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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimating global and North American methane emissions with high spatial resolution using GOSAT satellite data" *by* A. J. Turner et al.

Anonymous Referee #2

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P4500, L27 - Looking at Figure 1, I don't understand how the relevant spatial differences can be 10 ppb. It looks like they could be 4 times this number. General Comments

This is an interesting and well-written paper. I have what I think are only small concerns that could use some clarification.

Specific Comments

P4501, L28-29 - This statement doesn't seem to be backed up with evidence. How do we know what the day to day variability is, and how would it follow that GOSAT can

constrain the multi-year average? Please elaborate.

P4501, L14-24 - Do we have to worry that Xco2 produced by LMDZ is biased in places other than near large urban sources? The models can produce significant biases, especially in sparsely observed regions. What sort of errors can we expect to arise from this? Could comparisons with full physics retrievals be shown for other latitudes and locations?

P4501, L25-27- It seems odd to say that the GOSAT will be compared to surface and aircraft obs. by using a model (and not even one that has emissions optimized with the obs.!). I guess the idea is that GEOS-Chem agrees with the obs, so therefore GEOS-Chem is a proxy for the obs. On the other hand, Figure A3 seems to imply a bias in GEOS-Chem that can be as large 20-25 ppb vs flasks. Is this considered unimportant? If so, please explain because this difference could be as large as the 10 ppb spatial difference mentioned above.

Figure A3 - While I'm on the topic of Figure A3, I'd like to suggest that the N-S gradient figures be shown using a vertical axis that ranges from 1700 to 1900. It's hard to see the differences on this scale. The same goes for the middle figure, which could have a vertical axis ranging from -10 to 30 or something like that.

P4502, L10 - "Comparisons over North America with NOAA. . ." It's not clear to me what is being compared here - I think it's the model, but it could be GOSAT. Please clarify.

P4502, L16-29 - I don't think I follow this discussion that determines the model stratosphere is the cause of the latitudinal bias between the model and GOSAT. The solar zenith angle is of course determined by latitude (and season), so how can latitude and sea be separated? Also, if it is the model, then how was the stratosphere determined to be the culprit?

If it is the model stratosphere, then how come the agreement between HIPPO and GEOS-Chem doesn't show this? Didn't HIPPO fly into the stratosphere at high lats?

Also, why does the model-GOSAT residual still show differences over Greenland (while it doesn't show differences over the Tibetan Plateau)?

I think it would be very helpful to compare the modeled stratospheric CH4 to other data, like stratospheric aircraft or air cores.

Sections 3, 4 - It would be helpful to be more explicit about what is being estimated. Are parameters in the global inversion grid-box total emissions? Are they time dependent? Or annual totals?

P4504, L28-29- I don't understand this statement. How does one trust the prior distributions of sources processes at a local scale, but not at global scales?

P4505, L21-26 - I like this approach of reducing parameters, but these lines could use a bit more elaboration. What is the rationale for using the adjustments from the global inversions to cluster grid boxes?

P4508, L16-17 - Here again is the statement about prior source distributions that I don't understand. How can we trust the allocation to different sources, but not the spatial distribution?

Table 2 - Why is the posterior mean bias larger for the posterior than the prior? Shouldn't the fit improve after inversion?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 4495, 2015.