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Turbulent Mixing at the Edge of a Cloud RAYMOND SHAW, MATTHEW BEALS, Michigan Technological University, JACOB FUGAL, Max Planck Institute for Chemistry, BIPIN KUMAR, Ilmenau University of Technology, JIANG LU, Michigan Technological University, JOERG SCHUMACHER, Ilmenau University of Technology, JEFFREY STITH, National Center for Atmospheric Research — Numerical and field experiments have been brought to bear on the question of how atmospheric clouds respond when they experience turbulent mixing with their environment. Simply put, we ask when a cloud is diluted, do all droplets evaporate uniformly (homogeneous mixing) or does a subset of droplets evaporate completely, leaving the remaining droplets unaffected (inhomogeneous mixing)? First, the entrainment of clear air and its subsequent mixing with a filament of cloudy air is studied in DNS that combine the Eulerian description of the turbulent velocity, temperature and vapor fields with a Lagrangian cloud droplet ensemble. The simulations provide guidance on the proper definition of the thermodynamic response time for the Damkoehler number, and demonstrate the transition from inhomogeneous to homogeneous mixing as mixing progresses within the inertial subrange. Second, an airborne digital holographic instrument (Holodec) shows that cloud edges are inhomogeneous at the centimeter scales. In local cloud volumes the droplet size distribution fluctuates strongly in number density but with a nearly unchanging mean droplet diameter, until the fluctuations finally cascade to the centimeter scale, when the droplet diameter begins to respond.

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