

## ***Interactive comment on “Exploring 2016–2017 surface ozone pollution over China: source contributions and meteorological influences” by Xiao Lu et al.***

### **Anonymous Referee #2**

Received and published: 27 April 2019

The manuscript represents a comprehensive modeling analysis of background ozone and its origins in China for a recent period of 2016 and 2017 and explains how differences in meteorology between the two years led to ozone differences. It uses a high-resolution nested-grid version of the global chemical transport model (GEOS-Chem) and does a good job comparing to previously published coarser-resolution GEOS-Chem modeling studies of background ozone in China. The methodology used to quantify background ozone follows the conventional emission zeroing-out approach used by the literature. The manuscript is well-written and well organized. I recommend publication after the following comments are addressed.

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Figure 3: I was surprised that lightning NO<sub>x</sub> has the largest contribution to background ozone in western China exceeding stratospheric ozone and that this contribution does not have a clear seasonality. I would expect lightning NO<sub>x</sub> to peak in summer; in fact, the figure shows it is lowest in summer (6.5 ppbv vs. 8-9 ppbv in other seasons). Is there a way to validate this result with observations or by comparing with literature values (if any). It will be helpful to put an uncertainty estimate to these numbers. From the model validation plots in Figure 2, I can see the model overestimates surface ozone in western China although there is just a couple of sites available. Could the overestimation be partly caused by an overestimation of ozone contributed by lightning NO<sub>x</sub>?

Pg 10, line 292-295: This statement needs to be elaborated; otherwise it sounds superficial. What are the possible interactions between domestic and foreign anthropogenic emissions and to what direction would these interactions affect ozone (i.e. increase or decrease)?

Pg 13, line 380-385: The statement that “the missing rest can be largely explained by contributions from global methane” is too assertive. Other factors such as the interactions between different sources may also play a role which will not be captured by the sensitivity simulations by zeroing off individual emissions.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-98>, 2019.

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