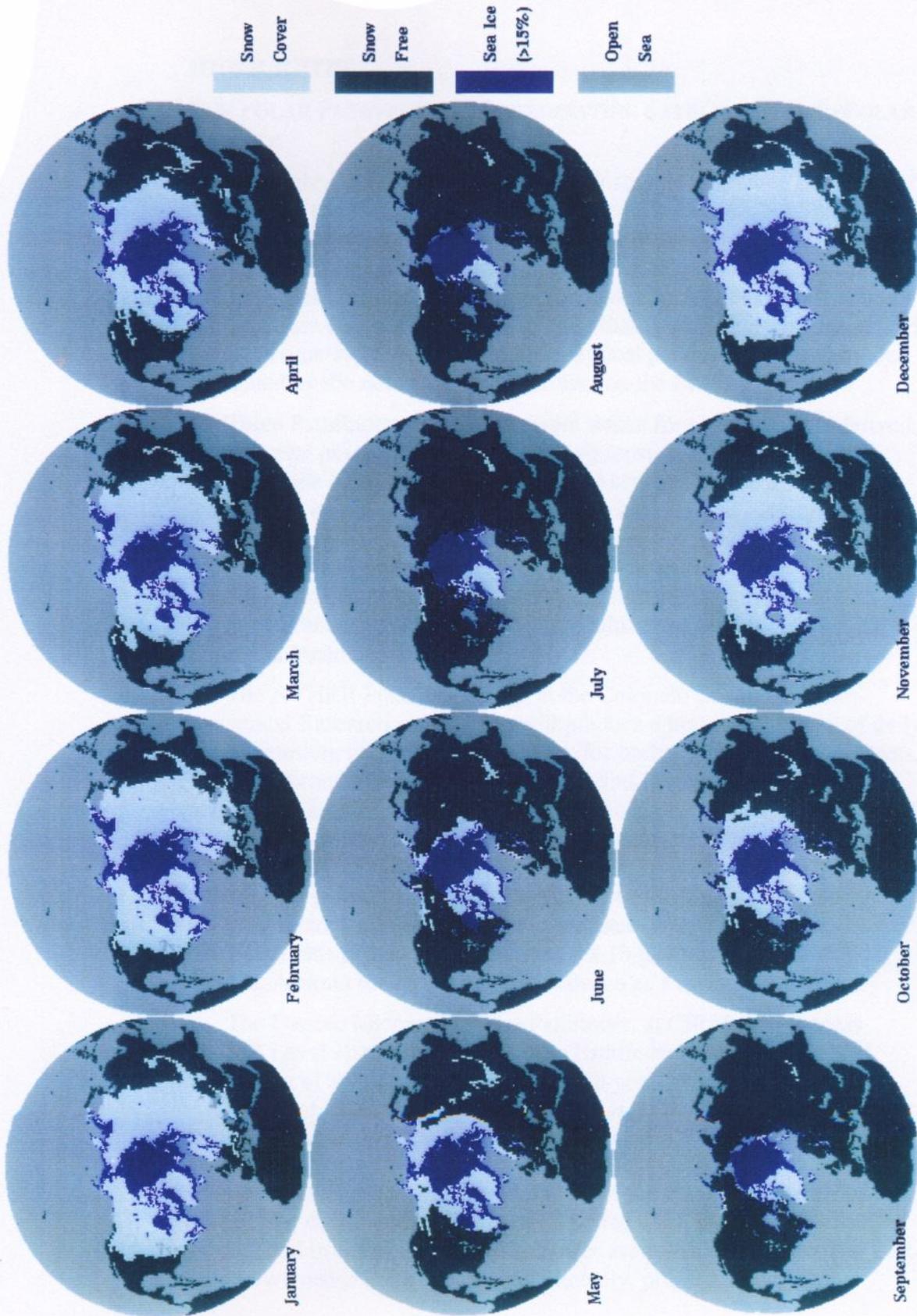


Figure 2: Average northern hemisphere snow cover (1971-1995) and sea ice extent (1978-1995)

investigators on data migration to NSIDC. We have established guidelines with staff at the University of Washington for acquiring Arctic Ocean Section (AOS) data and are working very closely with the Surface Heat Budget of the Arctic Ocean (SHEBA) Science Management Office (SMO) in establishing data migration plans for SHEBA Phase I Investigators. Planning for field support for Phase II will also continue through our close relationship with the SHEBA SMO. Other important oceanographic data sets for Arctic research are being compiled. For example, the Western Oceanographic Data Set (WODS) will include CTD, bottle, phytoplankton, and current measurements from cruises and studies apart from ARCSS. NEW, AOS and WODS CD-ROMs are scheduled for production in 1997.

HUMAN DIMENSIONS OF GLOBAL CHANGE IN THE ARCTIC (HARC)

A recent addition to the ARCSS program is the Human Dimensions of Global Change in the Arctic (HARC). An initial science planning meeting from this new program took place in Tucson in the fall of 1995 that brought together researchers from a variety of disciplines, including biology, archeology, anthropology and climatology. The National Science Foundation strongly encourages this program to complement the ongoing physical science program in the Arctic. ADCC personnel are beginning to work with HARC investigators on data management concerns. Social science data have many different characteristics from our usual data collections, and certain types of social data that the HARC project will contribute to the ARCSS archive are inherently sensitive. With this in mind, modifications were made to the ARCSS data protocol to address these concerns.

PALEOENVIRONMENTS OF LAKES AND ESTUARIES (PALE)

The strengthening relationship between the PALE SMO and the ARCSS Data Coordination Center fosters better integration between PALE and the rest of the ARCSS community. A Beringia Atlas is currently being developed through PALE; the ADCC is working closely with PALE to see this project come to fruition. Plans to move the PALE data manager position into the ADCC are being developed.

Modeling studies have recently become a focus due to the special nature of modeling data itself. Discussions with modelers are now taking place to decide what model outputs will be in the archive and the necessary modifications needed to help bring model data into the fold. We are also continuing to work with modelers to develop and enhance data access for the general scientific community.

HIGHLIGHTS

THE POLAR PATHFINDERS: COORDINATING SATELLITE-BASED POLAR SCIENCE

In October 1990, NOAA and NASA instituted a research program for the study of earth systems, called Pathfinder. The NOAA/NASA Pathfinder project seeks to create data products that emulate the planned products of the upcoming Earth Observing System (EOS) mission using existing satellites. Its objectives are twofold: to provide example data sets for algorithm development and testing of data distribution systems, and to initiate a time-series of important geophysical parameters which will be continued by the new sensors to be flown on the EOS platforms.

Three Pathfinder grant awards were issued for polar products derived from several passive-radiation-measuring sensors: SMMR and SSM/I (flown on the Nimbus and DMSP satellite series), AVHRR, and TOVS (both flown on the NOAA polar-orbiter series). Each of these grants intends to establish a continuous, calibrated and verified, geophysical data product using published algorithms. As discussed below, these products are both related and complementary. For this reason, the investigators of the three grants are planning now to coordinate the output products to make combined use of them easier.

The AVHRR Polar Pathfinder, at the Colorado Center for Astro-dynamical Research and CIRES, will produce a multi-year record of daily sea-ice motion, ice surface temperature for both sea ice and the ice sheets, and polar broadband albedo. The time period planned is 1982-1997, although this range may be restricted somewhat by data availability. Spatial resolution of the time-series products will be 5 km, based on 4-km resolution GAC data, and 1.25 km resolution, available for the last five years of the period, based on 1.1 km resolution LAC/HRPT data. Ice velocity vectors will be on somewhat coarser grids, since they are based on shifts in ice patterns measured on 10 x 10-pixel 'chips' from pairs of images. A cloud mask will also be produced as a secondary product.

The Passive Microwave Polar Pathfinder, at CIRES, will process SMMR Level 1b data from a previous Pathfinder project, and extend processing of SSM/I data, to produce a 20-year record of passive microwave data in the EASE-Grid format at 25 km grid cell size and a supplemental 12.5 km grid for the 85 GHz channel. EASE-Grid brightness temperature data are available in three equal area projections, azimuthal for Northern and Southern Hemisphere and cylindrical for full global. The data set will span the time-period 1978 to 1998. This data set is described in detail, and example images are provided by accessing URL <http://www-nsidc.colorado.edu>. Additionally, proposals have been

submitted to generate a snow cover and snow thickness product from this standardized 20-year record.

The TOVS Pathfinder, at the University of Washington Polar Science Center, will produce an 18-year (1979-1997) data set of daily atmospheric temperature and humidity profiles, cloud-cover and boundary layer parameters over sea ice for the north polar regions (>60 degrees). Spatial resolution of the product will be 100 km. As with the other two Pathfinders above, extensive validation information and error estimates will be provided. A 20-month sample of this data set for the Pathfinder benchmark period, April 1987-November 1988, is currently available from NSIDC.

To coordinate the data products from the three Polar Pathfinders, the investigators intend to generate compatible grids for the output products. For each project, the grids will match up precisely, differing only in pixel size. Thus, a single grid cell from the TOVS products will be exactly represented by four SSM/I brightness temperature grid cells, and 6400 (80 x 80) 1.25 km grid cells from the higher resolution AVHRR products. Utilities and documentation will be provided, together with examples on how to combine and use variables from these products. We will further intercompare duplicate variables (e.g., cloud fraction, surface temperature) and discuss the advantages and potential biases in the data sets.

The output grids for all the products will be based on a Lambert equal-area azimuthal projection of the data that is already in use for the SSM/I data (the EASE-Grid, see Armstrong and Brodzik, 1995). The advantages of this projection stem from the fact that each pixel represents an equal area; therefore the areal extent of a particular feature, i.e., sea ice, clouds, a particular surface temperature range, may be determined by simply counting grid cells in the product image.

Armstrong, R.L., Brodzik, M. J., 1995. An earth-gridded SSM/I data set for cryospheric studies and global change monitoring. *Advances in Space Research*, 16(10): 155-163.

Armstrong, R.L., Brodzik, M.J., and Tait, A. 1995: Global snow cover fluctuations derived from passive microwave remote sensing data. *EOS, Transactions American Geophysical Union*, Vol. 76, No. 146: F203.

**EOS ADVANCED SPACEBORNE THERMAL EMISSION AND REFLECTION
RADIOMETER (ASTER) GLACIER LAND ICE MONITORING FROM
SPACE (GLIMS) PROJECT**

NSIDC's participation in the ASTER GLIMS Project was defined this year, in the GLIMS Operational Plan, which was presented to the ASTER Instrument Team in October, by the USGS in Flagstaff, the organizers of the project. GLIMS objectives are to establish a global inventory of land ice, including surface topography, to measure the changes in extent of glaciers, and where possible, their surface velocities through the life of the ASTER mission.

The plan is to acquire images of glaciated areas on an annual basis, using an average of 3-5 imaging attempts per year. Highly automated software to detect and map ice margins and surface feature velocities is being developed by the GLIMS group in Flagstaff. The international glaciological community has been asked to collaborate in mission planning and data analysis. The derived products will be archived and distributed by NSIDC.

GLIMS processing will utilize the 15m-resolution, VNIR-stereo capability which the ASTER instrument provides. The image data will be manually screened for cloud contamination as they are received at the EROS Data Center from the ASTER Mission Operations (cloudy scenes will be rescheduled). The level 1a data will be used by a number of internationally distributed "Regional Centers", which adopt mission planning and data analysis activities for significant geographic regions with land ice, and "Stewards", which will perform data analysis for subsets of glaciers in their region.

The USGS GLIMS group will provide the basic analysis procedure and software used by the centers and stewards. The analysis products will be returned to NSIDC in standard form for inclusion into the GLIMS database. The database will include glacier IDs, names, cross-references to images and other databases, scalar glaciological parameters, polygons of ice and snow, image registration regions, ice displacement vectors, transforms between image coordinates, N and E offsets from a local reference point, geodetic coordinates, and uncertainties in all of these values.

NSIDC will make the GLIMS database available through the NSIDC DAAC (subject to EDIS Project approval) and coordinate the activity with the existing Eurasian Glacier Inventory and the World Glacier Monitoring Service.

Bedford, D. and C. Haggerty, 1996. A new digitized glacier inventory for the Former Soviet Union and China. *Earth System Monitor*, 6(3).

ANTARCTIC DATA COORDINATION CENTER

NSIDC has begun the development of the Antarctic Data Coordination Center. This Center will provide a U.S. focus for the collection of metadata for the Antarctic Master Directory (AMD) which is being hosted at the International Center for Antarctic Information and Research (ICAIR) in Christchurch, New Zealand. The National Science Foundation's (NSF) Office of Polar Programs is funding the Antarctic Data Coordination Center activity at NSIDC and much of the AMD effort at ICAIR. The AMD will be closely linked to the NASA Global Change Master Directory.

NSIDC will identify Antarctic data sets (and cognizant individuals for these data sets) in all disciplines and prepare or assist in the preparation of data descriptions (DIFs) which will be the basis of the AMD. Already underway is an inventory of U.S. Antarctic data sites on the World Wide Web. We also have prepared a brochure. Recently, NSIDC briefed the National Research Council/National Academy of Sciences Polar Research Board on this activity. The Board provided much of the impetus for the coordination of metadata for the Antarctic through its involvement in the Scientific Committee for Antarctic Research (SCAR). NSIDC also met with the relevant program managers from NSF to review plans for the Center.

NSIDC is proposing to attend the National Antarctic Data Center (NADC) managers workshop to be held at ICAIR in 1997. Representatives from each of the participating countries will meet to coordinate their activities, discuss guidelines for operation of the NADCs, and become familiar with the data description software tools being developed by ICAIR for use across the AMD.

GLOBAL LIGHTNING

NSIDC has been analyzing U.S. Air Force DMSP analog and digital images for the presence of lightning for several years. The goal of this project, funded by NASA's Marshall Space Flight Center, is to produce a global climatology of nighttime lightning. This information is a precursor to the more complete lightning climatology that will be available from the EOS Lightning Imaging Sensor (LIS) which will be flown in 1997. The data used in the project at NSIDC are collected by the Operational Linescan System (OLS) sensor. Lightning has a distinct signature in the nighttime visible-band OLS images. The OLS sensor records a horizontal streak about 100 km long that corresponds to the scanned portion of an illuminated thunderstorm cloud. Although only a sample of total lightning occurrence, the data base of these signatures provides a unique source of information about the spatial and temporal distribution of global lightning.

This information is being used in studies of climate, the hydrological cycle and the global electric circuit. In the past NSIDC manually identified and digitized these signatures from the analog OLS images.

A notable accomplishment this year was the implementation of an automated lightning detection system developed by NSIDC. This system uses pattern recognition algorithms that emulate the human process of lightning signature identification, and greatly improve the efficiency of the analyses. The algorithms use a series of tests and neural networks (generated by NASA's "NETS" software package) to distinguish lightning signatures from other similar looking features (moonlit clouds, cities, fires, scanline noise and dropout, etc.). Approximately 11 months of digital OLS data from 1994 and 1995 have been analyzed using the automated system. A preliminary comparison of a subset of these analyses with approximately coincident data collected by another lightning sensor, the Optical Transient Detector (OTD), indicates good agreement.

GLOBAL GEOCRYOLOGICAL DATABASE (GGD)

WDC-A/NSIDC was funded by the National Science Foundation to implement a pilot "Global Geocryological Database" (GGD). This effort provides start-up funding for the assembly of priority permafrost and frozen ground datasets in Russian archives, and for WDC-A/NSIDC to inventory, retrieve, and organize priority datasets identified by other members of the International Permafrost Association (IPA).

Several members of the Data and Information Working Group (R.G. Barry, Chair) and Jerry Brown, IPA Secretary General, met at WDC-A/NSIDC in July to review the results of preliminary inventories, and to plan future data activities. In preparation for the 1998 Seventh International Permafrost Conference in Yellowknife, Northwest Territories, Canada, the group reconfirmed two planned activities: (1) a data workshop organized by Dr. M.J. Clark (Geodata Centre, Southampton, UK) to be held during the conference, and (2) preparation of a CD-ROM containing permafrost data and information.

The planned CD-ROM will be called CAPS "Circumpolar Active-Layer Permafrost System: A Contribution to Global Change Research." IPA Adhering Members are being asked to contribute at least one long-term dataset for the CD-ROM, and individuals and IPA Working Groups are also invited to contribute important data to the project. Nominations for inclusion are needed as soon as possible.

In order to maintain a reasonable rate of progress, the IPA proposes to hold a series of small regional meetings over the next 6-12 months. The first, focused on North American data holdings, took place in

Denver/Boulder on 12-13 December 1996. Another is proposed for Pushchino, Russia, in late April 1997. There are numerous conferences in 1997 and we hope to use these as opportunities to review data submissions.

Further information on the GGD project is given in the IPA Newsletter *Frozen Ground*, no. 18, December, 1995, p. 12; also see the IPA Home Page: <http://www.geodata.soton.ac.uk/ipa>

PUBLICATION PROGRAM

Two series, *New Accessions List* and *Glaciological Data*, have been published by NSIDC/WDC since 1977. *New Accessions List* (NAL), a product of the CITATION data base, 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 400 scientists, research institutions, and libraries. One issue, comprising four quarterlies for 1994, was printed and distributed in FY96.

Glaciological Data (GD) is the principal publication of NSIDC/WDC. Issues usually focus on a single topic and include specialized bibliographies, inventories and survey reports, and workshop proceedings relating to snow and ice data/research prepared by NSIDC/WDC staff, as well as invited or contributed articles on data sets, data collection and storage, methodology, and terminology in glaciology. Current circulation of GD is approximately 1000 copies, 50 percent of which are mailed to addresses outside the United States, generally in exchange for publications submitted to the WDC. Whenever possible, GD publication costs are obtained through specific agency or project support.

One volume in this series was published in 1996. *Glaciological Data, Report GD-29*, was published in cooperation with the Cold Regions Research Centre, Wilfrid Laurier University, Waterloo, Ontario, Canada. *GD-29* comprises an extensive bibliography on the hydrology of the Himalaya-Karakoram region compiled by Gordon Young and Bhanu Neupane of the Cold Regions Research Centre, Wilfrid Laurier University, Waterloo, Ontario, Canada.

Four issues of *NSIDC Notes*, a quarterly newsletter, were distributed in FY96. The mailing list for this series continues to grow. Almost 1000 copies are distributed to a worldwide audience. *NSIDC Notes* provides information about activities at NSIDC including the NSIDC Distributed Active Archive Center (DAAC), the Arctic System Science (ARCSS) data management, the Antarctic Data Coordination Center, passive microwave data distribution, and research projects underway. It also offers

information from other centers which we think is useful to our audience. This newsletter is part of NSIDC's commitment to foster communication within the cryospheric research community.

ARCTIC SYSTEM SCIENCE DATA COORDINATION CENTER AT NSIDC (ARCSS)

The ARCSS Data Coordination Center(ADCC) at NSIDC entered the second year of its current grant and strives to be a catalyst for ARCSS integration through data and information management. The work performed for each ARCSS program has been extensive. This section describes details of ongoing work within each ARCSS component as well as the peripheral support needed to achieve the proper level of data and information dissemination to the ARCSS community.

GREENLAND ICE SHEET PROGRAM (GISP2)

The relationship developed with the GISP2 Science Management Office (SMO) has been profitable and their guidance has enhanced many of the project accomplishments. Data migration plans established with each investigator ensured that all data were received by December 1996. A CD-ROM of data from both GISP2 and the European Greenland Ice Core Project (GRIP) will be released early in 1997 in conjunction with the publication of a *Journal of Geophysical Research* special issue devoted to the GISP2/GRIP projects. We are working with an interface tool (PaleoVu) and an interactive search engine (both developed by the National Geophysical Data Center (NGDC)) that will assist in accessing data from the CD-ROM. The data will also be available via FTP from the ARCSS Home Page (<http://arcss.colorado.edu/>). Due to our mutual interest in ice core data, NGDC and NSIDC have established strong web page linkages. We have also worked closely with NGDC on a number of issues relating to data and information display and distribution.

LAND-ATMOSPHERE-ICE INTERACTIONS (LAI)

The LAI Project continues to be a significant contributor to the ARCSS archive. Field summaries of each research project are posted on the ARCSS Home Page and we continue to work with each LAI principal investigator in developing data migration plans. We are also currently planning a second edition of the ARCSS/LAI North Slope Data Sampler CD-ROM.

OCEAN-ATMOSPHERE-ICE INTERACTIONS (OAI)

The OAI project is another major focus of data management activity at NSIDC. We continue to work with Northeast Water Polynya (NEW)

investigators on data migration to NSIDC. We have established guidelines with staff at the University of Washington for acquiring Arctic Ocean Section (AOS) data and are working very closely with the Surface Heat Budget of the Arctic Ocean (SHEBA) Science Management Office (SMO) in establishing data migration plans for SHEBA Phase I Investigators. Planning for field support for Phase II will also continue through our close relationship with the SHEBA SMO. Other important oceanographic data sets for Arctic research are being compiled. For example, the Western Oceanographic Data Set (WODS) will include CTD, bottle, phytoplankton, and current measurements from cruises and studies apart from ARCSS. NEW, AOS and WODS CD-ROMs are scheduled for production in 1997.

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A new monthly gridded climatology of arctic downwelling short-wave radiation is being compiled at NSIDC. In conjunction with this effort, we are amassing all of NSIDC's Arctic radiation data for inclusion on a CD-ROM. This Arctic Radiation CD-ROM will include short-wave, long-wave and net radiation values from stations above 50° North as well as the new monthly gridded climatology of arctic downwelling short-wave radiation being compiled by M. Serreze, at NSIDC. The data will also be available via FTP from the ARCSS Home Page at <http://arcss.colorado.edu/>.

WEB PAGE AND DATA ARCHIVE DEVELOPMENT

The ARCSS Home Page available via WWW (<http://arcss.colorado.edu/>) has been completely revamped and includes many added features to assist in data and information acquisition from the ARCSS archive. The design was implemented to serve a broader community with a logical, user-friendly interface to retrieve data sets. All non-restricted data are now available via FTP; e-mail can be sent directly to an ARCSS investigator through the Home Page; more information about projects within ARCSS is now available; a calendar of events keeps users informed of ARCSS and ARCSS-relevant conferences and deadlines; overviews of the formal ARCSS projects are also presented to educate users about the goals of ARCSS and each of its components; and real-time weather data is accessible through built in "hot links" directing the user to other locations. The ARCSS data holdings have been modified from a project orientation (LAI, OAI, etc.) to a subject orientation (Climate Data, Ice Core Data, etc.) This major modification is an integral step in providing Arctic data and information to the growing ARCSS and general scientific communities.

In addition to our already established Listserver for ARCSS, we believe our WWW Home Page development to be one of the most important improvements in our outreach to the global scientific community. Since its implementation in May, the number of web page contacts has increased tremendously. Before May, the ARCSS WWW site averaged 525 hits and about 3 megabytes of data downloaded per month; since the new web page design, the hits and data downloaded have averaged 5,600 and almost 94 megabytes per month respectively. We strive to continue to be on the "cutting-edge" of this technology. We are planning to implement an interactive "point-and-click" map of the Arctic to help a user determine data availability for a specific region of interest. The ARCSS data holdings at NSIDC will continue to improve through the addition of more detailed data descriptions and more subject groups according to need. We think that our new web format will not only provide the ARCSS community with valuable services and an efficient

database, but also be an inviting site for the interested public and educators wishing to learn more about Arctic System Science. We anticipate a proactive role in maintaining an evolving web page to best meet the needs of our users.

K-12 OUTREACH

The ADCC is helping to bring students closer to current science. The ADCC is collaborating with a teacher in Denver, CO, who spent a summer at the GISP2 camp, to develop science curricula using ARCSS data and information. The Educational Home Page (available spring 1997) will include images, reading materials, lesson plans, and activities appropriate for K-12 curricula, with an emphasis on grades 9-12. A CD-ROM will serve schools without Internet access. Data from GISP2 will support the initial curriculum, but the future focus will expand to other projects within ARCSS. The ADCC views this project as a critical element in long-range outreach to all communities interested in ARCSS data.

FUNDING

Funding of NSIDC/WDC programs comes primarily from U.S. Federal Government sources. See Figure 3. NASA is our largest contributor, at 72% of the FY96 budget. NOAA and NSF provide most of the remaining funds. Small, but none-the-less significant, funds are provided by the State of Colorado and NATO.

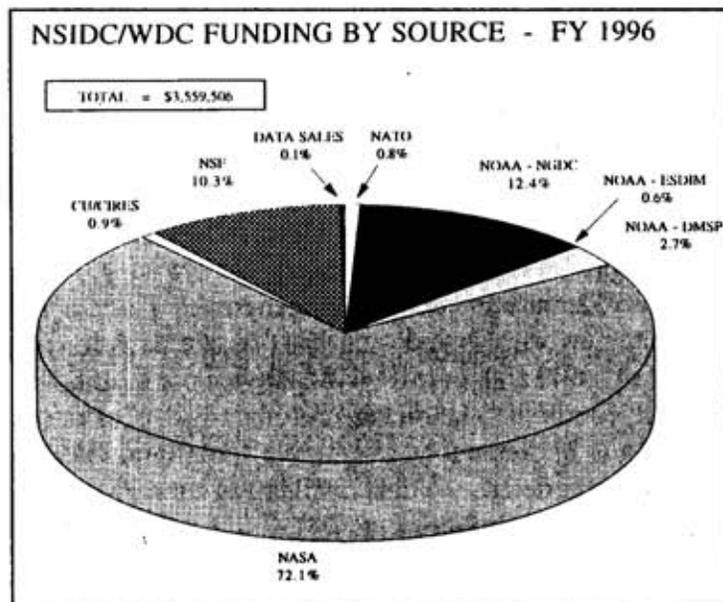


Figure 3.

The NSIDC/WDC budget continues to grow. The FY96 total is about \$3.5 million, however the rate of increase has been less in the past fiscal year. See Figure 4.

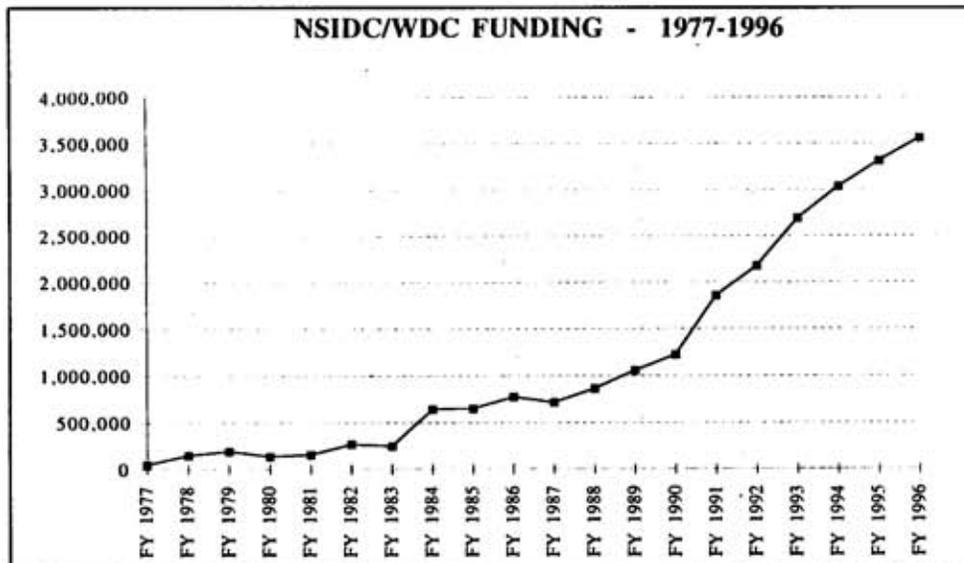


Figure 4.

DATA REQUEST STATISTICS

DATA CATEGORIES

SSM/I passive microwave data continues as the NSIDC product category with the largest number of users. During FY96 we received 150 new requests for the SSM/I polar stereographic product (including requests for information or support), and 146 requests for the SSM/I EASE-Grid product. There are currently 393 distinct, active subscriptions to both of these products (274 polar stereographic, 119 EASE-Grid), with 43 distinct users who currently subscribe to both products.

There were 1401 new data and information requests during the past year, representing 1096 distinct users, of whom 787 had not previously contacted NSIDC.

USER CATEGORIES

One of the variables by which NSIDC tracks users is by type of organization. Over the 19-year period of record, 1978 - September 1996, the distribution of users by category has remained relatively stable. Of the user categories for the new requests received this year, almost 26 percent are from U.S. universities, just over 29 percent are from outside the U.S., 15 percent are from U.S. government agencies, and 14 percent are from

U.S. industry. The 125 requests from members of the U.S. general public represents the largest percentage ever, 9 percent of the total requests.

Figure 5 presents total numbers of new data and information requests received during each fiscal year. A single request from a user (i.e., one contact) often results in multiple transactions or shipments, and may be a combination of information and data transactions or shipments. These multiple transactions or shipments, some of which are what we call "subscriptions", are not represented in this figure.

Only contacts received at NSIDC by e-mail, phone, fax, visit or attendance at a meeting are counted in these figures. No Web site statistics are included in this chart.

The increase in 1983 is related to the demand for DMSP OLS visible imagery from the archive established at NSIDC in 1980. The increase that begins in 1989 indicates distribution of the Nimbus-7 SMMR CD-ROM, continuing in 1990 when the first DMSP SSM/I CD-ROMs were shipped to users.

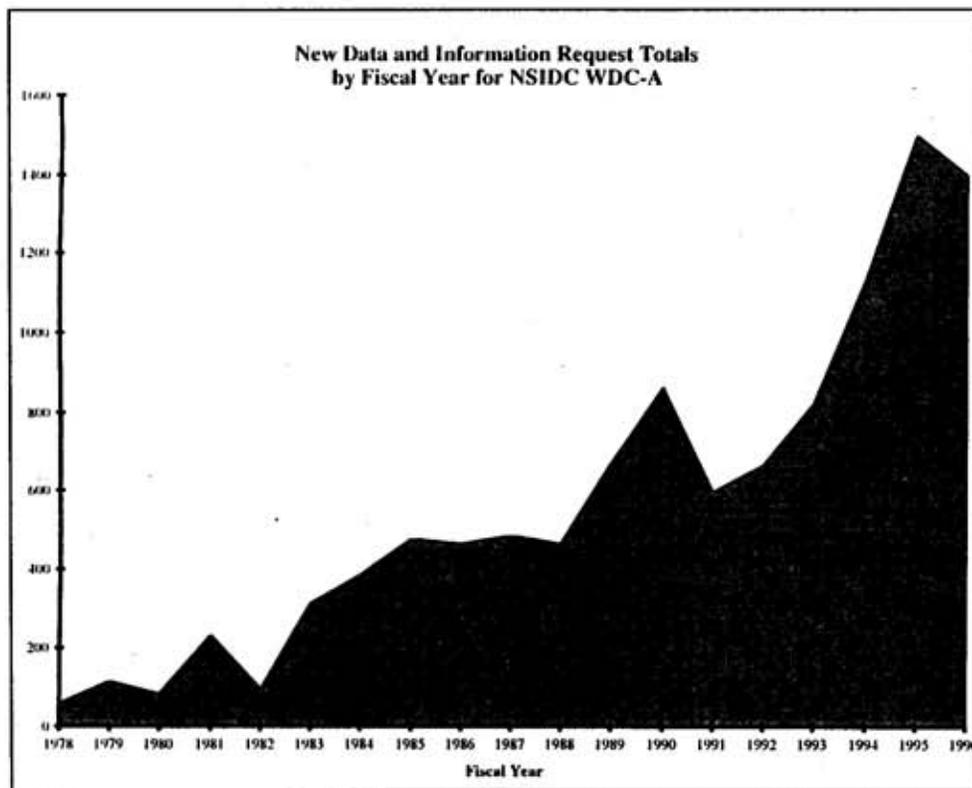


Figure 5. NSIDC WDC-A New Data and Information Request Totals by Fiscal Year

With the implementation of our new data request tracking system, we are able to identify distinct users associated with the requests or inquiries that we receive. Table 1 indicates that users of all types make multiple requests. Over the life of NSIDC, 69% of users have made only one request, 26% have made 2-5 requests, 3% 6-10 requests, and 1% over 10 requests. Three users have made 15 requests each.

Table 1. User Type/Number of Distinct Users by User Type/Number of Requests by User Type

User Type	Number of Distinct Users by User Type	Number of Requests by User Type
US General Public	85	125
US Industry	151	180
US University	284	344
US K-12	29	39
US Government	75	98
US State Government	13	15
NOAA	38	59
NASA	35	69
US Other	41	55
Foreign Government	58	117
Foreign Other	262	293
WDC Exchange	5	7

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