

Fieldwork

USGS Researchers Lead International Team Investigating Damage Caused by Offshore Earthquake Near World's Largest Nuclear Power Plant in Japan

By Rob Kayen

On July 16, 2007, a magnitude 6.6 earthquake occurred off the coast of Japan near the world's largest nuclear power plant. The $M=6.6$ mainshock of the Niigata Chuetsu Oki earthquake struck in the Japan Sea near the west coast of Honshu at 10:13 a.m. local time, with a shallow estimated focal depth of 10 km (details posted at URL <http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/us2007ewac.php>). The earthquake affected an approximately 100-km-wide area along the coast of southwestern Niigata prefecture.

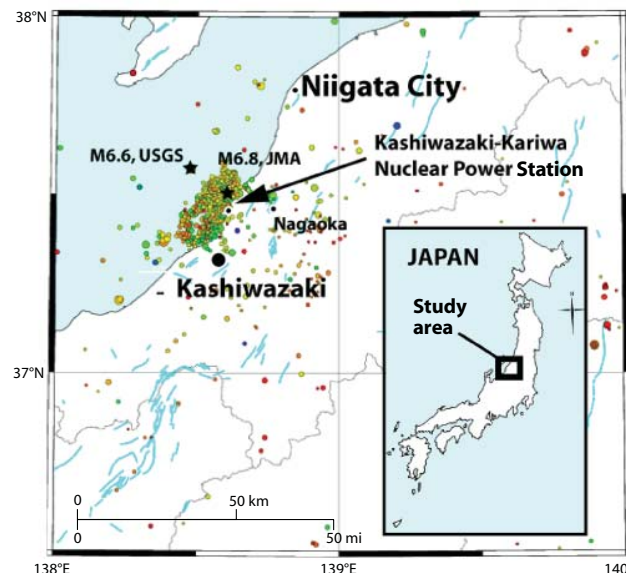
The site that sustained the highest seismic intensity was the Kashiwazaki-Kariwa Nuclear Power Station of the Tokyo Electric Power Co. (TEPCO), with seven independent reactors and a total output of 8,200 MW. This facility is heavily instrumented with strong-motion recorders, which captured the highest-amplitude motions ever recorded at a nuclear power plant. Ground-level and reactor-floor shaking was as high as $0.68 g$ ($1 g$ is approx 9.81 m/s^2 , the acceleration due to gravity at the Earth's surface), and the accelerations at the top of steam turbines and reactor roofs were twice as high.

Critical structures at the power plant appeared to have performed well, in view of the intensity of the shaking and the damage to the ground surrounding the reactors, including extensive ground settlement and evidence of liquefaction near the waterfront. Although shutdown of the reactors proceeded safely, some secondary damage did occur, and the plant remains shut down for ongoing inspection and repair. Outside the power plant, the earthquake strongly shook the nearby city of Kashiwazaki, resulting in 11 fatalities and

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Reconnaissance-team members **Scott Brandenburg** (UCLA, left) and **Brian Collins** (USGS) recording landslide-damage observations.



Epicenters of main shock (stars) and aftershocks (dots) of the July 16, 2007, Niigata Chuetsu Oki, Japan, earthquake. Note slightly different main-shock locations and moment magnitudes determined by the USGS and the Japan Meteorological Agency (JMA). The aftershock pattern is useful for defining the principal rupture plane of the event. The world's largest nuclear power plant, the Kashiwazaki-Kariwa facility of the Tokyo Electric Power Co. (TEPCO), which is sited in the epicentral region, sustained the strongest recorded motions of the earthquake.

Sound Waves

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Submission Guidelines

Deadline: The deadline for news items and publication lists for the April issue of *Sound Waves* is Tuesday, February 12.

Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.

Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator® files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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Can't find the answer to your question on the Web? Call 1-888-ASK-USGS

Want to e-mail your question to the USGS? Send it to this address: ask@usgs.gov

Fieldwork, continued

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nearly 2,000 injuries. Approximately 1,100 residences collapsed, almost all of them old houses with wood and clay walls and heavy clay-tile roofs.

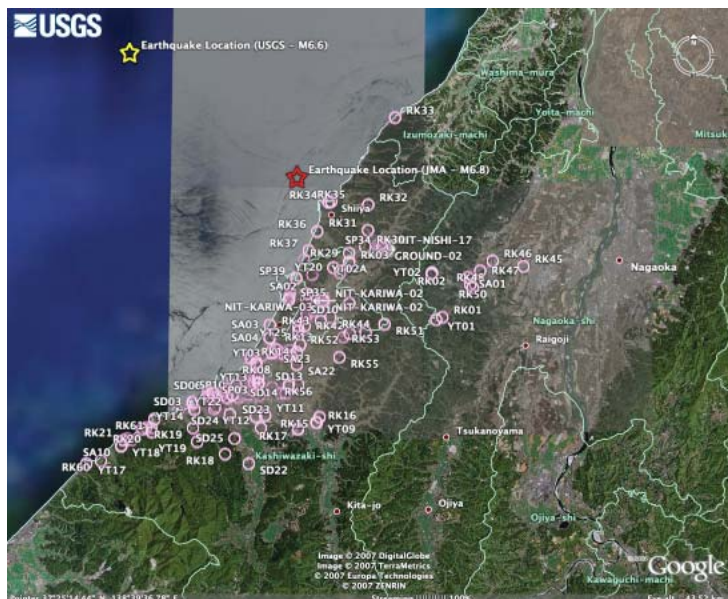
The earthquake reconnaissance of the Niigata event, begun only hours after the quake, was a combined effort by U.S. and Japanese engineers. From the United States, the National Science Foundation (NSF) supported the investigations of the Earthquake Engineering Research Institute (EERI) and the Geo-Engineering Earthquake Reconnaissance (GEER). The Japanese participants were from academia, the Japanese Society of Civil Engineers, and the Japan Association for Earthquake Engineering. The NSF reconnaissance-team leader for the combined EERI-GEER effort was USGS researcher **Robert Kayen**. USGS Mendenhall Postdoctoral Research Fellow **Brian Collins** was an investigator in the study and led the capture of critical terrestrial lidar (light detection and ranging) data at damage sites (for more information about terrestrial lidar, see URL <http://pubs.usgs.gov/fs/2006/3111/>). USGS researcher **Clint Steele** managed the data organization and produced multimedia Google Earth

maps for the investigation report (download maps from URL <http://walrus.wr.usgs.gov/infobank/n/nii07jp/html/n-ii-07-jp.sites.kmz>). During the investigation, USGS scientists participated in interviews with the Japanese print media.

The first reconnaissance team was organized and sent to the affected region within 48 hours after the earthquake, and in the following weeks, several other teams joined the effort to assess structural damage and soil effects at the nuclear power plant and surrounding cities. The teams quantified the spatial extent and amplitude of ground failures, soil liquefaction, and landslides, as well as damage to bridges, piers, ports and harbors, lifeline systems, and critical structures.

The reconnaissance effort was conducted largely from vehicles and covered most of the roads in the damaged region. Each vehicle carried teams equipped with handheld two-way radios, digital cameras, maps, computers for recording site logs, and Global Positioning System (GPS) units for recording the routes the teams traveled and the locations of sites where they collected data. During the fieldwork, the researchers

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Screen shot of Google Earth map of reconnaissance area. Stars, epicenters determined by the USGS (yellow) and the Japanese Meteorological Agency (JMA, red); M, moment magnitude; small dots, population centers; circles, locations of data, including photographs and written observations, collected during the recent study and viewable in Google Earth (download from URL <http://walrus.wr.usgs.gov/infobank/n/nii07jp/html/n-ii-07-jp.sites.kmz>).

Fieldwork, continued

(Japanese Earthquake continued from page 2)

merged their data into a common database so that they could generate Google Earth displays of all the observations on dynamic, multilayered digital maps. Individual data layers could be selected to create damage-specific maps, for example, a map showing only liquefaction damage. By using Google Earth to display and observe the damage



Landslide at the Umigawa train station.



Permanent lateral deformation of train tracks at the Arahama station, the result of compression due to surface waves.

they had mapped, the teams were able to identify unexplored areas for reconnaissance, discern spatial trends in the observations, and discover any errors in the GPS logs and recorded observations. The city of Kashiwazaki already had a file of three-dimensional views of the city's buildings available as a layer in Google Earth (check "3D Buildings" in list of Google Earth layers); the team used this layer to identify the locations of critical facilities, such as schools, water- and wastewater-treatment plants, municipal-waste incinerators, and ports, which they then visited for further data collection. In the USGS office in Menlo Park, California, **Clint Steele** took the dataset compiled by researchers in the field and added links to their photographs and written descriptions of each site, creating a Google Earth file (URL <http://walrus.wr.usgs.gov/infobank/n/nii07jp/html/n-ii-07-jp.sites.kmz>) that allows all interested viewers, researchers and the public, to take virtual tours of the damage zone.

Much of the damage from the Niigata earthquake was associated with geotechnical problems, that is, problems related to the physical response of rock and soil to the shaking. For example, evidence of soil liquefaction was seen in various settings: riverbank deposits, beach deposits, dune sand, and placed fill. Soil liquefaction affected structures severely, triggering a transformer fire and simultaneously damaging the fire-suppression system at the nuclear power plant, as well as closing the Kashiwazaki wastewater-treatment plant. Ground settlement caused by liquefaction broke large water mains and gas conduits, damaged bridge abutments, and compromised ports and harbors. Landslides caused by the earthquake consisted of shallow translational slides, debris slumps, and deep-seated rotational slides. Where transportation lines crossed areas of steep terrain, landslides blocked or destroyed whole sections of roadways and railways.

For more information on the earthquake and the investigation, see the detailed 230-page USGS Open-File Report (OFR 2007-1365) at URL <http://pubs.usgs.gov/of/2007/1365/>, which describes the seismologic, geotechnical, and structural aspects of the damage caused by the earth-

(Japanese Earthquake continued on page 4)



Details of failure of reinforced concrete at the Kashiwazaki municipal incinerator.



Coastal damage adjacent to the Kashiwazaki-Kariwa Nuclear Power Station.



USGS Mendenhall Postdoctoral Research Fellow **Brian Collins** collects terrestrial lidar data at the Kashiwazaki municipal-incinerator landslide site.

Fieldwork, continued

(Japanese Earthquake continued from page 3)

quake, as well as the effectiveness of the emergency response and recovery.

Engineers and scientists participating in the investigations were from Oregon State University (**Scott Ashford, Steve Dickenson, and Yohsuke Kawamata**); the University of California, Los Angeles (UCLA, **Scott Brandenburg**); Purdue University (**Santiago Pujol**, EERI coleader); the Japanese Association of Earthquake Engineers (**Toshimi Kabeyasawa, Nanako Marubashi, and Yousok Kim**); Kobe University (**Yasuo Tanaka and Hidetaka Koumoto**); the Tokyo Institute of Technology (**Kohji Tokimatsu**); the Pacific Gas and Electric Co. (**Norm Abrahamson, Ben Tsai, Lloyd Cluff, and Joseph Sun**); the California Department of Transportation (**Mark Yashinsky**); Kyoto University (**Laurie Johnson**); and a private consulting firm (**Peter Yaney**).✻

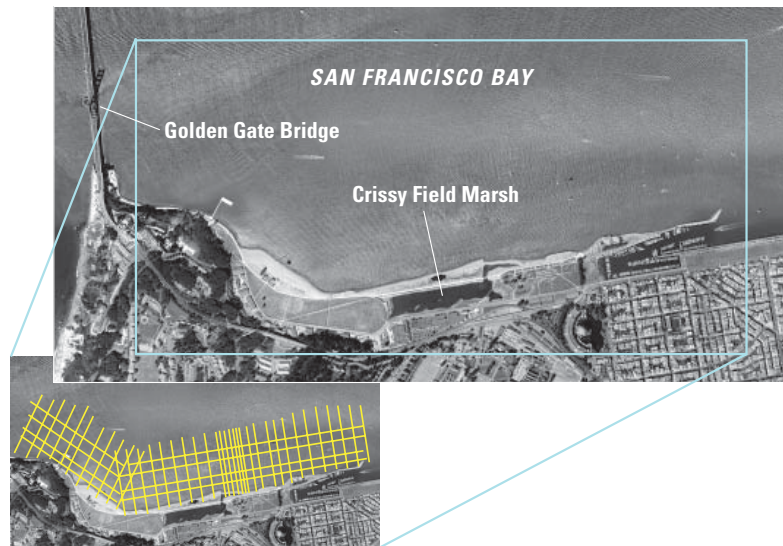


Excerpt from an article in the Kobe Shimbun (Kobe Times), published July 21, 2007. Photograph shows Japanese and U.S. scientists (Rob Kayen is at far right) discussing earthquake damage in Kashiwazaki.

USGS Scientists Investigate Coastal Processes Affecting a Restored Tidal Wetland in the San Francisco Presidio

By Li Erikson, Patrick Barnard, and Dan Hanes

Back in 1915, a 127-acre tidal marsh amidst a dune field at the north end of San Francisco was filled in to make room for the Panama-Pacific International Exposition. The site was part of the Presidio, established as the northernmost military outpost in western North America by the Spanish in the 1700s, later ruled by Mexico for 24 years, and eventually taken over by the U.S. military in the mid-1800s. Later this site served as a key airfield, where research and innovation helped develop the airpower that proved essential to Allied victory in World War II. The site was eventually transferred to the National Park Service (NPS) in 1994, which set out to convert large areas of the Presidio into a park stretching along the shore from the Golden Gate Bridge eastward to the San Francisco Marina. As a part of park construction, the NPS contracted with private consulting firms and successfully restored approximately 16 acres of the tidal marsh, now named Crissy Field Marsh after the airfield that formerly occupied the site. Crissy Field Marsh and the surrounding area are frequented by both locals and



Overview of study area. Upper right, Crissy Field Marsh and vicinity, with the nearby Golden Gate Bridge to the west; lower left, image of study area that includes transects (yellow) for CPS and backpack GPS surveys and sediment sampling.

tourists, serve as a popular feeding ground for shorebirds, and provide valuable habitats for numerous species.

The ecological benefits provided by the marsh, as well as its public-education value, depend on the continuing exchange of water with San Francisco Bay through a narrow and highly dynamic inlet. Since

its completion in 1999, the inlet has been closed off several times, requiring periodic maintenance to reopen it. The closures are thought to result from the marsh's limited tidal prism (the volume of water exchanged between the marsh and the bay during one complete tidal cycle)

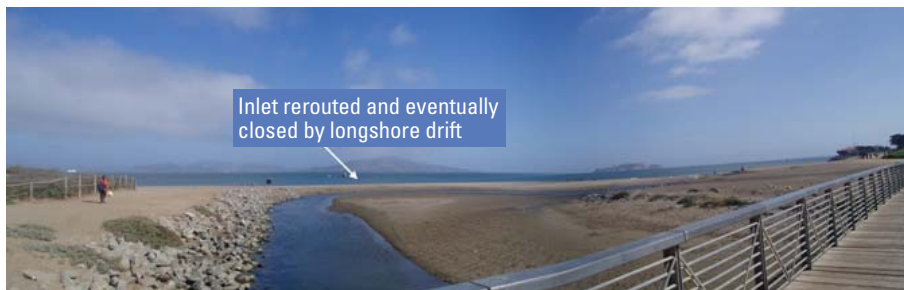
(Crissy Field Marsh continued on page 5)

Fieldwork, continued

(Crissy Field Marsh continued from page 4)

and the area's strong longshore transport (transport of sediment carried by currents moving alongshore), with a net transport from west to east. It was noted during the original design phase of wetland construction that the tidal prism of the restored marsh—considerably smaller than that of the original marsh—might be insufficient to keep the longshore transport from filling in the inlet channel.

USGS scientists **Patrick Barnard**, **Dan Hanes**, and **Li Erikson**, in collaboration with **Edwin Elias** from Delft Hydraulics, have begun a scientific investigation to understand the physical processes controlling the shape and function of the inlet to Crissy Field Marsh. For several years, this group has been developing a numerical model, using the state-of-the-art software package Delft3D, to simulate the hydrodynamic and morphodynamic processes of the San Francisco Bay region. The model domain includes the greater San Francisco Bay and the Pacific Ocean coast from approximately Point Reyes to Pacifica, with recent interest focused on the exchange of sediment between the open coast and the central bay, including the shoreline abutting Crissy Field Marsh. The related interests of the NPS (in the longshore transport responsible for closing the inlet at Crissy Field Marsh) and the USGS (in sediment exchanges between the bay and the open coast) provided an opportunity to obtain field measurements in the vicinity of the Crissy Field Marsh, extending from the



View northward along throat of marsh inlet. Inlet is occasionally excavated so that it is oriented approximately north-south. A flood shoal typically appears shortly after excavation and eventually fills in, causing the inlet to be rerouted and ultimately closed off by longshore drift from the west. Photograph by **Li Erikson**, September 18, 2007.

Golden Gate Bridge to the San Francisco Marina. The field measurements will be used to gain further understanding of the coastal processes in the southern part of central San Francisco Bay and to calibrate and validate the numerical model. The study area features extremely powerful tidal currents that peak at more than 2.5 m/s, strong wind gusts funneled through the Golden Gate Strait that annually exceed 14 m/s in velocity, and complex wave-current interaction as Pacific swell and local seas collide with strong tidal currents.

Baseline characterization of sediments and beach and nearshore morphology were obtained in October 2007 with a suite of measurement tools. A total of 39 cross-shore transects, spaced about every 100 m in the longshore direction, and 4 longshore transects were measured for bathymetry and topography profiles. Bathymetry was collected by USGS scientist **Barnard** and University of California, Santa Cruz

(UCSC) graduate student **Jeff Hansen** (with field support from USGS Marine Technician **Jackson Currie**) with coastal-profiling systems (CPSes). The CPSes are personal watercraft equipped with Ashtech Z-Extreme real-time kinematic (RTK) receivers linked to single-beam echosounders collecting depth measure-

ments at 5 Hz. **Tom Reiss** and **Gerald Hatcher** of the USGS Coastal and Marine Geology Marine Facility in Santa Cruz, California, maintained the RTK and Global Positioning System (GPS) receivers. The vertical- and horizontal-positioning accuracy of this system is approximately ± 10 cm in the vertical plane and ± 5 cm in the horizontal plane when atmospheric conditions and satellite geometries are optimum and surface waves are small.

The dryland segments of the cross-shore transects were completed with backpack RTK GPS systems carried by **Li Erikson** and **Kate Dallas**, a former USGS employee and current graduate student at UCSC.

Sediment grain sizes were recorded with a bed-sediment camera and analyzed by using an algorithm derived by team

(Crissy Field Marsh continued on page 6)



Patrick Barnard and **Jeff Hansen** using CPSes to obtain bathymetric data. The Golden Gate Bridge is in the background. Photograph by **Tom Reiss**, October 26, 2007.



Li Erikson carrying backpack and antenna for beach-profile measurements. Photograph by **Tom Reiss**, October 26, 2007.

Fieldwork, continued

(Crissy Field Marsh continued from page 5)

member **David Rubin**. (See *Sound Waves* article at URL <http://soundwaves.usgs.gov/2004/03/research.html> and technical abstract at URL <http://jsedres.geoscienceworld.org/cgi/content/abstract/74/1/160>.)

Nearshore bathymetry and beach changes over the winter season, followed by recovery rates, will be ascertained with future field efforts planned for winter and summer 2008, when waves and currents along the shore will also be measured. Additional fieldwork planned for early 2008, to complement the recently obtained data, consists of obtaining and analyzing sedi-

ment samples throughout the study area and measuring currents over spring and neap tides in the vicinity of the mouth of the bay. ❁

Kate Dallas (standing) and **Patrick Barnard** use a bed-sediment camera to obtain sand-grain-size measurements beside Crissy Field Marsh inlet. Alcatraz Island is visible on the horizon. Photograph by **Li Erikson**, October 26, 2007.



USGS Coral-Reef Investigation Featured in the *Molokai Times*

U.S. Geological Survey (USGS) scientists studying the effects of sediment-laden runoff on coral reefs off the Island of

Moloka'i, Hawai'i, were interviewed by **Kate Bradshaw**, a former USGS journalism intern, whose *Molokai Times* article

about their work is reprinted below, accompanied by photographs taken by **Mike Field**, USGS.

Scientists Come to Molokai to Study Imperiled Reef—Research Can Help Improve Land-Management Practices

By **Kate Bradshaw**

[Reprinted, with permission, from the Dec. 10, 2007, issue of the *Molokai Times*.]

Last week, after storms poured an astronomical quantity of rain across Molokai, anyone who ventured out of the house could see the brown streams washing across Kamehameha V Highway. These streams can be dangerous for people in cars trying to cross them, but the damage they can cause does not stop where land meets sea.

The dirt carried in these streams comes from higher elevations, where human alterations to the land have left no means of securing the soil. Factors like feral goats and pigs, nonnative animals that rip up vegetation with steadfast voracity, make it easy for rain on the mountain to wash the soil down to the sea. Modifications to residential properties have the same effect. The soil becomes more hazardous when it washes out onto Molokai Reef Flat, the longest fringe reef in all of the United States and its protectorates.

The United States Geological Survey and the University of Hawaii, among



The vessel *Alyce C* anchored in a sand channel on a coral reef off Moloka'i.

others, have been looking into the true impacts of all this dirt, or sediment runoff, on the corals that populate the reef. So far, they have found that corals do not respond well. Sediment, according to recent research, is inhibiting corals' ability to multiply on Molokai Reef Flat.

In late November, USGS researchers **Mike Field** and **Nancy Prouty** came to Molokai from the mainland to look at sediment behavior on the reef. Venturing out

in Captain **Joe Reich's** boat *Alyce C*, the crew braved "snarly" weather and misbehaving equipment to get samples that will help them map the history and future of sediment on the reef. "The goal is to see whether those corals contain a record of runoff through time," **Field** said.

Field says that while scientists have been taking "plugs" of coral in an attempt to study the animal, doing so

(*Molokai Times* continued on page 7)

Fieldwork, continued

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to study sediment behavior is a new method of studying the effect of runoff on coral-reef systems. “We’re trying to break some ground here,” **Field** said. “This may be the template” for future reef studies.

Field and **Prouty** said that they took nine core samples of coral in six locations on the reef. The cores are cylindrical samples 2 inches in diameter and range from 24 to 80 centimeters in height, depending on the age of the coral head they sampled. **Field** said that finding large, or old, enough coral heads was a challenge. “We had to search pretty diligently to find any,” he said.

Between Kawela and the Kaunakakai Wharf, he said, finding coral heads old enough to be ideal specimens was especially tough. While 2 meters is an optimal height, he said, the tallest they could find was 1½ meters.

Prouty, a recipient of a USGS Mendenhall Postdoctoral Research Fellowship after recently earning her Ph.D. from Stanford, has taken the reins on this project. The samples arrived at **Prouty**’s office at the USGS Pacific Science Center in Santa Cruz, California, shortly after her return.

Prouty said that she hopes that the cores will reach back 100 years. **Field** compared their study of the core samples to that of determining a tree’s ages and stress periods by looking at its rings. This, however, would still not give them a picture of sediment on the reef before Westerners, the alien animals they brought, and

their land-management practices altered the terrain of Molokai, they said.

Prouty will X-ray the corals. By measuring the amount of sediment contained in each coral segment, or annual “time band,” they hope to equate periods containing a high amount of sediment with major rainfall events.

Some areas of the reef may have had more sediment than others at any given time, so knowing where the sediment settles after a storm, and where it drifts as time passes, will help **Field** and **Prouty** get a picture of where runoff settles, resuspends, and settles again.

This kind of research, **Field** said, will help managers determine best land-management practices. Putting together the puzzle pieces, he said, will be a lengthy process. “It’s not like next week we’ll have answers,” **Field** said.

Field said that there was no new or startling evidence of impacts out on the reef, but that everything they observed confirms what his team has already known: coral is under stress in many areas of the reef.

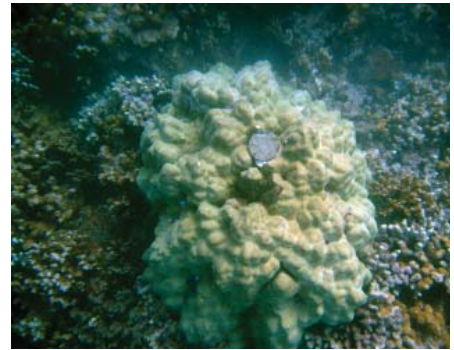
Because of sediment’s constant suspension and resettling on different parts of the reef, one area may show stress at a different time than another. Near Kawela it may be worse than it was 100 years ago, **Field** said, but the reverse may be true for the reef that sits off Pauwala.

No matter where the dust settles, there is much more of it on its way to the reef. With the rainy season in full and relentless swing, the reef is set to bear its brunt.



USGS scientists drill into a coral head to obtain a core for study of the impacts of sediment in runoff from Moloka‘i.

About the author: Kate Bradshaw was a journalism intern at the USGS Florida Integrated Science Center office in St. Petersburg, Florida, in 2006, working with USGS hydrologist and science-communications expert **Ann Tihansky**. She earned a Master of Arts in Journalism and Media Studies from the University of South Florida-St. Petersburg in May 2007. In summer 2007, before leaving for Hawai‘i, **Bradshaw** was recognized for volunteer news reporting at the local community radio station, WMNF (Tampa,



After drilling a core from the coral head, researchers seal the hole with a plug made beforehand from ready-mix concrete. The plug keeps out boring organisms that could weaken the structure of the coral head.

Florida), which named her “New News Volunteer of the Year.” Currently a freelance writer in Portland, Oregon, **Bradshaw** was an intern reporter at the *Molokai Times* when she wrote the article reprinted above, which can be viewed online at URL <http://www.molokaitimes.com/articles/71210162610.asp>. An earlier article written by **Bradshaw** about Moloka‘i coral-reef research can be viewed at URL <http://www.molokaitimes.com/articles/71170140.asp>. While a USGS intern in Florida, **Bradshaw** wrote articles for *Sound Waves* about ocean acidification (URL <http://soundwaves.usgs.gov/2007/01/>) and a community forum on red tide (URL <http://soundwaves.usgs.gov/2006/11/meetings.html>). She hopes to have a long career writing about the environment. ☼



USGS Mendenhall Postdoctoral Research Fellow **Nancy Prouty** examines a core drilled from a coral head off Moloka‘i. She will analyze this and similar cores to see whether they contain a record of storm-runoff carrying soil from the island out to the coral reef.

The Pulse of Earth Science Is Strong at the USGS in St. Petersburg, Florida

By Ann B. Tihansky

The U.S. Geological Survey (USGS) Florida Integrated Science Center (FISC) office in St. Petersburg welcomed more than 1,300 visitors to its 9th annual Open House, a 2-day event held November 7-8, 2007. The first day was Public Day, with the campus open to the general public; the second day was dedicated to 4th-grade students and followed the American Geological Institute's 2007 Earth Science Week theme: "The Pulse of Earth Science." Offering nearly 50 displays, the Open House highlighted many disciplines of Earth science, with a focus on hands-on activities. Biologists provided a live alligator, a lesson in manatee anatomy, and an introduction to the challenges of managing threatened species. Geologists demonstrated coring methods, submarine-mapping concepts, coastal hazards, and the many tools scientists use to study climate change. Several displays on water resources highlighted basic streamflow-measurement techniques and the properties of water, and illustrated ground-water concepts and water-quality issues. Online, real-time USGS water data, such as streamflow measurements, were viewed through an aerial flythrough using a Google Earth application and the National Water Information System (URL <http://waterdata.usgs.gov/nwis>). Exhibits about earthquakes, tsunamis, and volcanoes helped visitors appreciate the power of geologic hazards, with



Scientists from the USGS and the Florida Fish and Wildlife Conservation Commission teamed up on an interactive exhibit about manatees that had students stretching "intestines" across the lawn as they learned about manatee anatomy from a life-size model.



Enthusiastic teacher **Deidre Dempsey** of Northside Christian School in St. Petersburg, Florida, found all kinds of new ideas for incorporating Earth science topics into her programs.

several displays rocking, rolling, rumbling, and shaking so that visitors could literally "feel the pulse" of the Earth.

The USGS exhibitors were joined by community partners that included the U.S. Fish and Wildlife Service, the Friends of Tampa Bay National Wildlife Refuges, the National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries and National Weather Services, the Southwest Florida Water Management District, the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute, Sarasota County, Mote Marine Laboratory, Tampa Bay Watch, the Clearwater Marine Aquarium, the Pier Aquarium, the University of South Florida (USF)'s College of Marine Science, and the University of Florida's SeaGrant program. In addition to presenting displays, many of these agencies and partners contributed handout materials for students and visiting educators.

A special section of the Public Day Open House was created to host educators. Coordinated by **Theresa Burress** and library intern **Mary Halpern**, this section offered USGS resource materials and additional items donated by community partners to complement the exhibits. Such offerings were quite popular, as evidenced by teacher **Deidre Dempsey** of the Northside Christian School KARAT pro-

gram, who had visited the St. Petersburg center earlier in the year looking for guidance on geologic lesson plans. **Dempsey** was so enthusiastic about USGS online educational earthquake resources that she brought two examples of her students' earthquake models to the Open House. "All my students did a great job, but 10th-grader **J.D. Anderson** and 9th-grader **Billy Truxal** did such a great job that I just had to share. We all learned so much about earthquakes by simply following lessons and activities that came straight from the USGS. Not only did we all learn a lot, it sparked great interest in all of us about Earth science; that's why I *had* to return for the Open House to see what other great ideas and materials I could find."

Of the numerous teachers who visited the Open House, many attended with large organized groups. As part of a professional-development day, for example, Baypoint Elementary—a USGS partner school in the St. Petersburg Mayor's Corporate Sponsor Partner program and a Top Apple award winner—sent all of its teachers to the event, along with all the teachers from Baypoint Middle School. Baypoint Elementary's principal **Gaye Lively** also attended. Professor **Malcolm Butler**, of USF-St. Petersburg's Science Education Department, brought his class of soon-to-be science teachers to the Open House to gather ideas and information.

Several USGS guests came from afar to participate in the event, including **Gayle**

(FISC Open House continued on page 9)



Sarasota County cooperative program partner with the USGS, **Jennifer Steadman-Ryan** (on right), volunteered to assist **Sandy Kinnaman** (left) to share information about ground-water resources at their booth Understanding Ground Water.

Outreach, continued

(FISC Open House continued from page 8)

Sisler (Reston, Virginia), **Stacy Bushee** (Reston, Virginia), **Arturo Torres** (Fort Lauderdale, Florida), **Kim Crutchfield** (Columbia, South Carolina), and **Susan Russell-Robinson** (Reston, Virginia). Retired USGS hydrologist **Craig Hutchinson** participated as a tour guide to learn more about FISC in preparation for hosting an annual meeting of USGS Water Resources Discipline retirees in 2008.



At the display *Tracking Hurricanes*, kids build and manage their coastal community as storm-induced waves from a simulated hurricane ravage the shoreline and threaten the community.

Further contributions came from 42 National Honor Society (NHS) students from Seminole High School, who volunteered their time to earn community-service hours. They were organized by senior **Richard Livingstone** and NHS advisor **Susan Wolodkowitz**. This group helped handle the crowd of 1,000 4th-graders by assisting scientists at their booths, distributing refreshments, and serving as tour guides.

Awards were given to the most exceptional displays in each of three categories: “Best Science Communicator,” “Most Interactive Exhibit,” and “Most High-Tech.” Each prize was worth \$1,000 toward covering expenses to attend a scientific meeting of the winner’s choice. Three judges—FISC Director **Barry Rosen**, Associate Program Coordinator for Coastal and Marine Geology **Susan Russell-Robinson**, and geologist **Shawn Dadisman**—visited each booth and assessed it for overall effectiveness in communicating through visuals; quality of graphical representations; success in conveying scientific understanding, prompting inquiry, and providing a hands-on, “real” experience; use of materials in an innovative way; success in modeling and simulating real

scenarios; and illustration of new technical methods or use of highly technical methods to illustrate a scientific concept. The competition was especially close, with several exhibits finishing within one or two points of each other.

Tracking Hurricanes by **Karen Morgan** won “Best Science Communicator.” This exhibit featured an interactive model coastline community experiencing a hurricane. As the “hurricane” (an electric fan) approached the coastal area, wind-induced waves acted upon the coastal sediment, which responded in such a way that all major coastal processes and associated hazards were observable in a relatively short time. Visitors at the booth could rebuild, alter construction methods, and try to predict coastal response. **Susan Russell-Robinson** remarked that this exhibit was quite a hit at the Open House in Reston the previous week, adding that it “was extremely relevant to Florida residents and a perfect way to highlight our research-program objectives.”

The award for “Most Interactive Exhibit” went to *Catch Climate Fever*, created by **Wendy Kelly** and **Katie Merriweather**. This exhibit included several hands-on stations that described, in an interactive way, the concepts which help scientists investigate climate history. It included hand-size models of foraminifera and pollen grains that brought into plain view some elusive microscopic details which scientists use to decipher the Earth’s climate history. According to judge **Dadisman**, “This exhibit gave the nonscientists an appreciation for the tools used in understanding climate change by illustrating critical concepts about stratigraphy and time.”

The *Geowall*, hosted by **Rob Wertz** and **Brendan Dwyer**, won the award for “Most High-Tech.” In this exhibit, visitors don 3D glasses and then navigate through



Rob Wertz (upper right) and **Brendan Dwyer** (behind podium) steer their visitors through an *Earth-science odyssey in three dimensions* in the display *Geowall*.

three-dimensional landscapes and structural features on and beneath the Earth’s surface. This was a thrilling experience for many and used the 3D imagery to convey many complex concepts about the Earth. Special thanks go to **Chris Polloni** at the USGS office in Woods Hole, Massachusetts, for providing this exhibit.

FISC Director **Barry Rosen** proudly gave out the awards and acknowledged everyone’s contribution to making this event a great success. “When you tour the displays, you get a real feel for the broad and multidisciplinary aspect of our science programs. We are especially thankful that so many partners are able to participate in the event.”

Other notable awards included the “Materials Master” award for **McCarron Best**, who played an important role in gathering materials and led the way in

(FISC Open House continued on page 10)



Life-size pictureboards enabled kids to take turns “being” the scientist.

Outreach, continued

(FISC Open House continued from page 9)



Foraminifera Twister was a big hit with all the kids. Once they mastered the Latin names, the rest was easy.



Nancy Dewitt teaches basic sea-floor-mapping concepts to young students who are eager to get their hands wet in Bathy Bottoms.

creating 1,200 take-home goody bags for students and teachers. Nancy Dewitt received the "Button Team Leader" award for organizing the production of more than 2,000 souvenir buttons featuring various scientific images, including scanning-electron-microscope images of coral, aerial imagery of Hurricane Katrina, and photographs of the research vessel *G.K. Gilbert* deploying sonar equipment.

Other display highlights included *Foraminifera Twister*, a challenging game in which participants used their knowledge about foraminifera and climate to match left and right feet and hands to either benthic or planktic foraminifera, and warm- or cool-water species. When Kathy Tedesco called out "Left foot, *Cibicidoides wuellerstorfi*," everyone had to think for a moment! You could really "get your hands wet" at *Bathy Bottoms*, hosted by Nancy Dewitt, where visitors mapped features on a simulated sea floor. Jordan

Sanford and Dana Wiese's *Shake-O-Meter Earthquake Science* was a rocking good time where kids created their own S- and P-waves by working together as a group. *Tsunami!* triggered a giant earthquake-induced wave that repeatedly inundated a model coastal community. A few scientists were extra-creative in engaging the visitors: Lee Florea demonstrated the spelunking skills needed for conducting karst studies by hanging from a tree in full caving/climbing gear; Chris Kellogg turned a small room into a deep-submarine adventure where she could share stories from her deep-sea coral-ecology work; and Dan Brendle demonstrated how to make streamflow measurements by pumping water around in a canoe full of water.

Visitors could literally picture themselves as scientists in various settings, thanks to materials provided by Randy Hines and Carol Lowenberg of the Upper Midwest Environmental Sciences Center in La Crosse, Wisconsin. The life-size pictureboards, also popular the previous week at the USGS Open House in Reston, Virginia, entertained guests as well as USGS scientists. Next year will be the 10th anniversary of FISC's Open House at St. Petersburg, and brainstorming has already begun on ways to build on this and other exhibits to make next year's Open House really special.



Jordan Sanford (back left) and Dana Wiese (back right) propagated S and P waves through groups of students to demonstrate how the two kinds of waves differ.



Associate Center Director of the USGS Florida Integrated Science Center office in St. Petersburg, Jack Kindinger, catches a big fish at the Picture Yourself as a Scientist display.

For a list of displays, photographs, and information about previous Open House events, visit URL <http://coastal.er.usgs.gov/openhouse/>. ❁



USGS Florida Integrated Science Center 2007 Open House group photograph.

USGS Workshop on Sea-Level-Rise Impacts Held in Menlo Park, California

By Eric Grossman and Sam Johnson

Future impacts of sea-level rise are attracting significant attention from Federal, State, and local coastal-zone managers. To identify and address these managers' needs, the U.S. Geological Survey (USGS)'s Western Region held an internal USGS workshop on Sea-Level-Rise Impacts on November 6-7, 2007, in Menlo Park, California. The meeting was attended by 30 scientists from four USGS disciplines (geology, geography, biology, and water) and 13 different science centers in the Western Region. In part a follow-up to the Western Region's Climate Change workshop held October 10-11, the November workshop focused on just one important climate-change issue in the Western Region: the impacts of projected sea-level rise. The primary goal of attendees was to identify and develop new interdisciplinary-research opportunities and collaborations on sea-level-rise impacts to coastal settings in the Western United States.

This workshop was motivated by recent Intergovernmental Panel on Climate Change (IPCC) projections of sea-level rise that range from 18 to 59 cm by the year 2100 (URL http://www.aas.org/news/press_room/climate_change/media/4th_spm2feb07.pdf; see table SPM-2 and discussion). These estimates are commonly regarded as conservative (for example, see URL <http://www.realclimate.org/index.php/archives/2007/03/the-ipcc-sea-level-numbers/>) and are currently being debated. Other recent projections suggest that global sea-level rise by 2100 may range from 50 to 140 cm (for example, see URL <http://www.sciencemag.org/cgi/content/abstract/315/5810/368>).

Workshop participants met as a group for the first morning and early afternoon to review sea-level-rise science and scenarios and to hear brief summaries of ongoing USGS work on this subject. The rest of the first day and the beginning of the second were spent in four breakout groups focused on critical scientific issues in four geomorphic areas: estuaries and wetlands, high-energy mid-latitude coasts, high-latitude coasts, and tropical coasts. Each breakout group was tasked



Typical wetland in Puget Sound that now faces "squeeze" as rising sea level meets human infrastructure (in this case, levees and agricultural fields). Photograph by Eric Grossman.

with developing a list of key sea-level-rise issues, including uncertainties, data gaps, and needed maps and products. Breakout groups also developed preliminary conceptual models, influence diagrams (visual representations of the main features of a situation and the important relations that exist among them), and scenarios describing processes that affect change in the four geomorphic areas. This exercise served to highlight where research is needed and might be effectively integrated to examine systems that respond to multiple processes and feedbacks (for example, how sediment accumulation shapes wetland vegetation and succession, which, in turn, can influence sediment retention or change caused by bird and mammal foraging).



Breakout groups reported back to the entire workshop to collect feedback before preparing one-page summaries of project-scale scientific investigations of sea-level-rise impacts that could be pursued in the Western Region. Some of the discussion centered on short-term work and was used to refine proposals currently being prepared in response to the USGS Climate Change Request for Proposals. Other discussion was used to develop ideas for integrated science work in fiscal year 2009 and beyond. Highlights of the breakout-group discussions are summarized below.

Wetlands and Estuaries

This breakout group comprised biologists, geographers, geologists, and hydrologists who have been working in San Francisco Bay and the adjoining Sacramento-San Joaquin Delta (referred to jointly as the San Francisco Bay-Delta), Puget Sound, and the Columbia River estuary. This breakout group considered sea-level-related impacts to major urban estuaries (such as the San Francisco

(Sea-Level Rise continued on page 12)

Typical unconsolidated bluff along the central California coast undergoing cliff retreat. Retreat is especially rapid during El Niño periods, when sea level can be elevated 10 to 20 cm above its average position for several months at a time. Photograph from Cotton, Shires, and Associates, Inc., Geotechnical Report, Northridge Bluff Landslide, Daly City, California, April 2004.

Meetings, continued

(Sea-Level Rise continued from page 11)

Bay-Delta and Puget Sound), as well as small coastal wetlands throughout California, the Pacific Northwest, and Southeast Alaska.

Key issues identified for wetlands and estuaries along the developed west coast include:

- Loss of wetland habitat due to submergence
- Inability of wetland habitat to migrate laterally due to human infrastructure or geomorphology
- Wetland sediment supply, organic “buildup,” and vertical accretion
- Changes to estuarine mixing, water quality, and carbon export
- Changes to coastal watersheds, including water supply, sediment loads, and habitats
- Changes in habitat diversity, abundance, and distribution—especially for migratory birds and fish, many that are listed as endangered or threatened, including U.S. Department of the Interior (DOI) trust species
- The fate of large-scale habitat-restoration projects
- Increased vulnerability of agricultural and industrial infrastructure, especially prevalent in deltaic wetland settings
- Assessment of mitigation options despite high hazard due to flooding and inundation
- Cumulative impacts to wetlands associated with climate change (for example, reduced spring/summer runoff, warming estuarine surface-water temperatures)



The rapid retreat of Arctic tundra coastline has exposed oil-exploration infrastructure on the shore of the Beaufort Sea, subject to some of the highest coastal-retreat rates in the world. Shown here are the wellhead and pilings of the J.W. Dalton Test Well #1 in September 2004 (left) and September 2005 (right). Drilled in 1979 as part of USGS exploration in the National Petroleum Reserve in Alaska, the well was originally located 1,500 ft inland from the Beaufort Sea coast; it is approximately 120 mi northwest of Prudhoe Bay. Photographs by **Susan Flora**, Bureau of Land Management.

Although some baseline data exist for marsh and wetland habitats in the San Francisco Bay-Delta, the breakout group recognized that for most west-coast marshes and wetlands, important baseline information is still needed. Importantly, “reference” wetlands and marshes (those not impacted by human activities) are virtually nonexistent along the west coast. Specific information is needed on rates of vertical and lateral accretion of sediment and wetland vegetation, rates of relative sea-level rise, habitat distribution, habitat needs of principal biotic assemblages, biogeochemical cycling, and ecosystem function and diversity.

High-Energy, Mid-Latitude Coasts of California, Oregon, and Washington

This breakout group focused on stretches of the mid-latitude Pacific coast exposed to nearly continuous wave action. Sea-level-rise impacts on these coasts can be significantly amplified by high waves; storm surges; tidal currents; interannual climate phenomena, such as the El Niño Southern Oscillation (ENSO; see URL http://www.wrh.noaa.gov/fgz/science/el_nino.php?wfo=fgz); and decadal variation, such as the Pacific Decadal Oscillation (PDO; see URL <http://www.wrh.noaa.gov/fgz/science/pdo.php?wfo=fgz>).

Some important issues for high-energy coasts include:

- Need for baseline mapping data and indicators to monitor change
- Increased coastal inundation and storm surge as frequency of flooding increases



How coastal and tidewater glaciers, such as the Bering Glacier, shown here, will respond to sea-level rise remains uncertain. Understanding the modes and rates of change in glacier flow and freshwater and sediment export to coastal waters is essential to predicting how coastal habitats, ecosystem function, and sediment processes will change. Photograph by **Eric Grossman**.

- Changes in the rates of coastal erosion and shoreline retreat
- Changes to sediment budgets, sediment transport, and deposition that will affect nearshore and shelf habitats, beach widths, recreation, and water quality
- Implications for regional sediment management, including beach nourishment, dredging, coastal armoring, and navigation.
- Increased vulnerability of human populations and infrastructure and assessment of mitigation options
- Need for predictive models to predict impacts, assess risk, and provide warning systems

High-Latitude (Alaskan) Coasts

This breakout group considered issues related to sea-level rise and climate change over a wide range of Alaska’s coastal provinces, including impacts to infrastructure along the Yukon Delta and the North Slope. Participants recognized that many sea-level-rise impacts in Alaska will be greatly exacerbated by the range of climate changes (air and sea temperature, sea-ice extent, winds and storms, precipitation), expected to be most extreme at high latitudes.

Important issues facing high-latitude coasts include:

- Dramatically high rates of coastal erosion

(Sea-Level Rise continued on page 13)

Meetings, continued

(Sea-Level Rise continued from page 12)

- Impact of diminished icecap on Alaskan ecosystems and coastal erosion
- Changes in wetland locations and impact to migratory and DOI trust species, such as polar bears
- Saltwater inundation of ecologically sensitive habitats for birds and mammals
- Potentially severe impact on Native Americans' land and culture
- Erosion and inundation of extensive habitat and infrastructure along the North Slope
- Need for high-resolution land-surface baseline datasets for monitoring change
- Changes in tidewater glacier dynamics, including freshwater, sediment, and nutrient delivery to coastal waters
- Impact to nearshore and shelf habitat and marine resources
- Feedbacks of accelerated glacier melt on coastal climates and further warming
- Potential changes in Federally mandated management regimes for DOI lands

Tropical Coasts

This breakout group considered the impact of sea-level rise on low-latitude and tropical coastlines in the Pacific Ocean (for example, Hawai'i, Guam, American Samoa, and the Federated States of Micronesia), with a special emphasis on the fate of coral reefs, atolls, and the commonly narrow coastal fringes of tropical islands. The U.S. Department of Defense (DOD) and Department of the Interior (DOI) maintain extensive land holdings across the Pacific region, many of which support critical wildlife and (or) defense installations within just a few meters of today's mean sea level.

Important issues for tropical coasts include:

- Forecasting the impacts of sea-level rise on essential land areas, resources, infrastructure, and social systems
- Inundation of communities and infrastructure in narrow coastal fringes and over entire atolls; disruption and relocation of entire populations and cultures; loss of cultural resources



*Funafuti atoll, capital of the island-nation of Tuvalu, midway between Hawai'i and Australia. Continuing sea-level rise could have serious consequences for such low-lying islands, and could be compounded by other possible effects of climate change, such as an increase in the intensity of extreme storms. Thin freshwater lenses are also under serious threat from rising seas. Photograph taken in 1986 by **Bruce Richmond**.*

- Changes in physical processes on coral reefs (including water circulation, sediment dynamics, sediment resuspension by waves, and erosion by waves) due to higher sea levels
- Identification of at-risk habitats, species, and populations
- Saline intrusion of coastal aquifers and coastal freshwater and brackish habitats

Taking the Next Steps

The many impacts of sea-level rise identified in the workshop will be addressed in several ways, by using existing scientific methods as well as newly developed technology and by conducting new research efforts in mapping, monitoring, and modeling. Some of the methods to be employed include:

- Integrating projected sea-level rise and geodynamics (for example, tectonic uplift, subsidence, and isostatic rebound) to develop region-specific sea-level projections
- Identifying mapping data (for example, topography, bathymetry, habitats, and hazards) needed to address sea-level-rise issues
- Identifying effective mapping tools and approaches to mapping and detecting change, including mapping across the onshore-offshore boundary



*Many coral-reef systems are already undergoing increases in sediment impact caused by land use. Uncertainty remains as to how sea-level rise will influence the coastal processes, including sedimentation, that affect coral-reef growth. Photograph by **Michael Field**.*

- Modeling ecosystem changes, including species changes, ecosystem sensitivities, and change thresholds
- Developing integrated natural- and social-science models that quantify risks to populations, infrastructure, and ecosystems
- Developing tools for DOI land managers to help them assess options in view of likely economic and environmental consequences

The Sea Level Rise Impacts Workshop was convened by **Sam Johnson** (Western Coastal and Marine Geology Team [WCMG]), **Tom Suchanek** (Western Ecological Research Center), **Kim Taylor** (California Water Science Center), and **Len Gaydos** (Western Region Geography) and led by **Eric Grossman** (WCMG). Serving on the organizing committee were **Grossman, Ann Gibbs, Bruce Richmond, and Jane Reid** (all WCMG).

USGS employees can view additional information about the workshop—including the breakout groups' one-page summaries and a list of all attendees' names and e-mail addresses—on the USGS internal Web site; visit URL <http://www.usgs.gov/> and search the USGS Intranet for the phrase "Sea Level Rise Impacts Workshop."

Thanks to all the participants for a stimulating workshop! ❁

USGS Hosts International Delta Roundtable Meeting

By Gaye S. Farris

More than 150 scientists from 10 nations attended the International Delta Roundtable Meeting held November 28-30 in Lafayette, Louisiana, at the Cajundome Convention Center and the U.S. Geological Survey's National Wetlands Research Center. Nations represented were the United States, Canada, the Netherlands, Egypt, Russia, China, Vietnam, Laos, Cambodia, and Thailand, with 22 invited speakers and 55 technical-working-group presenters. (For a complete list of topics, visit URL <http://dl.cr.usgs.gov/dragon/>.) Among the speakers were **Tim Petty**, deputy assistant secretary, Department of the Interior; **Susan Haseltine**, USGS associate director for biology; **Larry Schweiger**, president, National Wildlife Federation; **Michael Reuter**, the Nature Conservancy; **Jeb Barzen**, director of field ecology, the International Crane Foundation; **Richard Lowerre**, president, Caddo Lake Institute; and **Karen Siderelis**, USGS chief information officer. The meeting provided a forum for integrating the work of scientists from many different disciplines who are addressing complex issues related to the effective and sustainable management of deltas and large rivers.

A major goal of the meeting, according to meeting organizer **Gregory Smith**, USGS National Wetlands Research Center director, was to create a community of scientists worldwide who will share in-



The Delta Research And Global Observation Network (DRAGON) project banner welcomes scientists from 10 nations to the International Delta Roundtable Meeting in Lafayette, Louisiana. DRAGON logo by **Andrew Smith** and **Christina Boudreaux**; photograph by **Gene Nelson**, USGS.

formation that promotes sound ecological forecasting to sustain the world's deltaic systems.

Smith explained, "The reason for sharing information and learning from the work of others is that rivers and deltas have geologic, hydrologic, and biological processes which form extremely dynamic environments, and these environments are significantly altered by human development and major coastal storms, such as Hurricane Katrina."

The National Wetlands Research Center (URL <http://www.nwrc.usgs.gov/>) hosted the meeting. The center demonstrated a Web-enabled system, the Delta Research And Global Observation Network (DRAGON), which is being constructed to integrate data on deltas and rivers from throughout the world. (Visit URL <http://deltas.usgs.gov/>

for more information on the DRAGON project.)

A highlight of the meeting was an evening activity called "Stories of the Deltas," which featured speakers telling personal stories of a delta or river that had influenced their lives, thereby integrating traditional and practical knowledge with science.



Selenga River delta on the southeast shore of Lake Baikal, Russia. "Earth As Art" satellite image courtesy of the USGS National Center for Earth Resources Observation and Science (EROS) and the National Aeronautics and Space Administration (NASA) Landsat Project Science Office.

A smaller group of international and U.S. scientists participated in a field trip after the meeting. In Louisiana, they toured the devastation from Hurricanes Katrina and Rita in New Orleans and at the delta of Mississippi River. In Florida they visited the USGS Florida Integrated Science Center office in St. Petersburg, Big Cypress National Preserve, Key Largo, and the Everglades.

Assisting the center in planning technical sessions and organizing the field trip were other USGS centers, including the Columbia Environmental Research Center in Missouri (URL <http://www.cerc.usgs.gov/>), the Upper Midwest Environmental Sciences Center in La Crosse, Wisconsin

(Delta Roundtable continued on page 15)



USGS ecologist **Kristen Hart** describes research on turtle populations and behavior to scientists visiting the USGS office in St. Petersburg, Florida, during a postmeeting field trip.

Meetings, continued

(Delta Roundtable continued from page 14)

(URL <http://www.umesc.usgs.gov/>), and the Florida Integrated Science Center in St. Petersburg (URL <http://coastal.er.usgs.gov/>).

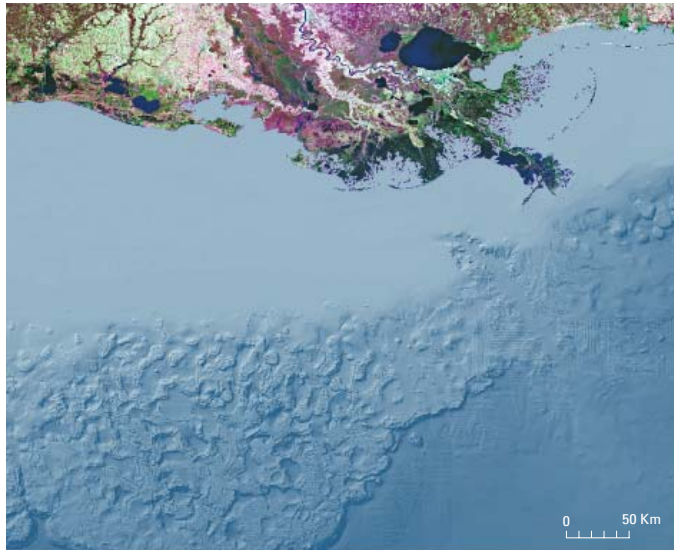
Partners and sponsors include the U.S. Fish and Wildlife Service, the National Park Service, the International Crane Foundation, the Caddo Lake Institute, the Great Lakes Fishery Commission, the University of Louisiana at Lafayette, and HDR Engineering, Inc.

Follow-up meetings to the International Delta Roundtable are being organized in Ethiopia and Hong Kong. ❁



USGS geologist **Jim Flocks** addresses scientists visiting the USGS office in St. Petersburg, Florida, during a postmeeting field trip. He is describing LASED (Louisiana Sedimentary and Environmental Database), which contains decades of geologic data gathered from the Louisiana coastal zone (see URL <http://pubs.usgs.gov/of/2005/1428/dadisman/>). Flocks' poster complemented an earlier presentation by **Shawn Dadisman** on "Data Management and Analysis Tools for Geologic and Hazards Information."

Modified Landsat Thematic Mapper image of the Mississippi River Delta (onshore) combined with National Oceanic and Atmospheric Administration (NOAA)'s Coastal Relief Model, v. 4, Central Gulf of Mexico (offshore), which depicts a shaded-relief raster image of the bathymetry in the northern Gulf of Mexico. Island chains are reworked and transported remnants of previous deltas that formed in response to sea-level rise. Note large relic Mississippi River valley southwest of the present delta. Map produced from data in LASED (Louisiana Sedimentary and Environmental Database).



USGS geologist **Nancy Dewitt** and a scientist visiting the St. Petersburg FISC office inspect a fiberglass-resin cast of a crab burrow made by USGS ecologist **Tom Smith** and his research team. The casts are made not only to study the morphology of the burrows but also to shed light on how the burrows affect other ecosystem functions.

USGS Coastal and Marine Geology Program is Represented at 2007 SACNAS National Conference

By **Claudia Flores** and **Ben Gutierrez**

Claudia Flores and **Ben Gutierrez** of the U.S. Geological Survey (USGS)'s Woods Hole Science Center in Woods Hole, Massachusetts, attended the National Meeting of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) in Kansas City, Missouri. SACNAS is dedicated to the promotion of mentoring between professionals and aspiring students from minority communities. The meeting took place October 11-14 at the Kansas City Convention Center. Approximately

2,000 participants attended this meeting, which focused on the theme "Stretching the Imagination to Support Leadership and Sustainability." The principal sponsors for this meeting were the University of Kansas and Haskell Indian Nations University, both located in Lawrence, Kansas.

The 4-day annual event is attended by undergraduate and graduate students, postdoctorates, research and academic scientists, and K-12 educators with the mission to provide an open environment

for developing and furthering minority involvement in the sciences. Activities at the conference are centered around exposure of students to science, engineering, and math; assistance in career development; and an opportunity for minority students currently in graduate and undergraduate programs to give oral and poster presentations of their work. Feature keynote addresses provide a forum for recognizing the achievements and dedication of current SACNAS members. The

(SACNAS continued on page 16)

Meetings, continued

(SACNAS continued from page 15)

banquets also facilitate interaction among meeting attendees and contribute to the open atmosphere of the meeting.

Flores and Gutierrez hosted a USGS information booth featuring recent and ongoing work at the Woods Hole Science Center and in the broader USGS community. The exhibition gave them an opportunity to speak with many students, teachers, and researchers. The most popular feature at the exhibit booth was a poster showing recently collected multibeam bathymetric data from the Mona Passage of Puerto Rico. Use of 3D ChromaDepth glasses gave visitors a striking, three-dimensional view of the bathymetric data. **Flores** used her knowledge and background as a geophysicist to explain the science behind the poster, and shared her experience as a member of the research cruise that collected the data. **Gutierrez** also spoke during a scientific symposium session focusing on the importance of coastal research.

Next year's SACNAS national conference will be held October 9-12, 2008,



Claudia Flores (right) with a graduate student from Puerto Rico at the SACNAS conference.

in Salt Lake City, Utah, with the theme "The International Polar Year: Global Climate Change and Our Communities." (For more information about SACNAS, its national conference, and its mission statement, visit URL <http://www.sacnas.org/>.) Anyone in the USGS who



Ben Gutierrez in the USGS exhibitor booth at SACNAS.

is interested in participating in exhibitor activities, volunteering as a speaker, or passing along information and opportunities for students at the next SACNAS conference should contact **Claudia Flores** (cflores@usgs.gov) or **Ben Gutierrez** (bgutierrez@usgs.gov). ❄

Technical Workshop on Ocean and Coastal Mapping Inventory

By Fran Lightsom

A comprehensive inventory of ocean and coastal mapping data and activities was the subject of an interagency

3-day workshop in Charleston, South Carolina, in September 2007. The Ocean and Coastal Mapping Inventory will offer a clearinghouse for data and interpretive information, and a registry of completed and projected mapping activities via a single Web portal. The inventory will reduce duplication of mapping efforts and facilitate cooperative mapping activities and data accessibility. The workshop was sponsored by the Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM), which was established in response to findings of the U.S. Ocean Action Plan and the 2004 National Research Council assessment of national coastal-zone mapping and charting activities.



At the workshop, participants identified key user requirements and reviewed existing data systems and inventories before reaching a consensus to use Geospatial One-Stop (GOS) as the tool to build the Ocean and Coastal Mapping Inventory. They also formulated concrete recommendations to move this effort forward. Concurrent working groups, focusing on technical, metadata, and management issues and requirements, outlined a short-term strategy and a detailed list of actions for the next 3 months. In addition, representatives of each agency met to recommend individual agency contributions and discuss commitments to this effort.

The U.S. Geological Survey (USGS) was represented by **John Haines** (Coastal and Marine Geology Program coordinator), **Fran Lightsom** and **Greg Miller** (Woods Hole Science Center), **Chris Cretni** (National Wetlands Research Center), and **Dean Gesch** (National Center for Earth Resources Observation and Science [EROS]). **Dan Sandhaus** attended to represent GOS. **Haines** also serves as a cochair of IWG-OCM. **Lightsom** was on the workshop planning committee and is continuing to serve on the project-management team for the inventory.

For more information and specific results of the workshop, visit URL <http://www.csc.noaa.gov/iwg/>. ❄

Biologists Honored for Rapid-Response Investigations of the Impacts of Future Sea-Ice Change on Polar Bears

A group of U.S. Geological Survey (USGS) biologists won two awards for conducting rapid-response scientific investigations of the impacts of future sea-ice changes on polar-bear populations: the U.S. Department of the Interior Unit Award for Excellence of Service and the USGS Western Region Director's Award. The recipients are:

- **Steven C. Amstrup**, research wildlife biologist at the Alaska Science Center in Anchorage, Alaska
- **David C. Douglas**, research wildlife biologist at the Alaska Science Center
- **George M. Durner**, research zoologist at the Alaska Science Center
- **Michael C. Runge**, research ecologist at Patuxent Wildlife Research Center in Laurel, Maryland
- **Eric V. Regehr**, wildlife biologist at the Alaska Science Center
- **Leslie E. Holland-Bartels**, center director, Alaska Science Center

Both awards were celebrated at the annual USGS Western Region Awards Ceremony in Menlo Park, California, on November 14, 2007, where **Frank Shipley**, Acting Deputy Western Regional Director, described the scientists' remarkable accomplishment in the following summary of the USGS award citation:

"In January 2007, the U.S. Fish and Wildlife Service proposed listing the polar bear as a threatened species under the En-

dangered Species Act. To ensure that the best information was available to inform the final listing decision, due in January 2008, **Secretary Kempthorne** asked the U.S. Geological Survey to generate new scientific data, models, and interpretations of polar bears and their sea-ice habitats to be available to the decision makers. A team of researchers from the Alaska Science Center, Patuxent Wildlife Research Center, researchers from Canada, academia, the private sector, and other Federal agencies were asked to develop population projections, evaluate sea-ice projections for the future, and model likely polar-bear-population responses to changes in sea ice. The rapid-response work that followed was presented in nine administrative reports in September, as well as numerous briefings to the Department, a number of Congressional Committees, and numerous interviews with TV, radio, and print journalists. The work by this team of scientists led by **Steve Amstrup, Dave Douglas, George Durner, Michael Runge, Eric Regehr, and Leslie Holland-Bartels** is a great example of cutting-edge science that goes above and beyond to serve the needs of the Department, Congress, and the American public. This work is a great example of bringing disciplines together to create new

knowledge. In recognition and appreciation of the work done by their teams, the Western Region Director's Award for 2007 is given to **Steve Amstrup, Dave Douglas, George Durner, Michael Runge, Eric Regehr, and Leslie Holland-Bartels** for their vision and leadership in framing and conducting the science that went into providing the information to decision makers on the impacts of future sea-ice changes on polar-bear populations."

Visit the Web site at URL http://alaska.usgs.gov/science/biology/polar_bears/ for additional information about polar-bear research by the USGS. ❁



June Thormodsgard (center), Acting Alaska Area Regional Executive, accepts award from Western Regional Director **Anne Kinsinger** on behalf of biologists honored for rapid-response scientific investigations of the impacts of sea-ice change on polar-bear populations. **Frank Shipley** is at the podium. Photograph by **Mike Diggles**.

Brian Atwater Honored for Receiving USGS Award, Being Elected to National Academy of Sciences

U.S. Geological Survey (USGS) scientist **Brian Atwater** was recognized at the annual USGS Western Region Awards Ceremony, held November 14, 2007, in Menlo Park, California, for receiving the USGS Excellence in Leadership Award and for being elected to the National Academy of Sciences. **Atwater** was given the USGS leadership award, which is granted annually, in recognition of his "outstanding acts, services, and achievements that

(*Brian Atwater continued on page 18*)



Brian Atwater leads a fleet of canoes from mudbank to mudbank along the Niawiakum River on Washington State's south coast, where he showed the paddlers evidence for the most recent Pacific Northwest earthquake of magnitude 9 and the associated Pacific Ocean tsunami (see article in *Sound Waves*, October 2007, at URL <http://soundwaves.usgs.gov/2007/10/outreach3.html>).

Awards, continued

(Brian Atwater continued from page 17)

exemplify and support USGS leadership goals throughout the bureau.”

Atwater could not attend the ceremony but was applauded warmly when **Frank Shipley**, Acting Deputy Western Regional Director, read a summary of **Atwater’s** Excellence in Leadership Award citation:

“While demonstrating unparalleled leadership in your contributions to the development of the Indian Ocean Tsunami Warning System, and related tsunami-hazard-assessment activities, you have engaged colleagues in the Indian Ocean region in numerous training sessions on the topic of paleotsunamis and have conducted numerous scientific field trips to examine evidence of past tsunami events [for example, see article in *Sound Waves*, October 2007, URL <http://soundwaves.usgs.gov/2007/10/outreach3.html>]. This training has greatly improved the abilities of Indian Ocean nations to understand their tsunami risk.

“In the course of your work, you have demonstrated effective interpersonal skills that consistently respond to the needs, feelings, and capabilities of different

people in different situations—especially noteworthy with workshop participants from many different countries—and have developed many new cooperative working relationships with scientists in the Indian Ocean region.

“Your dedication, hard work, and leadership abilities have greatly improved the capacities of scientists in the Indian Ocean region and have contributed to a greater USGS international stature.”

Also noted at the awards ceremony was **Atwater’s** election earlier in the year as a member of the National Academy of Sciences. He is among 72 new members and 18 foreign associates from 12 countries elected to the National Academy on May 1, 2007, in recognition of distinguished and continuing achievements in original research. **Atwater** studies historically recent earthquakes and tsunamis and their inherent hazards. He is widely noted for work that uncovered evidence of a giant earthquake off the coast of Washington. Subsequent work with scientists from Japan found evidence in that country of a destructive tsunami wave with no known



Brian Atwater points out sedimentary evidence of a Pacific Northwest earthquake of magnitude 9 and the associated tsunami to participants in a tsunami-training workshop (see article in *Sound Waves*, October 2007, at URL <http://soundwaves.usgs.gov/2007/10/outreach3.html>).

source, which led to a determination that the wave was generated by the earthquake off Washington’s coast on January 26, 1700. (See USGS Professional Paper “The Orphan Tsunami of 1700” at URL <http://pubs.usgs.gov/pp/pp1707/>.)

Peter Barnes Receives USGS Western Region Geology Discipline Scientist Emeritus Best Publication Award

Retired U.S. Geological Survey (USGS) marine geologist **Peter Barnes** won the USGS Western Region Geology Discipline Scientist Emeritus Best Publication Award for the book *Benthic Habitats and the Effects of Fishing*, published by the American Fisheries Society. The award was presented at the annual USGS Western Region Awards Ceremony in Menlo Park, California, on November 14, 2007.

The full reference for the publication is: Barnes, P.W., and Thomas, J.P., eds., 2005, *Benthic habitats and the effects of fishing: proceedings of the Symposium on Effects of Fishing Activities on Benthic Habitats—Linking Geology, Biology, Socioeconomics, and Management*, Tampa, Florida, November 12-14, 2002: American Fisheries Society Symposium 41: Bethesda, Md., 890 p.

Wes Ward, Acting Southwest Area Regional Executive, read the following summary of **Barnes’** award citation:

“This volume, which focuses on the effects of fishing activities on benthic habitats and the related science and knowledge needed to understand and quantify those effects, as well as to suggest new ways to address them for sustainable fisheries and healthy, diverse ecosystems, provides a groundbreaking contribution to science and policy about benthic habitats and the effects of fishing. It is the first multifaceted approach to scientific analysis and discussions of socioeconomic issues of fisheries resource management and provides an excellent advancement of the USGS mission of integrated science. **Peter Barnes**, as the co-editor of the volume and co-convenor of the symposium, is directly responsible for this important work.” (See article about the book in *Sound Waves*, December 2005/January 2006, URL <http://soundwaves.usgs.gov/2006/01/pubs.html>.)



Peter Barnes (left) receives award from USGS Western Regional Director **Anne Kinsinger**. Photograph by **Mike Diggles**.

Ralph Cheng Receives DOI's Distinguished Service Award

U.S. Geological Survey (USGS) senior research hydrologist **Ralph T. Cheng** received the Department of the Interior's Distinguished Service Award, the highest Departmental award that can be granted to a career employee. The award was presented on May 9, 2007, at the Department of the Interior in Washington, D.C., and celebrated again on November 14 at the annual USGS Western Region Awards Ceremony in Menlo Park, California. At the November awards ceremony, **Frank Shipley**, Acting Deputy Western Regional Director, read the following summary of the award citation:

"**Dr. Ralph Cheng** has been a pioneer in the development of leading-edge measurement technology and state-of-the-art hydraulic modeling and interpretation. He pioneered the widely adopted application of Acoustic Doppler Current Profilers to make stream-discharge measurements faster, more accurate, and more detailed. **Dr. Cheng**, in collaboration with the National

Oceanic and Atmospheric Administration (NOAA), developed the San Francisco Bay Physical Oceanographic Real Time System (SFPORTS, <http://sfports.wr.usgs.gov/sfports.html>) model which, since 1998, has been providing crucial information in real time to mariners, oil-spill-response teams, and managers of coastal resources about the bay's water levels, currents, salinity, and winds. **Dr. Cheng** has also served among a select group of scientists in advancing the methods and practices of stream gaging in the USGS, pioneering an entirely revolutionary new method based on radar frequencies to measure flood flows without having to place people or instruments in dangerous flood waters.

"For his outstanding scientific contributions to the USGS in the field of hydrologic measurement technology and hydraulic modeling and interpretation, **Dr. Ralph T. Cheng** is granted the highest honor of the Department of the Interior, the Distinguished Service Award." ❁



Ralph Cheng (left), recipient of the Department of the Interior Distinguished Service Award, is congratulated by USGS Western Regional Director **Anne Kinsinger**. Photograph by **Mike Diggles**.

Janet Thompson Receives USGS Western Region Diversity Award, Supervisory Category

U.S. Geological Survey (USGS) research ecologist **Janet Thompson**, who studies benthic (bottom dwelling) communities in San Francisco Bay, received the USGS Western Region Diversity Award, Supervisory Category, at the annual USGS Western Region Awards Ceremony on November 14, 2007, in Menlo Park, California. **Frank Shipley**, Acting Deputy Western Regional Director, read the following summary of the award citation, describing the actions for which **Thompson** was honored:

"**Jan**, you are being recognized for making a difference through your efforts and commitment to a diverse USGS workplace. Your contribution to the values of diversity include active pursuit of diversity through a leadership style that fosters discussion and exploration of others' viewpoints and opinions, consistently hiring using the Survey's Workforce Diversity Programs, and sup-

porting staff with ongoing mentoring and encouragement.

"Your belief in the value and contribution of diversity in our workplace underlies and strengthens the success of your research group, your diverse collaborations, and hence the agency in general. You represent an exemplary model of leadership, promoting diversity in the USGS workforce. You have directly hired and supervised over 14 employees, and the overwhelming majority of these individuals have been women and minorities. At this time, your research group is composed entirely of women and men of color, representing varied ethnic backgrounds. In active pursuit of diversity in your work group, you consistently hired students through the Student Interns for Workforce Diversity Program and sought out technicians with assorted backgrounds and ethnicities and varying levels of education, from local high schools and community colleges to state and private universities.



Jan Thompson (left) receives the USGS Western Region Diversity Award, Supervisory Category, from Western Regional Director **Anne Kinsinger**. Photograph by **Mike Diggles**.

"**Jan**, thank you for being an exemplary role model for all USGS managers and supervisors." ❁

Samples on the Move at the Woods Hole Science Center

By **Brian Buczkowski**

The long-awaited move of samples archived by the U.S. Geological Survey (USGS)'s Woods Hole Science Center (WHSC) took place in mid-November 2007, when the samples were transferred to their new home in the K.O. Emery Geotechnical Wing. This new storage wing is part of an addition of new offices and a conference room to the WHSC facilities on the Woods Hole Oceanographic Institution's Quissett Campus in Woods Hole, Massachusetts. The new storage facility now houses geologic and biologic samples collected from around the world by WHSC researchers during the course of their marine geologic and habitat investigations.



(Right to left) **Brian Buczkowski, Sandy Baldwin, Erin Twomey, Bill Winters, and Adrian Green** (hand on left) unload cores from the Freezer Farm and into the new storage facility. Photograph by **Dann Blackwood**.



John Bratton (left) and **John Crusius** bear a heavy burden, wheeling samples into the new geotechnical wing. Photograph by **Dann Blackwood**.

The new geotechnical wing comprises a refrigerated unit for core and sample storage kept at 4°C (approx 39°F) and a unit for frozen samples maintained at a chilly -22°C (approx -8°F). Adjacent to these cold rooms is a new core lab, which provides short-term storage for dried sediment samples and serves as a staging area for core splitting and sample description and analysis.

The monumental task of moving the entire collection of samples from their old home in outdoor trailers (locally referred to as the "Freezer Farm") to their new location would not have been possible without the back-breaking (and potentially toe-breaking) efforts of **Brian Buczkowski**,

Elizabeth Pendleton, Bill Winters, Ellyn Montgomery, Dann Blackwood, Kate McMullen, Adrian Green, Erin Twomey, John Bratton, Greg Miller, Laura Erban, Sandy Baldwin, P.J. Bernard, Rick Rendigs, Michael Casso, Matt Arsenault, John Crusius, Kevin Kroeger, and Bene Ferre (all USGS).

Many thanks to all those who helped with the "big sample roundup," as well as to those involved in the planning, design and construction of this new addition, including **Dave Nichols, Bill Schwab, Janet Paquette** (USGS), and **Ellen Mecray** (National Oceanic and Atmospheric Administration). ❁



Elizabeth Pendleton (left) and **Greg Miller** remove "D tubes" (named for the shape of their cross section) containing split core halves from the old refrigerated vans. Photograph by **Dann Blackwood**.

USGS Runners Team Up for the Cape Cod Marathon

By **John C. Warner and Jeff List**

October 28, 2007, was a pleasant day in Massachusetts for the 30th running of the Cape Cod Marathon Relay. The U.S. Geological Survey (USGS) Woods Hole Science Center provided two teams, each of 5 people, to participate in the 26.2-mi event. The race started in historic Falmouth, Massachusetts, and traveled along scenic coastal roads and passed historic New England homes. The 10 USGS runners included (for Team A) **John Warner, Rich Signell, Sandy Baldwin, Elizabeth Pendleton, and Ben Gutierrez**; and (for Team B) **Jeff List, Adrian Green, John**

Pohlman, Mike Casso, and John Bratton. Both teams completed the course in a little over 3 hours 30 minutes.

Other USGS runners included **Richie Williams**, who ran with the "Z" relay team (60- to 69-year-olds), which won its age group! ❁

*USGS Team A in the Cape Cod Marathon. From left to right, **Sandy Baldwin, Elizabeth Pendleton, John Warner, Rich Signell, and Ben Gutierrez**. Photograph by **Libby Signell**.*



Research Vessel *G.K. Gilbert* Helps Celebrate USF College of Marine Science Alumni Reunion and Faculty-Recognition Ceremony

By Captain Rich Young

The University of South Florida (USF)'s College of Marine Science held its first Alumni Reunion in 30 years on November 16 to recognize the careers, achievements, and retirement of four of its founding faculty members: **Peter Betzer**, **Kendall Carder**, **Norman Blake**, and **Gabriel Vargo**. The U.S. Geological Survey (USGS)'s Florida Integrated Science Center (FISC) office in St. Petersburg made the research vessel *G.K. Gilbert* available to help celebrate the 100+ man-years these scholars have contributed to chemical, physical, benthic, and biological oceanography, respectively. More than 300 past and present students, faculty members, staff members, and VIPs attended the evening event.

Peter Betzer, Dean of the USF College of Marine Science, came from the University of Rhode Island (URI) in the early 1970s to study trace metals in the oceans. His research ultimately led to the multinational Asian Dust Inputs to the Ocean System (ADIOS) program, where the "Dustbusters," as they came to be known, discovered that iron-bearing Asian dust reduces CO₂ concentrations in the Pacific Ocean by promoting primary productivity. In addition to his distinguished scientific career, **Betzer** developed the USF College of Marine Science into a world-class research facility that enticed the USGS to open the Center for Coastal Geology (now FISC) in a renovated Studebaker dealership next to the USF St. Petersburg Campus—the beginning of much collaboration



Research vessel *G.K. Gilbert* alongside the pier at the USF College of Marine Science during Reunion and Recognition (R&R) ceremonies in St. Petersburg, Florida. The underwater remotely operated vehicle (ROV) on deck with its yellow umbilical cable was demonstrated during the event. The signal flags flying overhead spell "A-D-I-O-S" for retiring Professors **Betzer**, **Carder**, **Blake**, and **Vargo**.

that he forged to create a major marine-research consortium in the area.

Carder came from Oregon State University to study the optical properties of the oceans. His powerful algorithms are used to model reflected light from the oceans collected by remote-sensing platforms and to derive the *in situ* composition of biotic pigments, detritus, and dissolved organic matter. His work has greatly aided the understanding of red tide, the global carbon cycle, and heat-budget calculations. The first submarine, microscopic, 3D holographic-imaging system was built in his lab in 1984 for the ADIOS project.

Blake came from URI to study benthic invertebrates and soon became widely known for his successful aquaculture of

scallops. Thanks to his research, we are again harvesting (and eating!) scallops from our coastal waters.

Vargo also came from URI to study phytoplankton-zooplankton dynamics and expanded his work to include phyco-toxin effects on fish and shore birds. Well known for his work with red-tide blooms, he also volunteers to care for and exhibit birds of prey at a local museum.

The USGS St. Petersburg office was proud to help honor the century of contributions these oceanographers have made to the marine sciences by hoisting flags on the research vessel *G.K. Gilbert* during the festive feast. The office is also proud to show our gratitude to this partnering institution for its pivotal role in bringing the USGS to St. Petersburg 20 years ago. 🌟

Publications

USGS Scientists Contribute to Book on Tidal Freshwater Forested Wetlands As a Result of USGS Climate-Change Program

By Susan Horton

Numerous U.S. Geological Survey (USGS) employees and contractors contributed research findings to a new book, *Ecology of Tidal Freshwater Forested Wetlands of the Southeastern United States*, edited by ecologists **Thomas W.**

Doyle and **Ken W. Krauss** of the USGS National Wetlands Research Center in Lafayette, Louisiana, and professor **William H. Conner** of the Belle W. Baruch Institute of Coastal Ecology and Forest Science, Clemson University, in George-

town, South Carolina. The new book is the result of several research projects conducted under the auspices of the USGS Global Change Research Program (URL <http://geochange.er.usgs.gov/>).

(*Wetlands Ecology* continued on page 22)

(Wetlands Ecology continued from page 21)

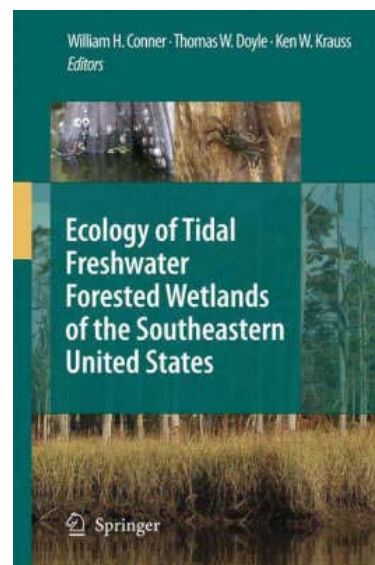
The tidal freshwater forested wetland is a unique ecosystem in the Southeastern United States that has not been well studied or widely understood, yet this ecosystem is among the most sensitive to sea-level rise and increased frequency of droughts or floods.

The editors have compiled up-to-date findings about the hydrology, biogeochemistry, community ecology, forestry, stress physiology, and restoration of these tidal freshwater forested wetlands. The book includes case studies from North Carolina, South Carolina, Georgia, Florida, and Louisiana. The publisher (Springer) believes that the book “will be an important resource for researchers, natural-resource managers, and students interested in understanding the complex dynamics of this unique coastal ecosystem, one that has been altered by land-use history and which is now undergoing decline due to changing climate, sea-level rise, and hurricanes.”

USGS contributors from the National Wetlands Research Center include **Richard Day**, **Thomas Doyle**, **Stephen Faulkner**, **Bobby Keeland**, **Ken Krauss**, **John McCoy**, **Pat O’Neil**, and IAP World Services, Inc., contractors **Andrew From** and **Marcus Melder**. Additional USGS contributors are **Daniel Kroes** and **Christopher Swarzenski** of the Louisiana Water Science Center (Baton Rouge), **Sammy King** of the Louisiana Cooperative Fish and Wildlife Research Unit (Baton Rouge), **Melanie Darst** and **Helen Light** of the Florida Integrated Science Center (Tallahassee), **Wiley Kitchens** of the Florida Cooperative Fish and Wildlife Research Unit (Gainesville), and **Cliff Hupp** and **Gregory Noe** of the USGS National Center (Reston, Virginia).

The full citation for the new book is:

Conner, W.H., Doyle, T.W., and Krauss, K.W., eds., 2007, Ecology of tidal freshwater forested wetlands of the southeast-



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