

Interactive comment on “High resolution modeling of CO₂ over Europe: implications for representation errors of satellite retrievals” by D. Pillai et al.

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We would like to thank anonymous referee for his comments. Authors' responses to these comments are as follows:

(1) My first comment is actually referring to the other review. I do not agree with the reviewer about his statement about the definition of bias. A bias is a systematic error on the relevant time scale. While this leaves room for different interpretations, I think the author's use of the term bias is actually correct. It refers to the representation error that is constant over a month, which I think is a relevant time frame for flux inversions. Observations do not have to be at the exact same location to have a bias component

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embedded in them.

(2) My second comment refers to section 4.3. The error model used to estimate the representation error is focused on the land area. However, in coastal zones there seems to be a significant representation error that is not related to σ_h , σ_f , or c . Is there another variable the authors could introduce, that would describe the error over sea?

Response: We have made a statement in the summary and outlook section (last paragraph), suggesting that the next step of refinement would take into account the advection of the subgrid variability. However, this was beyond the scope of the manuscript. We added a sentence in the summary and outlook section- "This would probably allow to better describe the representation error over the ocean near the coasts, which with the current linear (local) model cannot be described."

(3) Before applying the proposed error estimation method to flux inversions, I think we would need to know if the same error model works for other parts of the world. I would encourage the authors to apply the same study to other geographical areas, if possible. The manuscript should at least comment on this.

Response: Strictly applies for EU domain. Similar expected for continents with comparable topographic variations as well as variations in fluxes. Would need to be addressed for different regions such as the Amazon, where large forested areas exist that might have significantly less variability.

(4) Finally, how dependent are the results on the size of the grid boxes? Inversion models use different grids and the modelers should know if they can apply the method regardless of their chosen grid or not.

Response: We provided this information in Table 5, and mentioned this on page 20613. The coefficients are scale dependent, and we provided them for 100 and 200 km horizontal resolution.

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Detailed Comments: (5) Page 20601, lines 13 - 14: "but after ... re-launch." I find this a bit of a strange remark for a scientific paper. The authors could replace it with something like "but unfortunately the launch of OCO failed."

Response: Changed

(6) Page 20601, line 17: Please, also mention the American ASCENDS mission.

Response: Done

(7) Page 20601, lines 16 - 17: There are more advantages to an active mission than just being able to measure during night. For instance, it provides better control over the estimation of the aerosol scattering. I suggest that the authors either go into more detail here or just remove this last part of the sentence.

Response: We disagree. Night time measurements (in addition to daytime) will have a stronger potential to constrain respiration fluxes. We added the following to the last sentence: "and thus provide a stronger constraint on respiration fluxes"

(8) Page 20601, lines 25 - 27: The footprint of 0.1 km for A-SCOPE is not the real footprint of the observation. Active missions need some averaging to improve the signal-to noise ratio. While the 0.1 km FOV allows for looking in between the clouds, it will take several of these FOVs to provide a good signal. Please mention this in your text.

Response: We added the sentence "However, active missions need some averaging for these 0.1 km footprints to improve the signal-to noise "

(9) Page 20604, line 17: I would use "satellite-constrained" instead of "satellite-based".

Response: Modified accordingly.

(10) Page 20607, line 17: I would use "systematic" instead of "bias" in this sentence. In the next couple of sentences it is then explained what is meant by the bias.

Response: Done

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(11) Page 20607, line 18: Please remove "also".

Response: Removed

(12) Page 20608, line 25: There is a "and" missing between the "(a)" and "(b)" description.

Response: Included

(13) Page 20609, line 8: Please remove "a" before "strong".

Response: Removed

(14) Figures 4 and 5 are rotated by 90 degrees.

Response: We will inform ACP technical staff.

Please also note the Supplement to this comment.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 20599, 2009.

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