Atmospheric
Chemistry
and Physics
Discussions

Open Access

EGU

Interactive comment on "On the Limit to the Accuracy of Regional-Scale Air Quality Models" *by* S. Trivikrama Rao et al.

Anonymous Referee #2

Received and published: 5 October 2019

The paper presents some interesting findings about inherent uncertainties in chemistry transport model simulations of ozone concentrations. It is very well written, but sometimes hard to follow. In my opinion, some terms should be explained in more detail, before the paper can be published.

General comments:

The authors should explain why they think the data set they constructed by combining measured base line ozone with meteorology related short term variations from a 21 years CMAQ run could be seen as the output of a "perfect model". They claim that there is some inherent variability in the meteorological data that cannot be captured by any model system. However, reanalysis data may represent meteorologically related variations on time scales of few days very well, i.e. part of the variation included in the

SY component of the time series may be modelled quite well.

Why do you use 30+ years of ozone measurements for analyzing the observations while only 21 years can be used for comparisons to the model results? Wouldn't it be enough to look at the data set 1990 to 2010 for the observations, too? And why do you need to construct "pseudo ozone observations" and cannot use the observational data set as such? Please explain this in the text.

Specific comments:

Page 3, line 26: In equation (1) it should be made clear that the filter KZ(5,5) is applied to the ozone time series O3(t).

Page 4, line 17: Can you show by statistical evaluation that the SY component represents white noise.

Page 4, line 18: please explain AR(1)

Page 5, line 18-20: It isn't obvious for the reader which stations are at elevated sites.

Page 5, line 25: Define the "strength" of the SY component (being the standard deviation of the time series) here.

Page 6, line 8: Is there any reason why you selected this site?

Page 6, line 10/11: Is there an explanation why the model doesn't perform well for low concentrations?

Page 6, line 31/32: Couldn't this also be caused by emissions missing the correct temporal variation?

Page 7, line 9: How could these "slow changing processes" be improved in the models? What is the role of stratosphere/troposphere exchange which – to my knowledge – isn't well represented in the CMAQ model runs.

Page 7, line 13: See my comment above: I couldn't fully understand how you con-

structed the "perfect model data". As far as I understood it, they would in any case only be perfect for this model setup and model grid. Could you comment on this?

Caption of Figure 2: Explain the meaning of the number 420130801. Explain that the "observed" line in Fig 2a is for 2010.

Caption of Figure 3: Give the equations you refer to somewhere in this paper (e.g. in an appendix).

Figure 5: Use same colors for observations and model in both graphs.

Caption of Figure 6: "5)" should be "c)". "Light blue" in Fig 6d) appears to be grey. Figure 4 and Figure 7: Give units (ppb).