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Interactive comment on “Investigating the observed sensitivities of air quality extremes to meteorological drivers via quantile regression” by W. C. Porter et al.

Anonymous Referee #2

Received and published: 29 June 2015

Review of: Investigating the observed sensitivities of air quality extremes to meteorological drivers via quantile regression

Authors: W.C. Porter, C.L. Heald, D. Cooley, & B. Russel

Journal: Atmospheric Chemistry and Physics

Summary: This study conducts a statistical analysis of a myriad of temporally-diverse meteorological variables in relation to the full distributions of ozone and particulate matter concentrations. It is found that the various meteorological factors demonstrate greater/lesser influence on each pollutant, and that this importance varies with season.

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In addition, it is found that the meteorological variables show greater/lesser influence depending on the rank of the pollutant distribution quantile in question.

Review:

The manuscript is an excellent contribution. By and large it is well-written and clear. Examination of the full distribution of pollutant concentrations and the incongruent importance of meteorological factors across that distribution is an important finding. From a societal impacts point of view, the focus on the upper tail is both justified and topical. I recommend publication after the following critiques are addressed.

Critiques:

In terms of framing the results, I think the authors need to be careful with regard to their choice of language. In particular, since this is a statistical analysis, the conclusion and presentation of various meteorological factors as ‘drivers’ seems inaccurate (and the method does not seem up to the task of proving something to be a physical driver). This issue especially stood out to me with the contention that PM events were driven by temperature. I understand the authors’ intent, but nuance is required. I recommend that these language considerations be modified throughout the manuscript. The method has found influences, associations, and yes, some well-established drivers (ozone & temperature), but the physical links have not been established for all variables.

P14078 27: The use of “weather patterns” is general. When I see this I think of circulation patterns, but I’m certain that others have different interpretations. Perhaps the sentiment could be strengthened/clarified by being explicit regarding the meaning of weather patterns? One direction to follow/cite: Currently in review at ACP: Shen et al, 2015, Influence of synoptic patterns on surface ozone variability over the Eastern United States from 1980 to 2012

P14079 L7: I highlight this here, but it’s something that should be addressed throughout: the word extremes typically refers to both tails, but here it seems to be used to

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refer to the high tail only, as 'low' is later invoked. I'd suggest clarifying what 'your' extreme is early in the manuscript and sticking with that usage throughout.

P14080: I am interested to hear more about the biases and their influence on the conclusions. The results place such huge importance on temperature (which reanalyses do moderately well at capturing), but if there is threshold dependence in other variables that are not well-captured (e.g., precipitation & wind), would this not affect your conclusions?

P14081: In terms of derived products, if possible, I'd love to see your methods applied to two recent results that deal with the future: (a) Barnes & Fiore, GRL, 2013, Surface ozone variability and the jet position. Does jet position north/south of each EPA region have a controlling influence? (b) Horton et al, Nature Climate Change, 2014, Occurrence and persistence of atmospheric stagnation events. Does the influence of stagnation as defined in this study differ greatly from the stagnation discussed here?

P14087 L10: This may be a jargon question, but is Turbulent Kinetic Energy the same as Eddy Kinetic Energy as discussed in Coumou et al, 2015, Science, The weakening summer circulation in the Northern Hemisphere mid-latitudes?

Section 2.4: Could this section be rewritten with a bit more clarity? Is the method sensitive to the order of variable addition?

What does it mean that 'rain' is a top driver of PM? Is this, lack of rain?

I'm a tad confused on all the various variables names, especially in Fig 3 & 5. On the right they are called one thing and on the x-axis they are generalized.

Figure 3 & 5 could perhaps be broken up? Regional plots are miniscule.

Figure 7 is interesting...but I'd imagine averaging things over several stations removes some valuable information...and makes the differences rather insignificant? Perhaps doing this for two particular locales would give a better demonstration of the point?

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In general, I'd suggest a bit more attention to detail in the figures and figure captions. Axes labels, etc. would be great.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 14075, 2015.

ACPD

15, C4122–C4125, 2015

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