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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An analysis of long-term regional-scale ozone simulations over the Northeastern United States: variability and trends" *by* C. Hogrefe et al.

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General Comments: This paper presents an unusually long-term regional simulation of ozone and its precursors. The long simulation period provides the researchers a unique opportunity to assess variability and trends on a variety of spatial and temporal scales. The researchers apply an array of thoughtful approaches to capitalize on these simulations in evaluations against observations. For example, the very interesting results depicted in Figures 3 and 4 illustrating variability on various temporal scales are made possible by the long-term simulations.

The paper is well written, and the methods sound and well documented. The authors are to be commended for their thorough discussion of the current literature on dynamic evaluation and trends and variability assessment, and for adopting approaches from the literature where warranted.

Among the interesting findings of this work is how differently the model performs in simulating ozone variability and trends depending on the percentile of ozone levels being considered; this highlights a key issue that must be considered in dynamic evaluation studies. The paper also illustrates the importance of boundary conditions, although the improvement gained by the far more effort-intensive incorporation of temporally- and spatially-variable downscaled boundary conditions is disappointing.

In sum, the paper should be accepted for publication upon minor revisions suggested below.

Specific Comments: 1. There seems to be a tendency in the results and discussion to highlight the advantages of the ECHAM5-MOZART boundary conditions, even as the authors note its shortcomings. Although ECHAM5-MOZART yields greater variability than STATIC, it also experiences worse performance by many measures (e.g., Table 3 vs 5, Fig 12 a, Fig 14), in part due to the substantial high bias of ECHAM5-MOZART. This result is unfortunate, since it would be hoped that the much greater effort involved in generating and downscaling spatially- and temporally-resolved boundary conditions would have yielded better results.

2. The comparison of boundary conditions convolves two differences: static vs time-varying boundary conditions, and the use of CMAQ defaults vs MOZART generated BCs (which Table 2 shows to be very different in magnitude). While it is too late to isolate these differences, this limitation should be noted.

3. The claim that agreement is better for upper than lower percentiles (p. 23057, lines 1-3) is contradicted by Figure 7, which seems to show a steady offset between observed and CMAQ. Figure 7 itself seems inconsistent with Figures 5 and 6, which indeed show CMAQ performing better for the higher percentiles.

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Interactive Comment

Technical Corrections: 1. p. 23057, line 19: change “was” to “were”, for consistency with next sentence. 2. p. 23060, line 3: change “evaluation” to “evaluating” 3. p. 23061, line 16: specify what is meant by “recent work” 4. p. 23063, line 19: remove the word “simulations” 5. Table 2: Are the ECHAM5-MOZART results averaged over the 18-year period? 6. Tables 3 and 5: Since there’s no interesting difference between 1-h and 8-h performance, I’d recommend just showing 8-h and merging Tables 3 & 5 so that STATIC and MOZART results can be compared more readily. The statement on p. 23055, lines 4-5 is sufficient to note the similar 1-h and 8-h performance. 7. Table 4: It is confusing what is meant by the entries for maximum and minimum trends. Do you mean trends at the sites with min/max concentration (and if so, the numbers seem to be reversed), or do you mean minimal and maximal trends (and if so, it may make more sense to base this on maximal magnitude, since the maximal magnitude trends probably line up with the sites with maximal concentration). 8. Figures 4b and 7 are subsumed by Figure 10, and thus could be deleted to reduce the heavy figure count of this article. 9. Figure 11: Unclear whether it shows MOZART - STATIC, or absolute value of difference.

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