Distributed hydrologic modeling of extreme events on the Lui watershed, Malaysia

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Abstract. In Malaysia, floods have become the most significant type of natural disaster in terms of the population affected, financial losses and adverse socio-economic impact. Malaysia is subjected to Monsoon climate and most areas receive more than 2,500 mm of rainfall every year. This study uses the fully distributed two-dimensional TREX model for the simulation of infiltration, overland runoff and channel flow during extreme rainfall events. The main objective of this study is to investigate the applicability of the TREX model to simulate runoff under Malaysia's climate. The second objective is to investigate the spatial and temporal distribution of runoff and flooding areas during extreme rainstorms. Very large rainfall events covers return periods ranging from 2 to 100-years. Extreme rainfall events include both the Malaysia's PMP (from 1 to 12-hours rainfall duration) and the world largest rainfall events (from 1 to 16-hours rainfall duration). The Lui watershed covers 68 km^2 and has been selected for this study. Approximately 87% of the area is mountainous and valleys cover 13% of the watershed area. The model calibration has been done using field measurements at the Lui gaging station 3118445 during large storm events. The performance of the TREX model has been tested using NSEC and PBIAS methods. The TREX model shows good performance with NSEC between 0.36 and 0.8 and most of the PBIAS values at an average of 14%. The 3D visualization tools within TREX show areas prone to danger-level flooding (in excess of 2.71 m of flow depth) under Malaysia's PMP and the world largest rainfall events. The percentage of flooded area for both cases is 24% and 83% of the valley areas, respectively. However, for return periods less than 100 years, the flow depth in the valley did not exceed 2.71 m except in the main channel.