

Dear editor,

Thank you for the comment. I introduced all suggested corrections to the article.

Here is my response to specific comments.

Kazutoshi Sagi

**Line 20: 'of O3 has been removed from where the potential temperature is 600K'
This is a strange phrase. I suggest replacing it by 'of O3 has been removed at the 600 K isentropic level'**

>> We have changed the sentence.

Line 26: comma after 'Therefore' ?

>> Fixed

Line 26: 'Therefore, the periods during which the temperature inside the vortex goes below the threshold for PSC formation are highly infrequent'

I don't agree with this statement, specifically with 'highly infrequent', which suggests that this essentially never happens. In fact, we do observe significant chemical ozone losses in nearly every second winter in the NH. They are not as strong as in the SH, admitted, but they do occur.

>> I agree that this wording may lead wrong conclusion. What we noticed here is that the dynamics in NH is warmer and less stable than in SH. We changed the 'highly infrequent' to 'limited'.

Line 30: 'January(e.g.)' -> 'January (e.g.)'

>> Fixed

Line 88: 'SMILES observed' and one line below 'It vertically scans'

Tense not consistent

>> We have changed the tense.

Line 92: ‘evolves over 24 h after 1 – 2 months’

This is a very imprecise statement. Can you provide a more accurate number, or is there a reasons for the large time range?

>> Because the height of the ISS orbit varies around 350 km, the precession time varies some what. However, I checked the measurements and it appears to be approximately 1 month. The text changed to indicate this.

Line 96: ‘There are THREE instrumental configurations .. : TWO different observation .. and TWO different AOS units’

I find this sentence confusing, because I’d expect 4 instrumental configurations?

>>

The paragraph is unclear. We have changed the texts as below,

SMILES operates in three frequency bands: 624.32 – 625.52 GHz (band A), 625.12 – 626.32 GHz (band B), and 649.12 – 650.32 GHz (band C). Bands A and B contains the emission line of ozone at 625.371 GHz. The spectra measurements are spectrally resolved with an Acousto-Optical Spectrometer (AOS), which has a bandwidth of 1.2 GHz and a resolution of 1.2 MHz. Since SMILES only has two AOSs, the bands were observed on a time-sharing basis.

Line 125: ‘The ozone and N2O used in this study profiles’ -> ‘The ozone and N2O profiles used in this study’

>> Fixed.

Sentence before equation (1) and the following paragraph: ‘For a flow field (u,v,w) ..’

This suggests that u, v and w are the three wind components having all the same unit, i.e. m/s. Looking at equation (1) and also at equation (4), this cannot be the case. Please specify the units of w so that this paragraph is consistent.

>> Fixed.

Line 171: ‘where, T are the absolute temperatures’ -> ‘where T IS the absolute temperature’

>> Fixed.

Line 183: 'Assimilated fields at PT of 400 K and 1000 K have also been produced for the boundary layers for the analysis period.'

This sentence confuses me and I suggest deleting 'for the boundary layers', because this phrase seems to relate to boundary layers that were already mentioned earlier. This is, however, not the case, as far as I can tell.

>> We removed the sentence.

Line 186: Comma after 'Therefore' ?

>> Fixed.

Line 191: '40 days prediction' -> '40 day prediction'

>> Fixed.

Line 197: 'The modified potential vorticity is referred to the potential temperature level of 475 K'

This sounds a little awkward. Suggest replacing by 'The modified potential vorticity is show at the 475 K potential temperature level' if that's the intended meaning of the statement?

>> Yes. We have changed the text.

Line 205: 'eg.' -> 'e.g.'

>> Fixed.

Line 228: ', there are exponential increases in σ caused by' -> 'an exponential increase in σ occurs caused by'

>> Fixed.

Line 236: 'The SMILES ozone abundance, as expected due to known biases, was approximately 0.1 ppmv lower than SMR ..'

Well, looking at Figs. 7 and 8, there are many areas with significantly larger differences. How did you determine the value of 0.1 ppmv? The value seems to significantly underestimate the actual differences between SMR and SMILES.

>> The value is actually taken from Fig. 20 in Kasai et al. 2013. In the paper, they used the criterion of ± 1 hour and ± 300 km to find correspondences. Thus, the value is moderated in some way. Figs 7 and 8, on the other hand, show the results at certain time. Using SMR ozone, because they have fewer measurements than SMILES and comparable noise to the background error, produces large variations. Thus, it seems that the SMR ozone map has areas with significantly larger value while it also has smaller value. When I calculated the average of the difference between SMR and SMILES ozone maps with using similar criterion to Kasai et al. 2013, the difference varied within 0.1 to 0.5 ppmv.

Line 254: ‘while for SMILES the total error reflects the variation inside the vortex.’

Looking at Fig. 9 this statement only appears to be valid after DOY 45 or so, right? Perhaps I’m missing a point here?

>> According to the Fig. 9, it is indeed obvious that the natural variation dominates the uncertainty on the assimilation of SMILES ozone after DOY 45. However, I would like to say that the statement is also valid for the times where a sufficient number of SMILES ozone measurements are available for the analysis such as in DOY -30 or around 30. In the analysis error you can see a linear increase indicated as a triangular features at DOY of -20, 45 and 70. These increases occur when the number of measurements available is low in the vortex in Fig. 3. They are results of the linear growth of background error described in Line 192. We have changed the statement.

Line 290: ‘. Khosrawi et al. (2011) .’ ??

>> This reference is related to the removed sentence. Because of latex compiling, we could not strike out any reference but this is removed in the latest revision.

Line 293: ‘Vortex average ClO in daytime and nighttime IS also presented ..’

>> Fixed.

Line 297: ‘Jan’ -> ‘January’

>> Fixed.

Line 302: '(-45 DOY)' -> '(45 DOY)'

>> Fixed.

Line 318: 'Fig 12' -> 'Fig. 12'

>> Fixed.

Line 320: 'agrees here with the model results' -> 'agrees with the results presented here' ?

>> Fixed.

Line 356: 'SMILES measurements with data assimilation technique' -> 'SMILES measurements COMBINED with A data assimilation technique'

>> Fixed.

Line 372: 'The accumulated ozone loss as of 31 March derived from SMILES was higher than that from SMR by ~ 5%'

What PT level are you talking about? Looking at Fig. 12, the relative differences are at most levels significantly larger than 5 %.

>> This statement is not for the 31 March but for the 28 Feb. The difference between two instruments show 5~10%. We have changed the text.

Regarding the NO_x driven ozone loss near 600K: this is also discussed in Sonkaew et al. (2014).

>> Added.

Line 405: 'doi:doi:'

>> Fixed.

Line 430: 'K.-i.' -> 'K.-I.' ?

>> Fixed.

Table 1, right column, lines 9 and 10: '0.875 sec' and '3.5 sec'

It's not clear what these times refer to, please clarify.

>> Fixed.

Caption Fig. 3, last line: 'only measurements with measurement response BELOW THAN a threshold of 0.85 are considered'

I'm sure you mean 'above a threshold of 0.85 ..', right?

>> You are correct. We changed it.

Fig. 5: the title of all 3 panels says 'Error (SMR) at ', which is not what the panels show.

>> Fixed.

Fig. 6: the caption speaks of 'yellow area', but it appears green on my screen and also on my printout.

>> Fixed.

Fig. 11, caption line 1: 'Vertical profiles of accumulated ozone loss as of 28 February 2010'

Please mention the reference date (start date) for the determination of the accumulated ozone loss.

>> Added the start date.