



Impacts of 20th century aerosol emissions on the South Asian monsoon in the CMIP5 models

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Comparison of single-forcing varieties of 20th century historical experiments in a subset of models from the Fifth Coupled Model Intercomparison Project (CMIP5) reveals that South Asian summer monsoon rainfall increases towards the present day in GHG-only experiments with respect to pre-industrial levels, while it decreases in anthropogenic aerosol-only experiments. Comparison of these single-forcing runs with the all-forcings historical experiment suggests aerosol emissions have dominated South Asian monsoon rainfall trends in recent decades. By examining the 25 available all-forcings historical experiments, we show that models including aerosol indirect effects dominate this negative trend. Indeed, models including only the direct radiative effect of aerosol show an increase in monsoon rainfall, suggesting the dominance of increasing greenhouse gas emissions and planetary warming on monsoon rainfall in those models. The mechanism may be due to the indirect and direct effects acting in unison to suppress the monsoon, or to stronger local aerosol loading in the group of models containing indirect effects. The disparity between the two groups of models needs to be urgently investigated in the event that the suggested future decline in Asian anthropogenic aerosol emissions inherent to the representative concentration pathways (RCPs) used for future climate projection turns out to be optimistic.