

Review of “A study of measurement scenarios for the future CO2M mission: avoidance of detector saturation and the impact on XCO2 retrievals”

Comments based on <https://egusphere.copernicus.org/preprints/2025/egusphere-2024-3857/>
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General comments

Dear authors,

The paper is in general written in a clear and succinct manner and the reasoning is good to follow. The subject is highly relevant for the future CO2 mission.

There are however a few points, where clarifications are needed and the consistency needs to be checked. The biggest question I have is (see also SC2), if – instead of using oversampling higher than one – the sampling time can be decreased? Has this been investigated? Now the investigation is reduced to integration times of 271, 117 and 66ms. What would for example 250 ms sampling time produce as a result? Then the ground sample would be about 1.8 x 1.8 km, so the ground resolution would be higher (and produce symmetric ground pixels). What are the reasons to use 271 ms? With a back of the envelope calculation (using the results from Table 1) I estimate that 208 ms integration time are needed that the 24% saturated pixels for the OSF=1 case are within the FWC limit. Are there limitations on datavolume, internal datarate, synchronization of read-outs, co-registration or other reasons to use 308ms sampling time? Is there an estimate of the level of saturation versus integration time? How large are the signal independent contributions (dark current, thermal background, offset)? Can they be reduced? Please address these points in the article.

Please find below further specific comments on the content and in a separate table technical comments on typos and phrasing.

Specific comments

Item	Section	Line	Comment
SC1	2	86	CO2I -> CO2I/NO2I: the slit is also shared with the VIS spectrometer, so CO2I alone is not accurate
SC2	2	92	As an alternative to the OSF couldn't the sampling time of 308ms be reduced? With 250 ms the ground sample would be about 1.8 km x 1.8km. Why not? What are the limitations (detector limitations, datavolume,...)? Is there an estimation how short the exposure time would have to be to avoid saturation everywhere? See also separate discussion above.
SC3	2	110	The spatial sampling is not affected, but I would expect an impact on the the spatial energy distribution function. Can you please comment on this?
SC4	2	114	Only the detectors for SWIR 1 and 2 are mentioned here. What about NIR? What is the FWC of the NIR detector? Is it the same?

SC5	2	118	"a radiance spectrum with saturated pixels has to be discarded" The reasoning to discard the entire spectrum is not described clearly. I would advice to change the order of this paragraph somewhat and mention firstly (as described in line 268) that not single pixels but at least 60 are affected (what fraction is that of the spectrum?) and secondly that this impacts the straylight correction.
SC6	2	126	"neglect the effect... on neighbored spatial samples" . This is unclear: do you mean other viewing angles/swath angles/ spatial samples in the same frame where saturation occurs? Then it should be excluded as a whole anyways, as the straylight correction would be insufficient. Or do you mean the impact on following read-outs? (see next comment).
SC7	2	127	Is there anything known about detector blooming or the effect of pixelsaturation on the following (unsaturated) read-outs? Is there a memory effect? Or is the assumption here that only an individual frame is affected?
SC8	3	168	Can something be said about the off-nadir angles? Is the effect of saturation expected to be smaller there? And do you then assume the nadir spectrum for all viewing angles (spatial samples on the detector). This sentence seems to contradict the statement in line 126.
SC9	6.1	242	The numbers in the text are not consistent with the insets in Fig. 3. If you want to give ranges which include all bands, it should be 67 and 86% and 47 to 73 % for OSF 2. Or you can remove "in all bands" in line 243 and use the ranges 67-92% and 47-83%
SC10	6.1	256	"some high SNR values have a large noise error" Could you please add an explanation why that is the case?
SC11	6.3	306	"not done in this analysis": was this shown elsewhere? Please add a reference.
SC12	6.3	312	"decreased by about 20%", is this due to the saturation filtering? Please clarify this in the manuscript.
SC13	6.3	333	"glint mode could change" , change in what way? Please specify what you expect.

Technical comments/typos

Item	Section	Line	Comment
TC1	Abstract	1	"Human [...] release" The use of human as an adjective in this sentence sounds somewhat unusual to me. Consider replacing it by "release by humans" (also line 18)
TC2	Abstract	12	typo: sarutarion --> saturation
TC3		37	"or" -> shouldn't this be "and" ?

TC4	1	42	Listing the NO2I together with CLIM and MAP suggests that it is a separate instrument from the CO2I, that is confusing considering the description later (see also comment line 83)
TC5	2	83	CO2I/NO2I: earlier CO2I and NO2I are described as separate. Please keep this consistent, I would advice to use CO2I/NO2I
TC6	2	126	neighbored -> neighboring
TC7	Fig 2		typo: "white colours" --> white colour
TC8	Fig 2		Please consider decreasing the white space between the panels to make the actual figure content larger.
TC9	Table 1 caption		The caption reads rather difficult, could you rephrase it?
TC10	Fig 8 caption		"Note that the fraction is ..." there seems to be something missing in this sentence, please correct.