Comparisons of Florida Thunderstorm Cirrus Clouds using Concurrent Radar and Aircraft Measurements

Nicholas Gapp[1], Jerome Schmidt[2], David Delene[1], Paul Harasti[2], Joshua Hoover[3], and Peter Jones[4]

[1] University of North Dakota, Grand Forks, North Dakota
[2] Naval Research Laboratory, Marine Meteorology Division, Monterey, California
[3] Naval Surface Warfare Center Dahlgren Division, Dahlgren, Virginia
[4] L3 Interstate Electronics Corp., Anaheim, California

The Citation Research Aircraft conducted measurements of cirrus cloud particles in Florida thunderstorm anvils during 2015 (CAPE2015 field project). During the CAPE2015 field project, ice particles were sampled between an altitude of 29,000 ft and 40,000 ft on eight research flights. In-situ observations were made using a Two-Dimensional Stereographic probe (2D-S) and a Nevzorov Water Content Probe (Nevzorov). Remote sensing observations were made by the United States Navy's Mid-Course Radar (MCR) with its 37 m resolution (narrowband) and 0.546 m resolution (wideband) beams. Two separate scanning strategies allowed the MCR to use both beams to either track the aircraft while the aircraft was flown at a constant altitude or stare vertically while the aircraft completed multiple passes through the beams. The scanning strategies provide concurrency between the in-situ and remote observations of the cirrus clouds and allow for the examination of the variation of radar reflectivity that links the cloud microphysics to the large-scale cloud structure and enables the understanding of the cloud evolution over time. Data analysis includes comparisons between the derived radar reflectivity from in-situ data and the measured MCR radar reflectivity from both the narrowband and wideband beams for both scanning strategies. The radar reflectivity is derived using effective liquid particle sizes and particle concentrations from the 2D-S and total particle mass from the Nevzorov. The influence of the assumption of random distributed particles is also investigated to determine its effect on the measured radar reflectivity. Results prove the MCR can successfully track the aircraft through the ability to co-locate both the derived and measured radar reflectivity data sets and show that strong agreement exists between the data sets during aircraft tracking scans.