

# Seasonal and Regional Variation of Diurnal Cycle of Rainfall over Java Island and the Surrounding Area

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The seasonality and regional variability of diurnal cycle of rainfall (DCR) over Java Island and the surrounding area (coastal region of the Java Sea and the Indian Ocean) are analyzed through satellite observations. This study focus on the area where the studies of the seasonality of DCR over Indonesian Maritime Continent (IMC) are still limited. The DCR is a prominent phenomenon over IMC which is important for aviation industry and related to heavy precipitation events that cause hydro-meteorological disasters.

In this study, **we investigate seasonal and regional variation of DCR (the phase and the amplitude)** through satellite observations. High resolution (spatial and temporal) rainfall estimate is needed to capture feature of DCR over the study area which is difficult to obtain from ground observation. We **mainly employ the high-resolution dataset of Global Satellite Mapping of Precipitation (GSMaP) reanalysis (GSMaP\_RNL) and near real time (GSMaP\_NRT)**. The analysis of DCR seasonal variability is based on investigation throughout boreal winter (December-January-February), boreal spring (March-April-May), boreal summer (June-July-August), and boreal autumn (September-October-November) from 2008-2018 (GSMaP\_NRT) and 2009-2014 (GSMaP\_RNL).

The results show that hourly data of GSMaP\_RNL and GSMaP\_NRT with 0.1° spatial resolution are able to depict the detailed features of the seasonality and regional variability of DCR over Java Island and surrounding areas. **The comparison between GSMaP\_RNL and GSMaP\_NRT shows that GSMaP\_NRT represents significant time lag of DCR phase over off shore region. GSMaP\_NRT shows that the offshore region of the Java Sea is dominated by noon-afternoon rainfall while GSMaP\_RNL shows morning rainfall.** However, both of GSMaP\_RNL and GSMaP\_NRT show similar pattern on phase and amplitude of DCR. Phase of DCR indicates the time when maximum rainfall occurs, while amplitudes indicates the magnitude of DCR. In general, both of GSMaP\_RNL and GSMaP\_NRT composites, show that the land region with wider landmass area (West Java and western part of East Java) is dominated by evening phase while narrow landmass area (Central Java and eastern part of Java Island) is dominated by late afternoon phase. A large magnitude of the DCR is concentrated inland. The Java Sea has a higher amplitude of DCR compared to the Indian Ocean and the coastal region. The amplitude over the coastal region of the Indian Ocean is higher than over the Indian Ocean and the coastal area of the Java Sea.

**Both of rainfall estimates capture inhomogeneous seasonal shifting phase of DCR over this region. The remarkable seasonal shifting phase occurs along the coastal area of the Java Sea.** Though, phase shifting over inland of a wide landmass area and the coastal region of the Indian Ocean is not significant. Inhomogeneous seasonal shifting phase of DCR indicated interactions between local circulations, which affected by the topography (e.g. terrain and shape of the coastline), and large circulations (background wind, synoptic conditions, etc.). The analysis of wind profile from reanalysis data confirms the seasonal change of interactions between large and small circulations that caused seasonal shifting phase of DCR.

Keywords: Diurnal cycle of rainfall (DCR), Seasonal variability, Regional variability, Shifting Phase, GSMaP

