The angular light scattering function of atmospheric ice crystal ensembles

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Ice crystal sub-micrometer structures have a large effect on their optical properties. Theoretical calculations have shown, that compared to pristine crystals, complex ice crystals produce a flat and featureless scattering phase function with a significantly higher fraction of backscattering (e.g., [1–3]). Changing the radiative properties of ice crystals in general circulation models to those of roughened ice crystals could significantly affect the cloud radiative effect. Satellite measurements have indicated that natural ice crystals have a high degree of surface roughness and the latest MODIS collection 6 (C6) product has incorporated complex and roughened ice crystals [4]. However, the use of roughened ice crystals in general circulation models and in satellite retrievals is not well justified as long as observational evidence of the applicability of these models to represent the optical properties of atmospheric ice crystals is given.

In this contribution, we present *in situ* measurements of the ice crystal angular light scattering function from four airborne field campaigns. The *in situ* observations show that a uniform angular light scattering function with a relatively low asymmetry parameter is observed globally, which is the result of a high degree of ice particle complexity observed in these clouds. The measured cloud angular light scattering function was compared to a selection of optical particle models, and it was found that the C6 model best represented the measurements. Lastly, we investigate using the *in situ* dataset how many ice crystals are needed to reproduce the globally observed uniform angular light scattering function.

References

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