

Regional and Diurnal Variations of Lightning, Precipitation and Hydrometeor Characteristics along Equatorial Indonesia

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Regional and diurnal variations in lightning, precipitation and hydrometeor characteristics along equatorial Indonesia had been investigated using several remote sensing systems. The vertical structure of precipitation over four locations along equatorial Indonesia, namely, Kototabang (KT; 100.32° E, 0.20° S), Pontianak (PT; 109.37° E, 0.00° S), Manado (MN; 124.92° E, 1.55° N) and Biak (BK; 136.10° E, 1.18° S) were determined using the gradients of the radar reflectivity (dBZ) below the freezing level which were gathered from the latest 2A25 TRMM–Precipitation Radar product over a 17-year time span (1998–2014). Furthermore, the TRMM 2A12 data were used to study the vertical profile of hydrometeor and a network of Parsivel disdrometers were used to observe characteristics of surface raindrop size distributions (DSDs). The World Wide Lightning Location Network (WWLLN) data were used to study the lightning characteristics at each location. Finally, MODIS data were used to investigate the cloud properties at each location such as aerosol optical depth (AOD) and cloud effective radius. The convective storms are more intense at PT than at KT, MN and BK which were indicated by a higher storm height, cloud water content and lightning intensity. The average of storm height for PT, KT, MN and BK are 6.1, 5.9, 5.4 and 5.7 km, respectively. PT has the smallest ratio of the downward increasing (DI) to the downward decreasing (DD) of dBZ toward the surface, followed by BK, KT and MN. The ratio values are 0.92, 1.18, 1.30, and 1.33, respectively. Thus, precipitation systems at PT more continental in nature than those at other three locations because the DI is frequently observed over the ocean and the higher prevailing rain top heights over land as observed at PT are associated with DD, in most cases [1]. Number of stratiform rain profile at PT and BK is greater than other locations in which the ratio of the profile of stratiform to convective rains at PT, BK, KT and MN are 2.07, 2.01, 1.61 and 1.65, respectively. Moreover, the ratio of deep to shallow convective rains at PT (2.51) and KT (2.26) are greater than those at MN (1.26) and BK (1.60). While the DD pattern which indicates a decrease in the raindrop concentration is more dominant at PT, the DSD at PT has more large drops than at other three sites [2]. Because shallow convective rain, which is normally associated with large drops, is not dominant at PT, dominant large drops at this location may not associate with this rain type. Detailed information about the microphysical processes affecting the DSD at each location will be presented during the meeting.

[1] Marzuki, H. Hashiguchi, M. Vonnisa and Harmadi, 2018: Seasonal and Diurnal Variations of Vertical Profile of Precipitation over Indonesian Maritime Continent. *Engineering and Mathematical Topics in Rainfall*, H. Theodore and P. Rao, Eds. InTechOpen, Croatia, in press.

[2] Marzuki, M., Hashiguchi, H., Yamamoto, M. K., Mori, S., and Yamanaka, M. D., 2013: Regional variability of raindrop size distribution over Indonesia, *Ann. Geophys.*, 31, 1941-1948, <https://doi.org/10.5194/angeo-31-1941-2013>.

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