Spring 2005 Volume 6 Number 2

NSSL Briefings

A newsletter about the people and activities of the National Severe Storms Laboratory and Cooperative Institute for Mesoscale Meteorological Studies collaborative researchers

Figure 1: A boulder on the road near La Conchita, CA on Jan. 10, 2005

NOAA-USGS team formed to create debris flow forecasting system

Extreme rainfall over California during January and February 2005 has brought much-needed attention to the danger of flash flooding and mudslides. Major highways and commuting routes were washed out or covered by mudslides and debris flows while several communities were isolated by road closures. Cost estimates of road repairs are more than 30 million dollars. The excessive rainfall between January 7-11, 2005, directly and indirectly caused 22 deaths. Total crop damage in Ventura County alone was estimated to be near 52 million dollars according to the county Office of Emergency Services.

The National Weather Service (NWS) invited NSSL researchers David Jorgensen and J.J. Gourley (CIMMS) to serve on an interagency team to create a debris flow, or mudslide warning system for southern California. Although some do not meet traditional "flash-flood" criteria, rapidly-moving debris flow, triggered by severe rainstorms, are among the most numerous and dangerous types of landslides, particularly in California. Debris flows can begin suddenly, accelerate quickly, reach velocities up to 60 km/hr, and flow down streams or other channels for distances of several kilometers. They can smash homes and other structures, wash out roads and bridges, sweep away cars, knock down trees, and, finally, lay down thick deposits of mud, rock, and other debris where they come to rest, obstructing drainages and roadways (See Figure 1).

For example, a catastrophic rainstorm over the San Francisco Bay area in January 1982 deposited nearly half the normal annual rainfall in 32 hours and triggered more than 18,000 landslides -principally debris flows-causing 25 fatalities and $66 million in property damage. Although the NWS had forecast heavy rainfall and issued several special weather statements, the destructiveness of the debris flows and other landslides triggered by the storm were unexpected.

Following this disaster, the U.S. Geological Survey (USGS), in cooperation with the NWS, experimented with a prototype warning system for alerting the public when rainfall conditions reach or approach critical levels for triggering debris flows. The system operated on a daily basis and used precipitation fields observed and/or forecast by the NWS San Francisco Weather Forecast Office (WFO). Those fields were forwarded to the USGS' Menlo Park Office where geologists applied them to local basin-specific mudslide forecasting models. Based on the model results, the geologists recommended areas where mudslide warnings were warranted, and the corresponding warnings were issued by the WFO, following the standard warning dissemination procedures. After budget cuts in 1985, the experiment was terminated.

The NWS and USGS are now interested in reviving the service. Improvements to observing technology (e.g., see Fig. 2 for the distribution of special rain gauges and WSR-88D's in southern California) and hydrologic modeling capability hold great promise that the warnings will be much more effective than those produced by the prototype system in the 1980's. Moreover, recent severe wildfires in southern California have increased the risk of debris flows near high population centers. The interagency team will provide guidelines for the warning system including developing a research plan for improved Quantitative Precipitation Estimation (QPE) over the southern California Mountains. Accurate QPE is a challenge over mountainous terrain due to radar beam blockage of low-level scans (Fig. 2). Utilizing the NSSL national radar mosaic for gridding and quality control of WSR-88D for use with multi-radar, multi-sensor QPE techniques for input to USGS regional distributed hydrologic models would likely be beneficial to California residents as well as a fruitful NSSL research endeavor. ◆

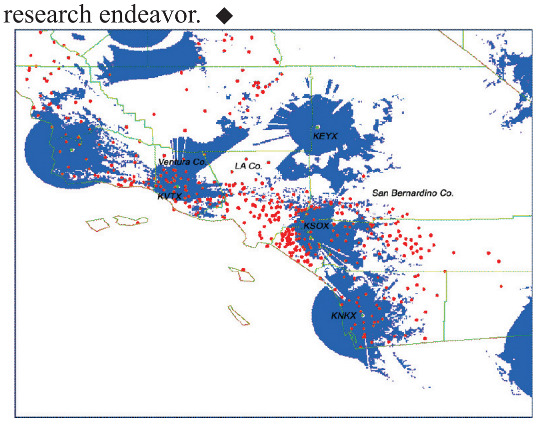


Figure 2: Distribution of Southern California ALERT rain gauges (red dots), WSR-88D radars (green dots). Green lines are county boundaries and the blue regions denote areas where radar coverage is below 1km above the ground.

Spotlight on: Dave Priegnitz

We associate Dave Priegnitz (CIMMS) with running -- running nearly every day over the lunch hour on the trails surrounding NSSL, and training for the half-dozen races a year that occupy his time. He says running relaxes him. If you saw his face while he runs you would agree. Though his nine marathons are an impressive accomplishment, Dave claims his biggest personal success sits on 100 acres southwest of Pauls Valley, OK. Dave and his wife, Virginia, took two years to build their own home, designing it themselves online. They and their son Nathan (17) enjoy the solitude of the countryside with their cats, chickens, guineas, and ducks.

Dave grew up in Algonquin, IL, northwest of Chicago, and witnessed the Palm Sunday tornado outbreak in 1965. He remembers the F4 tornado going through Crystal Lake, about 5 miles north of his home. From then on he kept his eyes on the weather. Dave graduated Northern Illinois University with a B.S. in geosciences (meteorology) and went on to the University of Wisconsin-Milwaukee to earn his M.S. degree in geography (meteorology). He had always planned to forecast, but the first job he found was in weather modification research and data analysis and software support at the South Dakota School of Mines and Technology (SDSMT) in Rapid City, SD. During his time there, Dave wrote software for the data systems on a T-28 research aircraft used in a hail research field project in Switzerland. Another memorable experience was watching grapefruit-sized hail plow up a field during a hail suppression project. Later, Dave worked for a contractor located at Offutt Air Force Base in Omaha, NE, on the Satellite Data Handling System (SDHS) project. Omaha was also where he met his wife Virginia, who was in the Air Force. From there they made a brief stop in Austin, TX, before moving back to Rapid City and SDSMT, where he developed software to aid weather radar research.

The Open Systems Radar Product Generator (ORPG) project brought Dave to NSSL in 1996, and he became the primary developer for the human-computer interface to the RPG component of the WSR-88D. Now his focus is on "learning the nuts and bolts of the Phased Array radar." He wants to help make the National Weather Radar Testbed a world-class facility easily accessible to researchers.

We still associate Dave with running. Now that his home is complete, his running has picked up again. His goal is to run another marathon within the next 12 months (once he turns 50) and finish it in under three hours. Dave has tracked his miles over the years--he has less than 7000 miles to go before having run roughly the equivalent of the circumference of the earth at the equator (24,901.55 miles)! ◆

The latest advancement in precipitation estimation

Why do accurate precipitation estimates matter? From the support of snow removal operations to watershed management, our nation’s health, economy, and security depend on the monitoring and prediction of fresh water resources. Unfortunately, seamless and systematic high-resolution monitoring of precipitation input into fresh water resource does not exist across North America. To fill this void, a joint initiative among NSSL, the NWS/Office of Hydrologic Development (OHD) and the NWS Office of Climate, Water, and Weather Services has created a national program and system for the research and development of new hydrometeorological applications and water resource management tools.

A key component of the program is the National Mosaic and Multisensor Quantitative Precipitation Estimation Project (NMQ). The NMQ will function as a community-based research and development platform for the creation of new applications, techniques and strategies toward precipitation estimation (QPE), short-range precipitation forecasting

News briefs

Comings and goings

Linda Skaggs has replaced Jon Domstead as NSSL's Administrative Officer. Linda came to NSSL in 1996 and has held positions within the lab as a division secretary, Administrative Assistant for the Acting Director, and Senior Budget Analyst. Linda's new position became effective at the end of November, 2004. **Deana Beneventi** (Budget Analyst) has taken over as Senior Budget Analyst, and **Sandra Allen** (Secretary for the Forecast Research and Development Division) has accepted the Budget Analyst position.

Yusif Nava and **Boris Hernandez**, from the University of Veracruz in Xalapa, are working with NSSL's **Mike Douglas** studying how the intensity of the sea-land breeze circulation changes from June through September and how this may be related to the changing patterns of rainfall around the Gulf of California. Nava and Hernandez were part of the NAME data collection and are currently participating in the data processing and interpretation phase of the project.

NSSL welcomes **Suzanne Van Cooten**, Ph. D., in June from the NOAA/NWS National Data Buoy Center, Stennis Space Center, MS. Suzanne is a hydrometeorologist and will join NSSL's hydrometeorology program.

NSSL scientist awarded DOC's Gold Medal

NSSL's **Vincent (Bim) Wood**, along with NWS's Jim Purpura, were recently awarded the Department of Commerce's 2004 Gold Medal for "instituting a program of disseminating NWS hazardous weather warnings to the Oklahoma deaf and hard-of-hearing community through alphanumeric pagers." The award is the highest honorary award given by the DOC. Bim has been working on the paging system since his nine-month study that revealed 81 percent of deaf and hard-of-hearing people have experienced fear about being unprepared for weather emergencies.

Bim Wood (left) and Jim Purpura (right) demonstrate the paging system.

News briefs, continued

Editorships

Mike Baldwin and **Jack Kain** have been selected to be associate editors for *Monthly Weather Review* to serve a three year term.

SPC/NSSL Spring Program

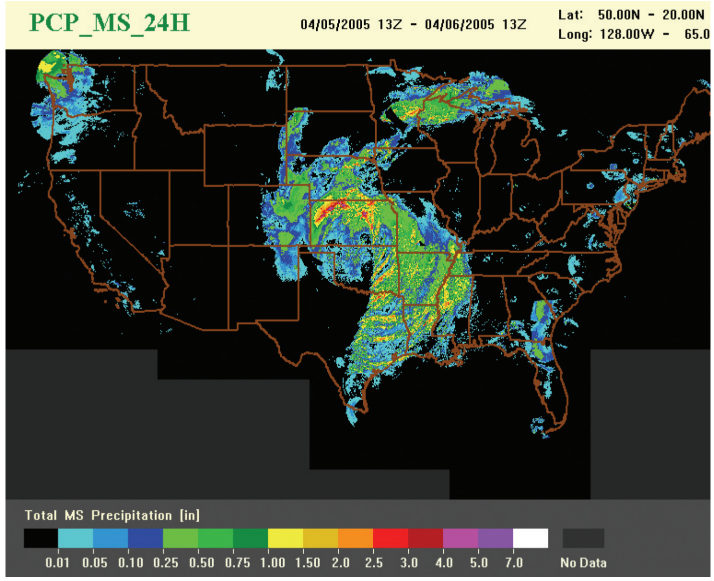
The fifth annual SPC/NSSL Spring Program operated from 8:00 a.m. - 4:00 p.m., Monday through Friday from April 25 through June 3, 2005. The program included daily weather briefings from 12:45-1:00 p.m. Forecasters and researchers worked together during this concentrated period to evaluate new products that have the potential to enhance severe storm forecasting operations.

"Category 6: Day of Destruction"

Producers of the CBS mini-series, "Category 6: Day of Destruction," consulted meteorologists from NOAA to ensure the accuracy of the program that aired last November. **Harold Brooks**, NOAA NSSL research meteorologist, and Joe Schaefer, Director of the Storm Prediction Center, reviewed scripts of the production and provided suggestions. "You have to consider the end result is entertainment, not necessarily realistic," said **Keli Tarp**, NOAA Weather Partners Public Affairs Specialist.

NSSL's Web site is at: http://www.nssl.noaa.gov

Since 1995, NSSL Briefings has been published from the National Severe Storms Laboratory to provide federal managers, staff, and other colleagues in the meteorological community with timely information on our activities. This newsletter also contains information about NSSL's scientific collaborations with the OU Cooperative Institute for Mesoscale Meteorological Studies (CIMMS). If you would like to be added to the NSSL Briefings mailing list, or have a change in your address, please forward requests to Kelly Lynn, NSSL, 1313 Halley Circle, Norman OK, 73069; by phone: (405) 366-0429 or by email: kelly.lynn@noaa.gov.



National composite reflectivity derived from the 3D radar mosaic grid using over 120 radars.

(QPF), precipitation classification (snow, rain, sleet, etc.) and severe weather monitoring and prediction. The NMQ will use a combination of observing systems ranging from radars to satellites on a national scale across small time and space resolutions. Successful results will be implemented into NOAA's Advanced Hydrologic Prediction Service and the Flash Flood Monitoring Program.

The NMQ system will be more than a powerful research and application development tool. The NMQ will also be quasi-operational and provide seamless precipitation estimates and short-term precipitation forecasts over the United States. A high premium will be placed on speed and modularity of the NMQ system so that new and advanced algorithms may be plugged in and out with ease and transparency. Rapid real-time communication of base-level WSR-88D data from the CRAFT network will provide the foundation for NMQ along with other data sets such as satellite, surface, and Numerical Weather Prediction (NWP) model data. Two high-performance computer clusters comprised of more than 80 individual CPU's will allow NMQ to combine research along with real time QPE product generation. One cluster will serve as a development and testing platform (Joint Applications Development Environment - JADE) that will provide field personnel, university researchers and NOAA scientists a common working environment for application development, intra-comparison, and evaluation. Utilizing the NMQ computing infrastructure and data stream, researchers will be able to develop and assess new QPE and short-term QPF techniques as well as multi-sensor severe weather applications. The second cluster, currently deployed, will serve as a pseudo-operational environment generating and disseminating QPE and basic severe weather products to researchers and end users. Over the next year, the spatial and temporal resolution of the NMQ system and QPE products will evolve from 1x1 km resolution to 250x250 meter resolution, and 21 to 31 vertical levels with updates less than every 5 minutes.

Part of the NMQ project includes the creation of next-generation multiple sensor QPE known as "Q2." Q2 continues NSSL's departure from radar-centric precipitation estimation and moves toward a multi-sensor approach focused on high-resolution integration of radar, satellite, model, and surface observations to produce very high-resolution precipitation estimates.

An initial version of Q2 is currently running to coincide with the first multiple agency Q2 Workshop hosted by NSSL and OHD at the end of June. The workshop will launch the NMQ as a community platform and focus on presenting and discussing operational needs and issues – especially those defined by the NOAA/NWS. The Q2 Workshop participants will ultimately form a plan that will make the most of the unique NMQ environment to improve monitoring and prediction of water-related hazards and freshwater resources in the U.S. More information can be found at: www.nssl.noaa.gov/wrd/wish/q2/workshop.shtml. ◆

Fred Sanders' adjuration never to accept anything as fact.

An invitation to speak at the Fred Sanders Symposium at the 2004 American Meteorological Society (AMS) conference rekindled Dave Schultz's (CIMMS) interest in cold fronts. Fred Sanders' career was being honored for his 50-year influence on our understanding of many areas of atmospheric science. But his most important contribution may have been how he inspired others to take a weather phenomenon that is considered "solved" by the research community and showed that compelling research problems still exist. Cold fronts happened to be one of these phenomena, and Sanders returned to them three different times in his career: "Fronts are a real and important feature of our environment," said Sanders, "and an effort should be made to better understand them." It seemed there was a lot we thought we knew.

For Dave, the invitation was an honor because of what Fred Sanders meant to him and his career. Sanders was Dave's first meteorology professor as a freshman, encouraged him to join the AMS as a student member, and was the Ph.D. advisor to one of Dave's Ph.D. advisors. The invitation also meant an opportunity to get some research projects off the ground that had been on Dave's mind for a while. Preparation for the symposium turned into a two-year, four-paper quest to describe cold front "knowns," "unknowns," and "unknown knowns" (things we don't know we know).

The first paper was Dave's chapter in the Sanders monograph, presenting Sanders' research on cold fronts within the larger context of the attitude of the meteorology community. After the Norwegian cyclone model first discussed the structure of fronts, Sanders remarked, "The practice of frontal analysis of surface data spread virtually everywhere outside the tropics, despite disappointment in cyclone behavior which often deviated substantially from the Norwegian rules." One of these deviations was pre-frontal wind shifts (often seen in Oklahoma as a shift to north winds several hours before the cold frontal passage). Dave wrote two articles on pre-frontal wind shifts for *Monthly Weather Review*. The fourth article was written with Paul Roebber and will be published in the Sanders monograph. It is a model simulation of the cold front of 17-18 April 1953, which is the case analyzed by Sanders (1955). Dave calls Sanders (1955), "the first, the simplest, and, I would argue, still the best quantitative study of the structure and dynamics of a cold front." "There are so many good publications showing complexities in the structure and dynamics of cold fronts, but I think people sometimes have overly simplistic views of how fronts work," says Dave. His goal was to bring to light excellent research done over the years on fronts, highlight many instances where we were stuck in the past with regard to frontal structures and dynamics, and show we still have a lot to learn about fronts (see box). ◆

Six and a Half Unknown Knowns About Cold Fronts

1. Not all cold fronts slope rearward with height. Many cold fronts are vertical at their leading edges or tilt forward.
2. Rope clouds are commonly perceived to be the surface position of the front, but sometimes the cloud band may not be related to the surface cold front.
3. Depending on local effects such as cold-air pooling in valleys, sometimes cold-frontal passages are associated with rising temperatures.
4. Cold fronts are not necessarily collocated with the wind shift and pressure trough.
5. Fronts do not align along the axis of dilatation.
6. Cold fronts are not material surfaces.

6.5. Whether cold fronts are density currents remains unresolved.

NSSL scientist studies C-Band polarization radar in France

The C-Band radar in France

Through a strategic partnership, scientists can now share and compare results across the Atlantic to jointly evaluate the feasibility of polarization at C-Band. The project is called PANTHERE, and the trans-Atlantic link is CIMMS scientist J.J. Gourley, who was offered a post-doc by MeteoFrance to lend his expertise to the program.

PANTHERE (Programme ARAMIS Nouvelle Technologie Hydromet Extension et REnouvellement – translated to "new program for the extension and renewal of new hydrometeorological technology") aims to extend and upgrade the French weather radar network. Meteo-France purchased a C-band dual-polarization radar from Gematronik and recently installed it approximately 20 km to the west of Paris in the town of Trappes. C-band radars use a shorter wavelength (5cm) than the WSR-88D radars (10cm) and are less expensive.

A major component of PANTHERE is to evaluate the improvements to quantitative precipitation estimation and hydrometeor particle identification afforded by dual-polarization radar. This part of the project is being designed very similarly to the Joint POLarization Experiment (JPOLE) conducted at NSSL. J.J. contributed to the early JPOLE proposal, he is familiar with the experimental design, and more importantly, he collaborates directly with JPOLE scientists to gain insight.

One challenge J.J. is addressing in his research is the drawback of using a 5-cm wavelength radar in heavy precipitation. The beam becomes absorbed by the precipitation, causing a "rain shadow," or wedge of relatively low reflectivity at ranges beyond which intense convection was sampled. In addition, he is assessing the quality, precision, and calibration of raw, polarimetric variables. Ultimately, he'll develop algorithms that incorporate all the information from polarimetric radar to identify different types of precipitation.

This temporary assignment offers benefits to both Meteo-France and NSSL. In exchange for NSSL's expertise, NSSL's radar group can use the information from France in their current project to determine the quality of polarization diverse measurements at C-band through a working relationship with the private sector and other countries. ◆