The Role of Local Circulations and Upper Tropospheric Disturbances in the heavy Rain over Western Java Island during the 2010 Rainy Season

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Five torrential rain events occurred repeatedly in the western part of Java Island, Indonesia during the rainy season of the region on February 6, 12, 17-18, 22-23, and February 28 to March 1, 2010, causing widespread floods. In Bandung, the capital city of West Java province, and the country's fourth largest city, the worst flood in 24 years occurred on February 6 and 17-18. Heavy rain triggered floods, washing into thousands of homes, some houses in Banjaran suburb, Bandung were submerged by four-meter-high flood waters. We performed intensive rawinsonde observations of 4-8 times a day at 5 stations in the region during the period from January 16 to February 14, 2010. We also carried out weather radar observations in the period.

The results from the intensive observations show that convection/rainfall occurs frequently over the mountainous areas of the island in the late afternoon. The observed wind profiles showed that the prevailing winds are relatively weak in the entire troposphere during the heavy events. Consequently, thermally induced local circulations, that is, sea breeze and upslope wind, are expected. Meanwhile, the heavy rain events occurred in the periods of transition of upper winds from northerly to southerly at the levels between 400 and 150 hPa (~8-15 km), which occurred with a period of about 5 days. These results suggest a possibility of the existence of upper level anticyclonic disturbances during the period of the heavy rain events. Convection/rainfall in the mountainous areas of the island is caused by the thermally induced local circulations on a daily bases, being presumably enhanced by the upper tropospheric disturbances periodically with a period of about 5 days. As a result, torrential rain occurred repeatedly over the island, which triggered severe flood in Bandung and the JABODETABEK region. The results of the present study revealed that the upper tropospheric disturbances and the thermally induced local circulations are the two major factors in determining the occurrence of torrential rain in the western part of Java Island during the rainy season of 2010.