Geophysical Research Abstracts
Vol. 15, EGU2013-2893, 2013
EGU General Assembly 2013

The relative importance of impacts from climate change vs. emissions change on air pollution levels in the 21st century

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So far several studies have analysed the impacts of climate change on future air pollution levels. Significant changes due to impacts of climate change have been made clear. Nevertheless, these changes are not yet included in national, regional or global air pollution reduction strategies. The changes in future air pollution levels are caused by both impacts from climate change and anthropogenic emission changes and the importance of these signals needs to be quantified and compared. In this study we use the Danish Eulerian Hemispheric Model (DEHM) driven on meteorological input data from the coupled Atmosphere-Ocean General Circulation Model ECHAM5/MPI-OM and forced with the newly developed RCP4.5 emissions. The relative importance of the climate signal and the signal from changes in anthropogenic emissions on the future ozone, black carbon (BC), total particulate matter with a diameter below 2.5 μm (total PM2.5 including BC, primary organic carbon (OC), mineral dust and secondary inorganic aerosols (SIA)) and total nitrogen (including NHx + NO_y) has been determined. For ozone the impacts of anthropogenic emissions dominates though a climate penalty is found in the Arctic region and the Northwestern Europe where the signal from climate change dampens the effect from the projected emission reductions of anthropogenic ozone precursors. The investigated particles are even more dominated by the impacts from emission changes. For black carbon the emission signal dominates slightly at high latitudes increasing to be up to an order of magnitude larger close to the emission sources in temperate and subtropical areas. Including all particulate matter with a diameter below 2.5 μm (total PM2.5) enhances the dominance from emissions change. In contrast, total nitrogen (NHx + NO_y) in parts of the Arctic and at low latitudes is dominated by impacts of climate change.