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## ***Interactive comment on “The tropopause inversion layer in baroclinic life cycles experiments: the role of diabatic and mixing processes” by D. Kunkel et al.***

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The tropopause inversion layer is influenced by many dynamical and diabatic processes. A systematic investigations of their relative influences welcome. The most interesting result for me the is importance of vertical convergence due to tropospheric ascent relative to in situ diabatic forcing in the case of latent heat release.

A comprehensive set of numerical experiments is performed to isolate and quantify the effects of the various processes. The model setup and diagnostics are appropriate. The use of an idealized baroclinic life cycle is convenient for sensitivity tests, but leaves

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open questions. In particular whether different vertical ascent patterns in an LC2 case would give different sensitivities, and what would happen in complex developments involving multiple and secondary cyclones which contribute to the global TIL.

Detailed comments:

I.277. Could you give a definition or reference to the definition of "thermal tropopause". There are so many versions around that I would like to be sure I have the right one.

I.299-300. The metric for spatial extent of the TIL involves arbitrary thresholds. Has this been used in previous work, and is there a reference that looks at sensitivity to the choices of parameters?

I.332ff. I found this discussion confusing. Comparing Fig. 2 (a) and (d), it looks like the main difference is located at the southern end of the trough, rather than in the WCB outflow as in some of the later experiments, which one would guess would be more related to convection (resolved vertical ascent since the parameterization is not used) than slantwise ascent. The Gutwoski reference would be more useful if there was a brief mention of what he said about the two processes.

Fig.7b. RAD R30 has even smaller values of  $N^2$  than REF before 100 hrs. Is this noise, or is the difference significant?

Fig.10,13. Why are these not plotted at 120 hrs? I would have liked to compare with Fig.8 (and maybe 12).

I.565ff. Is it possible to summarize in a couple of sentences what the effect of gravity waves is, or is it sufficiently complex or random that one must read the entire paper?

Typos:

title: ...life cycle experiments...

I.293. spontaneously -> suddenly

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I.296 than -> then

I.511. tenth -> tenths

I.523-525. Sentence fragment

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21495, 2015.

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