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Interactive comment on "The Tropical Tropopause Inversion Layer" *by* R. Pilch Kedzierski et al.

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General comments

This paper examines the tropopause inversion layer (TIL) in the tropics using GPS radio occultation temperature measurements. The coherent behaviors of static stability (N2; also TIL strength) with the Quasi-Biennial Oscillation (QBO) and near-tropopause divergence are clearly demonstrated. The equatorial waves and their signatures in temperature and N2 are also investigated in order to explain the role of the equatorial waves in setting TIL strength. This manuscript is generally well organized and successfully demonstrates the fine-scale feature of the TIL. Although there are couple of minor issues that should be addressed before publication, this paper is recommended for publication in ACP.

Some minor issues are listed below.

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Discussion paper

Specific comments (minor)

1. The title is too broad for the contents of the manuscript. Authors are mainly focusing on dynamical mechanisms that could enhance TIL in the tropics. Although they demonstrate the mechanisms clearly, the contents in the manuscript are still too limited to cover the whole spectrum of the tropical TIL (e.g., annual cycle, influence of deep convection and radiation, role of shallow Brewer-Dobson circulation). It is strongly recommend for authors to further specify the title of this manuscript.

2. Authors suggest that Kelvin waves cause the enhancement of N2 just below the westerly shear (or zero-wind line) of the QBO. This may be one possible cause, however, the zonal mean temperature anomaly associated with vertical wind shear of the QBO (cf. Fig. 4 in Baldwin et al. 2001) has a strong impact on N2. Several Kelvin of temperature changes in $\sim$10 km depth, and this could significantly modulate N2 in the lower stratosphere. In fact, this may have a bigger impact on N2 than Kelvin waves, particularly in zonal mean field. Some analysis and discussion on this effect will be helpful (a simple comparison of tropical mean temperature profiles in westerly and easterly QBO will be good enough).

3. Although influence of deep convection on TIL is beyond the scope of this study, some discussions on tropical convection will still be helpful. For example, the zonal structures in N2 (shown in Fig. 2) are largely related to deep convection in DJF and JJA. In fact, climatology of N2 shows similar structures as in Fig. 2, and this is largely due to tropopause cooling cause by deep convection (deep convection make tropopause colder; e.g., Johnson and Kriete 1982; Gettelman et al. 2002; Paulik and Birner 2012). Only a part of the N2 structure is explained by tropical waves.

In addition, the coherence between N2 and near-tropopause divergence (which is a noble contribution of this paper) is consistent with the hydrostatic adjustment mechanism, which is proposed by Holloway and Neelin (2007) to explain cold-top (tropopause) over deep convection. Those discussion could be helpful for readers.

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Technical suggestions

Line 35: Satellite GPS => Global Positioning System (GPS)

(In many place, satellite GPS => GPS)

Line 105: tropopause height (TPz) using the WMO lapse-rate tropopause criterion. . .

Line 169: latitude (y) and time (t). The maximum distance allowed from the grid point in each dimension is 5°longitude, 10°longitude, and 12 hours, respectively.

Line 214: 3.1 ?

Line 234: 2011=>2010?

Line 375: highest amplitude => maximum amplitude

Line 379: very high => very large

Line 393: high amplitude => large amplitude

Line 476: higher that within => larger than that in

Fig 5: why do you show N2 tendency (dN2/dt) instead of N2?

(also in Fig 6: dT/dt instead of T)?

References

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