DETAILED ANSWER TO REVIEWER #3

First, we would like to thank Reviewer #3 for all the comments, queries, and suggestions for modification. We considered all of them and tried to answer all queries. We transcribed the reviewer comments below, organizing them in a sequential order to help their identification in the revised version of the manuscript.

Review report of the paper “Variability and trend analysis of temperature in the upper troposphere and stratosphere region over the tropics (Réunion), by combining balloon-sonde and satellite measurements” by Gregori de Arruda Moreira et al. The paper “Variability and trend analysis of temperature in the upper troposphere and stratosphere region over the tropics (Réunion), by combining balloon-sonde and satellite measurements”, authors investigated how temperature and the height of the tropopause are changing over the tropics near Réunion Island using 15-year data from radiosonde, COSMIC-1 and MERRA-2. Using the combined datasets, they assess how well different methods match when estimating the tropopause height to explore a refined long-term trend. Studying tropopause temperature and height variability is very important for understanding the anthropogenic contribution to climate change, which is a highly relevant topic in ANGO. Given the sparse availability of datasets from the Southern Hemisphere, a long-term report on this subject from Réunion is particularly valuable and much needed. However, the referee feels that the paper currently lacks some important details, and the authors should provide further clarification on following concerns before the manuscript can be considered ready for acceptance.

Major concerns:

1. Methodology: The methodology section requires more detail and clarification. The authors state that they used radiosonde temperature profiles from 2006–2020 (available weekly) together with COSMIC-1 RO data within a margin of ±2° and ±3° spatial resolution. However, it is not clearly described how simultaneous these datasets were. Although they showed examples of simultaneous measurements in Figure 2, a clear description should be given in the methodology. As in Table 1 indicates a larger number of COSMIC profiles, but it is not specified whether the authors computed weekly averages of these data to match the radiosonde records, or how day-to-day variability was accounted for. Although a long-term analysis, a clear description of data is required for the reliability of the derived tropopause characteristics.

The final dataset was created by combining SHADOZ data (1 profile per week) and COSMIC-1 data (1 profile approximately every 2 days). For days when data from both instruments coincided, priority was given to using SHADOZ data. In order to clarify this point in the main text, this phrase has been added:

Line 310:

“SHADOZ and COSMIC-1 have different temporal resolutions (1 profile per week and 1 profile every 2 days, respectively), as mentioned in section 4.2. Therefore, the final database was created from the combination of these two datasets, and for days where there is data from both instruments, only the SHADOZ data were considered.”

2. Another concern about the Trend-Run model, the authors used a simplified approach to evaluate trend by only reporting the coefficient of determination (R^2). However, R^2 alone cannot provide information about the reliability or statistical significance. The authors are encouraged to include uncertainty analyses, for example confidence intervals and performing sensitivity tests to demonstrate which forcings have the most significant influence on the results.

Within Trend-Run, we consider that two successive measurements are not necessarily independent. The degree of dependence between successive measurements is evaluated using the autocorrelation coefficient. This coefficient makes it possible to determine the uncertainty on the estimated trend and on the contribution of each forcing. The trend uncertainty therefore, represents the uncertainty in the trend slope value.

The uncertainties associated with the trend estimates and with the contributions of individual forcings are provided in the article. As an example, uncertainties on the forcings are illustrated by the shaded areas in Fig. 2b, while trend uncertainties are shown by the grey shaded region and the dotted lines in Fig. 10.

3. Lack of proper discussion: Using the combined dataset, the authors identified differences/similarities in estimating tropospheric heights both CPT and LRT and reported some seasonal variations and small but significant long-term changes in tropopause temperature and height, which are important for understanding climate change. However, they did not properly discuss these results in the broader context of atmospheric dynamics, radiative forcing, or anthropogenic climate forcing. The discussion is limited to a brief comparison with Sivakumar et al. (2011) and Bègue et al. (2010) etc. The authors should expand the discussion of the results with additional published works and explain how their results align or diverge from global findings, focusing on the uniqueness or similarities of TTL dynamics in the southern hemisphere. Without a clear discussion and interpretation of the results, the manuscript remains incomplete in its current form.

We thank the reviewer for this comment. In order to improve this paper, the following paragraph has been added:

Line 362:

“Furthermore, it is important to highlight that the observed trends for both the CPT (cooling) and the LRT (warming) temperatures are directly associated with tropospheric warming, which has been exacerbated by intense accumulation of GHG in the lower troposphere as described by Ladstädter et al., 2023. This phenomenon is a key indicator of climate change and has been observed globally (Ladstädter et al., 2025), reinforcing the intense effect of anthropogenic activities across the planet.”

Minor concerns:

1. The introduction could be improved by more clearly highlighting key gaps in studying tropopause height and temperature over the tropics, and particularly importance of study over

Réunion. While this section is otherwise well written and easy to follow, motivation of the study would be stronger if the authors emphasized these gaps more explicitly.

In order to solve this question, the following phrases have been added:

Line 42

"However, they are endowed with lower temporal resolution. Therefore, considering the limitations and advantages of each methodology, an option to improve the tropopause monitoring is to combine them. Although, firstly, it is necessary to identify their similarities and differences."

2. Line 100: I feel the sentence 'Therefore, temperature gradients ….. and chemistry.' is irrelevant here.

Done