

EARTH SYSTEM MONITOR

NOAA altimetry sorts out Atlantic Ocean seafloor

Malvinas plate controversy resolved using altimetry

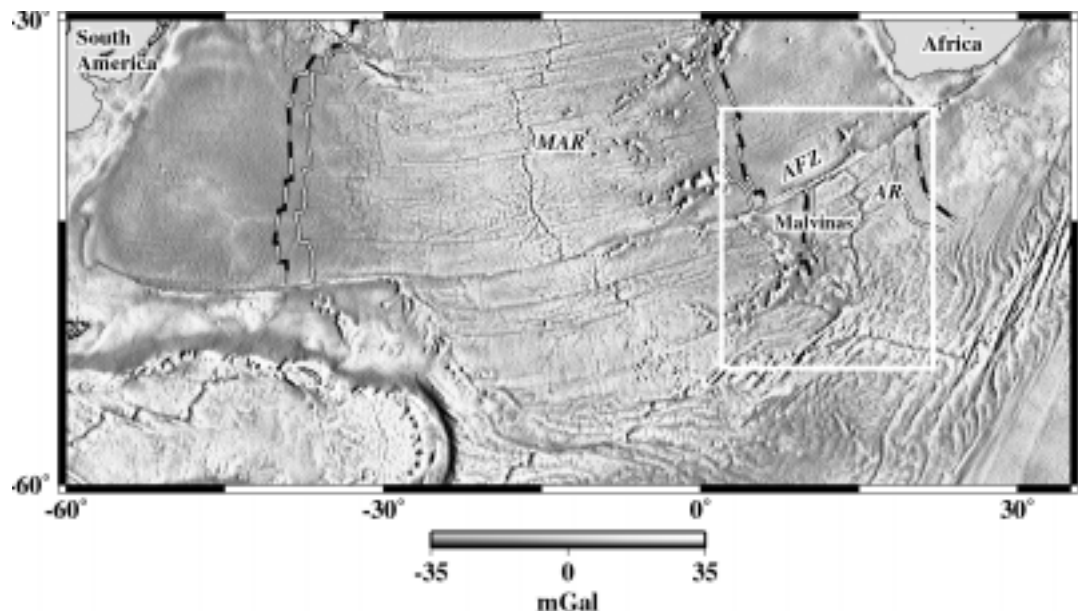
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According to the theory of plate tectonics, the continents have drifted around the globe as the shapes of the ocean basins have changed over time. As a result, the patterns of ocean circulation and climate were different in the past because the locations of land masses and oceans basins were different. Understanding of this "paleo-geography" is an important part of interpreting the fossil record of paleo-climate and paleo-ecology, and this history sets the framework for discussions of current and future ocean circulation and climate change. While the primary purpose for NOAA's Laboratory for Satellite Altimetry is to provide continuous monitoring of sea level to detect weather and climate phenomena active today, LSA scientists can also use

altimetry data to form "plate reconstructions," essentially winding plate tectonics backwards in time to reconstruct the geography ocean basins. Here we show how seafloor features such as fracture zones and mid-ocean spreading ridges, that are mapped in gravity derived from satellite altimetry, can be used to solve problems of how seafloor in the south Atlantic Ocean evolved.

More than two decades ago, LaBrecque and Hayes (1979) proposed that a tectonic plate (the Malvinas) existed on the western side of the Agulhas Basin (Figure 1) during the Late Cretaceous, between the times of magnetic anomalies 34y and 31 (about 83 to 68 million years ago). The presence of this plate could explain why the orientation of magnetic anomaly lineations (i.e., past locations of spreading at times called chrons) in the Agulhas Basin differ significantly from similar anomalies in the South Atlantic. However, this additional plate complicates what

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▲ **Figure 1.** Gray shaded-relief image of gravity anomalies computed from Geosat and ERS-1 satellite altimeter data (Sandwell and Smith, 1997) over the South Atlantic. Gravity anomaly amplitudes range between ≤ -35 mGal (black) and ≥ 35 mGal (white) and are "illuminated" from the east. Features are the Agulhas rift (AR), Agulhas fracture zone (AFZ), and the Mid-Atlantic ridge (MAR). Chain-lines are Chron 34y, and white lines are Chron 33r. The white box outlines the Agulhas Basin study area. The extinct Agulhas rift segments are offset dextrally by fracture zones trending southwest-northeast (both the ridge segments and fracture zones are linear gravity anomaly lows that are centered roughly along 15° E. longitude).

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**U.S. DEPARTMENT
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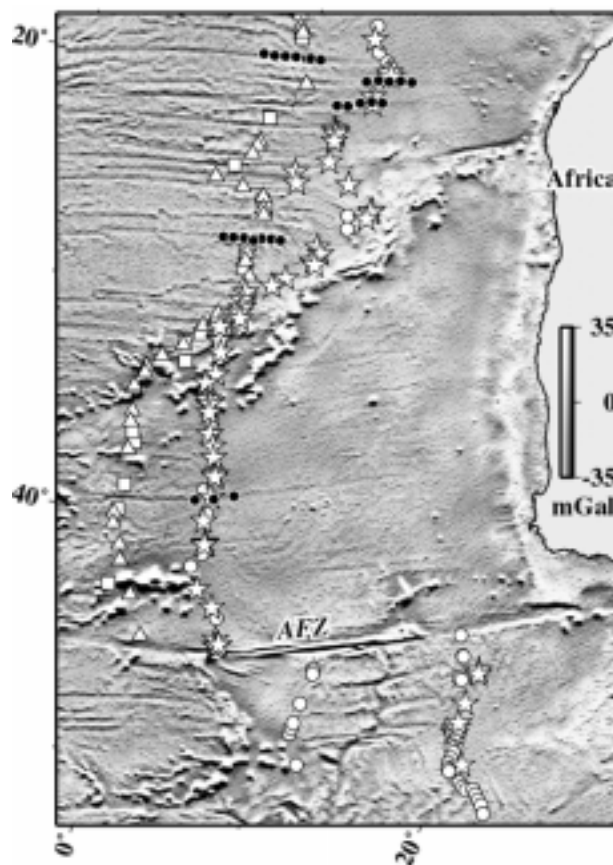
would otherwise be a simple opening of the south Atlantic Ocean as South America separated from Africa along the Mid-Atlantic spreading ridge. As a result, the existence of the Malvinas plate, and its size, has remained controversial.

We conducted simple tests that confirm a Late Cretaceous plate is required in the Agulhas Basin. First, we plotted the marine gravity field from NOAA's satellite altimetry in an oblique Mercator projection (Figure 2), having the South America-Africa 33r-27 stage pole (which describes the separation of South America from Africa between 79 and 61 million years ago) as the projection pole. On this projection, fracture zones formed by South America-Africa motion during this time should be horizontal. Indeed, those lying north of the Agulhas fracture zone plot horizontally between magnetic anomalies 33r and 27, indicating they formed by South America-Africa spreading. However, the Agulhas fracture zone and fracture zones generated on the Agulhas rift between anomalies 33r and 27 do not lie horizontally on this projection. Instead, they make a $\sim 10^\circ$ angle to the horizontal. This demonstrates they were not formed by South America-Africa spreading during this time period.

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For a second test, we moved magnetic anomalies 33r and 27 on the western flank of the Mid-Atlantic ridge (i.e., on the South American plate) to Africa using the South America-Africa 33r and 27 finite rotation poles, respectively. North of the Agulhas fracture zone, these rotations bring the South American magnetic anomalies into alignment with their conjugates on the African plate (see Figure 2). South of the Agulhas fracture zone, where spreading on the Agulhas rift ceased by

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▲ **Figure 2.** Monthly gravity anomalies plotted using an oblique Mercator projection, with the South America-Africa 33r-27 stage pole as the projection pole. Magnetic anomalies are 33r (white circles), and 27 (squares), those rotated from the western ridge flank are 33r (stars) and 27 (triangles). Black circles are fracture zone picks.

On this projection, fracture zones formed by South America-Africa motion during this period should be horizontal. An independent Malvinas plate is required because the Agulhas fracture zone and those generated on the Agulhas rift are not horizontal, and the South America-Africa 33r-27 stage rotation does not bring Malvinas 33r anomalies into alignment with their conjugates on the African plate.

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**U.S. DEPARTMENT OF COMMERCE**

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Acting Under Secretary and Administrator

Space environmental papers published

Helen E. Coffey of NOAA's National Geophysical Data Center (NGDC) had two papers published in refereed journals recently. She is co-author of "Comparison of Sunspot Area Data Bases," by T. Baranyi, L. Gyori, A. Ludmany and H.E. Coffey, that appears in the January 2001 issue of *Monthly Notices of the Royal Astronomical Society*, Volume 323. This paper resulted from a proposal in Solar Influences on Global Change that she had written for the Debrecen Heliophysical Observatory, Hungary, to reduce sunspot blocking data in Total Solar Irradiance models. The second paper entitled "When do the geomagnetic Aa and Ap indices disagree?" by H.E. Coffey and E.H. Erwin, both of NGDC, appears in a recent issue of the *Journal of Atmospheric and Solar-Terrestrial Physics*. The paper was originally presented at the 1999 International Union of Geodesy and Geomagnetism (IUGG) meeting in Birmingham, England. Several contacts with interested scientists have resulted from these published papers.

Data at Science Centers

National Climatic Data Center personnel participated in a conference call concerning NOAA's exhibit to the Association of Science-Technology Centers (ASTC). Founded in 1973, the ASTC, with over 550 members in 40 countries, is dedicated to furthering the public understanding of science. Membership includes not only science-technology centers and museums, but also nature centers, aquariums, planetariums, zoos, botanical gardens, space theaters, and natural history and children's museums. This 'brainstorming session' will help define the needs of the ASTC and allow NOAA's vast array of scientific data to be used in a museum setting.

Global seafloor sediment maps

The National Geophysical Data Center is cooperating with Dr. Chris Jenkins of the Ocean Sciences Institute (OSI), University of Sydney, Australia, on an OSI project to map the global distribution of seafloor sediment types. OSI has developed software to mine data in multiple formats from several international sources including those of NGDC to produce a global, gridded database.

News briefs

Greatest measured solar flare

A monster solar active region NOAA AR9393 crossed the solar disk in April. It grew to an area 14 times the Earth's surface and had a complex reversed-polarity magnetic configuration. The complexity warned of possible large eruptions in the area. On April 2, 2001, the largest solar X-ray flare ever recorded occurred when the region was in the northwest quadrant of the Sun. Luckily, the region had rotated past central meridian and most effects were directed to outer space. Earth did receive high-energy protons from this eruption.

An earlier flare on March 31, 2001 was more geo-effective, causing aurora as far south as Mexico and power system disturbances in New York. Fortunately, this storm occurred over the weekend when power system use is 50% lower than during the workweek; also, air conditioning use was not a problem. During a previous large geomagnetic storm on July 15, 2000, the U.S. had unusually mild temperatures insuring lower power consumption. NGDC holds the solar and geomagnetic data archives needed for investigating the past history of these major events.

Air Force/NGDC memorandum of agreement signed

A Functional Memorandum of Agreement (FMOA) between the National Geophysical Data Center and the U.S. Air Force's 55th Space Weather Squadron at Schriever Air Force Base, Colorado, has been signed. This FMOA concerns the archiving of Solar Observing Optical Network data and Radio Solar Telescope Network data. NGDC continues as the sole archive location for the digital and optical worksheets of both solar and solar radio data monitored by the USAF.

The USAF has a worldwide network of five stations that keep a 24-hour watch upon the Sun to monitor for solar explosions. These explosions (solar flares, coronal mass ejections, erupting prominences, etc.) affect High Frequency communications and navigation systems used by the USAF. The data provide a good historical record of solar activity and are used by the scientific community in solar-terrestrial research.

GCOS activities

Under the United Nations Framework Convention on Climate Change, countries are required to submit detailed reports on their Global Climate Observing System (GCOS) activities. Howard Diamond, the U.S. GCOS program manager, is coordinating the preparation of this report. The effort is being supported by a subgroup, chaired by NCDC's Russ Vose, addressing atmospheric monitoring systems in the United States. The subgroup has completed its chapter, describing surface, upper air, and atmospheric constituent observing networks operated by the U.S.

Dark Sky Reserves

Mr. Peter Goering of the Muskoka Heritage Foundations, in Canada, recently contacted NGDC about the development of Dark Sky Reserves. He has been heading an effort to have a Dark Sky Park created in Canada. Beneficiaries include amateur astronomers and anyone interested in limiting the use of electrical power. Their initial efforts have been successful, as the Torrance Barrows Conservation and Dark Sky Reserve, 150 miles north of Toronto, was created in the past year. A subset of the DMSP Radiance Calibrated Nighttime Lights, developed by NGDC, was used by Mr. Goering and his colleagues in their presentations to Canadian Province and National legislative groups. This year the reserve will be expanded, increasing the area five-fold.

Additional success has become evident as many of the communities surrounding Georgian Bay, a body of water attached to Lake Huron, have made applications to become Dark Sky Reserves. Mr. Goering and his colleagues are particularly excited about these areas because the communities themselves have voluntarily asked for this designation, and they currently have no major problem with light pollution.

Stratospheric ozone monitoring

The National Climatic Data Center, in cooperation with scientists from NOAA's Climate Prediction Center, Climate Monitoring and Diagnostic Laboratory, and Aeronomy Laboratory have developed and released a new web site which ties together the many diverse aspects of stratospheric ozone monitoring and research in NOAA. Access is available at <http://www.ozonelayer.noaa.gov>.

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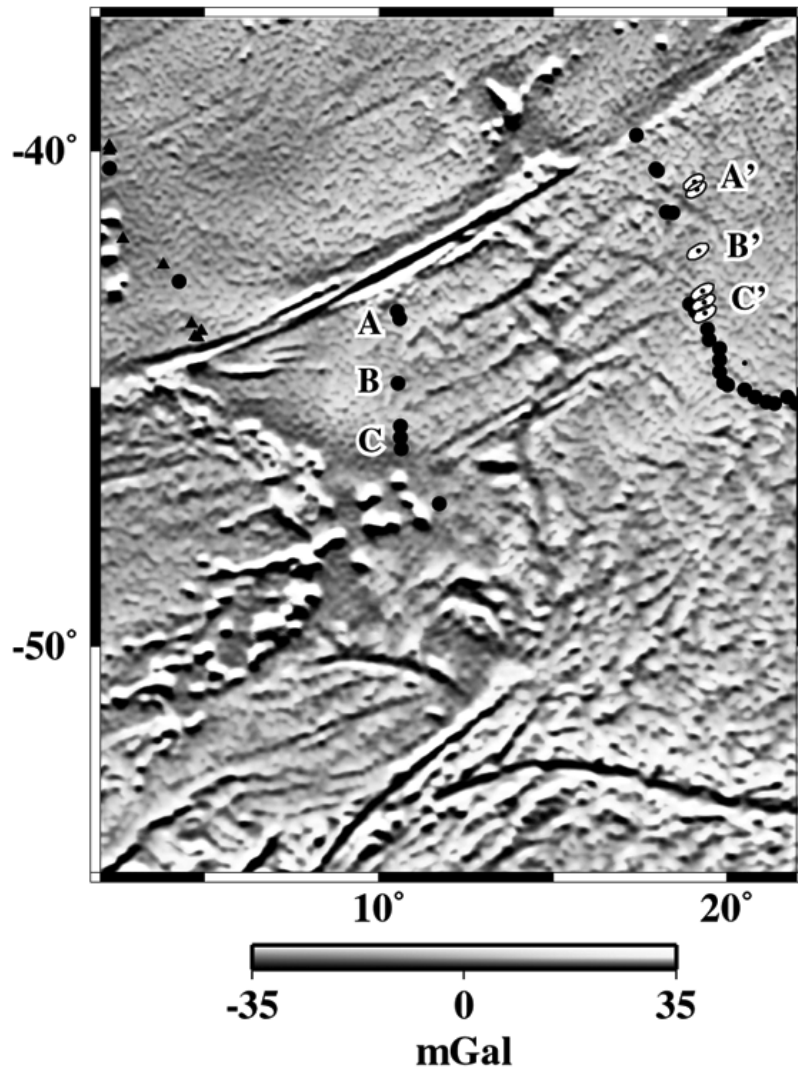
about anomaly 27 time, we used the South America-Africa 33r-27 stage pole to rotate the 33r magnetic anomalies on the western flank (Malvinas side) of the Agulhas rift to Africa. We find this South America-Africa 33r-27 stage pole does not bring Malvinas 33r anomalies into alignment with their conjugate anomalies on the African plate.

We also tested to see if errors in the South America-Africa 33r-27 stage pole could account for the misalignment of rotated Malvinas and conjugate African 33r magnetic anomalies. We find that the 95% confidence ellipses (that estimate an ellipse within which reasonable solutions could lie) associated with rotated Malvinas 33r anomalies (Figure 3) do not encompass 33r anomalies on the African plate. Furthermore, this stage rotation brings points into the wrong spreading corridors, that is, it moves points across fracture zones. Clearly, the South America-Africa 33r-27 stage rotation does not fit these Agulhas Basin data. We have calculated new Malvinas-Africa 33r finite rotations (Marks and Stock, submitted) that do an excellent job aligning corresponding Malvinas and African magnetic anomalies. The need for a different pole to align conjugate magnetic anomalies in the Agulhas Basin means a separate plate existed there.

These results confirm that a Malvinas plate is required in the Agulhas Basin during the Late Cretaceous. Further, the fact that the major Agulhas fracture zone does not lie on the horizontal on the Mercator projection discussed above demonstrates that it bound the Malvinas plate on the north. The locations of the elusive western and southern boundaries of the Malvinas plate are investigated in a more comprehensive work (Marks and Stock, submitted).

Acknowledgments

This research was performed with Prof. Joann Stock, California Institute of Technology. Walter Smith, NOAA Laboratory for Satellite Altimetry, provided editing which improved this article.



▲ **Figure 3.** 33r magnetic anomalies (black circles) plotted on marine gravity anomalies. Black triangles are South America 33r anomalies rotated to Africa via the South America-Africa stage pole, and black dots with 95% confidence ellipses (white) are from the Malvinas plate. This stage rotation brings points into the wrong spreading corridors (e.g., A has moved to A'), and the confidence ellipses do not encompass 33r anomalies on the African plate. The South America-Africa 33r-27 stage rotation does not fit these data in the Agulhas Basin.

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- Marks, K. M., and J. M. Stock, The Malvinas plate, *Marine Geophys. Res.*, 2001, submitted.
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Observing and Monitoring the Coastal Environment

The role of the NOAA Coastal Services Center

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The ability to monitor the coastal environment is becoming more important as expanding coastal populations increase the potential for negative environmental impacts. Widespread monitoring and observing systems can provide information of interest to scientific, commercial, and recreational users, with the information, gleaned from uninterrupted long-term monitoring, helping people to understand and protect this environment for the future. Many monitoring systems already exist in U.S. coastal waters, but improvements in coordination among interested parties are needed. The National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center is involved in a number of initiatives designed to fill this need.

Who is measuring what, and where?

The NOAA Coastal Services Center's involvement in the U.S. Coastal-Global Ocean Observing System (C-GOOS) created an opportunity to examine the current state of U.S. marine observing and monitoring systems. C-GOOS is an initiative designed to establish an observational/monitoring network to collect and distribute marine and coastal data needed by government,

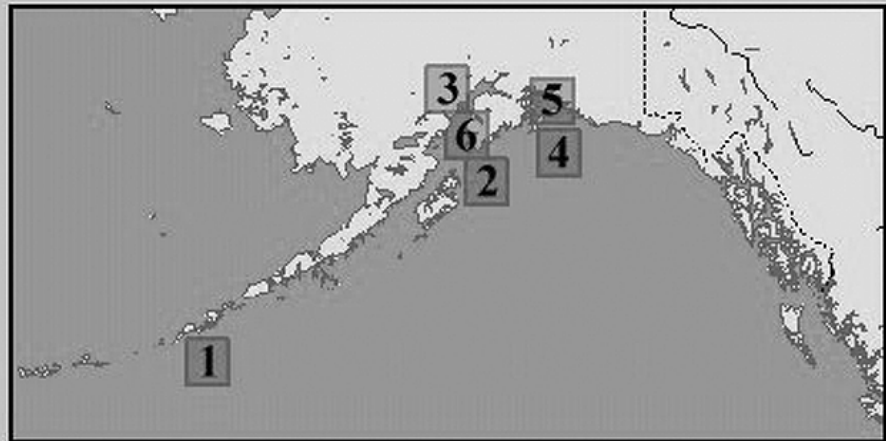
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science, and the public. Initially, the NOAA Coastal Services Center took a regional approach and looked at the networks and systems designed for long-term monitoring of the coastal and nearshore environment. This research resulted in the 1998 release of U.S. Coastal Observing Systems (COOS), a Web page (www.csc.noaa.gov/cts/coos/) featuring nearly forty systems. This number has since doubled in size, with frequent additions planned for the future.

The Web page is designed as a centralized information source, providing a synopsis of each system listed with a link to more details. Each synopsis contains a brief description, including system sponsors and managers, number of monitoring stations, and system goals,

followed by a list of the parameters measured. Following the list of parameters is a contact person to obtain more information, as well as the link to the observing system's own Web page. Generally, data are available in one form or another from a system's own Web page. There may be data restrictions, or the availability of data may be delayed to allow for processing, analysis, or research use. By simply providing descriptions of each system and links to any available data, instead of hosting the data, the Web page avoids the pitfall of constantly maintaining and updating data. Although COOS supplies a wealth of information on U.S. coastal observing systems, it was not designed as a data repository or data distribution site.

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- 1 - Deep Ocean Assessment and Reporting of Tsunamis Project
| 2 - Gulf of Alaska Global Ocean Ecosystem Dynamics
Monitoring Program | 3 - National Water Level Observation
Network | 4 - National Data Buoy Center Moored Buoys and
C-MAN Stations | 5 - Prince William Sound Nowcast-Forecast
System | 6 - Kachemak Bay NERR

▲ Figure 1. COOS Web page image of Alaska region.

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The COOS Web page orients the user with regional maps (inspired by the National Data Buoy Center's Web page) of the different observing systems. The systems are labeled with numbers on the map, which correspond to the names of the systems immediately below the map (Figure 1). The regional map is repeated for each entry so the user does not have to scroll back and forth to look at the map while reading the entry. Systems listed include federal, state, academic, and local/regional operations. This Web page is an ongoing project that continually adds new systems and removes or updates others. A full-scale update is undertaken twice a year, but new additions and minor adjustments and enhancements are always in progress.

What do the users want?

In addition to the COOS project, the NOAA Coastal Services Center also undertook a study to determine how the needs of coastal data users matched the available and proposed observing system data streams. The objective was to examine previously conducted user surveys to find both the common and disparate needs of different groups. With that in mind, four user surveys from a variety of sources were collected and examined. Two regional surveys (Chesapeake Bay and Florida), one system-specific survey (Tampa Bay PORTS), and one multinational survey (EuroGOOS) comprised the sample of user surveys.

One of the more difficult items tackled when analyzing these surveys

was combining the user groups and parameters measured into a single and manageable piece of information so that an analysis could be performed. Some of the surveys employed classifications with minimal groups and parameters, while others used a multitude of classifications. Combining the information from all four surveys to create one generalized survey sacrificed some detail, but allowed the opportunity to pick out trends and differences among user groups. Analysis of the surveys individually also provided some insight into differing needs by location and sample size.

The analysis highlighted a few basic parameters that always seem to be requested; temperature, currents, winds, waves, and tides are requested by most users. As these parameters are at the top of the list for many users, a basic system would do well to include them. Any additional measurements and observations depend heavily on user groups, and are much more difficult to decide upon. The sample size (number of surveys) for this study was small, however, the results provide some factors to keep in mind for anyone involved in the development or maintenance of coastal observing systems. To obtain a copy of the study, contact the Coastal Services Center.

Technology developers working with technology users

The NOAA Coastal Services Center is also involved with another project related to coastal and marine monitoring. The Alliance for Coastal Technologies (ACT) is a partnership designed to

address the needs of the monitoring community by bringing together technology users and developers. Based at the University of Maryland's Chesapeake Biological Laboratory, ACT is a state, federal, and industry partnership. The Center-sponsored initiative includes the University of Maryland Center for Environmental Science (UMCES), the University of South Florida, the Skidaway Institute of Oceanography, the Moss Landing Marine Laboratory, the Monterey Bay Aquarium Research Institute, and the Gulf of Maine Ocean Observing System (GOMOOS). All of these organizations will provide facilities and expertise for the demonstration, evaluation, and verification of promising monitoring technologies. Coastal resource managers, marine science researchers, and commercial equipment manufacturers will be involved through a unique stakeholders' council. Training in the use of new technologies and other related services will also be a part of ACT operations. For more information, visit the ACT Web site at www.actonline.ws/index.html.

Monitoring of the coastal environment is important for scientific, economic, and social reasons, and the NOAA Coastal Services Center's involvement in these projects shows its commitment to a better understanding of this environment. By continuing to improve the capacity and ability to monitor the environment, we should be better equipped to maintain and enhance the coastal zone. ■

Analysis of temporal variability in chlorophyll concentrations along the West Florida Shelf

Errata to be used with the March 2001 article in this publication

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Cynthia Heil¹ and Gabriel Vargo¹

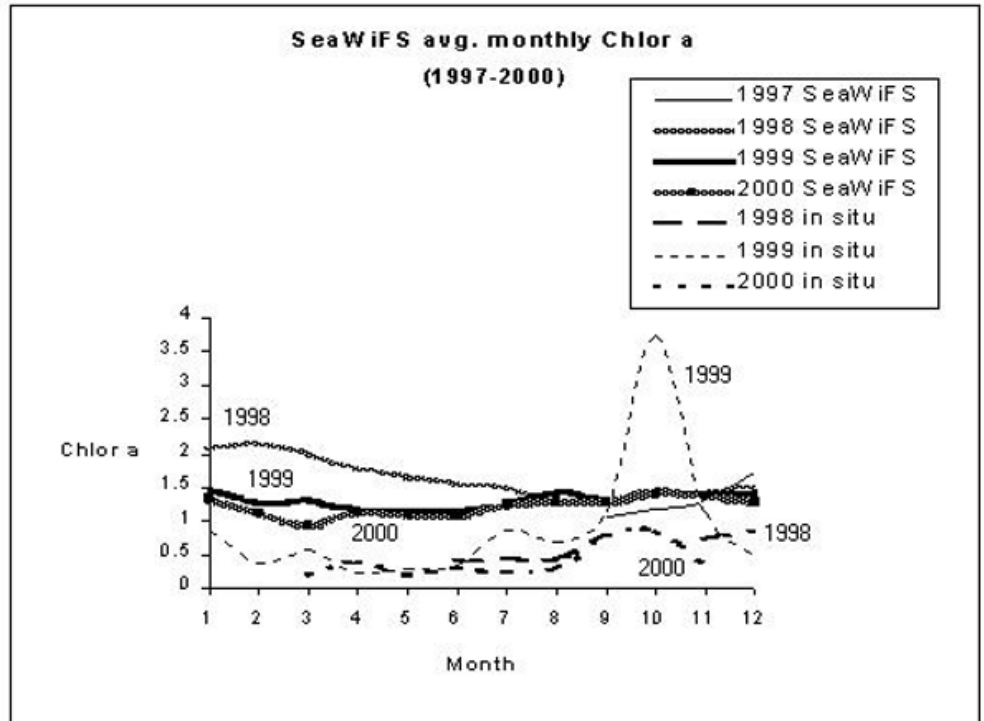
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We present here a correction to results presented in this publication in March 2000 ("Analysis of Temporal Variability in Chlorophyll Concentrations along the West Florida Shelf using Remote Sensing" by LV and FMK). This correction includes an updated analysis of SeaWiFS-derived and *in situ* chlorophyll-*a* data collected during the Florida ECOHAB program. This re-analysis addresses errors associated with the processing of the SeaWiFS data and with the derivation of regional chlorophyll-*a* concentration means derived from these data.

Comparisons between the *in situ* ECOHAB data and the SeaWiFS chlorophyll-*a* data reveal that the present SeaWiFS algorithm (O'Reilly et al, 2000) tends to overestimate the mean *in situ* values throughout the year (Figure 1), not just during the first half of the year as stated in our previous note.

Figure 2 shows that for most of the ECOHAB program, the greatest disparity between the SeaWiFS and *in situ* data occurred at inshore stations in waters shallower than 30 m. In these waters, SeaWiFS data overestimated the *in situ* observations by a factor of one to two (Figure 2). The only exception to this general observation occurred during the first week of October 1999, when the ECOHAB data exceeded the

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▲ Figure 1. Monthly SeaWiFS chlorophyll-*a* versus *in situ* chlorophyll data acquired during monthly ECOHAB cruises.

SeaWiFS data by a factor of two inshore and a factor of four offshore in waters deeper than 30 m (Figure 2). While the *in situ* results presented here are based on monthly averages for all the ECOHAB stations, current research is underway to examine the *in situ* data based on depth and enable additional comparative analysis with the SeaWiFS data.

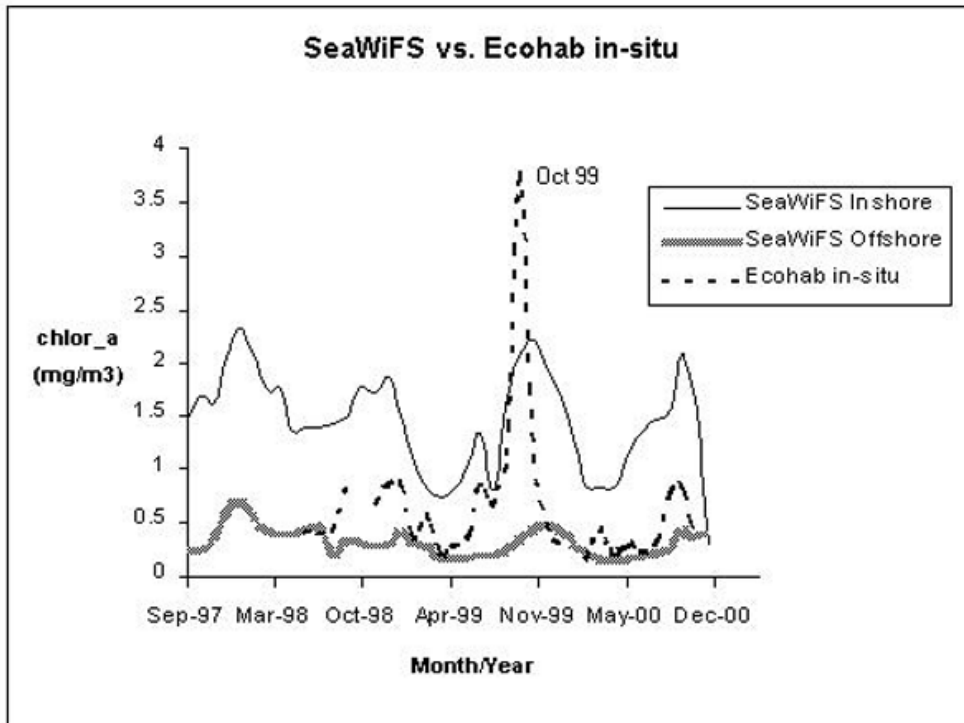
The disparity inshore between SeaWiFS and *in situ* may be due to several factors. As mentioned in the earlier article, during October 1999 there were elevated counts (>5000 cells/ml) of *G. breve* within the ECOHAB region possibly contributing to the disagreement between the SeaWiFS and *in situ* results

during this period. Signal interference or contamination due to turbidity and bottom reflectance in shallow waters may also be contributing to the elevated SeaWiFS-generated chlorophyll relative to *in situ* chlorophyll concentrations in inshore waters.

These factors are currently the subject of research at the University of South Florida. The objective is to improve algorithms for estimating chlorophyll concentrations from space in coastal and shelf environments. Such research will enable more accurate identification of blooms and the future prediction of harmful algal blooms.

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Chlorophyll, from page 7



▲ **Figure 2.** SeaWiFS chlorophyll 1997-2000 time series for inshore and offshore sub-regions versus Ecohab in-situ data.

Acknowledgement:

We explicitly acknowledge the contributions of Dr. Gabriel Vargo and Dr. Cynthia Heil, and of all the members of their ECOHAB research group at the University of South Florida, in generating the in situ chlorophyll-a dataset for the ECOHAB Project used in this analysis.

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The Integrated Taxonomic Information System

Increasing access to, and integration of, global biodiversity data and information

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A key element in providing access to globally distributed, multi-disciplinary biodiversity data sources (e.g., survey data, natural history collection specimen data, literature sources, species and sequence databanks, ecosystem-level datasets) is implementation of a credible taxonomic information service that serves as a consistent standard reference system for maintaining and representing dynamic biological nomenclature and taxonomy. This service can serve as a query, cross-referencing, and indexing tool in support of discovery, comparison, exchange, and integration of a wide variety of existing biological and ecological data accumulated over 250 years or more. Biological names are the unifying linkage among all these distributed information sources, serving as a primary index to the earth's 1.8 million known species.

Working in a unique partnership among federal agencies, with cooperators in the world biological systematics community of scientists, the Integrated Taxonomic Information System (ITIS) program has developed, and continues to enhance both scientifically and technologically, the first widely accessible taxonomic information service on the scientific names of the biota of North America and surrounding waters. The system is expanding to include global coverage of species based on partner needs. An outgrowth of earlier taxonomic code development efforts, including the extensively used NODC Taxonomic Code of the National Oceanographic Data Center, the ITIS partnership, through a 1996 Memorandum of Understanding, agreed to join

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together to develop ITIS and to develop a strategy for coordinating taxonomic database development, maintenance, and support. Founding ITIS partners include: the U.S. Geological Survey, the former National Biological Service, the Environmental Protection Agency, the Natural Resources Conservation Service, the National Oceanic and Atmospheric Administration (National Oceanographic Data Center and National Marine Fisheries Service), and the Smithsonian Institution's National Museum of Natural History. Additional partners have joined and benefited from ITIS participation, including the National Park Service, Agriculture and Agri-Food Canada, and CONABIO, Mexico. ITIS is also a member of Species 2000, the Global Biodiversity Information Facility, and is a cooperating database in a growing number of information networks, including the Census of Marine Life's Ocean Biogeographic Information System (OBIS) and the National Biological Information Infrastructure (NBII).

ITIS integrates a scientifically credible and dynamic biological names thesaurus with web-based tools for reporting, searching and indexing. It provides a reference standard of accepted scientific names of biological organisms from all biological kingdoms (animals, plants, fungi, protists, monera), along with synonyms and common names that have been used by workers in different organizations, geographical regions, or at different times in the past. Each scientific name is assigned a unique identifier (the Taxonomic Serial Number). Author and date of scientific name, geographic region, jurisdictional, and bibliographic information are also included, along with data quality qualifiers pertaining to degree of scientific review by a network of systematics experts serving as data stewards and cooperators. Enabling cross-referencing of names to a standard ensures that biological data pertinent to invasive species, fishery stocks, emerging diseases,

climate change, migratory birds, pollinators, agricultural pests, and biodiversity, can be located, summarized, and analyzed.

The ITIS partners provide leadership in the creation of an essential component of a biodiversity informatics infrastructure critical to meeting ecosystem challenges. Through each partner's commitment to contribute and share resources, partners have successfully developed and continue to enhance ITIS, a system that no one organization could finance or develop on their own. Partners and cooperators also develop common standards, procedures, and software that permit standardization and dissemination of ITIS taxonomic information. As an example, ITIS currently is partnering in the Federal Geographic Data Committee Biological Working Group's Biological Nomenclature and Taxonomy Data Standard project (<http://biology.usgs.gov/fgdc.bio/index.html>). The proposed standard will help facilitate discovery, comparison, exchange, and integration of any biological and/or geospatial data set (or related information products) that includes scientific names of species or higher taxonomic groups as part of its data structure. Common standards established and adopted by ITIS partners save significant amounts of time and money, avoid redundancy, and foster support of a common, scientifically credible system. Taxonomic data standards also help ensure the quality of the information that ITIS member agencies and cooperators provide and customers receive.

Customers of the ITIS database have grown to include numerous federal and state agencies, academic, private individuals, as well as international users. ITIS provides taxonomic services to professionals and the public. ITIS websites (U.S.: <http://www.itis.usda.gov>; and Canada: <http://sis.agr.ca/itis>) are accessible in English and French versions, and will be available in Spanish soon. ■

Hurricane forecasters expect normal Atlantic activity

Top hurricane experts from the Commerce Department's National Oceanic and Atmospheric Administration (NOAA) today said the 2001 Atlantic hurricane season likely will have normal levels of activity, bringing fewer storms than the past three years. However, officials advised residents in Atlantic and Gulf Coast states to be prepared for storms, high winds and flooding throughout the season, which begins June 1.

At a press conference at the Ronald Reagan National Airport near Washington, D.C., NOAA officials said the absence of strong La Niña conditions this year will likely result in a number of storms, but relatively fewer compared to the last three seasons. In 2000, there were 14 named storms, of which eight became hurricanes.

A normal Atlantic hurricane season typically brings eight to 11 tropical storms, of which five to seven reach hurricane strength, with two to three classified as major. A major hurricane packs sustained winds greater than 110 mph and is classified at Category 3, or above, on the Saffir-Simpson Hurricane Scale. Seasons with normal hurricane activity average one to two land-falling hurricanes in the United States, and one in the Caribbean.

"Although we expect an average level of activity this season, that is no cause to become complacent. With the possibility of five to seven hurricanes, residents in hurricane prone areas can't afford to let their guard down," said Scott Gudes, NOAA's acting administrator.

The news conference also marked the start of a nationwide Hurricane Awareness Week campaign led by NOAA, the Federal Emergency Management Agency (FEMA) and storm-vulnerable states to increase preparedness and safety among residents.

Gudes pointed to continuing improvements in technology and research that enabled forecasters to produce the 2001 outlook. "Better data from NOAA's weather satellites, better models, the latest supercomputers and an

improved ability to monitor and understand global climate patterns are helping to create better long-term forecasts," Gudes said.

Prior to the news conference, FEMA Director Joe M. Allbaugh said, "As we look to another hurricane season with an ever-growing population living in vulnerable coastal areas, our charge is clear. FEMA stands ready to provide both the leadership and the necessary technical assistance and guidance to communities as they assume responsibility for becoming more disaster resistant. Preventing the loss of life, minimizing the damage to property from hurricanes is a responsibility that is shared by all."

Retired Air Force Brig. Gen. Jack Kelly, director of NOAA's National Weather Service, said without a strong La Niña or El Niño the key climate patterns guiding this year's expected activity are long-term patterns of tropical rainfall, air pressure and temperatures of the Atlantic Ocean and Caribbean Sea.

"Forecasters will monitor these climate patterns, especially leading up to the August - October peak period of the season," Kelly said. "One of the most valuable forecast tools is the information gathered by NOAA and U.S. Air Force Reserve personnel who fly directly into these storms," Kelly added, while flanked by NOAA's WP-3D, G-IV and the Air Force's WC-130-H hurricane hunter/research aircraft.

Max Mayfield, director of the weather service's National Hurricane Center in Miami, said hurricane-spawned disasters occur even in years with normal, or below-normal, levels of activity. Hurricanes Donna of 1960, David and Frederic of 1979, and Elena, Gloria and Juan of 1985 are reminders of the destruction that can occur during seasons with normal hurricane activity, he said. Hurricane Andrew of 1992, the costliest hurricane on record, developed during a season of below-normal hurricane activity, Mayfield added. "[Hurricane] Donna killed 50 people in the United States, and [Hurri-

cane] Andrew caused more than \$25 billion in damage in Florida," Mayfield said. "We don't want people to be caught off guard by a land-falling storm because the hurricane outlook calls for normal storm activity."

Mayfield also highlighted the dangers of inland flooding. "In 1999, Hurricane Floyd brought record flooding to the East Coast. Fifty of the 56 deaths during Hurricane Floyd were a direct result of inland flooding. That kind of threat remains with each approaching storm."

Mayfield added, "Storm surge from hurricanes bring the greatest potential for loss of life. When an evacuation order is given, residents should treat it as a life or death matter."

Brig. Gen. Robert Duignan, deputy to the Chief of Air Force Reserve, said the Air Force Reserve Command mission significantly narrows the coastline warning made by the National Hurricane Center. "This warning saves millions of dollars for businesses and, more important, saves the lives of citizens located in the storm's path."

"Studies have shown the high accuracy data from our Air Force Reserve and NOAA aircraft have improved the forecast accuracy by about 25 percent. Aircrews in these storms also have detected sudden, dangerous changes in hurricane intensity and movement, which are currently very difficult to detect by satellite alone," added Duignan. "The Hurricane Hunters are proud to serve as a vital link in the hurricane surveillance and warning network, alerting vulnerable populations."

Hurricane Awareness Week features a new Web site (available at <http://www.nhc.noaa.gov>) that highlights five topics -- one for each day of the week -- vital to saving lives and property: Day 1 - Coastal and Marine Hazards; Day 2 - Wind Hazards; Day 3 - Inland Flooding; Day 4 - The Forecast Process and; Day 5 - Disaster Prevention. The Atlantic hurricane seasons ends Nov. 30.

— Curtis Carey
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New NOAA National Data Center annual climatological product

The long-awaited Annual Climatological Summary (ANCSUM) product is now online. The new system provides access to annual climatological summaries for thousands of U.S. stations going as far back as 1831. ANCSUM contains an annual summary of monthly temperature means, precipitations totals, departures from normal and extremes, heating & cooling degree data, and a monthly tally of rain days, snow days and days within selected temperature thresholds. ANCSUMs are dynamically generated on demand from NCDC's Oracle database tables. ASCII versions are available in addition to a printable web form. The new system runs on the new Linux Web Farm using Java Servlets. The NNDC OnLine Store price is \$3 per form. Subscriptions are also available for \$50 per station or \$300 for all stations which allows access to all historical data. Subscriptions provide access for one year from date of purchase. The URL for the new system is: <http://lwf.ncdc.noaa.gov/servlets/ACS>.
Contact: NCDC

IPAB Antarctic drifting buoy data available

NSIDC (National Snow and Ice Data Center) released the first series of Antarctic buoy data from the International Programme for Antarctic Buoys (IPAB). The IPAB, through participating research organizations in various countries, maintains a network of drifting buoys in the Antarctic sea ice zone to support a better understanding of sea ice motion, meteorology, and oceanography. The IPAB Antarctic Drifting Buoy Data archive presently spans the years 1995 to 1998, and includes measurements of buoy position, atmospheric pressure, air temperature, and sea surface temperature.

Data are organized by daily and three-hour averages; and raw, instantaneous, non-interpolated data values. Data were collected from buoys initially deployed in three study regions; East Antarctica; the Weddell Sea; and the Bellingshausen, Amundsen, and Ross Seas. Data are in ASCII text format and are available by ftp. Updates will become available as data are processed and new buoys are deployed.

Contact: NSIDC

Data products and services

Congressional testimony on Arctic Climate Change

The NOAA Paleoclimatology Program at NGDC contributed PowerPoint materials for testimony by NOAA Acting Under Secretary Scott Gudes, entitled "Written Statement on Involvement of NOAA in Arctic Climate Change." The materials included published analyses of past arctic temperatures from a variety of paleoclimatic data sources and published materials on the interaction of climate variability and fisheries in Alaska. It also included a new analysis of borehole temperatures from northwestern Canada. The paleotemperature data indicate a strong trend that the 20th century was the warmest century in the past 400 years for most of the arctic, especially Alaska and Canada. The materials were being prepared by Tom Karl and others at the National Climatic Data Center.

Contact: NGDC

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NOAA Central Library

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

Arctic meteorology Primer online

NSIDC's Arctic Climatology and Meteorology Primer for Newcomers to the North is available online at: <http://nsidc.org/arcticmet/index.html>. This educational site is a collection of information about arctic weather and the factors that determine weather and climate. The Primer was developed as part of the joint U.S.-Russian Environmental Working Group's Arctic Meteorology and Climate Atlas on CD-ROM, a product that combines data for research and information for the general public in one package. While scientists will want to order the full atlas on CD-ROM, students and casual browsers will enjoy easy access to educational material at the new site. The Primer includes a gallery of historical photos from the Russian North Pole series of drifting ice stations, and a glossary of meteorological terms in both English and Russian. It joins other educational theme pages from NSIDC including "State of the Cryosphere" and "All About Glaciers" (<http://nsidc.org/glaciers/index.html>).
Contact: NSIDC

Black Sea mysteries

The National Geophysical Data Center provided the index map for an article in the May 2001 issue of *National Geographic Magazine*, regarding the archaeological origins of the biblical flood. The NGDC illustration (pp 56-57) contains a 3D topographic-bathymetric model, which includes 30 arc-second topography from GLOBE and 1 arc-minute bathymetry from U.S. Navy sources. Links to the final published version of the illustration are available through the index page at: <http://www.nationalgeographic.com/ngm/01015/feature3/index.html>.
Contact: NGDC

Wright brothers weather data

First Flight Centennial Center in Philadelphia, Pennsylvania, contacted the National Climatic Data Center to obtain historical weather data on the Kitty Hawk, North Carolina area for 1903. The Centennial Center has collected letters and diaries of the Wright brothers to create a large exhibit about the "First Flight." The NCDC was able to provide the requested data for this great exhibit.
Contact: NCDC

NOAA storm researchers working to improve severe weather forecasts

Thunderstorms with lightning, hail, strong winds and tornadoes can be devastating, resulting in hundreds of deaths and millions of dollars in damage each year. National Oceanic and Atmospheric Administration (NOAA) researchers and forecasters in Norman, Okla., are working toward improving the tools used to predict such storms. Their aim is to provide the public more time to prepare for severe thunderstorm events.

NOAA researchers and forecasters are collaborating in an experiment to improve forecasts of when and where severe storms will occur. This spring, participants are evaluating several operational and experimental computer models and algorithms used by forecasters to determine which ones provide the best guidance.

Forecasters currently use a combination of computer model forecasts and observational tools, such as satellites and radars, to determine when to issue a severe thunderstorm watch. The experiment is designed to explore whether the computer models have improved enough to provide the guidance forecasters need to confidently issue watches several hours in advance, while the skies are still clear.

"We need to identify more clearly under what circumstances and with which models we can predict severe thunderstorm development with significant lead time *and* confidence," said John S. Kain, a research meteorologist at NOAA's National Severe Storms Laboratory (NSSL) and co-leader of the project with Paul R. Janish, science infusion meteorologist with NOAA's Storm Prediction Center (SPC). The computer models include operational versions developed at the NOAA National Centers for Environmental Prediction Environmental Modeling Center and the NOAA Forecast Systems Laboratory, as well as research versions developed at the NOAA National Severe Storms Laboratory.

"This is a great opportunity for us to stretch our forecasts toward the limits of current science," explained Russell Schneider, chief of the SPC's science support branch. "During the experiment, forecasters are forced to decide whether to issue watches sooner, sometimes before they see evidence in the satellite and radar data that storms have begun to form. It requires detailed analysis of multiple computer model forecasts made possible by the National Weather Service's super computer."

The next day, participants evaluate the output from the different models, rating them on their usefulness, and compare their forecasts with what actually happened. "This process helps the forecasters develop a better understanding of the numerical models that provide their primary source of forecast guidance," Kain said. "And it helps researchers design more useful model guidance products for forecasters' specific needs."

NSSL and SPC have worked together on several projects in the past few years, since the SPC moved its operations to Norman from Kansas City in 1997. A key goal of these programs is to improve forecasts of meteorological phenomena by speeding up the transfer of new technology and research ideas into forecast operations. At the NSSL and SPC, this is accomplished by combining the skills and mutual research interests of research scientists and forecasters.

Visiting scientists also participating in the experiment are from NOAA's Forecast Systems Laboratory, National Centers for Environmental Prediction Environmental Modeling Center, National Weather Service Norman Forecast Office, Iowa State University and the University of Oklahoma.

More information about the program is available online:
http://www.spc.noaa.gov/exper/Spring_2001.

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