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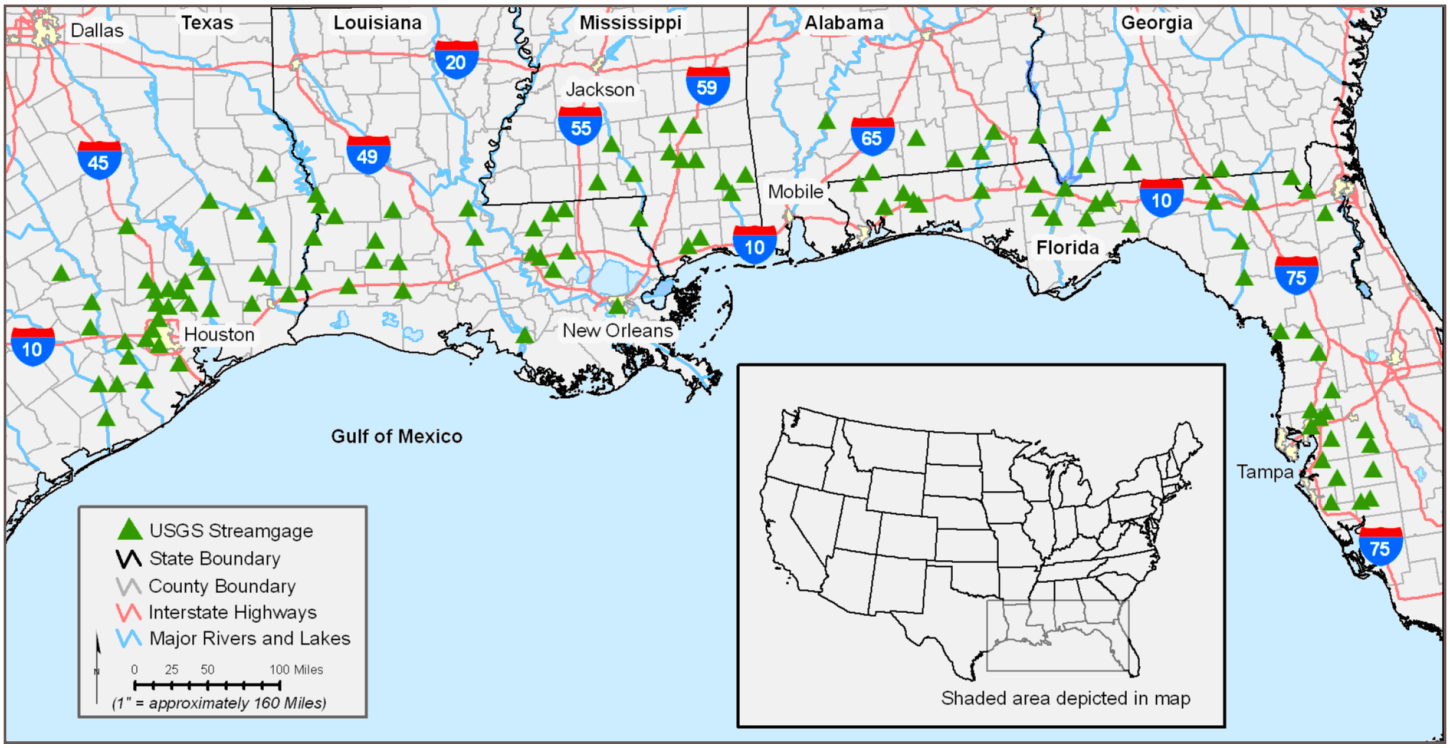
USGS Streamgaging Program Prepares for Future Hurricanes To Ensure the Availability of Flood Data Before, During, and After the Storm

The U.S. Geological Survey (USGS) National Streamflow Information Program (NSIP) has taken a number of actions to prepare for monitoring floods arising from hurricanes and other tropical storms. Activities include hardening of streamgages along the Gulf Coast; implementing rapidly deployable, mobile streamgages; installing an emergency satellite-communications and data-distribution system; and developing storm-surge monitoring capabilities. These activities, which are coordinated with National Weather Service, the U.S. Army Corps of Engineers, and other Federal, State, and local organizations, will ensure timely and uninterrupted water information for forecasters, emergency managers, scientists, and the general public. Improved flood monitoring and assessment will help reduce the risks to coastal communities, property, and human life.

We could not accurately forecast river flows and water-levels without the data and support we receive from the USGS. When river and tide data are not available, our job of forecasting is much more difficult and typically results in diminished accuracy of those forecasts.

(Dave Reed, Hydrologist-in-Charge of the National Weather Service Lower Mississippi River Forecast Center in Slidell, La.)

Hardened Streamgages from Florida to Texas



The USGS is hardening about 120 continuous-record streamgages within 100 miles of the Gulf Coast, in an area that stretches roughly between Miami, Fla. and Port Comfort, Tex. All of these streamgages are used by the National Weather Service for river flood forecasting and modeling. In addition, USGS is hardening 8 to 10 open-water tidal/water-quality gages in Mississippi and Louisiana (not shown).

The USGS operates a national network of more than 7,400 streamgages to address a multitude of drinking-water, infrastructure, flood-forecasting, and other water needs of Federal, State, and local agencies, as well as the commercial and recreational boating and fishing communities. In 2005, many USGS streamgages along and inland of the Gulf of Mexico were damaged or destroyed by Hurricanes Katrina and Rita. The damage resulted in interruptions of flow and water-level data needed during the storm by forecasters, emergency managers, and dam and levee operators. To ensure reliable delivery of data during future hurricanes, the U.S. Congress appropriated supplemental funds to repair USGS streamgages. The USGS is in the process of "hardening" 120 Gulf Coast streamgages from western Florida to eastern Texas to withstand hurricane generated flood waters. Streamgage hardening generally modifies streamgage structures to withstand a 200-year flood. In most cases, this involves raising the structure to a higher elevation, strengthening it to be more robust and lower in profile, and (or) upgrading data transmission capabilities.

Rapid Deployment of Mobile Streamgages

The USGS network of 7,400 streamgaging stations covers many of the Nations streams – but not all. The lack of a gage can be critical during a storm or when an emergency condition requires more detailed monitoring. Therefore, USGS has developed new rapidly deployable, mobile streamgages to provide short-term water-level data to those areas. These mobile gages can also serve as emergency replacements for damaged or destroyed gages. In the days following Hurricane Katrina, seven temporary streamgages with satellite telemetry were installed in and around New Orleans to help the U.S. Army Corps of Engineers track efforts to dewater the flooded city.

Data from all USGS streamgages, both mobile and permanent, are transmitted by satellite telemetry in real time to the USGS National Water Information System (http://waterdata.usgs.gov/nwis/rt).

Emergency Data Acquisition and Dissemination

Streamflow data are critical for emergency managers who need to make informed decisions about flood and storm response activities, which can save lives and property. Streamgages are just one component of the national system used to collect and synthesize those data and disseminate them to an extensive community of users who depend on the information all day, every day. Currently, USGS water data are relayed from the streamgage to the users via the National Oceanic and Atmospheric Administration (NOAA) Data Access and Processing System, which has a single command and data acquisition station at Wallops Island, Va. Since this station is located near the coast—only about 15 feet above sea level—it is vulnerable to hurricanes and other storms. The USGS, NOAA, and many other partners and data users recognize the potential for interruptions to the flow of crucial streamflow and meteorological data and are partnering to establish an emergency satellite data acquisition and dissemination unit at the USGS facility located in Sioux Falls, S.D. This unit is expected to be operational by the end of 2007.

Measuring Storm Surge

Hurricanes Katrina and Rita vividly demonstrated that storm surge can be as dangerous to coastal communities as riverine floods are to inland communities. Historically, storm-surge assessments were based on eye witness accounts and post-storm analysis of debris piles, high-water marks, and structural damage. While these assessments are useful to document the magnitude of the storm surge, they cannot provide reliable information about the timing of the inundation, nor do they facilitate reconstruction of the various flow paths by which the surge waters penetrate inland areas. In order to improve surge forecasting, design better infrastructure, and improve land use planning, quantitative data are needed to characterize the dynamic interaction of hurricane-driven surge waters and waves with coastal topography, buildings, bridges, roads, and channels.

This USGS hydrographer is deploying a storm-surge sensor (in a protective metal casing) to a bridge piling.

In response to these needs, USGS designed and developed mobile networks of rugged, inexpensive water-level and barometric-pressure sensors to measure storm surge accurately. The experimental network of 47 sensors was first deployed to areas of southwestern Louisiana and southeastern Texas in the hours preceding landfall of Hurricane Rita in September 2005. Information on water levels, barometric pressure, and related high-water marks were collected, and maps were generated to display flood duration, times of surge arrival and retreat, and maximum depths (available at *http://pubs.usgs.gov/ds/2006/220/*). By overlaying the storm-surge information on other visualizations of hurricane impacts, such as beach erosion and housing damage, and incorporating the information into complex hydrodynamic models, scientists, engineers, and emergency managers can better understand surge mechanisms and develop designs that will lead to safer coastal communities. Future USGS sensors may be able to monitor salinity and include real-time telemetry to help emergency officials respond when storm surge threatens any coastal community (see U.S. Geological Survey Fact Sheet 2006-3136; *http://pubs.er.usgs.gov/usgspubs/fs/fs20063136*).

This is the sensor used to collect water-level and barometric –pressure data

In 1889, the U.S. Geological Survey (USGS) established its first streamflow-gaging station (a site where regular observations of streamflow data are collected) on the Rio Grande River at Embudo, N.M. As the need for streamflow data increased, the USGS streamgaging network grew from that single gage to its current (2007) size of approximately 7,400 streamgages nationwide. More than 90 percent of these stations are operated with at least partial support from State, local, or other Federal agencies.

The data support a wide range of activities, including flood forecasts; drinking-water management; irrigation withdrawals; timing of wastewater discharges and reservoir releases; water-quality standards development; legal and treaty obligations on interstate and international waters; and infrastructure designs for dams, levees, bridges, and roads.

Streamflow data are provided electronically, in near-real time (updated at 1- to 4-hour intervals) over the Internet through the USGS National Water Information System (NWIS, http://waterdata.usgs.gov/nwis.rt). The many uses of streamflow data are enhanced by making these data available quickly to a wide audience. Recreationists can get current information to plan their outings. During floods, real-time streamflow data contribute to saving lives and property.

To access streamgage hardening locations and data visit the USGS Office of Surface Water Hurricane Web Site at: *http://water.usgs.gov/osw/hurricanes/*

To learn more about other storm programs, visit the USGS Hurricane Web site at: *http://www.usgs.gov/hazards/hurricanes/2007.asp*

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