Anonymous Referee #1 Received and published: 3 July 2017

Reviewer comments in black.
Author responses in blue.

General comments:

The authors present the measurements of OCS using MkIV FTIR spectrometer from both balloon campaigns and ground-based observations, and analyze the long-term trend and seasonal cycle. OCS is suggested to provide additional insights on carbon cycle, because of its similarity to CO2 during plant uptake. To use column measurements in the application, the OCS variations in the troposphere need to be extracted out. In this paper, the N2O column measurements are used to account/correct the stratospheric variations, because OCS and N2O share a similar profile shape and N2O is stable in the troposphere, which has been used on CH4 in other studies. This paper is a valuable contribution for making use of the OCS column measurements on the tropospheric variation. I recommend publication of this work in ACPD ACP after minor revisions.
Thank you.

Specific comments:
1. Line 51: it may worth to write the current uncertainties of using OCS to study the carbon cycle, such as the ocean and soil. It does not need to be a full review, but not mentioning it at all could not give the readers a clear view on the topic.
Agreed. Added the sentences: " CO_2 measurements alone can only determine net biosphere flux, but cannot differentiate between photosynthesis and respiration. OCS is also taken up by plants during photosynthesis but is not respired, and so may be able to help distinguish between these processes (Wang et al., 2012).

2. Line 125: could you explain more detail on why the weaker OCS bands provide more information than the strong bands at lower altitudes? Maybe show the AVKs from different bands.
L125 doesn't say "more information", it says "additional information". At low tangent altitudes the strong OCS lines of the v3 band saturate and also become blacked out by strong interfering absorption by H2O and CO2. Look at the lower panels of figure 1. Blacked out OCS lines don't provide any information to the retrieval. The weaker OCS bands, however, are in less cluttered spectral regions and don't get so blacked out at the lower altitudes and therefore provide relatively more information to the retrieval.

3. Line 190: Can authors give the confidence level of the relationship? It would be good to mention this uncertainty when using N2O2K to correct OCS stratospheric variations.
Added the following sentence to the Fig.A.1 caption: " A straight line fitted to the N_2O^{2K} > 120 ppb data (417 points) has a gradient of 0.22489 +/- 0.00202, an intercept of N_2O =118.4 +/- 0.8 ppb, and a Pearson correlation coefficient is 0.982. "

4. It would be better show the linear fitting between P and N2O in Fig.A.2, and mark the Pb and b.
The right-hand panel of Fig A.2 shows P and N2O. Are you suggesting dropping the left hand panel?

It will help the readers to understand how the N2O column above Pb is calculated in line 724.
Agreed. I have added dotted lines with Pb and b labeled to figure A.2.

Technical corrections:

1. The format of the citations should be consistent, the authors sometimes use “()”, sometimes use “[]”. I think ACP uses “()”.
Agreed and done.

2. Line 27: the full name of CS_2 should go to the previous sentence where it’s mentioned the first time.
Done.

3. line 116: Figure 1: the titles of subfigures are cut off;
Yes, this is to stop it running into the next panel. I could completely remove the text at the top of each panel, but this loses information, like the zenith angle, tangent altitude, rms fit, etc. So I tried to crop it a bit more neatly.

the y-axis of upper right panel is not clear.
Are referring to the slight overlap of the y-axis annotation? If so, this has been fixed.

The same problem is also in the Figure 5.
I've tried to tidy it up by additional cropping, but it is still not perfect.

4. Line 706: change “N_2O=120 ppt” to “N_2O=120 ppb”.
Fixed.