

Author's response

Minor revision-egosphere-2024-345-referee-report-1

We appreciate the valuable review and constructive feedback provided by the reviewers. We agree with the reviewers' suggestions and carefully revise the manuscript. The detailed corrections are listed below.

Dear authors,

please consider the following minor revisions for the final version of your manuscript.

1. Figure 2 L130: My impression is that the complete analysis is based on - the only here mentioned - 15-point running mean of (potential) temperature RS profiles. If this is the case, then please note this explicitly in the radiosonde section. This is an important information, even it is not used generally then please explain if you used any other vertical smoothing (what I would expect).

Reply:

We have added the sentence “A 15-point running mean was adopted for temperature and potential temperature profiles.” in Section 2.1 to introduce the processing of radiosonde data.

2. L163: 'buoyancy frequency' = N (not equal N^2).

Reply:

Thank you for your comment. We have corrected it.

3. L178: The information on how the PTGT works is too sparse. Please add information here.

Reply:

We have added more information about the PTGT method, such as specific definitions, in Section 2.4.

4. L200ff: Can you please explain in more detail why gravity wave with small vertical wavelength ($< 2-4$ km) shall not produce unrealistic 2nd and potentially 3rd tropopause events with your applied methods

I am also wondering why you introduce an additional TP detection, although you stay finally with LRT for comparison.

Reply:

1) Small-scale temperature fluctuations, resulting from small vertical-wavelength gravity wave perturbations (Rechou et al., 2014), may be defined as the local cold point(s). Firstly, some local cold points due to gravity waves with small vertical wavelength will be filtered out during the double Gaussian function fitting process in the whole search range.

Secondly, we set an inversion layer strength ($0.5 \text{ }^{\circ}\text{C}/\text{km}$) as a threshold for significance testing, so insignificant LCP(s) will be excluded.

Rechou, A., Kirkwood, S., Arnault, J., and Dalin, P.: Short vertical-wavelength inertia-gravity waves generated by a jet-front system at Arctic latitudes - VHF radar, radiosondes and numerical modelling, *Atmos. Chem. Phys.*, 14, 6785-6799, 10.5194/acp-14-6785-2014, 2014.

2) Figure 2 shows five existing thermal tropopause definitions, other contextual works that would help greatly in the presentation, framing, justification, and discussion of such work, which will help directly future efforts towards accomplishing this study or another iteration. Different definitions have their own advantages and limitations, so it is beneficial to understand the formation mechanisms of the tropopause and to further research stratosphere-troposphere exchange processes by defining the tropopause from various perspectives.

3) In the manuscript, in addition to LRT, we also compared it with CPT (see the Figure 10 in revised manuscript).

5. L239: could you explain what the \bar{Y} in the SST formula stands for. Is it the mean over the complete temperature profile or your defined altitude range?

Reply:

Thanks for your careful check. \bar{Y} is the mean of the measurement temperature profiles.

6. Table 4: I am a bit confused about the presented numbers here and the

summary on DT given in L261. The table tells me 22.9% for BG and 17.5% for LRT DT-events. Why are the numbers in the text different?

Reply:

I apologize for my carelessness. Table 4 shows the correct results, and we have corrected the relevant text description.

7. Figure 8: Although you used a relative-TP coordinate system, I would expect some units and a y-range for Figure b to h. Otherwise you must add corresponding information into the caption.

Reply:

We added the scale value and units of the y axis for Figure 8 (b)–(h), and also added more explanation of the y axis in the figure caption.

8. Figure 9: this caption should include some more details on curves, symbols, color code and isolines (TP types).

Reply:

We've added descriptions in the figure caption. Figure 9: Height–time cross section of temperature profiles (shaded) from radiosondes in 2014 at Kuqa site (119.7 °E, 49.25 °N). DTH1 (magenta dotted line) and DTH2 (red dotted line) is defined the first and second tropopause height by bi-Gaussian, respectively. LRTH1 (black dotted line) and LRTH2 (blue dotted line) is defined the first and second tropopause height by LRT, respectively.

10. L438: ‘In addition, the statistical analysis ...’ please revise this sentence.

Reply:

We modified the sentence to “In addition, the statistical analysis based on bi-Gaussian method are being analyzed in the future research work to get further understanding for tracer–tracer stratosphere–troposphere exchange, especially for the DT structures.”

11. L490: ‘Five-year (from 2012 to 2016) historical radiosondes’ : ‘Five-Year radiosonde data in China’ might be better.

Reply:

Thank you for your comment. We have corrected it.

12. L494: why do the latitude belts overlap with each other? Should it be 25-35, which are also not really mid-high latitudes?

Reply:

Thanks for your careful check. We have modified to “mid-high latitudes [25 °N, 35 °N]”.

Minor revision-egosphere-2024-345-referee-report-3

We appreciate the valuable review and constructive feedback provided by the reviewers. We agree with the reviewers' suggestions and carefully revise the manuscript. The detailed corrections are listed below.

Review of “A novel method to detect the tropopause structure based on bi-Gaussian function”

The authors have put a solid amount of work into revising the manuscript to address my comments and those of the other reviewers. The clarity of the paper and its assertions have improved and many of my concerns have been reduced. However, there are still a handful of edits that I believe must be made before this can be considered for publication. Most are technical in nature, but there are two general points remaining that are most important in my view.

General Comments

1. The use of “local coldest point(s)” throughout is unnecessarily confusing. This would be much clearer stated as “local cold point(s)”, since only one could possibly be the coldest.

Reply:

Thank you for your suggestion. We have revised "local coldest point(s)" to "local cold point(s)" throughout the manuscript.

2. Units for all equations and terms outlining the bi-Gaussian method are still absent from the paper. This includes Equations 5 & 6, where the resulting altitude units and dependent latitude units should be clearly defined, line 220 where the PTH height units for the search range should be defined, everything in Table 2, and everything in Table 3.

Reply:

Thank you for your suggestion. We have added the corresponding units to the locations where quantities appear for the first time in the revised manuscript.

3. Section 5 is somewhat vague, unclear, and includes a lot of hand-waving examples of double tropopause characteristics and purported linkages to other metrics. It is neither convincing or necessary based on my evaluation and I recommend simply removing it (lines 403-481; Figs. 13-15; Table 5) and related lines 503-507 from the manuscript.

Reply:

Thank you for your comment. We have deleted the discussion in Sec.5 and related expressions. At the same time, we will continue to improve this content in the next research work.

Technical Edits

Reply:

Thanks for the reviewer's modification opinions on scientific writing, as below. We have made corresponding modifications and rewritten some unclear sentences.

1. Line 12 – recommend revising second instance of “structures” to “characteristics.
2. Line 16 – “tropopauses” should be “tropopause”
3. Line 18 – “remarkable” should be deleted. This is subjective, non-scientific language.
4. Line 19 – delete “recognition”
5. Line 28 – “formatted” should be “formed”
6. Line 30 – recommend revising “the case of” to “with cases that” & delete “happens occasionally”
7. Line 37 – “tropopause” should be “tropopauses”
8. Line 43 – “of tropopause” should be “of the tropopause” & “formatted” should be deleted

9. Line 48 – “discovered the tropopause” should be “discovered tropopause”
10. Line 57 – “separated” should be “used”
11. Line 58 – “lapse minimum rate” should be “lapse rate minimum”
12. Line 65 – “called” should be “called the”
13. Line 71 – delete “tracers”
14. Line 75 – replace “compositions, with active STE” with “constituents”
15. Line 80 – “tropopause” should be “the tropopause”
16. Line 85 – “tropopause” should be “the tropopause”
17. Line 88 – “details” should be “detail” & “with the existing” should be “with existing”
18. Line 98 – delete “there are”
19. Line 147 – revise “influenced by stratospheric” to “constrained by”
20. Line 159 – “gradient” should be “gradients” & “compositions” should be “composition”
21. Line 164 – “following” should be “follows”
22. Line 169 – “following” should be “follows”
23. Line 179 – “LRT, provides” should be “LRT, and provides”
24. Line 197 – “minimum points” should be “minimum temperature points”
25. Line 202 – “following” should be “follows”
26. Line 252 – once again, “remarkable” should be deleted.

27.Line 261 – “general” should be “total” & the numbers here seem incorrect. If I total the lines from Table 4, I instead get 23.00% and 17.85%.

Reply:

I apologize for my carelessness. Table 4 shows the correct results, and we have corrected the relevant text description.

28.Line 289 – the dots are “magenta”, not “cyan”

29.Line 309 – “contradictory” should be “contradiction”

30.Line 315 – insert “with a” before “prevailing ST structure”

31.Line 320 – start sentence with “The”

32.Line 322 – “in the Fig.” should be “in Fig.”

33.Line 323 – “bi-Gaussian” should be “the bi-Gaussian approach”

34.Line 335 – “if exist” should be “if multiple exist”

35.Line 343 – “accuracy” would be better stated as “agreement with the LRT”

36.Line 400 – “in UTLS” should be “in the UTLS”

37.Lines 409-411 – I do not know what this sentence means.

Reply:

This sentence, in the Sec.5, has been deleted.

38.Line 427 – what “invades”?

Reply:

This sentence, in the Sec.5, has been deleted.

39.Lines 428-429 – I also do not know what this sentence means.

Reply:

This sentence, in the Sec.5, has been deleted.

40.Line 440 – “at 315 K” should be “at the 315-K”

41.Lines 444-446 – this sentence does not begin correctly, but I’m not sure I know exactly how you want to relate it to something shown/mentioned previously.

Reply:

This sentence, in the Sec.5, has been deleted.

42.Line 459 – “does” should be “do”

43.Line 488 – “based bi-Gaussian” should be “based on bi-Gaussian identifications”

44.Line 491 – delete “monotonous”

Line 500 – delete “and uploading”