



## **Seasonal Variability of Storm Top Altitudes in the Tropics and Subtropics Observed by TRMM PR**

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Seasonal variability of storm top altitudes for convective and stratiform precipitation in the tropics and subtropics is investigated based on measurements of the Tropical Rainfall Measuring Mission's (TRMM) Precipitation Radar (PR) from 1998 to 2011. Statistics indicate that the mean altitude of convective storm top varies from 3~7km over ocean and 5~10km over land compared to more uniform distribution of stratiform storm top (4~9km) for each season over land and ocean. In the tropical regions between 10°S and 10°N, both convective and stratiform storm tops show stable mean altitudes at 5km (6km) and 5.5km (6km) over the ocean (land), against larger seasonal variations of the tops outside the tropics. Generally, these variations in spring and autumn are smaller over land while relative larger over ocean. In subtropics, the altitude difference between summer and winter can reach ~4km for convective precipitation and ~2km for stratiform precipitation. The zonal mean storm top altitude for stratiform precipitation is highly correlated to the zonal averaged temperature in four seasons. Mean precipitation profiles for different storm top altitudes indicate that seasonal departures of near-surface rain rates are more significant with the increment of storm top altitudes. Generally, storm top altitudes increase quadratically with conditional rain rates for both convective and stratiform precipitation at the seasonal scale. By applying this quadratic equation, the retrieved rain rate shows a relatively good agreement with the observed rain rate at the seasonal scale.