

Interactive comment on “Seven years of IASI ozone retrievals from FORLI: validation with independent total column and vertical profile measurements” by A. Boynard et al.

Anonymous Referee #3

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GENERAL COMMENTS: The paper “Seven years of IASI ozone retrievals from FORLI” presents comprehensive intercomparisons between the IASI-A and IASI-B FORLI ozone datasets and several other datasets. Results from a new version of the FORLI are also shown. Overall, the paper is well-organized, with clear presentation of results. The performance of the IASI ozone datasets is assessed with a thorough data analysis and a good choice in validation datasets. The paper will make a good contribution to AMT, provided that the following comments are addressed.

The discussion of the factors affecting biases in the IASI dataset is confusing as it is integrated into the subsections describing intercomparison results. In some subsections, the brightness temperature is discussed, but in other sections things like the tempera-

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ture and a priori profiles are mentioned. It is not clear which latitudes/altitudes/seasons these factors are expected to be the most relevant and why they are mentioned in some subsections but not others. I think it would be useful if discussion of contributions to the various biases was consolidated and discussed separately from the comparison results between each validation dataset. Ideally, this discussion would explain which factors might be the most relevant at which latitudes/altitudes/seasons. Furthermore, this discussion could help explain the improvements observed in the new v20151001 dataset. On a related note, I agree with Referee #2 that figures showing how brightness temperature varies with latitude/season and how it affects retrieved ozone would be very useful.

Additionally, I found that in some of the subsections, the steps taken in the data analysis are unclear. For example, sometimes it's hard to tell how exactly data were averaged before comparing. Also, when mean relative differences are presented with an error, is this the standard deviation or the standard error or something else? I've included some specific comments where I've noticed this, but please check throughout the paper that methodologies are clearly described.

SPECIFIC COMMENTS:

Page 6, line 13: You discuss several possible reasons for differences between IASI-A and IASI-B datasets. Could you go into more detail about these? You state that some differences could be due to low numbers of IASI pixels being averaged – do these differences go away when you restrict comparisons to include only grid-cells with better sampling? You also mention sampling air masses at different local times. What are the typical differences in local times for each grid-point – are the times different enough that significant changes in ozone would be expected? Is there a reason that you would expect sampling differences like these to affect mean differences between the datasets (as opposed to just affecting the standard deviation)? You also mention that this could be due to differences in azimuthal angles. What do you mean by azimuthal angles and why would azimuthal angles affect agreement between the datasets? In

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the conclusion (Page 13, line 13) you mention differences in “observation geometry” – what do you mean by this?

Page 6, line 31: Delete the sentence starting with “This section shows and excellent agreement. . .”. This information is repeated in the conclusion, and doesn’t fully summarize the content of this section, given the much larger differences in the profiles at some latitudes.

Page 7, line 19: Were the gridded data averaged onto grids daily or monthly or something else?

Page 8, line 21: How were statistics in Table 1 calculated? E.g., were the maps averaged seasonally (as shown in Fig. 7) and then correlations calculated spatially across grid locations within a latitude band? Or were daily maps averaged within latitude bands and then correlations calculated over time for each latitude band? Or something else?

Page 8, line 30: When you say “extent of ozone depletion”, do you just mean TOCs in the ozone hole? What if IASI was used to estimate relative differences in ozone?

Page 9, line 12: Could you add a reference for the statement about the accuracy of Brewers?

Page 9, line 15: When you say, “All IASI TOCs meeting the above criteria were then averaged.” What was the averaging period? Was this on a daily basis?

Page 9, line 16: Is it necessary to both list the Brewer/Dobson station locations in a table and include the figure in the main text? Or could the table be removed or moved into an appendix or supplementary material?

Page 9, line 21: Why were IASI-B comparisons restricted to colocations with IASI-A? Were similar colocation requirements applied for other IASI-B comparisons (e.g., Figure 7, Figure 11, Figure 14)?

Page 9, line 24: How exactly were these relative differences calculated? Were the data averaged daily within the latitude bands, then daily relative differences calculated, then means calculated across all available days? Or were relative differences calculated for each comparison (for various latitudes/days) and then a mean calculated from this?

Page 10, line 13: What is the typical uncertainty in SAOZ measurements?

Page 10, line 15: Are the IASI nighttime/daytime measurements within the 300 km radius averaged daily for comparison with each SAOZ measurement?

Page 10, line 20: The relative difference is defined here, but not in previous subsections.

Page 10, line 22: Why is the RMS presented in Fig. 11 but other figures use standard deviation or have no errorbars? What do you mean when you use the term “noise”? Is this the RMS? Could the larger RMS values also be due to more systematic variations in the differences between the datasets or are the residuals random?

Page 11, line 1: Throughout this section and following sections, altitudes above 25 km are described as the “upper stratosphere”. I generally think of these altitudes as the middle stratosphere. Could you change your terminology and definitions of the partial column ranges throughout the paper to prevent this sort of confusion?

Page 12, line 8: Should the smoothing account for the problems with the vertical sampling and a priori described here?

Page 12, line 9: Based on Fig. 13, it looks like the positive bias in the stratosphere begins at different altitudes depending on the latitude, and is not just above 25 km. At high latitudes, the positive bias appears at lower altitudes (in the lower stratosphere and UTLS?), and at low latitudes the bias appears at somewhat higher altitudes (also near the tropopause?). Therefore, based on these figures, it looks like the high bias in the TOCs could be related to biases in the lower/middle stratosphere as well.

Page 12, line 12: Did you include requirements that ozonesondes measure up to a

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certain altitude/pressure level in order to be included in the comparisons (particularly for the 25-3 hPa range)? Are the ozonesonde partial columns for the 25-3 hPa range missing data at higher altitudes? If so, do you expect this to cause a significant low bias in the ozonesonde partial columns for 25-3 hPa or have you corrected them somehow?

Page 12, line 13: When considering R, did you check what the variability is like in the troposphere for each of these latitude ranges? E.g., if the variability in ozone is pretty low, R might be smaller just because there isn't as much variation for each dataset to capture. Did you also check the scatter plots to make sure R was based on a good relationship and not just a couple points that lead to higher R values?

Page 12, line 28: I don't understand the discussion starting here – please clarify the following. (1) What altitudes are you referring to when discussing diurnal variation? I thought this was relevant only at very high altitudes (~50 km), but the text seems to imply that this is in the troposphere. Please provide more information/references to demonstrate that this is relevant on the 50 minute timescale that is mentioned. (2) When you refer to differences being more pronounced in summer than in winter, what latitudes/altitudes are you referring to? Are you suggesting that IASI-A and IASI-B are more different from each other in the summer than the winter or that IASI is more different from the sondes in the summer than the winter?

Page 14, line 23: Do you have any idea which of the changes to the retrieval method for v20151001 most-contributed to the decrease in the biases above 25 km?

Page 15, line 16: Here, differences are attributed to brightness temperatures, but in the next bullet point (page 15, line 22), the a priori profile is mentioned. Is there a reason that these different factors are pointed out in the context of these specific comparisons at these latitudes/altitudes?

MINOR/TECHNICAL COMMENTS:

Throughout the text, there are some awkwardly worded sentences and minor gram-

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mathematical mistakes. As there are too many of these to list, I have not corrected them. They do not affect comprehension of the text in any way.

Abstract: Define all acronyms (e.g., TOC)

Page 3, define TIR (check elsewhere for acronym definitions)

Page 3, line 10: Is this bias positive for all the values reported here? Specify.

Page 5, line 24: What is the uncertainty here? Is this output as part of the retrievals?

Page 6, line 1: Where does the “specification” come from? Is this as GSCICS specification? Please clarify.

Page 14, line 22: Replace “no improvement is found” with “no significant differences are observed”?

Table 1: some of the table columns read R2, should this be R?

Figure 10 caption: This figure includes the line “For the period March 2013 onwards, only the common colocations between the two satellites are shown.” Similar information should be added to captions of other figures where applicable to help clarify the analysis methods (e.g., Fig. 9).

Figure 15, caption: Mention that this is averaged globally

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