Review of AMTD paper, Manuscript Number: amt-2011-28

Response to the comments of Reviewer #2

We thank the reviewer for the careful review and the helpful and constructive comments, which we fully took into account in the revision of the paper. Please see our detailed response below.

Minor comments

- *Several descriptions used the adjective of singular instead of plurality, examples: Page 2750, line 2: Single RO profiles, page 2752, line 11: single satellites, page 2754, line 15: single measurements, etc. It may confuse readers what the authors want to describe, singular or plurality?*

  Even though we found this style in other well known manuscripts written by English native speakers (e.g., Schreiner et al. (2007, 2009), who write about "two single patch antennas"), we rephrased these sentences:

  - page 2750, line 3: ~~Single~~ RO profiles can be used to build climatological fields . . .
  - page 2752, line 11: The number of high quality measurements provided by a single satellite within one month . . .
  - page 2754, line 13: RO climatologies are obtained from "binning" and "averaging" of ~~single~~ RO profiles . . .
  - page 2754, line 15: To derive these RO climatologies from individual measurements . . .
  - page 2758, line 7: Knowledge of the observational error of individual RO profiles . . .
  - page 2758, line 13: In monthly mean 10° zonal mean ~~single~~ CHAMP or GRACE-A climatologies . . .
  - page 2758/2759: the statistical error s_{statErr} for ~~single~~ CHAMP-type satellites . . .
  - page 2775, line 11: . . . can be calculated from ~~single~~ RO profiles . . .
  - page 2784, figure caption: Number of F3C (top) and CHAMP/GRACE-A (bottom) measurements as a function of latitude for each month (light lines) from 2007 to 2009 (note the different y-axis scale). Data from individual F3C satellites are depicted in different blue lines, . . .

- *Page 2754, line 16: Could you specify what the "common altitude grid" indicates? What is the vertical resolution? If the vertical resolution is coarse, then it may smooth some information from RO.*

  It is a common 200 m grid. We now specify this in the text and write:

"To derive these RO climatologies from individual measurements, profiles are first interpolated to a common 200 m altitude grid."

- *Page 2759, line1–4, and Fig. 2: Can all the error representation in the same way (in percentage)? Example for geopotential height and temperature.*

  We prefer showing error characteristics of physical quantities, which decrease exponentially with altitude, in units percent, but errors of geopotential height and temperature in meter and Kelvin, respectively. This terminology is in agreement with other publications like Leroy (1997); Rocken et al. (1997); Hajj et al. (2002) and our own previous publications. However, we now include a sentence specifying the errors' units and also briefly point to the relationship between absolute temperature errors given in Kelvin and relative temperature errors given in percent:

  Error estimates of parameters with exponential altitude dependence (bending angle, refractivity, dry density, and dry pressure) are given in percent, while errors of dry geopotential height and dry temperature are given in absolute units (meter and Kelvin, respectively). The temperature errors given may be readily scaled to relative errors as well, by multiplying them by 0.4 %/K (from the reasonable approximation that 100 % is 250 K).

- *Fig. 2: Is there any explain to the distribution of the F3C sampling errors at polar regions? It always shows positive at south hemisphere and negative at north hemisphere for all the parameters except the bending angle. For example: one of the F3C shows the error increasing from $-0,5$ % at $30° N$ to -2 % at nearly $90° N$ in dry pressure sampling error (left bottom panel).*

  Figure 2 shows April 2007, 2008, and 2009 sampling errors of different atmospheric parameters as a function of latitude, averaged between 20 km and 25 km altitude. Largest sampling errors always occur in regions with high atmospheric variability, i.e., at high latitudes. Compared to the other satellites, two F3C satellites (FM-3 and FM-4) show a distinctively larger sampling error, which is positive in the southern hemisphere and negative in the northern hemisphere. This is explained as follows:

  A closer look at the temporal sampling of FM-3 reveals no measurements from April 16, 2009 to April 26, 2009. In 2007, FM-4 did not deliver measurements from April 10 to April 13, April 16 to April 19, April 23 to April 27, and on April 30. Because of these significant measurement gaps temporal sampling of these individual satellites is not equally distributed within these months, yielding an enlarged sampling error at high latitudes. In both cases, monthly climatologies miss the atmospheric state mainly in the second half of the month of April, when atmospheric temperature decreases in the southern hemisphere and increases in the northern hemisphere, yielding a positive sampling error in the southern hemisphere (i.e., RO climatologies are too warm) and a negative sampling error in the northern hemisphere (i.e., RO climatologies are too cold).

In order to give readers who may pose themselves a similar question some hint to this behavior, we now added in subsection 4.2.1 to the discussion of Figure 2 before the sentence "A simple sampling error model was derived . . . " as follows:

The two blue sampling error lines from F3C that appear to exhibit some distinctly larger error at high latitudes are the flight models FM-3 and FM-4. The reason is that FM-3/FM-4 incurred significant measurement gaps in April 2009/2007.

(The sentence "A simple sampling error model. . . " is moved to start the follow-on paragraph now so that an adequate length of paragraphs is still ensured.)

- *Page 2762, line 21–23: The description within the bracket can be omitted. More details are already described in section 4.2.1.*

  We agree with the reviewer that this statement can be omitted. We removed it accordingly and refer to section 4.2.1. The sentence now reads:

  "Using OPSv5.4/CLIPSv1.3 RO climatologies provided by WEGC, sampling error estimates are available for each climatological field except for bending angle and dry geopotential height

  (see Sect. 4.2.1 for the derivation of bending angle and dry geopotential height sampling errors)."

- *Page 2763, line 17: Some sampling error close to zero which always happen in the bins at some altitude levels. On which levels? Is there any reason why it always happened at some specific levels?*

  There are no specific altitude levels, with sampling errors close to zero. It can happen at any single altitude level. In general, sampling errors are smallest in regions with low atmospheric variability.

  To avoid confusion, we now rephrased this and write as follows:

  "Note that if the original sampling error at some altitude level is incidentally very small (close to zero),

  ~~which will always happen in the bins at some altitude levels,~~ the residual sampling error ratio can formally become a very large quantity in utilizing Eq. (10) plainly."

- *Page 2766, line 1–4: The sentence of "This bending angle. . . " should be added some comma for easy reading.*

  We rephrased this sentence and included some commas. The sentence now reads:

  "This bending angle change , which is associated with the 11-year solar cycle, was estimated. . . "

- *Page 2767, line 9: The sentence ". . . assumed to be somewhat larger than for other atmospheric. . . " may be revised as ". . . assumed to be somewhat larger than that of other atmospheric . . . ".*—done.

- *Could the characters for axes and labels in each figure become larger? They are too small.*

  When preparing the manuscript we had the final layout in mind. We will make sure that the font size in the final paper version is sufficiently large.

References

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