

## Vertical gradient of stratiform radar reflectivity below the bright band from the tropics to the extratropical latitudes seen by GPM

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This study examined the vertical gradient of radar reflectivity below the detected bright band in stratiform regions from the tropics to the extratropical latitudes using data from the Ku-band (13.6 GHz) precipitation radar onboard the Global Precipitation Measurement (GPM) Core Observatory. Stratiform precipitation profiles with reflectivity decreasing (increasing) from the melting level toward the surface occur frequently in the tropical ocean (mid- and high latitude oceans). High fractions of downward increasing stratiform pixels are found over the North Pacific Ocean throughout the year and over East Asia except for winter. In contrast, the North American continent and the adjacent North Atlantic Ocean are characterized by low fractions of downward increasing pixels during summer. The difference is consistent with the dominant type of convection over East Asia (warm-type clouds) and over the North American continent (cold-type clouds). Even in the tropical oceans such as the Atlantic and eastern Pacific intertropical convergence zones, there are some areas with moderate fractions of downward increasing stratiform pixels where the warm rain process dominates. The downward reduction of reflectivity in the stratiform region of MCSs is obviously due to evaporation, which is a function of lower-tropospheric relative humidity. The downward increase of reflectivity in stratiform regions over the mid-latitude oceans appears the result of raindrop growth. This is achieved via the collection of cloud droplets while falling through low-level clouds produced by large-scale vertical motion in the lower troposphere due to large-scale convergence associated with synoptic-scale systems.