5.081 Climate impact of emissions of short-lived climate forcers.

Early Career Scientist

Presenting Author:
Maria Sand, CICERO Center for Climate Research, Norway, maria.sand@cicero.oslo.no

Co-Authors:
Terje Berntsen, Department of Geoscienses, University of Oslo, Norway
Knut von Saltzen, Canadian Centre for Climate Modelling and Analysis, Environmental Canada, Canada
Mark Flanner, Climate and Space Sciences and Engineering, University of Michigan, USA
Joakim Langner, Swedish Meteorological and Hydrological Institute, Sweden
Anna Lewinschall, Department of Meteorology, Stockholm University, Sweden

Abstract:

There is a growing interest in the potential for reducing short-lived climate forcers (SLCFs) to slow Arctic and global warming and at the same time improve air quality. In this study we have systematically quantified the Arctic climate impact of regional SLCFs emissions, taking into account black carbon, sulphur dioxide, nitrogen oxides, volatile organic compounds, organic carbon and tropospheric ozone, and their transport processes and transformations in the atmosphere. Using several chemical transport models we perform detailed radiative forcing calculations from emissions of these species from different sectors and regions. To estimate the Arctic surface temperature we apply regional climate sensitivities, the temperature response per unit of radiative forcing for each SLCF in four broad latitude bands. We find that the largest Arctic warming source is from emissions within the Asian nations owing to the large absolute amount of emissions. However, the Arctic is most sensitive, per unit mass emitted, to SLCFs emissions from a small number of activities within the Arctic nations themselves. A stringent, but technically feasible mitigation scenario for SLCFs, phased in from 2015 to 2030, could cut warming by 0.2 (±0.17) K in 2050. To extend the process-based understanding of the emissions-to-response approach we run a fully coupled climate model with emission perturbations of black carbon and sulphur dioxide over Europe, USA, South Asia and East Asia. We find significant changes in temperature and precipitation over many regions in the Northern Hemisphere (compared to a 200 year control run). We see similar response patterns in the Northern Hemisphere (locally and remotely) from emissions perturbations from very different regions (USA vs. East Asia).