Outstanding Accomplishments in Research

Severe Weather

Research is at the center of all National Oceanic and Atmospheric Administration services. NOAA's Office of Oceanic & Atmospheric Research (OAR) conducts research, develops products, and provides scientific understanding and leadership to support NOAA's mission to meet our nation's economic, social and environmental needs.

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NOAA's Office of Oceanic and Atmospheric Research (OAR) plays a key role in increasing our understanding of severe weather and in developing technologies for better detection and prediction of severe weather. Together, knowledge and technology lead to more timely and accurate forecasts and warnings, saving lives and property.

Better Tools = Better Forecasts

NOAA researchers pursue cutting-edge scientific understanding of severe weather, which enables them to develop tools that National Weather Service (NWS) forecasters can use to make more accurate and timely warnings.

One example is the Warning Decision Support System developed by NOAA's National Severe Storms Laboratory (NSSL) that provides automated detection tools for the NEXRAD Doppler radar, also developed at NSSL, and other sensors to identify rotation in storms preceding tornadoes and the likelihood and size of hail.

Since October 2007, NWS forecasters issue more accurate warnings with fewer errors and more precise storm motion information thanks to WarnGen, a tool developed at NOAA's Earth System Research Laboratory (ESRL). This computer-based system allows forecasters to spend less time estimating storm locations and searching a map for towns in the path of the storm, and more time analyzing radar data.

Studying Supercell Storms

In the spring of 2007, NOAA researchers and their partners used Shared Mobile Atmospheric Research and Teaching radars (SMART-radars) to collect data on supercell storms at low altitudes. Researchers are studying whether the assimilation of rapidly updated surface data into models will improve storm-scale forecasts. These radars also collected data on the vertical structure of multicell storms, especially in the mid-levels of the storm where the storm's updraft and downdraft structure rapidly evolve. Better diagnosis of multicell systems should improve the ability to model these storms for lightning research, precipitation forecasting, and hail prediction.

A supercell thunderstorm, often associated with violent weather.

Beyond Tornado Alley

When devastating flooding in the Carolinas claimed 51 lives and left thousands homeless following hurricanes and tropical storms in September 1999, the Coastal and Inland Flooding Observation and Warning (CI-FLOW) project was launched to reduce loss of life and property from hydrologic hazards in the Carolinas and across the nation.

NSSL is working with NOAA Sea Grant in North and South Carolina and university partners to evaluate and test new technologies and techniques for accurate and timely identification of inland and coastal floods and flash floods. CI-FLOW provides resource managers with data fundamental to ecosystem assessment, management, and hazard mitigation. CI-FLOW is based on three major thrusts – monitoring, modeling, and mitigating.

Flooding and Debris Flow

ESRL scientists are leading a testbed program designed to improve flood forecasts by infusing new technologies, forecast models, and results from the research community into daily operations of the NWS. One product being tested graphically displays water vapor flux in real time, allowing closer monitoring of atmospheric rivers that bring heavy rains to West Coast mountains and helping forecasters better predict rainfall events. (*Cont.)*

Flooding and Debris Flow
(continued)

Through the Demonstration Flash-Flood and Debris Flow Early Warning Project, part of the NOAA Hydrometeorology Testbed, NOAA researchers have helped the nation of Colombia promote and develop an early warning system that can help to avert disasters in a long and narrow valley region prone to flooding and debris flows.

Debris flow in California below a wildfire burn area hit with heavy rains.

PREEMINENT RESEARCH

Hazardous Weather Testbed Spring Experiment

Each spring, NOAA scientists and their partners gather in Oklahoma for the annual Hazardous Weather Testbed Spring Experiment. There is great potential to accelerate the precision of severe storm forecasts and warnings to protect the public by identifying and targeting issues of mutual interest for both severe weather forecasters and researchers. The Spring Experiments may soon enable meteorologists to issue detailed severe weather forecasts up to five days in advance.

To help forecasters more accurately predict when and where precipitation will fall – and importantly, how much – NSSL researchers are focused on the next generation of Quantitative Precipitation Estimation (Q2). This research incorporates a multi-sensor approach focused on high-resolution integration of radar, satellite, model, and surface observations to produce very high-resolution precipitation estimates.

Refining Radars

NOAA researchers continue to improve weather radars, the best tool for identifying and tracking severe weather on local scales. At NSSL, researchers are investigating dual polarization radar upgrades to Doppler radar technology to provide more information about precipitation in clouds to better distinguish between rain, ice, hail and mixtures. Improved data help forecasters provide more accurate and timely warnings for flash floods, the number one severe weather threat to human life.

NOAA researchers also are adapting state-of-the-art radar technology used on Navy ships for use in tracking severe weather on land. Phased Array radar (PAR) can detect rotation, hail, microbursts, and gust fronts well ahead of other radars due to its rapid volume scan capability. Reducing the scan or data collection time from five or six minutes to less than one minute, PAR can potentially extend the lead time for tornado warnings.

Value to Society

During 1980 - 2003, the U.S. sustained 58 weather- or climate- related disasters, with damages and costs exceeding $1 billion per event. Total inflation adjusted direct losses for these events were more than $350 billion. Accurate severe weather watches are dependent on forecasters being able to properly predict where and when severe thunderstorms will develop, how they will evolve over the next 4-8 hours, and what kinds of storms are most likely to occur.

By pinpointing the specific area of a storm, tools developed by researchers can reduce the area warned by as much as 70 percent. Storm-based warnings provide the public with more accurate descriptions of what's happening in their neighborhood and avoid needlessly alarming those outside the threatened area.

Hydrometeorologic research serves society's needs by developing methods to monitor and predict floods and flash floods. Accurate quantitative precipitation estimates and forecasts are critical to fresh water management in the United States and around the world. NOAA researchers are expanding beyond radar-centric precipitation estimates toward a multi-sensor approach focused on integrating radar and model data, and satellite and surface observations to produce very high-resolution precipitation estimates.

To Learn More, Visit These Sites:

Earth System Research Laboratory: http://www.esrl.noaa.gov/
National Severe Storms Laboratory: http://www.nssl.noaa.gov/

To Work or Study at OAR, Visit These Sites:

NOAA Careers: http://www.careers.noaa.gov
Hollings Scholarships: http://www.orau.gov/noaa/HollingsScholarship/
Knauss Fellowships: http://www.seagrant.noaa.gov/knauss/

OAR's mission is to conduct research, develop products, provide scientific understanding and leadership and to conduct outreach towards fostering NOAA's evolving environmental and economic mission. In 2007, NOAA celebrates 200 years of science and service to the nation, starting with the establishment of the U.S. Coast and Geodetic Survey in 1807 by Thomas Jefferson.