Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Entrainment in stratocumulus-topped boundary layers: a DNS study MONA KARIMI, JUAN PEDRO MELLADO, Max Planck Institute for Meteorology — Entrainment is an important multi-physics and multi-scale process in stratocumulus-topped boundary layers. Integral analysis provides analytical expressions of the mean entrainment velocity that exhibit the contributions from different cloud-top processes such as: turbulent mixing, radiative and evaporative cooling, and deformation across the region where the turbulent/non-turbulent interface lies. Previous analyses have investigated these contributions by simulating the cloud-top region alone without retaining the large-scale turbulent motions characteristic of the boundary layer, the vertical variation of in-cloud thermodynamic properties, and the effect of the surface fluxes. We extend this previous work by performing, for the first time, DNS of complete stratocumulus-topped boundary layers. By comparing DNS of the cloud-top region with DNS of the complete boundary layer, we aim to assess the role of large-scale structures on small-scale aspects of entrainment. Initial results indicate that the contribution of deformation, which cannot be neglected in the local analysis, is small in the stratocumulus-topped boundary layers, simplifying further analysis.

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Date submitted: 01 Aug 2017 Electronic form version 1.4