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NSSL Briefings

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

The Bow Echo and MCV EXperiment (BAMEX): air and ground-based strategies

Bow echoes are one of the best-known modes of high surface winds associated with severe weather events. Bow echoes can be over 300km long, last for several hours, and generate mid-level cyclonic vortices that often consolidate and grow in scale to become a mesoscale convective vortex (MCV). MCV's can have diameters of 100-200km and often persist long after the parent convective system has dissipated. Some MCV's re-initiate convective storms for several days as they travel distances of 1000km or more. BAMEX, a field experiment involving scientists from NSSL, NCAR, the NWS, and OU, seeks to understand both of these related mesoscale phenomena.

BAMEX proposes to use three aircraft: two Doppler-radar-equipped turboprops, and a high altitude jet for dropsonde deployment (Figure 1). Once inside the mesoscale convective system (MCS), the turboprop aircraft will use Doppler radars and in-situ data to map the three-dimensional circulation of these systems, particularly the "rear-inflow" jet and the relationship between convective line structure and surface wind. Deployed dropsondes, according to Project Director Chris Davis of NCAR, will provide unique observations of the vertical thermodynamic structure, which will be crucial in determining why some systems produce damaging surface winds while other similar systems keep their winds aloft. Dropsondes will also help map the thermodynamic structure of the developing and mature MCV.

In addition to the aircraft, a mobile array of ground-based instruments will be used to probe the structure of bow echoes, document the thermodynamic structure of the primary boundary layer, and any existing convergence boundaries, probe the surface cold pool, and measure surface horizontal pressure and wind variations behind the leading convective line (Figure 2). Some ground-based observing systems being proposed for BAMEX include two SMART-Radar truck-mounted radars, a mobile profiling system (MIPS), two mobile GPS sounding systems, and several mobile mesonet vehicles. "The combination of aircraft and ground-based measurements is important for understanding the coupling between boundary-layer and free-tropospheric circulations within MCS's, and, in particular, how the rear-inflow penetrates to the surface in nocturnal severe wind cases," said co-PI Mike Biggerstaff of OU.

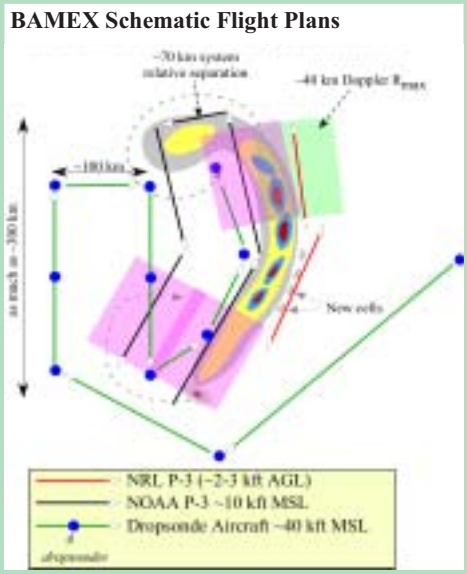


Figure 1

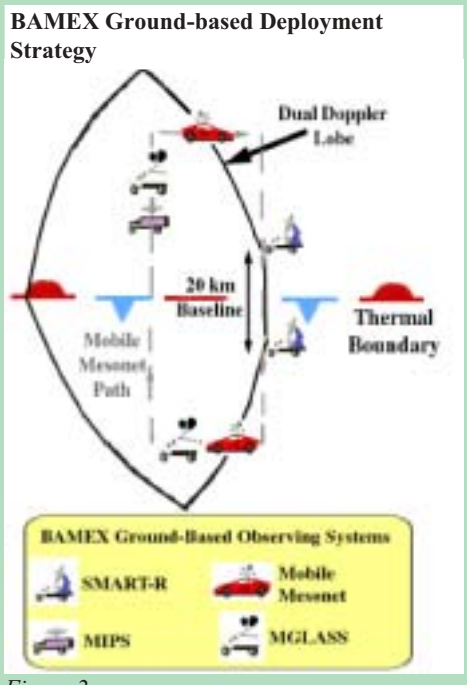


Figure 2

The spatial distribution of these events is clearly centered in the midwest United States with some extension into the Ohio Valley (especially bow echoes). Hence, BAMEX operations will be based at the St. Louis, MO NWS office, and aircraft will be based at Mid-America airport east of St. Louis in Illinois. BAMEX forecasts will be provided by a team of experts drawn from St. Louis and surrounding NWS offices and the SPC in Norman, OK. The domain for operations will be approximately 650km radius of St. Louis, or a 1.5 hour ferry for the turboprop aircraft. Once airborne, aircraft scientists will be in constant contact with Operations Center personnel through an aircraft-satellite 9600-baud data link. This link will keep scientists updated on the rapidly-evolving weather through voice, e-mail, and image transfers. Communications with ground teams will be via conventional cell phone. BAMEX is scheduled from May 20, 2003 until June 6, 2003. ◆

By Dave Jorgensen and Jeff Trapp

More information about BAMEX can be found on the Web at: http://www.mmm.ucar.edu/bamex/science.html, and in NSSL Briefings Volume 4 Number 4.

Spotlight on: Doug Kennedy

Doug Kennedy has a collection of bikes. He has a tandem bike for outings with his wife (they tow their two boys in a trailer), a road bike used for Bicycle League of Norman events, a commuter bike used for riding to work (with fenders and a rack), a mountain bike, a time trial bike that he built himself, and a couple of spare inexpensive bicycles that he uses when there is a chance they might be stolen. Someday Doug hopes to ride from Oklahoma to the west coast, then north along the coast to Washington and Oregon, east through Canada to Maine, south along the east coast to Florida, then return to Oklahoma. In the nearer future he'd like to ride across the state, but his support of CIMMS field projects in the spring hinders him from fulfilling these goals.

Doug (CIMMS) works with mobile data acquisition systems at CIMMS. He has written data collection software for the mobile mesonet and electric field meter. He also wrote software for the mobile digital network used during IHOP to send data back to the field coordination vehicle. Doug calls himself a computer scientist--a person who studies the use of computers to solve problems efficiently--as opposed to a system administrator, programmer, or database administrator (but he does all that too). He says he must constantly learn new technologies, then figure out how to apply these skills to help CIMMS scientists accomplish research goals--one of his favorite parts of the job.

Doug first became interested in computers while playing with an old Apple computer at the Murray State Library where his father was director. He also helped his dad set up a CD-ROM search system for the library when CD's were a novel storage system. His interest in computers and the library led him to get his B.S. in math and physics from Southeast Oklahoma State, and his M.S. in library science from OU. His job at the OU library in the computer support department wasn't exactly what he had hoped for. So, after a year, when a job opened up at CIMMS, he pursued it. He had visited NSSL while on a tour with his high school, and even met scientists and toured the computer room -- but he didn't think he was smart enough to work here. To his surprise, and our benefit, Doug has been at his "dream job" with CIMMS at NSSL for seven years. Doug is also working to complete an M.S. in computer science at OU this spring.

Doug spends his free time biking and gardening. The most unusual thing he grows is bitter melon -- a Chinese vegetable that is a cross between a bell pepper and a cantaloupe (more bitter than sweet). Friends say he has the most non-bitter bitter melon they have ever tasted. His wife Nan-I is from Taiwan and is working on her Ph.D. in communication. His boys Ian (3) and I-Kang (18 months) eat bitter melon too! ◆

NOAA and OU break ground at National Weather Center Site

NOAA officials and representatives from OU took part in a ground breaking ceremony for the National Weather Center on November 1, 2002. The building will be the largest weather research center of its kind in the nation and the premier facility for severe storm research, prediction, forecasting and warning. The 244,000-square-foot building, which is scheduled to open in 2006, will be shared by the five NOAA organizations in Norman, including NSSL and CIMMS, and key weather organizations at the university. "The one-of-a-kind weather center will bring research and operations under one roof in support of NOAA's strategic goal of improving short-range forecasts and warnings," said James R. Mahoney, Assistant Secretary of Commerce for Oceans and Atmosphere and NOAA Deputy Administrator. "In addition, consolidation will leverage personnel and facilities resources, create synergy, and shorten the time for bringing research advancements into operations." Actual construction is expected to begin in July 2003.◆

News briefs

Comings and goings

Victor Homar joined NSSL as an NRC post-doctoral scientist from Majorca, Spain. He is working with Dave Stensrud to examine the sensitivity of forecast extreme weather events in the U.S. and western Mediterranean to model initial and boundary conditions.

Zhongqi Jing left NSSL to continue working on software maintenance and development with the recently completed ORPG at the NWS Radar Operations Center.

FAA Excellence Award

NSSL was one of ten recipients of the Federal Aviation Administration's (FAA) Excellence in Aviation Award for 2002. NSSL was cited for its contribution to the FAA's Aviation Weather Research Program, which was organized to generate more accurate and accessible aviation weather observations, warnings and forecasts. The award formally recognizes significant accomplishments resulting from aviation-related research efforts. NSSL continues to develop better ways to use NEXRAD weather radar data in aviation safety products and displays. Kim Elmore (CIMMS) accepted the award on behalf of the CIMMS and NSSL employees who worked on the project.

NASA asks NSSL to use their radar expertise to help with shuttle investigation

Three NASA officials spent several days with NSSL researchers in Norman studying NEXRAD data for clues following the recent shuttle disaster. Researchers used the experimental Warning Decision Support System - Integrated Information (WDSS-II), to analyze radar images of shuttle debris gathered by the Radar Operations Center and the National Weather Service Southern Region immediately following the tragedy. The radar data will help determine the trajectory of the debris as it fell.

Outstanding Scientific Research Paper

The Office of Atmospheric Research (OAR) announced the 2002 Outstanding Scientific Paper Awards which included NSSL/CIMMS staff: Dave Jorgensen, et al. were recognized for "A dual-pulse repetition frequency scheme for mitigating velocity ambiguities of the NOAA P-3 airborne doppler radar." Outstanding Scientific Review Paper awards were given to R.B. Wilhelmson and Lou Wicker for "Numerical modeling of severe local storms," and to Bob Davies-Jones, Jeff Trapp, and Howie Bluestein for "Tornadoes and tornadic storms."

News briefs, continued

Severe Weather Workshop

The 2003 National Severe Weather Workshop was held February 27 through March 1 in Norman, OK. The annual three-day workshop, "Building Local and National Partnerships to Save Lives," was designed to enhance partnerships between severe weather forecasters and researchers, emergency managers, broadcast meteorologists, businesses, storm spotters and other weather enthusiasts. The latest techniques and practices for severe weather preparedness and response were presented by severe weather experts from across the nation during the workshop.

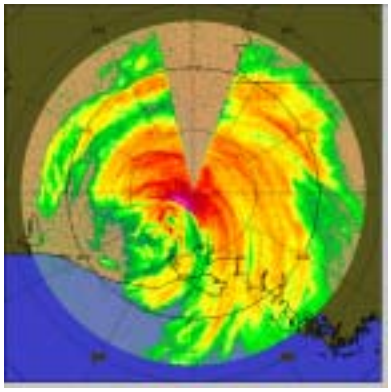
AUITI (Acronyms Used In This Issue)

CIMMS - Cooperative Institute for Mesoscale Meteorological Studies
FAA - Federal Aviation Administration
GPS - Global Positioning System
IHOP - International H_20 Project
MCS - Mesoscale Convective System
MCV - Mesoscale Convective Vortex
NCAR - National Center for Atmospheric Research
NOAA - National Oceanic and Atmospheric Administration
NSSL- National Severe Storms Laboratory
NWS - National Weather Service
OU - University of Oklahoma
SPC - Storm Prediction Center
SMART-R- Shared Mobile Atmospheric Research and Teaching Radar
WSR-88D - Weather Surveillance Radar - 88 Doppler, same as NEXRAD

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

NSSL Briefings *is a publication from the National Severe Storms Laboratory intended to provide federal managers, staff, and other colleagues in the meteorological community with timely information on our activities. Since most of these activities involve collaborations with scientists at the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS), at the University of Oklahoma, this publication contains information about CIMMS employees and various NSSL/CIMMS activities. 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 by email: kelly.lynn@noaa.gov.*

SMART-Radar captures images of Hurricane Lili



Horizontal view from SR-1 of Hurricane Lili reflectivity at 1455 CST 3 October, 2002. Maximum reflectivity is greater than 55 dBZ northeast of the eye. The triangular gap in the data is created from the radar beam being shut off when the radar dish rotates through the location of the vehicle's cab.

Research scientists captured images of Hurricane Lili with the SMART-Radar (SR-1) and two other mobile radars as it came onshore along the southern Louisiana coast in early October. The three radars were deployed to collect data simultaneously and were able to track the center of Hurricane Lili for about six hours. Wind speed and direction and estimations of rainfall amounts were recorded for an approximate 100-square-mile area. Several 40ft tall instrumented towers were also deployed southwest of the radars in order to directly measure the vertical profile of pressure, temperature, and winds as the hurricane made landfall.

Although maximum ground-based winds near the SR-1 radar exceeded 85 miles per hour during data collection, the radar was able to accurately collect data uninterrupted by the storm.

Combined data from the radars provide a more complete picture of the structure and intensity of the hurricane as it moved inland. Knowledge gained by analyzing radar and tower data will help emergency managers, structural engineers and weather forecasters mitigate the loss of life and property from future landfalling tropical storms and hurricanes. ◆

Installation of the OK-LMA

Operational: Oklahoma Lightning Mapping Array

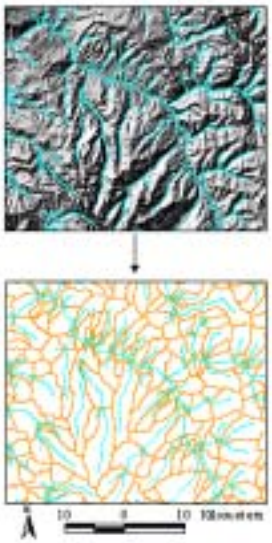
On July 31, little more than a year after the original Oklahoma Lightning Mapping Array (OK-LMA) was destroyed in NSSL's "Balloon Barn" fire, the replacement was delivered by New Mexico Institute of Mining and Technology (NMIMT). The system was purchased by grants to scientists at the University of Oklahoma and NSSL who will investigate how lightning characteristics relate to updrafts, precipitation, and severe storm processes. Scientists will also investigate assimilating lightning data into weather forecast models.

The OK-LMA consists of a central analyzer in Norman and ten stations distributed across central Oklahoma. Each station measures the time (to within less than a millionth of a second) at which a VHF radio pulse arrives from the lightning channel segment that generated it. From the differences in times that the pulse arrives at seven or more stations, the system determines the time and three-dimensional location at which the lightning segment itself was formed. Up to thousands of segments can be located for each lightning flash to reveal its initiation and development inside storms. The system maps three-dimensional lightning structure to a range of 75km and the plan location of lightning to a range of 200km.

The day after the system arrived, scientists and technicians from NSSL, OU, and NMIMT began installing the stations at sites that had been prepared in central Oklahoma. All ten stations were installed by the end of September. By late October, the system began trial operation to record lightning data. Just before Christmas, storms finally occurred within range, and the OK-LMA successfully mapped lightning. Minor adjustments continue to be made, with full operation planned to begin this winter, in plenty of time for the spring storm season. ◆ *by Don MacGorman*

NSSL and CIMMS scientists complete project to enhance flash-flood warning decisions

Although floods and flash floods on average cause more fatalities and property damage annually than any other weather-related hazard, tools to assist National Weather Service forecasters in flash-flood warning decisions have historically been lacking. To address this problem, a simple yet effective flash-flood monitoring tool has been developed during the past few years. The Flash Flood Monitoring and Prediction (FFMP) system, which is part of the Advanced Weather Interactive Processing System (AWIPS), computes average basin rainfall accumulations and rates based on WSR-88D precipitation estimates. These calculations allow NWS forecasters to monitor precipitation in flash-flood-scale basins, potentially improving their ability to make accurate and timely flash-flood warning decisions.



Synthetic streamlines and basin boundaries are derived from digital elevation data.

The success of the FFMP is largely dependent on the accuracy of the precipitation estimates and the accuracy of the flash-flood-scale basin definitions. In an attempt to maintain consistency and centralize the task of defining small basins for the nation, the National Basin Delineation Project (NBDP) was undertaken by NSSL and CIMMS. Initiated in 2000 and completed in the summer of 2002, the purpose of the NBDP was to define flash-flood-scale basins for the conterminous U.S., Puerto Rico, and Guam. The project was accomplished through a partnership with the U.S. Geological Survey Earth Resources Observation Systems (EROS) Data Center (EDC). The EDC's plans for creation of a dataset of Elevation Derivatives for National Applications (EDNA) coincided with the NBDP. The similar objectives of the NBDP and EDNA facilitated a partnership to eliminate duplication, ensure sound technique, and maintain consistency in hydrologic derivatives on a national level.

Based on the one arc-second (approximately 30-meter) resolution raster digital terrain data in the EDC's National Elevation Dataset (NED), hydrologically-conditioned elevation grids, flow-direction grids, flow-accumulation grids, synthetic streams, and flash-flood-scale basin boundaries were derived using Geographic Information System (GIS) software. Special techniques were applied in coastal areas, natural sinks, and closed basins to ensure the accuracy of derived basins and streams. Edge matching between basin boundaries and codifying each basin with a unique identifier produced a seamless dataset for use in FFMP and other national applications. FFMP basin datasets consisting of synthetic streams, basin boundaries, radar bin center points, and other reference data were assembled for 143 WSR-88D coverage areas and delivered to 115 Weather Forecast Offices.

The resulting NED-derived NBDP and EDNA datasets are currently being used by state and federal agencies throughout the country in a variety of applications, and they have many other potential uses in various operational and scientific communities. It is important for any user to be aware that the accuracy of basins and streams derived through an automated delineation process is directly related to the accuracy of the base elevation data. Through local customization at forecast offices and other agencies, the basin dataset will be refined to ensure an acceptable level of accuracy for each intended application. ◆ *By Ami Arthur*

Self-guided tour

After two years of hard work and countless drafts, NSSL's first self-guided tour displays are complete. Originally intended for walk-through visitors, the tour consists of 13 wall-size posters documenting the mission, accomplishments, current research and future vision of NSSL and its CIMMS research partners. The displays integrate educational material on severe and hazardous weather phenomena with efforts to understand them.

Although walk-through visitors are no-longer permitted in the NSSL building, invited guests and collaborators will have an opportunity to browse the displays. Guided tours will continue on a limited basis as security limitations permit. Future plans call for creating an audio CD that visitors can use to supplement the visual information as they tour. ◆