Global Assesment of Aerosol – Ice Cloud Interactions with the NASA Goddard Earth Observing System (GEOS-5)

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The interaction between aerosol and clouds plays an important role in many climate processes. Representation of such processes in climate models requires the coupling of aerosol activation and ice nucleation parameterizations with sophisticated cloud schemes. These schemes link cloud properties, i.e., cloud particle number and effective size, condensate amount and cloud fraction, to formation conditions and aerosol characteristics. In this talk the representation of aerosol cloud interactions within climate models is discussed. Emphasis is placed on the recent implementation of a two moment cloud microphysics scheme within the NASA Goddard Earth Observing System (GEOS-5) model. Using GEOS-5 the role of dust and soot acting as ice forming agents within stratiform and convective clouds is studied. Globally, dust is identified as the dominant ice nuclei, whereas soot may influence ice cloud formation and precipitation in polluted regions. It is shown that in agreement with satellite retrievals, dust determines to great extent the freezing level of mixed-phase clouds. The effect of dust and soot ice nuclei on the overall aerosol indirect effect on climate is analyzed.