

Interactive comment on “Analysis of summer O₃ in the Madrid air basin with the LOTOS-EUROS chemical transport model” by Miguel Escudero et al.

Anonymous Referee #3

Received and published: 4 August 2019

The article presented here proposes an evaluation of the LOTOS-EUROS model through the implementation of 5 different configurations of the model, for the simulation of the ozone concentration fields, in the Madrid region. The 5 configurations are discriminated by the use of different horizontal and vertical resolutions, either for meteorological calculations (ECMWF or WRF), or for the implementation of the LOTOS-EUROS simulation itself. The document is very well written, the subject well exposed and the analysis of the episodes and their simulation is comprehensive. But we regret that - in the introduction - the description of the scientific issue is somehow reduced to the evaluation of a model over a region. It seems important to reposition the problem within a broader framework, which is that of understanding the phenomena of produc-

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tion and transport of ozone. There have been many modeling studies on the subject, and in particular on the Mediterranean. And here, we miss the following information (which could help to better estimate the scientific impact of the paper) : what is the state of the art terms of fine restitution of the fields of ozone in the Mediterranean? what has been undertaken at this scale so far? What are the current shortcomings in terms of model performance for ozone, what are the locks for the restitution of fine-scale ozone fields, on the horizontal and on the vertical ? What is required to go further in terms of ozone modelling ? In what way does this fine-scale study bring new elements, not only to the evaluation of the model itself, but also to research on the subject? Also, why do the authors only focus on model resolution?

In the conclusions, there is a lack of discussion about the importance of improvements (improved indicators), with regard to the requirements of enhanced configurations (especially CPU time). It would also be important to give a strategy to choose a future configuration: is it reasonable to choose so many vertical levels (70)? Also, still for a contextualization (this time of the results and not of the stakes), the interpretations of the episodes (which are precise), lack some context. There has been indeed a lot of studies of ozone formation episodes in the literature. The formation of ozone downwind sources, and its dependence upon wind speed and vertical dilution are known: what exactly are the new knowledge at the end of the study, concerning the phenomenology of episodes and their properties, or concerning the ability of a CTM to simulate them? How can these new knowledge improve air quality management strategies? Are we just talking about improved scores from one version to another, or do some configurations allow to depict specific features that do not appear in the others ?

Specific comments :

Page 10 – line 5 - “In the plots corresponding to ECMWF_5 and ECMWF_70 runs we observe systematic positive bias especially in the period 14–20 UTC when the formation is strong although it only spiked with low wind speed. This feature was not so marked in the three remaining configurations and, in particular, in the two WRF runs

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the bias values were randomly distributed around zero.” How do the authors explain the mid-day biases of ECMWF compared to WRF? Is it just a problem of resolution of the meteorological calculations, or does it depend on the meteorological model itself?

Line 15 page 15: the best overall performance is analyzed on which criteria? Which parameters are used to affirm that the simulation is better? Should it be the restitution of the diurnal peak, the phasing of the morning increase, the total amount on the vertical, or just the indicator average...? In particular, the WRF70 has a strong underestimation of diurnal ozone in Figure 4 at El Pardo and this is still considered as the “best run”. What about this feature at other stations?

The difference between what is observed and simulated is not always specified, even if we can guess it. Example: in "Figure 7. Longitudinal and latitudinal vertical cross-sections of NO₂ and O₃ for 16 July 2016". Same for figure 9 and figure 11. Also, for page 17 lines 1 to 10, it is important to specify that it is a vision drawn by the model and not the result of observations.

Figures 6, 8, 10: The location / typology of the station groups should be mentioned.

Figure 7: it would be more convenient for the reader to visualize on a map the latitudinal and longitudinal cuts.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-334>, 2019.