

## ***Interactive comment on “Use of North American and European air quality networks to evaluate global chemistry-climate modeling of surface ozone” by J. L. Schnell et al.***

**Anonymous Referee #2**

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Studying the effect of climate change on air quality has been a hot topic for many years. Different approaches and types of models have been used. The present paper gives a very thorough and very important analysis of the performance of CCMs that have been used in IPCC. The statistical methods are very interesting and I think this is a highly valuable contribution, especially to air quality modellers who are interested in trends and impact of climate change on air pollution.

During the technical review I already valued the scientific quality of this paper and recommended publication, but I argued that it would fit better in GMD (topics assessing model performance, novel ways of comparing model results with observational data,

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model intercomparison description). I still think so, but I accept the point made by the authors that other papers of similar topics have been published in ACP. Also, while reading the manuscript more carefully during the ACPD stage I noticed quite some discussion of results providing the reader with quite interesting atmospheric chemistry information. So I agree publication in ACP is acceptable. Disregarding the GMD vs ACP question, the scientific significance is certainly good, if not excellent.

The methods are very well elaborated and the paper is well written. I would welcome air quality modelers to make use of some of these statistical methods. Oftentimes impact of climate change on air quality is studied only by monthly means and ozone concentrations pdfs. The present study suggests more interesting parameters such as summertime enhancements, episode size, change in extremes etc. For air quality modelers who usually deal with smaller scales it would be worthwhile investigating how the interpolation algorithm of S2014 can be optimized to 10 km, as mentioned at end of Section 4.1.

For the manuscript I suggest only minor revisions.

page 11371, line 17 : the 'observed linear relationship' between what? Ozone peaks and episode area? Difficult to understand in the abstract

page 11371, line 25 : 'the only means' ... too strong a statement. Running CTMs driven by climate data is an inferior method, but it can give useful clues. Better write 'provide a valuable means for'? Or start the sentence with 'According to Kirtman et al., (2013)...' to make it clear that this is not an established fact but the conclusion of a study.

page 11373, line 1 : the word 'Model' is missing

page 11373, line 9 : non-linearity

page 11375, line 1 : +0.6? ... isn't it -0.6 ppb? I assume the mju's in the figure panels represent the averages (-0.4, -0.6, -0.9 for the three percentiles) which you here refer

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to as being about +0.6 'overall'. OK, if the sign is corrected. Or did I miss something?

page 11375, line 12 : not obvious for everybody what is the difference between a CCM and a CGCM? Maybe give a reference where these are defined? Lamarque et al.?

page 11376, line 19 : The sentence starting 'For models with less than ...' was somehow difficult to understand. Maybe you can combine the two first sentences of this paragraph saying 'We define air quality extreme (AQX) events on a daily basis using local (i.e., gridcell) climatologies to identify the 10 times N worst days (i.e., highest MDA8) in an N-year period (e.g. the 100 worst days in a decade).'

page 11379, line 23 : I think they do include 'such emissions', but maybe you meant 'did not include weekly variation in such emissions'?

page 11380, line 1 : How does this sentence relate to the previous one? Why 'however'? Do you mean that even a perfect boundary layer scheme probably wouldn't remedy the underestimation of H? Probably need one more sentence here

page 11380, line 22 : I'd remove the word 'daily'. MDA8 is daily by definition.

page 11381, line 3 : show

page 11382, line 4 : 'meteorological sources'?

page 11382, line 5 : remove daily

page 11382, line 8 : what do you mean by '24 h monthly averages'?

page 11388, line 5 : 'magnitude of AQ' ...better write AQX. Or 'severity of air pollution'

page 11391, line 18 : 'This case is far less limiting than that here' .. can this be rephrased?

page 11391, line 20 : do you mean a specific MIP? ACCMIP? Better write ACCMIP or write out 'in this model intercomparison project'

page 11392, line 13 : could be highly relevant for many Air Quality modelers, dealing  
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typically with 10 km resolution or finer. Is there any activity to produce such a data set?

title of Section 4.2 what are 'AQ emissions'. Maybe write 'air pollutant emissions' or just 'emission data'

title of Section 4.3 'AQ' -> 'air quality'

Table S1 : can you please write 350-351 instead of 350-1? Similarly in the other grid cells.

Figure caption S3: maybe write 'with an asterisk' instead of 'with a \*\*\*' "

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