Response to Reviewer #2

The authors would like to thank the referee for her/his useful and detailed comments, which have helped us clarifying several points and improving the manuscript. Below are our responses to the comments brought up by the referee. Referee's comments and our replies are marked in blue and in black, respectively. In italic are the changes made in the manuscript.

1. In the manuscript (Sec. 2.2, page 5) authors describe the sensitivity of IASI to atmospheric ozone. According to this, the leading factor that affects IASI's sensitivity is a thermal contrast. Results, shown on Fig. 2, demonstrate that total DOFS increases from 2.69 with thermal contrast of 1K to 4.06 with contrast of 26K. This makes me wonder why authors didn't include any figure that shows ozone differences (IASI-GOME, IASI-sonde) as a function of thermal contrast. This seems like a logical way to validate IASI retrievals. Instead of considering all latitude bands and seasons, it would be better to focus on time periods and regions where IASI measurements have the most information. I also would advice authors to include a table or figure that shows mean values of thermal contrast for different latitude zones and seasons. This will help readers to better understand and interpret shown results.

With this comment we realized that factors impacting IASI's vertical sensitivity were not well described. Actually, IASI's sensitivity mainly depends on surface temperature: the larger the surface temperature is, the larger the thermal infrared (TIR) signal is and thus, the more independent pieces of information are contained in the measurement. Therefore the total and tropospheric ozone column retrievals are impacted by surface temperature. Thermal contrast is related to the sensitivity for surface/boundary layer and not higher in altitude: the larger the thermal contrast is, the better the sensitivity of TIR sounder to the surface/boundary layer is. So it is more useful to show brightness temperature instead of thermal contrast as suggested. In order to better understand the differences observed (and also as suggested by Referee #3), we included a new figure illustrating the global distribution of surface temperature and DOFS for the TOC averaged over the period 2008-2014, as well as a table including mean values of surface temperature retrieved from IASI data and DOFS for the O_3 profiles for different latitude bands and seasons.

The changes have been made accordingly on p. 7 and in Fig. 2 of the new manuscript.

"In order to get a global view of IASI vertical sensitivity and its relation with surface temperature, Fig. 2 illustrates the spatial distribution of surface temperature along with total DOFS for the period 2008-2014 for daytime measurements. Data were averaged monthly over a 1°x1° grid cell, then the monthly data were averaged over the period 2008-2014. The mean values of surface temperature and DOFS for the O_3 profiles for different seasons and latitude bands are given in Table 1. As expected, surface temperature varies with latitude and season, with the highest values found in the tropics during summer (~300 K on average) and the lowest values in the high latitudes especially over Antarctica (245-255 K). Same patterns are observed for the DOFS global distribution with the lowest values at high latitude (~2) and the highest values in the tropics (>4), which indicates that IASI is more sensitive in the tropics. There is no significant seasonal change in both surface temperature and DOFS in the tropics and Southern mid-latitude. However, at high latitudes and in the Northern mid-latitudes, surface temperature and DOFS can differ by 10-30 K and 0.7, respectively, between winter and summer."

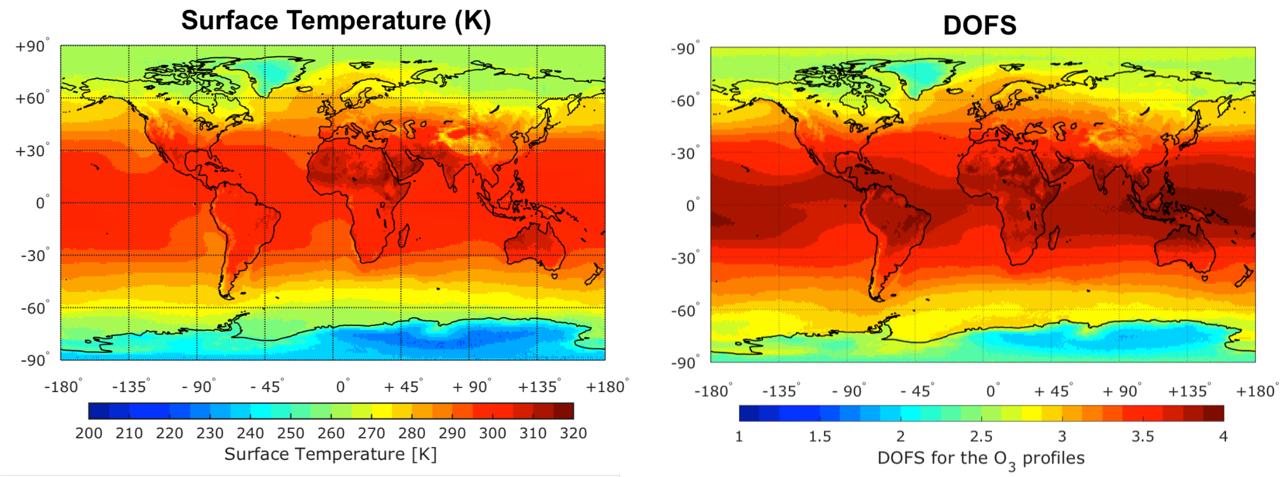

Figure 2: Global distribution averaged over 1°x1° for the period 2008-2014 for daytime measurements: (left) IASI surface temperature, and (right) DOFS for the O_3 profiles.

Table 1. Mean values of surface temperature (K) and DOFS for the O_3 profiles for different seasons and latitude bands for the period 2008-2014 for daytime measurements. The standard deviation is also indicated.

Latitude range	Dec-Jan-Feb		Mar-Apr-May		Jun-Jul-Aug		Sep-Oct-Nov	
	Surface temperature	DOFS	Surface temperature	DOFS	Surface temperature	DOFS	Surface temperature	DOFS
60–90°N	250±3	2.31±0.11	260±2	2.50±0.06	277±2	2.98±0.05	265±2	2.72±0.08
30–60°N	273±4	2.91±0.09	285±2	3.14±0.06	295±2	3.41±0.05	287±2	3.28±0.05
0–30°N	298±2	3.72±0.04	301±2	3.73±0.03	302±3	3.74±0.03	301±2	3.79±0.03
0–30°S	299±2	3.76±0.03	299±1	3.76±0.03	296±1	3.67±0.04	298±2	3.69±0.04
30–60°S	284±2	3.25±0.04	283±1	3.22±0.03	280±1	3.13±0.04	280±2	3.12±0.04
60–90°S	255±2	2.52±0.07	247±2	2.15±0.06	246±2	2.65±0.12	245±2	2.70±0.08

2. Results presented on Figure 1 and the corresponding discussion in the text are misleading on my opinion. By looking at this pictures and reading the text one might get a false impression that IASI retrievals reasonably represent a seasonal ozone depletion over Antarctica. But careful examination of results presented in sections 3-5 and on Figures 3-7 reveals that IASI retrievals have significant problems over Antarctica. Specifically, in section 4.1 authors demonstrated that largest differences between IASI and GOME-2 total ozone were observed over Antarctica (up to 30%) with the seasonal amplitude about 20% (see figure 7). Careful consideration of figure 6 (right column) shows that there is a clear gradient in IASI-GOME-2 differences between land and ocean surfaces. This gradient especially apparent in austral summer months (fig. 6, top right). Most likely this is related to the specific IASI instrumental/retrieval features (low brightness temperature ???). Largest disagreement between two IASI sensors are also found over Antarctica (Fig.4-5), which, perhaps, tell us that the retrieval algorithm is not robust over Antarctica (?). My point here is that with the current version of IASI ozone retrievals it is not possible to accurately estimate the Antarctic ozone loss (difference between winter O3 amount and min O3) and the size of the ozone hole because of large biases that strongly vary with the season and Earth's surface properties. Therefore, I think this figure (Figure 1) misleads readers and should be removed from the manuscript or should be moved into the section 4.1 and critical analysis of shown results must be provided.

We agree with the reviewer that overall largest differences between IASI and GOME-2 total ozone are observed over Antarctica during the austral winter and fall (up to 30% as shown in Fig. 7). However during the Antarctic ozone hole season (austral spring), the differences are generally lower than 10% (see Fig. 7 and Table 2 in the new manuscript). We think that Fig. 1 provides valuable information and should remain in the manuscript. As suggested by the reviewer we moved the figure (Figure 8 in the new manuscript) and corresponding description to Section 4.1 and added the following text: "*One has to be careful to the fact that although IASI is able to reproduce the spatio-temporal variability of TOCs, it remains difficult to accurately estimate the Antarctic ozone loss and the size of the ozone hole from IASI data because of large biases in the region*."

Specific comments:

1. Page 4, l.29-32: It is mentioned later in the manuscript (in section 5) that a priori information used in FORLI does not depend on latitude. However, this is not described in this section. Does the a priori depend on a season? Considering a poor IASI sensitivity to the middle stratospheric ozone (shown on Figure 2), I would assume that having reasonable a priori constraints, which vary with latitude and month, will improve retrieved profile and total ozone. Please, explain in this section the reason for choosing latitude independent a priori constrains.

As mentioned in this section:

The *a priori* information is composed of:

- a covariance matrix constructed from the McPeters/Labow/Logan climatology of O_3 profiles, which combines long-term satellite limb observations and measurements from O_3 sondes (McPeters et al., 2007).
- a vertical constant profile that is the mean of the climatology.

Therefore the current version of the retrieval algorithm relies on a single O_3 *a priori* profile and variance-covariance matrix.

It is likely that having an *a priori* profile depending on latitude/month may improve retrieved profile and total ozone, although there are other disadvantages (eg see George et al. (2015) who discuss the two options for CO, by comparing MOPITT (variable *a priori*) and IASI (single *a priori*) retrievals.

To make it clearer, l. 29-32 have been changed to:
"The a priori information consists of a covariance matrix $\mathbf{S_a}$ *constructed from the McPeters/Labow/Logan climatology of* O_3 *profiles, which combines long-term satellite limb observations and measurements from* O_3 *sondes (McPeters et al., 2007) and a global a priori profile* $\boldsymbol{x_a}$ *that is the mean of the ensemble. Therefore only one single* O_3 *a priori profile and variance-covariance matrix are used in FORLI."*

We added the following text in Section 5 (p. 18 l. 9-12 of the new manuscript):
"*Other possible reasons for the larger bias in the UTLS can be the limited IASI vertical resolution, spectroscopic uncertainties on ozone line or the use of inadequate a priori information. In particular the impact of using a priori constraints varying with latitude and/or month has to be tested yet.*"

2. Page 4-5, l. 33: It is stated here that due to a large volume of measured data by IASI, O3 retrievals are performed only for cloud clear or almost clear scenes. It remains unclear if IASI ozone retrievals are sensitive to clouds, and avoiding cloud contaminated scenes helps reduce errors, or retrievals are not possible in presence of clouds. This should be explained here.

We agree with the reviewer that the sentence was not clear. Retrievals are only performed for clear or almost-clear scenes not because of the amount of data but because the pixels are impacted by clouds.

The sentence has been changed as follow (changes in bold):
"***In order to avoid cloud contaminated scenes,*** *retrievals are only performed for clear or almost-clear scenes with a fractional cloud cover below 13%, identified using the cloud information from the*

Eumetsat operational processing (August et al., 2012)."

3. Figure 2, and corresponding discussion on page 5, l. 15-27:
3.1 First it is not clear why authors decided to divide the altitude range on 4 different partial columns.

We considered partials columns instead of the vertical profile because of the small number of independent pieces of information in the profile. We divided the altitude range on four partial columns based on the Wespes et al. (2016) study showing that these columns contain around one piece of information with a maximum sensitivity approximately in the middle of each of the layers and reproduce the well-known cycles related to chemical and dynamical processes characterizing these layers. To make it clearer, l. 15-17 have been changed to :
"*Because of the small number of independent pieces of information retrieved from the profile, which vary between 2 at high latitudes and 4.5 in the tropics (c.f. Fig. 2), in the following we assess ozone partial columns instead of the vertical profile. We divide the altitude range to four vertical layers: surface-300 hPa (TROPO for troposphere), 300-150 hPa (UTLS for Upper Troposphere and Lower Stratosphere), 150-25 hPa (LMS for Lower and Middle Stratosphere) and 25-3 hPa (MS for Middle Stratosphere) based on the Wespes et al. (2016) study showing that these columns contains around one piece of information with a maximum sensitivity approximately in the middle of each of the layers and reproduce the well-known cycles related to chemical and dynamical processes characterizing these layers. In the following, as ozonesonde profiles are generally available up to 30 km, the MS column is limited to 10 hPa.*"

3.2 After careful examination of AKs shown on Figure 2, I cannot agree with the authors' statement that three independent layers can be retrieved in cases of medium and high thermal contrast. Specifically, right plot on Figure 2 shows AKs in case of high thermal contrast, and AK for layer 300-150 hPa (red curve) peaks at the nominated layer, but has long tails below and above with almost _50% of information laying outside of the layer. I would hesitate to call considered layers "independent". Another prominent feature that authors didn't describe in the text is a very broad AK for the stratospheric ozone layer (25-3 hPa) without a clear peak and with a tail in the troposphere.

Taken globally, we found that the DOFS for the entire profile is larger than 3 and reaches ~4.5 in hot tropical regions, indicating that a minimum of three independent layers can be retrieved. Exception is only found (DOFS ~2.5) in very cold polar regions. A deep analysis of the IASI sensitivity to the O_3 vertical profile is provided in Wespes et al. (2016) who analyse the O_3 retrievals and variations in the so-defined layers.

Even if it is true that upper and lower atmospheric levels contribute to each other, we note that the maximum of sensitivity is located in the middle of the selected layers. For more consistency, "independent" should be changed by "almost independent" layers.

The goal of Fig. 2 is to illustrate that in case of high thermal contrast the IASI sensitivity near the surface increases. To make things clearer, we updated the figure (Fig. 1 in the new manuscript) and show one more representative example of AK in case of high thermal contrast.

In the new manuscript, the text has been changed to:
"*Figure 1 illustrates an example of averaging kernels for one mid-latitude IASI observation on 15 July 2014. The averaging kernels present four maxima located around 2 km, 8 km, 15 km and 22 km, and the total DOFS is 4.2. As shown in previous studies, the IASI sensitivity to tropospheric O_3 peaks between 6 and 8 km, with some seasonal variability (e.g. Clerbaux et al., 2015). However in case of significant thermal contrast (i.e. the difference of temperature between the ground and the atmospheric layer just above it), the sensitivity of IASI increases near the surface (Boynard et al., 2014). For the example illustrated in Fig. 1, the measurement is performed at a location associated with a large thermal contrast (18 K) and hence the averaging kernels corresponding to the*

troposphere exhibit two maxima, allowing to separate the boundary layer and the free tropospheric O_3 concentrations."

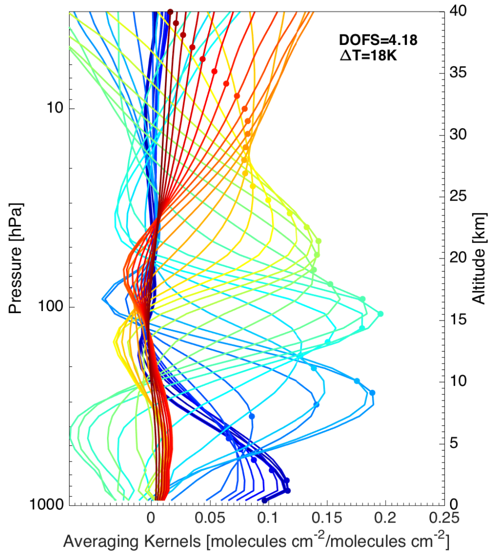

Figure 1: Examples of IASI-A averaging kernel functions for a daytime mid-latitude measurement (31.3°N, 46.7°E) obtained on 15 July 2014 for each 1 km retrieved layers from the surface to 40 km altitude (color scale). The total DOFS and thermal contrast are also indicated.

4. Page 7, l. 33. Authors emphasize that one of the benefits of IASI is its ability to provide O3 measurements in the winter season. However, this point is not clear to the reviewer, because IASI's sensitivity depends on thermal contrast, which I assume is very low during polar winter season. Do you think these winter time ozone retrievals will be reliable for the scientific applications?

Regarding the factors impacting the IASI sensitivity, we invite the referee to refer to response to comment 1. We agree that surface temperature is lower during winter than during the other seasons, and we anticipate the tropospheric column to be less reliable at the high latitudes. However, a previous study demonstrated IASI's ability to capture the seasonal characteristics of the ozone hole, during polar nights, which makes the nighttime IASI TOC product over Antarctica reliable for the scientific applications. We added the following sentence to make this point clearer:
"*Scannell et al. (2012) demonstrated IASI's ability to capture the seasonal characteristics of the ozone hole, in particular during polar winters, despite the low surface temperature and therefore the lower IASI sensitivity*."

5. Page 12, l. 12-17. Higher correlation for the layer surface-300hPa was found in the tropics. Authors explain this by the fact that IASI retrievals are more sensitive to tropospheric ozone in tropics because of higher surface temperature. At the same time in section 2.2 (page 5) the thermal contrast was defined as "a difference of temperature between the ground and the atmospheric layer just above it". I assume that in the tropics the difference between surface temperature and boundary atmospheric layer temperature should be fairly small, meaning low IASI sensitivity. Please, clarify that.

Regarding the factors impacting the IASI's vertical sensitivity, we invite the referee to refer to response to comment 1. As illustrated in Fig. 2 of the updated manuscript surface temperature depends on latitudes and is higher in the tropics, leading to higher DOFS and thus higher IASI sensitivity in this region. Figure R1 (below) illustrates the seasonal distribution of thermal contrast for day- and nighttime measurements. We can see that thermal contrast is higher during the day over land as well as for dry and sparsely vegetated regions.

However, based on Referee #3 comment, we removed this sentence since the variability in O_3 is lower in the Southern mid-latitudes, which could lead to the lower correlation coefficients.

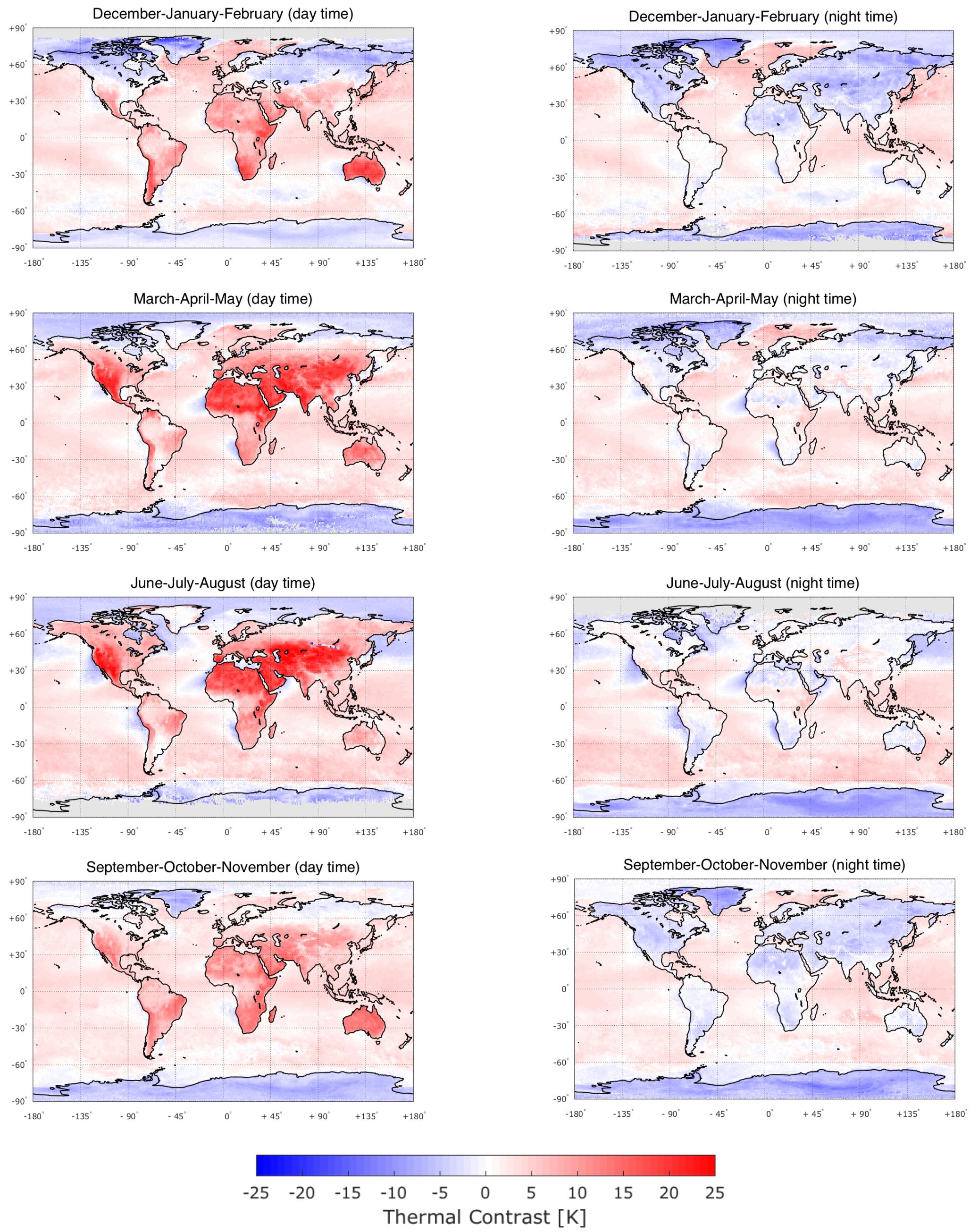

Figure R1: Seasonal and spatial distribution of thermal contrast obtained from EUMETSAT L2 data for the year 2014, for day- and nighttime measurements.

6. Section 5. In this section IASI partial ozone columns for four atmospheric layers are compared with ground-based sonde measurements. Authors heavily based their conclusions on the analysis of correlations. But interpretation of high correlations as a good agreement between two time series could be misleading in some cases. I would prefer that authors show the time series of IASI partial ozone columns along with sonde values at least for several locations to support their conclusions.

As suggested by the reviewer, in the updated manuscript we show the time series of the monthly mean relative differences between IASI and sonde O_3 partial columns for different zonal bands in the North and South Hemisphere (Fig. 15 and 16 in the new manuscript). Note that as Referee #3 asked to better describe the methodology for calculating the relative difference for each comparison, the methodology for calculating the relative difference between IASI and sonde data was changed. However, only the new statistical results (Table 5 in the updated manuscript) slightly change. The methodology is better described in Section 5.

We made the following changes:

"*Figures 15 and 16 show the time series of the monthly mean relative difference between IASI-A and ozonesonde partial columns for the period 2008-2014 for different zonal bands in the NH and SH, respectively. The differences between IASI-B and ozonesonde are not included since the number of available ozonesonde measurements is limited in 2014. A main feature that arises from this figure is the pronounced seasonality in the differences between IASI and sonde O_3 partial columns at high latitudes (except for the surface-300 hPa column), with the lowest differences found in summer and the largest differences found in winter. This is due to the large difference in surface temperature (c.f. Fig. 1) between winter and summer at these latitudes compared to the mid-latitudes and tropics. We also can see a small but apparent seasonality in the differences for the Northern mid-latitudes, especially for the 150-25 hPa column. In the high latitudes, the IASI surface-300 hPa column generally appears little biased with respect to the sondes, compared to the other partial columns. Actually this reflects the low sensitivity of IASI associated with low brightness temperature in the troposphere. As shown in Eq. 1, in such situations, the IASI retrieval mostly provides the a priori information. At high latitudes for both hemispheres, the bias and standard deviation are larger for the 300-150 hPa column during winter. This may be attributed to the strong variability in O_3 in those regions because of stratosphere-troposphere exchange. No seasonal dependence is apparent in the Southern mid-latitudes and the tropics, which is due to the little seasonal change in surface temperature (c.f. Table 1). The large standard deviations found in the tropics and the Southern mid-latitudes are due to the lack of ozonesonde data (c.f. Fig. 13).*
A detailed statistical comparison between IASI and sonde O_3 was performed for the four partial columns considered in this study (see Table 5). Globally, IASI is in good agreement with sonde O_3 partial columns with correlation coefficients of 0.74-0.89 and bias ranging from -10 % in the troposphere to ~14 % in the MS. The best agreement between IASI and sonde O_3 is found for the 150-25 hPa partial column with correlation coefficients ranging from 0.76 to 0.88 (except for the tropics). This is due to the fact that the maximum of O_3 is located in this part of the atmosphere. Note that the low bias found in the UTLS region in the middle latitudes and tropics should be treated with caution since IASI is negatively biased in the upper troposphere and positively biased in the lower stratosphere as shown in Fig. 14. In the LMS and MS, IASI systematically overestimates ozone, with values generally ranging from 5 % to 40%. This suggests that the positive bias found for the TOC (c.f. Section 4) could be related to biases in the middle stratosphere where most of O_3 is located."

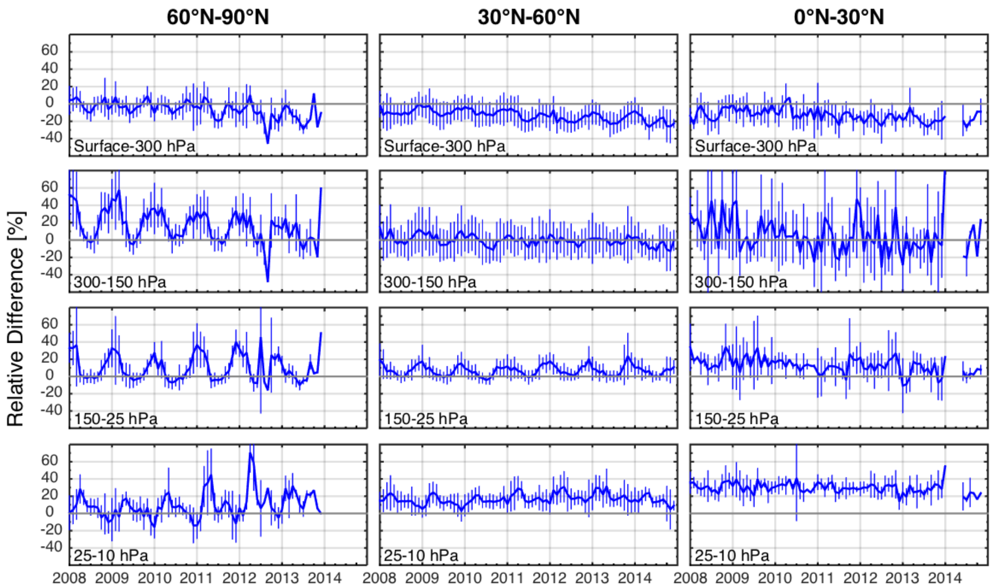

Figure 15: Monthly mean relative differences (in percent) between IASI-A and co-located smoothed ozonesonde for four different partial columns in the North Hemisphere: surface-300 hPa, 300-150 hPa, 150-25 hPa and 25-10 hPa, characterizing the troposphere (TROPO), the upper troposphere and the lower stratosphere (UTLS), the lower/middle stratosphere (LMS) and the middle stratosphere (MS), respectively. The error bars display the associated monthly mean standard deviation. The relative difference (in percent) is calculated as (100 x (IASI–SONDE) / SONDE).

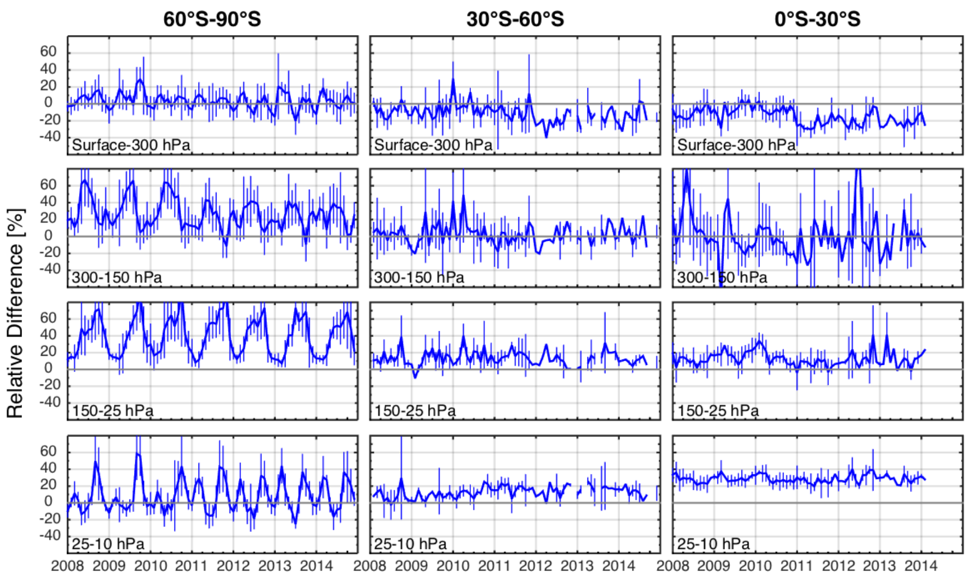

Figure 16: Same as Fig. 15 for the South Hemisphere.

7. Page 8, l. 15. Please, explain the effect of temperature profiles used in FORLI on ozone profile retrievals. This might be not obvious for readers. This could be done here or in section 2.2.

As suggested by the referee, we added the following text in Section 2.2:
"The total error on the O_3 profile retrievals is estimated statistically in FORLI, and different contributions to the total error can be isolated: from the limited vertical sensitivity, from the measurement noise, and from uncertainties on fitted (water vapor column) or fixed (e.g. surface

emissivity, temperature profile) parameters (Hurtmans et al., 2012). The errors introduced by the uncertainties on the temperature profile can contribute up to 10 % of the total error (Boynard et al., 2009) and thus, can have an impact on the retrievals."

8. Page 12, l. 25-27. Authors emphasize a good agreement between IASI A and IASI B instruments. But I think this is expected considering results presented in Section 3. There is no need to repeat this again.
As suggested by the referee, we removed the sentence.

9. Page 12, l. 27-29. It is not clear what authors describe here. It says that "largest bias and lowest correlation are found in summer". Is this statement about a bias between two IASI sensors? Is it for total column or specific layer? Can you, please, clarify that.
This sentence has been removed since it was related to Figure 14 (replaced by time series as suggested by the referee).

10. Page 12, l. 29. Considering that IASI is more sensitive to the lower stratosphere and troposphere, I don't understand why authors mentioned here a diurnal ozone cycle, which usually is observed at altitude above 3 hPa - above the top boundary of IASI retrievals. Please, explain that.
We removed this sentence.

11. Page 12, l. 30-33. It is stated that "the summer O3 values will change more in 50 min than in winter and hence the difference is more pronounced in summer than in winter." First of all, please, clarify whether you mean total ozone or tropospheric ozone. I would expect that total ozone varies more in winter months when dynamical processes are stronger. If you aware about some studies that can support your statement, please, add references. Secondly, it seems to me that this discussion of IASI-A and IASI-B comparisons is not relevant to validation against sondes. It might be better to move it in section 3.
We removed this sentence as well as the IASI-A and IASI-B comparison discussion.

12. Figure 13. Typically, ozone concentration is shown on a linear scale rather than log scale. One of the important characteristic of the successful ozone profile retrieval is a representation of the ozone peak and changes in ozone vertical gradients. Showing ozone concentration as log values makes it impossible to see these features. Please, make X-scale linear on these plots. Since IASI profiles go up to 3 hPa, please, extend the vertical scale to 3 hPa and show IASI's ozone profiles (even though you will not have sonde data at those altitudes). This will show how well IASI retrievals capture the ozone peak.

As suggested by the referee, we made x-scale linear and extended the vertical scale to 3 hPa on Figure 13 (Figure 14 in the updated manuscript). As shown in Fig. 14, although IASI overestimates the ozone peak, it is able to represent the ozone peak altitude and the changes in ozone vertical gradients. We added the following paragraph in the text :
"*Looking at the ozone vertical profiles (left panels), we clearly see that IASI is able to capture the main features of the ozonesonde vertical distribution except at the high latitudes of the SH. Those are: i) The ozone peaks around 20-30 km depending on latitude ii) a decrease in the ozone maximum altitude increasing with latitude, and iii) sharp ozone gradients between the troposphere and the vertically stratified lower stratosphere. Another feature that we can see is the Northern high and middle ozonesonde profiles exhibiting a small filament, which is also observed by IASI. Although IASI overestimates the ozone peak, it is able to represent the ozone peak altitude and the changes in vertical gradients, which is one of the important characteristics of the successful ozone profile retrieval.*"

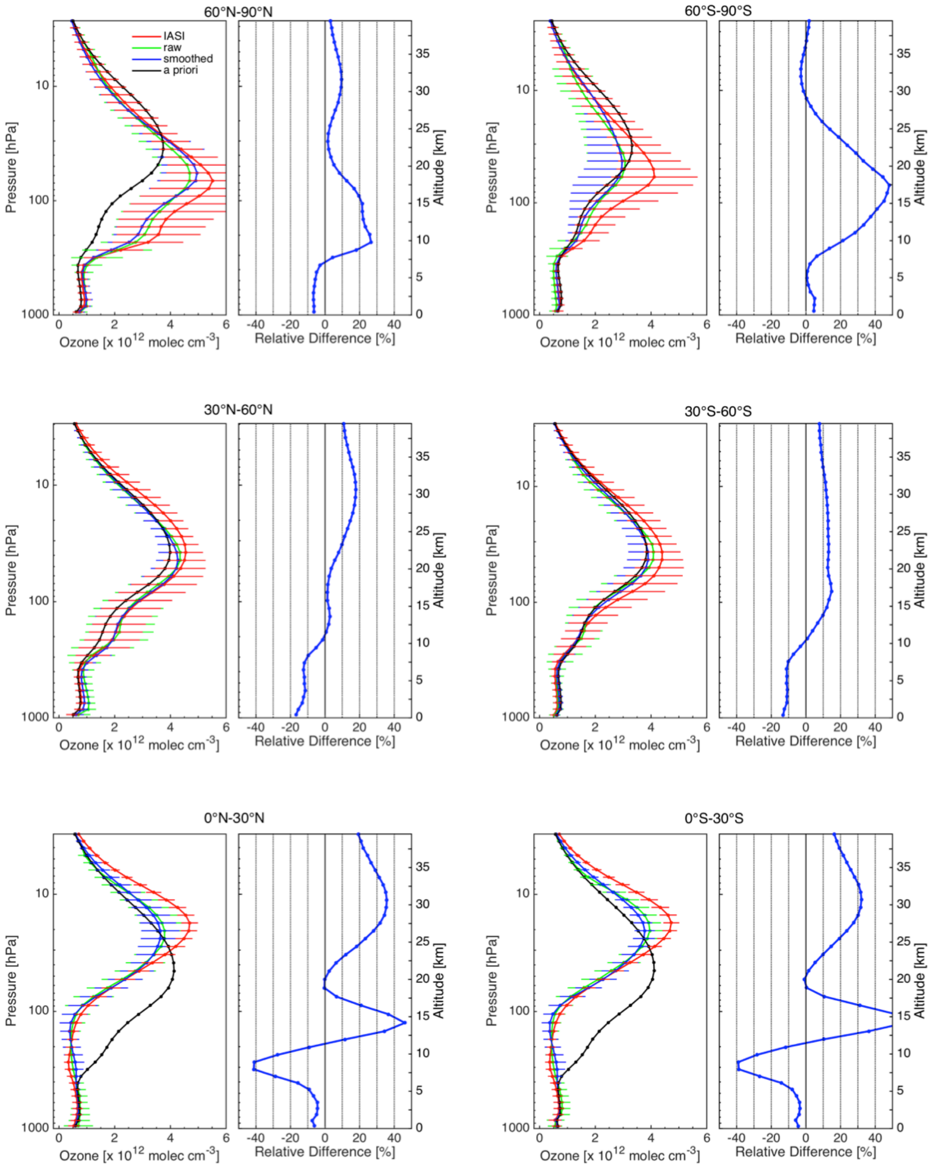

Figure 14: Left panels: Mean ozone vertical profiles retrieved by IASI-A (red), observed by the ozonesondes (green) and observed by the ozonesondes after application of the IASI averaging kernels (blue) for 30° latitude bands. The black line indicates the a priori O_3 profiles as used in the IASI retrieval with FORLI. Right panels: Vertical profiles of the relative difference (in percent) between the IASI retrieved mean profile and the smoothed ozonesonde mean profile.

13. Page 15, conclusions, #1: Please, indicate here that larger differences between two IASI sensors are observed over Antarctica with biases more than -10% in some seasons in the lower stratosphere.

As suggested by the referee, we added this sentence:
"Larger differences between both IASI sensors are observed over Antarctica with biases more than -10% for some seasons in the lower stratosphere. It is likely due to the low brightness temperature in this region."

14. Page 15, conclusions, #3:

14.1 Authors consider correlations as a measure of the successful agreement between sonde and IASI partial ozone columns. I will not agree with this conclusion, until authors show the time

series to support their conclusions (see my comment above).
As suggested by the referee and discussed previously, the updated manuscript includes time series of the difference between IASI and sonde ozone partial columns for different latitude bands to support our conclusions. We invite the referee to refer to response to comment 6.

14.2 Another comment here is that authors support their conclusions by saying that IASI sensitivity to tropospheric ozone is larger in the tropics due to higher surface temperature. My impression from section 2.2 is that thermal contrast (difference between surface and boundary atmospheric layer temperatures) is the leading factor that define IASI sensitivity, not just surface temperature. Please, explain that.
Regarding the factors impacting the IASI sensitivity, we invite the referee to refer to response to comment 1. Based on Referee #3 comments we removed this sentence since the variability in O_3 is lower in the Southern mid-latitudes, which could lead to the lower correlation coefficients.

15. Page 16, l. 3-5: What do you mean here by rough vertical sampling of 1 km? I assume IASI's vertical resolution is several kilometers in this altitude range versus _100 m for sondes. It is not clear how fine vertical sampling can change a coarse IASI's vertical resolution.

Ozone profiles are provided with a fixed number of vertical levels. Over the tropics, the number of levels in the UTLS is low. The smoothing of the ozonesondes will therefore interpolate the ozonesondes observations (which are more numerous) over the IASI altitudes, and therefore will lead to lower quality smoothing. We changes this part to:
"*Other possible reasons for the larger bias in the UTLS are the limited IASI vertical resolution, spectroscopic uncertainties on ozone line or the use of inadequate a priori information. In particular the impact of using a priori constraints varying with latitude and/or month has to be tested yet.*"

Minor/technical comments:
-Page 4, l. 29 and l. 31: a symbol for the a priori covariance matrix is not readable (I can't see it in my pdf version);
After checking the pdf version online, we confirm that the symbol for the a priori covariance matrix is readable.

-Page 7, l. 29: Please, add "Antarctic O3 hole" to "...except for the O3 hole season...";
We made the change.

-Page 8, l. 10-11. I agree with the statement about a "larger seasonal change in transport at high latitudes", but I doubt that "the seasonal cycle of photochemical activity" is "more pronounced" at high latitudes. Do you mean photochemical production in the troposphere or stratosphere? Please, add references on related studies.
We removed the sentence.

-Page 12, l. 20. Should be "and positively biased"
We made the change as suggested by the referee.

-Page 13, l. 11-12. Please, introduce coefficients n1, n2, n3.
Done. The corresponding sentence has been changed to :
"The line lists of the two databases HITRAN 2012 and HITRAN 2004 differ by 15 transitions of the very weak hot band v1+2v2+ v3-2v2- v3 in the mentioned above spectral range, ***where v1, v2 et v3 are the three vibrational modes of ozone.****"*

-Page 13, l. 27-28. I would suggest to change "upper stratosphere" to "middle stratosphere", because most of the atmospheric ozone is concentrated between 20 and 35 km.
"upper stratosphere" has been changed to "middle stratosphere" as suggested by the referee.

-Page 14, l. 8-9. It seems that "18%" and "13%" will be more accurate estimates based on results shown on fig. 18.

The values have been changed to 18% and 13% as suggested by the referee.

-Page 14, l22-25. I would suggest to replace "no improvements" with "no significant changes".
As suggested by the reviewer, we replaced "no improvements" with "no significant changes".

-Page 15, l. 31. I would suggest to spell out "LUT" in the conclusions.
As suggested by the reviewer, LUT is spelled out in the conclusions.

-Page 16, l. 2: It is not clear from the context what "a smaller bias" means here. Please, consider to re-phrase this part.
We agree with the reviewer and rephrased this part as follow:
"*No significant improvement is found the troposphere*"

References

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