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**Turbulence-induced broadening of cloud droplet size distributions: implications for aerosol indirect effects**[1] RAYMOND SHAW, WILL CANTRELL, KAMAL KANT CHANDRAKAR, GREG KINNEY, Michigan Technological University, MIKHAIL OVCHINNIKOV, Pacific Northwest National Laboratory, SUBIN THOMAS, Michigan Technological University, FAN YANG, Brookhaven National Laboratory — The optical properties and precipitation efficiency of warm clouds depend on the droplet size distribution and its moments, including the statistical relative-dispersion of the distribution. Cloud droplet growth in a turbulent environment is studied by creating turbulent moist Rayleigh-Bénard convection in a laboratory chamber (the Pi Chamber) and a parallel LES with (bin) cloud-microphysics. Cloud formation is achieved by injecting aerosols into the water-supersaturated environment created by the isobaric mixing of saturated air at different temperatures. A range of steady-state cloud droplet number concentrations is achieved by supplying aerosols at different rates. The results reveal a surprising role of turbulence in cloud droplet formation and growth that can be understood as occurring in two regimes: a polluted cloud regime ($Da \gg 1$) in which thermodynamic conditions are rather uniform and cloud droplet sizes are similar, and a clean cloud regime ($Da \ll 1$) in which thermodynamic conditions are highly variable and cloud droplet sizes are very diverse. The narrowing of the cloud droplet size distribution under polluted conditions introduces a new stabilizing factor by which increased aerosol concentration can suppress precipitation and enhance cloud brightness.

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