

Interactive comment on “Methane profiles from GOSAT thermal infrared spectra” by Arno de Lange and Jochen Landgraf

Anonymous Referee #1

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This paper presents and evaluates a new CH₄ retrieval from GOSAT, using the thermal infrared channels between 1210-1310 cm⁻¹ and a new cloud-screening procedure. The retrievals are evaluated by comparison with model profiles scaled to match TCCON retrievals of total CH₄ columns. A principal component analysis (PCA) bias correction scheme is also developed using airborne observations of CH₄ profiles from HIPPO II and III. The post bias-correction retrieval is shown to have biases of less than 2% over the entire altitude range and that the land-ocean and day-night differences in the performance of the initial retrievals are reduced or eliminated.

This is an interesting paper on a novel retrieval approach for the GOSAT instrument, and thus I think it should be accepted for publication after correction to address my minor issues listed below.

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Minor Comments

P1, L6: Make clear the MACC model profiles are scaled to match the TCCON observations. i.e. “scaled to the TCCON total column”. The phrasing on P2, L30-33 is more clear.

P1, L20-21: Some wildfires are also “natural” sources of CH₄, so this discussion should be reworded.

P1, L25-26 and P2, L3: Please provide a few references for these statements – I agree with them, you just need references to support them in the text.

P2, L4-9: Also include the Cross-track Infrared Sounder aboard the Suomi-NPP satellite.

P2, L35: I don't think you need to note that the correction scheme helps here, as if it didn't you probably wouldn't be publishing it.

P3, L6-19: I would appreciate more discussion of GOSAT in the main text of the paper, specifically on the spectral resolution of the infrared band and on any known instrument or retrieval issues with the thermal infrared observations.

P4, L14: What version of the MT_CKD continuum did you use? The reference discusses several different versions.

P4, L20-22: Can you provide more details on how the actual line-by-line calculation is done?

P8, L10: This is not true as stated, as you have just shown in Figure 1 that the sensitivity of the methane retrieval varies quite a bit with altitude. I think you are trying to say that, after the averaging kernel of GOSAT is applied to the MACC/TCCON columns, they have similar sensitivity and thus can be compared? If so, that is not currently clear in the text.

P9, L16-19: I'm not convinced that this cloud-clearing algorithm is sufficient for the

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type of validation study you are doing here. Did you make any independent checks to confirm that the cloud-filtered profiles were likely cloud free, say using independent observations from other bands for the daytime cases? How large of a cloud AOD can your procedure miss?

P9, L21: Is the chi-squared check considered part of the cloud filter?

Typos and Style Suggestions

P1, L18 and L20: I'd say "the year 1750" in both places, as the first time I read this I thought you were saying this was the pre-industrial concentration of CH₄ in ppbv.

P2, L24: Check the format of these references.

P7, L18: typo in "A priori"

P9, L12: I'm not sure what "we pertain to" means here, I think you mean something like "we focus on"

P11, L6: This is a bar chart, not a histogram.

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