MMM SEMINAR SERIES

Mesoscale & Microscale Meteorology MMM LABORATORY

A Unified EDMF Parameterization for Boundary Layer Turbulence, Shallow and Deep Convection

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Eddy-Diffusivity Mass-Flux (EDMF) parameterizations decompose turbulent flows into coherent updrafts, modeled by mass flux closures, and a turbulent environment, modeled by an eddy diffusivity closure. We have recently extended EDMF parameterizations to be prognostic, so they have explicit subgrid-scale memory, and to allow for features such as a variable updraft fraction, which are essential as we approach the grey zone for deep convection (Tan et al., 2018 JAMES). The extended EDMF parameterization is designed to unify parameterizations of boundary layer turbulence, shallow and deep convection in a single consistent framework. The framework also includes a consistent coupling to microphysical processes, which are coupled to dynamical equations for mean values, variances, and covariances of thermodynamic variables.

We test and optimize the parameterization with LES simulations in a variety of conditions, ranging from stratocumulus-topped boundary layers to deep convection. Specifically, we investigate how mixing lengths and entrainment/detrainment rates can be formulated based on similarity arguments, and how the functional form that is not determined by similarity arguments can be learned from LES output. We demonstrate that the extended EDMF parameterization can capture essential aspects of diverse cloud and boundary layer regimes, including convective life cycles.

Further, we describe first steps of a machine learning approach to optimize unclosed parameters and parametric functions in the EDMF closure. A Bayesian inversion is performed using a Markov Chain Monte Carlo method to determine the posterior distribution of closure parameters and coefficients that arise in the EDMF scheme.

Thursday, 11 October 2018, 3:30 PM

Refreshments 3:15 PM!

NCAR-Foothills Laboratory
3450 Mitchell Lane
FL2-1022, Large Auditorium

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