Impact of Cross-equatorial Asian Winter Monsoon and the MJO on Extreme Precipitation over Western Java Island

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The Indonesian capital of Jakarta experienced an extraordinary heavy precipitation/flood event in the middle of January 2013, as it did in 1996, 2002 and 2007. Heavy rainfall repeatedly occurred in a local area over western Java Island for 4 consecutive days 15-18 January. The central part of Jakarta city was inundated during 17-18 January 2013. This study examined the atmospheric circulations leading to the extreme precipitation event. Examination of ocean surface winds derived from the WindSat satellite measurements showed that a persistent, trans-equatorial, northerly wind took place 2-3 days prior to and during the heavy precipitation event, similar to that which occurred during the extreme precipitation event in Jakarta during late January into early February 2007 [1]. The strong, persistent, trans-equatorial Asian-winter monsoonal flow from the Northern Hemisphere was a main factor in the formation of extreme rain over western Java Island, as it induced an intensive low-level wind convergence along its leading edge over the island. In contrast to the extreme rain event of 2007, which was in an inactive MJO phase, the extreme precipitation/flood event of 2013 coincided with strong and coherent MJO activity with the enhanced convective phase centered on the western Pacific [2]. The active phase of the MJO caused strong to moderate westerly to northwesterly winds at the levels from near the surface up to 400 hPa (~8 km) over Java Island in early to mid-January 2013. The westerly winds, in conjunction with the trans-equatorial monsoonal flow, strengthened the low level wind convergence near western Java Island, providing favorable conditions for precipitation (Fig. 1). The results of the present study suggest that a persistent, trans-equatorial, northerly wind and the eastward propagation of an active phase of the MJO produced a great effect on the formation of extreme heavy rain over western Java Island.

References

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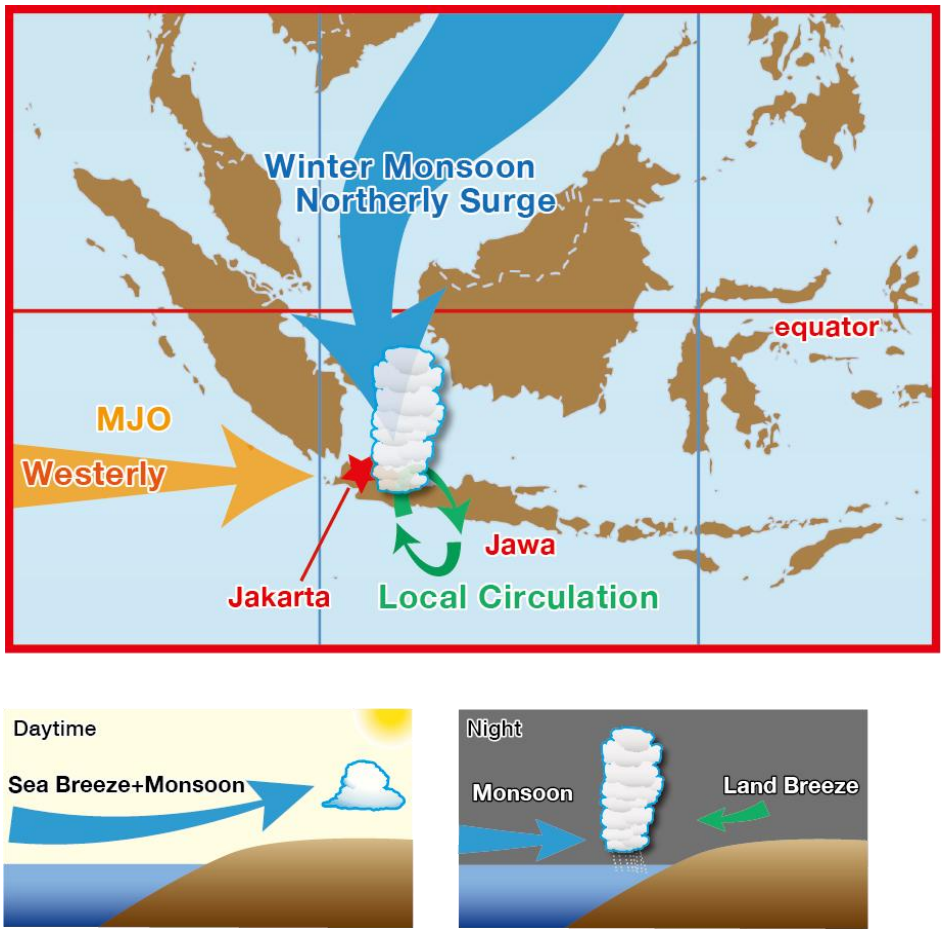

Fig. 1 Schematic diagram of the mechanism of torrential rain generation by the equator-crossing Asian winter Monsoon and the MJO. Simultaneous occurrences of a cross-equatorial northerly surge, strong westerly wind caused by the active phase of the MJO, and the local land-sea breeze circulations caused the Western Java Island torrential rains.