4.090 Aerosol impact on present day climate.

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Abstract:

To keep within 2° of global warming, we need large reductions of greenhouse gas emissions. Since aerosols often are co-emitted with greenhouse gases, reducing greenhouse gas emissions will simultaneously reduce aerosol emissions, -compounded by present and future effort to improve air quality. Using idealized simulations with fully coupled climate models, we show how cleaning up aerosols, predominantly sulfate, may add an additional half a degree of global warming. The northern hemisphere is found to be more sensitive to aerosol removal compared to greenhouse gas warming, due to the location of the aerosol emissions. We find a higher sensitivity of heavy precipitation intensity and hot extremes to aerosol reductions, per degree of surface warming, over the major aerosol emission regions, which are also among the main populated regions of the globe. East Asia is a region where extreme precipitation is particularly sensitive to a reduction in aerosol emissions. Further, reducing sulphate and black carbon emissions over four separate emission areas (East Asia, South Asia, North America and Europe respectively) result in strong climate changes locally, but also remotely in areas such as the Arctic. The differences in spatial pattern between climate forcing and response due to greenhouse gases and aerosols mean that for low global warming scenarios, e.g., consistent with the 2° target, the realized climate impacts will depend significantly on the path we take toward a global temperature goal.