

Interactive comment on “CH₄, CO, and H₂O spectroscopy for the Sentinel-5 Precursor mission: an assessment with the Total Carbon Column Observing Network measurements” by A. Galli et al.

Anonymous Referee #2

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This manuscript analyzed the uncertainties of CH₄, CO and H₂O by using similar observations of TCCON, which is important before the launch of a new space instrument. The experimental examples were carefully selected by covering different environment. The work is definitely suitable to publish in AMT. Although this manuscript is very well written, I still have some questions and suggestions for revision.

I. Mayor questions:

1. TROPOMI is a satellite based nadir viewing instrument, while TCCON is a ground

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based and up-looking instrument. The radiance sources, transfer path and the strength may not be the same. The authors have adjusted the spectra resolution, but it may not have been enough to make up the differences. The authors should explain how they can use up-looking radiances as a way to simulate down-looking radiances.

2. Page 2137, line 14-15, TROPOMI observes the back-scattered sunlight, but the scattering processes are neglected in the forward model of this study, it is better to add a reference or proof to support "TCCON spectrometers measure direct sun-light, which is, to good approximation".

3. Could you add jacobians or weighting matrix for the 3 species? I would like to see the jacobian differences between the back scattering sunlight (TROPOMI) and directly sunlight (TCCON).

II. minor questions:

1. Page 2137, line 20, please add an explanation for p , T and μ_0 .

2. Page 2139, line 10, "the degree of freedom of the inversion were insufficient to retrieve a meaningful profile", is the reason due to TCCON radiance or the TROPOMI originally design?

3. Page 2139, line 18, Eq(2), how do you decide γ ?

4. Page 2139, line 18, Eq(2), will H₂O, CH₄ and CO be retrieved simultaneously? If not, is there any sequence of 3 species? I mean, for example, were the retrieved H₂O, CH₄ used as inputs when doing CO retrieval?

5. Page 2139, line 20, signal-to-noise ratio was assumed as 1000. While in Butz (2012), it is found ~ 500 in the NIR channel and ~ 100 in the SWIR, in Wunch et al., (2011a), the signal-to-noise ratio (SNR) for a single spectrum ... is approximately 750 near 5000cm⁻¹. Why the signal-to-noise here is much larger than other studies?

6. Page 2140, line 9, Can you add a brief introduction for the GFIT algorithm and the

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difference between your algorithm and GFIT.

7. Page 2141, line 20, the meaning of χ^2/ν should be explained clearly.

8. Page 2143, line 28, what's the meaning of pressure vs total pressure?

9. Page 2444, line 20, fig 8 is referred before fig.5

10. Page 2148, line 3, "One reason might be", did you do tests to add a noise in your H₂O prior and see if your conclusion correct? Here I believe it is consistent with Page 2139 line 10-11, since your retrieval here are "insufficient to retrieve a meaningful profile".

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2131, 2012.