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The dynamics of droplets in moist Rayleigh-Benard turbulence[1]
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Clouds are an intricate part of the climate, and strongly influence atmospheric dynamics and radiative balances. While properties such as cloud albedo and precipitation rate are large scale effects, these properties are determined by dynamics on the microscale, such droplet sizes, liquid water content, etc. The growth of droplets from condensation is dependent on a multitude of parameters, such as aerosol concentration (nucleation sites) and turbulence (scalar fluctuations and coalescence). However, the precise mechanism behind droplet growth and clustering in a cloud environment is still unclear. In this investigation we use a facility called the Pi Chamber to generate a (miniature) cloud in a laboratory setting with known boundary conditions, such as aerosol concentration, temperature, and humidity. Through the use of particle imaging velocimetry (PIV) on the droplets generated in the cloud, we can investigate the dynamics of these cloud droplets in the convective (Rayleigh-Benard) turbulence generated through an induced temperature gradient. We show the influence of the temperature gradient and Froude number (gravity forces) on the changing turbulence anisotropy, large scale circulation, and small-scale dissipation rates.

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