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 local development of severe weather. Datasets from surface micrometeorological towers, rawinsondes, small Unmanned Aircraft Systems (sUAS), and more have been collected and analyzed under various conditions. ATDD has been part of two recent field studies: the Verification of the Origins of Rotation in Tornadoes Experiment in the Southeast US (VORTEX-SE) and the Land Atmosphere Feedback Experiment (LAFE). These data sets are used to initialize and evaluate Large Eddy Simulations (LES) to study the ABL. The VORTEX-SE data sets are helping to evaluate high resolution weather forecast models such as the High-Resolution Rapid Refresh (HRRR), and the LAFE datasets are being used to develop and improve flux gradient relationships for use in numerical weather prediction models.

Additionally, the group at ARL is supporting ATDD's sUAS program. To this end, CIMMS researchers are using sUASs to obtain high-resolution ABL thermodynamic observations. In addition to using sUASs in VORTEX-SE and LAFE, the sUASs have been used to study the 2017 Great American Eclipse, the evolution of 2017's Hurricane Maria, and to develop a new technique to obtain surface fluxes from infrared camera measurements. As a component of this work, CIMMS researchers are involved with calibration and validation work on new sensors used for ABL sampling.

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 developing methods for using other high-resolution datasets with the USCRN datasets to produce detailed observationally-based soil moisture products to improve drought analysis and forecasting.

Team Members
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