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DNS of cloud-clear air mixing at a shear-free interface PAUL GOETZFRIED, Technische Universitaet Ilmenau, Ilmenau, Germany, BIPIN KUMAR, Indian Institute of Tropical Meteorology, Pune, India, RAYMOND A. SHAW, Department of Physics, Michigan Technological University, Houghton, USA, JOERG SCHUMACHER, Technische Universitaet Ilmenau, Ilmenau, Germany — Direct numerical simulations of a cloud-clear air interface are performed to study the response of an ensemble of cloud water droplets to the turbulent entrainment of clear air into a cloud filament. The main goal is to understand the evolution of mixing of cloudy and clear air as turbulence and thermodynamics interact through phase changes of cloud droplets. Fluid turbulence is driven solely by buoyancy, which incorporates feedbacks from the temperature, vapor and liquid water content fields. Two main parameter variations are discussed, a simulation in a larger domain and a variation of the turbulence level of the clear air environment. It is found that due to droplet evaporation buoyancy dominates the subsequent evolution of the mixing layer. Its feedback leads initially to downdrafts at the cloudy-clear air interface and to updrafts in the bulk. The strength of the turbulence is domain size dependent, showing that the range of scales is an important parameter. In contrast, the level of turbulence in the clear air is found to have little effect on the evolution of the mixing process. The distributions of cloud water droplet size, supersaturation at the droplet positions and vertical velocity are more sensitive to large scale as opposed to small-scale properties of the flow.

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