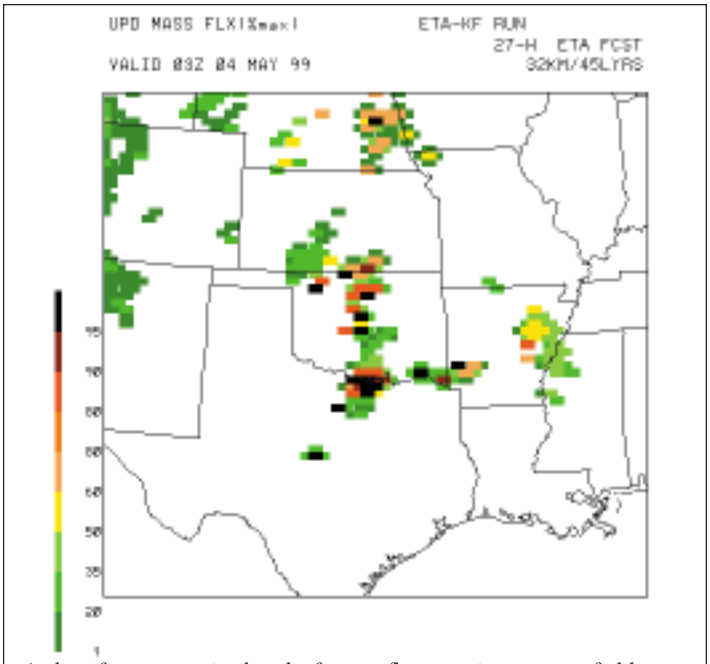
NSSL Briefings

Volume 4 Summer 2001 Number 1

A newsletter about the employees and activities of the National Severe Storms Laboratory



A plot of parameterized updraft mass flux, a unique output field derived from NSSL's version of EMC's Eta model, valid 0300 UTC 4 May 1999. Higher values indicate more intense convective overturning.

NSSL scientists work to improve operational forecast models

The National Centers for Environmental Prediction's (NCEP) Environmental Modeling Center (EMC) is the primary source of numerical model forecast guidance for the National Weather Service (NWS). This central facility produces a relatively small number of guidance products for a diverse group of users. For example, forecasters specializing in aviation concerns, quantitative precipitation amounts, severe thunderstorms, tropical cyclones, winter weather and air quality all utilize the same model output. Because of this one-size-fits-all approach, the specific interests of individual groups often get compromised in the final product. At NSSL, the Mesoscale Applications Group (MAG) collaborates with Storm Prediction Center (SPC) forecasters, other NSSL scientists, EMC, and other modeling centers to explore various techniques to provide operational forecasters with more useful model guidance products for their specific needs.

This effort is led by Mike Baldwin and Jack Kain within the MAG group. Over the past several years, they have built on the foundation originally laid by Dave Stensrud at NSSL to develop unique configurations of both EMC's Eta model and the Penn State/NCAR mesoscale model (MM5). These configurations have been specifically designed to provide alternative algorithms for convective initiation and evolution, with more detailed mesoscale structure than the currently available operational models. Procedures have been developed to produce forecasts and transfer output from these models to N-AWIPS (National-center Advanced Weather Interactive Processing System) forecaster workstations in the SPC in a time frame comparable to EMC's operational procedures. Output is also posted on the Web and transferred to NCEP's Hydrometeorological Prediction Center. In addition, precipitation fields from these forecasts are verified against observations and EMC's operational models through an automated process that is updated daily and compiled on a monthly basis. EMC scientists are involved in this effort and have also begun to run an NSSL-like configuration of the Eta model in parallel to their real-time forecast.

SPC forecasters and research scientists have provided valuable feedback to support this work. In turn, the forecasters have developed a better understanding of the numerical models that provide their primary source of forecast guidance. Interrogation of model output is a frequent topic of conversation at daily NSSL/SPC map discussions. In addition, NSSL and SPC conducted an intensive program to evaluate operational and experimental models and algorithms during six week spring periods in 2000 and 2001 (see related article in the *News Briefs*). These programs have benefitted from participation by scientists from both EMC and National Oceanic and Atmospheric Administration's (NOAA) Forecast Systems Laboratory. Future plans for this group include real-time development and testing of the Weather Research and Forecasting (WRF) model, which is expected to replace the Eta model as the primary 1-2 day forecast model by the year 2005. Further information, including current model forecasts and verification statistics can be accessed from the NSSL home page at http://www.nssl.noaa.gov/modeling.shtml. ◆ *By Jack Kain*

SPC Science and Operations Officer Bob Johns (left) shares his opinion with a group of forecasters and scientists at a recent NSSL/SPC daily map discussion.

Employee Spotlight: Kim Elmore

"Don't do anything stupid" is Kim Elmore's mantra, taken from a placard on the instrument panel of an airplane. He has logged over 1,000 hours as a pilot and owns a 1946 Cessna 140. Flying is one of his passions, and so is the weather. "Flying in a light aircraft," he says, "is a good way to experience good seat-of-the-pants meteorology."

Kim considered being an engineering physicist like his dad, or even an aerospace or electrical engineer. But he has always loved the weather, and especially the thunderstorms he experienced while growing up in Tulsa. He went to the University of Tulsa for two years as a physics major, then transferred to OU where he earned his B.S. and M.S. in meteorology. Kim then worked at the National Center for Atmospheric Research (NCAR) in Boulder, CO on projects ranging from JAWS (Joint Airport Weather Studies) and windshear to winter icing, polarimetric radar, and aviation weather products for non-meteorologists.

While at NCAR Kim met his wife Pam Wilson -- in a pig pen. Pam's father, a colleague at NCAR, had invited Kim to his home for dinner and a look at some newly-weaned pigs. Pam was asked to show Kim the pigs, and the rest is history. Kim moved back to Oklahoma in June of 1995. He was hired by NSSL to do a review of a microburst prediction radar, then worked on a Federal Aviation Administration (FAA) project predicting thunderstorm behavior around airports. This naturally lead to his next area of focus, ensemble forecasting with cloud models, which became the topic he would study during the pursuit of his life-long dream--a Ph.D. Kim says he owes NSSL a debt of gratitude for their support during his three-year quest. He graduated from OU in the spring of 2000, having fulfilled that dream. Kim is now the group leader for FAA MOU work, and has been working on ensemble forecasting with the SPC for their spring program.

Kim is passionate about many things including weather, flying, amateur radio and playing the violin. A new passion he has added to the list is his children (ages 2 1/2 and 9 months). Personally, Kim wants to raise good kids and be a good dad and husband. Professionally he wants to "do good research," and to shepherd others into good research and science. In general, Kim aims to not "do anything stupid." ◆ *By Susan Cobb*

Damage and death in historical tornadoes

NSSL scientists have been studying changes in deaths and damage from tornadoes in the United States occurring since the 19th century. The research has focused on more than 100 tornadoes in order to identify the trends and possible future changes. When scientists adjust historical damage amounts for the total wealth of the United States in current dollars, they have found that there has been roughly $1 billion dollars of tornado damage per decade since 1890. The most damaging tornado in United States history was the violent tornado that struck Saint Louis, Missouri and East Saint Louis, Illinois on May 27, 1896. In current costs, it caused almost $3 billion in damage.

Death tolls from tornadoes have been steadily decreasing in the United States since 1925. Prior to that, the average number of deaths per year was about 1.8 per million population. This has now decreased to 0.12 deaths per million. The decrease has occurred because fewer tornadoes kill people now than previously and because the death toll in the deadliest tornadoes has decreased. An important cause of this trend has been the improvement in forecasts and warnings of tornadoes. Mobile homes still present a major challenge, however. The death rate for mobile home residents is approximately 20 times the rate for permanent home dwellers. Since the number of mobile home residents in the central and southeastern United States, where tornadoes are most frequent, more than tripled from 1970 to 1990, the fraction of all tornado deaths in mobile homes has increased from about 25% of all deaths 25 years ago to 50% of all deaths now. ◆ *By Harold E. Brooks*

News briefs

Comings and goings

***Fang Zhao**, a new visiting scientist from the National Meteorological Center (NMC) of China will be working with the Western and Intermountain Storms Hydrometeorology Team (WISH) team on a project to quantitatively verify various existing QPE algorithms.*

***Bob Staples** has joined NSSL to work with Doug Forsyth as a Special Projects Consultant on the Phased Array Radar system.*

***Kevin Thomas** has left NSSL after almost 20 years. Kevin helped design and improve NSSL's WDSS system now in use in NWS offices across the country.*

Lightning Mapping Array

Installation of the Oklahoma Lightning Mapping Array (LMA) began in May and is expected to take one month. The LMA will make three-dimensional lightning mapping available to a range of 75 km from the network center in central Oklahoma, and two-dimensional mapping available to a range of almost 200 km. The LMA is owned by OU and managed by OU and NSSL scientists.

National Severe Weather Workshop

*The nation's premier severe weather experts discussed their latest research findings and forecasting techniques during the National Severe Weather Workshop on March 2-3 in Norman, OK. Guest speakers included **Mary Ann Cooper, M.D.**, a lightning effects expert; **Dr. Greg Forbes**, severe weather expert from* The Weather Channel*; and **Tim Marshall**, editor of* StormTrack *magazine and structural engineer from Haag Engineering, where he specializes in the analysis of property damage. NSSL's **Harold Brooks** gave a presentation on tornado climatology. Designed for emergency managers, storm spotters and other weather enthusiasts, the event was sponsored by NOAA, SPC, the Central Oklahoma Chapter of the AMS/National Weather Association and the Oklahoma Emergency Managers Association. Next year's workshop is planned for March 1-3, 2002.*

News briefs, continued

NSSL and SPC evaluate experimental forecast tools

***Jack Kain** and **Mike Baldwin**, in collaboration with **Paul Janish** and **Steve Weiss** of the SPC, carried out an intensive program to evaluate experimental numerical models and forecasting techniques during the last two spring seasons. These programs have received enthusiastic participation by scientists from NCEP's Environmental Modeling Center, NOAA's Forecast Systems Laboratory, and the university community.*

AUITI (Acronyms Used In This Issue)

AMS - American Meteorological Society
FAA - Federal Aviation Administration
FOFS - Field Observing Facilities and Services
MOU - Memorandum of Understanding
NASA - National Aeronautic and Space Administration
NCAR - National Center for Atmospheric Research
NCEP - National Centers for Environmental Prediction
NOAA - National Oceanic and Atmospheric Administration
NSSL- National Severe Storms Laboratory
NWS - National Weather Service
OU - University of Oklahoma
SPC - Storm Prediction Center
WDSS - Warning Decision Support System
WSR-88D - Weather Surveillance Radar - 88 Doppler, same as NEXRAD

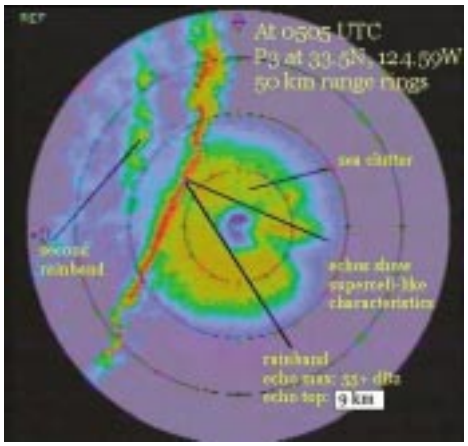
NSSL's web site is at: http://www.nssl.noaa.gov

***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 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 by email: kelly.lynn@nssl.noaa.gov.*

NSSL STAFF
Director.....Jeff Kimpel
Deputy Director.....Kevin Kelleher
Administrative Officer.....Jon Domstead
Chief, Forecast R&D/FOFS.....Dave Rust
Chief, Radar R&D.....Doug Forsyth
Chief, Warning R&D.....Don Burgess
Information &Technology.....Gary Skaggs
Assistant Dir. NSSL/CIMMS....John Cortinas
Public Affairs.....Keli Tarp

NEWSLETTER
Writer/Editor.....Susan Cobb

PACJET provides real-time telemetry of P-3 observations to NWS forecasters



Annotated plan-view reflectivity image from the P-3's lower fuselage radar as transmitted to NWS forecasters on 19 February 2001.

As highlighted in the previous issue of NSSL Briefings, the PACific landfalling JETs experiment (PACJET) was successfully conducted along and offshore of the West Coast of the U.S. during January-March 2001. One of PACJET's primary objectives was to improve short-term forecasts and warnings of life-threatening floods and severe windstorms produced by landfalling Pacific winter storms, which routinely originate well beyond the reach of NOAA's coastal observing network. Scientists from NSSL worked closely with NOAA's Environmental Technology Laboratory and the Naval Postgraduate School (NPS) personnel to plan and conduct 17 highly productive P-3 aircraft missions during PACJET. Both P-3 dropsonde data and flight-level observations were transmitted to the National Weather Service for direct assimilation into NCEP's operational model suite. A groundbreaking aspect of PACJET was the real-time telemetry (via a satellite communications system called INMARSAT) of the P-3's conventional and Doppler radar imagery for examination by NWS forecasters across the Western Region. These radar images, which require specialized interpretation, were annotated by NSSL and NPS scientists for efficient examination by NWS forecasters. The images were captured on board the P-3 with a television frame grabber, converted to gif format, annotated, and sent out as a e-mail attachments to the PACJET operations center Web site, where they were posted for viewing using standard web browser technology. On at least one occasion, the P-3 radar imagery and associated discussions triggered issuance of an advisory for waterspouts and rapidly deteriorating marine weather conditions as a severe cold frontal rainband swept toward the populous California coast. Analysis of PACJET data is ongoing. Further details on the PACJET dataset and related accomplishments and plans are available at http://www.etl.noaa.gov/programs/pacjet/. ◆ *By Brad Smull and Dave Jorgensen*

Operation Warn

Operation Warn is an initiative to make 100,000 specially-priced NOAA Weather Radios available to Oklahoma City residents by the end of 2002. The public has responded by purchasing nearly 22,000 of these life-saving radios in the past year. Staff from the NOAA Weather Partners in Norman, including NSSL, helped NOAA Weather Radio owners program their units at two events at local malls this spring and at three similar events last year. They also provided tornado safety information and answered questions about severe weather research and forecasting. The program is coordinated by Oklahoma City Emergency Management, Oklahoma Department of Civil Emergency Management and NOAA's NWS. NOAA Weather Partners' Keli Tarp has directed publicity efforts for Operation Warn and arranged radio programming events. NSSL's Daphne Zaras has recruited volunteers and programmed radios at most of the events. Operation Warn was recognized in May with the Mark Trail Award, an award honoring individuals, corporations, and state and county governments that used NOAA weather radios to save lives during severe weather events. Mark Trail is a comic strip character and the fictitious spokesperson for NOAA Weather Radio. ◆

NSSL's mobile lab on site in Hutchinson, KS. Photo by Sandra J. Milburn, Hutchinson News

NSSL's mobile lab helping to solve natural gas mystery

The Kansas Geological Survey and the NASA Jet Propulsion Lab (JPL) requested the use of one of NSSL's mobile labs to investigate a natural gas seepage under the city of Hutchinson, KS for nine days in April. Les Showell, NSSL special projects consultant, released a helium balloon carrying a radiosonde each day during the investigation. Information on wind speed and direction, air temperature, air pressure and humidity readings were transmitted to a computer in the mobile lab. At the same time, researchers from NASA's JPL were in a plane carrying an airborne spectrometer making measurements of the infrared signature of methane gas escaping from Kansas Gas Service's Yaggy storage field. Information collected by the project will allow researchers to plot maps of the gas at various places.

Sharing our field facilities through the Field Observing Facilities Support (FOFS) group is part of NSSL's ongoing commitment to observational science. Included under the oversight of FOFS are mobile, deployable, and fixed-site facilities for use by researchers. Individuals can make requests for the use of NSSL's field resources to the FOFS. We will allocate facilities based on a "2-Tier" system. Tier 1 gives priority to highly-organized field projects that require advanced planning. Tier 2 will accommodate projects with a shorter lead time, as the facilities are available. The FOFS advisory board is in the process of forming procedures for the submission and assessment of individual requests. ◆ *By Dave Rust and Susan Cobb*

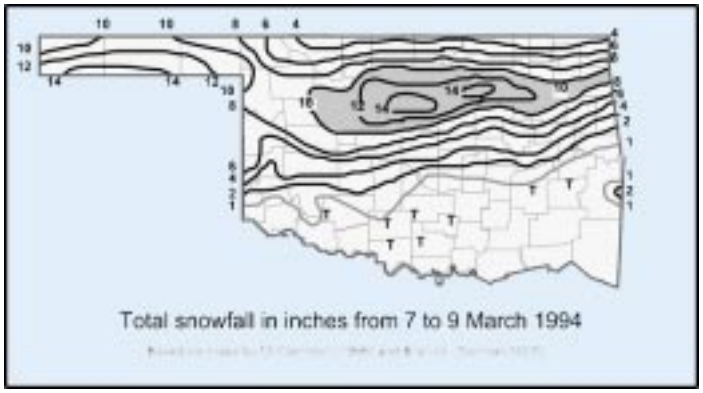


Figure 1

The multiscale structure and evolution of an Oklahoma winter-precipitation event

Those living in Norman in 1994 might remember the rather complex winter-precipitation event that occurred on 8-9 March in Oklahoma and neighboring states. This event created hazardous road conditions throughout Oklahoma, resulting in hundreds of traffic accidents and two fatalities. Snow accumulations greater than 30 cm (12 in) were measured within a ~50 km-wide corridor in northern Oklahoma. South of the heaviest snowfall – in Norman, for example – convective cells produced mixed-phase precipitation and significant cloud-to-ground lightning.

The structure and role of such storm-scale features in the overall winter precipitation has received little attention in the literature. This motivated Jeff Trapp, Dave Schultz, Alexander Ryzhkov and Ron Holle to analyze a unique dataset collected on this day using the Cimarron polarimetric radar; the Twin Lakes, Oklahoma, WSR-88D (KTLX) complemented the Cimarron radar, allowing in some instances dual-Doppler retrieval of 3-D wind fields. Conventional surface and upper-air observations also were analyzed to provide a synoptic-scale and mesoscale context for the storm-scale analysis and to determine the larger-scale forcing of the heavy snow that accumulated in a narrow band.

We found a broad region of generally stratiform snowfall coincided with lifting provided through frontogenesis forcing aloft, and persisted in the northern half of Oklahoma during our six hour period of study. Within this stratiform region, periods of heavier snow – at times accompanied by in-cloud lightning – were associated with embedded elevated convective elements that likely aided the production of the large accumulation of snow in a narrow band. More intense convective cells formed south of the stratiform precipitation, yet still well north of the surface cold front, in air with little or no surface-based conditional instability. One cell was a prolific lightning producer and particularly long-lived, owing to its rotational dynamics (Figure 2); in other words, it had a midlevel mesocyclonic vortex couplet! A transition zone existed between the areas of stratiform snowfall and convective rainfall and was accompanied by a unique signature in the polarization radar data. There are more details of this study in the March 2001 issue of *Monthly Weather Review*, and online at http://ams.allenpress.com/amsonline/. ◆ *By Jeff Trapp*

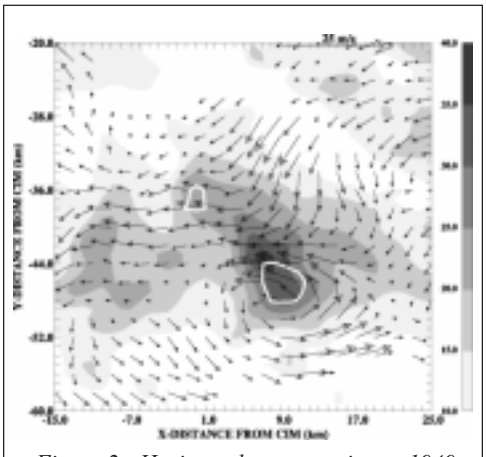


Figure 2 - Horizontal cross-section at 1949 UTC and 5.5km AGL of radar reflectivity factor (ZH; dBZ) and deviation wind vectors.