Review of

Observed changes in the temperature and height of the globally resolved lapserate tropopause

by Ladstädter et al.

This study provides an update of the lapse-rate tropopause trends based on GNSS-RO data. Tropopause height and temperature trends are provided globally with a focus on seasonal and regional features. The direct comparison of long-term changes of tropopause height and temperature allows a better understanding of the coupling of these quantities. The manuscript is well written and clearly structured. I recommend publication after the following comments have been addressed.

Major comments:

1. The results are clearly presented; however, detailed discussions of potential drivers of the trends are missing. There are a few hints on possible mechanisms, but these remain highly speculative. To give one example in line 152-153 a possible connection between tropopause changes in the subtropics and tropical widening is mentioned. What is the mechanism of this potential connection? Would it also impact tropical tropopause trends? Here and in other places, please add more detailed discussions as this would greatly benefit the manuscript.
2. Connected to the point above, please clarify the potential role of BDC transport changes for tropopause trends. How could BDC changes impact the tropopause in the tropics and at mid- to high latitudes? Are the observed tropopause trends consistent with BDC changes derived from observations? Line 135 hints at such a consistency, but ignores the hemispheric asymmetry in observed BDC changes derived from trace gas observations and also found in reanalyses. Is all of this consistent with model results?
3. Discuss if and how sampling inhomogeneities between the earlier GNSS-RO missions such as CHAMP and GRACE and later missions such as COSMIC can impact trend estimates especially for the regional and seasonal tropopause trends given in the paper.
4. Provide some discussions of the variability in tropopause height and temperature explained by the regression proxies QBO and ENSO. Why is no proxy for stratospheric aerosol included here? Given that stratospheric aerosol can impact lower stratospheric temperatures, it can potentially also play a role for tropopause temperature and height. Please also provide a discussion on if and how these proxies impact the trend estimates.

Minor comments

Section 2, first paragraph: The authors explain how water vapor is negligible for calculating the temperature profiles. Is this true under all circumstances, i.e., also after the Hunga Tonga eruption? Also, it would be nice to give the time period over which the data is available and analyzed in this first paragraph.

Line 87: Why is the climatology over 2007 to 2023 subtracted from the monthly mean fields and not the full climatology?

Line 129: Please provide more information on the fact that the LRT is less well defined in the cold SH polar regions. How could this impact your analysis?

Line 170: Would it be fair to say starting in 2016?