Review of "An assessment of differences in lower stratospheric temperature records from (A)MSU, radiosondes, and GPS radio occultation" by F. Ladstᵘadter et al., manuscript submitted to Atmos. Meas. Tech. Discuss.

General comments:

The manuscript demonstrated the importance of taking sampling errors into account when comparing temperature records from radiosonde and GPSRO. Accounting for this source of error leads to improved consistency between radiosonde and GPSRO anomalies. However, some assumptions and methods in the current manuscript are not clearly outlined in the method section (see below). Further descriptions and according revision are necessary to provide sufficiently complete and precise information to allow their reproduction by fellow scientists (traceability of results).

Further explanation and possible (major) revision of the current manuscript is recommended.

Specific comments:

Section 1 Introduction:

> 1. P2132, line 10:
>
> "The bulk temperature of the TLS .. These two channels closely match each other purposely, to ensure ….
>
> Here the authors imply AMSU ch9 weighting function is very close to MSU ch4 weighting function (e.g., AMSU TLS is equivalent to MSU TLS). This is simply not true. Accordingly to Mears, et al., (2008, Jtech), AMSU ch9 weighting function has a very complex relation relative to that of MSU ch4, and it will need to take lots of effort to "merge" MSU data (before 2004) and AMSU data (mainly after 2004) into one consistent dataset.
>
> Please revise.
>
> 2. P2134, line 7:
>
> " … are based on TLS layer-average brightness temperature (MSU-equivalent")."
>
> As stated above, since MSU TLS is different form AMSU TLS, please

explain why MSU-equivalent TLS is used here (why don't use AMSU-equivalent TLS where AMSU data are dominated after 2004 ?).

Section 2 Data:

Section 3 Method (Are the scientific methods and assumptions valid and clearly outlined ?)

Some assumptions and methods are not clearly outlined in the Method section.

1. P2134, line 12:

"We use RTTOV .. to compute layer-average TLS from RO and the collocated ECMWF temperature profiles".

Although it is not mentioned explicitly here, I assume a similar approach is also applied to RAOBCORE data to define TAOBCORE TLS (as shown in Figures 6, 7 …).

Please clarify that if a similar approach is also applied to RAOBCORE data ?

Since the vertical resolution between RAOBCORE and RO and ECMWF are very different, it would be good to know what are the vertical resolution of RO, ECMWF and RAOBCORE profiles and how will that affect the TLS estimates using RTTOV?

Are RAOBCORE profiles on standard vertical levels only (200 hPa, 100 hPa, 50 hPa etc) ? Does RAOBCORE have high enough vertical resolution to compute equivalent TLS like RO and ECMWF ? Are RAOBCORE and RO and ECMWF TLS differences due to vertical resolution mismatch negligible ? If they are not negligible, how do you justify the rest of the sample error estimates when there is still TLS vertical sample mismatch (between ECMWF and RAOBCORE, and between ECMWF and RO, and between RAOBCORE vertical sampling errors and RO vertical sampling errors) ?

These further descriptions are necessary to provide sufficiently complete and precise information to allow their reproduction by fellow scientists (traceability of results).

2. Page 2135, line 15:
"We do not consider sampling error for (A)MSU because we can assume that the error reaches virtually zero due to high horizontal resolution of the dataset."
Is this also a true assumption for temporal coverage ? It is mentioned in

2

the introduction section that "Further errors affecting (A)MSU data including shift in the diurnal variation etc. Are you assuming RSS, UAH, and STAR data have no "temporal" sampling errors ? Are there any references to support this assumption ?

3. Page 2136, section 3.3:
    The manuscript describes the TLS anomaly values as being obtained by first removing the seasonal climatology for 2002-2009 and then removing the sampling errors. In this way seasonal variations in the sampling errors (e.g. Figure 5) re-introduce seasonal variability into the de-seasonalized data. For anomaly comparisons, the sampling errors should be removed first before the 2002-2009 seasonal climatology is calculated and removed.

    Please revise all related plots.

4. Page 2137, line 4-5:   "In Fig. 5 the resulting sampling error for radiosondes and RO is shown for 20 zonal bands from 90 S to 90 N"

    Shall it be from 70S to 70 N ?
    The RO sampling changed in 2006 with the advent of COSMIC. Why is there no indication of a corresponding change in the magnitude of the sampling error (Figure 5 bottom) ?

5. Page 2137, line 21: "Temporal sampling of radiosondes (00:00 UTC and 12:00 UTC) seems to be sufficient to capture the diurnal cycle."
    The manuscript cannot claim to capture the diurnal cycle based on the sentences that follow.

Section 4 results (Are the results sufficient to support the interpretations and conclusions ?)

    1. Page 2140, line 2:   "Comparing the RO reference climatology with radiosondes, we showed the importance of taking into account these error characteristics also for radiosondes."

    The manuscript refers to "climatology" when it should refer to "anomaly". All references to climatology in the manuscript should imply the mean seasonal variations over the 2002-2009 time period. All references to anomalies should imply the monthly mean values which have had their climatology removed.

    2. Page 2140, line 10:   "We conclude that this results from the radiosonde network missing the atmospheric variability over the oceans, particularly in NH winter."
    This conclusion should be supported by partitioning the data

3

according to land/ocean.

3. Page 2140, line 28: "We suppose that the time range in Steiner et al. (2007) was still too short to detect significant trends in all latitude ranges."

This supposition could readily be supported by applying the methodology of this manuscript to the shorter time period 2001-2006.

4. Page 2141, line 4: "This indicates that a better vertical resolution (than provided by layer-average TLS of the (A)MSU instrument) is of advantage."

The purpose of applying of the RTTOV forward model to RO profiles is so that TLS temperatures with the same vertical resolution can be compared to each other. This conclusion should be removed.

Section 5 Summary and Conclusion (Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

1. Page 2133, section 2.4:
Exactly what ECMWF data is being used? Will the sampling error estimates change if some other dataset is used as a reference? What is the uncertainty introduce by this method ?

2. Page 2133, Section 3.1:
GPSRO, radiosonde, and ECMWF all have different vertical resolutions. The manuscript should clarify how RTTOV is applied consistently to each.

3. Page 2157, Figure 9: Find a way to get the labels "XXX-RO" lined up for clarity.