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Climate impacts of the ECLIPSE future emissions mitigation scenario

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We investigate the possible near-term climate benefits from mitigating aerosols, ozone and methane. The ECLIPSE (Evaluating the Climate and Air Quality Impacts of Short-Lived Pollutants) project developed a realistic emissions inventory based on current legislation for 2005-2050 (CLE), and a corresponding mitigation scenario designed to be beneficial for both air quality and short-term climate impact (MIT). We determine the climate impacts of the MIT scenario, focussing on the period 2040-2050. Four climate models with interactive chemistry and aerosols (HadGEM, NorESM, CESM-CAM4 and ECHAM-HAM) are used to provide multi-model ensembles of both atmosphere-only and coupled atmosphere-ocean simulations, to separate the effective radiative forcing (ERF) and the climate response.

The ERFs are derived from the atmosphere-only simulations. In all models the MIT scenario leads to a negative global ERF which is driven mainly by methane emissions reductions. There is variability between models in the relative importance of methane and aerosol emissions reductions, and in the sign of ERF response to aerosol emissions reductions.

The climate response to MIT is derived from the coupled simulations. In all models, MIT results in a decrease in the global mean temperature compared to CLE, with a model mean decrease of 0.22ºC. The temperature decrease is seen most strongly in the Northern Hemisphere and is particularly strong in the Arctic.

The ensembles of coupled-ocean simulations have therefore enabled us to identify a robust cooling signal from the air quality mitigation scenarios, which can be attributed to the different species using the ERFs.