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Abstract

Analysis of Raindrop Size Distributions Measured during the Mid-latitude Continental Convective Clouds Experiment

Data collected during the Mid-latitude Continental Convective Clouds Experiment (MC3E) are analyzed to determine how raindrop size distributions vary as a function of rain rate and environmental conditions. Particle images were acquired with a Cloud Imaging Probe (CIP), Two Dimensional Optical Array Cloud Imaging Probe (2DC), and High Volume Precipitation Spectrometer (HVPS) during MC3E. The CIP and 2DC measurements encompass particle sizes with maximum dimensions nominally between 0.05mm to 2mm sorted into 19 bins, whereas the HVPS measurements range from 0.2mm to 30mm sorted into 28 bins. These data were processed at the National Center for Atmospheric Research to generate composite number distribution functions at 1-s resolution that merges data from the 2DC, or the CIP when measurements are not present in the 2DC, with that from the HVPS with a switchover at 1mm. In this study, the variance in the shape of the number distribution functions for different rain rates is examined using data acquired at temperatures greater than 0 degrees Celsius to restrict analysis to rain clouds. Using the concept of a normalized distribution function, the variation of distribution shape as a function of rain rate, temperature, and acquisition date is examined. Further, an assessment is made as to whether the normalized shape varies for individual distributions measured in similar rain rate and environmental conditions. These size distribution curves are then compared to those that were observed in precipitation over the west Pacific Ocean and within two tropical cyclones.