The authors presented a manuscript entitled, "Variability and trend analysis of temperature in the upper troposphere and stratosphere region over the tropics (Réunion), by combining balloon-sonde and satellite measurements". Integration of datasets from various instruments, such as SHADOW, COSMIC-1, and MEERA-2, was used in the manuscript to assess the temperature in the upper Troposphere and Stratosphere region. The results are consistent. However, I identified some moderate-to-major issues that I believe should be properly addressed before the manuscript can be considered for publication. Below, I provide some major comments, along with minor corrections.

Major comments:

1 - The manuscript title emphasizes more on troposphere temperature rather than height; however, in the abstract part more emphasis is given to height relatively which break the flow/continuity (as per title). Hence, either the abstract can be modified accordingly, giving more emphasis on temperature, or the title can be modified (such as "Variability and trend analysis of temperature and height in the upper troposphere and stratosphere region over the tropics (Réunion), by combining balloon-sonde and satellite measurements").

We thank the referee and agree with their comment and suggestion. The title has been changed to:

"Variability and trend analysis of temperature and height in the upper troposphere and stratosphere region over the tropics (Réunion), by combining balloon-sonde and satellite measurements"

In addition, the abstract has been changed:

Line 12:

"This study compares tropopause height and temperature estimates from in-situ and remote …"

2 - In the introduction part, the authors has to discuss, the possible gaps in the previous study (if any) and how this study fill the gap/improves the existing results or different from the previous study.

We thank the reviewer for this comment. The main improvement of our study is to demonstrate the feasibility of combining different data sources to create a more detailed timeseries of the Tropopause characteristics. In order to clarify this point in the main text, the following text has been added:

Line 40:

"Considering remote sensing, Global Navigational Satellite System Radio Occultation (GNSS-RO) stands out for offering accurate tropospheric profiles with high vertical resolution and global coverage independently of weather conditions, however, are endowed of 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.

In this context, this study compares vertical temperature profiles from the Southern Additional Ozonesondes (SHADOZ) network, Constellation Observing System for Meteorology Ionosphere and Climate 1 (COSMIC-1), and Modern Era Retrospective analysis for Research and Applications – Version 2 (MERRA-2) over Réunion (2006–2020) to identify similarities and/or differences."

3 - In the methods section, three methods (radiosonde, COSMIC-1, MEERA-2) are discussed to measure the tropopause temperature and height.

3.1 What are their limitation with respect to each other and the variation in the obtained results?

- The radiosonde has limited spatial and temporal resolution. Such a characteristic can hinder a detailed observation of the dynamics of the tropopause.
- COSMIC-1 has as its main limitation the data gaps during maintenance periods, and progressive degradation that began in 2019 resulting in inoperability starting in May 2020.
- MERRA-2 has as its main limitation the fixed height values in the temperature profile. Such a characteristic can make it impossible to observe variations and trends in the tropopause behavior.

  To clarify these points, the following phrases have been added in the main text:

Line 72

"The radiosonde technique has as its main disadvantages the limited horizontal and temporal resolution, which can hinder a detailed observation of the dynamics of the tropopause."

Line 83

"Its main limitation is the data gap during maintenance periods and after the beginning of the progressive degradation, which began in 2019 and resulted in total inoperability in May 2020."

Line 97

"These fixed heights can make it impossible to adequately observe some variations and trends in the tropopause behavior."

3.2 For analysis of temperature profile (Figure 2d,e,f), the authors are taking Tshadow(Z) as base and calculating the TSHADOW(Z) - TCOSMIC-1(Z) and Tshadow(Z) - TMEERA-2(Z) . Is there any specific reason for it?

Yes. The radiosonde (SHADOW) is the reference instrument because COSMIC-1, like other satellites, was validated and calibrated from ground-based data and has limitations in its vertical profile, mainly in the lower troposphere, as demonstrated in section 4.1. MERRA-2, as mentioned in section 4.3, is a reanalysis model that incorporates balloon-sonde profiles and GPS-Radio Occultation information. Therefore, MERRA-2 temperature profiles can be a combination of COSMIC-1 and SHADOZ data, and consequently, it cannot be a reference instrument.

3.3 What happens if we take either TCOSMIC-1(Z) or TMEERA-2(Z) as base?

As indicated in the previous answer, the COSMIC-1 data presents problems in the first five kilometers of the troposphere; therefore, if used as a reference, it would result in comparisons that could incorrectly underestimate or overestimate the other equipment. Regarding MERRA-2, being a composite of the other two systems, its use as a reference is unfeasible, but if used, it would have excellent agreement with the radiosonde in the lower part of the profile and excellent agreement with COSMIC-1 in the upper part of the profile, as shown in Figure 5a.

4 - In method section, Trend-Run linear regression model used. Is there any statistical model (linear/non-linear) that can also be used for the available dataset?

We believe that other techniques can be applied. However, trend-run linear regression is a classic Multi-Linear Regression (MLR) model, which is the most widely used technique in this type of analysis. Therefore, in order to conduct a discussion with the main works cited in the literature, trend-run linear regression was selected.

5 - Section 4.2 Weekly and daily profiles: Is it weekly and daily profiles or weekly and monthly profiles? Please check

In this section, we present the Weekly temperature profiles of SHADOZ, and the daily temperature profiles of COSMIC-1. In order to clarify this point, the section title has been changed to:

Line 178

"4.2 Weekly (SHADOZ) and daily (COSMIC-1) temperature profiles"

6 - Under section 4.2: In the line no. 207, it is mention that "In contrast to SHADOZ and COSMIC-1 data, MERRA-2 does not show any data gap". However, the Time-height temperature cross-section by MEERA-2 is not shown (such as Figure 3 and Figure 4). Please add a Time-height temperature plot corresponding to MEERA-2, also (if possible) for better clarity and visualization of readers.
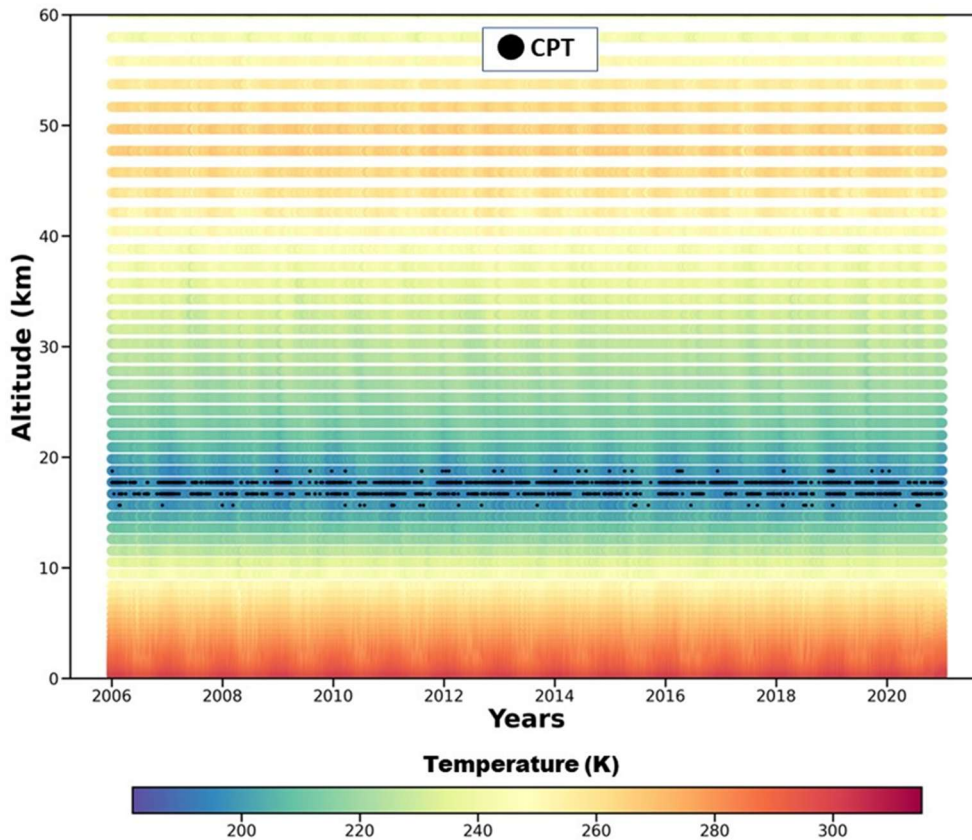
This new figure was added:

Figure 5: Same as Figure 3 and 4 but concerning COSMIC-1 measurements over Réunion.

7 - In the seasonal comparison section, it is mentioned that the thermal structure of the atmosphere is seasonally dependent, notably in the tropics and subtropics (line no. 238). With reference to the present study, are the obtained results valid in the region present only in the tropics and subtropics region around the globe? and how to check the robustness of the obtained results (if any)?

As described in section 4.4, this statement is based on the data and assertions presented in the following works:

Seidel et al., 2001; Bencherif et al., 2006; Sivakumar et al., 2011a; Bègue et al., 2010; Shangguan and Wang, 2022; Zhran and Mousa., 2023

The results obtained in this work reinforce this assertion. In addition, section 4.4 presents a comparison between the results obtained in this work and the results discussed in the references previously indicated. Therefore, this demonstrates the robustness of the results obtained.

Minor:

1- In the section 2 (under materials), experiments no. may be marked as 2.2a, 2.2b, 2.2c, respectively, as they are all different experiment. Or they can be mention in a single section separated with subsections.
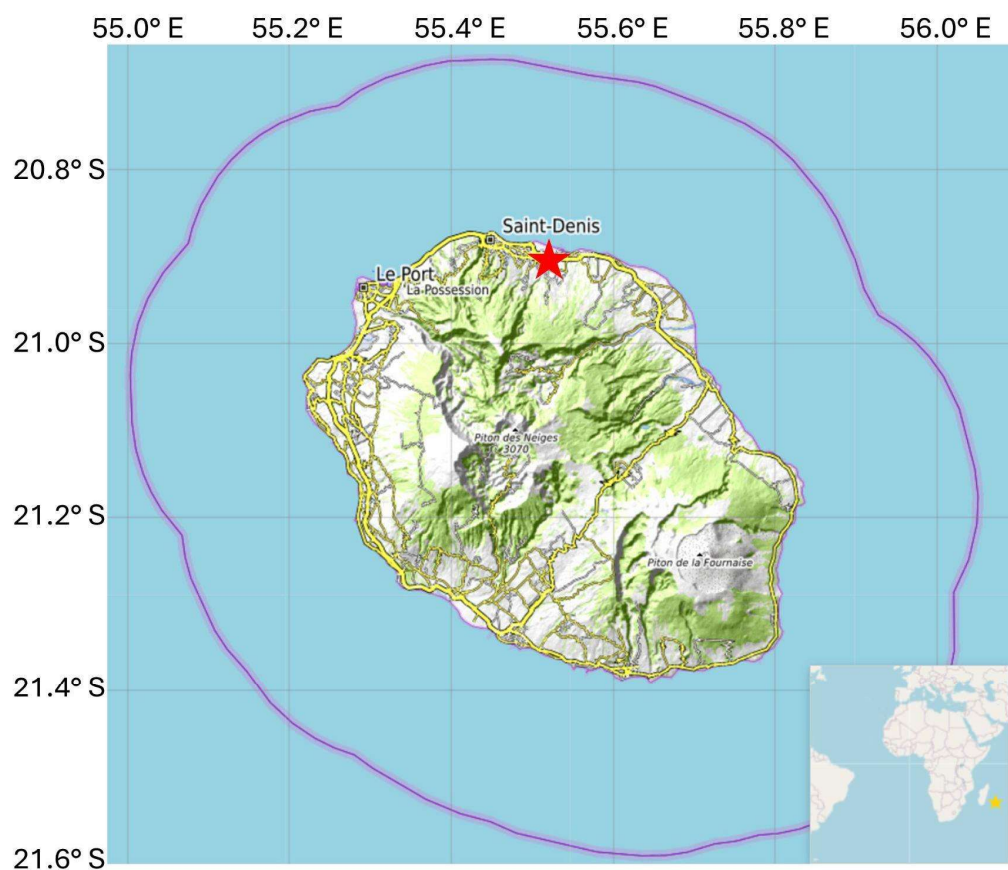
Done

2 - Sivakumar (2011), and Sivakumar (2011b, line no. 288) are mentioned in the citation but not marked properly in the references.
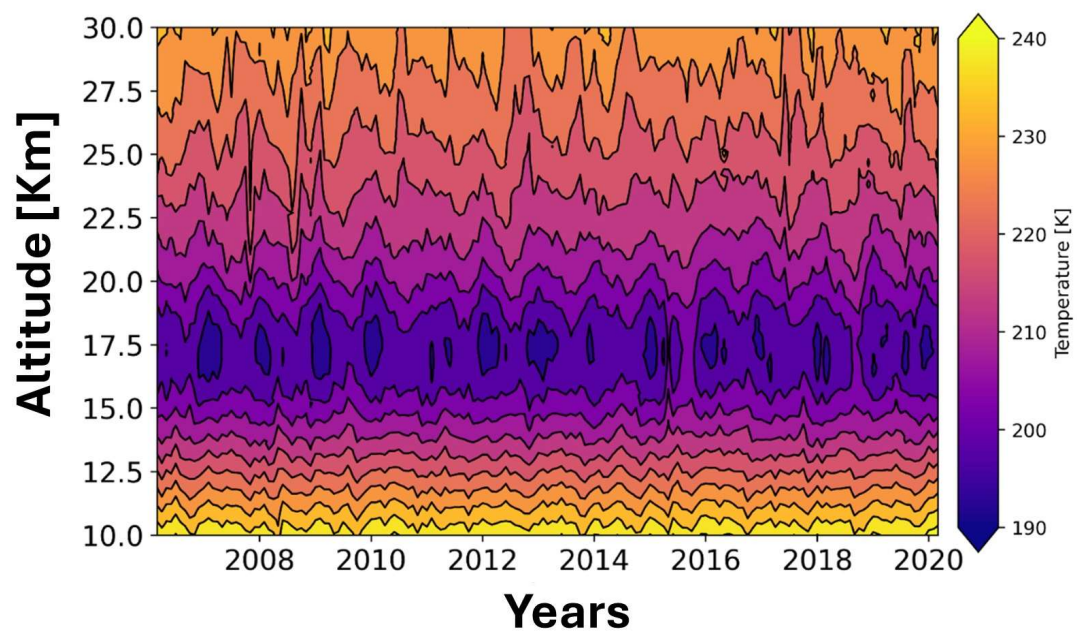
Done

3 - Figure 1: mention this figure in the main text body. In the caption, please mention what the blue balloon symbol represents. In case if it represents the study area, the location of this blue balloon in the map and the provided latitude/longitude are mismatched. Kindly recheck and correct it. Also, mark the Roland Garros International Airport on the map. The latitude/longitude of the study site, Airport, and map should be in uniform (either in Decimal Degree or in Degree Minute Second). Mark the location of the map in the inset map by an arrow or a square box.
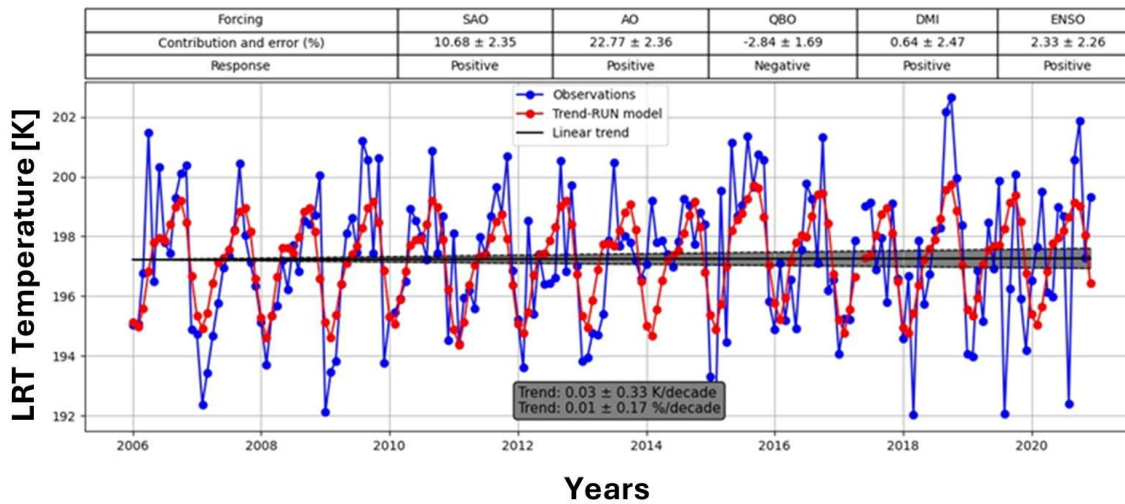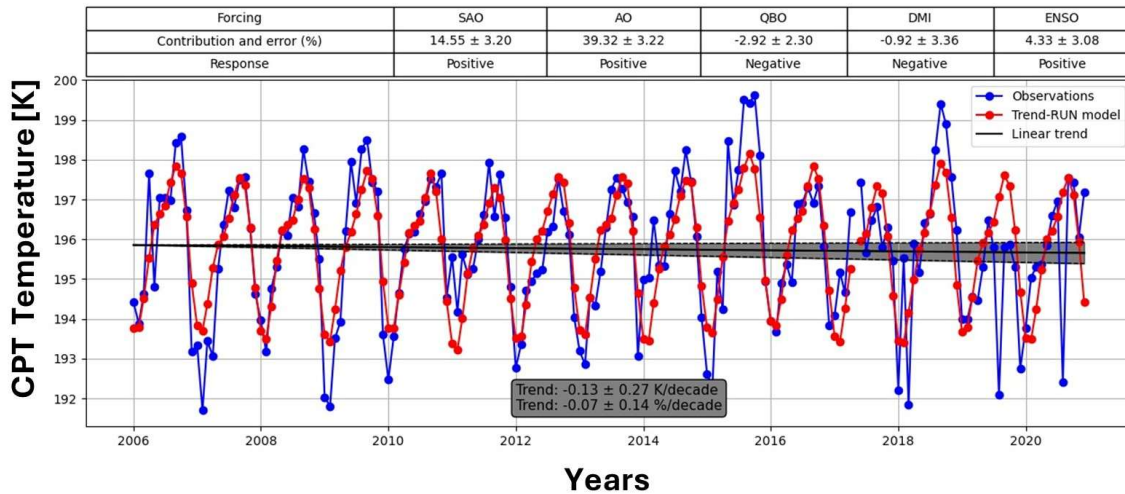
Done

4 - Figure 7 & 9: mark time in years as Time (years).

Done

Forcing	SAO	AO	QBO	DMI	ENSO
Contribution and error (%)	14.55 ± 3.20	39.32 ± 3.22	-2.92 ± 2.30	-0.92 ± 3.36	4.33 ± 3.08
Response	Positive	Positive	Negative	Negative	Positive

Forcing	SAO	AO	QBO	DMI	ENSO
Contribution and error (%)	10.68 ± 2.35	22.77 ± 2.36	-2.84 ± 1.69	0.64 ± 2.47	2.33 ± 2.26
Response	Positive	Positive	Negative	Positive	Positive

5 - Line 144: "In this section is performed…….." may be rearranged as, "In this section, a comparison is performed among……"

Done

6 - Figure 2 (d, e, f): In the caption, it mentions that the difference between Tshadow(Z) and TCOSMIC-1(Z) is represented by black line, while in the legend it is marked as orange color. Similarly, with the Tshadow(Z) and TMEERA-2(Z). Please check and correct it.

We apologize for this mistake.

The caption was rewritten:

Line 162

"*Figure 2: Comparison between $T_{SHADOZ}(z)$ (red), $T_{COSMIC-1}(z)$ (green) and T_{MERRA} (z) (blue) profiles on 25-06-2014 (a), 19-11-2014 (b) and 17-09-2014 (c) and the difference between $T_{SHADOZ}(z)$ and T_{COSMI} (z) (orangeblack line) and $T_{SHADOZ}(z)$ and T_{MERRA} (z) (blackorange line) profiles to the same days (d), (e), and (f), respectively.*"

Citation & References:

Most of the citations provided in the main text body are missed in the reference and vice-versa (such as in the Introduction section, the citations- Fueglistaler et al., 2009; Randel and Jensen, 2013; Astudillo et al., 2014; Santer et al., 2004; Reid and Gage, 1981, 1984, 1985; Randel et al., 2000) are missed in the reference part. Similarly, in the reference part, almost 33% references are missed/not cited in the main text body. Please check them and insert/remove accordingly.

We apologize for this mistake. All references have been properly cited in the main text or removed as indicated in the marked version of the new document