

Interactive comment on “Simulated retrievals for the remote sensing of CO₂, CH₄, CO, and H₂O from geostationary orbit” by X. Xi et al.

Anonymous Referee #2

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I agree with the very good and quite detailed general and specific comments of Referee#1 (R#1, C. Sioris) on manuscript “Simulated retrievals for the remote sensing of CO₂, CH₄, CO, and H₂O from geostationary orbit” of Xi et al.

To avoid repetition I focus on listing some additional items I would like to see considered by Xi et al. for a revised version of this manuscript.

Abstract (page 5810):

I agree with R#1 that the term “retrieval biases” should be used instead of “retrieval errors” in the entire manuscript including the abstract as this would make clear that systematic errors are meant here and not random errors, which are quantified and discussed separately and called “precision” in the manuscript.

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Line 18: Please add at the end of the sentence: “and biases”. The current sentence only refers to precision but biases are also very relevant in this context.

Last sentence of abstract and corresponding discussion in paper: It is not clear to what extent co-located retrievals of XCO₂ and XH₂O are useful “to better understand the close coupling between the carbon and water cycles” or if this would require to use altitude resolved (i.e., profile) information. This aspect should be better addressed in the paper and depending on the outcome the abstract needs to be adjusted (or not).

Introduction:

Page 5811, line 10 and following: Do the two listed references only refer to land fluxes? If yes, please add a reference related to the mentioned first challenged, i.e., to “quantifying uncertainty in fossil fuel CO₂ emissions”.

Methodology:

Page 5815, line 10: Reference is made to the Crisp et al., 2004, OCO paper, but OCO also covers a strong CO₂ band at 2 microns to get information on the wavelength dependence of scatterers. GeoFTS however does not have this band. It appears that GeoFTS will not be able to provide information on the wavelength dependence of the optical properties (optical depth) of aerosols and cirrus and this may be a problem for accurate enough XCO₂ retrieval. This aspect needs to be discussed in the paper.

Results and discussion:

Page 5822, line 7 and following: It is written that “This demonstrates that radiative transfer models dedicated to geostationary measurements can realistically simulate the diurnal variations of radiances.” This statement is too strong given the limited amount of results shown and their qualitative discussion. Please replace “demonstrates” by “indicates”.

Page 5823, line 5: Has noise been added to the spectra? If yes, please add this information and also add how many noisy spectra have been generated and analyzed

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per case.

Page 5823, line 12 following: Replace “our simulation results are better than those in real retrieval” by “our simulation results show smaller errors than those in real retrieval”.

Page 5824, last paragraph of Sect. 3.1: The radiance around noon should be higher than early morning and late afternoon resulting in better SNR and this should lead to better precision. However it appears that the other effects dominate leading to overall worse precision at noon. Is this correct?

Section 3.3: What is the main reason that the precision improves for better resolution: Is it because lines are better resolved and there is less interference or is it because – for constant SNR – there are simply more spectral points available (each having the same SNR) as increasing the spectral resolution implies better sampling of the wavenumber / wavelength axis?

Conclusions:

Page 5828, line 1: “We have performed simulated retrievals over a wide range of atmospheric and surface scenarios . . .”. “wide range” is too strong taking into account the quite limited number of scenarios investigated. Please replace by a less strong expression, e.g., use “significant range”.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 5809, 2015.