

Interactive comment on “Representing ozone extremes in European megacities: the importance of resolution in a global chemistry climate model” by Z. S. Stock et al.

Anonymous Referee #2

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The paper presents an interesting analysis of horizontal resolution effects on global atmospheric modelling ozone prediction. The paper is well written and easy to read and understand. The analysis findings reproduce results already published from other modelling studies and substantially confirms expected model behaviour, but it provides a systematic insight over the European area that can be useful for many issues concerning both global modelling and regional applications. Moreover it offers a specific analysis of resolution impact on megacities. Some aspects of the analysis need clarification and some further detail on technical aspect is worth to be added to complete the paper description and justify the proposed conclusions.

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Specific comments:

Page 27424 lines 23-26 In the abstract it is generally preferred to give a short resume of the paper results instead of mentioning what will be discussed in the paper.

Page 27426 line 15 The problem of averaging emissions from urban areas due to grid spacing limitation regards all cities and conurbation even smaller than megacities.

Page 27427 line 26 HR latitude grid spacing is 0.5 deg. While in Table 1 is 0.56 CR has longitude grid spacing larger than latitude grid spacing while HR has longitude grid step smaller than latitude grid step. Is it correct?

Page 27428 lines 2-6 It is mentioned that the convection parameterization causes differences between CR and HR model configuration. With no detail or explanation about the differences it is difficult to understand what can be the mentioned resolution effect. Later in the text it is mentioned NO_x emission due to lightning. Is this the major resolution effect tied to convection? Is there any difference due to vertical mixing or wet deposition? Did you perform analysis of differences in meteorological fields? Some more detail would help the comprehension.

Page 27429 lines 21-23 The HR run seems to produce lower/higher O₃ column density over the polar/tropical regions with respect to the CR run. Is there a known reason for this behaviour?

Page 27430 line 18 Does “rural and background station” means “rural and urban background stations” ?

Page 27432 lines 3-8 It is stated that the presented statistics are computed using monthly mean computed and observed values. Does this mean that the correlation index represents a “space correlation” instead of the more usual time correlation? The order of the stations can influence results in this last case.

Line 9 Is the mentioned RMSE calculation different from the standard one? If the difference is significant, it should be briefly resumed.

C10329

lines 18-20 The sentence “Both resolutions...” explains why O₃ has high values during the summer but it does not explain the overestimation obtained by both resolution runs. Is there any interpretation of this result? It could be interesting to verify if the overestimation of the average values is due to an overestimation of maximum daily concentrations or if it can be influenced by minimum nightly values. The verification of the reconstruction of the daily cycle is provided in a following chapter for London and Paris, but those cities are not located in areas where the overestimation of summer ozone is more pronounced (e.g. the Mediterranean area and eastern European continental region). The interpretation of the overestimation is of interest e.g. for the possible use of global models results to drive regional scale air quality simulations.

Page 27434

Figures 4 and 5 show for both resolutions better performance over Paris than over London. What is the interpretation of this result?

Page 27435 lines 19-22 The proposed interpretation is quite generic, unless you can support it with meteorological modelling results analysis. Did you perform any comparison of the meteorological model results with available reanalysis for the two simulated months?

Page 27439 What is the reason of the higher BLH values obtained for HR simulation? It is reasonable to get higher values in coastal areas or where orography is better resolved, but is less straightforward to understand the differences over the eastern part of continental Europe, where the horizontal variation of topography and land-use is weak. Are there large differences in the meteorological fields over those areas?

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