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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 #2

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General comments:

The authors retrieved nadir ozone profiles from SCIAMACHY, validated their results with ozonesondes and applied their data in the study of ozone hole in the Antarctic region during 2003-2011. This paper is ambitious to include retrievals (including slit function), validations and applications of SCIAMACHY's nadir ozone profiles. However, the focus of this paper is too broad, and unfortunately, many aspects were not well described and/or discussed. I think this paper could be separated into two papers at least: one validation paper and one application paper. In addition, the presentation of this paper could be significantly improved. Therefore, this paper needs a major revision

to meet AMT's publication requirements.

This paper simply used 1000-100 hPa and 100-10 hPa to separate the stratosphere and troposphere. Please use the tropopause pressures. Because tropopause pressures have strong temporal and spatial variations, a simple 100hPa separation could lead many scientific errors.

In Section 3, does OPERA have a slit function in the retrievals? Or did you apply a new slit function rather than the original slit function that improve the retrieval performance?

In Section 5, it is a clever idea to show the validation results in different latitude bands, as 90N-30N, 30N-30S and 30S-90S. However, it would be better to separate 90N-30N and 30S-90S latitude bands to 90N- 60N, 60N -30N and 30S-60S and 60S-90S. This is because satellite retrievals have a deficient performance at high latitude regions due to the large solar zenith angles. In the midlatitude, satellite retrievals usually are good.

Figure and table captions are too brief to understand.

Appendix A needs more discussions. "The validation results are clearly less noisy and smoother for the case where the AK was applied to the ozone sondes." Why?

Specific comments:

Page 1 Line 24: Tropospheric ozone could also come from the stratosphere.

Page 2 Line 7: "... the ozone trend layer...". Did you mean ozone layer trend?

Page 2 Line 9 – 12: Please add references to the descriptions and discussions of ozonesondes. Such as:

Deshler, T., Mercer, J. L., Smit, H. G. J., Stubi, R., Levrat, G., Johnson, B. J., Oltmans, S. J., Kivi, R., Thompson, A. M., Witte, J., Davies, J., Schmidlin, F. J., Brothers, G., and Sasaki, T.: Atmospheric comparison of electrochemical cell ozonesondes from different manufacturers, and with different cathode solution strengths: The Balloon Experiment on Standards for Ozonesondes, J. Geophys. Res., 113, doi: 10.1029/2007JD008975,

2008.

Smit, H. G. J., Straeter, W., Johnson, B. J., Oltmans, S. J., Davies, J., Tarasick, D. W., Hoegger, B., Stubi, R., Schmidlin, F. J., Northam, T., Thompson, A. M., Witte, J. C., Boyd, I., and Posny, F.: Assessment of the performance of ECC-ozonesondes under quasi-flight conditions in the environmental simulation chamber: Insights from the Juelich Ozone Sonde Intercomparison Experiment (JOSIE), J. Geophys. Res., 112, 19306, 2007.

Page 2 Line 16: Please add references for IASI and TES.

Page 2 Line 34: In your abstract, you mentioned only two version of SCIAMACHY, v7 and v8. Please specify three version numbers here.

Page 3 Line 2: Similarly, please specify the version number here.

Page 3 Line 4-6: The focus of this study is to apply the retrieval algorithm in different SCIAMACHY L1 data with validation against global ozonesonde observations during 2003-2011, and analyze the stratospheric ozone in the Antarctic region. Please rephrase the focus part.

Page 3 Line 7: It is the first time you use OPERA in your text, except the abstract. Please specify the full name here.

Page 5 Line 9: The link to describe goes to V8mfac, please revise the link.

Page 5 Line 17: "difference between this version with the ones above...". Please change with to and.

Page 5 Line 24: It would be a good idea to have a paragraph to describe briefly the retrieval theory in Rogers (2000), like van Peet et al. (2014) did.

van Peet, J. C. A., van der A, R. J., Tuinder, O. N. E., Wolfram, E., Salvador, J., Levelt, P. F., and Kelder, H. M.: Ozone ProfilE Retrieval Algorithm (OPERA) for nadir-looking satellite instruments in the UV–VIS, Atmos. Meas. Tech., 7, 859-876, doi: 10.5194/amt-

7-859-2014, 2014.

Page 5 Line 25: "... using UV and Visible wavelengths." Did you mean UV wavelengths here?

Page 10 Section 4.1:

1. I think it is a good idea to also include satellite retrieved ozone profiles 2002 and 2012 in your validation, although you have the entire year data.

2. Why did you only present mean profiles in 2003 and 2009? Could you list annually mean retrieved ozone profiles from 2002-2012 (or 2003-2011)? It would indicate the temporal variation of ozone profiles based on different level 1 data, and the instrument degradation. Page 11 Line 4: The ozonesonde ozone profiles have different top pressures because of some early burst balloons. Did you apply correction factors to ozonesonde profiles? Some ozone data processes should be described here.

Page 11 Line 10: please specify the equation of average kernel convolution. And Why did you need to convolve ozonesonde profiles with SCIAMACHY average kernels.

Page 10 Line 29: "... the lower- middle stratosphere (100 − 10 hPa)...". The lower-mid stratosphere is roughly 100-10 hPa. But it is key to point calculate the tropopause pressures. I suggest including yearly mean tropopause pressure here.

Page 11 line 10: "An ideal agreement between sonde and satellite would give a difference of zero at all layer heights." This is not necessarily true. Sometimes, small biases are because of retrieval information coming from the a priori due to the low satellite sensitivity in the lower troposphere,

Figure 3. Please convert x-axis ticks from year 0-8 to year 2002-2010 or 02 − 10.

Figure 4: In the right columns, please indicate that they are mean ozone profiles based on different level 1 data within the 10N and 10S region. And what do these dashed lines mean?

Figure 5: Please add latitude and longitude ticks in the figures.

Figure 6: What kind of uncertainty did you plot here? Standard deviations?