

## ***Interactive comment on “Total Ozone Dobson, Brewer, Saoz and satellites comparisons at the historical station Arosa” by Jean-Pierre Pommereau et al.***

### **Anonymous Referee #1**

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The paper “Total Ozone Dobson, Brewer, SAOZ and satellites comparisons at the historical station Arosa” by J.-P. Pommereau et al. presents a study that compares total ozone measurements obtained from SAOZ instrument at Arosa with two other ground-based instruments (Brewer #40 and Dobson #62) at that location and a number of satellite overpasses over the station. The time period for the inter-comparisons is limited to about 1.5 year from October 2015 to March 2017. In the abstract and conclusions authors summarize results of the inter-comparisons and offer explanations for the observed discrepancies. Though, authors provide a very comprehensive analysis of ground-based comparisons, the analysis of results with satellite measurements is very shaky. Some of the conclusions are based on an erroneous assumption that SBUV is a

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limb sensor, while it is a nadir sensor. I would suggest that authors either should collect more information regarding to different satellite retrieval techniques used in this study (perhaps, by contacting satellite groups), or rather show results of comparisons and avoid offering explanations for the observed differences. Another big concern to me is the statement that authors made in the abstract claiming that the agreement between SAOZ and Dobson/Brewer instruments is within 1% over 1.5 year and this agreement can provide “confidence to the long-term SAOZ measurements”. This is a very short overlap that does not allow to judge the long-term stability of SAOZ. On my opinion, the manuscript requires a major revision, some facts need to be corrected, and the conclusions have to be re-evaluated. My specific comments are below.

Specific comments:

Title: On my opinion, the title of the manuscript does not accurately reflect the content of the study, since it focuses mostly on validation of SAOZ measurements. I would recommend authors to reconsider the title.

Page 1, Abstract, Line 19: I do not agree with the statement that agreement within 1% over 1.5 year can provide “confidence to the long-term SAOZ measurements”. This is a very short overlap that doesn’t allow to judge the long-term stability of SAOZ.

Page 2, Introduction, line 13: It would be nice if authors can explain what is “an irradiance default of linearity” and how it would affect ozone retrievals from SAOZ.

Page 4, lines 17-22: Authors demonstrate that corrections for O3 cross-sections improve comparisons. However, by looking at Figs.1 - 2 it remains unclear whether cross section corrections reduce the large noise seen in Fig.1 or the noise remain the same. Authors should add error bars on Fig. 2 or add a discussion about the noise into the text. The same argument goes to results shown on Fig. 3 due to temperature corrections.

Pages 6, line14: The instrument/satellite name is not “Nimbus-19” but “NOAA-19”.

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Page 6, lines 14-16: The name of the ozone sensor on board of Suomi NPP is OMPS. It is a joint NASA/NOAA mission. I suggest to change that phrase with “the NASA/NOAA Ozone Mapping and Profiling Suite (OMPS) on board of Suomi National Polar orbiting Partnership (NPP) satellite”.

Page 7, Sections 4.1-4.2: Authors need to identify version of all data used in this study and provide references to the manuscript that describes the algorithm or validates the data. It is not enough to provide a link to the web page as a version of data can change.

Page 7, Section 4.3: This section provides incorrect information about SBUV. First, SBUV is a nadir sensor not a limb sensor as it noted in this section. Secondly, it has 12 spectral channels not 4. The name of SBUV/2 sensor used in this study over the 2015-2017 time period is “NOAA-19” not “Nimbus-19”. A proper reference to the SBUV v8.6 algorithm is (Bhartia et al., 2013). I didn’t find (Bhartia et al., 1996), referred in line 22, in the ‘References’.

Page 7, Section 4.4, Title: All sections are named after sensor’s names, not satellite’s names. Should then the section title be “OMPS”?

Page 7, line 35: Incorrect reference to the TOMS algorithm. This is one of references to TOMS v8 algorithm: Bhartia and Wellemeyer, 2002:

Bhartia, P. K., and C. W. Wellemeyer, "OMI TOMS-V8 Total O3 Algorithm", Algorithm Theoretical Baseline Document: OMI Ozone Products, P. K. Bhartia (ed.), vol. II, ATBD-OMI- 02, version 2.0, Aug. 2002.

Page 8, lines 1-2: Suomi NPP OMPS is on a polar orbit with the equatorial crossing time 1:30 pm or 13:30. Sensor can make measurements of the sunlit part of the Earth, therefore most of measurements are collected in ascending mode.

Page 8, lines 13-16. Authors need to clarify what “OMI-D” or “OMI-T” stands for. I assume “OMI-T” stands for OMI data processed with NASA TOMS algorithm, and “OMI-D” for OMI data processed with KNMI DOAS algorithm. But this should be clarified in

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the text.

Page 8, line 17: What does “the frequent masking of satellites” means? Do you mean “cloud mask” or some quality flags?

Page 8, line 24: All instruments here are listed by their names except for OMPS that is listed as “NPP”.

Page 8, lines 25-28: This is correct that SBUV v8.6 algorithm retrieves ozone profiles, and the total ozone is calculate as a sum of all layers. But SBUV is a nadir sensor.

Page 8, lines 29-31. This sentence is very confusing. It’s not clear which instrument uses “Averaging Kernels derived from TOMS v8 zonal mean climatology”. This part of the text needs major revision. I would recommend authors to find more information about different satellite algorithms to provide comprehensive explanations. Alternatively, they can show results of comparisons but avoid explanations for the observed differences.

Page 11, lines 15-17: Again SBUV is a nadir sensor. SBUV algorithm also uses seasonal zonal mean climatological profiles as the a priori (see Bhartia et al., 2013).

Technical comments:

Pages 1-2, Abstract/Introduction: There are number of abbreviations that are used for the first time in the manuscript (like SAOZ, OMI, SBUV, CINDI, CCD etc.) that are not explained.

Page 8, line 24: should be comma “TOMS v8, SBUV”.

Page 8, line 28: What does “GB” stands for? Ground-based?

Page 11, line 9: It seems that “larger” and “higher” mean the same here.

Page 11, line 13: What does “GB” means?

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