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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "A characterization of thermal structure and conditions for overshooting of tropical and extratropical cyclones with GPS radio occultation" *by* R. Biondi et al.

Anonymous Referee #2

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General comments:

This paper examines thermal structure of the tropical cyclones (TCs) on different ocean basin using GPS radio occultation data (RO) temperature measurement. Based on the thermal structure (cold anomaly in the lower stratosphere) the cloud top height is estimated, and their statistics are compared and documented over different ocean basins and latitudes. Analyzing TCs influence in the upper troposphere and lower stratosphere (UTLS) region is a meaningful topic, and use of GPS RO data is very suitable for the purpose. Also, considering limited observation in TCs, utilizing temperature anomaly as a signature of deep convection (and overshooting) seems a reasonable approach,

and the regional difference of TCs' overshooting convection is analyzed with a reasonably long record. The paper is generally well written, and recommended for publication in ACP. I have several minor comments and possible suggestions for the authors:

Specific comments (minor):

1. The major assumption here is the minimum temperature anomaly in the lower stratosphere (LS) corresponds with convective cloud top. The cold anomaly in the LS may not solely due to direct effect overshooting convection. The cold anomaly could also be formed by a large-scale dynamical response to latent heating below (e.g., Randel et al. 2003; Holloway and Neelin 2007), in this case, the cold anomaly is not necessarily correspond to convective cloud top. Although a reasonable agreement between these two properties are shown in Biondi et al. (2013) using CALIOP measurement (with limited number of profiles), additional discussion or physical reasoning on "robustness of this assumption" will be helpful for the future use (may be in the first paragraph of section 4.1).

2. The warm anomaly over Hcoldest and the double tropopause-like temperature anomaly in Figure. 6 could be a gravity wave signature (Kelvin wave, inertio-gravity wave; Tsuda et al 2000; Kiladis et al 2001) in the UTLS. Because gravity waves are well trapped in the deep tropics, the wave-like signal may larger in the tropical profiles compared to extra-tropical profiles.

3. In section 4.2, second paragraph proposes a mechanism of double tropopause formation. It is difficult to follow authors' interpretation because no actual double tropopause analysis is found in the manuscript, and the mechanism is different from the subtropical double tropopause formation (Rossby wave breaking and near-horizontal mixing in the subtropics; e.g., Pan et al. 2009; Wang and Polvani 2011). Further explanation and difference from the previously known mechanism would be beneficial.

Technical comments:

P.29400 L11: monthly mean => monthly climatology?

P.29401 L9: SD is used without definition

P.20702 L3-4: Hcoldest_std, Hcoldest_std+1 => Hcoldest, or

condition 1: Hcoldest > Hmm_trop + Hmstd_trop

condition 2: Hcoldest > . . .

P.29403 L13: Since there is not any good => Since there is not enough

P.29403 L19: below => above?

P.29403 L21: the minimum temperature => the minimum temperature (Hcoldest) ?

P.29404 L5: about 3 K (to my eyes it is 2-2.5 K)

P.29405 L17-19: Need to clarify. . .

P.29407 L 4-11: Figure 11 only has description, but no discussion on it.

P.29407 L27: The sentence "A double tropopause characterizes a storm. . ." needs a proof (or supporting reference)

P.29407 L27: does "convection dynamics" means "gravity wave response?"

P.29408 L3: The sentence "overshooting will overpass the climatological tropopause more deeply at extra-tropical latitude" doesn't supported by analysis.

References:

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