



Effects of climate change on aerosol concentrations in Europe

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Abstract

High concentrations of particulate matter less than $2.5 \mu\text{m}$ in size ($\text{PM}_{2.5}$), ozone and other major constituents of air pollution, have adverse effects on human health, visibility and ecosystems (Seinfeld and Pandis, 2006), and are strongly influenced by meteorology. Emissions control policy is currently made assuming that climate will remain constant in the future. However, climate change over the next decades is expected to be significant (IPCC, 2007) and may impact local and regional air quality. Determining the sensitivity of the concentrations of air pollutants to climate change is an important step toward estimating future air quality.

In this study we applied **PMCAMx** (Fountoukis et al., 2011), a three dimensional chemical transport model, over Europe, in order to quantify the individual effects of various meteorological parameters on fine particulate matter ($\text{PM}_{2.5}$) concentrations. A suite of perturbations in various meteorological factors, such as temperature, wind speed, absolute humidity and precipitation were imposed separately on base case conditions to determine the sensitivities of $\text{PM}_{2.5}$ concentrations and composition to these parameters. Different simulation periods (summer, autumn 2008 and winter 2009) are used to examine also the seasonal dependence of the air quality – climate interactions.

The results of these sensitivity simulations suggest that there is an important link between changes in meteorology and $\text{PM}_{2.5}$ levels. We quantify through separate sensitivity simulations the processes which are mainly responsible for the final predicted changes in $\text{PM}_{2.5}$ concentration and composition. The predicted $\text{PM}_{2.5}$ response to those meteorology perturbations was found to be quite variable in space and time. These results suggest that, the changes in concentrations caused by changes in climate should be taken into account in long-term air quality planning.

References

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