



## Frontiers in Atmospheric Chemistry Modelling

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The first pan-European kilometre-scale atmospheric chemistry simulation is introduced. The continental-scale air pollution episode of January 2009 is modelled with the CHIMERE offline chemistry-transport model with a massive grid of 2 million horizontal points, performed on 2000 CPU of a high performance computing system hosted by the Research and Technology Computing Center at the French Alternative Energies and Atomic Energy Commission (CCRT/CEA).

Besides the technical challenge, which demonstrated the robustness of the selected air quality model, we discuss the added value in terms of air pollution modelling and decision support. The comparison with in-situ observations shows that model biases are significantly improved despite some spurious added spatial variability attributed to shortcomings in the emission downscaling process and coarse resolution of the meteorological fields.

The increased spatial resolution is clearly beneficial for the detection of exceedances and exposure modelling. We reveal small scale air pollution patterns that highlight the contribution of city plumes to background air pollution levels. Up to a factor 5 underestimation of the fraction of population exposed to detrimental levels of pollution can be obtained with a coarse simulation if subgrid scale correction such as urban increments are ignored.

This experiment opens new perspectives for environmental decision making. After two decades of efforts to reduce air pollutant emissions across Europe, the challenge is now to find the optimal trade-off between national and local air quality management strategies. While the first approach is based on sectoral strategies and energy policies, the later builds upon new alternatives such as urban development. The strategies, the decision pathways and the involvement of individual citizen differ, and a compromise based on cost and efficiency must be found. We illustrated how high performance computing in atmospheric science can contribute to this aim. Although further developments are still needed to secure the results for routine policy use, the door is now open...