

***Interactive comment on* “The OCO-3 mission; measurement objectives and expected performance based on one year of simulated data” by Annmarie Eldering et al.**

Anonymous Referee #1

Received and published: 16 December 2018

This manuscript presents an analysis of the capabilities and performance of the OCO-3 CO₂ satellite instrument, a carbon copy of OCO-2, scheduled to be deployed on the International Space Station (ISS) early in 2019. Based on one complete year of simulated L1B data, the manuscript describes in detail the expected coverage in time and space (very different from OCO-2 due to the precessing orbit of the ISS), signal:noise ratios of the nadir (over land) and glint (over oceans) observations, the effects of the pointing mirror assembly (PMA) not present on OCO-2, and the performance of L2 data (column average CO₂) derived from the synthetic measurements using a full physics retrieval. Some analysis of the solar induced fluorescence data is also presented. The manuscript is relevant and timely and will be an important reference for future OCO-3

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publications. Writing and content are of high quality, although the paper is somewhat lengthy and not always very exciting to read due to its technical and documentary nature.

I clearly support publication after addressing my (embarrassingly small number of) minor points:

Section 3.2 presents the issue of polarization and the computation of Stokes coefficients, but no further analysis is presented in the results section. Why should the reader be interested in the computation of these Stokes coefficients (Eq. 1 and 2) if they are not used later on? It would be nice to actually see some discussion of polarization effects in Section 5.1, as promised at the end of Sect. 3.2.

Page 4, Line 25: Isn't the O2-A band also providing useful information on aerosols?

P15, L19: I didn't quite understand how exactly the random selection of cloud and aerosol profiles was made. Was the random selection made following some probability of detecting a cloud based on climatological cloud coverage?

Small corrections:

1. Page 3, line 32: 'then 4 km' -> 'than 4 km'
2. P3, L12. Point is missing in front of 'Finally'
3. P9, L14: It should probably be '30° south latitude'
4. P9, L26: It should probably be '2° longitude x 2° latitude'. Same issue in legend of Fig. 3.
5. P14, L12: There are two 'a' on this line that should be deleted.
6. P16, L15: I suggest to delete 'accurately' in this sentence. The calculation will always only be an approximation of reality and will only be (nearly) accurate, if the inputs such as aerosol properties are accurate.

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7. P17, L1: What is the 'NASA DISC'?
8. P17, L13: What do you mean by 'a priori state of the atmosphere'? What properties of the atmosphere are described?
9. P18, L29: 'anomoly' -> 'anomaly'
10. P19, L32: delete one of the two 'when'
11. P20, L6: There seems to be a closing bracket missing.
12. P20, L7: 'the OCO-3 SNR' -> 'the SNR'
13. Tables 2-4: These tables are full of acronyms and hard to read. I suggest adding another column "description" describing the variables.
14. P25, L2: Could you be more specific regarding the similarities and differences in the selected variables between OCO-3 and OCO-2?
15. Fig. 13, lower left panel: Why is the x-axis the square root of the AOD and not AOD directly?
16. Fig. 18: I can't see any 'tiny black dots'

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