Review of "Attribution of future US ozone pollution to regional emissions, climate change, long-range transport, and model deficiency," by He et al.

In this model study, He et al. examine the effects of changing emissions, climate change, and long-range transport on summertime surface ozone levels in the 2050s. They apply two scenarios, A1B and A1Fi, to two different models, the global NCAR Community Atmospheric Model with Chemistry (CAM-Chem) and the regional chemical transport model CMAQ. The scenarios differ in their magnitude of anthropogenic emissions, with A1Fi showing increasing NOx emissions over the US, and A1B showing a strong decrease. To investigate the role of long-range transport, they perform CMAQ model simulations with some kind of fixed chemical boundary conditions and with boundary conditions derived from the CAM-Chem simulations. To characterize what is called "model deficiency," the authors compared the ozone values simulated by CAM-Chem to those simulated by CMAQ.

Scientific significance. The paper reveals little new science, and is not suitable for publishing in its current form. The effect of changing intercontinental transport on surface ozone in receptor regions has already been studied extensively (e.g., Wu et al., 2008, 2009; Fiore et al., 2009; Wild et al., 2012; Doherty et al., 2013). Lam et al. (2011), not mentioned here, has previously used CMAQ to examine the effects of climate change and emissions on U.S. surface ozone, as has Penrod et al. (2014). The current study does not, in my view, add significantly to the existing literature. I recommend that the authors review carefully past literature and think how their work advances this topic.

Scientific quality. The description of the model simulations is scant, and the model analysis is insufficient. What methane concentrations are applied? Do the models include lightning NOx, soil NOx, or stratosphere-troposphere exchange? How are the meteorological fields downscaled for use in the regional model? How do emissions of anthropogenic and biogenic VOCs change in the US? (Just the sum is given). How do the model results compare to CASTNET observations? How do anthropogenic emissions change in the source regions (Asia and Mexico) for the two scenarios? How much ozone is transported into the domain as opposed to ozone precursors? Why are there regional differences in the contribution of climate change to the change in ozone (Figure 7)? Why does the contribution of "model deficiency" to model ozone appear so large in the Southeast US (Figure 7)? Isn't "model deficiency" just the difference between two models, both of which could be deficient? The reader is skeptical about the meaningfulness of such a metric, in part because models use the same chemical scheme, which could be flawed, especially in regard to isoprene oxidation (Mao et al., 2013).

Presentation quality. Tables 3 and 4 contain such a density of information that they are incomprehensible. Authors would be wise to choose what information is most important for the reader to know and to just present that. It would probably be best to present NOx and VOC emissions for the entire domain and for selected source regions – e.g., Asia and Mexico. Temperature changes would best be viewed as a map. Model validation would also best be viewed on maps such as in Figure 5. Most captions lack information on what

exactly is being shown – summertime average surface ozone? Paper has problems in written English, about 1-3 per paragraph.

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