Aerosol-cloud interactions: What do in-situ observations tell us and how can it constrain and improve modeling of the indirect effect?

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Abstract

The effects of airborne particulate matter ("aerosols") on clouds (known as the "aerosol indirect effect") are potentially one of the largest impacts humans have on climate. Even more important, the indirect effect is currently thought to have a net climatic cooling effect, largely offsetting the warming from greenhouse gases. Despite its importance, the indirect effect is one of the most uncertain components of climate change. This uncertainty originates from the complex and multi-scale nature of aerosol-cloud interactions, which often forces climate models to use empirical approaches to the problem. This talk will present assessments of the aerosol indirect effect using a state of the art global climate model framework and physically-based approaches of representing aerosol-cloud interactions. We present methods for constraining and evaluating these novel modeling approaches with *in-situ* observations of aerosol size distribution, chemical composition and cloud droplet formation potential. Finally, we present work on robustly constraining important sources of predictive uncertainty by coupling the *in-situ* observations with global climate modeling.