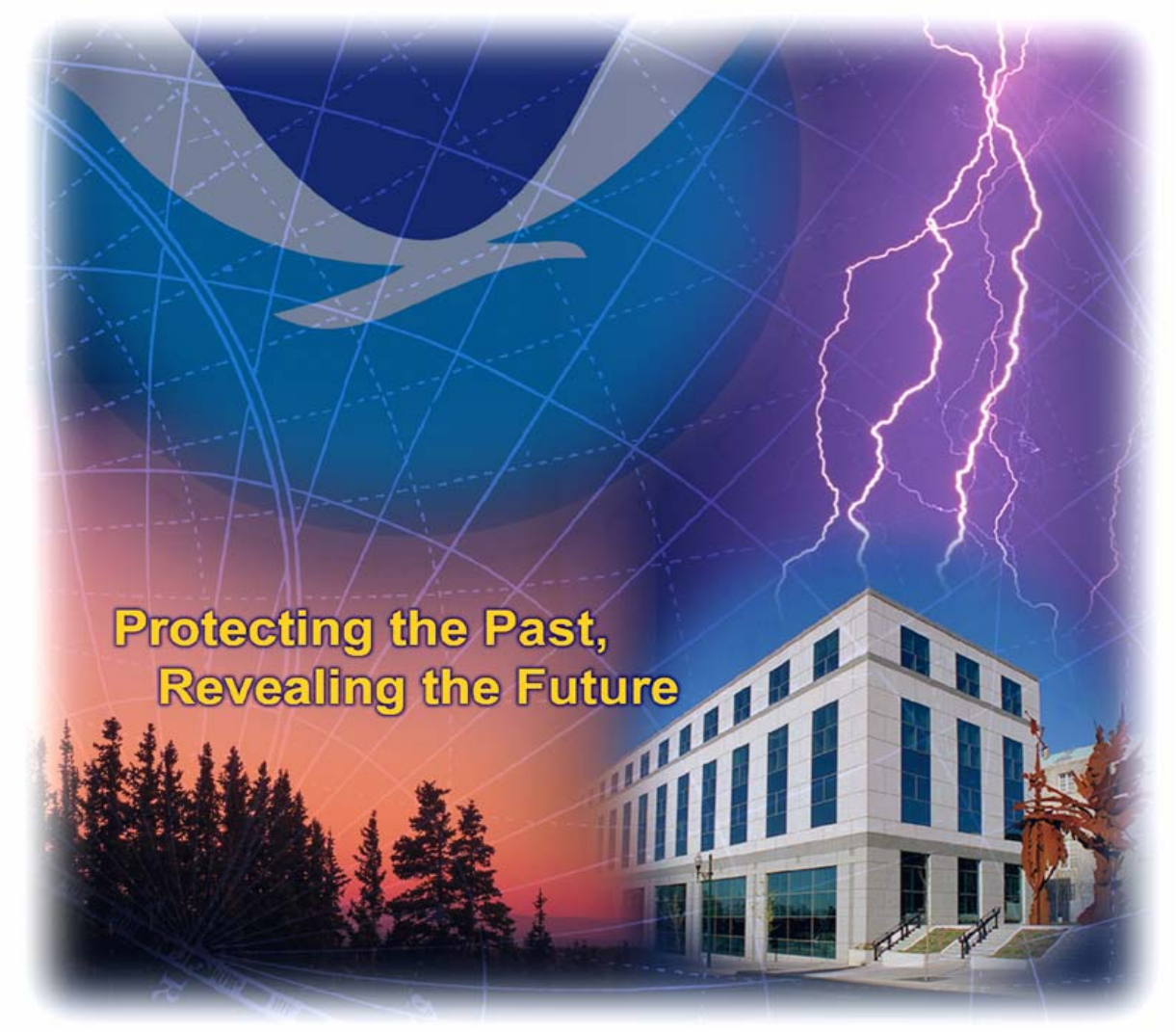
U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration (NOAA)
National Environmental Satellite, Data, and Information Services (NESDIS)

New Priorities for the 21st Century



National Climatic Data Center (NCDC) Strategic Plan

Updated for FY 2005 - FY 2011

July 27, 2005

Foreword from the Director

NOAA's Strategic Plan provides a broad vision for our Agency. It is the responsibility of our Center to capture that vision in relation to the Center's ability to contribute to the NOAA vision. I am proud to present the NCDC Strategic Plan that brings into focus the outcomes and objectives that are fundamental to NOAA's mission and service to our Nation.

When properly conceived, the strategic plan provides a shared vision and shapes executable strategies. The true value of a strategic plan is realized when people develop and execute the operating plan in support of the strategic plan. The operating plan identifies specific pathways to deliver the strategic goal outcomes. Both the strategic and operating plans must be realistic. This requires responsiveness to changing internal and external environments. Our ability to execute our strategic plan is dependent on a well conceived operating plan grounded in facts and reality. Issues that contribute to or impede our success are best identified through exchanges of diverse ideas among all of our Data Center's employees. The appendix to this NCDC Strategic Plan represents specific activities that require the development of operating plans and the subsequent execution of those plans.

It is my responsibility and the job of the NCDC leadership to provide the organization with the requisite resources to successfully execute the operating plan.

I look forward to everyone providing input that maintains a relevant NCDC Strategic Plan and your individual contributions in support of defining and executing our associated operating plan.

Thomas R. Karl, L.H.D.
Director
National Climatic Data Center

Priorities for the 21st Century

A Strategic Plan for NOAA/NESDIS

National Climatic Data Center (NCDC)
FY 2005 – FY 2011

NCDC VISION

To be the most comprehensive and accessible source of quality climate and weather related data and information services and to be an objective authority on climate monitoring.

NCDC Mission

To provide stewardship and access to the Nation's resource of global climate and weather related data and information, and assess and monitor climate variation and change.

NCDC CORE VALUES

People, Integrity, Quality, Objectivity, Initiative, Innovative, Scientific Stewardship, Service

The NCDC supports the NOAA/NESDIS Core Values, but has added others values also encouraged and promoted at the NCDC.

NCDC BENEFITS to the NATION

All sectors of the U. S. economy and the environment are either directly or indirectly climate or weather sensitive. The NCDC provides quality climate and weather data, information, and decision support products and services that: a) improve business, government, and personal decisions related to planning, operations, and assessments, b) support research leading to improved weather and climate forecast models, and c) provides information on the varying and changing states of the national and global climate.

NCDC MISSION GOALS

GOAL 1. PROVIDE RAPID AND CONVENIENT ACCESS TO QUALITY DATA, SCIENTIFIC INFORMATION, AND PRODUCTS.

The information technology revolution is changing the expectations and demands that customers have for access, visualization, and use of observations, data, information, products, and services. Customers are now able to transfer and process vast quantities of data and expect easy and efficient web-based browse, search, access, retrieval, and visual display capabilities and applications via the worldwide web and broadband Internet.

Entrepreneurs and researchers focusing on the economic and scientific value of information and intellectual property are finding numerous novel and innovative applications for NOAA data and information. This in turn is driving the NOAA Data Centers to provide more rapid access, as well as more timely and improved quality assurance and quality control of these data. The objective NOAA "quality assurance" stamp is critical to private industry and decision makers. They require confidence in the data when considering short and near term capital investments and annual business plans, as well as crafting long term business and environmental strategies and policies.

Implementation of current and evolving E-Commerce and E-Business techniques, such as Computer Telephony Integration (CTI) capabilities, together with large scale storage servicing systems and geographic information systems (GIS), will provide direct, immediate, and convenient access to the data and information under the stewardship of the NOAA National Data Centers (NNDC). The Comprehensive Large Array Storage System (CLASS) program and the NESDIS Data Centers PAC Plan are critical contributors to achieving a sustainable and modern Information Technology (IT) architecture.

Goal 1 OUTCOMES

- E-commerce/E-Business is available for all customer requests.
- Minimize the time between customer requests and delivery of data, information, products, and services.
- Minimize the time between NCDC receiving data, information, and products and availability to our customers.
- Minimize the time between measurement made in the field and received at NCDC.

GOAL 2. PROVIDE THE HIGHEST FEASIBLE DATA QUALITY AND INFORMATION.

Effective utilization of climate and weather related data and information requires the ability to scientifically manage the quality and fidelity of the Nation's climate records. Until recently, it has been difficult to meet the challenge of capitalizing on the full potential value and use of information and knowledge derived from new measurements and the historical climate data records. Effective scientific data stewardship requires considerable knowledge about the data we archive and distribute. Attributes of an effective scientific data stewardship program include:

1) Data that are improved through iterative analysis, application, and evaluation;
2) Data whose measurements are well understood and described; and
3) Data that are made readily accessible with new technologies and innovative structures.

The NOAA Scientific Stewardship Program provides an approach to the challenges of maximizing the performance, quality, and utility of climate observing systems, data, and information. Four fundamental principles provide the framework for scientific data stewardship:

1) Ensure observing system quality during the design phase and real time monitoring of performance;
2) Develop an end-to-end climate processing system that includes the timely ingest, quality control processing, effective access to new and long-term records, and the long-term safeguarding of the climate records for future generations;
3) Adequate Information Technology (IT) Support including data security; and
4) Evaluation of past and present observations and anticipation of new observing technologies and related observations.

Application of the scientific data stewardship principles will ensure the "scientific quality, integrity, and long term utility" of climate records for a broad range of users. This will be accomplished through network monitoring, improving quality, and the extraction (data mining) and blending of new observations and the historical records.

Goal 2 OUTCOMES

- Improved confidence in the quality and integrity of climate records.
- Increased short and long term value, as well as utility of observations and data.

GOAL 3. OBSERVE AND MONITOR CLIMATE

Since the President's climate statement of June 2001, climate issues have held a particularly high profile, as highlighted in the Climate Change Research Initiative (CCRI), which focuses on reducing uncertainty in our understanding of climate change. The Department of Commerce took the lead in developing the larger U. S. Climate Change Science Program (CCSP) Strategic Plan.

NOAA has a long history of leadership providing climate assessments and predictions focused on regional, national, and global scales, spanning time scales from a week to seasons, and extending to decades and centuries. Assessments that enhance understanding and convey knowledge of the current state of the climate are critical to understanding the climate system, and are provided on a regular basis for monthly, seasonal, and annual reporting periods. Examples include participation in the Intergovernmental Panel on Climate Change (IPCC) Assessments (e.g., Vertical Temperature Trends (VTT) and Climate Extremes), the U.S. National Assessment of Climate Change Impacts on the U.S., and the Arctic Climate Impact Assessment Report.

Supporting activities include:

1) Design, deployment, and life cycle management of the Nation's first surface climate quality observing network (USCRN);
2) Release of monthly and annual State of the Climate Reports for the U.S. and the North American Drought Monitoring Reports, a collaborative effort between Canada, Mexico, and the U. S.;
3) Real time Health of the Network Performance Monitoring;
4) Responding to U.S. Climate Change Science Program (CCSP) Strategic Plan;
5) NOAA's Integrated Observing Systems and Data Management Plan;
6) U. S. Integrated Earth Observation System (USEOS); and
7) Global Earth Observation System of Systems (GEOSS).

The NCDC is leading new endeavors to improve knowledge and understanding of the climate system. Using state of the art model reanalysis and the development of a climate and weather model inter-comparison (MIP) capability will contribute to reducing the uncertainty in climate simulations and promote improvements to numerical weather prediction models, as well as reduce errors in the observational records. Also emerging is the capability to perform data *mining* and *blending* of specific land, ocean, and terrestrial variables from hyper-spectral satellites, NEXRAD, and in-situ observing systems in near real time, as well as from the historical records. These activities will produce a new series of climate data records and assessments leading to improved understanding of climate. These data will support scientific research into the nature of past, present, and possible future climate variability and change.

Extracting the full potential value from the Nation's and the global observing assets, including past proxy (paleoclimate) data, will lead to new insights and understanding of climate variation and change. The benefit to the public will be increased confidence derived from enhanced understanding and knowledge that is conveyed through new products and services. This provides a stronger foundation of support for decision makers and planners in business and government when developing economic and environmental policies and plans. The involvement of the research community, particularly regarding analysis and assessments, is essential and will lead to increased knowledge and understanding of climate variation and change for the benefit of current and future generations of society and the environment.

Goal 3 OUTCOMES

- Monitor in near real time climate change, including extremes.
- Lead the Nation by providing policy makers with objective decision support assessments consistent with the CCSP.
- Improved capability and capacity to data mine and blend real time and historical data.

Appendix

Significant NCDC Pursuits for FY 2005 to FY 2011

Scientific Data Stewardship (SDS)
SDS is the new paradigm in observation data management consisting of an integrated suite of functions to preserve and exploit the full scientific value of NOAA's environmental data. The two primary functions are: 1) the careful monitoring of observing system performance for long-term applications, and 2) the generation of authoritative long-term records. Full implementation of the Scientific Data Stewardship suite of activities provides a basis for informed decisions by policy makers, climate researchers, and those in the energy sector, agriculture, water resources, health, and engineering. The end objective is to maximize the potential utility of NOAA observations and provide a high degree of confidence in quality, integrity, and fidelity of the climate data records. Successful implementation of stewardship will ensure maximum use of NOAA's environmental data, now and in the future.

Web-based Dynamic Next Generation NORMALS
Users from a number of economic sectors have petitioned NOAA to develop a new generation of optimal climate normals that can support their respective business needs that require projections on the order of several weeks, months, and years into the future. Industry leaders, such as the American Engineering Society and the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) and the Weather Risk Management Association (WRMA) have indicated that climate variability and customer demands are to the point where the typical 30-year climate normals can no longer adequately support the rapid changes associated with today's national and international business environments. For example, ASHRAE notes that design specifications based on traditional normals were exceeded with alarming frequency during the 1990s and the WRMA use of degree day normals were tied to over $12 billion in contracts in 2002.

Implementing a new operational process will provide a more comprehensive generation of dynamically built web-based optimal climate normals easily accessible on a variety of time scales and updated on a regular basis using the most current data. These will be available on-demand through direct web access in spatial grids for metropolitan areas, climate divisions, and geographic regions. Next Generation Climate Normals will make use of past and present climate, as well as future climate scenarios to provide users with a set of probabilistic information related to means, variability, and extremes for a given location, variable, and specific period of time in the future. The robust web access and servicing system will give the user the flexibility to produce information that is application-specific, greatly facilitating the development and use of a wider variety of new normals to support U. S. businesses. These normals will support users in their plans and actions designed to minimize the impacts of unanticipated adverse climate conditions and maximize the benefits of anticipated climate conditions. Applications include energy and water resources management, agriculture, construction, industry and commerce, transportation, and research, as well as government uses, such as forecast verification done by the NOAA.

Coastal and Adjacent Terrestrial Climatologies of the U. S.
A suite of regionally-oriented spatial and temporal coastal climatologies will provide an improved perspective on the dynamic nature of terrestrial, oceanic, and atmospheric coastal environments. Web accessed tools will enable coastal managers and users (particularly state and local governments and coastal regional associations) to mitigate the effects of climate variability and change on resources and development (including environmental, economic, ecosystem health, human health, and safety issues). These products will capture and communicate the complexity of coastal zone climatic processes in user-based terms. The CWISE Cooperative Agreement established a partnership between NCDC, CSC (NOS), and North Carolina State University (NCSU) that will contribute to developing coastal climatologies.

Ingesting, Processing, Archiving, and Access 24/7/365 Continuous Operations
Information technologies (IT) will be in place to accommodate the ingest, processing, access, and archive of large volumes of new data and information that will begin arriving within the next several years from new in-situ and remote observing systems. NCDC must be able to provide 24/7/365 operational support to ingest, process, and provide on demand access to new and historical data in real time. While it is anticipated that technology will somewhat reduce the impact of the large growth in volume, there will be increased requirements to manage the data. The Comprehensive Large-Array Stewardship System (CLASS) initiative will provide much of the Information Technology (IT) infrastructure to support Access, Archiving, and Assessments (AAA). Additional high performance computing (HPC) will be required for processing and reprocessing data. Scientists will be required to provide the appropriate stewardship for these important data.

Petabytes of all new and historical in-situ and large portions of select current and recent satellite and radar data will be directly available on-line for retrieval by customers. Next Generation Normals, Coastal Climatologies, Climate Data Records (CDRs), and other products will be routinely produced and available. Large portions of the historical archive will be reprocessed on an annual or otherwise determined basis. Data mining and blending performed as new data arrives with historical data will be routine and available to NOAA users.

Visualization and data mining tools will be operational and continuously improved. Data mining tools will browse radar data archives to reveal, analyze, and extract unique unknown continuous variables in the data that may lead to identification of specific weather events or phenomena. The improved capabilities include: faster volume coverage pattern and more scans per volume coverage pattern; increased resolution from 1.0 km reflectivity data to 0.25 km reflectivity data; increased azimuthal sampling from 1.0 degree to 0.5 degree; and implementation of dual polarization. The benefits of these new capabilities include: faster detection of severe weather; better detection of severe weather at longer ranges; improved precipitation amount estimation; improved estimation of rain and snow rates; discrimination of hail from rain and possibly gauging hail size; identification of precipitation type in winter storms; identification of electrically active storms; and identification of aircraft icing conditions.

Integrating Observing Systems (IOS) - NOAA, National, and Global

In order to maximize the potential value and benefit of observations and observing systems, there is the need to integrate the planning, implementation, and life cycle support for existing and future observations and observing systems. To this end, corporate NOAA has established the NOAA Observing Systems Council (NOSC) and in collaboration with the NOAA Ocean Council (NOC) is working to define issues and procedures for corporate NOAA to adopt as "best business practices." Integrating NOAA observing systems is a high level concern of the NOAA Corporate Board that encompasses an end-to-end data stewardship concept that starts with a measurement through the entire data management pathway to include NOAA products and services. The priority of NOAA Integrating Observing Systems (IOS) initiative is to focus on NOAA funded and operated surface observing systems, identifying opportunities for consolidation/efficiency and minimizing current observing overlaps and gaps.

NCDC is directly involved in developing a NOAA Integrated Observing System Implementation Plan that not only addresses common core integration issues across all NOAA observing systems but also identifies short term deliverables associated with Integrating Surface (NOAA) Observing Systems (ISOS) directly related to USCRN, COOP Modernization, and mid life cycle upgrades to the ASOS. Internationally and globally, the U. S. GCOS Implementation Plan has identified the upgrade and/or installation of stations for the Global Surface (GSN) and Upper Air (GUAN) Networks. The GCOS activities also include a NOAA Pacific Island Region Data Management Plan Report to Congress. NCDC is the lead on writing the NOAA Integrated Data Management Plan and the IEOS Data Management Plan.

Considerable work has been done regarding the integration of ocean observations as evidenced by the Integrated Ocean Observing System (IOOS) and the associated Data Management and Communications (DMAC) plans and recent legislation, such as HR 5001 – Ocean and Coastal Observations Systems Act of 2004. Requirements meetings have been scheduled for the Integrated Upper Air Observing System (IUOS). The NOSC has published the *Strategic Directions for NOAA's Integrated Global Environmental Observations and Data Management*, July 2004 (http://www.nosc.noaa.gov/). Two other key documents are: Group on Global Earth Observations, *Global Earth Observing System of Systems 10-Year Implementation Plan* (http://earthobservations.org) and the U.S. Group on Earth Observations, *Strategic Plan for the U.S. Integrated Earth Observation System* (http://iwgeo.ssc.nasa.gov/default.asp).

NCDC is contributing toward meeting the goals of the July 31, 2003 Global Earth Observation (GEO) Summit Declaration and subsequent meetings. Under the White House Office of Science and Technology Policy (OSTP) Committee on Environment & Natural Resources (CENR), the Interagency Working Group on Earth Observation (IWGEO) Planning and Integration subgroup formed and tasked the Data Management team to develop an information management infrastructure that will support decision-making that fulfills the societal benefits identified in the Interagency Working Group on Earth Observation (IWGEO) *Strategic Plan for the U.S. Integrated Earth Observation System (IEOS).* A modern, integrated information infrastructure will greatly increase the societal impact of US federal and state investments in Earth observing systems. The IEOS Data Management team is Co-chaired by NOAA/NCDC personnel.

Integrated Data Processing and Data Management from a NOAA, National, and Global Network of Networks

Continue enhancement to the Integrated Data Processing (IDP) set of operations provides a common set of quality control procedures to all designated observed variables regardless of the observing system, NOAA, other federal and state systems (mesonets), and global earth observing systems (GEOS). This new approach produces more uniform, comprehensive data sets that have a wider range of applications and improves the confidence level of the QC processed data (along with the associated metadata). Integrated data processing system will produce Integrated Datasets (IDs) organized as comprehensive and universal variable based archive structures as opposed to observing network centric (stove pipe organized) with metadata tags identifying the observing system and the essential station history information. To date, the emphasis has been on prototyping and developing U. S. hourly data and several daily variables. The techniques will continue to be expanded to integrate additional data sources and networks, along with more daily and monthly variables. Integrated Datasets (IDs) offer the advantages of a single "platform" for data processing, quality control, on-line access, and application development.

Near real time monitoring of Climate Extremes across North and Central America:

NCDC will continue to expand the routine operational delivery of U. S. specific, North and Central American Climate Extremes Indices (CEI) beyond the current FY 2004 development activities, which include routine information on status and trends for weather and climate events that lead to loss of life and economic hardship (e.g., billion dollar disasters). CEIs will include heavy rainfall and floods, droughts, heat waves, snowstorm, blizzards, ice storms, tornadoes, hurricanes, intense precipitation and high wind events, and severe local storms.

National Integrated Drought Information System (NIDIS)

NCDC will oversee implementation of a Federal and non-Federal partnership for drought preparedness, mitigation, relief and recovery efforts for economic stability throughout the Nation employing a user-friendly web accessible system to serve policy and decision makes at all levels (local, state, regional and national). A coordinated research, monitoring and operational dissemination and access system for advanced modeling and forecasts of local and regional drought extent are achieved using models developed within the Earth System Modeling Framework (ESMF). Space and surface-based observations are from NASA's Hydros missions including MODIS Surface Resistance and Evapotranspiration (ET) parameters, and the Community Land Model (CLM) for coupling atmospheric numerical models to study land-atmosphere interactions of energy, moisture, momentum fluxes, the hydrologic cycle, and soil temperatures. NCDC scientists will continue to provide scientific leadership in assessments of the climate and were authors on the recently released Arctic Climate Impacts Assessment and are currently leading assessment efforts for the U.S. Climate Change Science Program (CCSP) and the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

NOAA/National Operational Model Archive and Distribution (NOMADS)

NOMADS has been developed as a ▪*Unified Climate and Weather Archive*• that provides web access to information on time scales from days (weather), to months (El Nino), to decades (global warming). Users make decisions about their specific research, operational, and educational needs. In response to the growing need for remote access to high volume numerical

weather prediction and global climate models and data, the National Climatic Data Center (NCDC), along with the National Centers for Environmental Prediction (NCEP), the Geophysical Fluid Dynamics Laboratory (GFDL), and NASA initiated the NOMADS project. NOMADS addresses model data access needs as outlined in the U.S. Weather Research Program (USWRP) *Implementation Plan for Research in Quantitative Precipitation Forecasting and Data Assimilation* to "redeem practical value of research findings and facilitate their transfer into operations." The NOMADS framework was also developed to facilitate model and observational data inter-comparison issues as discussed in documents such as the Intergovernmental Panel on Climate Change (IPCC 1990, 1995, 2001) and the U.S. National Assessment (2000).

NOMADS is a highly-collaborative, grass-roots network of data servers using established and emerging technologies to access and integrate model and other data stored in geographically distributed repositories in heterogeneous formats. NOMADS enables the sharing and inter-comparing of model results and is a major collaborative effort, spanning multiple government agencies and academic institutions. The data available under the NOMADS framework include model input and Numerical Weather Prediction (NWP) model input and output from NCEP; and Global Climate Models (GCM) and simulations from GFDL and other leading institutions from around the world.

The short-term goals of NOMADS will improve access to NWP and GCM's, improve the linkages between the research and operational modeling communities, foster collaborations between and among both the climate and weather communities, and provide the observational data and model analysis initialization products for regional models; and for verification of forecast and climate models. The long-term goal is to promote product development and collaborations within the geoscience communities (ocean, weather, and climate) to study multiple earth systems using collections of distributed data under sustainable system architectures.

International Polar Year (IPY) 2007-2008

The Climate Program will be supporting several Arctic Initiatives as part of the IPY. The NCDC will be directly involved with the Alaskan Climate Reference Network (AK CRN) and the Alaskan Coastal Climatology, specifically near shore wind/wave hind-cast modeling. Climate variability and change, and increases in UV radiation have become important issues in the Arctic region over the past few decades. The results of scientific research and the resultant knowledge have documented climatic changes are more pronounced in the Arctic region than in other regions of the world. Observations indicate that the Arctic physical and biological environments have been changing. The International Polar Year (IPY), 2007-2008, (http://www.ipy.org/) is a global focus on the high latitude regions to analyze past and present observations and studies to determine the extent these changes represent natural variability over years and decades and the influences associated with human activities. The first International Polar Year was 1882-83.