

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

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First and foremost, we would like to thank referee 1 for the detailed assessment of the manuscript and valuable suggestions for improvement. The late reply from our side depends vacation for the first author.

General comments:

The introduction tries to summarize studies of diurnal variations by satellite data, not reviewing different techniques for satellite observations. The referee wants a more detailed discussion of the sensitivity of IR sounders, but, since as we are not using IR data, this seems to be irrelevant. We would like to emphasize that we are not question-

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ing the value of IR observations. The manuscript contains the sentence (referring to IR observations): "Thus, this type of instrument is not optimal for studying the diurnal cycle of the upper tropospheric water budget." This sentence will be removed. It is unnecessary as there exist no such observations. Mm data are less affected by clouds (see further below), which is also emphasized by referee 2, but can not be claimed to be "optimal".

Stefan Buehler is a close colleague and we are fully aware of his work around AMSU-B. AMSU and geostationary IR observations give the relative humidity for the 200-500 hPa layer. We selected a somewhat higher altitude range, for several reasons (see manuscript) which renders these data sources irrelevant. To make this clear, a first title of the manuscript included "uppermost troposphere", but after a discussion with the editor this was changed to "upper troposphere".

A more detailed presentation of the Odin-SMR RH_i retrievals is requested. Even though CloudSat and MLS are more well known instruments, we do not see any reason to treat SMR differently, the corresponding sections for CloudSat and MLS are maybe even more brief. The issues raised are described in detail by Rydberg et al. (2009). However, it will be clarified that RH_i is directly retrieved from the observations.

The request for a more detailed description of the alternative CloudSat retrievals is well justified and will be provided (by extending Section 2.2.2). This section will also describe how the CloudSat data have been averaged (both horizontally and vertically), as suggested by the referee. (No Odin-SMR averaging kernels were used. A pure "rectangular" weighing in both dimensions was applied, were the rectangular window sizes were set according to the spatial resolution of Odin-SMR.)

The first paragraph of Sec 3.2 will be rewritten, to avoid the obscurities and possible misinterpretations. Though, we do not agree that the text imply that the ice particles are the primary source of moistening, but the present discussion will be removed as it is incomplete and, anyhow, not necessary.

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The fuzzy terminology regarding “convection strength” on pages 11726 and 11730 will be corrected (or be removed).

The term “thin cloud” is vague and will be avoided (as it depends on observation technique).

Section 2 gives the time coverage and output frequency of the model data. The treatment of the model data is otherwise described in the start of Section 4, but the referee comments show that some information is lacking, and the text will be extended.

The referee discussed how observation errors/limitations can affect the conclusions. This is a critical point, that we have considered and discussed in detail. Unfortunately this consideration/discussion did not make it into the text. In addition, the derived diurnal cycles have some implications for the error characterization of the instruments and these aspects should also be reported. Regarding this, the main criticism of referee 2 and that a quite extensive discussion is needed, we will add a new section (3.4 Discussion) treating these issues and extending the concluding section accordingly.

Editing, grammatical . . . :

All suggestions and corrections make sense and will be followed, with one exception. In fact, Figure 7 contains the observed mean IWC for the N. Pacific region, but the values are very small (and can easily be missed).

Patrick Eriksson for the author team

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