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# The potential to constrain aerosol water uptake in climate models using remote sensing observations

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Depending on the environmental humidity and their hygroscopicity, aerosols may absorb water causing their size to increase. Consequently, aerosol scattering and hence the direct aerosol effect increases with water uptake. In addition, aerosol hygroscopicity largely determines its effectiveness to act as cloud condensation nuclei. Aerosol hygroscopicity and water content assumed or predicted by climate models have been shown to be highly variable among models, which contributes to the large uncertainties in anthropogenic aerosol radiative forcing through direct and indirect effects. Information for validation of modelled water uptake is very limited. We recently developed and validated a simple approach to infer the water volume fraction from the fine-mode refractive index retrieved using multi-angle polarimetry. The approach was applied to observations of the airborne Research Scanning Polarimeter (RSP) and results were shown to compare well to water volume fraction estimated from in situ probe observations. In addition, we demonstrated that the multi-angle polarimetry observations allow the estimation of the fraction of soluble versus insoluble particles, as well as the dry size distributions. In this presentation, we summarize the approach and further discuss its application to space-borne observations such as those from the SPEXone instrument that will be launched on board of NASA's PACE satellite in 2024. Furthermore, we discuss the possibility to validate satellite retrievals of aerosol water content using airborne and ground-based in situ observations, as well as potentially with sun-photometers. Finally, we show a preliminary demonstration on how water uptake in a global aerosol climate model (ECHAM-HAM) may be validated with such aerosol water volume fraction data.

**Keywords**: aerosol, model validation, future missions