Hydrometeorology Research

National Severe Storms Laboratory
Hydrometeorology Research at NSSL

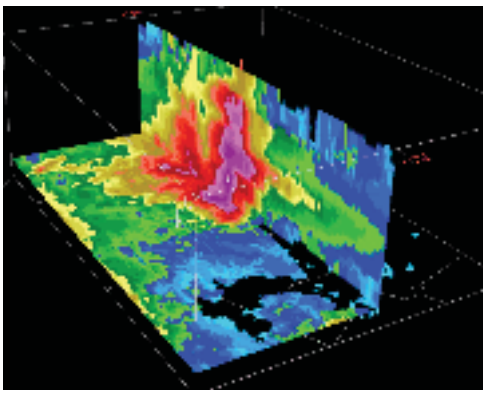
Our nation's health, economy and security depend on the monitoring and prediction of fresh water resources. NSSL hydrometeorology research works to develop new weather and water related applications and water resource management tools, with a focus on forecasting floods and flash floods.

Estimating precipitation types, amounts, and locations

NSSL created a powerful research and development tool for the creation of new techniques, strategies, and applications to better estimate and forecast precipitation amounts, locations, and types. The tool is called NMQ, the National Mosaic and Multi-sensor Quantitative Precipitation Estimation. NMQ uses a combination of observing systems ranging from radars to satellites on a national scale to produce precipitation forecasts. As new concepts are developed, they can be plugged in and out of NMQ with ease.

High-Res 3-D Mosaic Project

As part of NMQ, NSSL has developed a system piecing together radar data from every National Weather Service (NWS) radar in the U.S. This is called a "mosaic," and produces 3-D radar images at many levels of the atmosphere every five minutes. The mosaic is extremely useful for multi-sensor severe storm algorithms, generating regional rainfall products, aviation weather applications, and for convective scale numerical weather modeling.



The mosaic system takes base level data from all available radars at any given time, performs quality control, and then combines reflectivity observations from individual radars onto a common 3-D grid.

Q2

The Next Generation Quantitative Precipitation Estimation (Q2) is a joint project, combining the most effective techniques to estimate precipitation developed at NSSL and NOAA's Office of Hydrologic Development. Researchers are testing radar data from other sources besides the NWS, combining the data into a 3-D mosaic, using satellite to fill in gaps in radar coverage, and studying ways to forecast mountain or lake-effect snow amounts more accurately.

Q2 Verification System (QVS)

NSSL developed QVS to check the accuracy of the products they are working on. QVS provides current and archived 3-D mosaic data and precipitation amount estimates from a variety of sources, including Q2. A number of verification tools are available including product differences and performance statistics.

Basin Delineation

NSSL developed and continues to enhance and maintain a flash-flood-scale basin data set in support of the National Weather Service Flash Flood Monitoring and Prediction System (FFMP). The FFMP is used to assist flash flood warning decision-makers at 122 Weather Forecast Offices across the U.S.

CI-FLOW (Coastal and Inland Flooding Observation and Warning)

NSSL is part of a research group working to find a way to connect all the water monitoring and prediction systems available in coastal North Carolina. Their goal is to combine satellite, radar, and rain-gauge data with information on streams and rivers from their sources in the mountains to the ocean.

Partners hope to develop and test CI-FLOW techniques to accurately identify and predict floods and flash floods along the coast and inland, and their impacts on the ecosystem, especially when threatened by hurricanes. CI-FLOW's mission is to reduce the number of fatalities due to flooding, the leading cause of storm-related deaths.

Debris Flow Warnings

In January 2008, the National Weather Service Forecast Office in Oxnard, CA used SMART-R high-resolution rainfall data when deciding to issue a flash flood warning for areas previously scarred by wildfires and prone to mudslides.

NSSL operates a Shared Mobile Atmospheric Research and Teaching Radar (SMART-R) mobile radar during winter seasons in California near an area damaged by wildfires. The SMART-R provides real-time close-up radar data during rainstorms in areas not easily scanned by NWS radar due to rugged terrain. The effort is part of the Flash Flood Demonstration and Debris Flow project sponsored by the U.S. Geological Survey to help forecasters improve flash flood and debris flow (mudslide) warnings in burn areas. Areas damaged by wildfires are particularly susceptible to flash floods and debris flows during rainstorms. Rainfall normally absorbed by vegetation can run off almost instantly, causing creeks and drainage areas to flood much earlier and at higher levels than normal. California was hit hard by storms at the beginning of January 2008 and SMART-R data was transmitted in real-time to the Oxnard, CA NWSFO. Forecasters reported the extra data was extremely helpful in their decision to issue a flash flood warning.

NOAA Hydrometeorology Testbed (HMT) Program

NSSL participates in the NOAA HMT Program aimed at moving new technologies, models, and scientific results from the research community into daily forecasting operations of the National Weather Service and its River Forecast Centers. The HMT program is being implemented incrementally in different regions of the U.S. beginning with the Russian River and American River Basins in California (HMT-West). HMT-Southeast will be implemented in FY10 in the Tar-Neuse River Basin of North Carolina.

Microburst impacts

NSSL operated the SMART-R to observe the lifecycle of strong microbursts and assess their impacts on the Salt River Project's electrical power transmission infrastructure in Phoenix, AZ. NSSL also worked with the local NWS forecast offices to assess advance precipitation estimation techniques for use in their Flash Flood Monitoring and Prediction System.

Taiwan

NSSL and NOAA's Earth System Research Laboratory collaborated with the Central Weather Bureau and Water Resources Agency of Taiwan to develop a high-resolution precipitation amount forecasting system for Taiwan. The two agencies worked to improve Taiwan's capabilities to issue flash flood and flood warnings and improve river and reservoir water management.

For more information, contact: Keli Tarp, keli.tarp@noaa.gov
On the web: http://www.nssl.noaa.gov/research/hydromet/
3/2009