Interactive comment on “Diurnal variations of humidity and ice water content in the tropical upper troposphere” by P. Eriksson et al.

Anonymous Referee #2

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This is a review of ACP manuscript acp-2010-233 (“Diurnal variations of humidity and ice water content in the tropical upper troposphere”) by Eriksson et al.

This is an interesting paper that investigates the diurnal variations of water vapor and ice water content in the tropical upper troposphere through a synergistic use of multiple polar-orbiting satellite measurements. Although approximately 6-hourly measurements are not definitely sufficient to fully decompose the diurnal variations, since microwave measurements are less affected by clouds compared to infrared measurements, the results shown in this paper will help to supplement and improve the previous findings on the diurnal variation of upper tropospheric humidity. Furthermore, this paper presents the diurnal variation of ice water content for the first time. Thus, this paper is suitable for publication after the following issues are addressed.
Major comments:

1. Due to the temporal sampling issues of polar-orbiting satellites in comparison to geostationary satellites, the authors combined measurements of Odin-SMR, AURA-MLS, and CloudSat in order to determine the amplitude and phase of diurnal variations of water vapor and ice water content in the tropical upper troposphere. However, it should be noted that any bias between satellite measurements and possible orbital drift of satellites may distort both amplitude and phase of the diurnal variations. Therefore, it is required to confirm the consistency between these satellite measurements using a vicarious calibration method (e.g., Breon et al., 2000; Gunshor et al., 2008).


2. The authors addressed that AURA-MLS produces ice water content in addition to profiles of humidity and temperature. Thus, the AURA-MLS ice water content should be employed to supplement the poor spatial coverage of CloudSat. In addition, it appears more reasonable to include results of comparison between the CloudSat ice water content derived by the authors with the standard product.

Minor comments:

P11712, Line 10: ‘in the order of 6%’ to ‘∼7%’

P11712, Line 20: also show

P11713, Lines 22-29: More detailed analyses are given in Horvath and Soden (2008) and Sohn et al. (2008).


P11714, Lines 6-7: It is true that infrared measurements have sampling problems in the presence of clouds. However, the infrared measurements from geostationary satellites provide a superior temporal sampling compared to polar-orbiting satellites. Thus, this point should be addressed.

P11714, Line 27: Please delete ‘within’.

P11715, Line 7: the tropical upper troposphere

P11716, Lines 20-23: The observational time difference (∼6 hours) between CloudSat and Odin and the poor spatial coverage of CloudSat may induce uncertainties in the construction of retrieval database.

P11716, Line 22: Please clarify ‘weather information’.

P11717, Line 4: It seems that ‘the horizontal footprint size’ is a more accurate expression than ‘the horizontal resolution’.

P11717, Lines 5-6: Please provide references on the accuracy of retrieved RHi and ice water content.

P11717, Lines 16-17: What does ‘a 6 dB footprint resolution’ mean?

P11718, Line 13: a 13:40 h local time ascending node

P11719, Line 6: a 3-month spin-up

P11721, Line 14: member states

P11722, Line 6: were then
the humidity distribution

Needed to be rephrased.

the datasets

noisier

It is not clear what 'relatively local convection' means.

show

noisier

show

observes

typo ('tho')

show

How about 'previous observational studies' instead of 'what can be expected from previous observations'?

amplitude and phase of the diurnal variations

meaningful

respective

accurately

combinations

second and third paragraphs: The vertical phase distributions of high cloud diurnal variations are presented in more detail in Tian et al. (2004) and Chung et al. (2009).


P11730, Line 1: relatively
P11730, Line 1: double maxima
P11730, Line 19: provide
P11731, Line 6: captures
P11731, Line 15: the IFS is
P11732, Line 13: also show
P11732, Line 22: Please clarify ‘the measured’.
P11733, Line 1: the diurnal variation
P11733, Lines 12-15: Needed to be rephrased.
P11733, Line 19: occurs
P11733, Line 22: 05:00 h
P11734, Line 4: How about ‘atmospheric layer’ instead of ‘region’?
P11734, Line 18: maximum or peak
P11734, Line 19: an early morning maximum
P11735, Lines 14-15: The RHi variations in ERA data were found to be excellent agreement with the observations.
P11735, Line 22: a little difference

Table 1: The diurnal amplitude over the tropical Indian Ocean is smaller than that over the northern Pacific Ocean. In addition, the diurnal amplitude is significant in spite of the small mean value over the northern Pacific Ocean. Is there any reason?

Table 2: Is there any reason that the northern Pacific Ocean has a significantly large diurnal amplitude?

Figure 1: It will be better to superimpose the geographical distribution of wind vectors.

Figure 1: (Caption) The red and cyan

Figures 2 and 3: It would be more reasonable to change the order of two figures.

Figure 4: (Caption) CloudSat.

Figure 5: (Caption) Fig. 4 instead of Fig. 1

Figure 7: It is difficult to identify the satellite-estimated IWC of the northern Pacific region due to the legend box.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 11711, 2010.