Evaluation of TRMM satellite-based precipitation indexes for flood forecasting over Riyadh City, Saudi Arabia

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1. Introduction

Among various natural disasters, floods have been the most common one (\textit{World Disasters Report}, 2003). Moreover, flash floods are among the mostly faced and the most deadly (Hapuarachchi et al., 2011; Jonkman and Kelman, 2005) despite their limited affected area (Borga et al., 2014) and being one of the most challenging topics for the research community (Alfieri et al., 2011). Hapuarachchi et al. (2011) tied the driving mechanisms of flash floods either to excessive rainfall or to dam failure; they mentioned the rareness of dam failures and focused on excessive rainfall.

Regions with plentiful rainfall, as well as arid and semi-arid regions, are equally vulnerable to flash floods. Actually, the strongest convective storms are detected in semi-arid regions (Zipser et al., 2006). Recent flood events that occurred in Riyadh, Jeddah and Abha Regions among others in Kingdom of Saudi Arabia (KSA) reflect flash flood risks in arid/semi-arid regions (Fig. 1).

The high fatalities and damages of flash floods arise from the fact that they occur rapidly without enabling time to take mitigation effects. Severity of the damage increases in developing countries where generally warning systems are missing and infrastructures are inadequate (Pombo and de Oliveira, 2015). Developing flood warning systems have been reported in literature as the most effective way to reduce loss of life and property damage (Negri et al., 2005). The advances and criteria in flash flood occurrence methods were reviewed and summarized in Hapuarachchi et al. (2011) and Alfieri and Thienel (2012) in three main categories: Flood Susceptibility Assessment (FSA), Rainfall Comparison (RC) and Flow Comparison (FC). They mentioned that RC indicates a good tradeoff between simplicity and good estimates by requiring just Quantitative Precipitation Estimates (QPE). As mentioned in Negri et al. (2005), during the flooding events rainfall measurements from ground-based gauging stations can be problematic, since they can be damaged or data transmission may not be possible. These can be minimized by optimal sensor