DEPENDENCE OF CIRCUMSOLAR RADIATION ON ICE CLOUD PROPERTIES

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**MOTIVATION**

- In the presence of an ice cloud, the scattered solar radiation is strongly concentrated into the forward direction.
- Radiation scattered into the solar and circumsolar region can bias the measurement of direct radiation.
- Sensitivity of shortwave circumsolar radiance to ice crystal shape and surface roughness is not well known.

**METHOD**

Radiative transfer simulations and measurements of downwelling monochromatic radiances were compared in the angular range of 0-8° from the Sun. The simulations were based on in-situ derived size distributions of ice crystals. To quantify the sensitivity of the radiances to crystal shapes, simulations were carried out with different single-habit shape distributions in addition to the in-situ derived shape distributions.

**MEASUREMENTS**

Measurements were conducted during ARM’s SPARCitus 2010 field campaign at the SGP site. Size and shape distributions of ice crystals were measured using in-situ probes installed on the SPEC Inc. Learjet. Ground based solar disk and circumsolar radiances were measured using Vaisalan’s Solar and Aureole Measurements (SAM) sensors.

**HABITS**

Shape distributions of large ice crystals were obtained using the IC-PCA classifier1 which classifies the CPI images of individual ice crystals into six habits: column, plate, bullet rosette, irregular plate and column aggregate. Small crystals (<100 μm) were assumed to be droplets. Single scattering properties for the habits were obtained from existing databases.

- **Database_2000**: column, plate, bullet rosette, and smooth and rough aggregate, droxtal.
- **Database_2013**: solid column, plate, solid bullet rosette, plate aggregate with 5 and 10 branches, column aggregate, and droxtal.

All habits with three roughness options (smooth, moderately rough, severely rough).

**REFERENCES**

7Hos et al. (1998), ARM, 79, 5.
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