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Early Ice Formation in Tropical Maritime Convection Observed during the Ice in Clouds-Tropical Experiment

A. Heymsfield, P Field, S Lasher-Trapp, Z Wang, J. French, S. Haimov, D. Leon, D. Rogers, J Stith, P. Demott, and K Prather

NCAR, MMM Division, co, United States (heyms1@ucar.edu)

During the Ice in Clouds Experiment-Tropical (ICE-T) in July 2011, the NSF/NCAR C130 aircraft flew thirteen research missions into towering cumulus thru cumulonimbus clouds in the vicinity of the Virgin Islands in the Caribbean. The primary goal of ICE-T is to understand how the first ice particles originate and impact the subsequent spread of the ice in clouds from this climatologically important region. ICE-T provided detailed aerosol and microphysical measurements of the interactions of episodic Saharan dust events with tropical cumuli. The C130 was equipped with a complement of cloud particle probes sizing from micron to cm sizes, online and offline chemical composition measurements of the residuals of evaporated droplets and ice particles, aerosol, cloud condensation and ice nuclei (aerosol and cloud residuals) spectral measurements, and upward and downward viewing Doppler cloud radar and lidar.

The C130 observations focus on the critical temperature range from 0 to -10C, where primary nucleation on a few ice nuclei is thought to lead to a cascade of ice particles through subsequent secondary processes that are responsible for ice phase precipitation from these clouds and also affect the cloud dynamics. We will report on the in-situ observations from the C130,, drawing upon remote sensing observations where possible to provide context. Primary ice nucleation and secondary processes will be discussed in relation to our observations in this important class of clouds.