

A55B-05 - Investigation of Cloud Interior Structure Using a Tomographic Technique Based on Radon Transform. Application to the Measurements Made by the Research Scanning Polarimeter During CAMP2Ex



Friday, 16 December 2022



16:30 - 16:40



E271ab (Lakeside, Level 2, McCormick Place)

Abstract

The Research Scanning Polarimeter (RSP) is an airborne along-track scanner measuring the polarized and total reflectances in 9 spectral channels. The RSP's uniquely high angular resolution coupled with the high frequency of measurements allows for characterization of liquid-water cloud droplet sizes using the rainbow structure observed in the polarized reflectance measurements. The RSP observations also provide for derivation of 2D field of extinction coefficient inside the cloud using a tomographic technique. This technique utilizes the family of cloud shapes derived using "cutout" technique and corresponding to a number of thresholds in total reflectance (separating bright cloud from its darker background). These shapes can be interpreted as level curves of an abstract "reflectance density", which is then used for derivation of the directional cloud optical thickness (dCOT) tomogram. The latter is a collection of dCOTs parameterized by the angles and offsets of the corresponding view rays (chords) relative to the cloud center. After this, the inverse Radon Transform (the mathematical basis of the X-ray computer tomography) is applied to the dCOT tomogram yielding 2D spatial distribution of the extinction coefficient. The latter can be converted into droplet number concentration using the droplet size profiles derived from the RSP's polarized reflectance measurements.

After tests on synthetic data this technique was applied to real RSP measurements from NASA's Cloud, Aerosol and Monsoon Processes Philippines Experiment (CAMP2Ex) conducted in the vicinity of the Philippines during the Southwest Monsoon (August–September 2019). We have investigated the interiors of a number of clouds observed during CAMP2Ex focusing on Cu and CuCg (Tcu) cases. Our retrievals were routinely compared with the correlative measurements by lidar (HSRL-2) and cloud radar (APR-3) that were deployed on the same airborne platform (NASA P-3B) during this field experiment.

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