Climate impacts of a Short-lived climate forcer mitigation scenario

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Short-lived climate forcers (SLCFs) cause poor air quality such as particulate matter and ground level ozone, and also affect climate. Between now and the middle of the century the largest changes in forcing agents are likely to be in chemically reactive short-lived species such as ozone and aerosols, as emissions of these are expected to reduce dramatically due to air quality legislation. The relative importance of short-lived species is further increased if CO_2 emissions are reduced under Paris negotiations. Mitigation of some short-lived climate forcers is also needed to meet the Paris goals.

The climate effects of SLCFs are not straightforward to calculate as perturbations lead to additional changes beyond the direct (instantaneous) radiative forcing. SLCFs can induce rapid changes in meteorology, through localised heating or cooling of the atmosphere, with the overall effect encompassed in the Effective Radiative Forcing (ERF). Because of their short lifetime SLCFs are concentrated near the regions of emission and hence their ERF patterns are spatially heterogeneous - leading to heterogeneous warming patterns.

To study the policy relevant question of the climate benefit of SLCF mitigation measures we use four Earth system models to simulate the temperature impacts of a future mitigation scenario for SLCFs developed under the ECLIPSE project. To understand the spread in model results and to apportion the temperature change between the different pollutants we repeated model simulations with fixed sea surface temperature and sea ice to generate effective radiative forcings (ERFs). We find a multi-model mean reduction in temperature rise of 0.25 K globally and 0.44 K over the Arctic. From a ERF analysis we suggest that all of the global temperature mitigation comes from methane controls and that BC controls slightly offset this.

Key words: key word SLCFs, climate mitigation, methane, black carbon