National Aeronautics and Space Administration

SCIENCE SERVING SOCIETY: DISASTER MANAGEMENT

NASA Earth observing satellites can help assess damage caused by natural disasters. When Hurricane Katrina struck New Orleans on August 29, 2005, it caused breaches in the levees along the canals that run through the city from Lake Pontchartrain. The Advanced Land Imager on NASA's Earth Observing-1 (EO-1) satellite acquired this detailed image of the flooded city on September 6, 2005, after the breaches had been sealed. The floodwaters rose to cover 80% of the city—flooded areas appear darker in the picture—but a narrow strip of the city along the banks of the Mississippi River remained dry. In this dry area, which includes downtown New Orleans and the historic French Quarter, a white plume of smoke rises from a fire burning near the lower edge of the image.

Each year, the U.S. government spends billions of dollars to assist regions impacted by natural disasters—e.g., from left to right: floods, earthquakes, and fires. NASA Earth observing satellites contribute valuable information that helps to improve the accuracy of predictive models used to forecast natural disasters. The improved forecasts help community planners predict, plan for, and possibly prevent the impacts of a pending natural disaster on society.

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Overview of the Program

At present, an array of Earth observing satellites are in orbit, and additional launches both by NASA and others will continue throughout the next decade. Our ability to observe our home planet from space has never been greater. Increasingly, studies of the Earth focus on understanding the Earth's land, atmosphere, oceans, and life as a whole integrated system rather than as individual independent elements. NASA is an important contributor in this systems approach to Earth science studies.

In addition to providing Earth observing capabilities, NASA forms strategic partnerships with other government, academic, private, and international organizations. Through these partnerships, NASA's Earth science observations and measurements are linked to practical applications. NASA data, information, and predictive models help NASA's partners, and nontraditional users of Earth science, make timely and accurate decisions regarding management of resources and development of policy. The agency's goal is to maximize the benefit of science and technology to stakeholders by smoothly flowing Earth science data and information from NASA satellites to society.

Disaster Management

Each year, the U.S. government spends billions of dollars to assist regions impacted by natural hazards worldwide such as severe thunderstorms, tornadoes, hurricanes, tsunamis, blizzards, floods, landslides, volcanic events, wildfires, and earthquakes. Decision makers need access to the most accurate and timely information available to help them plan their response to these natural disasters. Such information helps community planners understand where their jurisdiction might be vulnerable and possible lessen the harmful impacts of the destruction on society. Emergency response personnel need advanced warning to know when extreme events will occur as well as timely, detailed data to conduct post-event environmental assessments.

To reduce the overall impact of natural disasters on society, and to aid evacuation and recovery efforts, NASA works collaboratively with the Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Association (NOAA), the U.S. Department of Agriculture (USDA) Forest Service, and the U.S. Geological Survey (USGS). Our partnership has improved the nation's ability to understand the risk and predict the occurrence of natural disasters. FEMA uses decision support systems to run computer simulations that provide information to aid community planners, early warning systems and first responders, and also contribute to impact assessments, risk communication, mitigation, and implementation of relief efforts. NASA's Earth science data and models provide important input into these decision support systems that help improve their accuracy and predictive capabilities.

Several specific areas where Earth observations from NASA satellites make a significant contribution are in hurricane, wind, and flood prediction. NOAA combines satellite-derived estimates of precipitation from the Tropical Rainfall Measuring Mission (TRMM) satellite and wind velocity from the Quick Scatterometer (QuikSCAT) satellite to improve hurricane track and intensity forecasts. Integrating NASA data into NOAA meteorological models improves the accuracy of forecasts of landfall and increases the lead-time for warnings for both hurricanes and floods. More accurate forecasts, in turn, enable improved decision and policy making which enhances community preparedness for these types of events.

The Moderate Resolution Imaging Spectroradiometer (MODIS) Land Rapid Response System is another example of how NASA data make an immediate difference in planning for, and responding to, disasters. This system is designed to serve the need for quick access to data from the MODIS instrument onboard the Terra and Aqua satellites, whenever and wherever disaster strikes around the world. NASA collaborates with the University of Maryland, the USDA Forest Service (USFS), and NOAA to provide firefighters with the most up-to-date fire maps and satellite images from Terra and Aqua, to help them plan responses to wildfires. Once a fire is under control, land managers can use the same information to assist in recovery efforts, such as planning for rehabilitation of the burned areas and protection of homes and water quality in the affected area.

Despite all these efforts, natural disasters will always be a threat to society. When disaster does strike, NASA's Earth observing satellites contribute timely information to assess the damage. In cases where damage is widespread—e.g., major floods and tsunamis—MODIS can obtain an image of the area after the disaster and it can be compared to an image of the same area obtained before the disaster occurred to see how the landscape has changed. The Advanced Land Imager (ALI) on Earth Observing-1 (EO-1) can gain even more close-up images of impacted areas (see the image from EO-1 on the front for an example) and are also particularly useful for viewing the damage caused by smaller-scale disasters such as landslides and tornadoes that MODIS cannot see.

As data from additional Earth observation satellites and surface measurement systems are integrated into predictive models over the next few years, the accuracy and reliability of the forecasts issued will continue to improve, as will their usefulness for disaster management applications. Provided with such information, decision makers will be better equipped to respond to disasters when they occur. NASA's collaborative investments in improved forecasting should make it possible to significantly reduce the losses from weather-driven disasters over the course of the next decade.

LG-2006-1-099-GSFC (rev. May 2006)