

Interactive comment on “Sources of nitrogen deposition Federal Class I areas in the US” by H.-M. Lee

This is a well written and interesting manuscript on the use of GEOS-Chem to analyze the origin of reactive nitrogen that impacts Class I areas in the U.S. The authors first establish credible model performance by comparing deposition estimates from GEOS-Chem with those from measurements and other modeling approaches. Next, the authors examine the spatial and sectoral footprints of nitrogen deposition. Finally, the authors document the sensitivity of the source attribution to NH<sub>3</sub> emissions inventories.

Comments:

Section 2.1 – It would be helpful to have a table that lists which NADP and CASTNET sites were used to represent each Class I area. At SM, the closest NADP site to the CASTNET site is 32 km away. It isn't clear if this is the site that was used.

Line 118 – the abbreviation JJA has not been defined. The abbreviation for all seasons (i.e. MAM, SON, DJF) while somewhat obvious, should be defined somewhere.

Line 118-119 – Did you test the validity of the approach for obtaining the values for 2010 at GT by taking the average for other years where there were data and comparing them to the value at GT?

Line 128-129 – The use of the Yellowstone and Pinedale CASTNET sites as surrogates for GT is questionable, particularly for Pinedale. Figure 1 shows that at GT, the land cover 100% cool coniferous. The CASTNET deposition value at Yellowstone is calculated assuming the land cover is 68% pine, 5% grass, and 27% rock. The CASTNET deposition value at Pinedale is calculated assuming the land cover is 70% grass and 30% sagebrush. The deposition velocity will depend on the land cover characteristics, so the values at Yellowstone and Pinedale will not likely be the same as what would be predicted for the land cover type at GT.

Line 414-418 – The discussion of the impact at VY of the different emissions inventories is not clear.

Line 418 – 420 – The sentence does not make sense as written. Consider breaking into smaller sentences.

Figures – A large number of the maps (Figure 5, 7, 8, 10, 12) have the aspect ratio incorrect. They are too wide which causes states such as Colorado to become rectangles instead of the near square shapes they really are.

Figure 2 – I don't see the benefit of having the maps for reduced and oxidized nitrogen smaller than the one for total nitrogen. It makes it harder to read.

Table 1 – The caption should indicate the year for the emissions.

Figure 3 – As noted above, the abbreviations for the seasons should be explained.

Figure 4 - It is difficult to see the color difference between HNO<sub>3</sub>-dry and NO<sub>3</sub>-wet, however their position in the column may be enough of a clue.

Figure 5 – It is difficult to distinguish between the colors for NH<sub>3</sub> and NO<sub>x</sub>. The yellow for NH<sub>3</sub> really gets lost. Maybe making it closer to orange would help. The circles for the site locations are hard to see, especially for VY. They might need to be darker.

Figure 7 – Same color concerns as for Figure 5.

Figure 12 – The maps are too small.