A Comparison of Size Distribution Calculation Methods on Single Scattering Properties of Anvil Cirrus Clouds

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The University of North Dakota's Citation Research Aircraft was used during eight flights in Florida to take in-situ measurements of high-altitude cirrus clouds during the CAPE2015 research project. Particle imaging probes included a two-dimensional stereographic (2D-S) probe and High Volume Precipitation Spectrometer version 3 (HVPS3) probe. The clouds observed were in thunderstorm anvil outflow regions between 29,000 ft and 40,000 ft, and images indicated that crystals had very similar size and habit. Three different size distribution calculation methods are performed on the 2D-S data: "reconstruction", "center-of-mass", and "all-in". The "reconstruction" method involves reconstructing edge images by mirroring the observed part of the particle. The "center-of-mass" method involves only using edge images where the center of mass of the particle is known to be within the image. The "all-in" method does not use particles that are not entirely in the image. These three methods are evaluated by comparison with manual review of images for consistency. Each size-distributions is used to calculate bulk single-scattering properties of the cloud, including mean extinction efficiency, absorption efficiency, and asymmetry factor. The uncertainty of the bulk single-scattering properties is evaluated from the spread of applying the threes different methods.