Black Carbon Aerosols and the Third Polar Ice Cap

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Over the last 20 years India has witnessed rapid economic growth and consequently emissions of aerosols have increased with an increase in energy used for power consumption. During this time period, the snow/ice cover in the Himalayas has decreased and ice core records also indicate an increase in the concentration of aerosols, particularly black carbon, that is released from incomplete combustion. We use the Goddard Institute for Space Studies climate model coupled to an aerosol chemistry and transport model to perform global climate simulations to examine regional climate change over India for the 1990 to 2010 time period. Anthropogenic aerosols included are sulfates, organic and black carbon and all aerosol processes (direct, semi-direct, indirect and black carbon deposition on snow) are included. Using newer emission estimates of black carbon aerosols released from coal burning, transportation and biofuel sources, we examine changes in climate from these enhanced aerosols. Several sets of simulations were performed to isolate the impacts on snow/ice cover and precipitation from black carbon. Based on these simulations, we found that aerosols significantly impact snow/ice cover compared to GHG forcings and the spatial increase/decrease in snow/ice cover were best captured by simulations that include the enhanced black carbon aerosols with other climate forcings (SST and GHG changes). The precipitation patters for the summer monsoon over India were also best captured by simulations with the enhanced black carbon. Since black carbon aerosols may be controlled more easily than GHGs we suggest concerted efforts to reduce the emissions of black carbon.