

Direct comparison of LES of cumulus convection with ARM-SGP observations

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Introduction

- A good understanding of size-dependent behavior of clouds is necessary for modern scale-aware parameterizations (e.g., ED(MF)ⁿ)
- We use LES (using MicroHH), LIDAR, and TSI to characterize cumulus convection as a function of cloud size

Method

- LES simulations using MicroHH; 25m resolution, 25km domain
- Cases based on GCSS intercomparisons (BOMEX, ARM, RICO) and LASSO Alpha 2; results are robust between cases
- TSI Simulator developed using Blender
- Comparison of measured and simulated cloud chord properties at ARM SGP

Take Home Messages

- Our LES results match well with observations based on a TSI Simulator comparison
- A maximum overlap assumption ignores the dominant terms in the actual overlap of individual clouds (hence cloud fields)
- Comparing 2D cloud slices from LES to LIDAR requires rotating cloud slice to match wind direction
- Cloud chord vertical velocity at cloud base increases with chord length

From 3D LES fields to LIDAR chords – With Neil Lareau

Object

50deg





TSI Simulator in LES – With Jessica Kleiss







LES generates a cloud size distribution and cloud cover that is in good



The effect of wind direction on 2D LES chords



ASR

Atmospheric System Research



- agreement with TSI
- The simulator tends to overestimates cloud cover a bit, but still ok for reasonable zenith angles
- Cloud cover matches between TSI and the simulator, but "real" LES shows later cloud onset

Cloud Overlap for individual clouds



- model overlap well across cloud sizes



Cloud base vertical velocity binned by chord length

-3 LASSO days run with MicroHH at 25 m resolution provide roughly 2 million chords

-Sorting by size shows that the percentiles of vertical velocity at cloud base scale with chord length.