Evaluation of air pollutant emission reduction strategies in the context of climate change

Abstract

Climate change resulting from greenhouse gas emissions is expected to have a significant impact on air quality. The main meteorological parameters influencing the transport and transformation of pollutants will experience significant changes in the future. The impact of climate change alone was shown to have a significant impact on ozone levels in Europe by the end of the twenty-first century (Langner et al. 2005; Meleux et al., 2007). This project aims at gathering a climate and air quality research community in order to provide a common shared and sustainable framework for the assessment of air quality in the context of climate change. The results will be used as a basis for design making its assessing the optimal emission reduction strategies in order to reduce transboundary pollution in Europe. A test part of the project is dedicated to the development of a complete air quality/climate modeling platform in Europe.

Keywords: climate change - air pollution - integrated modeling - emission scenarios - ozone - deposition - greenhouse gases

Climate system

The global climate fields issued from IPSL-CM have been compared to observations on a climatological point of view for the period 1860-2005. Annual cycles below show a negative bias of T2m (mainly in winter) sometimes enhanced by the use of WRF.

Conclusions - Perspectives

The novelty of this work is to build an Air quality / Climate modeling chain with an assessment of downscaling methodologies. Large biases on temperature and water content will have strong implications on air quality simulations (PM and ozone) and this needs to be assessed in a follow-up study.

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Flowchart of the modeling chain

Three GEA scenarios (Riahi, K. et al.), representing air pollutant emission reduction strategies are selected to be consistent with RCP climate scenarios:

- GEA1: current legislation (base case)
- GEA2: current legislation + ambitious climate policy
- GEA3: current legislation + stringent air pollutant reduction strategies

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Flowchart after Jacob and Winner, 2009

References

- Clain et al. (2011) Modelling the impact of global changes on summer European surface ozone levels at the 2050 horizon. ACCENT-Plus Symposium, Urbino 13-16 September 2011.

Several tests were performed to select the best WRF parametrizations in an air quality perspective

Flowchart after Jacob and Winner, 2009

Sensitivity of modeled temperature and ozone compared to surface observations for several configurations of the mesoscale model

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