Author response to associate editor

July 8, 2021

We thank the associate editor for the comments and suggestions. We answered all points addressed in the review and implemented your suggestions. All page and line numbers refer to the tracked changes file of the revised manuscript. Appended to this document is a differential view between the revised version after the referee review and the revised version after the editor review for convenient tracking of the applied changes.

1) Introduction (page 1, line 23)
The expression 'slit based spectrometers' is rather unfamiliar, perhaps it should be changed to something like: '... spectrometers incorporating an entrance slit as optical element ...'.

Response: Instead of "slit based imaging spectrometer" we rather call them "grating based spectrometers".

Changes in manuscript: In grating based imaging spectrometers, the Earth ground scene is imaged by the telescope onto the instrument entrance slit plane.

2) Introduction (page 1, lines 24 following):
Is the text '... scanning mirror or a push-broom configuration, where different areas of the surface are imaged as the satellite flies:forward ...' actually describing the situation correctly? Is not rather one dimension (along track) of the scanning always provided by the motion of the satellite and the other (cross track) either by scanning or imaging?

Response: We think, that both expressions are correct and do not contradict one another. As suggested by referee # 2, our intention was to briefly mention the scanning mechanism without going into too much detail.

3) Introduction (page 2, line 42):
What is a monochromatic spectrum?

Response: A Monochromatic spectrum denotes the top of atmosphere spectrum before convolving with the ISRF. The term was suggested at this point by referee 2.

4) Introduction (page 2, line 56):
Explain 'IFOV'

Response: The abbreviation of IFOV will be added when mentioning the instantaneous field-of-view in line 52.

Changes in manuscript: The impact of e.g. albedo variations depends on the instantaneous field-of-view (IFOV) and the sampling distance in ALT (for Sentinel-5/UVNS: FoV = 2.5 km, ALT

SSD = 7 km).

5) Sect. 2.2, (page 9, line 173):
'... are based ...'

Response: Done

Changes in manuscript: In contrast, the variations in the spectrograph illumination are based on a geometrical reallocation of the angular distribution of the light exiting the SH in combination with interference effects in the spectrograph pupil plane.

6) Sect 2.4, (page 11, lines 236, 237):
'... the simplified approach is valid also for this case (i.e. the immersed grating) ...'?

Response: We will add the explanation, that this is also the case for the immersed grating of Sentinel-5/UVNS.

Changes in manuscript: The simplified approach is also valid for this case, as the SH does not affect the general behaviour of the grating.

7) Sect. 4 (page 17, line 348 following):
The sentence starting 'Therefore, although not a realistic case ...' does not appear to be complete.

Response: Done.

Changes in manuscript: Therefore, although it is not a realistic case, we impinge pure aberrations of a single type in order to determine critical Zernike terms for the ISRF stability.

8) Page 22, Table 2:
The table is lacking a proper and descriptive caption.

Response: We will repeat parts of the description in table 1 and mention the different scenes and the information, that the values are exaggerated with respect to real flight scenarios.

Changes in manuscript: 50 % CAL scene - ISRF stability. The presented errors combine the remaining SH exit non-uniformity (near-field) and effects due to the variations of the spectrograph pupil illumination (far-field). The strength of the aberrations are chosen such that the spot size matches the case of a PSF size of 6.85 µm (80 % EE). Remark: ISRF values are exaggerated with respect to real flight scenarios. Calibration scenes are used for on-ground SH performance validation.

Additional authors changes:

1) Note, that we changed the name of a variable in eq. (17,18,19) from y to λ. We want to emphasize that by the introduced transformation, the ISRF is now given in units of wavelength (λ) as also depicted in figure 7.)

2) We would like to add an additional co-author who contributed to the major revision of the previous referee review. The additional co-author will be added in the revised manuscript and the tracked changes file.