A Numerical Study of the Initialization of Boundary Layer Roll Structures over Lake Michigan during a Cold-Air Outbreak

Gijs de Boer, Gregory J. Tripoli

Boundary layer cloud streets are a common occurrence over the Great Lakes during cold-air outbreaks. These organized cloud formations can lead to locally heavy snowfall, and the accurate prediction of their formation location would strongly aid precipitation forecasts along the Great Lakes states. Although their formation and maintenance has been heavily studied, mechanisms leading to the exact positioning of these bands are yet to be well understood.

On January 10, 1998, as part of the Lake-Induced Convection Experiment (Lake-ICE, Kristovich, 2000), the University of Wisconsin Volume Imaging Lidar (UW-VIL) observed a divergence field stemming from the disruption of the atmospheric flow by a power plant on the Sheboygan, WI shoreline. This observation led to the question of whether a small topographic or shoreline effect could cause a disturbance large enough for the formation of one of the cloud streets to form on. We have attempted to answer this question with a series of numerical simulations that were designed to try to isolate the effects of the powerplant, and the effect of topography in general. Preliminary analysis of these simulations reveals some interesting results, with significant variation in the flow field down-wind of the simulated power plant. This paper will present the findings of these simulations.