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Extreme responses of a coupled scalar-particle system during turbulent mixing[1] JOERG SCHUMACHER, BIPIN KUMAR, Ilmenau University of Technology, Ilmenau, Germany, RAYMOND SHAW, Michigan Technological University, Houghton, USA — Extreme responses of a droplet ensemble during an entrainment and mixing process as present at the edge of a cloud are investigated by means of three-dimensional direct numerical simulations. We combine therefore the Eulerian description of the turbulent velocity and vapor content fields with a Lagrangian ensemble of cloud water droplets which are advected in the flow and can shrink and grow in correspondence with the supersaturation at their position. We find that the Damköhler number Da, a dimensionless parameter which relates the fluid time scale to the typical evaporation time scale, can capture all aspects of the initial mixing process. The mixing process is characterized by the limits of strongly homogeneous ($Da \ll 1$) and strongly inhomogeneous ($Da \gg 1$). We explore these two extreme regimes and study the response of the droplet size distribution to the corresponding parameter settings through enhancement and reduction the response constant K in the droplet growth equation. Thus, Da is varied while Reynolds and Schmidt numbers are held fixed, and initial microphysical properties are held constant. In the homogeneous limit minimal broadening of the size distribution is observed as the new steady state is reach, whereas in the inhomogeneous limit the size distr

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Joerg Schumacher
Ilmenau University of Technology, Ilmenau, Germany

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