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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Composite analysis of the tropopause inversion layer in extratropical baroclinic waves" *by* Thorsten Kaluza et al.

Anonymous Referee #1

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The study analyses the influence of cyclones on the tropopause inversion layer. The work builds on previous studies of baroclinic waves and performs of a detailed analysis of cyclone composites using ECMWF analysis data to show the transient behaviour of the static stability maximum. The last part of the study also briefly looks at the possibility that the high vertical shear in the TIL could lead to turbulence. Whilst I think that the study is detailed and interesting, I have several comments that the authors should address before publication.

Comments:

- Cyclone tracking: P5, lines 6 to 11. I appreciated the detailed description of the cyclone tracking algorithm but I am concerned about the effect of the projection and interpolation. The final composited feature in static stability looks like a North-South

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dipole. I am wondering what the effect of the original grid and interpolation does to this feature. E.g., does it enhance the dipole?

- Composites of cyclones: P6, line 11. Do you mean cylindrical rather than spheric? The data you have is on an equidistant grid (Is this gridding only done for the cyclone tracking or is this gridded data used for the subsequent composites). I am confused about which data is being interpolated to the red pillar since the underlying grey grid in figure 2 is not equidistant.

- LC1 and LC2 case studies: Seeing the case studies is helpful in interpreting the composites. Care should be taken in discussing the static stability strength, particularly with the discontinuities that are seen as a result of the analysis in fig 3c and 5c. I would be interested in seeing the average of Nˆ2 (as opposed to Nˆ2 max) in the region 3 km above the tropopause. Side note: Add your definition of Nˆ2 max to the caption in Fig 3c.

- In figure 4, it may be more helpful to show the cross section at some latitude north of the cyclone centre since this is the region where there is an enhancement in Nˆ2.

- Composite analysis: I have some concerns about the compositing the values of Nˆ2 max and artefacts that might arise as a result of this. Have you looked at a number of cyclones in your composite to make sure that the features in Nˆ2 are indeed present in most of them?

- Richardson number analysis: I find this very interesting. Do the corresponding plots for the case studies in section 3 show very low values of Ri above the tropopause (regions with Ri <1)?

-P18 line 31. The Richardson numbers found are not low enough for turbulent flow. I would suggest not making such a strong statement in the conclusion.

- The colour scale on some of the figures could be chosen to be slightly more intuitive. E.g., Fig 10 (c) At first glance, I thought the red values were bigger.

Other comments:

- P2, line 31. Fix reference - P4 line 3 "the a more", line 25 "oder" - P6 line 6, "North Africa an the" - P9 caption a) "seal level" - P12 line 7 "extend" - P13 lines 17 and 18 "This region of strong with..." Meaning unclear. - P14 line 8 "stronger" to more pronounced - P 16 fig 10 caption "Vertical crosssection as in figure 8" should be figure 9. also "north the cyclone", "of" missing. -

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