Geophysical Research Abstracts,
Vol. 11, EGU2009-3003, 2009
EGU General Assembly 2009

Space-Based Evaluation of the Aerosol Indirect Effect and Wet Scavenging in the Arctic

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Prior ground based studies from Barrow Alaska have demonstrated that anthropogenic aerosols from mid-latitudes have the potential to alter Arctic cloud surface radiative forcing in both the solar and thermal IR bands. Studies of the indirect effect in the Arctic are less explored using satellites, which have the advantage of more comprehensive spatial coverage. The disadvantage of satellite studies is that they do not provide retrievals of aerosol concentrations under cloudy conditions nor do they resolve aerosol vertical profiles; co-location of aerosol and cloud fields is therefore impossible under similar meteorological conditions. In order to circumvent these concerns, we co-locate both vertically and horizontally MODIS and CERES cloud products with anthropogenic pollution tracers from a high resolution Lagrangian tracer transport model (FLEXPART). A pan-Arctic analysis of these co-located fields demonstrates a small yet discernable impact of mid-latitude pollution on cloud properties. We interpret the weakness of the signal as being indicative not of low sensitivity of Arctic clouds to pollution aerosols, but rather of low sensitivity of Arctic clouds to mid-latitude pollution plumes. In transport to the Arctic pollution aerosols are efficiently scavenged by wet deposition while more insoluble pollution tracers remain.