A new *in situ* hyper-angular cloud polarimeter for airborne platforms

Emma P. Järvinen[a,*] and Franz M. Schnaiter[b]

[a]*National Center for Atmospheric Research, PO Box 3000, Boulder, CO 80307, USA*
[b]*Karlsruhe Institute of Technology, Kaiserstraße 12, 76131, Karlsruhe, Germany*

[*]*Presenting author (jarvinen@ucar.edu)*

Polarimetric satellite observations provide important information on the cloud phase and particle properties. After the end of the PARASOL mission that carried the POLDER polarimeter in 2013, a future satellite mission PACE will carry a hyper-angular polarimeter (HARP-2) instrument that will be used to retrieve, among others parameters, the cloud droplet size distribution, ice particle shape, and roughness.

For validation of polarimetric satellite observations, it is important to establish a direct link between the cloud optical and microphysical properties. An *in situ* hyper-angular polarimeter is capable of measuring the cloud properties within meters from the fuselage. The instrument will be designed to measure the rear partial scattering phase function including the rainbow feature with a high angular resolution of less than a tenth of a degree. This information can be used to accurately derive the droplet size distribution in real time. Additionally, the scattered light intensity is split with respect to its polarization components that define the depolarization and polarization ratios of the cloud particles. These measurements can be used to derive information on the cloud phase, ice crystal shape, and surface roughness and will support space-borne observations by CALIOP and HARP-2.

In this contribution, we present the concept of an *in situ* hyper-angular cloud polarimeter that is currently being developed as a collaboration between National Center for Atmospheric Research and Karlsruhe Institute of Technology. We also present the first measurements performed with a laboratory prototype.

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