Anonymous Review of "Multi-scale modeling study of the source contributions to near-surface ozone and sulfur oxides levels over California during the ARCTAS-CARB period" by M. Huang et al. (acpd-10-27777-2010)

The authors use a regional chemical transport model driven by WRF meteorology in two different horizontal resolutions to explain the ozone and sulfur oxides measured during the ARCTAS-CARB campaign in summer 2008 and identify the sources for the ozone and sulfur oxides during the period focusing on southern California. Both local (including anthropogenic, biogenic, and fire) and long-range transport contributions to California near-surface ozone and sulfur are quantified. They found long-range transport from Asia did not significantly affect surface air quality in the study region during the period. Two emission inventories are used to study the modeling sensitivity to the emission inventories. Maritime (mostly shipping) emissions are found significantly affecting the air quality over South Coast region of California.

General Comments

I find this paper to be well presented but the experiments could be better designed for authors' purpose for 1) future emission reduction strategies; 2) better understanding of EI's uncertainties. In order to identify the sources of sulfur oxides, the model performance is relatively poor (underestimate surface SC SOx by a factor of 2). Model bias of sulfur simulations makes the authors' conclusion less valued. I would only suggest this paper for publication if the authors address the comments listing below.

Specific Comments

1. In model description part, what are the domains of three model simulations? Should have more description of the model configurations, although you cite a reference.
2. Why are the LBCs for aerosols and gases of 60 km regional scale simulation different (aerosols from STEM tracer and gases from RAQMS)? No description of LBCs in the text for 12 km simulation, although you put it in table 1.
3. I am confused by your conduction of the simulations. The purpose of your study is to investigate the impact of resolution and EI uncertainties on ozone and sulfur simulations. So why shouldn't you design more clean simulations, such as 12 km

simulation with both EI's and a 60 km simulation with one of the EI's. It should be better than mixing the effects from resolution and EI together.

4. For section 3.1, a table to show the comparison between ozone observations and simulations as table 3 is preferred.
5. What's the problem for ozone simulation at night (Fig 3c)? The NOx titration issue in the model? In case that NOx is important to your ozone simulation (you also discussed the NOx-regime versus VOC-regime in later section), it is worth to include an evaluation of modeled tropospheric NO_2 column with satellite measurements.
6. In page 27793, you calculate the factors for nighttime. But it's not very clear to me why don't you just use the nighttime surface observations to calculate the factors?
7. In section 3.4, how to calculate the age of VOC and the China contribution? Need more description here.
8. In line 25-28 of page 27796, the authors argued to scale SO_2 and SO_4 in order to correct the uncertainties from CARB EI, but how could author prove that the model bias of sulfur is not from model itself (e.g., chemical production and loss processes of sulfur and also the deposition of SO_4)? At least, author should show the comparison of modeled SO_2 to aerosol SO_4 ratios with observations. In this way, we can know if the major atmospheric oxidation processes leading to aerosol sulfate formation are captured correctly in the model.
9. In line 7 of 27799, what's 2008 emission? The paper only talked about 2001 and 2005 inventories. And also, how could authors exclude that some of the simulation underestimate may be from model bias by itself?

Technical Comments

1. Figure is too small to read. It's very hard to get the information from figures themselves.
2. In abstract, line 5 of page 27779, change "simulations with the STEM …" to "simulations using the STEM …".
3. Line 6 of page 27779, change "used to assess" to "conducted to assess".
4. What is the unit of ug/sm^3 in line 12 of page 27779?
5. Line 5 of page 27780, "troposphere ozone" to "tropospheric ozone".

6. Line 4 of page 27782, “in on-shore SO_2 concentrations” to “of on-shore SO_2 concentrations”.
7. Line 9 of page 27782, “impacts of O_3” to “impacts on O_3”
8. Line 12 of page 27782, “model resolution” to “model resolutions”.
9. Line 24 of 27783, why Fig. 2b is mentioned before Fig. 1?
10. Line 8 of 27789, add “for” after “Eq. (1)”.
11. In line 32 of page 27793, Fig. 7 is shown here without explanation of the case “12 km TR”, which should be at least described in the caption of the figure.
12. Section 3.5, I feel that the long-range transport events should be moved to the end of the results part.
13. Section 3.7 also discuss the maritime NOx emissions on ozone, but not mentioned in the title.
14. In line 16-17 of page 27799, the sentence should be re-worded.