intermountain precipitation experiment

Intermountain Precipitation Experiment (IPEX)

For the eighteen million people who live in the mountain regions of the western United States, winter weather can be unpredictable. Heavy snow slows urban traffic and can lead to deadly avalanches in the mountains, stranding travelers. The Intermountain Precipitation Experiment (IPEX) is a research project designed to improve the understanding, analysis and prediction of precipitation and precipitation processes in complex terrain, specifically the causes and variation in mountain precipitation and lake-effect precipitation downwind of the Great Salt Lake.

"During the past ten years, the fastest growing states have been Nevada, Arizona, Colorado, Utah, and Idaho. The steep terrain in this area makes it one of the most difficult places to forecast snow and rain," said project co-lead scientist Dr. David Schultz, research meteorologist with NOAA's National Severe Storms Laboratory (NSSL) in Norman, Okla. "Future analysis of the data we collected during IPEX should allow scientists to develop better understanding of the structure and evolution of these weather systems, eventually leading to better forecasts."

The Wasatch Mountains of northern Utah served as a backdrop for IPEX.

NOAA's P-3 aircraft flew into clouds where scientists could take direct measurements of the processes producing heavy snow.

A University of Utah student prepares for a nighttime launch of a weather balloon from NSSL's mobile laboratory.

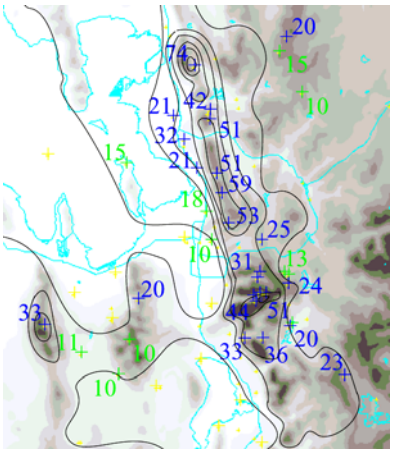
INSTRUMENTATION

A variety of sophisticated atmospheric observing platforms were used during the data-collection phase of IPEX, held over a four-week period in February 2000. The NOAA P-3 research aircraft, equipped with meteorological instrumentation and radars, flew into the storms. On the ground, scientists released instrumented weather balloons from two NSSL mobile laboratories. Three mobile Doppler weather radars and a stationary microwave radiometer were deployed throughout northern Utah to map areas of clouds and precipitation. More than 200 weather balloons were released two to eight times a day at National Weather Service sites near Salt Lake City, Utah; Boise, Idaho; Grand Junction, Colorado; Elko, Reno, and Las Vegas, Nevada. These measurements enhanced an existing surface observing system known as the MesoWest Cooperative Networks coordinated by the University of Utah and the National Weather Service (NWS) in Salt Lake City. IPEX brought together scientists from NOAA laboratories (NSSL), forecasters from the NWS, and faculty and students from the Universities of Utah, Nevada, and Oklahoma.

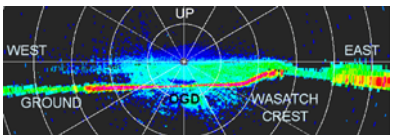
PRELIMINARY RESULTS

During the IPEX field phase, seven storms were studied intensively. A variety of precipitation features were observed: a line of tornado-producing thunderstorms, rapidly moving and slowly moving cold fronts, isolated precipitation bands, events with orographic precipitation enhancement versus events without apparent orographic enhancement. An interesting observation was how often lower-atmospheric features were decoupled from middle and upper-atmospheric features, in contrast to our present thinking about such weather systems. The surface data from MesoWest were invaluable in delivering crucial observations from otherwise data-sparse areas. Experimental graphical probabilistic forecast products, such as might be employed in the future by the NWS, were tested and will be evaluated.

The OU Doppler-on-Wheels and the NSSL mobile laboratory take measurements of a snowstorm in Idaho during IPEX.



Precipitation (mm) in one storm (IOP 3) studied during IPEX fell primarily along the Wasatch Mountains, east of the Great Salt Lake.



Radar cross section of a snowstorm (IOP 3) that produced over three feet of snow in the Wasatch Mountains. This P-3 radar image shows enhanced reflectivity (greater snowfall) west of the Wasatch Crest and a rapid decrease immediately to the east.

Relatively little is known about the causes of thundersnow, but IPEX scientists collected the first data on the electrical structure of wintertime storms over the United States. During two storms, values of the electric field inside the cloud approached values about one third to one half those of thunderstorms in the Great Plains. These profiles show there can be significant electrification in winter storms, even those that do not produce lightning. These observations will help scientists better understand the electrical structure and causes of lightning in storms.

PAYOFF

"The results from IPEX will have positive scientific and socio-economic benefits for the Intermountain West, including Salt Lake City, host of the 2002 Winter Olympics," said Dr. James Steenburgh, meteorology professor at the University of Utah and IPEX co-lead scientist. "Local forecasters will use the data on a real-time basis during the experiment and the results will be used in future weather forecasts."

The results of IPEX are already beginning to influence forecasting in northern Utah. One study that examined the errors in the numerical weather prediction models over northern Utah is affecting forecaster thinking. Patterns reminiscent of flow blocking may help forecasters identify potentially significant lowland storms in the future. NWS forecasters for the 2002 Winter Olympic and Paralympic Games were exposed to preliminary results from IPEX. Over the coming years, further information about IPEX and postIPEX data analysis can be found in future scientific publications and on the IPEX Web site *(http://www.nssl.noaa.gov/~schultz/ipex)*.

INTENSIVE OBSERVATION PERIODS (IOPs)

Number	Date	What Happened? Data Collected
IOP 1	2/5/00	Detailed airborne Doppler radar observation of snowfall in Teton Mountains
IOP 2	2/11/00	Major winter storm at Sundance: 14" snow
IOP 3	2/12/00	3 feet of snow in Little Cottonwood; major avalanche near Bridal Veil Falls resulting in damming of Provo River
IOP 4	2/14/00	Unusual severe storm during February in Nevada, Idaho and Utah; 71-mph wind gust in Cache Valley; Woman killed in Brigham City due to high winds
IOP 5	2/17/00	Very localized snowfall in Tooele County 6-8"; 14" in Settlement Canyon
IOP 6	2/21/00	Another shot of February thunderstorms: lowland rains, Big Cottonwood Canyon closed due to rockslide
IOP 7	2/24/00	Major winter storm: 41" at Snowbird

For more information contact:
Dr. David Schultz, david.schultz@noaa.gov
http://www.nssl.noaa.gov/~schultz/ipex
National Severe Storms Laboratory
120 David L. Boren Blvd.
Norman, Oklahoma 73072

1/2002