

Interactive comment on “Evaluation of the GEM-AQ model in the context of the AQMEII Phase 1 project” by J. Struzewska et al.

Anonymous Referee #2

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General Comments

This manuscript describes the evaluation of GEM-AQ regional-scale air quality simulations over Europe performed in the context of the first phase of the Air Quality Evaluation International Initiative (AQMEII). The design of the model simulations is sound. The analysis focuses on ozone and PM₁₀. The description of the model evaluation results is thorough but provides little insight into specific reasons for model behavior. Moreover, the large number of figures and the use of separate sections for presenting the results (Section 3) and discussing them (Section 4) results in an long article that sometimes reads more like a technical report tabulating results than a manuscript with a clear focus and message. Nevertheless, despite this relative lack of novelty, it is of interest to the scientific community to document the performance of GEM-AQ in the

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context of AQMEII. Therefore, I support the publication of this manuscript. The authors may want to consider the following suggestions in revising their manuscript:

- 1) Rather than providing a comprehensive summary of model performance in all seasons for all subregions, the authors may want to consider focusing on the most interesting aspects, such as model behavior that differs from other AQMEII groups and can be tied to unique aspects of the GEM-AQ modeling system, or model behavior that confirms findings from other AQMEII groups. The authors may also want to consider combining Sections 3 and 4, i.e. providing a discussion of results whenever they are presented rather than presenting the discussion later in the manuscript.
- 2) Including results for meteorological variables, ozone precursors and possibly speciated PM concentrations may allow the authors to determine potential reasons for the GEM-AQ ozone and PM₁₀ results, adding a diagnostic evaluation dimension to the manuscript.
- 3) Given that GEM-AQ did not use the ECWMF GEMS fields used as boundary conditions by most other AQMEII groups, it would be of interest to compare the GEM-AQ results to the GEMS fields in inflow regions for the European analysis domain. This may allow the authors to determine to which extent the different boundary conditions may be the cause of differences in model performance between GEM-AQ and that reported by other groups.

Specific Comments:

Page 1472, line 21: change “Galmarini et al. (2012)” to “(Galmarini et al., 2012)”

Page 1473, line 14: wasn't the DEHM model participating in AQMEII Phase 1 also a hemispheric-to-regional model?

Page 1474, line 11: please provide additional details on the height of the lowest level and the approximate number of levels within the PBL.

Page 1475, line 26 – 28: why weren't the North American emissions compiled for

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AQMEII used over North America in the global GEM-AQ simulations?

Page 1477, line 9 (also page 1478, line 4): suggest rewording the beginning of this sentence as “Spatial distributions of model data and model performance statistics for maximum 8-h running ...”

Page 1478, line 19: suggest adding “modeled” before “ozone concentrations” for clarity.

Page 1481, line 18: suggest adding “modeled” before “daily averaged PM10 concentrations” for clarity.

Page 1483, lines 5-6: Suggest rewording as follows: “The lowest modeled PM10 concentrations (lower than 20 ug/m3) occur over Scandinavia and over the ...”

Page 1483, line 9: replace “is modeled” with “occurs”

Page 1485, line 18: could the authors provide a hypothesis why GEM-AQ behaves different from other AQMEII models in this respect?

Page 1492, line 22 – Page 1493, line 4, also Page 1490, lines 12 -29: Here and in the discussion section, can the authors provide a hypothesis why this overestimation was not seen or at least not as pronounced in other AQMEII simulations over Europe that used the same emission inventories (e.g. Figure 8, Appel et al., 2012; Figures 4/6/7/ and Table 3, Wolke et al., 2012; Figure 2, Pirovano et al., 2012. All of these articles were published in the AQMEII special issue, Atmospheric Environment, Volume 53, Pages 1-224)?

Page 1493, lines 5 – 12: Given that large-scale dynamics are important for these seasonal fluctuations, it would be interesting to contrast the global GEM-AQ results with the ECMWF GEMS fields used as boundary conditions for the other AQMEII simulations and compare both sets of data to available observations in inflow regions for the continental-scale analysis.

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