

**Direct and semi-direct effects of aerosol on the climate system**

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High-resolution (1x1 degree) global tropospheric aerosol datasets are generated using the atmospheric component of CESM1.0 coupled to an active bulk aerosol model for the 1850's and the period 1960-2000. The interactive aerosol module incorporates surface and elevated emissions of anthropogenic and natural aerosol precursors and oxidants. Experiments performed with the new aerosol datasets in atmosphere only GCM runs reveal that current level of aerosols can cause significant surface cooling and shift precipitation when compared to pre-industrial levels of aerosols. Experiments performed with the atmosphere component coupled to a slab ocean model reveal that aerosols can enhance the land-sea contrast, and cross-equatorial SST gradient leading to enhanced reduction in the monsoon rainfall and shift in the ITCZ over the tropical Atlantic as compared to the atmosphere only runs. AMIP style experiments with the new aerosol dataset further reveal that aerosols could have had a significant impact on the trends in regional surface temperature and precipitation in the later part of the 20th century.