

Boundary Layer Processes

CIMMS scientists with the NOAA Air Resources Laboratory (ARL) Atmospheric Turbulence and Diffusion Division (ATDD) perform research to improve scientific understanding of the meteorological processes occurring within Earth's atmospheric boundary layer (ABL). This research is accomplished using a combination of observations and high-resolution numerical simulations. Recent research within the group at ATDD has focused on studying the impacts of differences in land characteristics on the lower ABL, particularly how surface heterogeneities (e.g., surface temperature, surface moisture, vegetation type and coverage, etc.) influence ABL structures, convection initiation, and development of severe weather. Datasets from surface micrometeorological towers, rawinsondes, small Unmanned Aircraft Systems (sUAS), and other observing platforms have been collected and analyzed under various conditions. ATDD has been part of three recent field studies: the Verification of the Origins of Rotation in Tornadoes Experiment in the Southeast US (VORTEX-SE), the Land Atmosphere Feedback Experiment (LAFE), and the Chequamegon Heterogeneous Ecosystem Energy-balance Study Enabled by a High-density Extensive Array of Detectors (CHEESEHEAD). These data sets are used to:

1. Initialize and evaluate Large Eddy Simulations (LES) and high resolution weather forecast models such as the High-Resolution Rapid Refresh (HRRR)
2. Develop and improve surface-layer parameterizations to better represent exchanges of heat, moisture and momentum in weather forecast models.

Additionally, the group at ATDD is supporting the Laboratory's sUAS program. To this end, CIMMS researchers are using sUAS to obtain high-resolution ABL thermodynamic and kinematic observations, not only during field campaigns, but also for routine profiling to support weather forecast operations at local National Weather Service offices.

Finally, CIMMS researchers at ATDD are actively involved with the United States Climate Reference Network (USCRN), which is a network of quality-controlled climate observations across all 50 US states. Team members are creating gridded data analyses for public consumption and are using other high-resolution datasets (i.e., precipitation and evapotranspiration) to develop gridded soil moisture products to improve drought analysis and forecasting.

Team Members

Dr. Michael Buban

Dr. Temple Lee

