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Towards global constraints of aerosol-convection interactions from space

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Aerosol-cloud interactions arguably remain the single greatest uncertainty among anthropogenic perturbations of the climate system. In particular interactions between aerosols and convection remain highly uncertain.

In this presentation, I will critically review some of the achievements made towards constraining aerosol-convection interactions from satellite remote sensing and their role in the evaluation of global aerosol-climate models. This will particularly focus on model-data synergies in the assessment of observational constraints, from the suitability of satellite retrieved aerosol properties as proxy for cloud condensation nuclei, all the way to the difficulty to constrain meteorological co-variability in observational studies of aerosol-cloud interactions.

Most of the satellite-based work on aerosol-convection interactions has been based on data from sun-synchronous polar orbiting satellites. While these instruments often offer superior data quality, they capture only a certain stage of the convective life-cycle. A life-cycle based approach to aerosol-convection interactions, combining results from polar orbiting instruments with non sun-synchronous or geostationary data provides entirely novel insights into the convective lifecycle and aerosol-convection interactions, which we apply to constrain aerosol-precipitation interactions.