



A very unusual precipitation event associated with the 2015 floods in Jakarta: an analysis of the meteorological factors



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ABSTRACT

“The 2–days precipitation event over Jakarta in February 2015 was very unusual, the highest in the 135–year long historical records with a return period more than 60 years in the current climate. An intensified monsoon with an unusual northerly winds leading to this event is described. The 2015 event has become about 2.2 times more likely due to the trend towards more extreme precipitation.”

1. Introduction

Jakarta experienced a major flooding on 9–10 February 2015 after having seen two occurrences of major flooding in the two preceding years 2013 and 2014. The 2015 flooding inundated 52 locations (~20% of Jakarta) with depth of inundation varying from 40 cm to 1 m causing more than 14,000 people being evacuated, crippling transportation and economic activities. The Agency for National Disaster Management Authority (BNPB) reported that losses reached up to USD 114 million per day.¹

The aim of this paper is to describe the 2015 flooding event, to explain its meteorological context and put this event in a historical perspective.

2. Material and methods

We use observed daily precipitation series from 61 rain gauges within the Greater Jakarta Metropolitan on 8–10 February 2015 obtained from the Indonesian Meteorological Services (BMKG). The rain gauges record 24-h precipitation sums and are read at 07 local time (00 UTC). The 24-h period therefore falls mostly on the preceding day. Assessment of extreme rainfall statistics is based on 135 years of observed and quality checked daily precipitation series measured at

Jakarta Observatory (*hereafter* Jakarta Obs.). In this analysis we will use data from 1900 onward (Siswanto et al., 2015, 2016). This series is now available on the Southeast Asian Climate Assessment & Dataset (SACA & D²) (van den Besselaar et al., 2015). Estimated rainfall retrieved from the Integrated Multi-Satellite Retrievals for Global Precipitation Measurement (GPM/IMERG) is used to visualize the spatial distribution of the precipitation. The NCEP/NCAR Reanalysis-1 data (Kalnay et al., 1996) on 8–10 February 2015 is used to describe the large-scale atmospheric features related to the 2015 extreme precipitation event.

3. Results and discussion

3.1. Meteorological context

The 2015 flooding event followed two consecutive days with excessive rainfall ($> 100 \text{ mm day}^{-1}$) over Jakarta and its direct surroundings (Fig. 1A). The highest daily precipitation values were recorded in the Sunter rain gauge (367 mm), and in the harbour of Tanjung Priok (361 mm) on the morning of 10 February (Fig. 1A). Jakarta Obs. observed 277 mm on that day. On Feb. 9, the station with the largest amount of recorded precipitation was Jakarta Obs. with 177 mm, already much higher than the Simple Daily Intensity Index

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¹ <http://dibi.bnpb.go.id/>.

² <http://sacad.database.bmgk.go.id>.

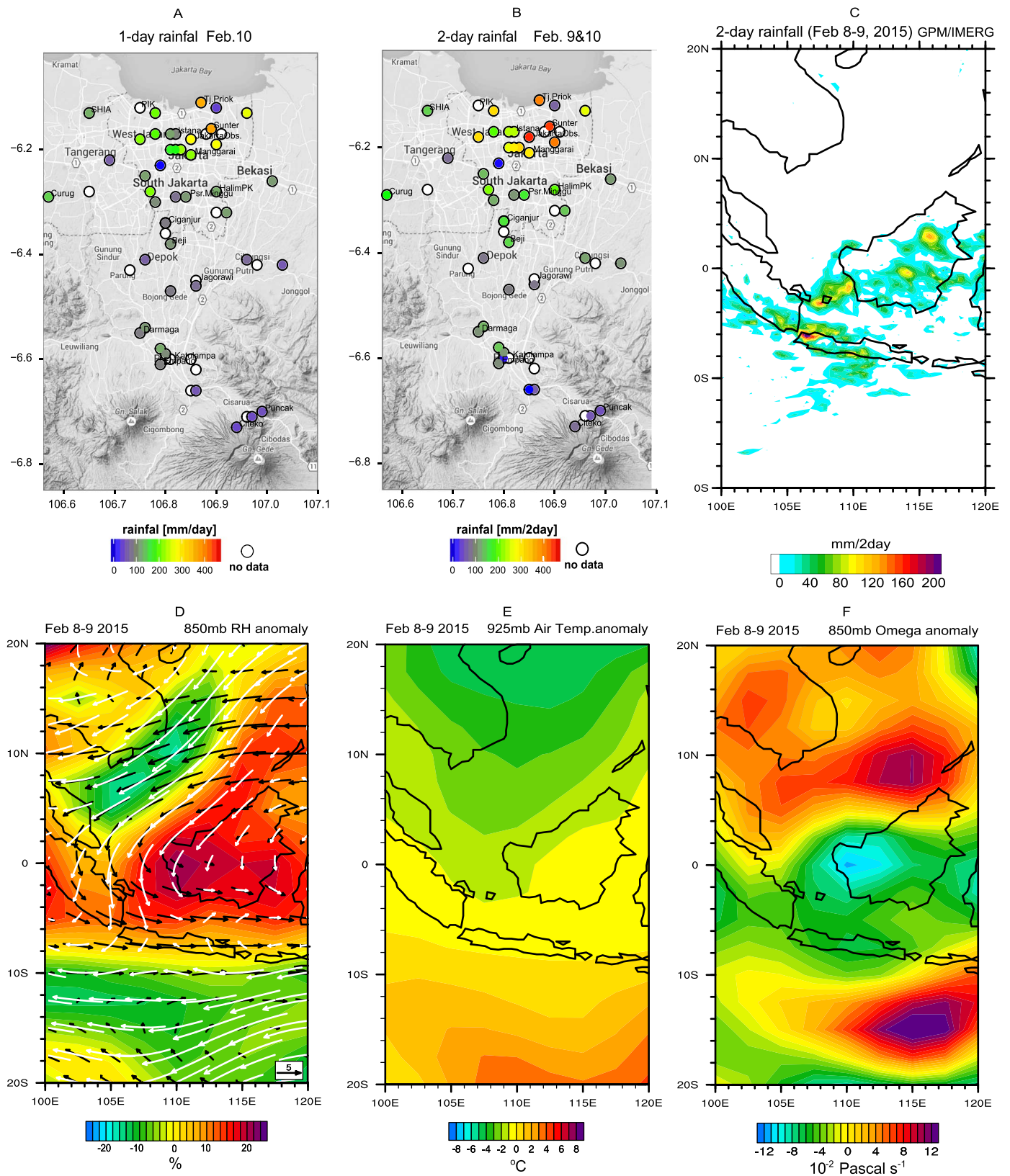


Fig. 1. (A) Observed 24 h rainfall (mm day^{-1}) at 47 of 62 rain gauges in the Greater Jakarta on February 10, 2015 (Source: BMKG). Rainfall is observed at 07 local time. The recorded value on Feb. 10 relates to precipitation which fell mostly on Feb. 9. (B) as in (A) but valid for 2-day sum precipitation amount recorded on Feb. 9 and 10. (C) 2-day estimated precipitation on February 8 and 9, 2015 retrieved from the daily (0–24 h) product of GPM/IMERG multi-satellite precipitation. (D) 8–9 February 2015 composite anomaly of 2-days consecutive relative humidity (%) relative to February 1981–2010 climatology overlaid to the 850 hPa wind field (ms^{-1} with reference vector). The white (black) vectors denote the 8–10 February 2015 composite mean (climatology). (E, F) As in (D) but for 925 hPa air temperature (in degree Celcius) and omega (in 10^{-2} Pa/s), respectively. Negative values of omega indicate upward motion.

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