Dear Referee#1,

We would like to thank your suggestions in order to improve our manuscript, which are fully addressed below. Your comments appear in bold.

Best regards,
Omaira García et al.

Specific comments

1. The systematic seasonal differences in retrieved column ozone were attributed to the combination in differences in vertical sensitivities, tropopause altitude and the ozone evolution in tropospheric ozone as observed in Izania, a subtropical site (see Section 4.2): How large and how systematic are these differences in seasonal variation expected to be at extra tropical (mid-latitude and polar) sites, or in case of different humidity condition?

In order to analyse the feasibility and consistency of the ozone retrieval strategies presented in this work under different atmospheric conditions (humidity and ozone), we have retrieved the ozone total column amounts (OTC) from the FTIR solar absorption spectra recorded in the 1000, 3040 and 4030 cm^{-1} spectral regions for the polar site of Kiruna (67.8ºN, 20.4ºE, 420 m a.s.l.). For the analysis, we have considered the same time series as for the Izaña site (2005-2012). Please note that we don't have an easy access to FTIR solar absorption spectra representative for mid-latitude sites, although we would expect intermediate results between those observed at sub-tropical and polar latitudes due to the latitudinal distribution of ozone.

Figure 1 shows the time series of the OTC amounts obtained at 1000 cm-1 (our reference, upper panel) and the relative differences between 3040 cm^{-1} or 4030 cm^{-1} and the 1000 cm^{-1} OTC (middle and lower panel) for Kiruna site. Table 1 summarises the statistics of these relative differences.

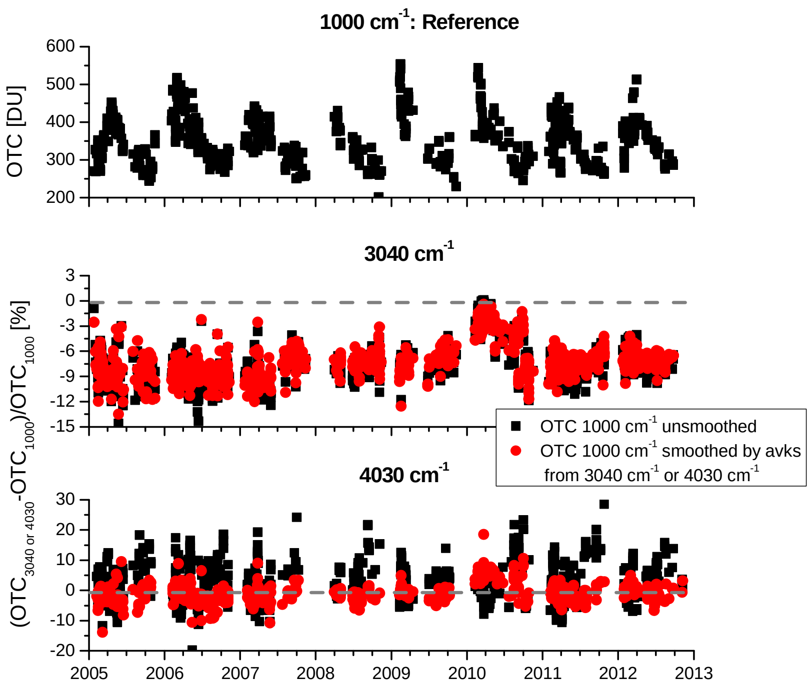

Figure 1. Times series of the OTC amounts retrieved at 1000 cm-1 at Kiruna between 2005 and 2012 (upper panel) and relative differences between 3040 cm^{-1} or 4030 cm^{-1} and the 1000 cm^{-1} OTC (middle and lower panel, respectively). The relative differences are shown for the unsmoothed ozone profiles at 1000 cm-1 (black squares) as well as after smoothing the ozone profiles at 1000 cm-1 with the 3040 or 4030 cm-1 averaging kernels (red dots).

	3040 cm^{-1}	4030 cm^{-1}
	Mean±SEM (STD)	Mean±SEM (STD)
OTC 1000 cm^{-1} unsmoothed	-7.76±0.07 % (2.2%)	2.59±0.23 % (6.6%)
OTC 1000 cm^{-1} smoothed by avks	-7.50±0.06 % (2.0%)	-0.78±0.11 %(3.1%)

Table 1. Mean and standard error of the mean, SEM, (shown in %) of the relative differences between the OTC retrieved for the different spectral regions, considering the 1000 cm^{-1} region as the reference. The standard deviation of the relative differences (STD) is shown in brackets.

The comparison results are very consistent to those found at Izaña. The systematic difference with respect to the OTC at 1000 cm^{-1} is about 7-8% for the 3040 cm^{-1} spectral region and only between 1- 3% for the 4030 cm^{-1} spectral region. This fact confirms the significant inconsistency between the spectroscopic ozone parameter (HITRAN 2012) of both regions, already pointed out by our work at Izaña. Furthermore, when the different vertical resolutions and sensitivities are accounted for (i.e., smoothed ozone profiles at 1000 cm-1), the scatter and the peak-to-peak amplitude of the relative differences is significantly reduced (Table 1). Please note that the scatter observed at Kiruna almost duplicates those found at Izaña, due mainly to the fact that polar sites like Kiruna shows the highest ozone values at a global scale as well as very marked/strong annual cycles (due to ozone transport from lower latitudes and ozone photochemical production/destruction). The peak-to-peak amplitude of the ozone annul cycle at Kiruna (about 150 DU) almost quadruples that observed at Izaña (about 40 DU).

Regarding humidity conditions, the two-step strategy used to retrieve the OTC reduces the water vapour interference error and makes it not critical for the ozone retrieval, as we can observe in Figure 2. This figure shows the scatterplot of the relative differences between the OTC retrieved for the different spectral regions versus the H2O total column in the slant path at Kiruna. Like for Izaña site, these relative differences are completely independent on the water vapour content.

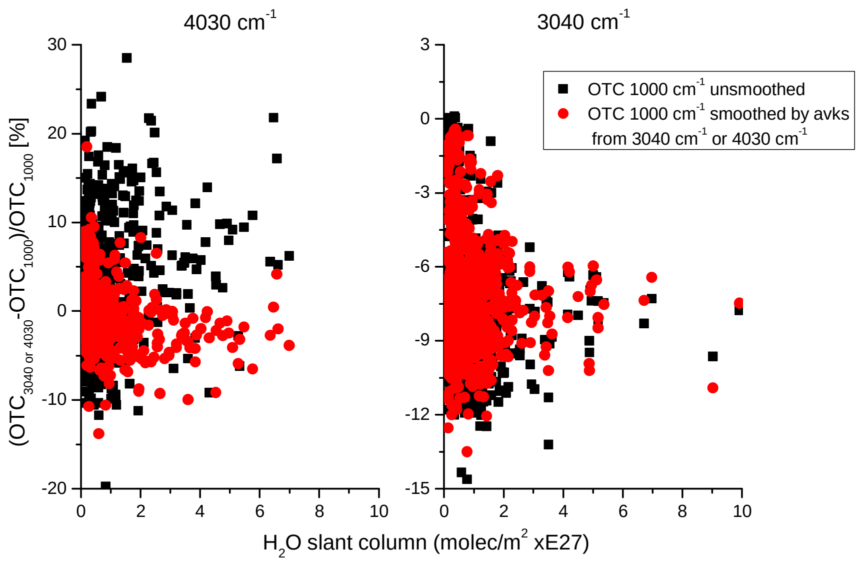

Figure 2. Scatterplot of relative differences versus the water vapour total column in the slant path.

2. At the end of the Abstract and in Section 4.3 the authors argue, that the examined series demonstrate the long-term stability ("good consistency") of the OTC (ozone total column amount) retrievals for 2005-2012 as deduced by the FTIR measurements of Izania using a rather sophisticated procedure. For (even more convincing) support of this point I recommend to compare the FTIR-data with collocated Brewer data, also taking into account the newest development of the analysis of Brewer data (see A. Redondas, R. Evans, R. Stuebi, U. Köhler, and M. Weber, Evaluation of the use of five laboratory-determined ozone absorption cross sections in Brewer and Dobson retrieval algorithms, Atmos. Chem. Phys., 14, 1635–1648, 2014, doi:10.5194/acp-14-1635- 2014.

The high quality and consistency of the FTIR ozone products retrieved in the 1000 cm^{-1} spectral region (standard reference for the NDACC community) have been extensity documented by several works in the literature (e.g. Barret et al., 2002; Schneider et al., 2008a,b; Vigouroux et al., 2008; Lindenmaier et al., 2010; Viatte et al., 2011; García et al., 2012, 2014). In particular, part of these studies has been carried out at the Izaña Observatory in different periods, showing that the high quality of the FTIR ozone observations is very consistent over time. For example, Schneider et al. (2008) found an agreement of 99.6% between Brewer and FTIR OTC amounts for the 2005-2007 period, with a systematic difference of 4.8% and a scatter of about 0.5%. These values are well reproduced by the works of Viatte et al. (2011) and García et al. (2014), considering OTC observations performed in 2009 and 2013, respectively. In particular, the latter found a correlation of 99.8%, a scatter of 0.45% and a systematic difference of 4.3% between Brewer and FTIR OTC data. Please note that this study used the most updated Brewer ozone data using ozone cross sections presented by Redondas et al. (2004).

We consider that the intercomparison of the Brewer and FTIR OTC data might be the scope of the other work as well as the consistency of the FTIR OTC products is well documented in the literature. We will add some references to Section 2.2 (Ozone Retrieval Strategy) to support the consistency and high quality of the FTIR OTC products obtained at the Izaña Observatory as follows:

"As aforementioned, the 1000 cm-1 region is the standard NDACC ozone microwindow, thus, it will be our spectral region of reference. At Izaña, the OTC FTIR observations retrieved in this spectral region are continuously compared to coincident Brewer UV spectrometer and ozone radiosonde measurements, documenting their high quality and consistency over time (Schneider et al., 2008a, b; Viatte et al., 2011; García et al., 2012, 14)."

Reference: Redondas, A., R. Evans, R. Stuebi, U. Köhler, and M. Weber, Evaluation of the use of five laboratory-determined ozone absorption cross sections in Brewer and Dobson retrieval algorithms, Atmos. Chem. Phys., 14, 1635–1648, 2014, doi:10.5194/acp-14-1635- 2014.

3. You might also consider how the FTIR instruments operated in NDACC could contribute to the goals of the TCCON network as they might be interested in synergies as well.

The TCCON network is affiliated with the NDACC/Infrared Working Group (NDACC-IRWG) and most of the currently operational ground-based FTIR experiments contribute to TCCON, to NDACC or to both networks (e.g. the Izaña Observatory).

Although both networks have different working philosophy (different spectral regions, different spectral resolution, etc), the atmospheric observations given by both networks are completely complementary. In this sense, combining TCCON/NDACC observations could allow us to document the quality and consistency over time of long-term FTIR observations or to detect possible instrumental issues.

4. For the general readers of AMT it might be useful to provide some additional information on the status and planning of the TCCON network: How many stations are presently operated/planned at TCCON? How many sites could produce column ozone data and how many sites would need additional technical installations?

Following the referee's recommendation, we will add the number of the TCCON sites currently operational and the number of them already operating an InSb detector to provide OTC products from the 3040 cm−1 region in "Conclusions" as follows:

"The final conclusion of our study is that solar absorption spectra of the 3040 cm−1 region – if measured at a high spectral resolution (about 0.005 cm−1) – are well suited for monitoring OTC. NDACC FTIR sites routinely measure this spectral region, but currently only a subset of TCCON FTIR operates an InSb detector to cover near

infrared spectra > 3000 cm−1 (about 15 out of the 22 sites currently operational). In the light of the above results, adding such detector and/or recording this solar absorption spectral region at high resolution might be desirable and useful for TCCON sites. Hence, both NDACC and TCCON ground-based FTIR experiments might contribute to global ozone databases."

5. I suggest to consider to include the concrete recommendation in the Abstract (not only in the conclusions)

Following the referee's suggestion, we will add the following statement at the end of the Abstract of the revised manuscript:

"These findings demonstrate that recording the solar absorption spectra in the 3000 cm^{-1} spectral region at high spectral resolution (about 0.005 cm^{-1}) might be desirable and useful for TCCON sites. Hence, both NDACC and TCCON ground-based FTIR experiments might contribute to global ozone databases."