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(Virtual Talk)
Boundary layer clouds and turbulence are fundamentally intertwined phenomena. For example, supersaturation in the boundary layer typically arises from surface-forced turbulent motion while the release of latent heat from condensation of cloud water is one of the basic building blocks of moist convection. Yet it is only since the dawn of the 21st century that serious efforts have been made to unify the representation of these phenomena in NWP physics parameterizations. In this context, "unified" refers to a single, self-consistent set of assumptions regarding subgrid-scale variability of dynamics, thermodynamics, and cloud properties across physical processes (e.g., turbulence, convection, production of clouds/precipitation). Evaluating the performance of such unified parameterizations necessitates coincident observations of both input quantities (e.g., mean thermodynamic soundings, turbulent kinetic energy) and outputs (diagnosed variances/fluxes, cloud cover, mean liquid water amount, etc.).

Ground-based remote sensing stations can provide the constraints necessary to evaluate parameterization performance over much longer time periods than are obtainable from airborne measurements and with finer-grained spatial and temporal resolution than are available from spaceborne platforms. In this talk, we assess the performance of a non-operational eddy diffusivity/mass flux (EDMF) unified scheme with self-consistent cloud macro- and microphysics closures for warm rain processes run in single column mode against observations of boundary layer clouds from the ARM Eastern North Atlantic site. We demonstrate that omission of downdrafts from the EDMF scheme likely produces poor agreement with observed height-resolved turbulence. Furthermore, the response of simulated turbulence to precipitation occurrence suggests that the spatially heterogeneous nature of drizzle evaporation is important to capture for improved boundary layer prediction.
Presentation file
witte-dod-2023.pdf
YouTube link
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