Impact of rainfall temporal resolution on urban water quality modelling performance and uncertainties

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ABSTRACT

A key control on the response of an urban drainage model is how well the observed rainfall records represent the real rainfall variability. Particularly in urban catchments with fast response flow regimes, the selection of temporal resolution in rainfall data collection is critical. Furthermore, the impact of the rainfall variability on the model response is amplified for water quality estimates, as uncertainty in rainfall intensity affects both the rainfall-runoff and pollutant wash-off sub-models, thus compounding uncertainties. Hence, a modelling study was designed to investigate the impact of altering rainfall temporal resolution on the source and magnitude of uncertainties associated with (a) the rainfall model inputs, (b) the hydrological modelling and (c) the water quality model structure and parameters. For the investigated 85 ha combined sewer sub-catchment in Bogotá (Colombia), water quality estimates showed some sensitivity to rainfall input temporal resolution, but this was weaker than the inter-event differences in the rainfall hyetograph characteristics of the modelled rainfall-runoff events. Overall, model output uncertainties, particularly those stemming from the water quality sub-model parameters, were too large to make recommendations for model structure and parameters with respect to rainfall temporal resolution, due to the intrinsic scarcity of observations in urban water quality modelling.

KEYWORDS

Bogotá's sewer system; Build-up and wash-off processes; Calibration and uncertainty analysis; Rainfall temporal resolution; Sediment load modelling.