4.175 The Impact of Carbon Mitigation Measures on Future Air Quality.

Early Career Scientist

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Abstract:

Future policy measures to reduce air pollutants will improve air quality but policy measures aimed at reducing climate change could also inadvertently impact future air quality through changes to air pollutants co-emitted from carbon sources. Additionally, future changes in climate could also influence the concentration and spatial distribution of air pollutants. In this study, we quantify the impact on air pollutants from implementing measures to mitigate climate change, both in terms of their effect on air quality and climate forcing. Two consistent future emissions scenarios are used within the composition-climate model HadGEM3-UKCA: one is a reference scenario of future economic growth and development (REF), whilst the other (RCP4.5) assumes the same development pathway but stabilises anthropogenic radiative forcing at 4.5 W m^{-2} in 2100. Implementing carbon mitigation measures in RCP4.5 reduces the impact of a changing climate on air pollutants and can additionally reduce their emissions by between 15-30% in 2050. The change in emissions and climate from implementing carbon mitigation measures reduces annual mean surface concentrations of ozone and $PM_{2.5}$ by 10-20% over different regions. Additionally, the total number of days that exceed the World Health Organization's (WHO) daily mean air quality standards for ozone and $PM_{2.5}$ is reduced. In terms of climate forcing, the reduction in global mean effective radiative forcing (ERF) in 2050, relative to the present day, due to enacting carbon mitigation measures is enhanced by decreases in tropospheric ozone but is partially offset by a positive aerosol ERF from reductions in aerosols. This study demonstrates that carbon mitigation policies to mitigate climate change have added co-benefits for global and regional air quality. However, the effectiveness of the carbon policies in reducing climate forcing is lessened due to the combined changes in ozone and aerosols.