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Interactions between rainfall spatial distribution and flow path network structure in relation to urban hydrological response

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In this study, the interaction between rainfall spatial distribution and flow path network structure in relation to hydrological response was analysed based on 15 years of flow observations for five (semi)urbanised basins ranging from 7.0 to 111.1 km2 in size. We use the concept of rainfall-weighted flow distance to look into the effect of rainfall spatial concentration in relation to the drainage network. Results show that for the majority of events, rainfall spatial variability and rainfall-weighted flow distance variability are uncorrelated, showing that the flow path network clearly alters the way spatial rainfall variability affects hydrological response in these basins. The flow path network leads to strong smoothing of spatial rainfall variability, increasingly so for larger basin size. Correlation analysis shows that mean rainfall-weighted flow distance is significantly correlated with flow peak in some of the basins, while there is no significant correlation with lag time. Storm movement in relation to the flow path network is investigated based on time changes in rainfall-weighted flow distance. Results show that the direction of storm movement does not seem to play a significant role, while storm movement velocity does have an influence on lag time and flow peaks, under certain conditions.