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Merging personal weather stations with real-time radar rainfall estimates at the catchment scale

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Real-time flood forecasting and warning during extreme rainfall events remains challenging since accurate and real-time available data are critical. Nowcasting based on radar rainfall can be utilized for this, as it has a high spatial and temporal resolution (i.e. typically 1 km and 5 min). However, the quantitative precipitation estimates (QPE) from the radar, upon which radar rainfall nowcasting is based, often contains substantial uncertainty and bias. While the QPE are usually corrected with official rain-gauge networks, these networks are sparse, and not always available in (near) real-time.

Instead, personal weather stations (PWS) can be used, as they have a much higher density and are available in real time. While PWS are prone to several sources of error, quality control algorithms can be used to improve their accuracy. Previous research already showed that merging quality controlled PWS with radar rainfall estimates reduces the underestimation for 1-hour accumulated rainfall at the pan-European scale. However, this has not yet been investigated at the catchment scale. This research aims to investigate the potential of merging PWS data with radar rainfall estimates for different catchments in the Netherlands, by considering multiple rainfall events starting from 2018. The goal is to quantify the performance in relation to rainfall type, quality control algorithms and catchment properties, validated against the climatological gauge-adjusted radar dataset from the KNMI. The insights obtained from this research have the potential to be utilized for real-time radar rainfall nowcasting and consequently flood forecasting.