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Discussions

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Interactive comment on "The tropical tropopause layer in reanalysis data sets" *by* Susann Tegtmeier et al.

Anonymous Referee #3

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General comments:

This paper evaluates the temperature structure and tropopause characteristics in the tropical tropopause layer from various meteorological reanalysis data sets. The paper is generally well written and the results of the comparison are valuable for the community. Therefore, I recommend publication after the following specific and technical comments have been addressed.

Specific comments:

1. As accurately stated in p4 L44-45, this paper investigates "key characteristics of the temperature and tropopauses in the TTL". The title, however, gives the impression that other TTL properties are also being investigated (i.e., too broad). I suggest revising

the title to indicate that the study focuses on the temperature structure and tropopause characteristics in the TTL.

2. The reasoning for choosing a certain data for certain analyses and is not always clear. Without sufficient explanation, it appears that the authors are cherry picking their results. For example:

a. Why doesn't the vertical profile for CFSR (green) in the right panel of Fig. 4 extend down to 140 hPa? Fig. 1 shows that CFSR has a model level at or just above the 140 hPa level. One of the key results, as presented in the text (e.g., Summary), is that tropical mean temperatures between 140 and 70 hPa in CFSR agrees best with those of GNSS-RO observations. I would like to see the CFSR data point near 140 hPa.

b. I would also like to see a panel using ERA5 data in Fig. 7. In all previous analyses and plots, ERA5 data are shown, but not here. Since ERA5 dataset is the newest of these reanalyses, readers will be most interested in seeing this result.

c. In Fig. 10, the temperature anomaly time series at 70 hPa (top panel) includes a time series using the RAOB radiosonde data. The second panel showing the temperature anomalies at the cold-point tropopause includes a time series using the IGRA radiosonde data. Why are the radiosonde data sources different in these two panels? Is there a reason for showing one data at 70 hPa and another at the cold point?

d. Why doesn't the right panel of Fig. 11 include data points from RATPAC, RICH and RAOBCORE (as in the left panel)?

e. The choice of radiosonde dataset in Fig. 12 is HadAT and RAOBCORE. Again, it is unclear why these two radiosonde data were chosen for this particular analysis. Perhaps it is best to stick to the same set of radiosonde data throughout the entire analyses?

3. There is a lot of discussion about the vertical resolution for obvious reasons (e.g., large impact on tropopause temperature). There is no mentioning of the horizontal

resolution of the reanalyses data used for these comparisons. While the horizontal resolution likely plays a limited role, it would be good to document what resolution was used.

Technical comments:

- p5, L20: RATPAC data are mentioned, but none of the results shown in the paper use this data.

- The second paragraph of Section 2.1 describes the various GNSS-RO measurements assimilated by the reanalyses, which are shown in Table 1. Table 1 also shows MetOp and C/NOFS data, but these are not mentioned in the text.

- p6, L32: ATOVS suite has a higher number of channels *compared to TOVS*?

- p6, L42 and p7, L12: What do you mean by "high vertical resolution"? How much higher are they compared to those of the reanalyses discussed in detail here?

- p7, L7: Is RICH also a radiosonde data (like RAOBCORE)? It is the first time this data set has been mentioned.

- p7, L5: ERA-40 reanalysis data are not analyzed in this paper. Best to leave it out?

- p8, L12: Section 3.1 does not exist. Do you mean Section 3? Or Section 2.1?

- While I see the Fig. 3 caption describing the overlapped symbols, I suggest using a different symbol so that all the data points are visible.

- It may be worthwhile to mention again at the beginning of Section 4 that the interannual variability of ERA5 variables are not analyzed due to the short data record. The sentence "In particular, . . .interannual variability" on p22, L25-28 is slightly misleading since the interannual variability in ERA5 is not analyzed.

- p17, L34: I am having difficulty seeing the positive temperature anomalies related to Mt. Pinatubo eruption in Fig. 10 (top two panels). . .

- The color of the lines for GNSS-RO and JRA-25 in Fig. 10 are difficult to distinguish. I suggest using a different color (or line style?) for JRA-25.

- Fig. 11 caption: It would be helpful to mention the 1980-2010 time period in the caption.

- p21, L31: "small negative bias at model levels *and small bias shift*, has the most realistic. . ."