We would like to thank the reviewer for his/her feedback on this study, which helped us clarifying some points and improving our paper. Our answers to the different comments are detailed below.

Remarks from the reviewer are in blue while our answers are in black. The changes proposed for the revised manuscript are in italic (*grey* for unchanged sentences and **bold black** for modified/new sentences).

Reply to Referee ♯1 :

General comments

1. Some of the individual analyses related to the ENSO influence are similar to what is described in Wespes et al. (2017, JGR) which analyzes nine years of TOC observations from the IASI instrument with geophysical drivers. Although Weespes et al. (2017) analyzes the influence of the ENSO on TOC one step further by examining the ENSO-related tropospheric O_3 responses over tropical and extra-tropical regions, this earlier study should be acknowledged in the paper as the first one reporting ENSO-related O3 variations in IASI TOC measurements and should be discussed accordingly.

Indeed, results from [Wespes et al., 2017] on the multi-year variability of IASI tropospheric O3 represent a key reference for our study. We were not aware of this study when the manuscript was submitted. We recall the main conclusions from the study of Wespes et al., 2017 in the revised manuscript (introduction, after line 31, page 3 of the original manuscript):

Since we have already about 10 years of data the IASI mission provides a valuable dataset to study the O3 variability and trends ([Toihir et al., 2015, Wespes et al., 2016] both in the troposphere and the stratosphere [Wespes et al., 2009, Wespes et al., 2012, Dufour et al., 2010, Barret et al., 2011, Scannell et al., 2012, Safieddine et al., 2013]). ***More recently, the tropospheric O_3 variability due to ENSO has been studied using 8 years (January 2008 to March 2016) of IASI measurements [Wespes et al., 2017]. They have shown that IASI retrievals can capture the variability of tropospheric ozone related to the large-scale dynamical modes of ENSO.***

2. I realize that I do not feel qualified to the rigor of assimilation techniques, but I do not fully understand the added value of the assimilation for analyzing the ENSO-related variability in IASI TOC. The IASI dataset has been shown to be huge enough in previous studies to perform that kind of analysis. It could therefore be interesting to compute an OEI from the direct IASI TOC and to compare it with the IASI-a index derived in this paper. Could you bring that additional information and better discussed the added value of the assimilation technique in this study ?

We agree with the reviewer on the exceptional data coverage provided by IASI. However, the frequent occurence of convective clouds in South-East Asia and in the Pacific Ocean tropical band can greatly reduce the number of tropospheric ozone retrievals. This phenomenon is in particular enhanced during El-Nino phase.

The number of IASI-SOFRID monthly retrievals available for some selected months during the 2010 ENSO episode are shown in figure 1. Note that large regions without any retrieval are present, matching geographically with the enhanced convection zones. The benefit of performing data assimilation is twofold: i) scattered retrievals due to clouds are still able to correct the modeled ozone field in the surroundings of the observed locations thanks to the background error correlations (B matrix) ii) the model itself further propagates the corrections over cloudy regions through wind advection. Hence, this synergy can in principle produce more accurate results that both satellite data and models taken alone.

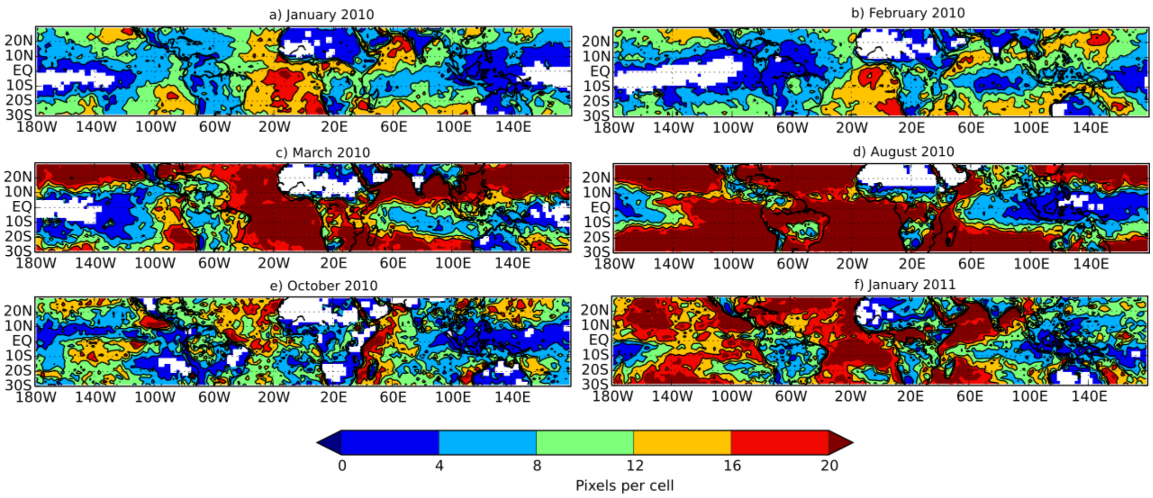

Figure 1: Monthly mean number of pixels per cell during the day for IASI-SOFRID : a) January 2010, b) February 2010, c) March 2010, d) August 2010, e) October 2010 and f) January 2011.

In order to better quantify the added value of the data assimilation scheme compared to IASI-SOFRID dataset alone, we report in figure 2 the OEI indexes from figure 7 of the manuscript and add the index computed using the IASI-SOFRID TCO alone. Note that when computing the IASI-SOFRID OEI, only the retrieved TCO was used, whereas averaging kernels, a-priori information and a bias correction of 10% were used for the assimilation. Therefore, differences between IASI-SOFRID and IASI-a OEI are not only due to the assimilation synergies discussed above.

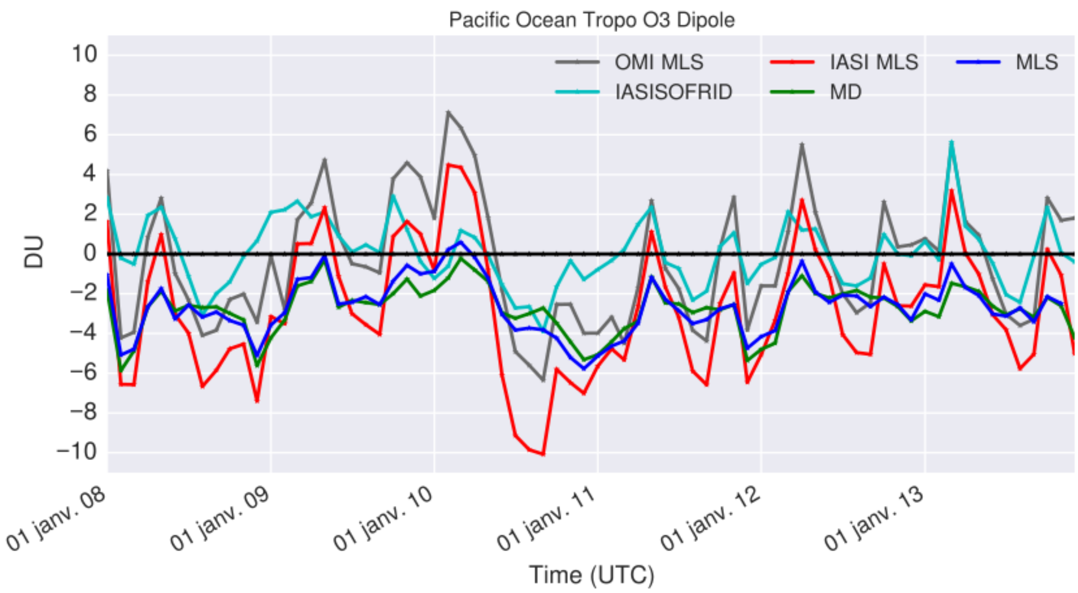

Figure 2: Monthly mean tropospheric Ozone ENSO Index (in DU) derived from the OMI-MLS data (grey line). Also shown is the MLS-a (in blue curve), the direct model (in green curve), the IASI-a (in red curve) and the IASI-SOFRID data (in cyan curve). All ENSO indices extend from January 2008 through December 2013. Tropopause pressures used to compute tropospheric column of OEI have been specified in section 2.2.1 of the paper.

We remark that the IASI-SOFRID OEI matches the multi-year variability observed with the OMI-MLS index. However, the intensity of the signal is significantly underestimated during the strongest ENSO episode (El Nino on January-March 2010 and La Nina on August-January 2011). Note also that in some circumstances where IASI data gaps due to clouds are not critical (e.g. January 2011) all OEI indexes except IASI-SOFRID suggest the presence of a strong La Nina phase. This is probably due to the better capacity of the direct model or MLS-a to capture the intensity or the vertical features of the enhanced UTLS exchanges in the Eastern Pacific Ocean (see also response to question number 4).

We conclude that, even when satellites provide a very dense global coverage, data assimilation techniques remain of interest to provide results that are less influenced by the retrieval sampling and can benefit from the synergy of several independent sources of information. A sentence has been added to the revised manuscript to better clarify this point (see reply to comment number 9). Since our original manuscript is focused on results from data assimilation experiments, we prefer to avoid adding the IASI-SOFRID OEI and the relative discussion in the revised paper.

3. In addition, given that IASI provides vertical information on stratospheric O3, I'm not sure neither about the added value of using stratospheric O3 from MLS (for IASI-a) instead of the whole IASI profile. I understand that the MLS vertical profile in the stratosphere is better resolved that the one of IASI, but the focus is given on TOCs and one could think that IASI would constrain the model enough in the stratosphere for assessing comprehensive TOC analysis. Could you please clarify ?

This work has been conducted using a methodology proposed and validated in previous studies [Barré et al., 2013, Emili et al., 2014]. In both papers the authors limited the assimilation of IASI retrievals to the single tropospheric column. The main reason is that current IASI level 2 retrievals are affected by biases that can be as high as 20% in the UTLS region [Dufour et al., 2012], whereas MLS accuracy is generally better than 5%. For example, [Massart et al., 2009] removed the bias from IASI total columns prior to data assimilation in order to obtain correct ozone reanalyses when assimilating both IASI and MLS. On the other hand [Massart et al., 2012, Emili et al., 2014] showed that MLS assimilation alone provides already very accurate ozone fields above 100 hPa. Therefore, we favoured using a methodology that was already extensively validated and avoiding the possible introduction of IASI-related biases in the UTLS. We think that assimilation of IASI full O_3 profiles or stratospheric columns deserves additional research, but this would represent a topic for a dedicated study.

4. Furthermore, it is obvious that IASI-a is more appropriate than MLS-a for analysing variation in TOCs and computing an OEI given that MLS does not sound the troposphere and that "little information is brought by the assimilation of MLS data" (cfr p.13, l.2). I'm also wandering in what way the different biases from IASI and MLS would impact on the IASI-MLS analysis. Could you specifically explain in the text the advantage of assimilating MLS in the stratosphere for the purpose of this study ?

Concerning the first comment, we agree with respect to the relative importance between IASI and MLS. However, we believe that a precise quantification of the contribution of MLS data deserved some place in the study, since intense stratosphere-troposphere exchanges, especially during La Nina episodes, could amplify the role of MLS in the reanalysis (see Figure 7 and 8 of the original manuscript). We could not easily quantify this effect without performing the relative reanalysis. The impact of MLS was therefore discussed through the paper. The following sentence has been included in the revised manuscript (Introduction, page 3, line 34):

We use the MOCAGE CTM to assimilate tropospheric ozone profiles from IASI and stratospheric profiles from MLS with a 4DVAR algorithm. ***The joint assimilation of IASI and MLS data was already found very effective to improve modelled O_3 in the UTLS [Barré et al., 2013, Emili et al., 2014]. Even if IASI data are expected to provide the most significant contribution to the tropospheric reanalysis, the assimilation of MLS allows to introduce complementary information in case of stratosphere-troposphere exchanges [Barré et al., 2012], which intensify over the Eastern Pacific Ocean during La Nina phase of the ENSO. We will evaluate in this study the relative importance of assimilating MLS and IASI in the context of the O_3 variability related to ENSO.***

Concerning the question about the impact of the different biases of IASI and MLS on the reanalysis : all biased data that are assimilated can eventually introduce a bias in the resulting reanalysis. If two instruments with opposite biases are assimilated and they both influence the same region of the ozone field, the original biases could eventually cancel out. However, in our case, assimilated MLS data have biases lower than 5% and impact mostly the UTLS. On the other hand, IASI TCO data, which could be still affected by residual biases after the global correction of 10%, impact mostly the free troposphere (see also reply to specific comment number 12). Therefore, we think that possible biases introduced by the assimilated data in the reanalysis can mostly be attributed to IASI (see for example Figure 4, bottom plot).

5. In Section 3.2.1, figure 6 : you validate the IASI-a analysis with the OMI-MLS residual method, meaning that MLS measurements are used in both sides. One could think that you turn around here. I guess here that you want to leave out the effect of the stratospheric O3 variation from the validation of IASI-a TOC. If correct, it would derserve to be clearly mentioned in the text.

The comparison of our results with the OMI-MLS residual method was not motivated by the objective of leaving out the stratospheric impact in the comparison. We have used OMI-MLS data because they represent one of the few TCO datasets independent from IASI with a dense enough global coverage, and were used so far in most of the studies concerning O_3 and ENSO variability.

Specific comments

6. p.2, l. 24-26 : That sentence which refers to the increasing biomass burning in Indonesia, not convection, should be moved after the following sentence in l.26-27.

The sentence has been moved in the revised manuscript.

7. p.3, l12-14: It should be mentioned that O3 sensitivity to ENSO has been already studied with IASI as well (Wespes et al., 2017)

We have added this reference in the revised manuscript (see also reply to general comment 1).

8. p.3, l.20-21 : The added value of using both IASI in the troposphere and MLS in the stratosphere to obtain direct evaluation of tropospheric O3 is not clear to me and should be specifically explained

We removed MLS from this specific sentence to maintain the focus on IASI in the following paragraph. But the explanation concerning the added value of MLS has been added to the revised manuscript some lines after. Please refer to general comment number 4 for more details.

9. p.4, l.6-8 : The 6-years reanalysis is here presented as the first IASI dataset suitable to perform analyses of O3 variations in the tropics. It is obvious that if the analysis of O3 variability can be performed from the direct IASI measurements, the reanalysis dataset is also suitable for that study. The added value of using the reanalysis is not clear. Please explain.

We have already discussed in details the added value of computing a reanalysis compared to IASI-SOFRID data in the reply to the general comment number 2.

The following text has been added (Introduction, page 4, line 6) in the revised manuscript to clarify this point for the reader.

Fewer studies used data assimilation to study the distribution and inter-annual variability of tropospheric ozone in the Pacific [Liu et al., 2017, Olsen et al., 2016]. ***Data assimilation allows to obtain homogenous time-series of chemical fields by integrating all available information from measurements and models. This can be particularly useful when tropospheric satellite retrievals become very sparse, due for instance to the occurence of convective clouds in the tropical region.***

10. p.5, l.18-20 : The values here are discussed in terms of accuracy, precision or bias. All these terms are used depending on the altitude layers. I think the reported values refer here to bias only. Please clarify. What is the bias in stratospheric O3 from MLS in comparison with IASI ?

The reported values refer to precision in the UTLS and biases elsewhere. The revised sentence is :

The MLS ozone profiles show good quality in the UTLS, with a precision of about 5 %. Biases for MLS ozone profiles are about 2 % in the stratosphere but they increase in the upper troposphere and can be as high as 20 % at the 215 hPa level [Froidevaux et al., 2008]. To avoid the introduction of biases at this level in our analyses we have taken the MLS ozone data only between 12.12 hPa to 177.83 hPa.

The bias in stratospheric (from 16 to 30 km) tropical O_3 from MLS is around 2 % while it is around 7 % with IASI-SOFRID [Dufour et al., 2012].

11. p.7, l.27 : The exact portion of the IASI profile "(1000-345 hPa)" which is assimilated in the model should be defined earlier in the abstract and in the IASI measurements.

section 2.1.1. I thought that the whole IASI profile was assimilated with the MLS stratospheric profile. I only get the information later in Section 2.3.2 (p.7).

Why using 1000hPa for the bottom level and not the surface ?

The IASI partial O_3 columns have been mentioned in the abstract and in the IASI measurements paragraph (2.1.1). We add this clarification in the text as follows :

Abstract : *In this study, Microwave Limb Sounder (MLS)* ***O_3 profiles*** *and IASI* ***O_3 partial columns (1013.25 hPa - 345 hPa)*** *are assimilated in a chemistry transport model to produce 6-hourly analyses of tropospheric ozone during six years (2008 - 2013).*

Section 2.1.1. line 5 : *SOFRID retrieves the O_3 profiles on 43 levels from* ***1013.25 hPa*** *to 0.1 hPa using a single a priori profile and covariance matrix based on one year of in-situ observations (see [Barret et al., 2011] for details). Validation of six months of tropospheric O_3 columns from IASI-SOFRID against ozonesondes and airborne data have shown biases of about 5 % and Relative Standard Deviation (RSD) of about 15 % in the tropics. In their validation study of three IASI O_3 products over one year, [Dufour et al., 2012] found also biases of 3.8 % and RSD of 9.5 % for IASI-SOFRID tropospheric O_3 relative to ozonesondes data in the tropics.* ***In this study, a partial O_3 columns between 1013.25 hPa and 345 hPa has been computed from the IASI-SOFRID profile prior to the assimilation.***

Indeed, the bottom pressure level was not well specified in the original text: it is not 1000 hPa but the last level of the SOFRID retrievals (1013.25 hPa).

12. In section 2.1.2.: it is written that you use the MLS data only between 12.12 hPa and 177.83 hPa, which means that no satellite measurements between 345 hPa and 177.83 hPa are assimilated and hence that there is no direct constrain on UTLS O3. How would it affect the assimilated TOC from 1000 to 100 hPa that are later validated and analyzed ?

The reviewer is almost right: no satellite measurements are directly assimilated between 345 hPa and 177.83 hPa. The reason for neglecting the lowermost levels of MLS are given in the manuscript. However, concerning IASI, the above sentence is not totally exact and the reason to choose a relatively low top with respect to the tropical tropopause height (∼100 hPa) is related to the O_3 averaging kernels.

Figure 3 shows an example of IASI-SOFRID averaging kernels. We can observe that the retrieved O_3 at 150 hPa has a non negligible sensitivity to O_3 values at levels as high as 50 hPa. Using a IASI column top at about 100 hPa the effect of the corresponding averaging kernels would be twofold: i) contribution of the stratospheric O_3 profile would impact the differences (misfit) between IASI partial columns and model equivalent values that the assimilation tries to minimize ii) the assimilation corrections would spread both in the troposphere and in the stratosphere. With a top column level set at 345 hPa the sensitivity of the assimilated measurements remains confined below 100 hPa and stratosphere impact is negligible. However, IASI kernels, and therefore model corrections are still non-zero between 100 and 350 hPa. Therefore, the assimilation of 345-1013 hPa columns impose some kind of "direct constrain" in the upper troposphere as well.

The choice of the column top has been made in order to minimize the direct influence of stratospheric ozone on tropospheric corrections. This choice also avoids as much as possible the need to estimate possible biases between MLS and IASI measurements and the need to account for them prior to assimilation (see also reply to general comment number 4).

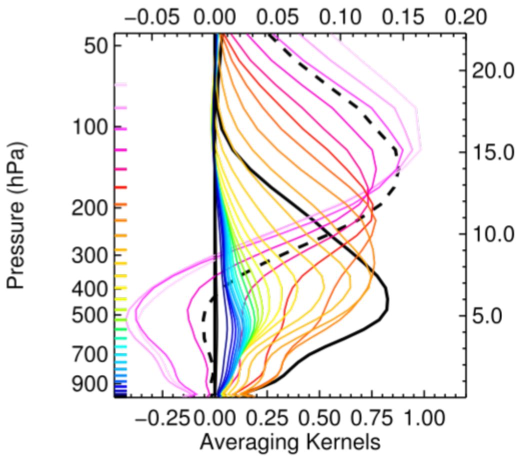

Figure 3: Averaging kernels example for ozone retrievals of IASI-SOFRID over Indian Ocean on November 2008 [Barret et al., 2011]. The solid curve is given for the TCO (1013-225hPa) and the dashed curve is for the UTLS (225 - 70 hPa). Each color lines are associated to x-axis and characterise averaging kernels for individual layers.

To clarify, we included the following sentence in the revised manuscript (after page 7, line 27 of the original manuscript):

IASI partial O_3 columns (1000-345 hPa) and MLS profiles have been assimilated in the troposphere and in the stratosphere respectively to constrain the ozone concentration along the full atmospheric column. ***Previous studies assimilated IASI tropospheric columns between 0-6 km [Coman et al., 2012, Barré et al., 2013] or 1013-225 hPa [Emili et al., 2014]. For this study, the choice of the assimilated column top (345hPa) has been taken based on SOFRID averaging kernels found over the tropics [Barret et al., 2011]. The objective was to minimize the extent of the atmospheric layer where both MLS and IASI can have a direct impact. This avoids to some extent the need of quantifying and accounting for possible biases among the two instruments.***

13. p.9, l.12 : (validation section) I do not understand why you validate the TOC ranging from 1000 to 100 hPa. This range covers more than the troposphere (and than the assimilated IASI TOC) including the UTLS and, hence, it does not seem the most appropriate column for the IASI-a validation. It may mask a part of the added value of IASI. That would be fully achieved by validatin the 1000-345 hPa column from IASI-a vs from MLS-a.

The tropopause level in the tropics band (between 15° S and 15° N) is located between 150 hPa and 70 hPa [Fueglistaler et al., 2009]. The section on ENSO variability (3.2) uses tropospheric columns based on a dynamical tropopause layer for both OMI-MLS (Section 2.2.1) and reanalysis data. Hence, the definition and validation of a TCO ranging from the surface to 100 hPa is in better agreement with the main focus of the study, independently of the specific impacts of either IASI or MLS on the reanalysis (see also previous reply).

14. p.9, l.28-32 : (figures 3c and 3d) The authors explain the larger biases from IASI-a than from MLS-a in the boundary layer by the weaker sensitivity of IASI in that region; However, MLS does not even sound the boundary layer at all. How could you explain that MLS-a better reproduces the O3 sonde observations than IASI-a? please clarify ?

The explanation was indeed not clear enough. In the boundary layer, as expected, the MLS-a simulation gives practically the same results as the direct model (DM), both overestimating the ozone concentration by about 20%. The boundary layer ozone is completely determined by the CTM. In the free troposphere the DM bias is negative (-40%) and a positive, albeit small, impact of assimilating MLS can be observed. Since IASI retrievals have approximately one degree of freedom for the entire troposphere and we assimilate tropospheric columns, it is not possible to correct both a positive bias in the boundary layer and a negative bias in the free troposphere. The shape of the IASI averaging kernels provides a strong positive correction of the DM bias in the free troposphere (Fig. 3e,f). However, part of the positive ozone correction is propagated by the AVK also in the boundary layer and/or is transported downward in the forecast step. This explains the incresead bias of IASI-a in the boundary layer. This kind of situation is tipically encountered when the assimilated mesurements do not have enough sensitivity to discriminate among different layers of the atmosphere. The original sentence (page 9, line 31) has been replaced with the following text:

Larger biases in the boundary layer are a consequence of both the low DOFs of IASI retrievals in the troposphere and the presence of a DM bias with opposite sign between the free troposphere and the boundary layer. The positive correction provided by IASI assimilation in the free troposphere propagates downward in the boundary layer, therefore increasing the original DM bias.

15. p.10, l.24-26 : What could explain the peak observed over Indonesia in October 2011 (Fig 4c) in the O3 sonde dataset only and not in IASI-a ?

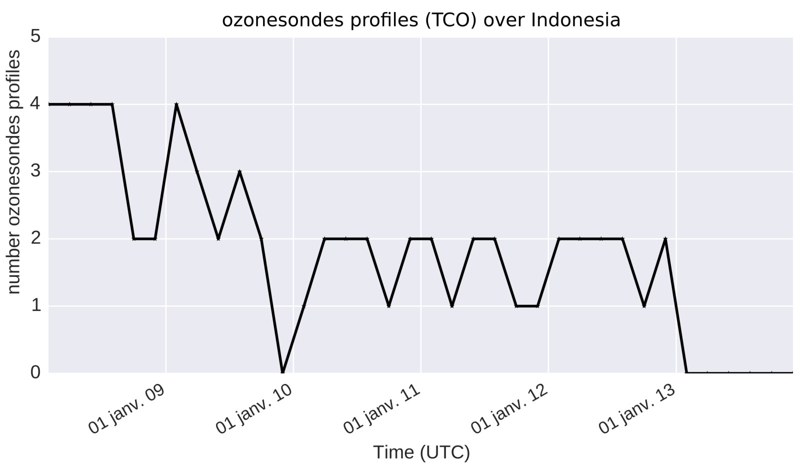

Figure 4: Ozonesondes number from January 2008 to December 2013 over the Indonesia.

Ozonesondes measurements and IASI-a show a good agreement from January 2008 to October 2009. Since January 2010, biases seem to increase between the two datasets. If we observe the number of monthly ozonesondes measurements over Indonesia (figure 4), we note a significant decrease since January 2010. Even if the ozonesondes profiles and the the reanalyses are colocated in time to compute the validation statistics, the likelyhood of sporadic but large mismatch between the model prediction and the measured profile can still be significant. When few measurements are available the risk of a noisy comparison increase. The following sentence has been included in the revised manuscript (after line 15, page 10 of the original manuscript):

Ozone measurements for each site are available over different time periods. The Malaysia site provides measurements only between January 2008 and December 2009, the Indonesia site from January 2008 to December 2012, and the Samoa site from January 2008 to December 2013. ***Due to the reduced number of available ozonesondes measurements, results of the statistical validation presented here should be considered with more caution than in the previous section. The main objective of this section is to check whether the reanalysis can capture strong local variations of TCO due to ENSO.***

16. p.13, l.25 :"... Nino 3.4 is calculated from SST anomalies in the Pacific Ocean": One reference or the source of the avalaible dataset is missing here.

This information is now given in the revised manuscript.

The Nino 3.4 index calculated from SST is avalaible from the NOAA website (http://www.cpc.ncep.noaa.gov/data/indices/). Sea Surface temperature anomalies were calculated using the monthly Extended Reconstructed Sea Surface Temperature version 4 (ERSST.v4, 1950-2016 base period).

Bibliography

[Barré et al., 2012] Barré, J., Peuch, V. H., Attié, J. L., El Amraoui, L., Lahoz, W. A., Josse, B., Claeyman, M., and Nédélec, P. (2012). Stratosphere-troposphere ozone exchange from high resolution MLS ozone analyses. *Atmospheric Chemistry and Physics*, 12(14):6129–6144.

[Barré et al., 2013] Barré, J., Peuch, V.-H., Lahoz, W. a., Attié, J.-L., Josse, B., Piacentini, A., Eremenko, M., Dufour, G., Nedelec, P., von Clarmann, T., and El Amraoui, L. (2013). Combined data assimilation of ozone tropospheric columns and stratospheric profiles in a high-resolution CTM. *Quarterly Journal of the Royal Meteorological Society*.

[Barret et al., 2011] Barret, B., Le Flochmoen, E., Sauvage, B., Pavelin, E., Matricardi, M., and Cammas, J. P. (2011). The detection of post-monsoon tropospheric ozone variability over south Asia using IASI data. *Atmospheric Chemistry and Physics*, 11(18):9533–9548.

[Coman et al., 2012] Coman, A., Foret, G., Beekmann, M., Eremenko, M., Dufour, G., Gaubert, B., Ung, A., Schmechtig, C., Flaud, J.-M., and Bergametti, G. (2012). Assimilation of IASI partial tropospheric columns with an Ensemble Kalman Filter over Europe. *Atmospheric Chemistry and Physics*, 12:2513–2532.

[Dufour et al., 2012] Dufour, G., Eremenko, M., Griesfeller, A., Barret, B., LeFlochmoën, E., Clerbaux, C., Hadji-Lazaro, J., Coheur, P.-F., and Hurtmans, D. (2012). Validation of three different scientific ozone products retrieved from IASI spectra using ozonesondes. *Atmospheric Measurement Techniques*, 5(3):611–630.

[Dufour et al., 2010] Dufour, G., Eremenko, M., Orphal, J., and Flaud, J.-M. (2010). IASI observations of seasonal and day-to-day variations of tropospheric ozone over three highly populated areas of China: Beijing, Shanghai, and Hong Kong. *Atmospheric Chemistry and Physics*, 10(8):3787–3801.

[Emili et al., 2014] Emili, E., Barret, B., Massart, S., Le Flochmoen, E., Piacentini, A., El Amraoui, L., Pannekoucke, O., and Cariolle, D. (2014). Combined assimilation of IASI and MLS observations to constrain tropospheric and stratospheric ozone in a global chemical transport model. *Atmospheric Chemistry and Physics*, 14(1):177–198.

[Froidevaux et al., 2008] Froidevaux, L., Jiang, Y. B., Lambert, A., Livesey, N. J., Read, W. G., Waters, J. W., Browell, E. V., Hair, J. W., Avery, M. A., McGee, T. J., Twigg, L. W., Sumnicht, G. K., Jucks, K. W., Margitan, J. J., Sen, B., Stachnik, R. A., Toon, G. C., Bernath, P. F., Boone, C. D., Walker, K. A., Filipiak, M. J., Harwood, R. S., Fuller, R. A., Manney, G. L., Schwartz, M. J., Daffer, W. H., Drouin, B. J., Cofield, R. E., Cuddy, D. T., Jarnot, R. F., Knosp, B. W., Perun, V. S., Snyder, W. V., Stek, P. C., Thurstans, R. P., and Wagner, P. A. (2008). Validation of Aura Microwave Limb Sounder stratospheric ozone measurements. *Journal of Geophysical Research: Atmospheres*, 113(D15):D15S20.

[Fueglistaler et al., 2009] Fueglistaler, S., Dessler, A. E., Dunkerton, T. J., Folkins, I., Fu, Q., and Mote, P. W. (2009). TROPICAL TROPOPAUSE LAYER. (2008):1–31.

[Liu et al., 2017] Liu, J., Rodriguez, J. M., Steenrod, S. D., Douglass, A. R., Logan, J. A., Olsen, M. A., Wargan, K., and Ziemke, J. R. (2017). Causes of interannual variability over the southern hemispheric tropospheric ozone maximum. *Atmospheric Chemistry and Physics*, 17(5):3279–3299.

[Massart et al., 2009] Massart, S., Clerbaux, C., Cariolle, D., Piacentini, A., Turquety, S., and Hadji-Lazaro, J. (2009). First steps towards the assimilation of IASI ozone data into the MOCAGE-PALM system. *Atmospheric Chemistry and Physics*, 9(14):5073–5091.

[Massart et al., 2012] Massart, S., Piacentini, A., and Pannekoucke, O. (2012). Importance of using ensemble estimated background error covariances for the quality of atmospheric ozone analyses. *Quarterly Journal of the Royal Meteorological Society*, 138(665):889–905.

[Olsen et al., 2016] Olsen, M. A., Wargan, K., and Pawson, S. (2016). Tropospheric column ozone response to ENSO in GEOS-5 assimilation of OMI and MLS ozone data. *Atmospheric Chemistry and Physics*, 16(11):7091–7103.

[Safieddine et al., 2013] Safieddine, S., Clerbaux, C., George, M., Hadji-Lazaro, J., Hurtmans, D., Coheur, P. F., Wespes, C., Loyola, D., Valks, P., and Hao, N. (2013). Tropospheric ozone and nitrogen dioxide measurements in urban and rural regions as seen by IASI and GOME-2. *Journal of Geophysical Research Atmospheres*, 118(18):10555–10566.

[Scannell et al., 2012] Scannell, C., Hurtmans, D., Boynard, A., Hadji-Lazaro, J., George, M., Delcloo, A., Tuinder, O., Coheur, P.-F., and Clerbaux, C. (2012). Antarctic ozone hole as observed by IASI/MetOp for 2008–2010. *Atmospheric Measurement Techniques*, 5(1):123–139.

[Toihir et al., 2015] Toihir, A. M., Bencherif, H., Sivakumar, V., El Amraoui, L., Portafaix, T., and Mbatha, N. (2015). Comparison of total column ozone obtained by the IASI-MetOp satellite with ground-based and OMI satellite observations in the southern tropics and subtropics. *Annales Geophysicae*, 33(9):1135–1146.

[Wespes et al., 2012] Wespes, C., Emmons, L., Edwards, D. P., Hannigan, J., Hurtmans, D., Saunois, M., Coheur, P. F., Clerbaux, C., Coffey, M. T., Batchelor, R. L., Lindenmaier, R., Strong, K., Weinheimer, A. J., Nowak, J. B., Ryerson, T. B., Crounse, J. D., and Wennberg, P. O. (2012). Analysis of ozone and nitric acid in spring and summer Arctic pollution using aircraft, ground-based, satellite observations and MOZART-4 model: Source attribution and partitioning. *Atmospheric Chemistry and Physics*, 12(1):237–259.

[Wespes et al., 2017] Wespes, C., Hurtmans, D., Clerbaux, C., and Coheur, P.-F. (2017). O3 variablity in the troposphere as observed by IASI over 2008-2016: Contribution of atmospheric chemistry and dynamics. *Journal of Geophysical Research*, 122(4):2429–2451.

[Wespes et al., 2009] Wespes, C., Hurtmans, D., Clerbaux, C., Santee, M. L., Martin, R. V., and Coheur, P. F. (2009). Global distributions of nitric acid from IASI/MetOP measurements. *Atmospheric Chemistry and Physics*, 9(20):7949–7962.

[Wespes et al., 2016] Wespes, C., Hurtmans, D., K Emmons, L., Safieddine, S., Clerbaux, C., Edwards, D. P., and Coheur, P. F. (2016). Ozone variability in the troposphere and the stratosphere from the first 6 years of IASI observations (2008-2013). *Atmospheric Chemistry and Physics*, 16(9):5721–5743.