October 18, 2013

Author response to the comments of Reviewer #1 – Manuscript ACP-2013-457 *Longitudinal hotspots in the mesospheric OH variations due to energetic electron precipitation* by Andersson et al.

We would like to thank Reviewer #1 for the comments. We greatly appreciate the time and effort spent by the reviewer on our paper.

Response to the specific comments of Reviewer #1

1. **Comment:** Page 19898, line 19: "of about 13 orbits per day." Aura actually completes about 14.6 orbits per day, not 13.

   Response: Line 19 page 19898 was corrected as suggested by the Reviewer.

2. **Comment:** Page 19899, line 11: The systematic error of the H_2O/temperature data is typically less than 25 %/5 %. Can you provide the temperature error in K rather than %?

   Response: We now provide temperature and H_2O errors also in K and ppmv. Page 19899, line 11 was modified as follows:"The systematic error of the H_2O/temperature data is typically less than about 0.8 ppmv (25%)/3 K (5%) ".

3. **Comment:** Page 19899, line 21: "consists of two electron telescopes and two proton telescopes pointed approximately perpendicular to each other." This is just a minor point, but from the way the sentence is phrased it is not clear which telescopes are pointed perpendicular to each other.

   Response: The sentence on page 19899, line 21 was reformulated as follows: "consists of two electron telescopes and two proton telescopes. The pairs of telescopes are pointed approximately perpendicular to each other."

4. **Comment:** Page 19900, line 8: in 2005, 2006, 2008 and 2009. I think a brief explanation why 2007 is not shown would be appropriate.

   Response: We now add a brief explanation as follows: "Because the year 2007 is very similar to 2008, considering electron precipitation and OH, we omitted it from the Fig. 1 (and also from Fig. 2 later) for clarity reasons. However, our analysis is conducted for the whole period between 2005–2009."

5. **Comment:** Page 19900, line 11: "For each day of the year selected, a 1deg spatial resolution map of the median $>$ 30 keV fluxes was produced for each POES spacecraft in subsatellite coordinates." Was there a specific reason why median maps and not maps of the arithmetic mean electron fluxes were made? How would maps of the mean electron fluxes look like?

   Response: We are using median values because is much more representative of the tendency of the data set and is not affected by the outliers. In the 2s resolution data odd spikes can occur and one have to be careful when doing the mean of everything. However, we have checked how the maps of the mean electron fluxes would look like. The electron fluxes are slightly higher when taking into account mean values but the longitudinal distribution is preserved. Similar behavior we have observed with OH data.

6. **Comment:** Page 19900, line 18: In Fig. 1 the electron precipitation is confined to the geomagnetic latitudinal bands 55–72 N and 55–72 S and can occur at all geographic longitudes. I suggest adding lines showing 55 and 72 N/S magnetic latitude to the panels of Fig. 1.

   Response: We did try add the lines showing 55 and 72° N/S magnetic latitudes, however the plots do not look good and clear as lines cover the borders of precipitation.

7. **Comment:** Page 19900, line 26: "with lower electron fluxes observed between 15030W, i.e., North America (NAm) hot–spot." Perhaps Im not getting the point, but it seems to me that the fluxes between 150 and 30 W in the northern hemisphere are larger, not lower than in the remaining part of the latitude belt.

   Response: Indeed, fluxes between 150 and 30 W are larger in the NH. The mistake in the text was corrected.

8. **Comment:** Page 19902, line 17: "Figure 3 gives an example of the OH mixing ratios from SIC model run averaged between 70–78 km." Can you provide a brief qualitative statement as to the main reason for this local time variation?

   Response: We now provide a brief statement as to main reason for the local time variation. Lines: "A major part of the OH production is due to daytime water vapor photodissociation, which is absent between sunset and sunrise. This leads to a decrease of OH values during nighttime. Thus, considering the difference in local time, MLS nighttime OH observations made in SH should show higher values compared to those from NH." were added to the description of Fig. 2 (paragraph 2, section Results).

9. **Comment:** Page 19902, line 29: "of nighttime OH medians between 70–78 km and 2005–2009 You write 2005–2009". Does this imply that 2007 is now included?

   Response: Year 2007 is included in all calculation. We now clarify the text in Page 19900, line 8 (please see comment 4).

10. **Comment:** Page 19906, line 11: "The amplitude of the PC 1 is highly correlated with ECR" Looking at the bottom panel of Fig. 7 also shows periods with enhanced PC 1 values, but quite low electron count rates, e.g., immediately after March 2006. Possible reasons for this should be discussed.

    Response: We now discuss possible reason for the enhanced PC1 values at the beginning of March 2006 and in the middle of March 2008. Lines: "Note that the enhanced PC 1 values at the beginning of March 2006 are connected to the enhanced OH values at latitudes$>$ 70° N and longitudes $0 - 120°$ W, i.e., outside radiation belt latitudes. Similar OH enhancement, again outside the radiation belt latitudes, is observed in March 2008 at latitudes $>$ 70° S and longitudes $90°E - 120°$W. In the SH, the reason for such OH enhancement is unclear. In the NH, it could be connected to the descent of OH maximum layer, which occurred in 2006 after a sudden stratospheric warming event (Damiani et. al. 2010). " were added to the description of the Fig. 7.

    Here, we would like to also point out that EOF analysis was repeated. We have realized that equatorial regions should be removed from analysis in order to avoid possible impact from other

factors that could affect the OH variation (for example tides). The obtained results are the same with higher variance explained, i.e. 9% instead of 6%.

11. **Comment:** Caption Fig. 2: "Approximate geomagnetic latitudes" In what sense are these geomagnetic altitudes approximate?

    Response: Because Earth's magnetic field is changing over the time and the geomagnetic latitudes are calculated as a mean values between year 2005–2009 we use word "approximate".

12. **Comment:** Fig. 5: I assume that only nighttime measurements have been used to produce these Figures? Perhaps this should be mentioned explicitly in the Fig. caption.

    Response: Corrected as suggested by the Reviewer.

    Typos etc.:

13. **Comment:** Page 19896, line 22: which suggest → which suggests

    Response: Corrected as suggested by the Reviewer.

14. **Comment:** Page 19897, line 4: and loss process occur → and loss processes occur

    Response: Corrected as suggested by the Reviewer.

15. **Comment:** Page 19897, line 11: of the particle → of the particles

    Response: Corrected as suggested by the Reviewer.

16. **Comment:** Page 19897, line 12: see e.g. → see, e.g.

    Response: Corrected as suggested by the Reviewer.

17. **Comment:** Page 19899, line 13: Pickett et al. (2008); Lambert et al. → Pickett et al. (2008), Lambert et al.

    Response: Corrected as suggested by the Reviewer.

18. **Comment:** Page 19899, line 14: Note, that → Note that

    Response: Corrected as suggested by the Reviewer.

19. **Comment:** Page 19903, line 21: nightime → nighttime

    Response: Corrected as suggested by the Reviewer.

20. **Comment:** Page 19904, line 7: in average → on average

    Response: Corrected as suggested by the Reviewer.

21. **Comment:** Caption Fig. 3: from SIC model → from SIC model simulations ?

    Response: Corrected as suggested by the Reviewer.

22. **Comment:** Caption Fig. 7: for 6 selected month → for 6 selected months

    Response: Corrected as suggested by the Reviewer.