

## Dear Referee #2

We would like to thank Referee #2 for the thorough review and valuable comments on our manuscript. We appreciate the reviewer's constructive suggestions, which have helped us significantly improve the manuscript. Our responses to the individual comments are given below.

### Major concerns

#### *Referee comment: -*

- 1. In session 2.3, pressure-level ERA5 data are interpreted to 100m resolution to calculate the tropopause. I'm wondering how accurate the interpolated data are. The cited paper (Hindley et al., 2015) used COSMIC data, which has a much higher vertical resolution than pressure-level ERA5. Have you tried using 137 model level ERA5 data and see if there is any difference in calculating the tropopause?*

#### *Answer: -*

We thank the reviewer for raising this important point regarding the vertical resolution of ERA5 data and the potential limitations associated with the use of pressure-level fields. In this study, we employed monthly averaged ERA5 data on 37 pressure levels, which were subsequently spline interpolated to a 100 m vertical grid. This approach was adopted to improve the detection of the lapse rate tropopause (LRT) by providing a smoother and more continuous representation of the temperature profile. Regarding this citation (Hindley et al., 2015), it has been removed from the manuscript.

While ERA5 model-level data (137 hybrid sigma-pressure levels) indeed offer higher intrinsic vertical resolution, their availability is typically limited to hourly temporal resolution, resulting in substantially larger data volumes and increased computational cost. These constraints pose practical challenges for long-term analyses over extended spatial domains. Importantly, the primary objective of this study is to investigate the spatiotemporal variability and long-term trends of the tropical belt edges and their interactions with climatic parameters, rather than to resolve fine-scale vertical temperature structures.

Therefore, the adopted methodology represents a balance between computational efficiency and physical consistency. To ensure the robustness of this approach, we further support it through the following analyses:

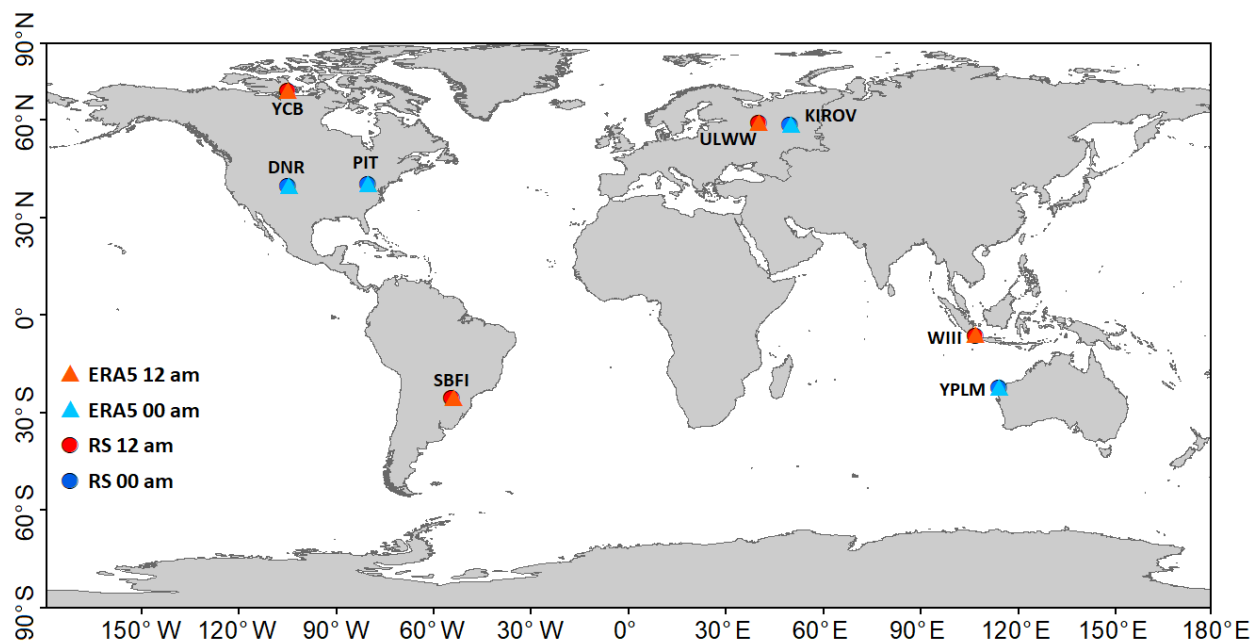
1. Validation of ERA5 (37 pressure levels) data against independent radiosonde observations.
2. Intercomparison of ERA5 (37 pressure levels) data with ERA5 (137 model levels) data.
3. Accuracy Assessment of ERA5 (37 Pressure Levels) Interpolated to 100 m vertical Resolution

### **1. Validation of ERA5 (37 pressure levels) data against independent radiosonde observations.**

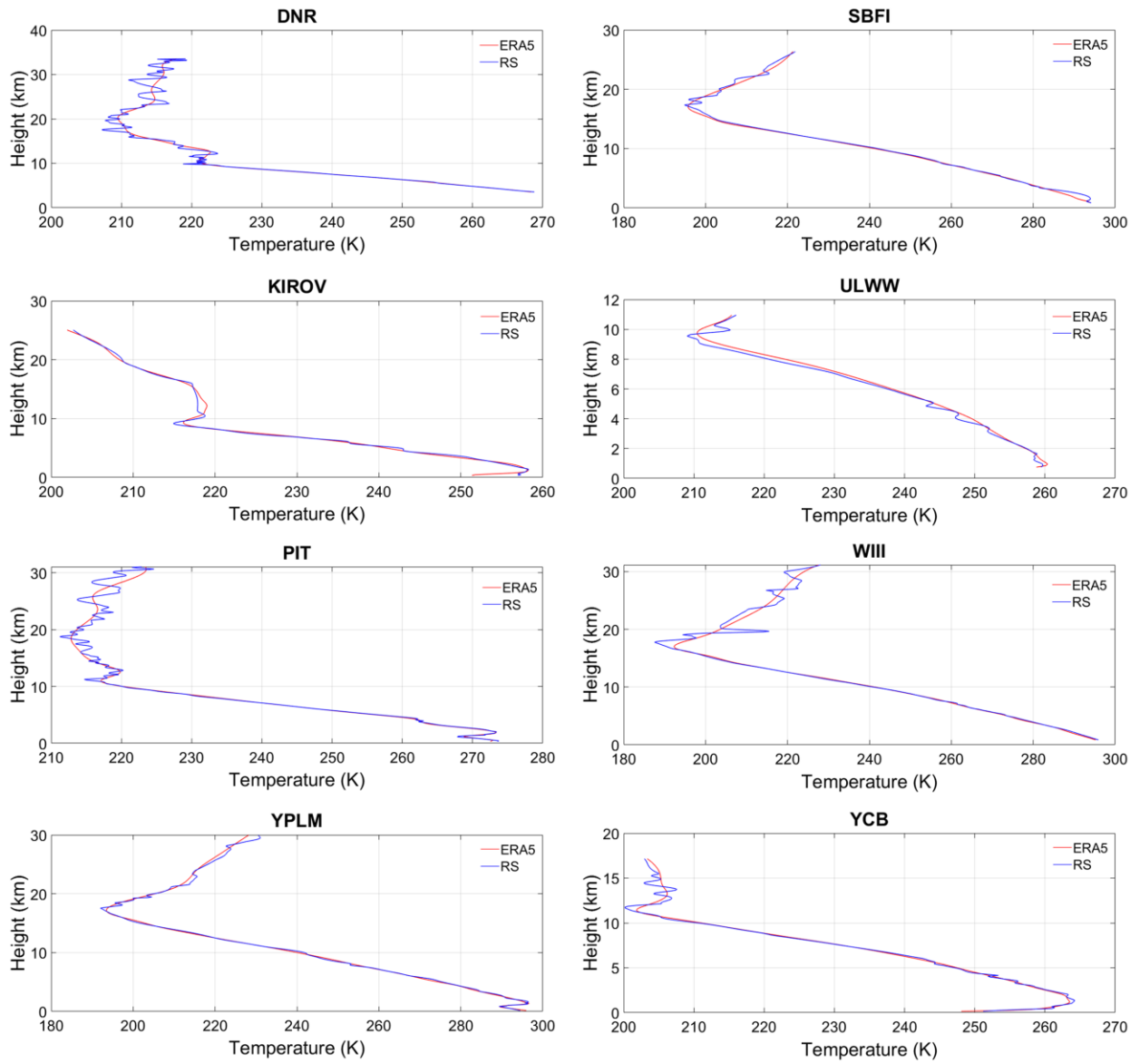
To ensure the sufficient quality of the ERA5 (37 pressure levels) data which was interpolated to 100 m vertical resolution for this study, it has been validated against collocated radiosonde temperature profiles. Atmospheric profiles data from 8 radiosonde stations on 3 January 2016 at different geographic locations spatially, while temporarily 4 profiles are in the daytime and the other 4 are in the nighttime (Fig. 1). The results of the assessment of collocated ERA5 and radiosonde profile pairs showed a high level of consistency between both techniques (Fig. 2). The correlation coefficient between ERA5 and radiosonde is approximately 0.99 at all locations (Table 1), which indicates the strong reliability of ERA5 for atmospheric sounding. The mean difference in temperature between both ERA5 (37 pressure levels) and radiosonde profiles ranges from 0.02 to 0.67 K (Table 1), demonstrating excellent agreement and confirming the reliability of ERA5 in representing the vertical temperature structure. In addition, the lapse rate tropopause height (LRT-H) estimated from both techniques shows a high level of agreement, with differences ranging from 0.1 to 1 km (Table 1).

**Table 1.** Distance, correlation coefficient, and mean temperature difference between collocated ERA5 (37 pressure levels) and radiosonde (RS) profile pairs for 3 January 2016 at 00 and 12 am. Additionally, the lapse rate tropopause height (LRT-H) estimated from both datasets is presented.

Station name	Distance (km)	Correlation coefficient	Mean difference (K)	RS LRT-H (km)	ERA5 LRT-H (km)
<i>at 00 am</i>					
DNR	10.25	0.99	0.40	9.90	10.10
KIROV	18.05	0.99	0.03	9.10	9.00
PIT	3.73	0.99	0.02	10.60	10.80
YPLM	8.52	0.99	0.40	17.30	16.90
<i>at 12 am</i>					
SBFI	8.10	0.99	0.31	17.40	16.60
ULWW	8.73	0.99	0.67	9.10	9.60
WIII	16.47	0.99	0.30	17.80	16.80
YCB	13.54	0.99	0.14	10.70	11.30



**Figure 1.** Geographic locations of radiosonde (RS) profiles and their corresponding ERA5 (37 pressure levels) grid locations.



**Figure 2.** Vertical profiles from ERA5 (37 pressure levels) compared with radiosonde (RS) observations. The left panels represent 00 am for DNR, KIROV, PIT, and YPLM, respectively, while the right panels represent 12 am for SBFI, ULWW, WIII, and YCB.

## **2. Intercomparison of ERA5 (37 pressure levels) data with ERA5 (137 model levels) data.**

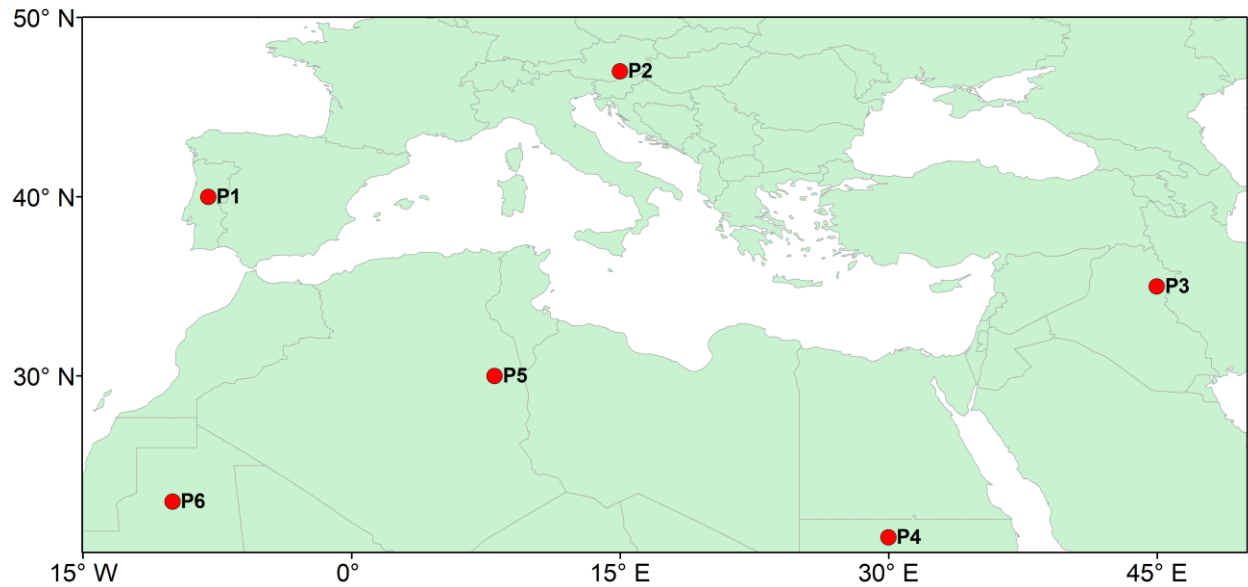
This section presents an intercomparison between ERA5 data at 37 pressure levels and the native ERA5 137 model levels across 6 locations in the Mediterranean region, covering an altitude range from 0 to 30 km at 00 am on 1 January 2020 (Fig. 3). As summarized in Table 2, the results reveal a high level of agreement between the two datasets at all locations. The correlation coefficient is approximately 0.99 for all profile pairs, indicating an almost perfect linear correspondence and demonstrating that the interpolated 37 pressure-level dataset effectively preserves the vertical temperature structure of the original model-level data.

The mean temperature difference between the two datasets ranges from 0.02 to 0.38 K (Fig. 4), which is very small and well within the expected uncertainty associated with vertical interpolation and numerical discretization. This level of agreement confirms that the interpolation to a 100 m vertical resolution does not introduce significant distortion in the thermal structure of the atmosphere. Consequently, the ERA5 (37 pressure levels) dataset can be considered reliable for applications sensitive to vertical temperature gradients, such as tropopause detection and the identification of the tropical edge latitudes.

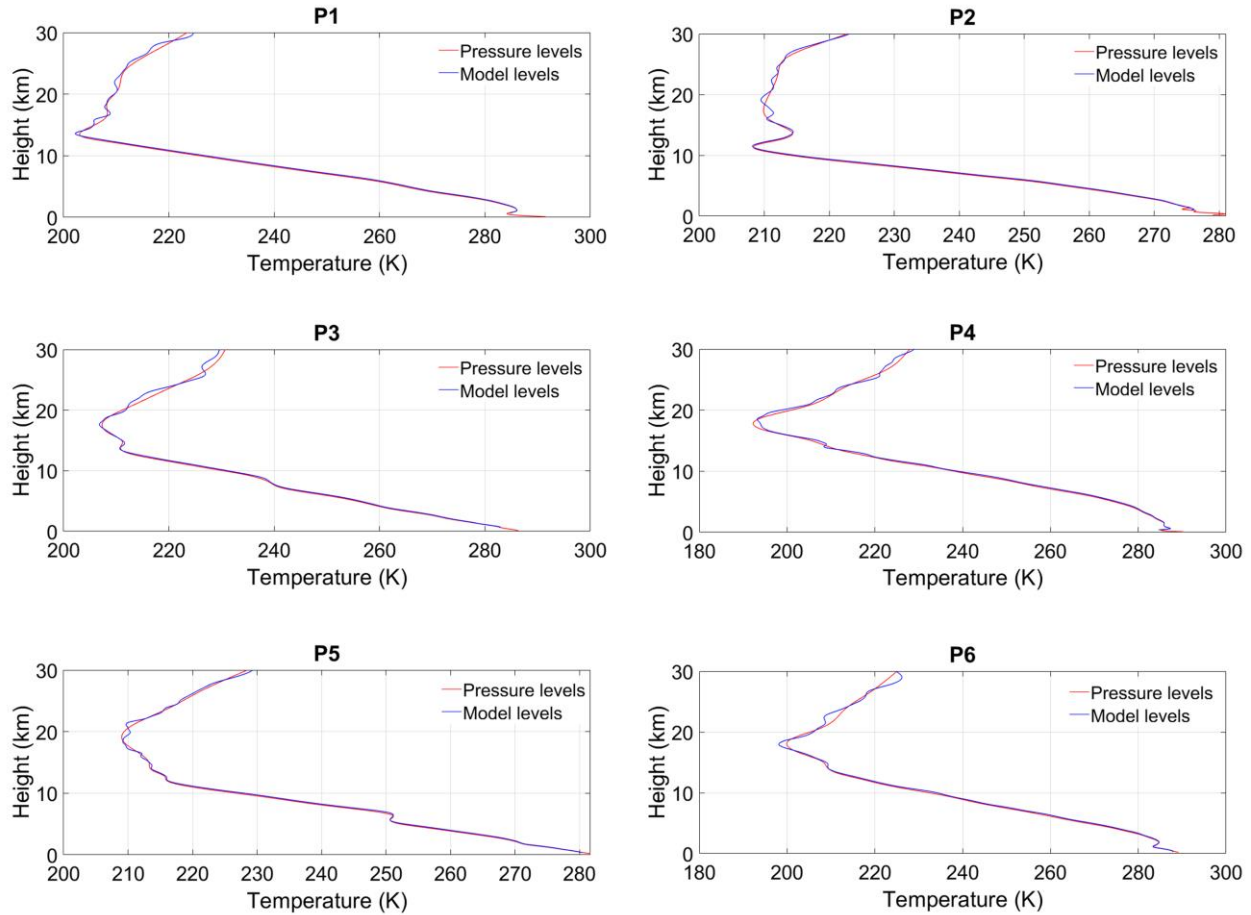
Furthermore, the lapse rate tropopause height (LRT-H) derived from both datasets shows strong agreement, with differences ranging from 0.08 to 0.31 km (Table 2). These small discrepancies are consistent with the inherent sensitivity of tropopause detection to vertical resolution and gradient estimation. Overall, the results demonstrate that the interpolated pressure level ERA5 dataset retains the essential dynamical and thermal features of the original high-resolution model levels, supporting its suitability for detailed atmospheric structure analysis.

**Table 2.** Correlation coefficient, and mean temperature difference between ERA5 (37 pressure levels) profiles (P1-P6) at altitude range 0-30 km with their equivalent ERA5 (137 model levels) profiles at 00 am 1 January 2020. Additionally, the lapse rate tropopause height (LRT-H) estimated from both datasets.

Profile No	Correlation coefficient	Mean difference (K)	ERA5 (37 level) LRT-H (km)	ERA5 (137 model level) LRT-H (km)
P1	0.99	0.11	13.21	13.48
P2	0.99	0.21	11.11	11.34
P3	0.99	0.02	13.29	13.48
P4	0.99	0.23	17.40	17.09
P5	0.99	0.23	11.89	12.05
P6	0.99	0.38	13.85	13.93



**Figure 3.** Geographic locations of ERA5 (37 pressure levels) profiles (P1-P6) and their corresponding ERA5 (137 model levels) profiles at the same grid points in the Mediterranean region.



**Figure 4.** Vertical profiles (P1-P6) at altitude range 0-30 km from ERA5 (37 pressure levels) compared to their equivalent ERA5 (137 model levels) profiles at 00 am 1 January 2020.

### 3. Accuracy Assessment of ERA5 (37 Pressure Levels) Interpolated to 100 m vertical Resolution.

In this section, six ERA5 temperature profiles at 37 pressure levels, representing different geographic locations across the Mediterranean region, are used to evaluate the accuracy of vertical interpolation to a 100 m resolution (Fig. 3). The assessment is based on a reconstruction (back-interpolation) approach, which is widely used to objectively quantify interpolation performance. Specifically, the original coarse-resolution profiles are first interpolated to a fine vertical grid (100 m), and subsequently interpolated back to their original pressure levels. The reconstructed profiles are then compared with the original data using statistical metrics, including bias and root mean square error (RMSE), to

quantify interpolation-induced deviations. In addition, the preservation of vertical thermal structure is assessed through comparison of lapse rate profiles.

The results indicate an almost perfect reconstruction of the original temperature profiles at all six locations (Table 3). Both bias and RMSE are effectively zero, demonstrating that the interpolation and back-interpolation process introduces negligible numerical error. Furthermore, the mean difference in lapse rate between the original and reconstructed profiles is also approximately zero, confirming that the interpolation fully preserves the vertical temperature gradients and key atmospheric structure. These results are well within, and indeed significantly better than, the typical uncertainty thresholds reported in the literature (bias < 0.1–0.2 K and RMSE < 0.3–0.5 K), indicating an exceptionally high level of interpolation accuracy. Overall, the findings demonstrate that the interpolation of ERA5 temperature profiles from 37 pressure levels to a 100 m vertical grid is robust and does not distort the atmospheric thermal structure, thereby supporting its suitability for applications requiring high-resolution vertical analysis, particularly tropopause detection and gradient-based diagnostics.

**Table 3.** Bias, root mean square error (RMSE), and mean lapse rate difference between original ERA5 temperature profiles (37 pressure levels; P1–P6) and their corresponding back-interpolated profiles.

Profile No	Bias	RMSE	lapse rate mean difference
<b>P1</b>	0	0	0
<b>P2</b>	0	0	0
<b>P3</b>	0	0	0
<b>P4</b>	0	0	0
<b>P5</b>	0	0	0
<b>P6</b>	0	0	0

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***Referee comment: -***

2. *“TPD” and “TPG” have very high correlation (0.9 shown in figure 3) and they showed very similar results. Session 3.2 have a lot of descriptions about what it’s shown in the figures from both methods. Figure 5 and Figure 6 are very similar. Left and right columns in Figure 7 are similar. Figure 8 and Figure 9 are similar. It looks redundant to me to include the discussion for both methods.*

***Answer: -***

We thank the reviewer for this important comment regarding the apparent redundancy between the TPD and TPG metrics and the similarity of the associated figures and discussion.

We agree that TPD and TPG show a high correlation ( $\approx 0.9$ , Fig. 3) and produce very similar spatial and temporal patterns. However, this agreement is intentional and scientifically meaningful rather than redundant. The tropical edge latitude (TEL) is estimated here using two distinct tropopause-based diagnostics: (1) TPD, defined as the latitude where the lapse-rate tropopause height (LRT-H) decreases by 1.5 km relative to the tropical mean (15°S–15°N), and (2) TPG, defined as the latitude of the maximum poleward meridional gradient of LRT-H. While both metrics are derived from the same physical field, they represent different methodological perspectives—one based on an absolute threshold and the other on a gradient-based transition.

The use of multiple tropopause metrics is a well-established approach in the literature to ensure the robustness of tropical edge detection and to avoid method-dependent bias (e.g., Davis and Rosenlof, 2011; Ao and Hajj, 2013; Maher et al., 2019; Darrag et al., 2022; Zou et al., 2023). In this context, the strong agreement between TPD and TPG in our results provides mutual confirmation of the diagnosed expansion patterns, increasing confidence in the physical interpretation rather than introducing redundancy.

Zou, L., Hoffmann, L., Müller, R., & Spang, R. (2023). Variability and trends of the tropical tropopause derived from a 1980–2021 multi-reanalysis assessment. *Frontiers in Earth Science*, 11. <https://doi.org/10.3389/feart.2023.1177502>

Darrag, M., Jin, S., Calabria, A., & Samy, A. (2022). Determination of tropical belt widening using multiple GNSS radio occultation measurements. *Annales Geophysicae*, 40(3), 359–377. <https://doi.org/10.5194/angeo-40-359-2022>

Maher, P., Kelleher, M. E., Sansom, P. G., & Methven, J. (2019). Is the subtropical jet shifting poleward? *Climate Dynamics*, 54(3–4), 1741–1759. <https://doi.org/10.1007/s00382-019-05084-6>

Ao, C. O., & Hajj, A. J. (2013). Monitoring the width of the tropical belt with GPS radio occultation measurements. *Geophysical Research Letters*, 40(23), 6236–6241. <https://doi.org/10.1002/2013gl058203>

Davis, S. M., & Rosenlof, K. H. (2011). A multidiagnostic intercomparison of Tropical-Width time series using reanalyses and satellite observations. *Journal of Climate*, 25(4), 1061–1078. <https://doi.org/10.1175/jcli-d-11-00127.1>

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***Referee comment: -***

3. *There are many abbreviations throughout the paper. Reducing them may improve readability*

***Answer: -***

We acknowledge that a relatively large number of abbreviations are used throughout the paper. This is mainly because the study investigates multiple variables and diagnostics, particularly in relation to tropopause-based metrics and derived quantities. In such cases, the use of abbreviations is necessary to maintain clarity and conciseness, especially in figures where space is limited and the use of full variable names is not practical.

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**Line-by-line comments**

***Referee comment: -***

*Lines 24-25: “both applied methods” is confusing because the methods are not stated earlier. I suggest revising this sentence to something like “the tropical belt shows poleward expansion ranging approximately between 0.14 °/dec and 0.27 °/dec.”*

***Answer: -***

We thank the reviewer for this helpful comment. In response, we have revised the sentence to explicitly state the methods used, thereby removing the ambiguity associated

with the phrase “both applied methods.” The sentence now reads: “The tropical belt shows a poleward expansion of approximately 0.14 °/dec and 0.27 °/dec, estimated using the tropopause drop (TPD) and tropopause gradient (TPG) methods, respectively.” This revision improves clarity and ensures that the methods are clearly identified for the reader.

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***Referee comment: -***

*Line 25: “of both applied approaches” seems redundant.*

***Answer: -***

Following the previous referee’s comment, we have revised the text to explicitly state the two methods (TPD and TPG), and the phrase “both applied methods” has been removed. Accordingly, this potentially redundant expression has been removed, and the phrase “both applied approaches” in Line 25 is the first to appear.

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***Referee comment: -***

*Line 40: “climate change has been documented at a magnitude that exceeds global averages” is very broad. Does climate change here means temperature, precipitation, or something else?*

*I notice this sentence is rephrasing “As mentioned before, Mediterranean climate change has been observed at a magnitude exceeding global means, despite the fact that the emission of greenhouse gases (GHGs) in Mediterranean countries lie at relatively low levels” from the reference. In this paper, this sentence is missing context. I’m not sure if this sentence is a good one to put at the beginning.*

***Answer: -***

We agree that the original statement was too broad. In the revised manuscript, we have clarified that this statement primarily refers to temperature changes in the Mediterranean region, as discussed in Lange (2020). The sentence has been modified accordingly to improve precision and avoid ambiguity.

The original sentence, adapted from Lange (2020), lacked sufficient context. Our intention was to highlight the apparent discrepancy between relatively modest regional GHG emissions and the amplified warming observed in the Mediterranean, which suggests the role of additional regional factors.

In the revised manuscript, we have rephrased the sentence to improve clarity and explicitly emphasize that this statement refers primarily to temperature increase. We have also adjusted its wording to better integrate it into the introductory context and avoid it appearing as an isolated or decontextualized statement.

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***Referee comment: -***

*Lines 47-48: This sentence repeated “the Mediterranean region has experienced significant shifts of climate in the past” in Line 45.*

***Answer: -***

Thank you for pointing out this repetition. The sentence previously appearing in Line 45 has been removed in the revised manuscript to avoid redundancy. As a result, the statement in Lines 47–48 is now presented only once, improving clarity and readability.

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***Referee comment: -***

*Lines 59-60: There is no subject in this sentence. A suggestion is “In astronomy and cartography, the tropical boundaries are at latitudes of ~23.5° north and south”.*

***Answer: -***

Thank you for this helpful clarification. We followed your suggestion and have modified the revised manuscript accordingly to reflect that. In astronomy and cartography, the tropical boundaries are at latitudes of ~23.5° north and south.

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***Referee comment: -***

*Lines 63-64: A better flow is needed. The previous sentence is about the seasonal change and “Tropical belt expansion” in this sentence is due to climate forcing. A suggestion is adding “Under climate change,” at the beginning of the sentence.*

***Answer: -***

We followed your suggestion and modified the sentence accordingly by adding “Under climate change” at the beginning, which improves the flow and clarifies the context in the revised manuscript.

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***Referee comment: -***

*Lines 66-67: “sea-surface temperature (SST) variability over the tropics” and “absorbing aerosols hemispheric asymmetry” don’t appear to be the changes driven by the climate change.*

***Answer: -***

Thank you for this important comment. We agree that not all the listed factors are directly driven by climate change. In the revised manuscript, we have clarified this point by distinguishing between externally forced drivers (e.g., GHG forcing and ozone depletion) and other contributing factors such as internal variability (e.g., tropical SST variability) and hemispheric asymmetries in absorbing aerosols. The sentence has been revised accordingly to improve accuracy and clarity.

[ The expansion of the tropical belt has been attributed to a variety of factors, including externally forced processes such as tropospheric warming caused by GHG forcing and stratospheric cooling caused by ozone depletion, as well as other contributing factors such as tropical sea-surface temperature (SST) variability and hemispheric asymmetries in absorbing aerosols. ]

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***Referee comment: -***

*Lines 71-73: “even slight expansion of the tropical belt could cause substantial changes in the global climate system” repeats “The expansion of the tropics could cause substantial changes in the global climate system”.*

***Answer: -***

Thank you for highlighting this repetition. The sentence “The expansion of the tropics could cause substantial changes in the global climate system” has been removed in the revised manuscript. We retained the more specific statement “even slight expansion of the tropical belt could cause substantial changes in the global climate system,” thereby eliminating redundancy while preserving the intended meaning.

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***Referee comment: -***

*Lines 76-77: I suggest revising “one of the most vulnerable regions to the effects of climate change” to “one of the most vulnerable regions affected by*

***Answer: -***

We have revised the manuscript accordingly, modifying the sentence as recommended to improve clarity and readability.

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***Referee comment: -***

*Line 79: “increasing” to “being”.*

***Answer: -***

We have revised the manuscript accordingly, modifying the sentence as recommended to improve clarity and readability.

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***Referee comment: -***

*Line 82: Add “continue to” before “rise”.*

***Answer: -***

We have revised the manuscript accordingly, modifying the sentence as recommended to improve clarity and readability.

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***Referee comment: -***

*Lines 98-99: "This accelerated...and biodiversity" repeats Lines 88-89.*

***Answer: -***

Thank you for highlighting this redundancy. We agree that the sentence in Lines 98–99 repeats the content of Lines 88–89. To improve the conciseness and readability of the manuscript, we have removed the sentence "This accelerated ... and biodiversity" from the revised version.

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***Referee comment: -***

*Lines 115-131: Most of session 2.1 repeats the content already shown in the introduction. Please consider shortening or deleting session 2.1.*

***Answer: -***

We agree that the original Section 2.1 contained material that overlapped with the Introduction. In the revised manuscript, Section 2.1 has been substantially shortened and refocused to include mainly the essential information required to define the study domain and its geographical boundaries.

[ This study investigates the Mediterranean region, including parts of Southern Europe, North Africa, and the Middle East. The study region is defined as the area between 20.00° N and 50.00° N latitude and 15.00° W and 50.00° E longitude. This spatial extent is selected to capture the full Mediterranean basin and its surrounding land–sea system, which is relevant for analyzing large-scale atmospheric variability and tropical edge dynamics. The Mediterranean basin is characterized by substantial environmental and geographical gradients, complex morphology with mountain chains, and significant land-sea contrasts. Its location in a transition zone between mid-latitude and subtropical atmospheric circulation systems contributes to its complex climate patterns (Lange, 2020). The Mediterranean hosts one of the world's richest biodiversity reserves with

numerous endemic species. However, rising temperatures, habitat loss, and changing phenological patterns pose significant threats (Coll et al., 2010; Lionello et al., 2012). ]

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***Referee comment: -***

*Lines 180-181: The captions in Figures are repeated in the text. Same in Lines 192-193.*

***Answer: -***

The repeated descriptions of the figure captions in the main text have been removed to avoid redundancy. Specifically, Lines 180–181 and Lines 192–193 have been deleted in the revised manuscript. The text has been adjusted to focus on the interpretation of the figures rather than duplicating their captions.

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***Referee comment: -***

*Lines 181-183: Previous literature also shows an increasing trend, but the values presented in this paper are much larger.*

***Answer: -***

We have carefully revised the manuscript to clarify the comparison with previous studies and to better explain the differences in the magnitude of the reported trends. The relevant text (Lines 181–183) has been modified accordingly in the revised manuscript.

The larger values obtained in this study can be attributed to the fact that the Mediterranean region has experienced warming at rates exceeding the global average.

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***Referee comment: -***

*Line 185: Add “in LRT-T also” after “our findings”.*

***Answer: -***

The manuscript has been modified accordingly, and the phrase “in LRT-H also” has been added after “our findings” in Line 185.

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**Referee comment: -**

Line 189: “consistent with earlier research” appears three times in this paragraph. Please consider revising to avoid repetition.

**Answer: -**

The repeated use of the phrase “consistent with earlier research” has been reduced/removed by rephrasing the relevant sentences. The revised manuscript has been modified accordingly to enhance clarity and avoid redundancy.

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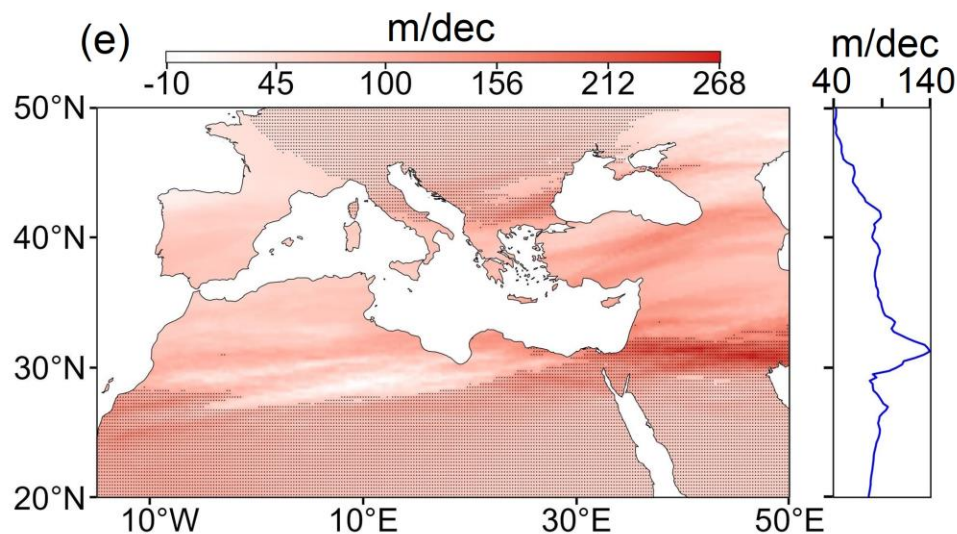
**Referee comment: -**

Line 207: “most of the grid points” is vague. Please consider stippling the regions where  $p < 0.05$ . Same for line 213, line 510, line 530, line 570.

**Answer: -**

In the revised manuscript, we removed “most of the grid points” and indicated the statistically significant trends ( $p \leq 0.05$ ) in all trend maps using stippled regions. This representation highlights the grid points where the trends are statistically significant and improves the clarity of the figures. The figure captions have been updated accordingly.

Example: As shown in Figure 1e, black stippled regions indicate grid points where the trends are statistically significant at  $p < 0.05$ .



***Referee comment: -***

*Figure 2: Repetition in the caption. For example, “Monthly time series of the TPD TEL method over the Mediterranean region for the period January 1980 to December 2022 (a) and monthly time series of the TPG TEL method over the Mediterranean region for the period January 1980 to December 2022 (b).” can be revised as “Monthly time series of the (a) TPD TEL method and (b) TPG TEL method over the Mediterranean region for the period January 1980 to December 2022”.*

***Answer: -***

The repetition in the caption of Figure 2 has been removed and the caption has been revised accordingly. In addition, the repeated statements of the investigation period (January 1980–December 2022) have been reduced throughout the manuscript, particularly in the figure captions.

[ **Figure 2.** Monthly time series of the (a) TPD TEL method and (b) TPG TEL method. The linear regression model between TPD TEL and LRT-H (c) and the linear regression model between TPG TEL and LRT-H (d). Longitudinal variation of TEL using both methods over the Mediterranean region is displayed. The blue line in (e) represents the mean TPD TEL at each longitude over the study period, while the blue shading depicts its SD. In (f), the red line represents the mean TPG TEL at each longitude over the study period, with the red shading indicating its SD. Seasonal variation of TPD TEL (g) and TPG TEL (h). ]

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***Referee comment: -***

*Line 244: “major tropical systems” is vague.*

***Answer: -***

We agree that the term “major tropical systems” is vague. In the revised manuscript, we have clarified this expression by specifying the relevant large-scale tropical–extratropical teleconnection processes affecting the Mediterranean region. The manuscript has been revised accordingly to improve precision and clarity.

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***Referee comment: -***

*Line 250: Why stronger land-sea contrast leads to the following statement “resulting in higher TEL values in this region”?*

***Answer: -***

We agree that the causal link was not sufficiently explained in the original text. In the revised manuscript, we have clarified the physical mechanism by explicitly describing how stronger land–sea thermal contrasts can influence regional thermal structure and circulation patterns, which in turn affect the spatial distribution of TEL values. The sentence has been revised accordingly to improve clarity and physical justification.

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***Referee comment: -***

*Lines 283-284: “even minor expansion would have significant consequences” is repetition.*

***Answer: -***

In the revised manuscript, this expression, “even minor expansion would have significant consequences,” has been removed to avoid redundancy and improve clarity.

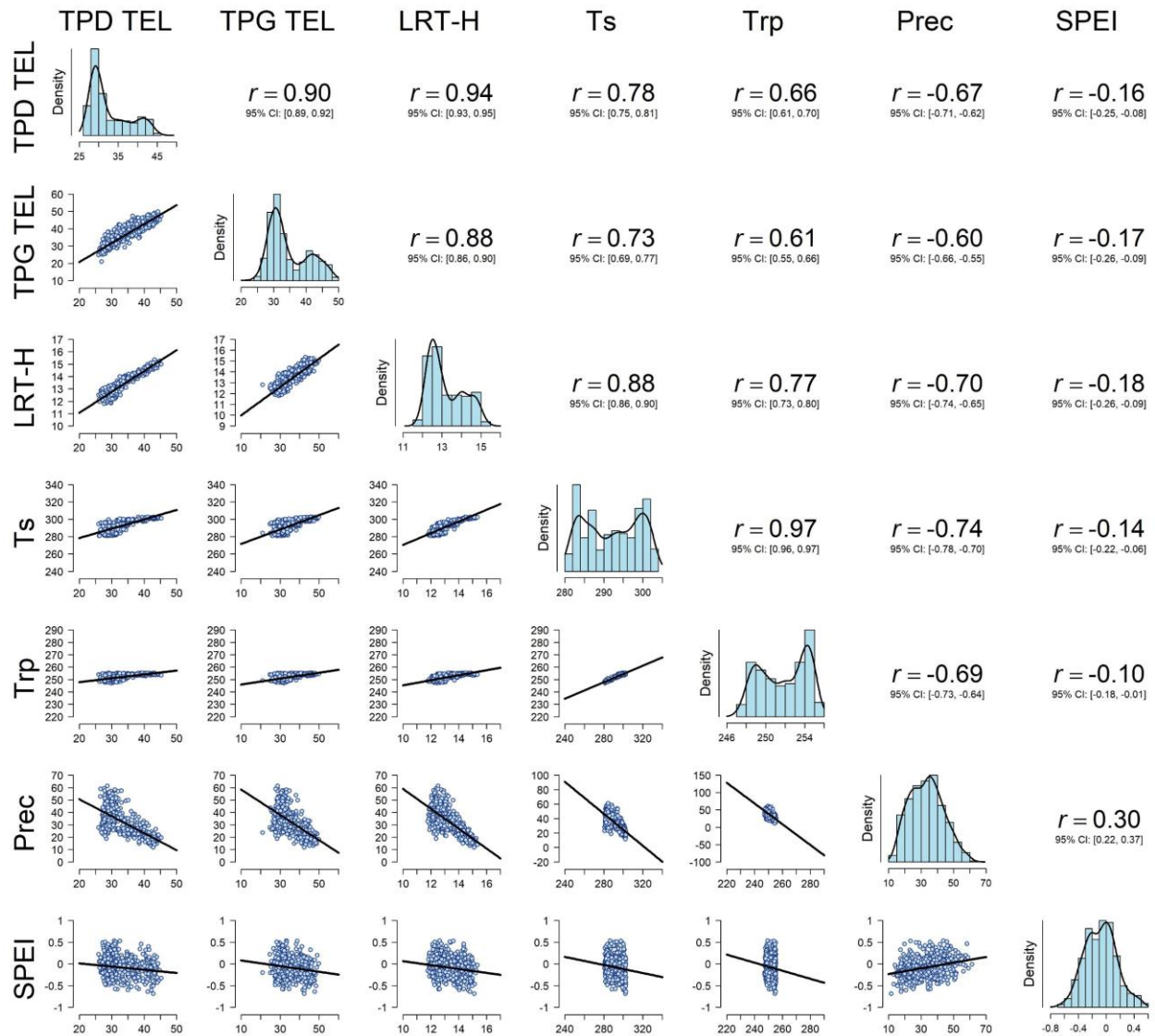
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***Referee comment: -***

*Figure 3: It will be more straightforward to put the correlation numbers on the top right panels.*

***Answer: -***

We thank the reviewer for this helpful suggestion. The correlation coefficients have now been added to the top-right panels of Figure 3 to improve clarity and readability.



**Figure 3.** On the right side, correlation coefficients among monthly TPD TEL, TPG TEL, LRT-H, Ts, Trp, precipitation (Prec), and SPEI with 95% confidence intervals are shown. On the diagonal, the density distribution of all variables is displayed. On the left side, linear regression models between variables are depicted.

**Referee comment: -**

**Figure 10: Repetition in the description of panels.**

**Answer: -**

The description of Figure 10 has been revised to remove repetition and improve clarity.

[ **Figure 10.** On the left, monthly time series of Ts (a), Trp-1 (c), and Trp-2 (e). On the right, decadal trends regression maps and their corresponding zonal mean, Ts (b), Trp-1 (d), and Trp-2 (f). Temperature trends in the troposphere and lower stratosphere (0-20 km) in addition to LRT-H represented by the red line (g). Black stippling indicates regions where the trends are statistically significant at  $p < 0.05$ . ]