Characteristics of the tropical tropopause inversion layer using high resolution temperature profiles by COSMIC GPS-RO

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Using long-term observation of COSMIC GPS-RO with 0.1 km vertical resolution in the upper troposphere and lower stratosphere (UTLS), we investigate global distribution of static stability (N^2) and the variation of tropical TIL, the sharp gradient of temperature profile which is related to N^2. We show the mean N^2 in the conventional height coordinate and relative to both Lapse Rate Tropopause (LRT) and Cold Point Tropopause (CPT) locations in the vertical. The double layers of strong N^2 appear in the tropics, within 1 km and near 2 km above LRT height. When the N^2 profiles are averaged relative to CPT height, it shows a single thin layer less than 1 km in thickness with maximum about 12.0 x 10^{-4} s^{-2}. The mean and standard deviation of TIL sharpness (S-ab) is (10.5 +- 3.7) x 10^{-4} s^{-2} and about 70% of TIL thickness (dH) are in the range 0.4 +- 0.04 km. Seasonal variations of S-ab and dH are closely related with the deep convections as shown by low Outgoing Longwave Radiation (OLR) values. S-ab anomaly (S-ab$^{\Lambda}$) has anti phase with OLR anomaly (OLR$^{\Lambda}$) both in 90-150E and 170-230E regions. The correlation between S-ab$^{\Lambda}$ and Sea Surface Temperature (SST) Nino 3.4$^{\Lambda}$ index over Pacific region is +0.88 which means during El-Nino Southern Oscillation (ENSO) warm event, warmer SST produces more deep convections which tend to force the air upward to the tropopause layer and enlarge the temperature gradient. Intraseasonal variation of S-ab$^{\Lambda}$ in the fast and slow episodes of Madden-Julian Oscillation (MJO) demonstrated that eastward propagations of positive S-ab$^{\Lambda}$ are associated with organized deep convections. This suggests convective activity in the tropics influence the variation of tropopause sharpness.