Field Research Equipment

National Severe Storms Laboratory
Field Research Equipment

NSSL has been a pioneer in designing innovative field research equipment used for taking measurements of hazardous weather. Understanding thunderstorms – their life cycle and basic structure down to the smallest detail – leads scientists to a clearer understanding of the hazards that come from them.

Mobile radar fleet

NSSL's three mobile radars provide valuable information on hazardous weather at close range. These radars can be placed in position as a storm is developing, rather than waiting for storms to occur within range of stationary radars.

SMART-Radars: NSSL, Texas A&M, Texas Tech and the University of Oklahoma built and continue to operate two Shared Mobile Atmospheric Research and Teaching Radars (SMART-Radars). The C-band (5 cm) wavelength Doppler radars are mounted on diesel flatbed trucks and have an extended cab to house radar control systems and onboard computers. The SMART-Radars have been deployed to Florida, Louisiana, and Texas to scan landfalling tropical storms, to California to help monitor heavy rainfall causing flash floods and debris flow, and to the Central and Southern Plains to study details about thunderstorms.

NO-XP: NSSL and OU recently built a mobile X-band dual-polarimetric radar. X-band radars operate on a shorter, more sensitive wavelength to detect smaller particles, and the dual polarization capability provides additional details on the microphysics of storms. This radar can be used to detect tiny water droplets as clouds form, and can see light precipitation such as snow. NO-XP is used for very short-range weather observation, and was first deployed to Texas to scan Hurricane Ike as it made landfall in September 2008.

A SMART-R scanned this thunderstorm to provide precipitation data for a flash flood study in Phoenix, AZ during the summer monsoon season.

The NO-XP mobile radar (rear), mobile field command vehicle and mobile mesonet were deployed to collect data when Hurricane Ike made landfall on the Texas coast.

Mobile laboratories

NSSL modified two 15-passenger vans into versatile mobile research laboratories that can carry up to five people and multiple instruments into the field. These special vehicles can launch balloons, take surface measurements, or serve as field command units during projects.

Field coordination: One of NSSL's mobile laboratories can be configured as a field command unit to organize and communicate storm intercept activities in real-time. Weather observations from other mobile instruments, SMART-Radar data, and location information are broadcast over a mobile digital radio network to the

Techniques for launching balloons in high winds were developed at NSSL, allowing researchers to take upper-air soundings near thunderstorms.

field coordinator. (FC). The FC then plots the information and directs team members to ideal field positions. Coordination during field projects is important to collect the most valuable data while keeping participants safe.

Mobile balloon launching: NSSL developed the first truly mobile capability for collecting data at upper levels of the atmosphere. NSSL also invented a high-wind launch device for releasing helium-filled balloons in very high winds. The balloons are equipped with radiosondes, electric field meters, lightning sensors, and other special probes and can track measurements of temperature, pressure, relative humidity, dewpoint, wind speed, wind direction, and precise 3-D location every second. The laboratory receives GPS-located data from the balloons in all types of weather during both day time and night time. When the lab is in mobile mode, scientists can launch a balloon and track it while driving to the next launch site. These unique capabilities have allowed NSSL to take upper-air soundings in the vicinity of tornadoes and drylines, gathering valuable data near thunderstorms.

Mobile Mesonet System

Racks of surface weather instruments can be mounted on the roof of vehicles, called mobile mesonets, to take measurements near severe storms and landfalling hurricanes. The instruments measure temperature, humidity, pressure, wind speed and direction, vehicle orientation and precise vehicle location by means of GPS. A special communication system allows the vehicles to automatically report data to a central command vehicle in real time.

Mobile mesonets enroute to intercept this supercell thunderstorm refuel before continuing to their designated locations to observe and record data.

Oklahoma Lightning Mapping Array (OK-LMA)

The OK-LMA detects and measures all types of lightning, including flashes inside clouds. The 11-station OK-LMA provides high resolution, 3-D mapping of all types of lightning over west central Oklahoma and 2-D mapping over most of Oklahoma.

Instruments from the past

TOTO (TOtable Tornado Observatory) is a 55-gallon metal barrel weighing from 250-350 pounds. TOTO was outfitted with a variety of weather instruments – anemometers, pressure sensors and humidity sensors. The idea was that TOTO would collect weather data within the circulation of a tornado, but TOTO was deployed close to a tornado only once. The deployment was unsuccessful because the weak tornado sideswiped TOTO and knocked it over. TOTO was retired after 1987 because of safety issues and the difficulty of placing such a large, heavy object in front of a tornado. It is on display at the National Weather Center in Norman OK, along with "Dorothy," a similar device modeled after TOTO that Universal Studios created for the movie "Twister."

Smaller, more manageable "turtles" were developed later with the same intent. These mixing-bowl-size heavy, aerodynamic instrument packages were designed to withstand tornado wind speeds while measuring temperature, pressure and humidity at ground level. During the VORTEX program in 1994-1995, they were sometimes placed on the ground at 100-250 yard intervals in the path of tornadic mesocyclones.

For more information, contact: Keli Tarp, keli.tarp@noaa.gov
On the web: http://www.nssl.noaa.gov/observations/
3/2009