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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Decadal regional air quality simulations over Europe in present climate: near surface ozone sensitivity to external meteorological forcing" *by* E. Katragkou et al.

Anonymous Referee #2

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This paper presents air quality simulations over Europe for a 10-year period from 1991 to 2000 with focus on near surface ozone. It uses a regional air quality model driven by the meteorology calculated by a regional climate model. The regional climate model itself is forced by two different external global meteorological forcings: re-analysis dataset and output from a GCM. The sensitivity of the model results to the boundary conditions and the meteorological forcings is thus investigated.

This work has the potential to become a very useful paper for the scientific community by demonstrating the quality and robustness of regional air quality simulations actually used for air pollution studies and their sensitivity (inaccuracies related) to the modeling

set-up.

However, although rather extensively and systematically discussed this sensitivity, the authors do not examine at all the importance of chemical boundary conditions. Because of the relatively low upper boundary of the air quality regional model (about 6.5km), it is expected that the ozone simulations will be significantly affected by the imposed boundary conditions.

In page 10679, line 25, it is mentioned that 'top and lateral boundary conditions were kept constant to a clean atmosphere'. This sentence needs to be clarified: Do the authors mean that they used the same boundaries for all months and years of the decanal simulations? (Of which chemical compounds?) These conditions will definitely affect the chemical compounds that are subject to long range transport like for instance carbon monoxide, the reactive nitrogen family and ozone.

If these conditions were kept constant, it is somehow expected that small changes in near surface ozone will be calculated. Changing meteorology on global scale will modify oxidant fields on global scale and thus their long range transport terms, including stratospheric influx to the troposphere. These 'chemical weather' changes at all boundaries need to be accounted when constraining the regional air quality model. Unfortunately, the authors restrict their analysis to the meteorology impacts – totally decoupled from the chemical changes on larger scales than that studied. They conclude that changes in meteorology and regional biogenic emissions that are meteorology-driven result in changes in near surface ozone by about 5 ppbv. This result needs to be complemented by the evaluation of its robustness to the large scale chemical weather changes at least by performing shorter term (for instance one year) simulations and applying a proper 'chemical forcing' to the boundaries.

Minor comment: Most figure and Table captions need to be rephrased to clarify to which level they refer. Is it model surface level values? or integrated values?

To incorporate the results of these 'chemical forcing testing' simulations that might

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modify some of the conclusions of the presented work, the paper will require additional editing. I consider that this sensitivity analysis –complemented as above suggested- will be highly educative for regional air quality modelers and could be suitable for publication in ACP.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 10675, 2009.