Warm-Season Lake-/Sea-Breeze Severe Weather in the Northeast

Patrick Wilson, Lance Bosart, and Daniel Keyser
Department of Earth and Atmospheric Sciences, University at Albany,
State University of New York, Albany, NY

Tom Wasula
NOAA/NWS Weather Forecast Office, Albany, NY

Thunderstorms that form along lake- and sea-breeze convergence zones over the Northeast sometimes are observed to become severe when they migrate from their source regions. These thunderstorms can pose a significant forecast challenge because they typically form under conditions of weak synoptic-scale forcing. The dynamical and thermodynamical processes, modulated by physiographic effects, that are responsible for creating severe weather from lake- and sea-breeze convergence zones are discussed through selected case studies. The results from these case studies will be shown during the presentation.

Ten cases were selected for analysis. The NCEP/NARR gridded datasets, along with data from radar, soundings, and surface observations, were used to construct the analyses. These cases were divided into two classes: pure cases where lake- and sea-breeze convergence zones were primarily responsible for initiating severe weather in the apparent absence of synoptic-scale forcing, and mixed cases where synoptic-scale forcing acted in conjunction with mesoscale forcing from the lake and sea breezes to generate severe weather. The 10-case sample includes a null event where the arrival of marine air from a sea breeze suppressed convection.

Pure cases were characterized by the absence of significant synoptic-scale forcing. Typically, pure cases featured: 1) a ridge axis at the surface or aloft, 2) temperatures (dewpoints) of at least 30°C (20°C) in the planetary boundary layer with ample heat and moisture to provide instability, and 3) weak flow with weak unidirectional wind shear. In contrast, mixed cases typically featured: 1) a trough at the surface or aloft, 2) boundary-layer temperatures ranging from 20°C to 30°C with dewpoints approaching but not exceeding 20°C, and 3) stronger flow and stronger wind shear than in the pure cases. Perhaps the most essential general finding for all cases was the prevalence of multiple synoptic and mesoscale boundary intersections. These boundary intersections served as locations where convergence and lift were enhanced to the point where deep convection was initiated.