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Interactive comment on "Late-Spring and Summertime Tropospheric Ozone and NO$_2$ in Western Siberia and the Russian Arctic: Regional Model Evaluation and Sensitivities." *by* Thomas Thorp et al.

Anonymous Referee #2

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The manuscript presents a WRF-Chem modeling study of evaluating NOx emission inventories and ozone source attribution in West Siberia. The region has rapid changing emissions but few in situ measurements and thus the authors relied on OMI NO2 retrievals for inventory evaluation. The analysis is solid, and it is well written. I have a few comments on the modeling approach.

1) When is the OMI overpass time over West Siberia? Did the authors sample the WRF-Chem outputs at the time of OMI overpass and remove model days when no data from OMI is available (e.g. due to clouds), or simply used the model's monthly

mean for comparison? The former should be the correct way. There is no mention of this in the manuscript.

2) For the sensitivity simulations of zeroing transportation, energy, and fire emissions, did the authors turn off only NOx emissions or were other emissions (e.g. VOCs) from these sectors also turned off? It is not clear in the manuscript. Since the sensitivity is per sector, all emissions from the sector should be turned off.

3) The model using either of the two inventories underestimates NO2 columns in cities by a factor of two in the warm season (May – August), as shown by Figure 2. This large bias suggests there is a large missing source of NOx in the region or a large underestimate in some sectors' emissions. Without correction for the low bias, the model's sensitivity analysis of sector's contribution should not be reliable. The authors should estimate the impact of the low bias on their source attributions. One way to do that is to run another sensitivity analysis of increasing NOx emissions in the model to match with OMI NO2 columns and compare the resulting changes in NOx and ozone to the sector's contributions.

Minor comments: 1) pg 14-15: these figures should be Figure 3 and Figure 4.

2) pg 8, section 2.2: What does "anthropogenic" to soil NOx emissions refer to? Did the model include "non-anthropogenic" component of soil NOx emissions?