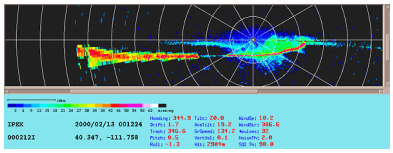
national severe storms laboratory

Winter Weather Research at the National Severe Storms Laboratory

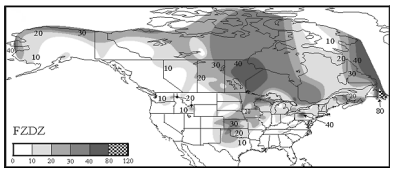
Improving understanding and forecasts of hazardous winter storms

NSSL is about more than just tornadoes and thunderstorms--we are also a focal point for National Oceanic and Atmospheric Administration (NOAA) research on hazardous winter weather. In addition to conducting research on convective storms, NSSL scientists study blizzards, freezing precipitation, and heavy snow. Radar research and development efforts also are being conducted to improve the discrimination of rain from snow, the quantitative measurements of snowfall, and the small-scale structure of winter-weather systems.

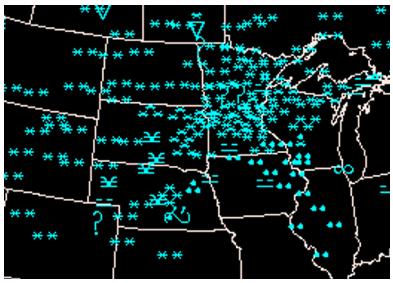
The Wasatch Mountains of northern Utah served as a backdrop for IPEX.



Radar cross section of a snowstorm that produced over 4 feet of snow in the Wasatch Mountains in northern Utah



Freezing drizzle is most likely to occur in central North America.



Numerical models are used at NSSL to improve precipitation-type forecasts.

- **The Intermountain Precipitation Experiment (IPEX)**

  IPEX is a research program designed to improve the understanding, analysis, and prediction of precipitation and precipitation processes in the mountains of the western United States. Over 30 scientists from NOAA and the Universities of Utah, Oklahoma, and Nevada collected data in February 2000 using research aircraft, mobile radars, and weather balloons. Analysis and interpretation of this data will allow project scientists to examine the factors controlling the distribution and intensity of snow across narrow, steeply sloped mountain ranges like the Wasatch Mountains.

  PAYOFF: The knowledge gained through analysis of IPEX datasets conducted by NSSL scientists will lead to better forecasts of deadly winter storms in the western United States.

  MORE INFORMATION:
  http://www.nssl.noaa.gov/~schultz/ipex/

- **Precipitation Type**

  Predicting the type of precipitation (rain, snow, freezing rain, or sleet) can be a difficult forecast challenge. A first step in such predictions is understanding the climatological distribution of precipitation type. NSSL scientists are working with collaborators at the National Center for Atmospheric Research, Environment Canada, and the University of Oklahoma to compile such information for North America. The next step to improve forecasts is to develop algorithms for the prediction of precipitation type. The goal of the Precipitation-Type Algorithm Experiment (PTAX) is to determine the quality of existing algorithms and investigate ways to display the results using probabilities. Other research at NSSL showed the importance of falling snow melting aloft to changing the precipitation type observed at the surface.

  PAYOFF: Better information will help forecasters provide more accurate warnings for freezing rain, sleet, and snow.

  MORE INFORMATION:
  http://www.nssl.noaa.gov/~cortinas/preprints/avi09/9aviation.html
  http://www.spc.noaa.gov/exper/ptax/

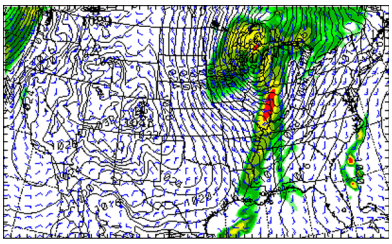
The OU Doppler-on-Wheels and the NSSL Mobile Laboratory take measurements of electrified snowstorms in Idaho during the Intermountain Precipitation EXperiment.

- **Winter Lightning**

Lightning is not restricted to summertime thunderstorms--sometimes snowstorms can produce lightning as well. NSSL scientists have produced maps of wintertime thunderstorms across the United States that show these storms occur most frequently in the Great Plains. Another study provides guidance for forecasters in Buffalo and Salt Lake City for determining the occurrence of lightning associated with lake-effect snowstorms in their localities. Finally, during IPEX, NSSL scientists and their collaborators obtained the first measurements of the electric field inside winter storms over the United States.

PAYOFF: This research will improve the fundamental understanding of conditions that cause wintertime lightning.

MORE INFORMATION:
http://www.nssl.noaa.gov/mag/network.shtml



NSSL explores new techniques for the numerical modeling of winter storms.

- **Banded Precipitation Studies**

When precipitation appears as organized bands on radar, accumulation at the surface can be extreme. Researchers are looking at conditional symmetric instability and frontogenesis as predictors of banded precipitation. Other studies have shown that small-scale circulations in winter precipitation can sometimes be similar to supercell thunderstorms.

PAYOFF: Studies of banded precipitation ultimately result in better mesoscale forecasts, traveler's advisories, and other detailed forecast products used by schools, businesses, transportation systems and local governments.

MORE INFORMATION:
http://www.nssl.noaa.gov/~schultz/csi
http://www.nssl.noaa.gov/~trapp/winter-wx/OK-winter-storm.html

A Salt Lake City NWS hydrologist and NSSL meteorologist check remote weather data collection instruments.

- **Improving WSR-88D Snowfall Estimates**

Data from IPEX and previous winter storm studies in the mountains of northern Utah are being used to calibrate the nearby WSR-88D. A special network of snow gauges provides snow water equivalent measurements that are used to determine correction factors for remote radar precipitation estimates.

PAYOFF: More accurate radar precipitation estimates provide forecasters with better real-time water-equivalent snowfall rates. In addition, hydrologists and water managers (e.g., reservoir operators) have more accurate knowledge of potential snow melt run-off.

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http://www.nssl.noaa.gov/mag/winter.shtml
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