Response to RC2

The authors describe the successful characterisation and quantitative measurement capabilities of a new optical absorption instrument called MULTICHARME installed at the CHARME atmospheric simulation chamber in Dunkirk. The instrument is capable of measuring rovibrational transitions over the range of infrared to THz radiation with path lengths from 120 m to 280 m in the THz and up to 540 m in the IR range. Measurements of N_2O and O_3 are shown, highlighting the potential for the distinction of isotopic composition and kinetic investigation.

We would like to thank RC2 for its comments and time to read our work. Please find below the different responses, we have brought.

Why was a zero-biased detector chosen for the THz radiation, instead of a typically more sensitive, powered alternative?

There are presently no active sensors available in the THz region. On a laboratory scale it is possible to use a bolometer which is more sensitive than a zero-biased detector but requires cryogenic cooling. We observe significant standing wave that produce strong baseline variation in our measurements. Using a zero biased detector our measurements are limited by the baseline variations rather than the detector performance. We would therefore expect identical results using a bolometer.

On Page 15, Line 370 you describe the loss processes for ozone before your THz measurement begins. However, if the losses occurred already during the ozone injection, the photometer should also have shown a lower value, no? And also, how long is the pumping time to reach the THz measuring pressure, such that it could explain the loss of half of the ozone? Is this consistent with the resulting wall losses in Section 3.2.3?

Taking into account the remark of RC2, the sentence *"An unknown quantity of ozone was introduced at atmospheric pressure into CHARME. Based on the time calibration of the generator, performed with a photometric O_3 analyzer, and the injection time, the calculated number density is 500 ppmv. Then the ASC was pumped down to 1.5 mbar and the THz spectrometer was used to detect and quantify O_3 traces from individual rotational transitions"*

has been replaced by:

"Based on the calibration of the ozone generator, performed with a photometric O_3 analyzer, and the injection time (90 min), the ozone volume ratio introduced in CHARME was estimated around 500 ppmv. Then the ASC was pumped down (in 45 min) to 1.5 mbar and the THz spectrometer was used to detect and quantify O_3 traces from individual rotational transitions. The O_3 wall losses occurring during the ozone introduction as well as during the pumping procedure contribute to reduce the ozone mixing ratio to an unknown lower value which will be measured by THz spectroscopy.".

Can you elaborate on the relatively larger error bars for the ozone detection between ~460 and 600 minutes in Fig. 8b, also with respect to how the LOD for ozone was determined?

According to both remarks of the two reviewers, in the revised version, we detail the determination of the LOD at the end of the subsection 3.2.2. The batch process used in Fig.8b used the same method to determine the LOD which constitutes the error bars. We agree with reviewer 2 than the largest error bars are observed between 460 and 600 min. According to the observed absorbances, the measured S/N ratio is clearly weakened during this period. It seems that the phase of the standing waves, which affect the baseline, drift with the time. These oscillations could interfere destructively with the absorption signal leading to an irregularity in the profile's evolution and associated errors. We can assume that the dispersion variations, which occurs in parallel with the absorption variations, involves the phase drift of

the baseline oscillations. One more time, the only outcome is to find a way to correctly model the baseline variations due to standing waves in MULTICHARME. This work is under progress and will be the subject of a future publication.

P16 L396: Why does the cleanliness of the chamber walls change with different ozone concentrations?

The ozone wall losses are dependent on the cleanliness of the walls since adsorbed VOCs can react with ozone and thus contribute to reduce its lifetime in the gaseous phase. As example, Wang et al. (Wang et al., 2011) have found that overnight treatment with ozone mixing ratio in the range of 100 ppmv followed by a secondary vacuum pumping was suitable to reach much longer ozone lifetime in the CESAM chamber.

All the technical corrections suggested by RC2 have been taken into account.