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Characterization of Cloud Microphysical Parameters Using Airborne Measurements by the Research Scanning Polarimeter

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We present the retrievals of cloud droplet size distribution parameters (effective radius and variance) from the Research Scanning Polarimeter (RSP) measurements made during recent field campaigns, including Routine AVP CLOWD Optical Radiative Observations (RACORO, 2009) and Development and Evaluation of satellite Validation Tools by Experimenters (DEVOTE, 2011). The RSP is an airborne prototype for the Aerosol Polarimetery Sensor (APS), which was built for the NASA Glory Mission project. This instrument measures both polarized and total reflectances in 9 spectral channels with wavelengths ranging from 410 to 2250 nm. For cloud droplet size retrievals we utilize the polarized reflectances in the scattering range between 135 and 170 degrees where they exhibit rainbow, shape of which is determined mainly by single-scattering properties of the cloud particles. Two different retrieval methods were used: standard fitting of the observations with a model based on pre-assumed gamma distribution shape, and a novel non-parametric technique Rainbow Fourier Transform (RFT), which does not require any a priori assumptions about the droplet size distribution. The RSP measurements over cumulus clouds also allow for estimation of their geometry (cloud width, top and base heights), which, combined with the droplet size, can provide further insight into cloud microphysics. Our retrievals showed good agreement with the correlative near-cloud-top in situ measurements of cloud droplet sizes performed during the field campaigns.