

Interactive comment on “The detection of post-monsoon tropospheric ozone variability over south Asia using IASI data” by B. Barret et al.

Anonymous Referee #2

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The authors have presented a validation of ozone retrievals from IASI and an analysis of the ability of these data to capture variations in ozone over South Asia. This is a region with significant anthropogenic emissions of ozone precursors and complex atmospheric transport patterns, but few ozone observations. The IASI instrument provides considerable observational coverage and offers the potential to better understand the processes controlling ozone in this region. In this context, the manuscript could represent a valuable contribution. However, I have concerns about the analysis conducted to demonstrate that IASI captures the ozone variability as seen by MOZAIC. As explained below, this aspect of the manuscript is unclear. In contrast to the authors, I find it difficult to conclude from the discussion that IASI is capable of capturing the “fast changes in chemical composition related to tropical weather conditions.” I cannot recommend the manuscript for publication until the authors have adequately addressed

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these concerns.

Major Comments

1) Figure 7 shows the variations in ozone as seen by IASI and MOZAIC, however it is not clear if the MOZAIC data here have been smoothed with the IASI averaging kernels and a priori profile. IASI significantly overestimates the low ozone events, which one would expect if the MOZAIC data were not smoothed (as shown in Figure 4c for the ozonesonde data). Indeed the authors allude to this in lines 23–24 on page 10047. But if the MOZAIC data were not smoothed, then it is difficult to meaningfully compare the variability in the MOZAIC and IASI data - i.e. Figure 7 is not very useful. On the other hand, if the MOZAIC data were smoothed, the authors must explain the overestimate by the IASI data, since this represents a significant failure of IASI to capture the observed ozone variability. Is this because of contamination from the stratosphere in the upper tropospheric retrievals?

My guess is that transforming the MOZAIC data is a challenge because the profiles do not extend into the UTLS. An alternative approach would be to use the sonde profiles from Thiruvananthapuram (8N, 77E) and Delhi (28N, 77E) (or even the Sepang airport in Kuala Lumpur (3N 102E)). These may be more limited temporally (i.e., just one or two per month), but they could be useful to show that IASI is capturing the ozone variability over the July to December period. Then the authors could use the MOZAIC data to focus on the November period of interest and link them to the IASI measurements using the FLEXPART analysis.

2) The ozone variability shown in Figure 7 was for the tropospheric column, averaged from the surface to 225 hPa. However, as shown in Figure 9, in their analysis of the impact of transport on the ozone abundances, the authors focused on the particles reaching the middle troposphere between 3500 – 4500 m. This is odd since Figure 2 shows that the IASI retrievals have low sensitivity to ozone at altitudes below about 400 hPa (e.g. Figure 2b shows that the error reduction in the retrievals is small at altitudes

below about 400 hPa). It is not explained why the authors focused on the 3.5 – 4.5 km altitude range instead of looking at higher altitudes, where IASI is more sensitive to ozone. Furthermore, the discussion about the FLEXPART analysis on page 10048 is very unclear. For example, on lines 4-5 the authors explain that "an important fraction of the particles reaching the middle troposphere over Hyderabad have spent some time in the BL", but Figure 9 shows residence time in the BL and upper troposphere. It and does not tell me what fraction of the air in the middle troposphere is from the BL. Figure 9 needs to be better explained and the connection between the FLEXPART analysis and the ozone variations should be better established.

Minor Comments

- 1) Page 10037, line 12: Please change "i-thx j-th element" to i-th x j-th element".
- 2) Page 10041, equation (4): Ozonesonde data were used in constructing the a priori (xa), but it is not clear if these same ozonesonde data are being used in the validation? If that is the case, it would be difficult to determine if a small bias between the sonde and the retrieval means a good retrieval or just low ozone sensitivity in the retrieval (which returns the a priori in the retrieval). I am concerned that this may be the case below 400 hPa in Figures 3a,b, and c.
- 3) Page 10041, line 10: Please change "combined to the low" with "combined with the low".
- 4) Figure 3: It is not explained why the authors chose as their coincidence criteria 1 degree and 12 hours. A reference or explanation for this would be helpful.
- 5) Figure 6 caption: Please put a comma before "(dashed line)" and before "and (dotted)". Change "[vmr]" to "[ppb]".
- 6) Figures 9 and 10: What are the units for the residence time? The values peak at over $2.0\text{E}+11$ so it cannot be seconds since that would be more than 7 months.

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