

Respond to the third reviewer

General comments:

This is an interesting paper that characterized the changes in simulated surface O<sub>3</sub> and NO<sub>x</sub> when replacing bottom-up NEI2005 NO<sub>x</sub> emissions with the GOME-2 NO<sub>2</sub> column constrained (top-down) NO<sub>x</sub> emissions over the contiguous U.S. The paper is well written and could provide some insights into the potential biases in the NEI2005 NO<sub>x</sub> emissions over some regions of the U.S. The limitation of the study is fully discussed at the conclusion section. I recommend the publication of this paper after minor revision.

Specific comments:

1. Is there a particular reason to choose NO<sub>2</sub> column retrieved from GOME over those from OMI for this study?

**Consistent dynamical random errors have appeared since January 2009 in the OMI product (<http://www.knmi.nl/omi/research/science/>) and The GOME-2 works in this manuscript were validated in our previous study by Choi et al. (2012).**

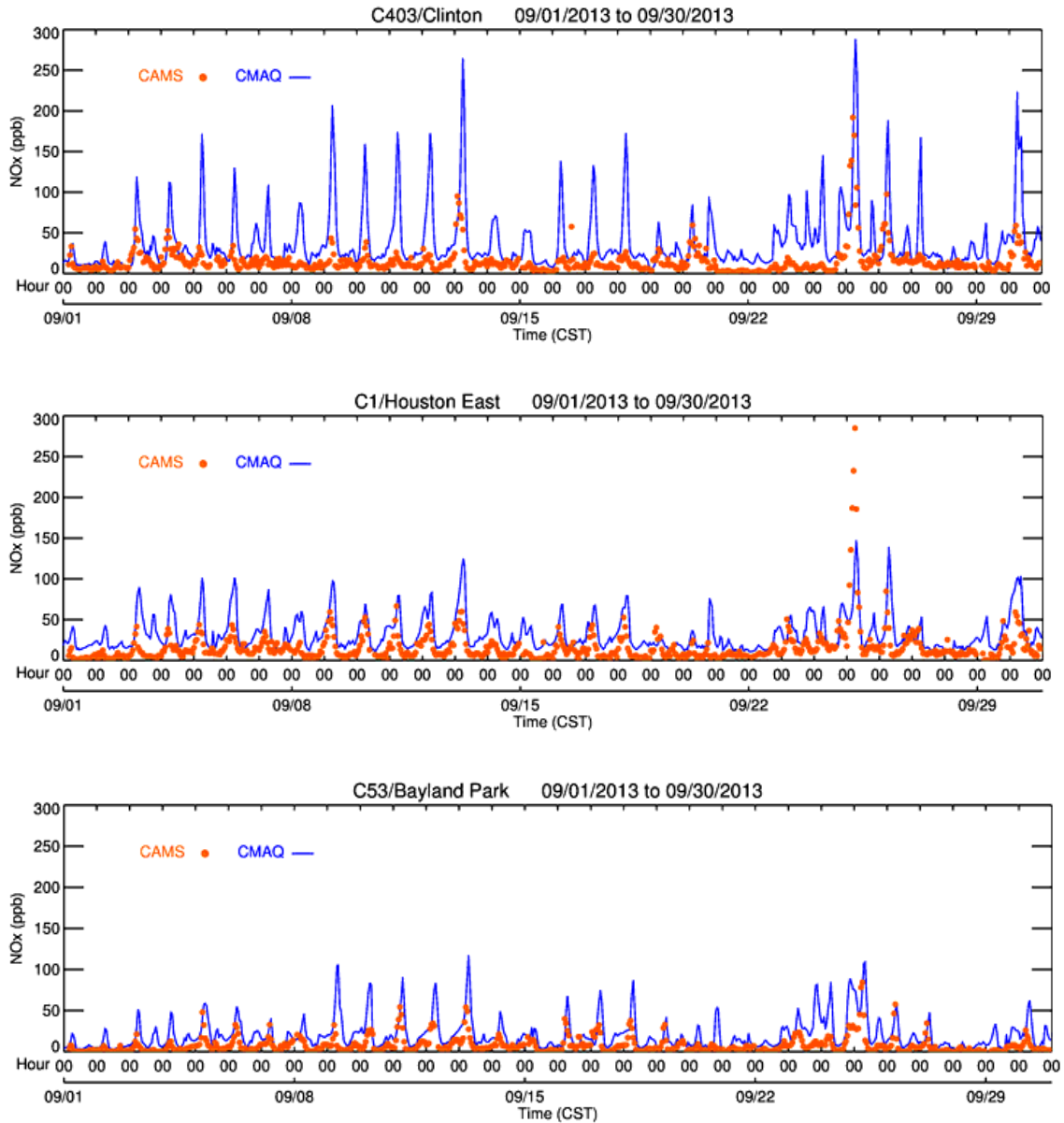
2. Some details should be provided on how the GOME2009 emissions were obtained. I imagine that satellite NO<sub>2</sub> column retrievals are more accurate for regions with high NO<sub>x</sub> (emissions), and may be less accurate (or below the sensitivity of the satellite sensor) for regions with low NO<sub>x</sub>. How does GOME2009 accounts for those during the inversion process?

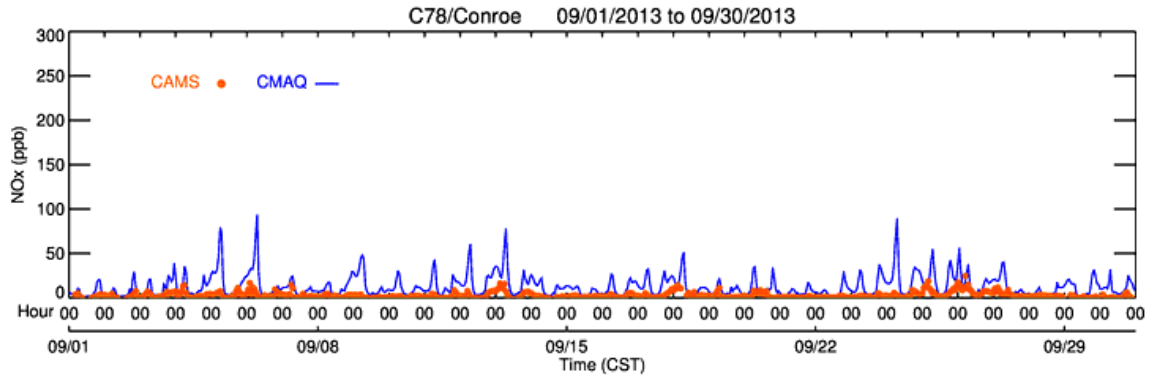
**Thanks for initiating a good point. We added this sentence in Section 4.2 of the revised manuscript, “To filter out the remote region data (with low sensitivity of the satellite sensor), the monthly averaged GOME-2 and CMAQ NO<sub>2</sub> column were estimated and only the regions showing NO<sub>2</sub> column densities > 1×10<sup>15</sup> molecules cm<sup>-2</sup> were considered to adjust the emission inventory as in our previous study (e.g., Choi et al., 2012).”**

3. To me the significance of this study is its implication of potential NO<sub>x</sub> emission biases in NEI2005, hence it would be valuable to discuss whether the likely biases in NO<sub>x</sub> emission found this study is reduced in NEI2008.

**Thanks for sharing a good idea. As the referee suggested, we added this issue in the discussion section and add some comparison figures in Appendix 1 in the revised manuscript. We described about high NO<sub>x</sub> biases over the Southeast Texas both from the modified NEI2005 to NEI2008. From our comparisons (from Air Quality Forecasting system at UH, AQF-UH, see <http://spock.geosc.uh.edu>), the simulated high NO<sub>x</sub> biases are shown in the comparison of NO<sub>x</sub> concentrations from the CMAQ including NEI2008 and the observations from the CAMS sites over Southeast Texas for the DISCOVER-AQ Houston campaign (September of 2013). It is interesting to examine how the high biases of NO<sub>x</sub> concentrations found in this study are changed in CMAQ with NEI2008. Here are some comparisons between AQF-UH and the CAMS site observations (Appendix 1). The discussion is added by saying, “More interestingly, the high simulated NO<sub>x</sub> biases are still shown in the comparison of the NO<sub>x</sub> concentrations from**

the CMAQ including NEI2008 from Air Quality Forecasting system at UH (AQF-UH) and the observations from the CAMS sites over Southeast Texas for the DISCOVER-AQ Houston campaign (September of 2013) (Appendix 1), but they are not shown to be significant as much as in those of CMAQ including the modified NEI2005 in this study. The detailed investigation needs to be followed to examine how the biases of  $\text{NO}_x$  emissions found in this study are changed in the modeling study with NEI2008 using same resolution and same time simulations”.





**Appendix 1. Surface NO<sub>x</sub> concentrations at CAMS stations (pink color) and corresponding 4km CMAQ simulations with NEI2008 from Air Quality Forecasting system at UH (<http://spock.geosc.uh.edu>) (blue color). The CAMS sites are from Clinton site, Houston East site, Bayland Park site, and Conroe site.**

4. Although well written in general, the manuscript is a bit on the lengthy sides. Maybe that it could be more concise.

**As the referee suggested, I will proofread the manuscript and make the manuscript shorten.**

Technical and minor comments:

On page 21166, lines 20-23: When several observational sites collocated with one same model grid, do the observational data from those sites averaged before comparing with simulated data for the grid point?

**Yes. One more grids points were averaged before comparing the corresponding modeling grid point.**

On page 21173, Lines 10-14: Not clear what “decreased in a more efficient manner” means. Did you account for PBL depth variability at night for this statement?

**The word, “more” is switched to “similar”.**