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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The potential effects of climate change on air quality across the conterminous U.S. at 2030 under three Representative Concentration Pathways (RCPs)" *by* Christopher G. Nolte et al.

Anonymous Referee #4

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This paper describes a multi decade air quality simulation over the contiguous US using a regional scale application of the model "CMAQ" with downscaled meteorology from global climate scenarios. The authors employ constant anthropogenic emissions and investigate changes to ambient concentrations of ozone and PM2.5 (mass and chemical composition) due to temperature/climate changes only. They find the largest changes in [PM2.5] come from reduction in [NO3] in winter and increased [OM] in warmer seasons, presumably due to higher biogenic VOC emissions. Though the authors provide no direct evidence for the biogenic emission/higher [OM] - but I do

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Discussion paper

happen to agree. The authors find the largest changes in 8 hour max ozone occur at the higher end of the distribution. Their findings are consistent with many previous studies. The downscaling and model applications methods are done well. The figures in the manuscript and supplemental information are excellent. However the analysis is not as strong as the rest of this work. Below I list specific reasons why I think this.

This paper contributes to the body of knowledge indicating temperature and air quality relationships. The authors have a unique opportunity to evaluate chemical-temperature trends and better context is needed.

Specific Comments: A powerful motivation for this study is that future PM2.5 is less well constrained than ozone. The authors use of CMAQ with detailed particle chemistry in long term simulations is an improvement over global scale models (with less particle chemistry) typically used in such research.

The model simulations have been conducted for time periods for which changes in ambient values of O3 and PM2.5 have been recorded. Links of measurements to EPA policy and temperature change can be evaluated. Why is this not part of the model evaluation and work presented in this manuscript? If the authors expect confidence in the future relationships they present, evaluation of past trends and relationships for retrospective periods builds confidence for their assessment and is necessary. What are the current d[O3]/dT and d[PM2.5]/dT, for example in the regions outlined in Figure 1? Can they be replicated by the modeling system?

There are temperature dependent anthropogenic emissions. Electricity sector emissions, in particular in the United States (e.g., California: Miller et al., 2008; Farkas et al., 2016), change with increasing temperature and this is not captured in this work. The absence of such relationships suggest changes at peak O3 and PM2.5 pollution is under represented here. The authors should note this and explain the uncertainty, the complications this introduces, in particular when they describe changes at the peak end of pollutant distributions.

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Starting at Line 22, page 1: The authors state that due partly to Tier 3 emission standards for motor vehicles, anthropogenic emissions are expected to decrease through 2030. Is this still true? How does the Ozone Standards Implementation Act of 2017 affect/not affect expected trends in emissions and ambient air quality?

The references for AERO6 (Simon and Bhave, Nolte et al.) are insufficient to describe the AERO6 module. Further, the authors discuss that some of the largest [PM] prediction changes are due to temperature induced changes on BVOC emissions that affect [OM] predictions in some portions of the the US. The chosen references do not explain why this would be the case in the model at all. Please provide better reference(s) that help readers understand the relationship between biogenic VOC emissions and the connection it PM2.5 OM (presumably biogenic secondary organic aerosol) in CMAQ.

Line 25, Page 5: Can the authors explain what "wet bias" means and the implications? Does this mean excess precipitation? Does this mean the implication is there is more wash out/cleaning of the atmosphere?

Line 12, Page 9: "This supports the conclusion that warmer temperatures in a future climate results in increased partitioning of aerosol NO3 to HNO3" Presumably, the authors can test this idea/hypothesis in their model output?

Editorial

Line 22: “Pope III”, is that formatting correct?

References: Farkas et al., "High electricity demand in the northeast U.S.: PJM reliability network and peaking unit impacts on air quality", Environ. Sci. Technol. 2016, 50(15), pp 8375-8384. Miller et al., "Climate, extreme heat, and electricity demand in California", J. App. Met. Clim. 2008, 47, pp. 1834-1844.

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