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Atmospheric Measurement Techniques Discussions

Interactive comment on "Optimised degradation correction for SCIAMACHY satellite solar measurements from 330 to 1600 nm by using its internal white light source" *by* Tina Hilbig et al.

Anonymous Referee #1

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GENERAL SUMMARY AND COMMENTS

This paper presents a revised analysis of the long-term degradation of the SCIAMACHY instrument flown on the Envisat satellite, focusing on corrections for solar spectral irradiance (SSI) measurements. Since SCIAMACHY did not make end-to-end calibration measurements on-orbit, data from an internal white light source (WLS) are used in combination with a physical model of optical surface contamination to characterize instrument changes.

This paper is well-written, with good discussion of the procedures that were developed and the key results. Some suggestions and comments related to specific items are

provided below.

SPECIFIC COMMENTS

1. p. 4, line 3: As a point of terminology, I would call the results presented in Hilbig et al. (2018) the "absolute radiometric calibration", whereas the work presented here improves the relative (or time-dependent) instrument calibration.

2. p. 9, lines 2-3: I'm not sure about this assumption. Many instruments experience the most rapid degradation early in their lifetime, when contaminants are fresh. It is true that cumulative degradation in early 2003 will be small compared to the end of the SCIAMACHY mission.

3. p. 10, lines 11-13: What is the typical amount of burning time per year for the WLS? Figure 5 suggests ∼40-50 minutes per year during 2003-2012, although apparently there was more usage during 2002 (∼180 minutes?) that is not used for the degradation correction. Does the statement on p. 11, lines 18-20 mean that the WLS was used weekly? If so, this would imply only ∼1 minute of operation during each sequence, which represents a fairly short duration for an on-orbit lamp to reach stable operating conditions. Please comment.

4. p. 11, lines 4-6: How does the uncertainty in the degradation fit change with wavelength? The relative uncertainty at 630 nm shown in Figure 5 [bottom] is clearly small. Was there a specific threshold that caused you to set 330 nm as a lower limit? I ask in part because corrected SCIAMACHY SSI data covering 212-330 nm would be a valuable addition to the SSI database during 2003-2012.

5. p. 11, line 18: Figure 6 is very useful.

6. p. 12, lines 12-14: I don't understand why the ESM mirror appears to have a steady buildup of contaminant throughout the mission (Figure 7), while the ESM diffuser has a constant layer of contaminant (p. 12, lines 4-5). Is there a large difference in exposure to contaminating material between these two elements?

7. p. 13, lines 3-5: The magnitude of the SCIAMACHY solar cycle decrease at 330 nm ($\sim$0.8%) is still somewhat larger than would be expected from TSI change ($\sim$0.1-0.2%). Meanwhile, the 430 nm time series shows an increase of $\sim$0.3-0.4% that is out of phase with the TSI variation. This result is discussed more extensively in Section 5.2, but it might be helpful to mention it here.

8. p. 17, lines 1-2: I feel that the authors have done a lot of excellent work to reach this level of accuracy.

9. p. 17, lines 12-14: The SCIAMACHY SSI data are valuable for studies of short-term solar variations because they have sufficient spectral resolution in the visible and near-IR to provide unique information about the behavior of solar absorption features in those spectral regions.

10. p. 18, lines 24-25: Are there any plans to release these revised SSI data? Is there a timetable for the creation of an ESA Version 10 data product?

TYPOGRAPHICAL ERRORS

p. 1, line 22: “simultaneous” should be “simultaneously”.

p. 6, line 9: “begin” should be “beginning”.

p. 6, line 31: “reasonable” should be “reasonably”.

p. 12, line 12: “now clearly the” could be changed to “now clearly follow the”.

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