1 General

The paper is well structured and written. The investigation of effects of polarized scenes on slit homogenizer was missing so far. To our knowledge neither measurements nor simulation exist. In this respect this study is a novelty. While the result on polarization dependence performance is of general interest also the second goal of the study is very interesting, i.e. the dependence on the different devices – even with the same geometry but from different vendors. The result is very helpful for future missions.

Just a remark: The performance of a scene homogenizer for a step and stare system like GeoCarb Mission is more important than for a push broom like Sentinel-5 (due to smearing effects of the moving scene). So it is not understandable why the slit homogenizer has been removed from GeoCarb instead adding a polarization scrambler. Another option would have been fibre-based 2D-slit homogenizer concepts. Maybe this technology was not mature enough by the time of design freeze of GeoCarb, wasn't it? Some comments in this direction would be helpful.

The conclusion from the results seem to be not consistent. In the abstract (line 3f, 9f) one reads that a slit homogenizer is recommended but polarisation should be controlled. While in Discussion you reveal that the SH is not used at all for several technical reason.

Throughout the full paper one gets the impression, that the use of a SH is a mistake even in other missions like Sentinel-5. Only in the last paragraph this impression is corrected. Other missions (like Sentinel-5) may differs from GeoCarb in many aspects, which have a significant impact on the SH performance. As you pointed out these may be different f# at the slit plane or the observation geometry (pushbroom) or the use of a polarization scrambler. The comparison with Sentinel-5 should be neutral and more elaborated. The differences must be given already at the first occurrence of Sentinel-5 in the paper to avoid a misleading understanding.

2 Detailed comments

Criticality "major" doesn't mean "not acceptable". It means "would be very nice".

Text position	Criticality	Comment
Introduction	major	The theme of the paper is on polarisation, therefore the description of GeoCarb should be extended by the information, that it does not include a polarisation scrambling device.
Introduction	minor	Why wasn't the usage of fibre homogenizer considered?
Introduction	minor	Why wasn't a polarization scrambler considered? Were the results from SH too late?
§2.2 formular L142	minor	Please add that "*" means convolution and use different signs for multiplication in line 142, e.g. \cdot like $2 \cdot F\# \cdot w$ or just $2\ F\#\ w$
Figure1	major	Please avoid alt and act, and the mixture with north/south, as a geostationary satellite has not a real track direction.
Figure2	minor	Although it is clear please insert the definition of "slit length" as it is used in the abstract
3. slit homogeniser	minor	Please provide the f# at slit earlier in the document. The pre-conditioned reader wants to compare the optical conditions of GeoCarb with other instruments (e.g. Sentinel-5), where the paper gives references to.
3. slit homogeniser	major	The simulation model is extensively used and an important part of this paper. But it is never described. Please insert the model in form of formula or give a reference where it is described. At least a scratch or changes to existing models.

Line 142	minor	Please remove or use different signs for multiplication, e.g. \cdot like $2 \cdot F\# \cdot w$ or just $2\ F\#\ w$
Line 148f	minor	The following sentence is difficult read: “We applied the computed transfer function for each depth and the resultant coefficient of variation measured.”
Line 190	major	Could you please provide the impact (in terms of ISRF distortion) by the given tilt?
Figure 8		Please insert axis labelling – at least in the figure below. Pixel information on the above image would be nice.
§5 (e.g. Table 2 or line 322ff)	minor	If possible (only if possible) add explanation why different devices with the same geometry produce different results. One explanation is e.g. that the two plane parallel mirrors of the SH couldn’t be produced 100% plane and parallel.
Line 256	minor	The sentence is not clear. To the contrary, I expect that the effect grows with growing wavelength (more prominent in SWIR than in NIR).
Line 281	major	Usually the ISRF knowledge should be in the order of <1% (of the peak) to not cause severe retrieval errors. As model and measurement deviate by much more than 1%, it is not “a very good agreement” (openly spoken, the modelled ISRF cannot be used in a retrieval). I appreciate the quality of the comparison and I understand that there are limitations, especially as details of the Zemax algorithm are not known. But could you please find a weaker formulation instead of “very good”?
Figure 11	minor	Some axis titles would be nice (and mandatory). Please use the capability of the plotting tool to display Greek letters, to match the parameters names with the descriptive text.
around line300	major	Usually spectrometers are polarisation sensitive due to the grating. This may be mentioned here. Further, the issue on ISRF is because the incident radiance is polarised, that could be also mentioned somewhere in the paper. Either here, or in the introduction chapter.
Line 322	minor	The results are too different to be described as consistent
Figure 12	minor	Orange and yellow are hidden by the green curve. This could be mentioned in the figure caption