Department of Atmospheric Sciences
Seminar Announcement

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Analyzing Cloud Droplet Spatial Tendencies on the Millimeter and Centimeter Scales in Stratocumulus Clouds

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Date:	**Wednesday, December 2, 2020**
Time:	**3:30pm HST**
Zoom Meeting:	**https://hawaii.zoom.us/j/97454168193**
	Meeting ID: 974 5416 8193
	Passcode: 207183

Abstract:

Up until recent decades it was mostly accepted that droplet spacing within clouds was uniform and not important for calculating the growth of an ensemble of droplets. This must be viewed as tentative as theory and laboratory results suggest that droplet clustering occurs on the order of the Kolmogorov length scale, with the magnitude of said clustering depending on the Stokes number (St). The accuracy of these theories remains largely unquantified for in situ atmospheric cloud however. Therefore, this research aims to measure droplet clustering within stratocumulus clouds to gain a better understanding of how cloud droplets interact on the smallest scales.

Cloud droplet-turbulent relationships are derived from the Peruvian stratocumulus (Sc) deck sampled over 14 flights during the 2008 VAMOS Ocean-Cloud-Atmosphere-Land Study Regional Experiment (VOCALS-REx) by the Center for interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Twin Otter aircraft. Time stamps for when each cloud droplet was encountered were measured using the Artium Flight phase Doppler interferometer (AF-PDI). The temporal pair-correlation function ($\eta(t)$) is used to determine (1) does the theoretical picture of inertial clustering change for in situ conditions; (2) does the clustering magnitude measured show correlations with St; (3) are there trends in the magnitude of clustering within the vertical layer of the stratocumulus deck.

Results indicate that droplet clustering is evident in most cases from analyzing $\eta(t)$, with a maximum in the magnitude of average droplet clustering occurring near Sc middle. Theoretical predictions observed include droplet clustering beginning in the turbulence dissipation range, and the magnitude of droplet clustering being strongly correlated with St (as a function of in-cloud normalized height), and thus, is correlated with drop size and turbulent kinetic energy dissipation rate (ε), where St depends on drop size and ε.