



Smart climate ensemble exploring approaches: the example of climate impacts on air pollution in Europe.

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Because of its sensitivity to weather patterns, climate change will have an impact on air pollution so that, in the future, a climate penalty could jeopardize the expected efficiency of air pollution mitigation measures. A common method to assess the impact of climate on air quality consists in implementing chemistry-transport models forced by climate projections. However, at present, such impact assessment lack multi-model ensemble approaches to address uncertainties because of the substantial computing cost. Therefore, as a preliminary step towards exploring large climate ensembles with air quality models, we developed an ensemble exploration technique in order to point out the climate models that should be investigated in priority.

By using a training dataset from a deterministic projection of climate and air quality over Europe, we identified the main meteorological drivers of air quality for 8 regions in Europe and developed statistical models that could be used to estimate future air pollutant concentrations.

Applying this statistical model to the whole EuroCordex ensemble of climate projection, we find a climate penalty for six subregions out of eight (Eastern Europe, France, Iberian Peninsula, Mid Europe and Northern Italy). On the contrary, a climate benefit for PM_{2.5} was identified for three regions (Eastern Europe, Mid Europe and Northern Italy).

The uncertainty of this statistical model challenges limits however the confidence we can attribute to associated quantitative projections. This technique allows however selecting a subset of relevant regional climate model members that should be used in priority for future deterministic projections to propose an adequate coverage of uncertainties. We are thereby proposing a smart ensemble exploration strategy that can also be used for other impacts studies beyond air quality.