NSSL Briefings
Volume 3 Winter/Spring 2000 Number 1
A newsletter about the employees and activities of the National Severe Storms Laboratory

P-3 research aircraft at MAP headquarters in Innsbruck, Austria. Photo by Dave Jorgensen

NSSL scientists direct research aircraft in Europe's Mesoscale Alpine Project

NSSL scientists are involved in the largest weather research project ever conducted in Europe. The Mesoscale Alpine Project (MAP) is an effort of researchers from 11 countries to study the effects of winds and precipitation on weather over the Alps. Data were collected during September, October and November 1999 during "wet-MAP" and "dry-MAP" activities. Wet-MAP examined how wind flowing over the mountains affects precipitation and flooding. Dry-MAP investigated how mountains produce clear-air turbulence and damaging surface winds. NSSL scientists provided expertise in the design and execution of flight plans involving multiple research aircraft

Additionally, in cooperation with researchers from the University of Oklahoma and Princeton University, NSSL scientists directed the use of the portable DOW ("Doppler On Wheels") radar unit. The DOW, previously known mainly for its close-up studies of winds within tornadoes, provided direct measurement of precipitation intensity and winds within several Alpine valleys that were too deep to be well-sampled by radar-bearing aircraft flying overhead. ◆

Doppler On Wheels in the field near Lodrino, Switzerland. Photo by Scott Richardson

IPEX collects unprecedented data during February

IPEX (Intermountain Precipitation EXperiment) scientists saw several major winter storms during their field research project in northern Utah, including one that produced 3 feet of snow in Little Cottonwood, and a major avalanche that dammed the Provo River. The weather was slow to cooperate at first, but by the end of February scientists had collected data on seven precipitation events, gained the first intensive observations of winter storms in the Teton and Wasatch Mountains, and made detailed observations of the two largest storms in the Wasatch Mountains in the last two winters. They also collected exceptional radar data during a Valentine's Day wind storm, unprecedented measurements of electrification and lightning in winter storms, and the first dual-Doppler radar analysis of a cold front interacting with the Great Salt Lake and surrounding mountains.

The P-3 aircraft flew a total of 41 research hours, two mobile Doppler radars were used for the first time in winter-storm research for 70 total hours of operation, and 305 balloons were launched by the NWS and NSSL Mobile Laboratories. Data collected during IPEX will be used to study terrain-induced precipitation events and interactions that produce lake-effect snowbands. ◆

For more information about IPEX, see http://www.nssl.noaa.gov/~schultz/ipex

Quantitative precipitation estimation improved by multiple sensor approach

A new, real-time multi-sensor algorithm to estimate rainfall and snowfall is being developed by the Western and Intermountain Storms Hydrometeorology group at NSSL. The multiple-sensor approach will address problems that radars have with operational quantitative precipitation estimation in areas situated in complex terrain. In addition, the algorithm has been designed to detect mixed phase precipitation, and thus handle rain at low elevations, and snow at high elevations.

Case study examples showed that including infrared satellite data in a Quantitative Precipitation Estimation (QPE) product improved precipitation estimates. Satellite-derived cloud top temperatures provided the spatial pattern of precipitation. In addition, identifying bright band heights helped segregate rain from snow. Finally, after the initial QPE product was generated, estimates were calibrated by rain gauge reports.

The multi-sensor approach is evolving into a real-time automated algorithm called QPE SUMS (Quantitative Precipitation Estimation and Segregation Using Multiple Sensors) with the initial proof-of-concept taking place in Arizona. ◆

For more information on the Web go to: http://www.nssl.noaa.gov/teams/western/qpe

News Briefs

NSSL's Paul Griffin voted Employee of the Year by OAR

__Paul Griffin__ was voted employee of the year by the Office of Oceanic and Atmospheric Research. He was honored for "being instrumental in improving NSSL's mobile observing capabilities and in providing excellent support in the field efforts of the lab."

SRAD awarded Silver Medal

The __Stormscale Research and Applications Division__ of NSSL was awarded the Department of Commerce's Silver Medal. SRAD was recognized "for making significant enhancements to the NWS warning program through developing, testing and transferring tools from a prototype Warning Decision Support System to NWS operational systems." Silver Medals are granted to employees and offices that have made contributions of exceptional value in support of overall Departmental goals that serve the nation.

1999 ERL Outstanding Paper Awards include 3 from NSSL

Three 1999 ERL Outstanding Paper Awards were given to NSSL employees:

Dave Stensrud, John Cortinas and Harold Brooks for: "Discriminating between Tornadic Thunderstorms Using Mesoscale Model Output."

Jeff Trapp and Bob Davies-Jones for "Tornadogenesis with and without a Dynamic Pipe Effect."

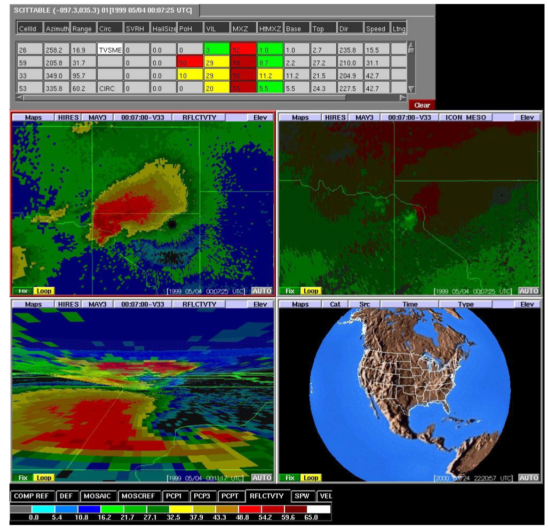
Don MacGorman and Dave Rust for: The Electrical Nature of Storms, a book published by Oxford University Press.

Rodger Brown elected

Rodger Brown has been elected to a two-year term as a Councilor of the National Weather Association (NWA). He just completed a three-year appointment as the NWA's first Commissioner of Committees. He also has held elected positions of Vice President and Secretary within the association.

WDSS-II part of Sydney 2000 Olympics testing

NSSL'S WDSS-II has been selected as one of the world's best systems to be showcased during the World Weather Research Program Forecast Demonstration Project. The NSSL WDSS-II is an evolutionary step above the original WDSS. WDSS-II provides real-time data processing for various types of data (radar, lightning, satellite, model, etc.), graphical product creation and a 3D visualization capability (see graphic above). In addition, WDSS-II contains a Web-based display capability for the user who is interested only in product and base data display and non-intensive analysis and interaction. The operational objectives of WDSS-II are to provide the most useful weather information to decision makers for enabling the best and most timely decisions possible.



During the forecasting project, WDSS-II will use data from Australian radar systems to be processed by a number of the NSSL severe weather detection and prediction algorithms, creating end products for the decision makers. ◆

NSSL and NCEP improving precipitation-type forecasting

Meteorologists in the Mesoscale Applications Group at the NSSL are working with forecasters at the Storm Prediction Center (SPC) and the Hydrometeorological Prediction Center to test the accuracy and forecast utility of six precipitation-type algorithms during the winter of 1999-2000. Predicting winter-time precipitation (e.g., rain, snow, freezing rain or ice pellets) is a difficult task for most forecasters. The computer programs being tested use data generated by NCEP's Eta model to forecast the most likely type of precipitation that will occur at a particular location. The algorithms that will be tested during the Precipitation-Type Algorithms eXperiment (PTAX) have the potential to provide forecasters with a good estimate of the type of precipitation that may occur across the United States and southern Canada, as well as the forecast uncertainty. Meteorologists hope that the algorithms tested this winter will provide accurate and timely forecasts of precipitation type, helping forecasters warn the public of any impending hazardous winter weather. ◆

For more information, contact John Cortinas (cortinas@nssl.noaa.gov, 405-366-0482).

Phased Array radar

SPY-1 technology will be tested and enhanced at NSSL with the vision of using this technology to potentially upgrade the WSR-88D radars. The Department of Defense has allocated $10 million for the project which will create a testbed facility in Norman during its initial stage. SPY-1, a phased array radar, uses multiple beams and frequencies, controlled electronically, that allow it to scan the atmosphere six times faster than the WSR-88D. "Phased array radar uses electronic scanning to quickly provide a full three-dimensional picture of the atmosphere," said NSSL deputy director Doug Forsyth. "This radar could ultimately allow weather forecasters to increase the average tornado warning lead time from the current 12 minutes to as much as 22 minutes." SPY-1 was originally developed by Lockheed Martin to support tactical operations aboard U.S. Navy ships. ◆

NSSL goes 'south of the border' to improve global climate forecasting

During the past 30 months, special pilot balloon observations have been made at 27 sites in nine countries ranging from Mexico to Paraguay as part of NOAA's Pan American Climate Studies (PACS) program. PACS aims to improve our understanding of climate variability in the Americas. The network has recently been approved for an additional 3-year period to obtain wind information that will help scientists improve global climate analyses, forecasts, and modeling activities, especially in the tropical Americas. A new phase of the project will stress real-time transmission of the observations, so each country can use them for its own daily weather forecasting activities.

Beach front training on Cocos Island 300 miles southwest of Costa Rica

Mike Douglas (NSSL) and other collaborators have partnered to help set up the observing network. The original objectives of the observational program were limited to explaining rainfall variability over Central America during the wet season and evaluating the accuracy of NCEP global analyses that are widely used by the climate research community. The scope of the project has now expanded to include studies of El Niño rainfall variability along the coast of Peru and Ecuador and investigations of the strong low-level jet over the flat terrain of the Bolivian and Paraguayan Chaco.

New activities include setting up more balloon stations in Bolivia and Paraguay to monitor variations in the low-level jet east of the Andes mountains and installing additional stations in Mexico, to improve estimation of the moisture fluxes towards the US. The PACS-SONET project also has an active educational component, with ten visitors from six different countries having participated in one to three month stays at NSSL during the past two years. More visitors are expected in the future. ◆

The official homepage address for the PACS-SONET project is: http://www.nssl.noaa.gov/projects/pacs

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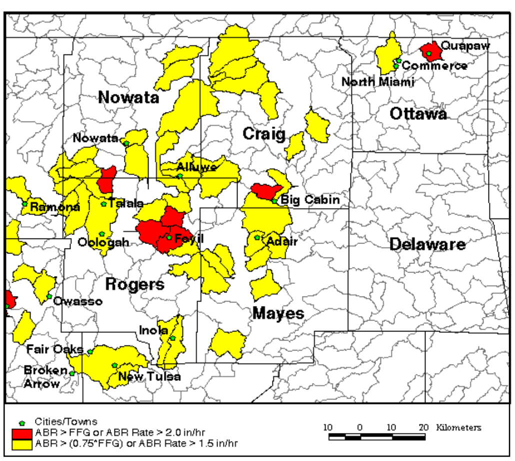
Basin delineation/AMBER implementation

A flash flood alert tool has been implemented in NSSL's WDSS for use by forecasters in heavy precipitation events. The AMBER (Areal Mean Basin Estimated Rainfall) algorithm monitors the amount of precipitation that falls into a water-shed or basin and alerts the forecaster to a potential flash flood situation. In addition, NSSL has been working with the originators of the algorithm (Bob Davis of the Pittsburgh Weather Forecast Office), the U.S. Geological Survey, and the National Weather Service (NWS) to develop automated streamlined methods for "delineating" the basins to be used by each Forecast Office in the U.S. Testing is taking place in the Tulsa, OK and Sterling, VA NWS Forecast Offices. This effort is part of the national implementation of AMBER within the NWS's Advanced Weather Interactive Processing System (AWIPS). AMBER is anticipated to be available within AWIPS in early 2001. ◆



NSSL Briefings new format:

We are experimenting with a more streamlined format for this issue of NSSL Briefings. Let us know what you think by email to: Susan.Cobb@nssl.noaa.gov

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AUITI (Acronyms Used In This Issue)

AMBER - Areal Mean Basin Estimated Rainfall
AWIPS - Advanced Weather Interactive Processing System
DOW - Doppler On Wheels
ERL - Environmental Research Laboratories
IPEX - Intermountain Precipitation EXperiment
MAP - Mesoscale Alpine Project
MRAD - Mesoscale Research and Applications Division
NCEP - National Center for Environmental Prediction
NEXRAD - NEXt Generation RADar, same as WSR-88D
NOAA - National Oceanic and Atmospheric Administration
NSSL- National Severe Storms Laboratory
NWS - National Weather Service
NWSFO - National Weather Service Forecast Office
OAR - Office of Oceanic and Atmospheric Research
OU - University of Oklahoma
PACS - Pan-American Climate Studies
PACS-SONET - PACS-SOunding NETwork
QPE-SUMS - Quantitative Precipitation Estimation and Segregation Using Multiple Sensors
SPC - Storm Prediction Center
SRAD - Stormscale Research and Applications Division
WDSS II- Warning Decision Support System - Integrated Information
WSR-88D - Weather Surveillance Radar - 88 Doppler, same as NEXRAD

NSSL's web site can be found at: /http://www.nssl.noaa.gov

__NSSL Briefings__ is a publication from the National Severe Storms Laboratory (NSSL) intended to provide federal managers, staff, and other colleagues in the meteorological community with timely information on activities and employees. 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) 360-3620; or email: kelly.lynn@nssl.noaa.gov.

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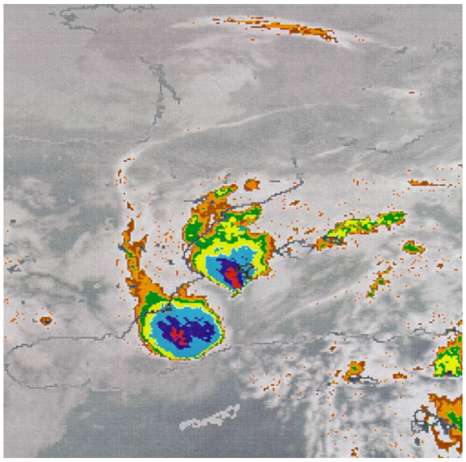
NSSL scientist studies Western Mediterranean flash floods

A chance meeting between NSSL and European scientists has sparked a research collaboration on the topic of flash floods. Chuck Doswell spent five months at the University of the Balearic Islands (UIB) studying heavy rain events in the Mediterranean from late 1995 to early 1996, with support from the government of Spain and the European community. A goal of this collaboration was to test a mesoscale numerical model as a potential operational tool in support of heavy precipitation forecasts.

The Western Mediterranean region is dominated by the relatively warm waters of the Mediterranean Sea and the complex terrain that surrounds it. Prior work by scientists at UIB had shown that most of the heavy precipitation episodes were associated with relatively strong synoptic scale weather systems. Earlier studies done at NSSL by Dave Stensrud and his collaborators had shown that mesoscale prediction models tend to perform best in situations with strong synoptic-scale signals and when dominated by topographic influences.

Three Western Mediterranean flash flood case studies were chosen for detailed study, and mesoscale numerical model simulations were attempted for each case. Results gave considerable optimism about use of mesoscale model forecasts as guidance for flash flood forecasting. Additional cases will be explored in an effort to increase scientific understanding of heavy rainfall and to explore further the application of mesoscale numerical model simulations in support of flash flood forecasting. ◆



False color enhanced infrared image of the dual mesoscale convective systems along the eastern coast of Spain that produced flooding at Valencia and a tornado on the island of Menorca.

May 3 tornado outbreak work

Data collected from the May 3 tornado outbreak in Oklahoma has initiated the following research:

Dave Schultz and Paul Roebber (University of Wisconsin-Milwaukee) are using a mesoscale model simulation (2km grid spacing) of the May 3 event to look at the influence of a region of inertial instability prior to convective initiation and the possible use of such high resolution model simulations as a forecast tool.

Jack Kain, Mike Baldwin, and Dave Stensrud, along with SPC's Steven Weiss and John Hart, are examining mesoscale numerical weather prediction model output to determine its ability to provide useful guidance in predicting important synoptic and mesoscale features leading to the outbreak and to explore the critical prediction of convective initiation and evolution.

Patrick Burke has performed an in- depth study of the performance of WDSS algorithms on the May 3 event. He has focused on the Mesocyclone Detection Algorithm, Tornado Detection Algorithm, Bounded Weak Echo Region Algorithm, and the Neural Network for Tornado Prediction.

Mark Askelson is using polarimetric radar data from the May 3 event. It is part of his Ph.D. research concerning differences between tornadic and non-tornadic supercells as revealed by polarimetric radar data.

Damage photo taken by Kevin Kelleher

Bim Wood and Rodger Brown are using special data collected with the KCRI WSR-88D to produce higher resolution reflectivity, mesocyclone, and tornadic vortex signatures at low elevation angles in the May 3 storms.

Bob Rabin has conducted some research on the upper level mesoscale wind structure using an automated algorithm which tracks features in GOES water vapor imagery. It appears that a well-defined wind maximum played a role in the development of the convective cluster.

Erik Rasmussen is co-advising an OU student who is studying the May 3 storm.

Greg Stumpf continues to work with damage survey results.

Lou Wicker is examining the May 3 storms via cloud modeling. ◆

Lightning mapping

NSSL has recently begun exploring the use of lightning mapping data from a new system developed by the New Mexico Institute of Mining and Technology (NMIMT). The system maps where all types of lightning flashes occur inside clouds to a range of 150-200 km. Though the present National Lightning Detection Network used by the NWS maps only cloud-to-ground flashes, technologies for mapping both intracloud flashes and cloud-to-ground flashes are becoming feasible and can help improve our ability to detect and forecast storms.

From the detailed, 3-D lightning maps provided by the NMIMT system, we are learning how storms produce intracloud flashes and cloud-to-ground flashes and how each flash type is related to other storm hazards. Scientists are finding how to use trends in the flash rate and location of each type of lightning to help identify the development of thunderstorms, the growth of updrafts, and the formation of precipitation and downdrafts.

NSSL is also investigating techniques for assimilating lightning mapping data into mesoscale forecast models. Benefits are similar to those from assimilating radar data, but lightning data are more compact than radar data, are easier to transmit and process, and are available for regions having no radar coverage. ◆