Atmospheric
Chemistry
and Physics
Discussions

ACPD

**Interactive
comment**

Interactive comment on "Error apportionment for atmospheric chemistry-transport models: a new approach to model evaluation" *by* E. Solazzo and S. Galmarini

Anonymous Referee #2

Received and published: 22 March 2016

General comments

The work presented herein, presents a new approach to model evaluation that attempts to shade light into the processes that influence model errors, rather than traditionally compare modeled ozone concentrations to in-situ measured values. The methodology is scientifically solid and sound and will help the AQ community move toward new ways of error diagnostics and thus, model improvement. The title of the manuscript reflects the contents of the paper and is considered sufficient. The main comments from the review process are related to obscure parts in the discussion of the figures and results. The specific comments that follow are meant to strengthen the communication of the results to readers that may not be as familiar with the history of the AQMEII initiative or

[Printer-friendly version]

[Discussion paper]

the details of the spectral decomposition methodology. I am in favor of publishing this paper with Atmospheric Chemistry and Physics, after addressing the minor specific comments that follow.

Specific comments/suggestions

1. Section 2.1: In the beginning of the error decomposition section, please add references to the original published work (i.e. Wilmott, Murphy and others). The part that was uniquely developed for this work should also be clearly identified in this section.

2. Page 5: in the minimization of MSE, the authors want to achieve independency of MSE from the model's statistical metrics, since the observed ones are not controllable. Can you please add a brief explanation in the text as to why you chose to differentiate over the mean model value and model standard deviation?

3. Page 6, spectral decomposition: In Rao et al. (1997) and Hogrefe et al. (2000) the ozone time series are log-transformed before the analysis to stabilize the variances. Did the authors use the log-transform in their KZ application? If not, please explain the rationale behind using the original ozone data.

4. Page 6, lines 188-190: what is the meaning of the bias in the discussion of the decomposition components? Equation 10 is applied to modeled and observed values separately.

5. Table 2: please denote in the title which table corresponds to which AQMEII phase.

6. Page 8, section 4.1, line 249: the phrase "spatially averaged over the two continental areas" must be rephrased to "spatially averaged over each continental area". I am assuming that the MSE is calculated for each spectral component and each station and then averaged over each continent (there is one value of MSE for each component and each station for the period of May-Sep). Please clarify in the text accordingly.

7. In Figure 1, the cross components are denoted by subscript cc in the name of the variable. I suggest using the same name convention in the appendix, where the

description of the cross components is included. This will avoid confusion to readers that are not familiar with the prior literature.

8. Page 9, lines 281-283: Is this statement based on results from the current or previous published work? Please add a reference to this statement accordingly.

9. Page 9: in the 1st paragraph of section 4.2 the bias is described as influenced by both internal and external model errors (which is true). In the 2nd paragraph (line 292), the authors suggest that the bias of LT shows the externally induced errors. Can you clarify this inconsistency?

10. The units in Figure 2 are ppb square (ppb2) or ppb? If the former is true, then the MSE breakdown must be bias2, variance and mMSE from equation 9? Please revise the label accordingly.

11. Section 4.3, figures 3-6: even though I embrace the idea of including a lot of information in one plot, it has been very challenging to read and understand the figures. I don't understand where the under- or over-estimation is indicated. I suggest the inclusion of one example (maybe in the figure caption or in the text) that will describe the results from one specific station (highlighted with a square of circle). That way, it will be easier for the reader to connect the color coded scale with the different components. The plots provide valuable information which must be communicated in the most efficient manner.

12. Page 12, figure 7: the components of figure 7 must be explained in more detail. What are the units? x and y axes? What is shown in the upper plot? The paragraph describing figure 7 and the method behind it needs further improvement to communicate a clear message.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-15, 2016.