

Interactive
Comment

Interactive comment on “Dynamic evaluation of a multi-year model simulation of particulate matter concentrations over Europe” by È. Lecœur and C. Seigneur

Anonymous Referee #1

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Overview

In this paper, the authors conduct an evaluation of a 9-year simulation of air quality over Europe. This work is based on the Polyphemus/Polair3D chemistry transport model, run with a $0.5^\circ \times 0.5^\circ$ resolution. It is focused on the study of PM_{2.5} and uses an operational evaluation and then a dynamic evaluation. The paper is well written and clearly organised. Its originality and interest come from the use of a dynamic evaluation to identify the response of PM_{2.5} to changes in the meteorological forcings. This is an important step which can serve in future work for the interpretation of the impact of climate evolution on air quality. Nevertheless, I have several comments (detailed

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below) that need to be addressed before acceptance for publication.

General comments

Both the operational and the dynamic evaluations are based on a small number of stations for PM_{2.5}. This means that the statistical indicators are not highly significant. The available data do not provide enough information for a full model evaluation and thus for assessing the link between meteorology and air quality. In particular, the impact on air quality of weather regimes in the parts of Europe having no station cannot be analysed. This issue needs to be discussed in the paper.

The authors perform an interesting evaluation of the model (operational and dynamic). Some deficiencies of the model are shown and it would be interesting to provide an analysis of the reasons/processes leading to these deficiencies.

Specific comments

Introduction: Only PM_{2.5} are studied. PM₁₀ are also of interest. Moreover there are more observations available for PM₁₀. Why did you focus on PM_{2.5}? This should be explained more clearly in the introduction.

Introduction, page 479 line 9-10: The goal of the study is to make a dynamic evaluation. This will likely serve the analysis of future simulations aiming at studying the impact of climate evolution on air quality. This could be added to make clear the link between the dynamic evaluation and the paragraph on studies on the effect of climate change on air quality (starting on page 477 line 23).

Section 2 page 480 line 9-10. Specify if this is ECMWF forecasts or analyses which are used.

Section 2, page 480 last paragraph: For the years 2000 to 2003 pseudo-climatological boundary conditions are created from the mean of 2004-2008. This choice needs to be argued. Since the emission policies tend to decrease emissions in Europe and in the North American continent, the pseudo-climatological conditions used (corresponding

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to 2004-2008) will not reflect the possible changes from 2000-2003 to 2004-2008. The use of the mean over 2004 would likely be closer to the years 2000-2003 than the mean of 2004-2008. Since regional model results depend partly on the boundary conditions used, it might be one of the sources of uncertainty of the model results that could be discussed.

Section 2.2 page 482, comments on figure 2e and 2b: there is a large gradient on sea salts and organic matters in the North West part of the model domain. This indicates significant differences between MOZART boundary conditions and Polyphemus/Polair3D. How do you explain these differences?

Section 3.1 page 484 first paragraph: This paragraph describes the sources of uncertainties in the observational data. An estimation (even rough) of these uncertainties would add useful information to the evaluation.

Sections 3.2 and 3.3: These sections provide comparisons with existing evaluations of other model simulations. The authors compare their statistics on 9 years (only on July August for AQMEII comparison) over the few stations they selected to statistics obtained with different sets of stations and in different time periods. This is not obvious why the authors have chosen this strategy. To be more meaningful, these comparisons could have been done on the same time periods as used in the other models and on a larger set of stations (closer to what was used in the other model simulations).

Section 3.3: It would be useful to have the number of observations used to evaluate the 4 one-year simulations.

Section 4.2: Two indicators are used in the dynamic evaluation: correlation and regression coefficient. I assume that it is a linear regression which is used. This information is needed. If this is a linear regression which was chosen, this does not fit with the variations of the correlation with the lag which are not linear as expected.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 475, 2013.

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