

Quantification and mitigation of the impact of scene inhomogeneity on Sentinel-4 UVN UV-VIS retrievals, S. Noel et al., Atmos. Meas. Tech. Discuss., 5, 2043-2075, 2012.

General comments:

The paper has been well written and is about an important topic that affects to more or lesser extent the 1-2 retrievals of earth atmospheric chemistry missions with hyperspectral resolution and should definitely be published.

Having said this, there are a number of points that can be considered for improvement in terms of completeness and clarity.

Specific comments:

1) Section 1.

The following paper provides a nice and reasonably complete overview of the Sentinel-4 UVN instrument. Consider to add this reference.

Ahlers, B. et al, "GMES Sentinel-4/UVN instrument concept and calibration approach", 20th CALCON Technical Conference proceeding, Logan, Utah, USA, 29 August – 1st September 2011.

2) Page 2045, line 12: The wavelength shifts in OMI are reported to be up to 0.5 spectral pixel, which corresponds to 0.07 nm in UV2 and 0.10 nm in VIS.

This shall be corrected.

3) Page 2046, lines 5-12: Explain in more detail what the UVN instantaneous field of view is, how it scans from east to west over 8 km in about 6 seconds and what the convolution of the 2 looks like, since this is important to understand the impact of scene inhomogeneity of instrument spectral response.

4) Page 2049, lines 21-28. The description on how the OMI spectral assignment and calibration works is incorrect and shall be corrected.

For OMI the situation is as follows:

- There are two independent algorithms: one for spectral assignment and one for spectral calibration. Both algorithms are operational at any time.
- The spectral calibration fits the solar Fraunhofer lines much in the way as described, using the wavelength-dependent spectral response functions for homogeneous illumination.
- The spectral assignment is based on a fixed set of polynomials per ground sample (providing a wavelength per pixel) and correction parameters to these polynomial parameters for optical bench temperature dependence and non-homogeneous illumination of the instrument entrance slit. The scene inhomogeneity is measured / derived from measurements with higher spatial (temporal) sampling at specific wavelengths. The mentioned polynomial correction parameters are derived from comparing the in-flight spectral assignment and spectral calibration data.
- Both algorithms have their own advantages and disadvantages: The spectral calibration is more accurate, but may fail in case of low input fluxes. The spectral assignment is more robust.

5) Page 2050, lines 11+12: Explain why the radiance and irradiance wavelength grids are usually slightly different.

6) Page 2050, lines 20-22: Clarify that the high sampling interpolation method is used in 1-2 data processing.

7) Section 2.5. There are almost no details on the used 1-2 retrieval techniques. One major deficiency in the paper (that needs to be improved):

It needs to be better explained to what extent observed errors are originating from spectral errors in the level-1b data or from the used algorithms for the 1-2 retrievals. This is not as black and white as currently suggested by the paper.

8) Section 3. Explain how big the observed UVN spectral shifts are (that lead to the quoted results at level-2).

9) Section 4: The conclusions are rather qualitative, where the paper itself presents many quantitative results.

Line 7: "significant tropospheric column errors". How significant?

Line 10: "largely reduced". By how much?

Line 11: "good measure". How good?

10) Page 2054, lines 17-24: This paragraph is not understood and not in line with the rest of the paper, i.e. it comes a bit out of the blue.

Since these conclusions seem to make sense, this means that this paragraph has to be better introduced (in the paper, not in the conclusions) and explained:

- Applying spectral calibrations with the homogeneous ISRF mitigates nearly all problems associated with inhomogeneous scenes. Why then is it still necessary to calibrate the inhomogeneous ISRFs?
- It is my understanding that the spectral calibration uses only the homogeneous ISRF. Is this correct? How are then the inhomogeneous ISRFs used?

The above needs to be taken into account. Maybe I misunderstood something, but then this needs to be clarified.

Technical corrections / minor points:

11) Page 2044, lines 24+25: "... will be homogeneously illuminated, ...". Clarify that homogeneously applies to the entrance slit dimension that affects the spectral resolution, i.e. the slit width.

12) Page 2044, line 25: slit function refers to spectral response function, or spectral response function in the spectral domain. Consider to clarify this once or twice at the beginning of the paper, like here.

13) Page 2045, line 28. Explain acronym MTG the first time it is used.

14) Page 2046, line 5: Consider to change to "The typical UVN ground pixel size is 8 km x 8 km, which is considerably smaller than currently operational similar earth atmosphere observation instrumentation in low-earth orbits".

15) Page 2049, line 11: Typo "ration".

16) Page 2050, line 3: Consider to change to "... in both cases solar Fraunhofer absorption features are filled to the measured spectra.".

17) Page 2052, line 20: Consider to change to "With spectral calibration with instrument spectral response function for homogeneous illumination the errors ...".

18) Page 2054, line 5: tropospheric O₃, NO₂, SO₂, HCHO.