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**Interactive
Comment**

Interactive comment on "A Joint data record of tropospheric ozone from Aura-TES and MetOp-IASI" *by* H. Oetjen et al.

Anonymous Referee #1

Received and published: 3 January 2016

This study provides a time series analysis by merging TES and IASI measurements over a ten-year period. The manuscript is well written and it is an interesting work which investigates a dedicated methodology for homogenizing two different datasets in order to study in the future long-term trends in tropospheric ozone. However, I do have one major concern related to the results presented in figures 7 and 8, which should be addressed before final publication.

Major comments:

My biggest concern is related to the time series you show in figures 7 and 8 (top panels for Eastern Asia). I do have doubts about the methodology you use when looking at the sharp decrease you obtain after 2011 which seems quite unrealistic and coincident with the change of TES observing strategy.

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Is it possible that the random distribution of IASI scenes in spring 2011 is biased due to reasons you evoke in p.31034, l.25? Did you over-sample the IASI data over a specific period of the month or part of the region, which could possibly explain such a change in the time series? I'm wandering to what extent the different sub-samples might affect the results. I would recommend to provide some more sample testing in order to get a feeling for the robustness of the time series.

p. 31035, l.1-3: You discuss the results considering the confidence limit, but not the standard deviation while this metric is independent of the sample size. I would suggest to represent the standard deviation associated with the monthly mean on Fig.7 and Fig.8 (error bars). If the std is larger than the sharp drop-off in 2011 or larger than $\sim$5ppb which corresponds to the trend approximated over 2011-2014, it means that the decrease in 2011 or the increase since 2011 in Fig.8 might not be significant.

In addition, I'm also wandering in what way the offset values determined from the global measurement is suitable for the ROIs. If relevant, I would also recommend to provide IASI-TES frequency distribution panels for the ROIs.

Furthermore, the results presented in Fig.7 and 8 which are the most important results of the paper suffer from the lack of analysis and discussions with previous studies. It is quite frustrating to read here "Analysis and attribution of the ozone changes over Eastern Asia is under investigation in a follow-up study". Impact of drivers of tropospheric O3 variations, of East Asian monsoon,... could be discussed and numerous previous studies should be cited.

Specific comments:

p. 31031, l.5-8: It is not clear for me from panel b that the TES ozone profile shape deviates more from the a priori than the IASI one. I could even suspect the contrary. Instead of showing TES and IASI profiles for all global surveys which mask the differences, would it be more appropriate to show one example for one individual survey or for one of the selected regions of interest (e.g. eastern Asia)?

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p. 31031, l. 22-23: Could you here mention the DOFS you obtain for the TES and IASI retrievals in that altitude range?

p. 31031, l.26-27: This is not clear to me. Do you mean here the sum of the "rows" of averaging kernel matrix in the relevant pressure range...? But then how do you obtain one single value (x axis in figure 2) and not a sensitivity profile with 5 levels corresponding to the 5 retrieval vertical grid points in the selected pressure range? I do not understand what represents the "IASI sum of AK matrix" values you plot in fig.2. Please clarify.

p. 31032, l. 3-4: Figures 2 is quite hard to visualize and looking at that figure, it even seems that the IASI-TES differences are dependent on the ozone values with larger differences corresponding to large amount, while I agree that the differences seem independent on what you called here the IASI sensitivity.

p.31032, l.8: Some words of caution related to the impact of using different external parameters for TES and IASI retrievals on the IASI-TES differences should be added here.

p.31032, l.11-12: Do you obtain the same offset (3.9 ppb) when looking at different regions or at different time periods? What is the offset for the measurements over the three regions of interest? I would suggest to show the frequency distribution for the regions of interest in addition to the one you present for the global surveys, to get a feeling of the impact of the differences on the homogenized time series.

p. 31034, l.15-16: Is the offset value of 3.9 ppb which has been determined for some specific short period at a global scale suitable for the three regions of interest?

p. 31034, l. 21: Did you use a cloud fraction of 13% or 6% as previously mentioned in p. 31030, l.20?

Technical corrections:

p.31032, l.16: I guess you mean "IASI-TES" differences, not IASI-TOE.

p.31033, l.26: "area the size" → "area of the size", same in the figure 5 caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 31025, 2015.