

Response to Referee #1

Manuscript Number: amt-2010-203

Manuscript Title: An assessment of differences in lower stratospheric temperature records from (A)MSU, radiosondes, and GPS radio occultation

Authors: F. Ladstädter, A.K. Steiner, U. Foelsche, L. Haimberger, C. Tavolato, and G. Kirchengast

We thank the Referee for the valuable review. We will implement the following changes according to the Reviewer's suggestions:

Section 2.1 *“This section would benefit from just adding two or three sentences describing which RO data that actually are used as input to the analysis. In Section 3.1 it is mentioned that the RTTOV radiative transfer model is used to compute layer-averaged TLS from RO data. But which RO data is used as input to this model? Is it just a simple vertical weighted-averaging of RO temperature profiles, or is it something more complex based on refractivity or bending angle profiles. If RO temperature profiles are used, is it dry temperatures or 1D-Var temperatures? I do not suggest to go into any detail, but it is important for the reader to know more precisely which RO data that is actually being used.”*

Thank you for this input. We will include the following information to Section 2.1: “We use dry-temperature profiles in an altitude range of 4 km to 35 km at a vertical resolution of 0.1 km. The RO specific dry-temperature is essentially the same as actual temperature at altitudes above 10 km where moisture is negligible (Scherllin-Pirscher et al. 2011). Therefore it can be directly used to study the (A)MSU lower stratosphere channel of interest here (Steiner et al. 2007, 2009).”

Section 2.1, Line 4 *“Is it really correct to refer to excess phase versus time as an ‘excess phase profile’?”*

We will change “excess phase profile” to “excess phase data” to avoid confusion.

Section 2.1, Line 12 *“‘distributed almost uniformly’: uniform with respect to what: over month, day, local time, or spatially over latitude and longitude?”*

We will clarify the statement by reformulating the last sentence of Section 2.1: “In both cases the observations are distributed almost uniformly in space and time within each month.”

Sections 3.2 and 4.1 *“As shown by Figure 5, the sampling errors are larger at high latitudes compared to low latitudes. This is also discussed in Section 4.1. A 2.5 degree longitudinal grid means that the collocated ECMWF profiles have a spatial resolution comparable to the RO observations at low and mid latitudes, but a higher spatial resolution than the observations at high latitudes. This is a simple consequence of extracting profiles from an equal-angle grid without doing any further spatial smoothing. It means*

that the high-latitude collocated ECMWF profiles include a larger variability than the low-latitude profiles, leading to a larger sampling error. Now to my question: Is it obvious that this effect is negligible, or could it add to the latitudinal distribution shown in Figure 5? It's just an idea - I do not require that you address this in the paper."

We agree that defining the sampling error for the polar caps would indeed require a more detailed discussion, which is out of scope of this work (but is a matter of discussion in our research group in the context of further improvements of error estimates, especially at high latitudes). Since this study focuses on comparison of TLS temperatures between 70 N to 70 S, we decided to now limit Figure 5 to 70 N to 70 S as well, in order to make the figures consistent. (This also addresses a comment of Referee #2 why this figure in particular shows the bands pole to pole.)

References

- Scherllin-Pirscher, B., G. Kirchengast, A. Steiner, Y.-H. Kuo and U. Foelsche (2011). 'Quantifying uncertainty in climatological fields from GPS radio occultation: An empirical-analytical error model'. In: *Atmos. Meas. Tech. Discuss.* 4, pp. 2749–2788. DOI: 10.5194/amtd-4-2749-2011 (cit. on p. 1).
- Steiner, A., G. Kirchengast, M. Borsche, U. Foelsche and T. Schoengassner (2007). 'A multi-year comparison of lower stratospheric temperatures from CHAMP radio occultation data with MSU/AMSU records'. In: *J. Geophys. Res.* 112, D22110. DOI: 10.1029/2006JD008283 (cit. on p. 1).
- Steiner, A., G. Kirchengast, M. Borsche and U. Foelsche (2009). 'Lower Stratospheric Temperatures from CHAMP RO Compared to MSU/AMSU Records: An Analysis of Error Sources'. In: *New Horizons in Occultation Research: Studies in Atmosphere and Climate*. Ed. by A. Steiner, B. Pirscher, U. Foelsche and G. Kirchengast. Berlin Heidelberg: Springer. DOI: 10.1007/978-3-642-00321-9_18 (cit. on p. 1).