European atmosphere in 2050, a regional air quality and climate perspective under CMIP5 scenarios

Exposure to air pollution

Health impact assessment

Health impact assessment

Modeling framework

Regional climate projections

Air pollution projections

Particulate matter composition

Disentangling driving factors

Cost benefit analysis

Conclusion

Using a new modelling suite, relying on the latest quantitative projections, and analysed in a cost-benefit framework, we could assess future air quality pointing out the relative role of external factors and concluding on the balance between the technological cost of mitigation and expected benefits.

The main conclusions of the work regarding (1) the dominating role of emission reduction compared to external penalties and (2) the compensation of costs by projected sanitary benefits clearly argue in favor of the effectiveness and efficiency of climate mitigation.

The comprehensiveness of the present modelling suite includes a number of assets, and also offers the possibility to highlight the main uncertainty sources and future research needs. Implementing a state-of-the-art chemistry transport model (Chimere) driven by regional climate projection (CORDEX) and using future boundary conditions (ACCMIP) allows quantifying the non-linear role of external factors. It also makes the results more sensitive to possible biases in driving data than using fitted transfer functions. The main route to improve the robustness of the present findings consists in moving towards ensemble approaches, raising significant computational challenges for the years to come.

Abstract:

We present a first assessment of future air quality under CMIP5 scenarios. This assessment relies on explicit representation of climate mitigation and air quality legislation, hence including a quantification of associated costs. It also relies on comprehensive atmospheric models (global and regional climate as well as chemistry and transport) hence offering a detailed representation of external factors. The modelled air pollutant concentrations are analysed in a monetized health assessment framework in order to put the costs in perspective with the sanitary benefits.

The main conclusion of this work are: (1) air pollutant emission reduction dominate the projected changes compared to climate penalty and long range transport and (2) mitigation costs are largely compensated by expected sanitary benefits.

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Health impact assessment

Using relevant concentration response functions we can quantify the health outcome of exposure to air pollution in terms of premature death, number of hospital admissions, life years lost etc.

In turn, using various monetization reference values (Value of Statistical Life, used for valuing premature deaths or Value Of Life Year, used for valuing loss of life expectancy) we can quantify the overall damage.

The underlying risk assessment model is alphatech2000 (ATOPICA) and 2013.

Accounting for changes in total population and age distribution yields, for instance, to an increase in premature deaths from acute exposure to ozone in the RCP8.5 scenario, over the population weighted ozone decrease slightly.