Response to Ellis Remsberg

We would like to thank E. Remsberg for his constructive and positive comments. The comments and proposed corrections have been taken into account and helped improving the paper. Each comment has been addressed as detailed hereafter.

Specific comments

(1) Introduction, p. 3, line 68—I would argue that it is difficult to use such column data for quantitative studies of the HNO3-ozone cycles.

We understand that you are referring here to the different vertical sensitivity of IASI for ozone (O_3) and nitric acid (HNO_3). This is indeed a good point. We are confident, however, that this would not be such an issue, considering that there is quite a good vertical sensitivity for O_3 (DOFS ~ 3-4) allowing the distinction of a stratospheric column (sometimes even two independent columns within the stratosphere), and that most of the information about HNO_3 (whether considering a total or a stratospheric column) is located in the same lower part of the stratosphere. This type of parallel study for O_3 and HNO_3 was already conducted by Wespes et al. (2012).

However, the difference in vertical sensitivity would of course need to be adressed when analysing the two species in parallel.

(2) Section 5, p.10, line 303—The overestimation by IASI of 47% is rather large in the lower stratosphere for Lauder. I note that the a priori profile for HNO3 comes from your chemistry transport model at up to 15.6 km altitude. Might this be a cause of the rather large bias?

First of all, it should be noted that Lauder and Arrival Heights data sets have been corrected after the manuscript was published; this was due to errors in the averaging kernels for both these stations. The comparison has been redone and all figures and tables have been updated with the correct values. No major differences were found but still the correction of the AvK improved slightly the comparison. The maximum relative difference in Lauder is now reduced to 37.2%., as can be seen below with the updated version of Table 3 for the profile validation (page 24, Table 3):

	Minimum (%) [altitude (km)]	Maximum (%) [altitude (km)]
Thule	0.4 [22]	12.5 [13]
Kiruna	-0.1 [24]	18.0 [13]
Jungfraujoch	0.1 [37]	25.8[12]
Izaña	0.21 [2]	45.0 [13]
Lauder	~~1.2 [39]~~ 0.7 [39]	~~47.2 [12]~~ 37.2 [12]
Arrival Heights	~~0.4[4]~~ 0.3 [4]	~~4.7[13]~~ 1.8 [13]

Despite of this and as you point out, the differences in Lauder and Izaña are still quite large. The a priori profiles do indeed seem to have quite a large impact on the IASI retrieval (see George et al. 2015 for the example of CO), hence on the comparison between the two data sets. It should also be noted, as is mentioned in the paper, that IASI uses a common a priori profile for all measurements, whereas FTIR stations use an a priori profile adapted to the

region. In our work, the influence of the a priori was examined with the example of Izaña and a short sentence was added in the conclusions to account for the fact that it might also explain the large differences observed in Lauder: "However, as was shown by the comparison at Izaña, the influence of the a priori profile on the validation can be quite large, and the application of a common a priori profile to both measurements largely improves the comparison. The difference in the a priori profiles could also explain in part the differences found at other stations (Lauder, for example)." (page 15, line 443-446).

(3) *Section 5, p. 11, line 308—Please add a few sentences about the hypotheses of Dufour et al. (2012). For example, I note that they discuss a likely interdependence for the retrieved partial ozone columns between the stratosphere and the UTLS regions.*

A few sentences about the hypotheses of Dufour et al. (2012) have been added to complete the paragraph on this open question: "While some hypotheses have been brought forward by Dufour et al. (2012), the exact reason for that particular feature of FORLI for both HNO_3 and O_3 retrievals is not clear. The loose constraint applied for the retrieval at these altitudes, combined with a lack of vertical sensitivity, could be one reason to explain the overestimation in the UTLS, as it might be that the UTLS concentrations are overestimated to compensate for lower values in the rest of the profile (Dufour et al., 2012). A more in-depth analysis would, however, be needed to assess this matter in more details." (page 11, lines 311-316).

(4) *Section 6, p. 13, lines 385-387—Day/night differences in HNO3, due to photochemistry, ought to be small in the tropics below about 25 km. Is this the issue that you are referring to?*

What we are referring to here is the fact that the diurnal variability (i.e. the 3σ standard deviation - grey shaded areas) is of the same magnitude as the retrieval error. Strictly looking at the figure, it is thus hard to assert that there is any diurnal variability. It means that the IASI measurements would not allow the monitoring of diurnal variability, even if there were any, considering that the error is too large.

(5) *Section 7, p. 14, lines 433-435—This finding is important and may be one cause of the positive bias of 47% that you found at Lauder (see Section 5 comment above).*

See Comment 2.

George, M., Clerbaux, C., Bouarar, I., Coheur, P. F., Deeter, M. N., Edwards, D. P., … Worden, H. M. (2015). An examination of the long-term CO records from MOPITT and IASI: Comparison of retrieval methodology. *Atmospheric Measurement Techniques*, *8*(10), 4313–4328. http://doi.org/10.5194/amt-8-4313-2015

Wespes, C., Emmons, L., Edwards, D. P., Hannigan, J., Hurtmans, D., Saunois, M., … 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. http://doi.org/10.5194/acp-12-237-2012