THE UNIVERSITY OF UTAH
Atmospheric Sciences

DISSERTATION DEFENSE ANNOUNCEMENT

Why do some clouds grow taller than others? An investigation of some physics relevant to convective parameterization

Why do some clouds grow taller than others? Predicting the heights to which all sizes of convective clouds grow is part of how convection parameterizations in weather and climate models help predict the future state of the atmosphere. Cloud models at the core of parameterizations typically account for the importance of cloud base properties, entrainment of clear air above cloud base, and the indirect effect one cloud has on another through their stabilization of the surrounding atmosphere.

Recent research on shallow cumulus has suggested that detrainment height has no dependence on cloud base properties and that random entrainment events can fully explain cloud top height variability. We investigate deep convection using output from three different large eddy simulations (LES) based on two different observational campaigns (GATE and TWP-ICE).

We show for the first time the importance of updrafts merging above cloud base: direct interactions not accounted for except in one experimental parameterization. We find that apparently random entrainment events are indeed an important process. But we also find that knowledge of the cloud base vertical velocity, cloud base area, and whether there is merging or not just above cloud base can be used to fully explain the variability of cloudy updraft detrainment height in our simulations.

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