

# ***Interactive comment on “Nadir ozone profile retrieval from SCIAMACHY and its application to the Antarctic ozone hole in the period 2003–2011” by Sweta Shah et al.***

## **Anonymous Referee #1**

Received and published: 4 July 2017

### I. General impression:

The authors present an application of KNMI’s OPERA nadir ozone profile retrieval algorithm to three versions of SCIAMACHY IPP L1 data. Although the manuscript provides interesting and promising studies of the L1 versions and the resulting L2 retrieval, the work in general appears too broad and too superficial to be clear and satisfactory. It is therefore recommended to reconsider this manuscript after major revisions have been made. At least the extent of the result discussions (possibly with narrower focus) and scientific formulations (following a clear overall framework) have to be improved.

### II. Specific comments:

The coverage of this manuscript is too broad to provide clear and satisfactory discussions: Topics addressed are L1 version intercomparison, instrument slit function retrieval, ozonesonde validation, satellite intercomparison (e.g. GOME-2), stratospheric, tropospheric, and total ozone (despite different claims, see below), Antarctic ozone depletion, averaging kernel shape and smoothing. . . As a result, the manuscript's title is unsatisfactory for its content, and vice-versa. Narrowing down the focus of the text would allow for appropriate coverage of these promising subjects and could strongly improve its scientific quality.

The overall readability of the manuscript could be (strongly) improved: - Word order mixing - Lack of use of definite and indefinite articles - It is difficult to derive the number of L1 versions that is actually studied from abstract and introduction, and to which of those the instrument slit function retrieval is applied. - Lack of a clear storytelling framework. - Untidy scientific formulations: "each nadir state is an area on the Earth's surface" (page 3, line 19-20), mixing of "degradation" and "degradation correction" which are quite different, "collocated geolocations indicating the location" (Figure 5 caption), "the median values of the quantity in the table conversions" (page 11 line 3), "[AK smoothing] gives a smoothed sonde profile which is more suitable to compare with the profile retrieved from the satellite instrument and influences the results" (page 11, lines 11-12), Table captions are typically too brief to be clear. . .

Page 6, line 14-15: "An inversion [. . .] is carried out until convergence is reached or until the maximum number of iterations is reached." What is the effect of the difference between the two options on the quality of the retrieval outcome?

Page 7-9, Section 3: The instrument slit function calibration parameters are well-explained, but their application is not: Is the slit function retrieval part of the OPERA retrieval? Why is it not applied to L1 v7 data to compare directly with v7\_mfac? Why is there no squeeze in Channel 1? How can the retrieval start from 260 nm, if only data starting from 265 nm are considered? Why is the Channel distinction different in the text (at 308 nm) and in Table 1 (314 nm)? Please clarify.

Figure 4: Why show results for a narrow tropical band if the later focus is on the Antarctic ozone hole?

Starting from Section 5, reference is made to the “ESA CCI” requirements (including reference to a non-existent Section 4.3 on page 13, line 5). From the website link (page 12, line 17) and paper content, it is understood that the Ozone-CCI project is intended, but any clarification on the project or motivation for its reference is lacking.

The comparison with GOME-2 results obtained by van Peet et al. (2014) in the last paragraph of Section 5.3 seems to be of marginal support for the general discussion.

The added value of the discussion in Section 7 is poor. This section could be redistributed over the previous sections the keep relevant information together.

The conclusions in Section 8 are unsatisfactory in comparison with the amount of topics that have been covered in the manuscript and do not provide a summative overview that is clear to an external reader. Throughout the text, plot and table descriptions are not in balance with (too) short result discussions.

It is agreed with the associate editor that a discussion of the nadir ozone profile retrieval’s averaging kernels is of importance for understanding the retrieved product. The single-pixel example (without discussion) and single-sentence conclusion on the effect of smoothing provided in Appendix A however are unsatisfactory: “The validation results are clearly less noisy and smoother for the case where the AK was applied to the ozone sondes.” A lot more information on the retrieval performance can be derived from the averaging kernels.

III. Technical corrections:

Abstract, line 7: “focus on stratospheric ozone” and page 3, line 6 “we will focus exclusively on the study of ozone in the stratospheric region” does not match the many tropospheric and total column discussions appearing in the text.

Page 2, line 11: “their geographical coverage is limited to approximately 300 stations

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worldwide” is exaggerated. It’s rather about half of that.

Page 5, line 3-4: The statement on L1c data reproduction comes out of thin air. Please clarify.

Page 5, line 8: The (van Soest et al., 2005) reference for L1 v7.04–W data release in 2012 seems unfitting.

Figure 2: dashed lines, mean or median, explain order indication, “residuals for  $\sim 300$  spectra” in contrast with “each curve is a residual for one solar spectrum” in text (page 8, line 18)

Page 6, line 6-7: Provide proper definition and explanation for DFS. The current phrasing is vague.

Page 10, lines 5-6: The text provides conflicting information on the years that are covered in this section’s discussion.

Page 12, line 6: Interpercentiles are indicated as errors, but in fact are (random) uncertainties on the relative differences.

Page 12, line 33: “solar azimuth angle” should be “solar zenith angle”

Section 6: Table numbers seem to be wrong.

Journal names in the References section are sometimes wrong (ACP and AMT are mixed) and both abbreviations and full names are used.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-136, 2017.

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