Volume Imaging Lidar Observations and Large-eddy Simulations of Convective Internal Boundary Layers

Shane D. Mayor*, Gregory J. Tripoli, and Edwin W. Eloranta

Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison
1225 W. Dayton St., Madison, WI 53706-1695
Phone: 608-262-7327 (Eloranta) or 608-263-0629 (Mayor)
Fax: 608-262-0166
Poster presentation preferred. (A computer with MPEG player would be helpful if we can't bring laptop.)
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Suggested session: Battlespace sensing techniques and applications

In previous work we showed 2-D vector wind fields obtained from the cross-correlation of aerosol backscatter images collected with the University of Wisconsin's Volume Imaging Lidar (UW-VIL). We also presented our first attempts of a large-eddy simulation (LES) of an inhomogeneous boundary layer using the University of Wisconsin's nonhydrostatic modeling system (UW-NMS).

In this new presentation we focus on 2-D correlation functions of eddy-structure throughout convective internal boundary layers (CIBLs). The correlation functions, which provide a quantitative measure of the mean eddy size, ellipticity and orientation, will be presented as a function of altitude and offshore distance from both the VIL observations and the LES. Optical aerosol scattering is estimated from model output to enable comparison of the LES results with the lidar observations. To do this, we use model relative humidity, liquid water, and a passive tracer concentration to estimate relative optical scattering intensity. Images of this simulated scattering show striking resemblance to the lidar scans. Thus, the lidar data provides and a unique observational constraint for the LES. Furthermore, the cross-correlation technique that was applied to the lidar data to estimate wind has also been applied to the simulated aerosol scattering in the model. Therefore, we use the model to estimate the difference between aerosol structure motion and the actual wind. Finally, a simple new technique to maintain fully-developed boundary-layer turbulence on the upwind side of the model domain has been implemented to enable a more realistic boundary layer transition in the simulation.