

The Influence of Madden Julian Oscillation to the Tropical Tropopause Inversion Layer as revealed by COSMIC GPS-RO

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This study focuses on the sharp variations of the temperature structure near the cold point tropopause (CPT), which is called the tropopause inversion layer (TIL). We analyze the height variations of the Brunt-Väisälä frequency squared (N^2) from the vertical gradient of the temperature data retrieved from the COSMIC GPS-RO in 2007-2016 using the Full Spectrum Inversion (cosmicfsi), which has the vertical resolution of about 0.1 km. This study describes new definition of tropical TIL utilizing high resolution of cosmicfsi that able to delineate the thin layer of static stability near tropopause. We examine the statistical distribution of the TIL parameters; such as S -aCPT, which is the difference between the maximum N^2 above CPT ($maxN^2$) and N^2 at CPT, and S -bCPT, the difference between the minimum N^2 below CPT ($minN^2$) and N^2 at CPT, the height difference distance for $maxN^2$ and $minN^2$ relative to CPT (dH -aCPT and dH -bCPT). The mean values of S -aCPT and S -bCPT are $6.4 \times 10^{-4} \text{ s}^{-2}$ and $4.1 \times 10^{-4} \text{ s}^{-2}$, respectively, and the standard deviation of S -aCPT is approximately two times larger than that for S -bCPT. The mean and standard deviation of both dH -aCPT and dH -bCPT are $0.4 \pm 0.2 \text{ km}$ and $0.5 \pm 0.2 \text{ km}$, respectively. We find the annual mean of S -ab, which is the difference between the $maxN^2$ and $minN^2$, has similar spatial pattern as S -aCPT and shows the largest mean value about $16 \times 10^{-4} \text{ s}^{-2}$ around the deep convective regions, particularly in the Maritime Continent and Western Pacific. We discuss the intraseasonal variation of S -ab which its peak value is somewhat shifted eastward from the peak of organized deep convection during Phase 3 through Phase 6 of the active Madden Julian Oscillation (MJO).

Keywords: COSMIC, GPS-RO, Full Spectrum Inversion, MJO, Tropopause Inversion Layer