



# EARTH SYSTEM MONITOR

## NESDIS's Economic Value for the Nation

*Summarizing our services with respect to public return on investment*

*A guide to NOAA's data and information services*

Allen M. Hittelman and Joy A. Ikelman  
National Geophysical Data Center  
NOAA/NESDIS

To obtain a copy of this report, contact:

Email: [info@ngdc.noaa.gov](mailto:info@ngdc.noaa.gov)  
Phone: 303-497-6826  
Fax: 303-497-6513  
Web: [www.ngdc.noaa.gov](http://www.ngdc.noaa.gov)

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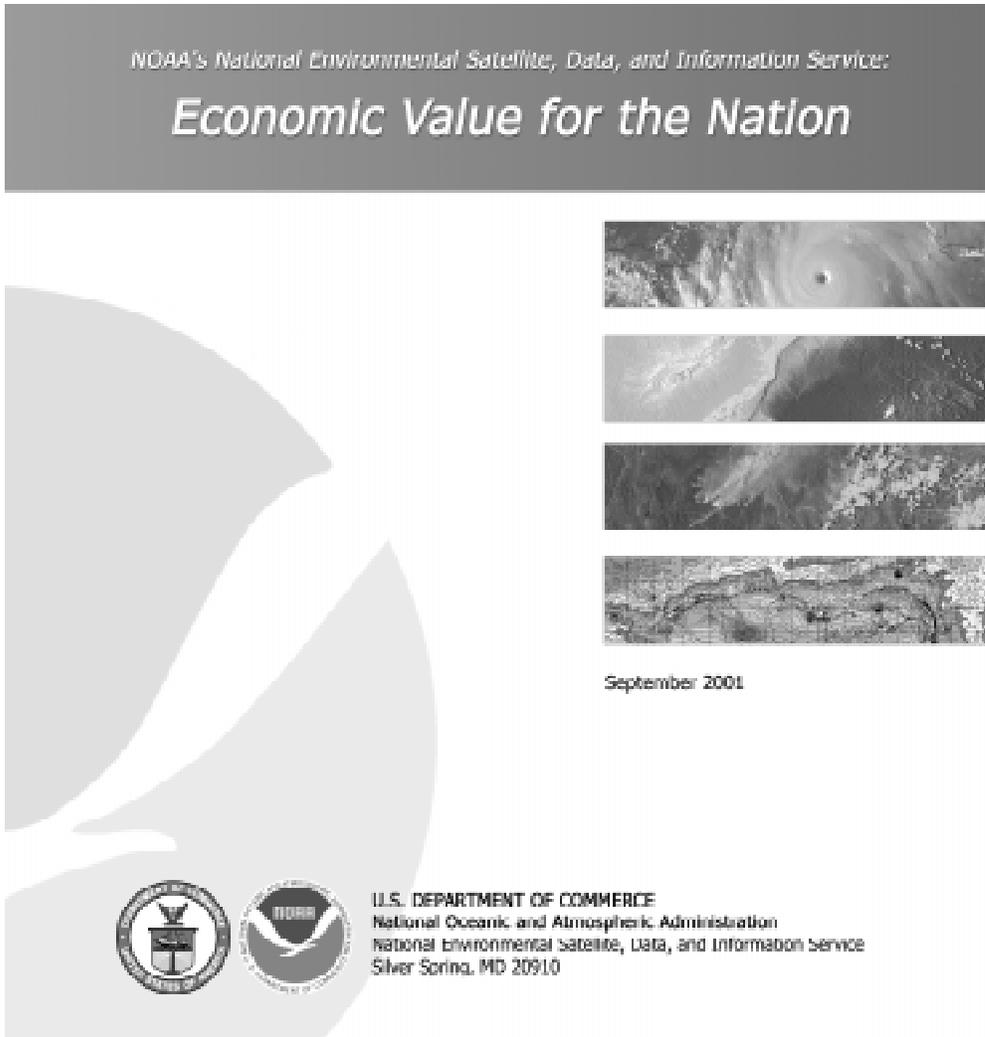
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The National Environmental Satellite, Data, and Information Service (NESDIS) is committed to increase our awareness of the benefits and opportunities derived from public and private sector interfaces. In a continuing effort to improve our understanding of the specific economic impacts of our products and services, we have produced a 24-page brochure — summarizing our services with respect to public return on investment. This publication is available on request and can also be downloaded via the Web.

### Multifaceted Industry Interaction

As the women and men of NESDIS work daily to accomplish our mission, we interact closely with U.S. industry and affect the economy in a variety of ways. It is a multifaceted and mutually beneficial relationship. Our roles with industry can be summarized as follows:

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**U.S. DEPARTMENT OF COMMERCE**  
National Oceanic and Atmospheric Administration

▲ Figure 1. Cover of NESDIS's new consumer-oriented publication.

**Economic Value**, from page 1• *Customer*

NESDIS procures launches, spacecraft, instruments, ground systems, technical services, and commercial imagery. We depend on the expertise and robustness of U.S. industry to meet our needs for improved technology and cost-efficient solutions to accomplish the mission entrusted to us in service to the public.

• *Employer*

The NESDIS workforce is an integration of civil service and on-site contract employees, with a commitment of achieving the most efficient workforce structure possible.

• *Data, information and service provider*

NESDIS provides timely access to global environmental data, information, and assessments used by almost every sector of society and benefiting all Americans. As a multiplier of effect, the private sector adds enhanced value to these products and services.

• *Partner*

Beyond the traditional procurement relationship, public and private sector entities work closely in innovative ways while addressing some of the Nation's most challenging environmental issues.

As an integral component of the Department of Commerce (DOC) and the National Oceanic and Atmospheric Administration (NOAA), NESDIS is committed to maintaining and strengthening its relationship with business, which in turn promotes job creation, economic growth, sustainable development, and improved living standards for all.

**Quality environmental information enhances our national economy**

Virtually every sector of the Nation's economy relies upon rapid and reliable access to environmental data and information. NOAA's environmental data form the basis for making decisions that have far-reaching eco-

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NOAA/NESDIS/NGDC

*Solid Earth Geophysics Division  
David Skaggs Research Center  
325 Broadway, Mail Code E/GC  
Boulder, Colorado 80305  
E-mail: allen.m.hittelman@noaa.gov*

conomic consequences on local, regional, and global levels. These data, which cost billions of dollars to collect, are distributed to, and used by government, commerce, industry, science, engineering, and national defense.

NOAA's satellites and Data Centers operated by NESDIS-focus upon the delivery of high-quality scientific information to U.S. industry to meet its needs. The dramatic explosion of affordable information technologies throughout the 1990s and the growing value-added industry have helped NESDIS reach all economic sectors.

NESDIS is committed to preserving the long-term data record of environmental conditions, to capturing current conditions and trends, and to providing these data and information to ensure that the business sector has the best available insight to secure the success of our Nation's economic future. Records that can be used in past, present, and future applications are key:

• *Past*

Records of our environment are crucial to understanding Earth's evolving nature and sustainable health.

• *Present*

Observations from space and from ground-based systems are essential in helping society understand our ever-changing environmental conditions, prepare forecasts, and evaluate seasonal trends.

• *Future*

Trends must be understood to ensure that our economy will continue to be prosperous.

**NESDIS needs: U.S. industry delivers**

As a satellite service, NESDIS procures launches, spacecraft, instruments, ground systems, technical services, and commercial imagery. NESDIS Data Centers also receive support from numerous and geographically diverse commercial entities. NESDIS depends on the skills and expertise of U.S. industry. Its annual budget for space systems and related services exceeds \$500 million. From 1990 through 2000, total estimated contract value for satellite programs and associated services reached \$3.72 billion.

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**EARTH SYSTEM MONITOR**

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

National Oceanographic Data Center  
NOAA/NESDIS E/OC1  
SSMC3, 4th Floor  
1315 East-West Highway  
Silver Spring, MD 20910-3282

**EDITOR**

R. Torstenson

Telephone: 301-713-3281 ext.107

Fax: 301-713-3302

E-mail: [rtorstenson@nodc.noaa.gov](mailto:rtorstenson@nodc.noaa.gov)

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**U.S. DEPARTMENT OF COMMERCE**

Donald Evans, Secretary

**National Oceanic and Atmospheric Administration**

Conrad C. Lautenbacher, Jr.,  
Under Secretary and Administrator

### New Geoid model provides accurate elevations

A new Geoid model and software with the capacity to provide accurate elevations across Canada was released on October 17 by Natural Resources Canada (NRCan) at the GeoSask2001 conference in Regina, Saskatchewan. The Canadian Gravimetric Geoid model (CGG2000) and Canadian Height Transformation Package (GPS•H Package), the latest advance in the Canadian Spatial Reference System (CSRS), allows direct conversion of NAD83 (CSRS) GPS ellipsoidal heights to the more useful orthometric elevations (heights above mean sea level), referenced to Canada's standard vertical datum, CGVD28.

Users will now have the capability, depending on the procedures used, to obtain decimetre-level elevations or better throughout the country. This capability will result in economic and environmental benefits. Vertical data is used for such applications as water and watershed management, floodplain mapping and marine safety. It is also used in GPS-based precision farming, such as controlling unwanted runoff and stream contamination, and for forestry applications such as modeling the spread of wildfires. In order to integrate and share this data, it must be based on standardized measurements and referenced to a national infrastructure.

The CGG2000 model replaces the previously adopted GSD95 model. Through advances in the CSRS and products such as these, NRCan provides a framework for the greatest possible accuracy for all spatial positioning and makes this framework as accessible as possible to GPS users in Canada. The CSRS system is a fundamental building block for GeoConnections, a federal-provincial partnership for sharing and integrating geospatial data on the Internet.

The GPS•H Package includes the Canadian Gravimetric Geoid model (CGG2000), HTv2.0, and the new version of the software GPS•Hv2.1. Subscribers to the CSRS database can download the package free from <http://www.geod.nrcan.gc.ca/> (under Products and Services). It is also available on CD-ROM for \$40 in either English or French from the following address:

Geodetic Survey Division, Room 440, 615 Booth Street, Ottawa, Ontario K1A 0E9 Canada. Telephone (613) 995-4410.

## News briefs

### Afghanistan data reference list

In support of events occurring in Afghanistan, the National Climatic Data Center (NCDC) has developed a comprehensive bibliography of the data, climatologies, and research that the NCDC has or is currently performing for Southwest Asia. NCDC has developed numerous and very detailed climate summaries for Afghanistan and surrounding countries over the years. The Center has extensive data bases containing observational data for these areas and is also developing satellite products that could be useful. Knowledge of these data, climatologies, and research could avoid duplication of efforts to develop the same information. This could save valuable time and resources that could be used instead to build upon the existing information base. NCDC is planning the development of an Afghanistan Climate web page that will provide an easier mechanism to assimilate the information. Due to the sensitive nature of the information, this bibliography will not be externally publicized at this time. For public distribution, NCDC will continue to maintain a recently developed web page that contains more general summaries and information: <http://wf.ncdc.noaa.gov/oa/climate/research/afghan/afghan.html>.

### Increase in solar activity

Although Solar Cycle 23 peaked in April 2000, a secondary peak of activity is occurring, consistent with earlier solar cycle behavior. In the last year the National Geophysical Data Center has monitored more than 17 X-level solar flares. In April 2001 the greatest solar X-ray flare ever recorded occurred. More recently, several X-level flares and large coronal mass ejections caused environmental effects on Earth, including the impact of satellites with high-energy protons, blinding them temporarily. While the Ulysses satellite observes the Sun calming down at its high latitudes with the solar polar fields reversing, at the lower latitudes some enormous sunspot regions are still emitting high energy particles from flares. A Cosmic Ray Ground Level Event (GLE) followed by a major Forbush decrease was detected on November 4.

### GOES satellite data used to understand time scales

A new educational exhibit for the Science Museum of Minnesota is being created with a theme on scales of time. The exhibit will include satellite movie loops spanning from 24 hours up to one year using the visible and infrared channels from the GOES Imager, which is capable of scanning the entire United States every fifteen minutes. The exhibit will give visitors a better sense of the fluid nature of our atmosphere, how storms evolve, move, and interact with fronts and other storms over a time frame of hours to weeks. Movement of the jet stream and its ceaseless undulations will also be depicted using the popular water vapor imagery. All images were provided by the National Climatic Data Center which will be credited as the source. The availability date of this new exhibit is not known.

### Canada/Mexico/United States Troika a big success

The Canada/Mexico/United States Troika on Monitoring Near-Real Time Climate Extremes, hosted by NOAA's National Climatic Data Center, was a big success. The results of the workshop included the development of a plan that begins with an annual extremes monitoring product for North America scheduled to be released in time for the WMO Annual Climate Statement for 2002. Each country was very enthusiastic about this cooperative effort in monitoring and assessing climate extremes, particularly with the prospect of an eventual system for near-real time monitoring across all three countries. The NCDC presentation described current data and product delivery systems, future plans for online data to be added to those systems, the overall data model and requirements for the systems, and the factors and impact of the placement of data online.

### New NGDC image in National Geographic ocean atlas

The just-published National Geographic Atlas of the Oceans displays a map of the ocean floor topography as represented by NGDC's new ETOPO2 data base. Peter Sloss of NGDC prepared the shaded relief image in National Geographic's requested Miller Projection using their required color scheme. Grid lines were then added by the publisher.

### *Economic value, from page 2*

NESDIS provides jobs and opportunities for regional economic growth through employment and contracts. NESDIS comprises 830 Federal employees and 530 contractor support members. This dedicated team works diligently to ensure timely access to global environmental data.

NESDIS is eagerly harnessing the best research and development, production, operations, and innovative business solutions that U.S. industry offers to ensure continuity and improvement of our critical services.

### **Commercial remote sensing: licensing and advocacy**

NESDIS has regulatory authority to license private, remote-sensing space systems. On behalf of the Secretary of Commerce, NESDIS-through a responsive, predictable, licensing program-has issued 17 licenses covering more than 40 satellites. NOAA plays an integral role in the Federal government's policy to support and enhance U.S. competitiveness in this exciting new sector of the space and information community. These new commercial sources of geospatial information will contribute to wide-ranging civil, commercial, and military applications.

As a separate and independent function from licensing, NESDIS is providing NOAA with leadership in acquiring data as the commercial remote-sensing industry develops. Industry data have helped NOAA with the acquisition of ocean color information to assist in the effective management of fisheries, space-based synthetic aperture radar data for operational ice forecasting, and high-resolution imagery for coral reef monitoring.

### **NOAA's eyes on the environment**

As the Federal Government's leading provider of environmental data, NESDIS supports the goals of e-government. Our award-winning, Web-based services benefit society by providing timely information to a broad segment of the U.S. economy. These services help:

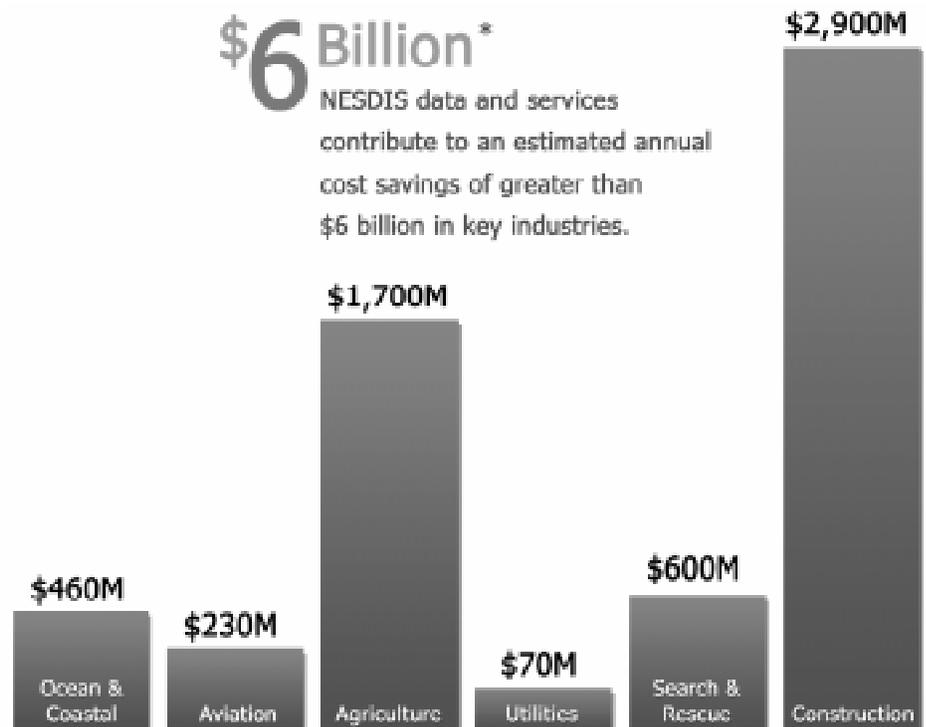
- Insurance companies resolve claims more rapidly
- Energy companies manage utilities more effectively
- Engineers develop safer construction criteria
- Community planners address environmental impacts
- Public safety providers improve their level of services.

Industry interacts with NESDIS on numerous levels-developing state-of-the-art technology for NOAA's satellite programs, constructing observation networks, building vast warehouses of data, and transmitting and displaying information to millions of users. Industry uses NESDIS data to develop value-added products such as weather derivatives that help manage weather-related risks.

Day and night, NOAA scientists maintain their vigil, monitoring changes detected by satellites hovering above Earth and from land, ocean, and atmospheric-based observing systems. In partnership with industry and academia, NESDIS develops critical information streams, which are shared worldwide to sustain life and empower healthy economies.

### **NESDIS Delivers:**

- Improved global weather observations
- Data for improved construction designs
- Estimates of crop, range land, and forest health
- Fuel savings for maritime and air transportation
- Increased efficiency of U.S. fishing fleets
- Search and rescue information
- Volcanic ash cloud monitoring for airline safety
- Improved Great Lakes navigation during ice season
- Better water management in the western U.S.
- El Nino sea surface temperature measurements
- Tracking capabilities to manage migratory birds and marine mammals
- Early forest fire detection
- Global drought watch
- Data for climate studies
- Ozone hole monitoring
- Solar storm warnings ■



\* estimated by Lockheed Martin study, 1999; Inflation adjusted by Rodney Welke, NOAA, 2001.

# Detecting shoreline feature change within ports using high-resolution satellite imagery

## *NOAA's Coast and Shoreline Change Analysis Program*

*Susan Vidal, Doug Graham, and Maryellen Sault*  
Remote Sensing Division  
National Geodetic Survey  
NOAA/NOS

The National Geodetic Survey (NGS) a program office in the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA), is tasked with providing shoreline and associated data for mapping our nation's 95,000 miles of coastline. The Remote Sensing Division (RSD) within NGS, conducts photogrammetric surveys to photograph and when prioritized, compile shoreline and associated data for application to the Office of Coast Survey's nautical charts. The update cycle for a nautical chart varies from as often as every 6 months to as infrequently as 12 years depending on factors including the rate of cultural and natural changes. This shoreline data is available to the coastal GIS community through the National Geodetic Survey Shoreline Data Explorer website.

The Coast and Shoreline Change Analysis Program (CSCAP), managed by NGS, acquires contemporary high-resolution imagery to evaluate ports. The imagery is accurately georeferenced and compared with the nautical chart to detect changes. The analysis of these discrepancies is used to determine which ports or areas within a port require expensive photogrammetric survey mapping.

### **CSCAP procedure**

Imagery with the highest spatial resolution is required to detect changes within ports. To date, NGS has evalu-

ated four primary sources of high-resolution satellite imagery: SPOT, IRS, SPIN2, and IKONOS. The spatial resolution of SPOT (SPOT, Inc.) and IRS (SpaceImaging, Inc.) panchromatic imagery (10 and 5 meters respectively), is not adequate to detect a significant number of charted features within ports. SPIN2 (Aerial- Images, Inc.) panchromatic imagery has a 2 meter spatial resolution which allows for identification of many more shoreline features than are visible on IRS or SPOT imagery. SPIN2 imagery is orthorectified, although not necessarily accurately georeferenced. The newest source of high-resolution satellite imagery is IKONOS (SpaceImaging, Inc.). NGS acquires IKONOS panchromatic "geo" imagery (1 meter spatial resolution) that has been map oriented (aligned to conform with a map projection using satellite ephemeris data), but not orthorectified by the vendor. Although IKONOS and SPIN2 imagery provide adequate spatial resolution, they are not georeferenced accurately enough by the vendor for direct use in shoreline change analysis.

When NGS receives satellite imagery ( IKONOS "geo" or SPIN2), there is a shift of up to 30 meters from the actual geographic position of the scene (Figures 1a and b). This shift must be corrected in order to be able to make meaningful comparisons with other shoreline data. This is accomplished by NGS personnel through "re-georeferencing" the satellite imagery using two-dimensional polynomial or rubber sheeting transformations.

Georeferencing satellite imagery within CSCAP involves three steps. First, reference information (Ground Control Points or GCPs) is obtained from maps or from GPS observations. The most accurate reference maps currently available for port areas are either

raster scanned T-Sheet shoreline manuscripts produced by NOAA or vector digital cartographic feature files produced by NGS, NOAA (Byrnes et al., 1991, Crowell et. al., 1991). At the present time, raster T-Sheets are not georeferenced when NGS receives them, so georeferencing must be the first step when they are used for reference data.

The next step is to register the imagery to the reference map. Corresponding points that are clearly visible on both the image and the reference map are chosen as GCPs. Since two-dimensional polynomial transformations are being used, the GCPs as well as the features of interest must be at or near the same elevation, in this case, sea level. After the appropriate GCPs have been selected, those with the largest RMS errors are eliminated from the transformation. As the selection of GCPs narrows, an even distribution of points across the image must be maintained. The combination of polynomial order and numbers of final GCPs has varied for SPIN2 imagery from first order polynomial and 7 high quality control points at Detroit, MI, to rubber sheeting and over 60 control points at Charleston, SC. Results for IKONOS imagery have been much more uniform. Typically, first and second order polynomial transformations using 20 to 40 control points have yielded satisfactory results. After georeferencing has been completed, the resulting image is checked for positional accuracy.

Final image georeferencing accuracy is the combination of errors produced during reference map creation, reference map georeferencing, and image registration. Reference data errors range from about 0.5 meters for GPS positions to less than 1.5 meters for T-sheets compiled during the 1970s and

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NOAA/NOS

National Geodetic Survey  
1315 East West Highway  
Silver Spring, Maryland 20910  
E-mail: susan.vidal@noaa.gov

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*Shoreline feature change, from page 5*

1980s (Crowell, et.al., 1991). To illustrate typical accuracy of image georeferencing using the process described above, the following additional errors were computed for an IKONOS image of Tacoma, WA:

Source of Errors	RMS X Error	RMS Y Error	Total RMS Error
T-sheet Georeferencing	0.19 meters	0.46 meters	0.49 meters
Image Registration	2.20 meters	1.80 meters	2.80 meters
Combined RMS Errors	2.39 meters	2.26 meters	3.29 meters

The same Tacoma, WA IKONOS image was compared with an independent source of higher accuracy. In this case, 33 GPS observation check points with an average horizontal accuracy of 0.495 meters were analyzed. RMS X error was 1.69 meters, RMS Y error was 1.86 meters, and total RMSE was 2.51 meters when distinct points visible on the image were compared with the GPS point data supplied by the Office of Coast Survey Navigation Services Division field operations. The circular error at the 95% confidence level for this image is 4.34 meters, when computed according to National Standard for Spatial Data Accuracy procedures (Federal Geographic Data Committee, 1998). Because two-dimensional georeferencing techniques were used, these accuracy assessment statements are only valid for points at or near sea level.

After the imagery has been georeferenced, it is then used for comparison to the raster Nautical Chart or vector Electronic Navigational Chart. Much of the imagery that NGS has obtained was received only a month or two after the acquisition date. This imagery provides an excellent means for comparing "current" conditions with the representation of the shoreline on the charts. NGS personnel view the imagery as a base layer in a GIS along with the raster or vector chart. Descriptions of differences between the chart and image are recorded along with the geographic location of each discrepancy.

**Future activities**

NGS will evaluate new sources of imagery for CSCAP as they become available. Efforts will continue to assess the accuracy of image georeferencing and mono shoreline compilation from panchromatic satellite imagery. With the release of high-resolution satellite sensor models, NGS could investigate stereo softcopy compilation that would improve overall positional accuracy and feature identification.

**Conclusion**

The Remote Sensing Division (RSD) of the National Geodetic Survey manages the Coast and Shoreline Change Analysis Program (CSCAP) to make more efficient use of its remote sensing resources to map our nation's coastline. CSCAP uses high-resolution contemporary imagery such as 2 meter SPIN2 orthorectified imagery, and 1 meter IKONOS non-orthorectified imagery to detect shoreline changes when compared with nautical charts.

NGS personnel improve the initial geometric accuracy of the imagery supplied by the vendor to meet requirements for identifying shoreline changes through two-dimensional techniques. Well-defined points near the shoreline plane of reference are chosen from an accurate base map (NOAA's georeferenced raster T-Sheets or vector digital cartographic feature files) or from GPS observations. The imagery is then rectified to conform to the geometry of these reference points, resulting in imagery that is georeferenced to

within 2 to 5 meters of true geographic position.

With limited funding resources for Federal Government mapping, CSCAP provides a cost effective means to update nautical charts within selected ports. Areas of interest could be expanded to include port approaches and open coastal areas given dedicated funding. CSCAP is currently used as a planning tool to help set priorities in determining which regions require photogrammetric mapping. Features of significant change may be extracted from the CSCAP georeferenced imagery and applied to the nautical chart until a more accurately controlled survey can be conducted. CSCAP provides reliable and contemporary updates that promote national commerce by improving safe navigation within our ports.

**References**

- Byrnes, M., McBride, R., and Hiland, M., 1991. Accuracy Standards and Development of a National Shoreline Change Data Base. *Coastal Sediments >91 Proceedings*, pp. 1027-1042.
- Crowell, M.; Leatherman, S. and Buckley, M., 1991. Historical Shoreline Change: Error Analysis and Mapping Accuracy. *Journal of Coastal Research*, Vol. 7, No. 3, pp. 839-852.
- Federal Geographic Data Committee, 1998. Geospatial Positioning Accuracy Standards, Part 3: National Standards for Spatial Data Accuracy. Available online: [www.fgdc.gov/standards/status/sub1\\_3.html](http://www.fgdc.gov/standards/status/sub1_3.html). ■

# Management of the Florida Keys Seascape

## *Sustained ecological research of the SEAKEYS environmental monitoring program*

J. Chris Humphrey  
SEAKEYS Field Manager  
Florida Institute of Oceanography  
Keys Marine Laboratory

Ecological processes vary greatly from environmental management scheme time scales. The life long argument of which happens first and the ensuing causes have always been up for interpretation. One's perception on a day to day basis may actually be a lot different than the true environmental trends. Long-term data sets have always helped put some black and white or

"real" trends into the gray areas of resource management.

The SEAKEYS environmental monitoring program, an oceanographic extension to the meteorologically oriented Coastal-Marine Automated Network (C-MAN) of NOAA, has accumulated an unparalleled long-term database of meteorological and oceanographic data from the Florida Straits and Florida Bay. SEAKEYS was organized in 1991 by the Florida Institute of Oceanography (FIO) with initial funding from the John D. and Catherine T. MacArthur Foundation and continuing funding from the South Florida Ecosys-

tem Restoration, Prediction and Modeling (SFERPM) program, which is administered by the National Oceanic and Atmospheric Administration (NOAA). The SEAKEYS network is comprised of six C-MAN stations and one Coastal Ocean Monitoring and Prediction (COMP) station in cooperation with the University of South Florida's College of Marine Science. The COMP station is the northwestern most station of the SEAKEYS network and the southern most link to the COMP system. Together, the two near-real time systems create an unprecedented coverage of the Florida Keys environment (Table 1).

**Table 1.**

Station ID	FWYF1	MLRF1	LONF1	SMKF1	SANF1	DRYF1	NFB
Station Location (lat. & long.)	Fowey Rocks N 25°35'25" W 080°05'48"	Molasses reef N 25°00'36" W 080°22'48"	Long Key N 24°50'36" W 080°51'42"	Sombrero reef N 24°37'36" W 081°06'36"	Sand Key N 24°27'25" W 081°52'42"	Iowa Rock N 24°38'18" W 082°51'42"	N.W. Florida Bay N 25°05'00" W 081°05'00"
Site Depth	2 meters	1.5 meters	2 meters	2.5 meters	4 meters	6 meters	3.5 meters
Sensor Depth	1 meters	1 meters	1 meters	1 meter	1,3 meters	1,3 meters	1 meter
Oceanographic Instruments	CT	CT	CT; water level; 1m (PAR) Trans.; Fluor.	CT; water level; 1m (PAR) Trans.;Fluor (4/99)	CTD; 1,3 meter (PAR) 4/99	CT; CTD	CT; water level; Trans.; Fluor (4/99)
Sensor Manufacturer	Falmouth	Falmouth	Falmouth,Bartex, Li-cor,Wetlabs	Falmouth,Bartex, Li-cor,Wetlabs	Falmouth,Li-cor	Falmouth	Falmouth, Greenspan, Bartex
Data on the Internet*	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	2,4

**\*Internet sites**

1. National Data Buoy Center (meteorological, sea temperature, and water level data only)

<http://www.ndbc.noaa.gov>

2. Coral Page/ Atlantic Oceanographic and Meteorological Laboratory

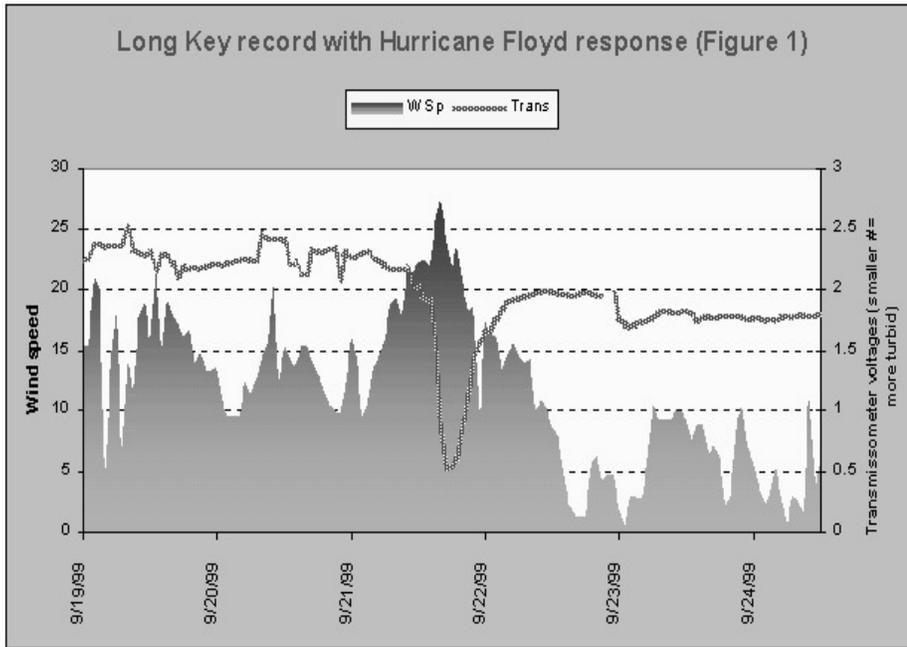
<http://coral.aoml.noaa.gov/cman>

3. National Weather Service (meteorological, sea temperature, and water level data only)

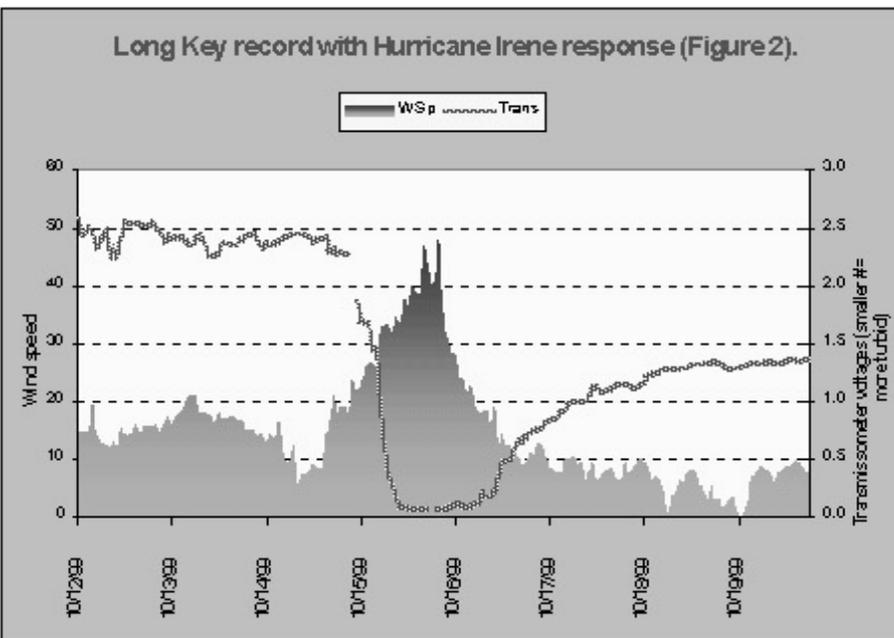
<http://nws.fsu.edu/buoy>

4. University of South Florida

<http://comps.marine.usf.edu/nfb>



▲ Figure 1. Wind stress response during Hurricane Floyd.



▲ Figure 2. Wind stress response during Hurricane Irene.

Daily near-real time SEAKEYS data are available to researchers via NOAA's Coral Health and Monitoring Program (CHAMP) web site at <http://www.coral.noaa.gov>, while historical data are available at <http://www.neptune.noaa.gov>.

**Regional monitoring: oceanographic patterns**

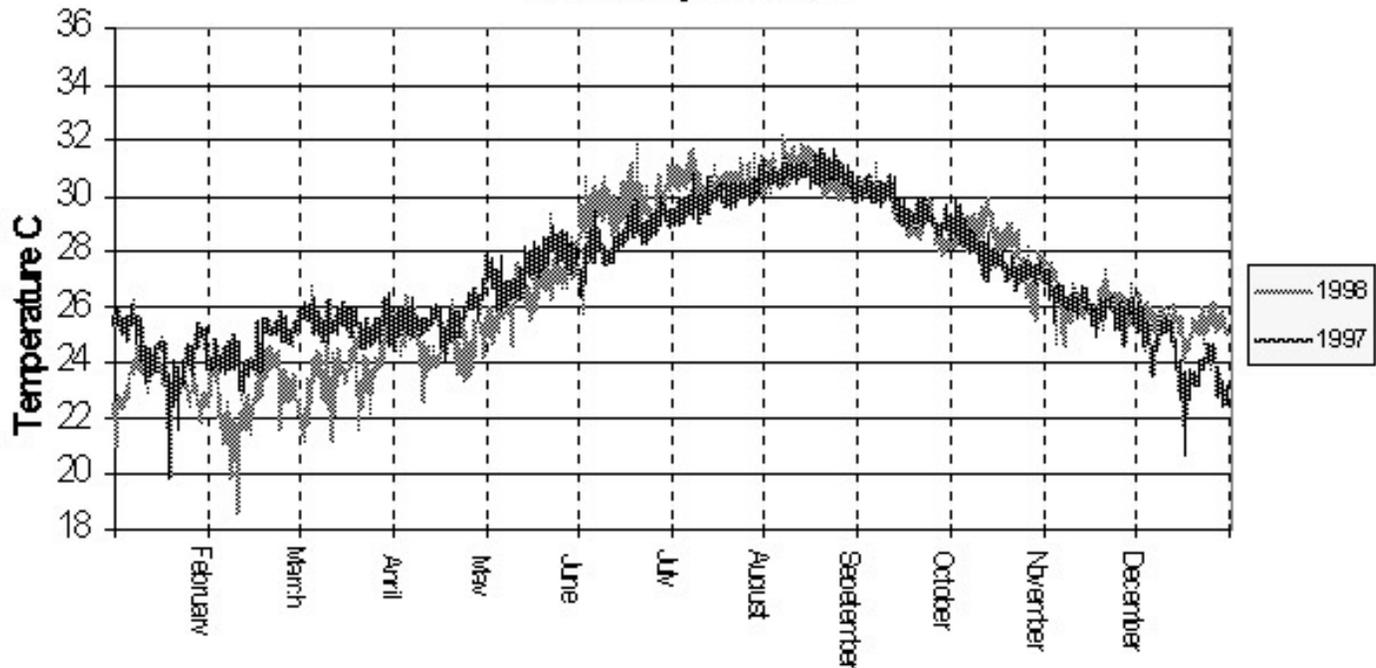
Severe conditions reported by the SEAKEYS stations include Hurricanes Andrew, Georges, Irene, tropical storm Mitch, Storm of the Century, and the 1998 Ground Hog Day storm. During such meteorological events the modeling community has gained insight into wind stressors in the Florida Keys environment. For example, wind events during Hurricanes Irene and Floyd show similar wind stress responses under similar conditions. (Figures 1,2). The monitoring network was also designed to track patterns and their changes between average years and extra ordinary occurrences. During the summer of 1993 record floods occurred in the Mississippi river eventually resulting in depressed salinity in the Loop current in the Gulf of Mexico and hence the Florida Current. Abrupt drops in salinity were recorded at all of the SEAKEYS network C-MAN stations during the month of September (Ogden *et. al.*, 1994). The 1997-98 El Nino and La Nina Southern Oscillation events (ENSO) were captured and quantified using the SEAKEYS Oceanographic data. For example, sea temperatures peaked at 32.1 C in 1998, a full degree centigrade warmer than the year before. Sea temperatures were also two degrees centigrade cooler than the year before at the same site during winter conditions (Figure 3).

**Multifaceted use structure**

The SEAKEYS network has long been known for its reliable and sometimes lone existent data in the Florida Keys. The SEAKEYS program's presence has become an essential tool for weather forecasters, marine sanctuary managers, hurricane research staff, physical oceanographers, modelers,

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**Figure 3. Mblasses reef 1997 to 1998  
Sea Temperatures**



▲ **Figure 3.** SEAKEYS oceanographic data was used to quantify the 1997-1998 ENSO events.

#### SEAKEYS, from page 9

remote sensing platforms, emergency management, law enforcement, and commercial shipping traffic. Several of the SFERPM models use the SEAKEYS network data. One of the many models that use the SEAKEYS network is NOAA's Coral Reef Early Warning System (CREWS) (Hendee, *et.al.* in press). CREWS, which utilizes the near real-time hourly data from six SEAKEYS stations, is an online expert system which monitors environmental conditions on the reef that are theoretically conducive to coral bleaching. If these conditions occur, alerts are sent via e-mail to researchers and posted to the Web at <http://www.coral.noaa.gov/sferpm/seakeys/es>. CREWS, coupled with

NOAA's space-based Sea Surface Temperature (SST) derivations, utilize SEAKEYS data to extend the predictive capabilities through ground truth measurements within the Florida Keys region.

Monitoring of the Florida Keys Coastal environment is important for scientific, economic, and management reasons. The SEAKEYS program's involvement in these projects shows its commitment to understanding the Florida Keys environment. By continuing to upgrade and improve program abilities and capacities to monitor the environment, the SEAKEYS should be better equipped to assist users in answering future management questions.

#### References

- Ogden, J.C., J.W. Porter, N.P. Smith, A.M. Szmant, W.C. Jaap, D. Forcucci. 1994. A Long-term Interdisciplinary study of the Florida Seascape. *Bull. Mar. Sci.* 54(3):1059-1071.
- Hendee, J.C., E. Mueller, C. Humphrey, and T. Moore. 2001. A data-driven expert system for producing coral bleaching alerts at Sombrero Reef in the Florida Keys. *Bulletin of Marine Science* 69(2): 673-684. ■

## Reagan National Airport operations decision

Rainer Dombrowsky of National Weather Service Headquarters contacted the National Climatic Data Center and requested wind rose data for Reagan National Airport, just outside of Washington, DC. The airport was closed on September 11 following the terrorist attacks, and the Federal Aviation Administration needed the data to make decisions about future operations at the airport. Because of its proximity to the White House, Capitol, and significant national monuments, the airport remained closed even after other airports were allowed to reopen. Overnight NCDC produced a new 1991-2000 ten-year monthly, seasonal, and annual day-night wind rose tabulation and provided it to Mr. Dombrowsky. On October 2, President Bush announced that Reagan National Airport would reopen under new restrictions. Planes can fly in and out of the airport only during the hours from 7:00 a.m. to 10:00 p.m., and flight patterns that follow the Potomac River near the White House, Capitol, Pentagon, and CIA were temporarily prohibited.

Contact: NCDC

## Detailed coastal relief of Florida and Gulf of Mexico on CD-ROM

The National Geophysical Data Center has distributed three additional volumes of the Coastal Relief Model series, covering the Florida and Gulf of Mexico coastlines. Volume 3, Florida and Eastern Gulf of Mexico, covers the east and west coasts of the state of Florida. Volume 4, Central Gulf of Mexico, covers the states of Alabama, Mississippi, and Louisiana. Volume 5, Western Gulf of Mexico, covers the Texas coast. Each of the volumes integrates land topography with offshore bathymetry into a geographic 3 arc-second grid, which is managed by the GEODAS software which is on each CD-ROM. Any common web browser may be used to access the data and images. Software enables users to create custom-sized grids of areas within the coastal zone at a variety of resolutions and in several common grid formats. Five CD-ROMs are currently available covering the U.S. East and Gulf Coasts. See <http://www.ngdc.noaa.gov/mgg/coastal/coastal.html> for more information.

Contact: NGDC

## Data products and services

### NGDC posts GIS interface for peer review

A preview of the Geographic Information Systems ArcIMS interface, to the NGDC Index to Marine and Lacustrine Geological Samples database, is now accessible at [http://map2.ngdc.noaa.gov/website/sample\\_index/](http://map2.ngdc.noaa.gov/website/sample_index/). NGDC manages the Sample Index for twenty international oceanographic institutions and government facilities, which provide data and oversight. The original Index to Marine Geological Samples database was recently expanded to include data for lake samples at the newly-formed Lacustrine Research Center, funded by the National Science Foundation, at the University of Michigan. Additional ArcIMS user interfaces to NGDC's marine geology data files are under development by NGDC's Marine Geology and Geophysics Division in collaboration with the Geospatial Data team.

Contact: NGDC

### CONTACT POINTS

#### National Climatic Data Center (NCDC)

828-271-4800

Fax: 828-271-4876

E-mail: [Climate Services - orders@ncdc.noaa.gov](mailto:ClimateServices-orders@ncdc.noaa.gov)  
[Satellite Services - satorder@ncdc.noaa.gov](mailto:SatelliteServices-satorder@ncdc.noaa.gov)

WWW: <http://www.ncdc.noaa.gov/>

#### National Geophysical Data Center (NGDC)

303-497-6826

Fax: 303-497-6513

E-mail: [info@ngdc.noaa.gov](mailto:info@ngdc.noaa.gov)

WWW: <http://www.ngdc.noaa.gov/>

#### National Oceanographic Data Center (NODC)

301-713-3277

Fax: 301-713-3302

E-mail: [services@nodc.noaa.gov](mailto:services@nodc.noaa.gov)

WWW: <http://www.nodc.noaa.gov/>

#### NOAA Server Data Directory

301-713-0575

Fax: 301-713-0819

E-mail: [help@esdim.noaa.gov](mailto:help@esdim.noaa.gov)

WWW: <http://www.eis.noaa.gov/>

#### NOAA Central Library

Reference Services:

301-713-2600

Fax: 301-713-4599

E-mail: [reference@nodc.noaa.gov](mailto:reference@nodc.noaa.gov)

WWW: <http://www.lib.noaa.gov/>

## Climatological report for 2002 Winter Olympics

The National Climatic Data Center has completed a technical report describing the climatology for the venues of the 2002 Winter Olympics in Salt Lake City, along with other areas of northern Utah. The 26-page report includes a climatological narrative; nine data tables/summaries showing the February means and extremes for temperature, precipitation, snowfall, and snow depth; and six contoured analyses of temperature, snowfall, and snow depth. The report has been provided to NOAA Public Affairs and to the National Weather Service, for inclusion in their package of materials for the Games. The report will also be placed online for free access.

Contact: NCDC

## Ice Ages slide set

A slide set on The Ice Ages covering the causes of the Pleistocene ice sheets is now available through the NOAA/NGDC Paleoclimatology Program website at <http://www.ngdc.noaa.gov/paleo/slides.html> where the slide set can be purchased or accessed online. The slide set traces the history of investigation of the ice ages, from the discovery of glacial erratics and moraines in the 1800s to recent investigations of the glacial-interglacial cycles using evidence found in ice cores and deep sea sediments. The set includes photos of evidence of glaciers, pictures, graphs from ice cores and marine sediment cores, and pictures illustrating changes in the Earth's orbit.

Contact: NGDC

## Comprehensive snow climatology

The National Climatic Data Center has prepared the most comprehensive snow climatologies ever for the United States. The data base consists of snow climatology and return period statistics for over 5,000 cooperative stations in the contiguous United States and Alaska. It was created under a grant from the Federal Emergency Management Agency to provide an objective basis for declaring federal snow disasters. The snow climatologies can be accessed via the web and will be updated operationally. The web page address is: <http://lwf.ncdc.noaa.gov/oa/climate/monitoring/snowclim/mainpage.html>.

Contact: NCDC

## NSIDC'S Frozen Ground Data Center seeks assistance

Permafrost underlies about 24% and seasonally frozen ground underlies up to 60% of the surface of the Northern Hemisphere. Data and information on frozen ground collected over past decades and in the future are critical for fundamental process understanding, environmental change detection, impact assessment, model validation, and engineering applications. However, much of this information remains widely dispersed and relatively unavailable to the science and engineering community, and some data are in danger of being lost permanently.

The International Permafrost Association (IPA) has developed a strategy for data and information management to meet the requirements of the cold regions science, engineering, and modeling community.

The World Data Center (WDC) for Glaciology at Boulder and the National Snow and Ice Data Center (NSIDC) have played an active role in implementing this strategy by developing and distributing the first Circumpolar Active-Layer Permafrost System (CAPS) CD-ROM including the Global Geocryological Database (GGD). Now, the WDC, in collaboration with the International Arctic Research Center (IARC), is developing this Web site to help expand and further improve access to frozen ground related data and information.

Frozen ground data and metadata contributions are being sought. The GGD may be browsed to determine current frozen ground data holdings here and around the world. The frozen ground data page lists the WDC's current frozen ground data holdings (<http://nsidc.org/frozenground/index.html>). ■



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