Millersville meteorology students take part in lake-effect snow study

Fierce wind speed at 50-60 mph, snow accumulation of 5 inches/hr, and a wind chill of -40 F, while launching sounding balloons at 3:00 am were just a few of the challenges that a group of 22 students from Millersville University had to face during a two-month field project to study lake-effect snow systems in upstate New York. Millersville was one of nine collaborating institutions with instruments and facilities spread across the south and east of Lake Ontario intent on examining the formation mechanisms, cloud microphysics, boundary layer processes and dynamics of lake-effect systems (LeS) using new observational tools capable of detailing characteristics not documented in previous LeS field experiments. Ontario Winter Lake-effect Systems (OWLeS) is a collaborative project funded by the National Science Foundation that involved several universities in the proximity of the Great Lakes (SUNY-Oswego, Hobart and William Smith Colleges, Univ. Illinois in Urbana – Champaign, Penn. State University, Millersville University, as well as the National Center for Atmospheric Research, the Center for Severe Weather Research, the University of Utah, the University of Alabama in Huntsville, and the University of Wyoming. The OWLeS field project focused on Lake Ontario because of its geometry and size, frequency of LeS, nearby orography, and location downwind of the other Great Lakes.

Both short-fetch LeS (those oriented at large angles to the long axis of the lake) and long-fetch LeS (those more aligned with the lake's long axis) were targeted in OWLeS. Facilities include the University of Wyoming King Air aircraft with cloud radar and cloud lidar (WCL) systems, three Doppler on Wheels (DOW) radar systems, and an array of mobile and stationary flux, surface, and sounding systems. Millersville deployed an acoustic sodar, micropulse Lidar, and instrumented tower for measuring surface fluxes, a rawinsonde sounding system for upper air profiles, and a tethered balloon system for measuring conventional meteorological parameters and fluxes in the boundary layer. In addition, a group of Millersville students were deployed to the Tug Hill plateau to support the scientific objectives of the long-axis study, and were commissioned to the Doppler-on-Wheels and the mobile mesonets to strategic locations in support of a variety of objectives. Millersville students were also trained in ice crystal photography and captures well over 1000 images of snow crystals during the project. [See link for a photo gallery of these images.]

The overarching objectives of the OWLeS project are to:

a) Describe the upwind surface and atmospheric factors determining the three-dimensional structure of short-fetch LeS convective bands that develop over a relatively-warm, open water surface;
b) Understand the development of, and interactions between, internal planetary boundary layers (PBL) and residual layers resulting from advection over multiple mesoscale water bodies and intervening land surfaces;

c) Examine how organized, initially convective LeS structures in short-fetch conditions persist far downstream over land, long after leaving the buoyancy source (i.e., the ice-free water);
d) Examine how surface fluxes, lake-scale circulations, cloud microphysics and radiative processes affect the formation and structure of long-fetch LeS;
e) Understand dynamical and microphysical processes controlling the fine-scale kinematic structures and lightning characteristics of intense long-fetch LeS;
f) Provide in situ validation of operational (S-band) and research (X-band) dual-polarization hydrometeor type classification and lake-effect snowfall QPE; and
g) Understand the influence of downwind topography on LeS generated over Lake Ontario.

It is anticipated that the OWLeS research will expand our understanding of mesoscale and boundary layer processes, cloud microphysics, and orographic mechanisms to improve the forecasting of these intense winter storm systems.