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Radiatively Driven Turbulence at the Cloud Top ALBERTO DE LOZAR, JUAN PEDRO MELLADO, Max Planck Institute for Meteorology — We use Direct Numerical Simulations to investigate a radiatively-driven smoke cloud-top mixing layer. This configuration mimics relevant aspects of stratocumuls clouds, in particular the mixing across an inversion that bounds a radiatively driven turbulent flow. A 1D formulation is employed for the radiation calculations. Below the inversion a convective boundary layer propagates downwards into the cloud-bulk. The convective boundary layer decouples from the inversion properties other than the injected buoyancy flux. This buoyancy flux is equal to the total radiative cooling minus the cooling of the inversion layer where the cloud mixes with the free atmosphere. An exact equation at a properly defined inversion point divides the inversion cooling into three components: a molecular flux, a turbulent flux and the direct radiative cooling by the smoke inside the inversion layer. The normalized turbulent flux levels to a constant value (0.175 ± 0.05), which is independent of the stratification. As suggested by earlies studies, we observe that the turbulent entrainment only occurs at the small scales and that eddies larger than four optical lengths (50 m in a typical DYCOMS-II cloud) perform little or no entrainment.

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