

EARTH SYSTEM MONITOR

Frozen soils and the climate system

New study addresses freeze-thaw cycle knowledge gaps

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While glacier recession, trends in snow cover, sea ice extent, and sea level are typical climate change markers, the role of frozen soils within the climate system has yet to be well-defined. To help remedy this situation, NOAA Climate and Global Change Program administrators recently funded Tingjun Zhang, research associate at the National Snow and Ice Data Center, Cooperative Institute for Research in the Environmental Sciences, and his colleague, Richard Armstrong, for an investigation into the seasonal freeze-thaw cycles of soils in the GEWEX (Global Energy and Water Cycle Experiment) Continental-Scale International Project study regions, centered on the Mississippi River Basin.

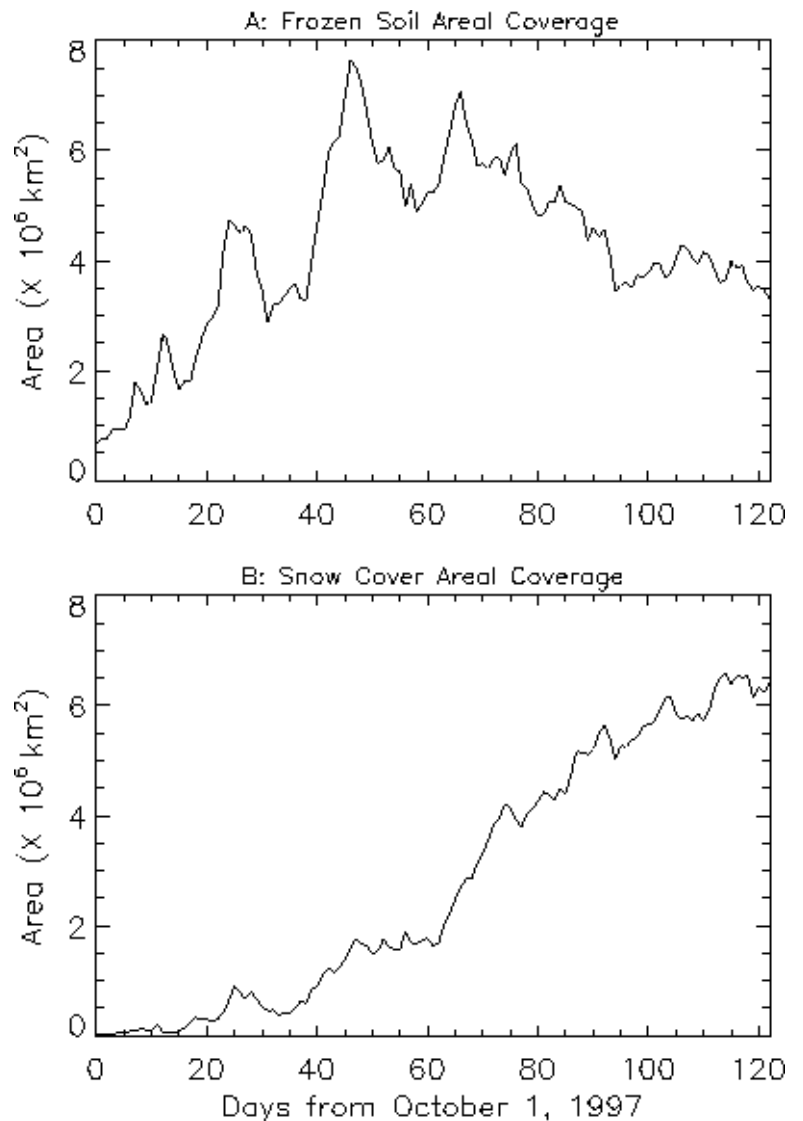
"Research on the effects of frozen soil indicates that it has a significant influence on land surface and overlying atmospheric processes," Zhang says. "The timing, duration, thickness and distribution of frozen soils are primarily controlled by heat exchange between the atmosphere and land surface. Changes in any of these events are good indicators of climate change."

According to Zhang, 55 percent to 60 percent of the exposed land surface in the Northern Hemisphere freezes and thaws seasonally, with

tremendous impact to ecosystem diversity and productivity. Freezing and thawing cause changes in soil structure, affect land surface and subsurface hydrology, and nutrient supplies.

"Even a thin frozen layer can essentially halt the moisture exchange between the atmosphere

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▲ **Figure 1.** Extent of frozen soils (A) and snow cover (B) over the GCIP regions from October 1, 1997 through January 31, 1998. Frozen soil area (A) over snow-free land increased rapidly in the early winter, reached its maximum in mid-November, then declined due to the increase in snow-covered area. Zhang and Armstrong will determine soil freeze-thaw status under snow cover using remote sensing techniques and numerical modeling.

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and soils," Zhang says. Frozen soil possesses a large apparent heat capacity, consuming or releasing about 80 times the amount of energy in freezing or thawing than is consumed or released by water during heating and cooling.

Additionally, soil freeze and thaw processes can impact physical degradation of organic substances and migratory patterns and physiology of soil biota. Greenhouse gas exchange between the atmosphere and land surface may be minimal when soil is frozen, but can increase following spring thaw in a dramatic release noted in research as "respiratory burst" (Skogland, Lomeland and Goksoyr, 1988).

Unless snow cover is thin, its overall effect is to insulate soil and keep soil water from freezing. Over the past 20 years, snow area extent has decreased in the Northern Hemisphere, leaving more ground exposed to the cooling effects of air temperatures. However, at the same time air temperatures have increased nearly 1 degree Centigrade over the same region. A key question for the researchers will be the response of seasonally frozen soils to these climate changes.

After an analysis of field measurements taken from sources such as the University of Minnesota, the National Water and Climate Center Natural Re-

sources Conservation Center, and the NSF Niwot Ridge Long Term Ecological Research Program operated by the University of Colorado, the researchers will expand their study to regional scales. Using passive microwave data available from the NSIDC, they expect to improve and validate a remote-sensing algorithm that will detect surface soil freeze-thaw status over snow-free land surfaces. A validated numerical model will be employed to predict soil freeze-thaw status and freeze-depth under seasonal snow cover.

Ultimately, Zhang and Armstrong will characterize the climatology — timing, duration, thickness and areal extent — of seasonally frozen soils over the entire GCIP region from 1978 forward. The data set generated will be archived at the NSIDC and made available to researchers.

NSIDC is affiliated with the National Geophysical Data Center. Visit <http://nsidc.org/> for data or information.

Reference

- Skogland, T.S., Lomeland, and J. Goksoyr.
1988. Respiratory burst after freezing and thawing of soil: experiments with soil bacteria. *Soil Biol. Biochem.* 20:851-856. ■

EARTH SYSTEM MONITOR

The *Earth System Monitor* (ISSN 1068-2678) is published quarterly by the NOAA Environmental Information Services office. Past issues are available online at <http://www.nodc.noaa.gov/General/NODCPubs/>

Questions, comments, or suggestions for articles, as well as requests for subscriptions and changes of address, should be directed to the Editor, Roger Torstenson.

The mailing address for the *Earth System Monitor* is:

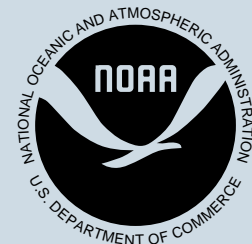
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Atmospheric Administration
D. James Baker,
Under Secretary and Administrator

Solar activity makes nightly news

Spectacular images of a major coronal mass ejection from the Sun's surface were reported by all the major news media during the first week of June, which resulted in greatly increased customer requests and inquiries at the National Geophysical Data Center. A magnetically complex region at the center of the Sun's disk exploded with several of the highest level X-ray events, spewing out solar protons and a billion tons of charged particles towards Earth. The X-rays caused scattered radio blackouts. The protons caused a Polar Cap Absorption event. The geomagnetic field was at severe storm levels for about 10 hours. GOES-8 moved into the solar wind for about one hour due to the increased magnetosphere compression.

NSIDC's "Glacier Story" receives award

Nationally syndicated columnist Barbara Feldman awarded five stars recently to The Glacier Story, a web site created by the National Snow and Ice Data Center's (NSIDC) communications group. Feldman's weekly column, *Surfing the Net with Kids*, is distributed internationally by The Los Angeles Times Syndicate and devoted to What's Wonderful on the Net for family entertainment and education. Feldman's column can be accessed at www.surfnetkids.com/. The Glacier Story leads users through a nine-page tour in the life of a glacier. NSIDC's graphic artist, Laura Cheshire, selected rare historic photos archived by the World Data Center for Glaciology at NSIDC to illustrate concepts such as glacier formation, growth, movement, and decline. The Glacier Story is part of a larger web site, All About Glaciers, found at <http://nsidc.org/glaciers/>.

Hourly precipitation project

The analysis phase of the project funded by the Office of Global Project to determine the variation in the frequency, duration, and intensity of precipitation in the U.S. is underway. This phase consists of establishing boundaries for regions based on the precipitation regions defined by a former member of the Climate Archaeology and Analysis Branch for the U.S. in the paper entitled, "The Use of L-Moments in the Determination of Regional Precipitation Climate."

News briefs

The statistics developed from the rehabilitated Hourly Precipitation Data database, developed in phase 1, are used to develop "pooled" regional precipitation statistics data bases for each of the 12 pre-defined precipitation statistics. These data bases will be sequentially complete with the period of record varying in length from region to region, but will probably be at least 30 years in length. Statistical tests for normality and simple linear regressions will be performed, and time series plots will be generated. Analyses of the statistics, slope and residual parameters, and the time series plots will be performed to identify trends in the parameters over both space and time. Results will be presented in a report or paper.

NOAA involved in paleoclimate modeling

On August 25-26, Dr. Mark Eakin, Chief of the Paleoclimatology Program at NGDC, participated in a meeting of the Project on Modeling Earth System History (PMESH) held at Penn State University. The National Science Foundation (NSF) funds several universities under PMESH and the NOAA Paleoclimatology Program is a cooperating member. The PMESH group discussed plans for upcoming paleoclimate model runs on Penn State's Cray and IBM supercomputers, and model-data comparisons to be made using data sets at the National Geophysical Data Center and elsewhere. The PMESH group also discussed the proposal for a Science and Technology Center, pending review at NSF.

Arctic climate change

A study led by investigators at the National Snow and Ice Data Center (NSIDC) demonstrates significant recent changes in Arctic environments. The findings that temperatures in the Arctic in the 20th century are the highest over the past 400 years are published in *Climatic Change* (vol. 46, pp 159-207.). Dr. Mark Serreze, NSIDC and the Cooperative Institute for Research in Environmental Sciences, University of Colorado, authored the study with Dr. T-J Zhang (NSIDC), Roger Barry, Director, NSIDC, and scientists at five other institutions.

NCDC hosts ESIP staff

In July, the National Climatic Data Center hosted representatives from the Federation of Earth Sciences Information Partners (ESIP). ESIP is a Federation model to facilitate the public availability of data from geographically-dispersed providers. The Federation facilitates collaboration among the various ESIP types and among scientists involved in related work inside as well as outside of the National Aeronautics and Space Administration (NASA). Successful Federation of ESIPs will prompt NASA to establish a permanent Federation to enable science interoperability and public dissemination of data. There are three types of ESIPs: NCDC is a Type 1 which handles the archiving and distribution of data (Type 2 create products; Type 3 develop practical applications).

NOAA Library photo site serves as prototype for new search engine

The NOAA Central Library was selected by the HPCC (High-Performance Computer Center) as the prototype site for use of the software package HTDig, short for Hyper-Text Dig, a web-crawling package that allows search of discrete websites or multiple websites. The integration of this package with the Photo Library is part of a general revision, upgrade, and relocation of the library that is adding both storage capacity and improved capabilities to the photo site. This work has been accomplished by a team led by Janet Ward of HPCC. HTDig will become the search engine for all NOAA Websites in the near future. It also shows great promise for use with sites, such as the library's WINDandSEA, that will allow key-word searching through all URLs associated with the WINDandSEA site.

An example of how valuable the NOAA Photo Library is to the nation is a recent request by CNN news. CNN contacted Gregory Hernandez of NOAA Public Affairs in early September to inquire about the availability of photos of the Galveston Hurricane of 1900, arguably the country's greatest natural disaster, for a centennial feature. CNN was assured that the photos were in the public domain and were available. CNN used them in a historic photo gallery documenting the effects of the storm, and also linked to the NOAA Library history site for the official report on the Galveston Hurricane; the feature story is at: <http://www.cnn.com/SPECIALS/2000/galveston/>.

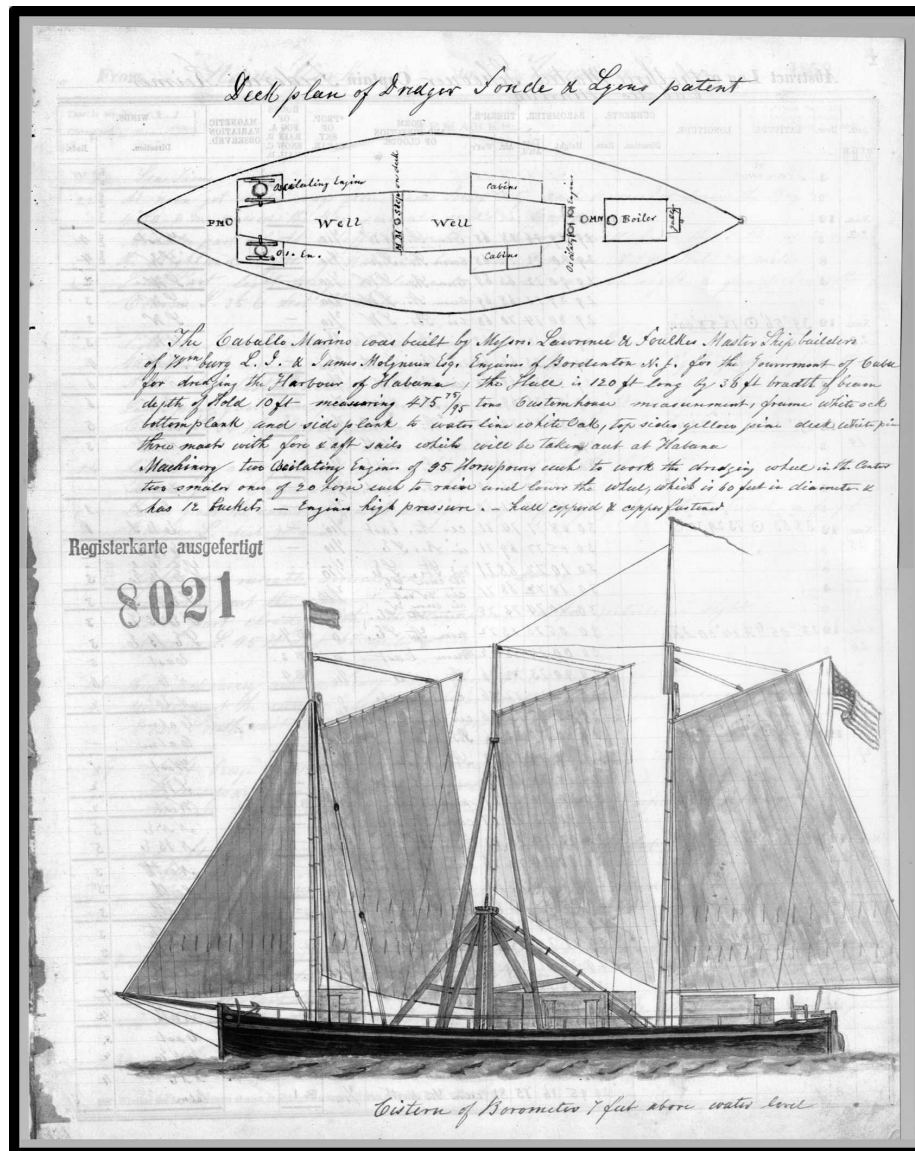
Scientific vision, a passion for observation, and the impetus for change

Germany loans Maury logs to the National Climatic Data Center

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NOAA/NESDIS

"... every fresh fact that is revealed.....is a clue leading from the very chambers of knowledge, which the discoverer leaves behind him to guide his followers. It is never lost.....for we may at pleasure take up the thread and commence where he ended..."

Matthew Fontaine Maury, University of Virginia, June, 1855



▲ Figure 1. Deck plan and description of the "Caballo Marino," an American-built dredger bought by the Cuban government; from the 1859 abstract log of her positioning voyage to Havana Harbor.

Science may be the matter-of-fact analysis of data from carefully made and recorded observations, but the data also hold evidence of the passion and drive that sustain large efforts. The evidence is found in the words and images left behind by those attempting to describe the rules by which the universe operates. The nineteenth century saw such an explorer, one with a vision of an international uniform system for oceanographic and meteorological observation. His vision drew countless others into the work — a global fleet of volunteer observers whose initiative and enthusiasm show in the details of records kept beyond the requested minimum (Figures 1 and 2).

Matthew Fontaine Maury, considered the world's first great oceanographer, was the first to solve the problem of making deep-sea soundings and the first to describe the winds, currents, and climate of the sea. As early as 1851, he actively advocated an international system of land-based weather observers

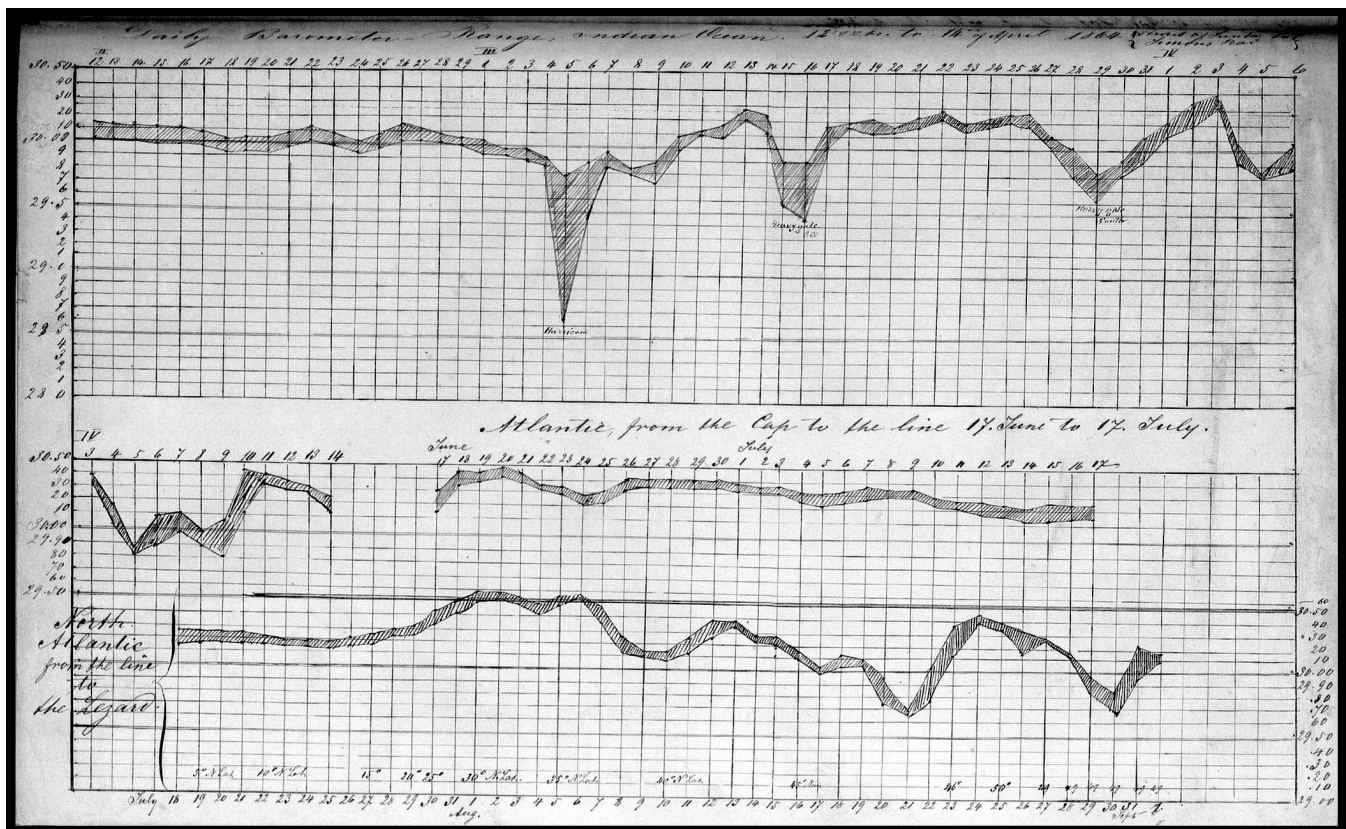
and lobbied for a telegraph-connected observing network in the U.S. He gave the Transatlantic Cable its stable position on the sea bed and transatlantic steamships the safety of east- and west-bound shipping lanes. It all happened because an accident left Lieutenant Maury, USN, with a broken leg and temporarily unfit for sea duty.

In 1842, the convalescent Maury was assigned to the post of Officer-in-Charge of the Depot of Charts and Instruments (later the U. S. Naval Observatory), where he found a number of old ship's logs. He had experienced the dangers of sea voyages and had traveled in areas where it was hard to find information on winds, currents, and storm frequencies. Maury had his staff survey the data stored at the Depot and published the results in the first chart for the North Atlantic in 1847. Wishing to publish additional charts and sailing directions, he set about persuading ship's commanders to continue providing data.

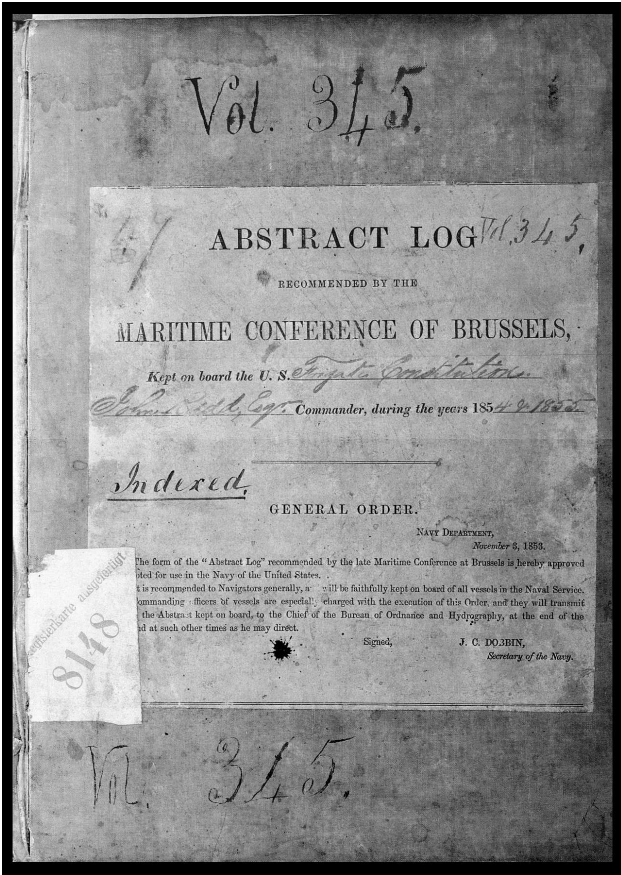
Science routinely serves public safety, commerce, and the military. Ships, their crews, and cargoes were commonly lost to an unpredictable sea in Maury's time, and the captain who could be the first to bring a cargo to port or a ship to battle was a priceless asset to the global fleet. When Maury supplied free wind and current charts to ship's captains, he requested that, in return for future free charts, the attached pre-formatted logs (Figure 3) be used to record additional observations. These logs were known as Abstract Logs and were kept explicitly for recording wind, current, and weather data from the world's oceans. The captains, having put Maury's charts and directions to the test, enthusiastically returned completed Abstract Logs to the U.S. Naval Observatory.

With the human, military, and commercial benefits providing an impetus for change and with the backing of the Secretary of the Navy, an inter-

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▲ Figure 2. Three graphs of daily barometer range, February through August, 1864, Indian and Atlantic oceans. Included is a March 5, 1864 typhoon in the Indian Ocean, not part of a log but likely from a Prussian ship.



▲ Figure 5. Abstract log of the US Frigate Constitution, 1854-1855. Naval Observatory volume #345; Deutscher Wetterdienst Registration # 8148.

Ship Climate meeting held in Southampton, England, in an effort to preserve the scientific data recorded in the deteriorating journals. There are comparatively few existing digitized data for the period covered in these logs (1845-1867). The U.S. holdings of Maury Logs are found in National Archive's Maury Collection. Those data have already been digitized, in cooperation with China's National Marine Data and Information Service of the State Oceanic Administration, for inclusion in the Comprehensive Ocean-Atmosphere Data Set (COADS) release due out later this year.

NCDC plans to inventory the German collection and create scanned images of the logbooks. It is hoped that sufficient resources will eventually be located to digitize the records for inclusion into COADS.

Today, international recognition takes forms similar to those offered to Maury in his lifetime: medals, ac-

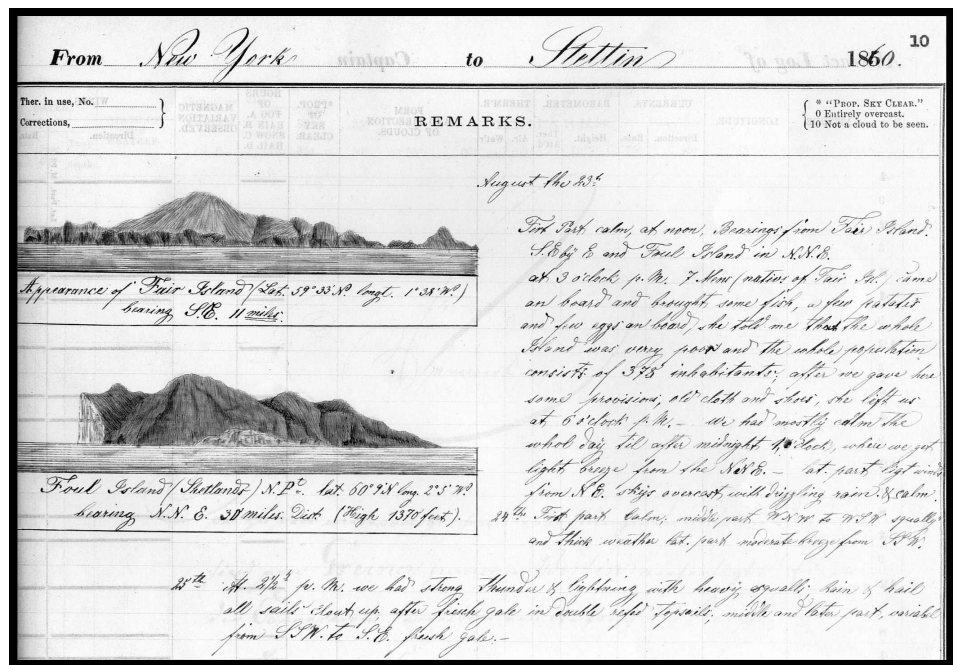
knowledge in books and articles, and a name preserved on buildings and collections. But evidence of the usefulness of the work may also be found in the grateful acknowledgment of those who benefit from the application of the science — a ship's captain whose life had been made easier or perhaps longer through the efforts of the scientist whose vision awakened the latent scientist in a generation of ocean-going observers (Figure 6):

"Lieu't Maury

Respected Sir your Nautical Monographs No. 1 wich you have kindly sent has been thankfully received.

Also an acknowledgement of my Log - I am glad that it is of some use to you - and I am now Constrained to acknowlege at this (late hour) the good effects the study of your works has had on me from time to time - Morally & Spiritually I have read with wonder & look up to him who holds the winds in his fists & the sea in the hollow of his hand."

Letter from Andrew Mearns, Captain of the British ship "Peerless", November 1860. ■



▲ Figure 6. Sketches of the navigational landmarks Fair and Foul Islands in the Shetlands from the abstract log of the Prussian brig "Elise."

Access to Harmful Algal Bloom data at NODC

Developing a system to support HAB research and resource management

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Over the last several decades, there has been a dramatic increase in the number of harmful algal events worldwide. The term "red tide" was formerly used to describe these events, since in the case of some dinoflagellates, an increase in numbers is such that they dominate the plankton community causing discoloration of the water. Since other toxic blooms may have no effect on water color, the term "harmful algal bloom" (HAB) is now used by the scientific community.

An increase in the number and extent of these events is not only a threat to the fisheries resources throughout the world, but also of great concern to human health. The impacts of HABs are both widespread and diverse, and are not exclusive to toxic species. They include: mortalities of fishes in both natural and aquacultural settings; human health hazards due to concentrated toxins within coastal waters, shellfish and higher trophic levels; alteration of marine habitats due to anoxia, shading, etc.; and economic costs due to the fouling of beaches as well as the direct effect on the seafood industry (Anderson *et al.* 1993; Anderson 1995).

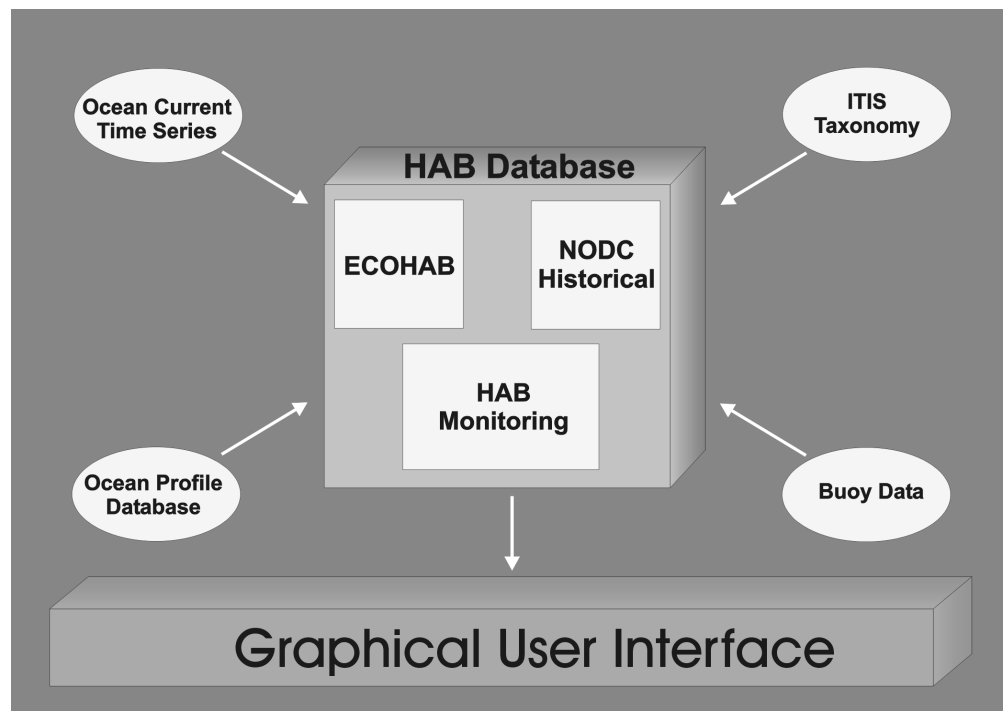
Although there has been a consensus by the research community that HAB events have increased in number, extent and severity in the last several decades, the reasons for this increase are not well understood. Possible explanations in-

clude: eutrophication of coastal environments due to human activities; a rise in aquaculture activities; climatic changes; increased nutrient loading into coastal and estuarine waters; introduction of toxic species via ship ballast water; as well as the extension of scientific regulation and monitoring to coastal waters which has led to increased observations of HABs (Boesch *et al.* 1997).

To attack the problems associated with HABs in the U.S., a workshop was held in 1993. Two primary objectives were to formulate a National Plan for prediction, control and mitigation of HAB effects on the biota in U.S. coastal waters and to promote the safe consumption of seafood (Anderson 1993). As a result of the vision of workshop

attendees and interagency efforts, the national, multi-agency sponsored research program to provide the scientific framework for understanding the Ecology and Oceanography of HABs (ECOHAB) was established. ECOHAB involves various government and academic institutions with a mission to develop an understanding of the population dynamics and trophic impacts of harmful algal species by investigating the fundamental physical, biological, chemical and oceanographic questions critical to scientifically based management of fisheries resources, public health, and ecosystem health (Anderson 1995).

There have also been increased efforts to establish regional monitoring programs to better understand the con-

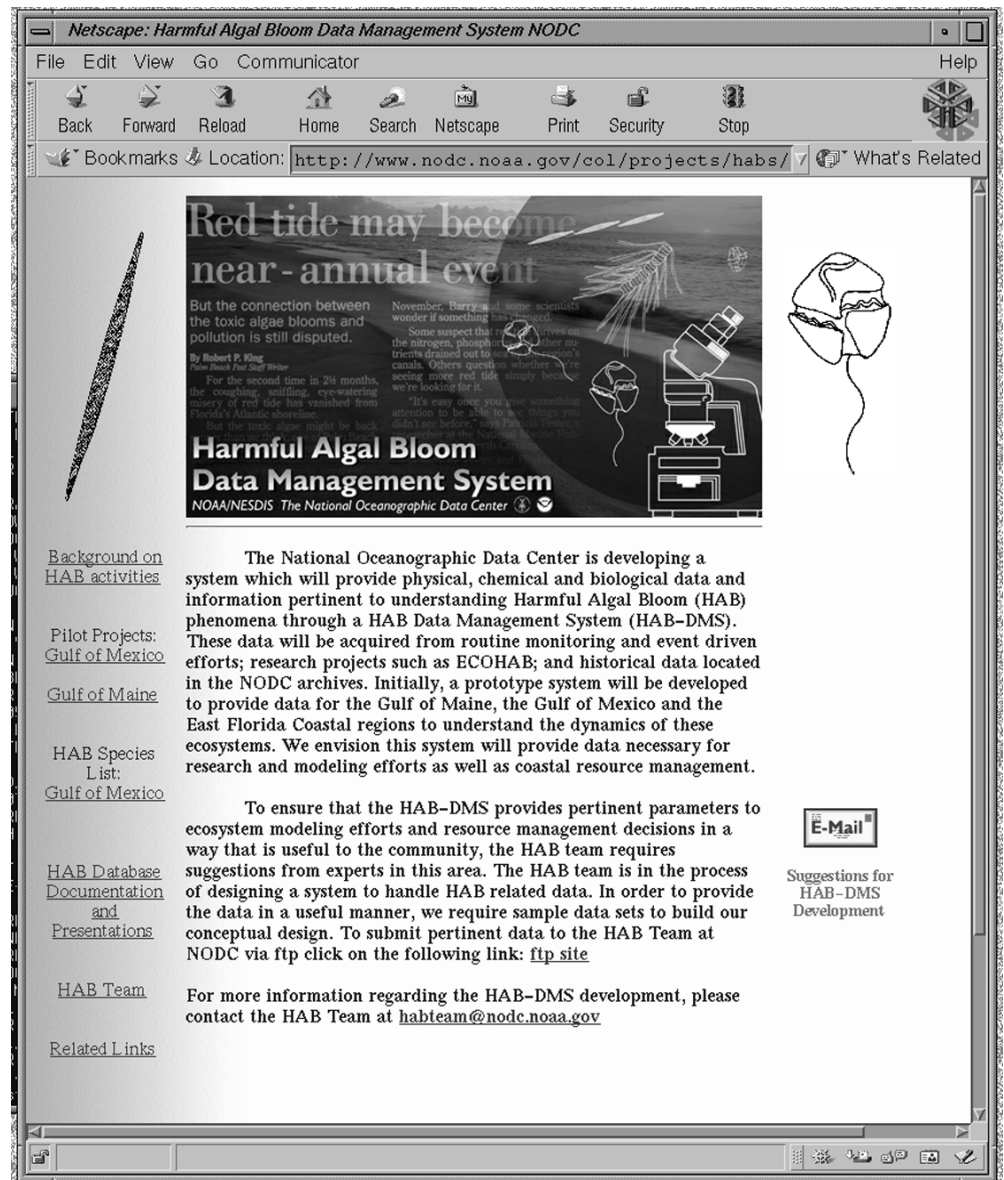


▲ **Figure 1.** Conceptual design of the HAB-DMS. Elements in yellow boxes represent data types which will be incorporated into a new HAB database at NODC. The yellow ovals represent additional sources of data that may be selected through a graphical user interface.

ditions that occur prior to, during and after a HAB event. For example, the National Ocean Service's Center for Coastal Monitoring and Assessment (CCMA) has funded monitoring efforts in the states of Maryland and Washington, for *Pfiesteria* monitoring in the Chesapeake Bay, and the Olympic Regional Algal Bloom (ORHAB) project, respectively. In association with these efforts, extensive data sets are being acquired to better understand the physical, chemical and biological conditions necessary for HAB events to occur in specific locations. In addition, physical and chemical measurements are being taken by other programs for non-HAB related purposes that would be important for understanding HAB phenomena.

Through funding provide by NOAA's Environmental Services Data and Information Management (ESDIM) program, the National Oceanographic Data Center (NODC) is developing a HAB Data Management System (HAB-DMS) to facilitate the integration of data acquired from research driven programs such as ECOHAB, routine monitoring programs, records of *in situ* measurements to support HAB research initiatives and resource management. The purpose of the system is to provide physical, chemical and biological data and information pertinent to understanding Harmful Algal Bloom (HAB) phenomena.

The HAB-DMS will provide a single interface to access physical, chemical, taxonomic and event data and information, in addition to HAB specific data sets (Figure 1). A prototype system is being developed in cooperation with ECOHAB, to provide data for understanding the mechanisms which cause HABs to occur within the Gulf of Mexico and Gulf of Maine regions. Data collected from the *Pfiesteria* monitoring efforts in Maryland, Delaware and Virginia will also be incorporated



▲ Figure 2. Opening page of the NODC Harmful Algal Bloom Data Management System website.

into the HAB-DMS. Once developed, this project will expand to incorporate data from all U.S. coastal regions where HABs occur. Physical, chemical, and biological data from many sources will be provided to support research and modeling efforts, as well as coastal resource management.

The HAB-DMS will provide an integrated system and ensure that HAB data collected at great cost to the nation is maintained in a permanent archive and

is easily accessible to the world's science community and other users. The structure of the developing database utilizes the database design from the Chesapeake Bay Program model for *Pfiesteria* monitoring, which was developed to incorporate water quality, biological and taxonomic data and information for the Chesapeake Bay (Figure 1). This HAB monitoring database design was modified to include

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New Continuous Plankton Recorder (CPR) survey data policy implemented

The Sir Alister Hardy Foundation (SAHFOS) maintains and update the unique Continuous Plankton Recorder database. Data are held in a relational database containing the plankton abundance data together with time, date and position of sample recorder over 60 years on more than 174,000 samples from the North Atlantic and North Sea. Data are extracted by area coordinates and species or taxonomic entities, creating a matrix of plankton abundance values.

SAHFOS's data policy is compliant with the developing data policy for the Global Ocean Observation System (GOOS). The data are freely available, provided that the recipient has signed a

Data Licence Agreement, available from the SAHFOS data manager.

Limited data are currently available on a number of samples in a given area via the SAHFOS web site. It is planned to allow more detailed data searches via the web in the future. Currently all data requests are dealt with by the data manager to ensure the integrity of the data. He may be contacted via e-mail at sahfos@wpo.nerc.ac.uk. The website is <http://www.npm.ac.uk/sahfos>.

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United Kingdom ■



Advanced Microwave Scanning Radiometer news from the National Snow and Ice Data Center

The Advanced Microwave Scanning Radiometer (AMSR) is a passive microwave instrument that will fly aboard the Advanced Earth Observing Satellite-II (ADEOS-II), scheduled to be launched by the National Space Agency of Japan (NASDA) in November, 2001. AMSR will measure geophysical parameters, primarily those related to water, for the investigation of global water and energy circulation.

The AMSR-Earth Observing System (AMSR-E) is a mission instrument modeled on the AMSR (described above). AMSR-E is scheduled to launch on NASA's Earth Observing System (EOS)

Aqua Satellite in May, 2001. The Aqua mission provides a multi-disciplinary study of the Earth's atmospheric, oceanic, cryospheric, and land processes and their relationship to global change. With six instruments aboard, the Aqua Satellite will travel in a polar, sun-synchronous orbit.

The AMSR and AMSR-E instruments are being developed by Mitsubishi Electric Corporation through a contract with NASDA. Although AMSR has two additional channels, the two instruments will measure the same parameters, including cloud properties, radiative energy

flux, precipitation, land surface wetness, sea surface temperatures, sea ice, snow cover, and sea surface wind fields.

The National Snow and Ice Data Center (NSIDC) will archive and distribute all AMSR-E products, including Levels 0, 1A, 2, and 3 data. Although NSIDC will archive Level 1A data from AMSR, contact information for user access to these data has not yet been determined.

This information is subject to change, as details of the Aqua and ADEOS-II missions are still being worked out. ■

Climatology for Sydney, Australia

The National Climatic Data Center (NCDC) has prepared a climatology summary for Sydney, Australia, site of the 2000 Summer Olympic Games this September. The report, NCDC Technical Report 2000-01, is online at the NCDC website. It includes 15 climatological tables for Sydney, taken from the International Station Meteorological Climate Summary CD-ROM. Statistics include a September mean maximum temperature of 68° F, a mean minimum temperature of 50° F, and an average precipitation for the month of 2.2 inches. In the past, NCDC prepared similar reports for Lillehammer, Norway and Nagano, Japan, sites of the 1994 and 1998 Winter Olympics.

Contact: NCDC

Drought website launched

The NOAA Paleoclimatology Program at the National Geophysical Data Center (NGDC) recently launched a new informative website entitled 'North American Drought: A Paleo Perspective.' This site is the second in the Paleo Perspectives series, following the one on Global Warming. 'North American Drought: A Paleo Perspective' explains how paleoclimatic data can provide information about past droughts and discusses the natural variability of drought over time scales of decades to millenia. It provides the reader with an evaluation of 20th century North American droughts, such as the 1930s Dust Bowl, in the context of hundreds to thousand of years, and provides insights on future droughts. The website can be visited at <http://www.ngdc.noaa.gov/paleo/drought>.

Contact: NGDC

Tornado and hail maps developed for new U.S. climate atlas

The National Climatic Data Center has created maps depicting tornado tracks and hail occurrences for the 1961-1990 period. The data were provided by the Air Force Combat Climatology Center (AFCCC) who compiled the data from the Storm Prediction Center database. ArcView was used to create maps showing tornado tracks by Fujita scale, decade, and season, and hail incidences by hail size, decade, and season. The maps will be part of the new U.S. Climate Atlas to be released on CD-ROM this fall.

Contact: NCDC

Data products and services

Bathymetry poster completed

The National Geophysical Data Center (NGDC) has announced the completion of a full-color poster measuring 28 by 64 inches depicting bathymetric contours of the Northern Gulf of Mexico and the Northern Bahamas. This new bathymetry was compiled with multibeam, survey, and trackline data from numerous government, academic, and industry sources as part of the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBBCA) regional ocean mapping project.

More information and an image of the poster can be viewed at <http://www.ngdc.noaa.gov/mgg/fliers/00mgg02.html>. NGDC is working with NOAA/NESDIS Public Affairs on a formal news release.

Contact: NGDC

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E-mail: help@esdim.noaa.gov
WWW: <http://www.esdim.noaa.gov/#data-products>

NOAA Central Library

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Fax: 301-713-4599

E-mail: reference@nodc.noaa.gov
WWW: <http://www.lib.noaa.gov/>

International weather data

The National Climatic Data Center is developing a database which lists the sources for climate data and product information available from the National Weather Service and other agencies around the world. This database is being developed for the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and will be made available through the World Wide Web (WWW). Nearly 100 international sources of weather data were contacted to obtain information on type of data, ordering information, etc. that will be part of the Global Weather Data Source database. Responses to the inquiry can be entered directly into a web-based form. The information will be available via the web in mid-2001.

Contact: NCDC

Mariana trench fly-through

The History Channel broadcast of "The World's Deepest Dive" includes an animation fly-through of the Mariana trench, starting above the northeast end of the trench, diving through the water surface to follow the trench to the deepest point at the Challenger Deep. The animation was computer-generated at the National Geophysical Data Center using a 2-minute grid developed from satellite altimetry and echosounding bathymetry by Walter Smith of the Satellite Altimetry Lab at NOAA and David Sandwell of the Scripps Institution of Oceanography.

Contact: NGDC

NCDC data used in child development research

The National Climatic Data Center, in support of a study made by the National Institute of Child Health and Human Development (NICHD), has provided climatic data for ten major cities across the United States. The seven-year study was accomplished by a research team who monitored the development of nearly 1400 children from birth to seven years of age. Part of the analysis involved an evaluation of how temperature and humidity affect children's behavior patterns. NCDC provided the necessary hourly measurements of temperature, relative humidity, and precipitation amounts to complete this part of the study.

Contact: NCDC

Harmful Algal Bloom, from page 9 data from HAB programs in all U.S. coastal areas and will manage data acquired through ECOHAB, HAB routine monitoring programs such as those funded through CCMA and historical biological data types archived at the NODC.

In addition to HAB data acquired by ECOHAB and CCMA supported research and monitoring programs, the HAB-DMS will allow access to physical and chemical data sets currently managed at the NODC through a web-based interface. Types of data include: current meter data; profile measurements collected from a variety of CTDs, bathythermographs, Nansen bottles and other instrumentation; air temperature and pressure, wind speed and direction, wind gust, sea surface temperature, wave height, wave period, and wave spectra from the NOAA marine environmental buoys; and taxonomic information for HAB species provided by the Integrated Taxonomic Information System located at: <http://www.itis.usda.gov/plantproj/itis/index.html> (yellow ovals in Figure 1).

Through the HAB-DMS, HAB related data from disparate sources will be integrated and provided via the WWW in a consistent format. This interface will allow a user to select HAB data based on spatial, temporal and parameter specific requirements, visualize the data results, and download the data to their local machine.

To follow the development of the HAB-DMS, visit our website at: <http://www.nodc.noaa.gov/col/projects/habs> (Figure 2).

Following the development of the HAB-DMS, the NODC hopes to expand the pilot regions to encompass all U.S. coastal regions affected by HAB events and to incorporate data collected at the state and local level, in addition to data sets acquired under NOAA funding.

Future work will include the incorporation of satellite imagery and other sources of in situ data for the development of HAB forecast models and decision support, as required by the HAB scientific community. In addition, a workshop sponsored by NOAA, NSF, NASA and EPA will be held in Gulf Breeze, Florida this November to develop a working proposal for designing a Harmful Algal Blooms Observing System (HABSOS) for harmful algal events in Gulf of Mexico. This is a workshop to design a proof of concept for the Coastal component of the U.S. Integrated Ocean Observing System. It is anticipated that data collected through this pilot project will also be integrated into the National HAB-DMS.

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