

Cloud droplet sizes and number concentrations derived from global polarimetric observations

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Accurate satellite retrievals of cloud droplet number concentrations are crucial to quantify aerosol-cloud interactions. While the satellite record of droplet number concentrations has been extremely useful for ACI studies, it is well-known that the bi-spectral retrievals of drop size and cloud optical thickness on which these are based may provide biased results in situations with broken, small, inhomogeneous and/or mixed-phase cloud regimes. Polarimetric cloudbow observations provide an alternative approach to derive drop size information as input for derived droplet number concentrations that has been shown to be less affected by cloud inhomogeneity and 3D radiative transfer effects. The HARP-2 and SPEXone polarimeters on the NASA PACE mission provide cloudbow retrievals on a 5x5 km² pixel level with a global sampling. We show that the differences between the polarimetric and bi-spectral drop effective radius retrievals are largely consistent with expected biases in the bi-spectral retrievals. Consequently, global cloud droplet number concentrations derived from the polarimetric drop size distributions are generally much higher than those used in previous aerosol-cloud interaction studies. In this presentation we will further scrutinize the cloud droplet number concentrations derived using polarimetric and radiometric observations and discuss implications for aerosol-cloud interaction studies.

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