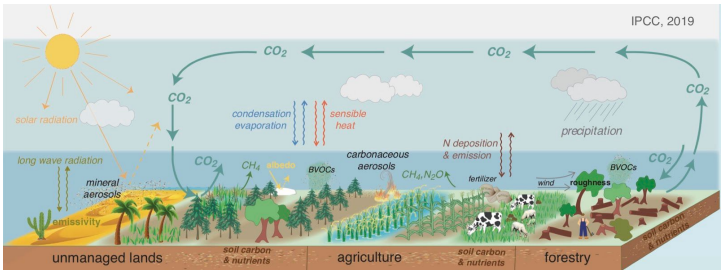
Boundary Layer Breakout Session



Topic Overview and Background: Building boundary layer (BL) knowledge, expertise, and predictive skill across the Earth system science community remains an important challenge in our field. Reports from the International Panel on Climate Change (IPCC, 2019), recent workshops held by the National Academy (e.g., on Boundary Layers, and Atmospheric Chemistry), and by NCAR (e.g., C-RITE and UAS) point to some of the community's key research needs and strategies necessary to advance predictive skill of weather and climate models. Advancing the state of knowledge on BL processes and their representation in models lies at the intersection of many of these reports.

Boundary Layer and Actionable Earth System Science: The BL is the region of the atmosphere/ocean that responds directly to processes induced at the Earth's surface and – for the atmosphere – is the region where humans live. The exchange of mass, momentum and energy between the underlying surface and the atmosphere forms a key component of the weather and climate system. However, motions at spatial and temporal scales smaller than those resolved within most numerical weather prediction (NWP) and Earth System Models (ESMs) strongly modulate this exchange and therefore must be parameterized. For the needed progress in understanding of BL processes and model predictive skill, it is essential for the BL community to develop innovative strategies connecting observations, simulations, and theory.

Current NCAR Activities: Rising to these challenges, NCAR has recently launched a number of efforts in this area:

- LOwer Troposphere Observing System (LOTOS): Development of an integrated network of vertically profiling systems including remote sensors and surface flux and auxiliary measurement systems designed to provide more holistic observations of the processes controlling the BL.
- Turbulence-resolving capabilities within the Model for Prediction Across Scales (MPAS) for refinement of weather, climate, and air quality simulations.
- A new GPU-accelerated large-eddy simulation code (FastEddy) for rapid coupled meso-to-microscale simulations of flows over heterogeneous terrain and urban environments.
- Combined suites of observational and 4D turbulence-resolving simulation data, designed for evaluating single-column models under known time-evolving forcing and for evaluating processes controlling turbulent transport. Available for community use.
- Developing a lidar simulator to interrogate numerical data toward optimizing lidar deployment and retrieval strategies.

We look forward to engaging with you on the science priorities and hearing your ideas on ways to partner in addressing them!