



## A generalised framework for large-scale evaluation of discharge uncertainties across England and Wales

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Benchmarking the information content and quality of discharge data in England and Wales is essential for analyses of catchment behaviour and modelling results for research and water management. This is particularly pertinent for comparative hydrological analysis and modelling performance conducted over regional and national scales to ensure the information content of discharge data is effectively characterised.

In this study, the first country-wide assessment of discharge uncertainty in England and Wales is undertaken. We analyse rating-curve data and stage-discharge measurements for over 700 gauging stations and present a novel, generalised framework for quantifying discharge uncertainty that is readily applicable to many gauging stations. Our methodology utilises a non-parametric regression technique for fitting the rating curve, specifically accounting for measurement error by bootstrap sampling from derived measurement uncertainties and for scatter in the stage-discharge relationship. Additionally, the framework incorporates techniques to account for different types of stage-discharge relationships, including time-variable rating curves, gauging station changes and outliers in the stage-discharge measurement data. Results for all gauging stations across England and Wales are presented demonstrating (1) how discharge uncertainty varies spatially for low, mean and high flows, (2) how the framework captures place-specific uncertainties for a number of case studies and (3) the links that can be drawn between catchment characteristics and discharge uncertainty. We also analyse changes in the official rating curves to deduce the stability of the stage-discharge relationship and find this is dependent on catchment dynamics. Finally, we discuss the significance of these results for national scale uncertainty analyses and comparative hydrological assessments. This methodology is applicable to any catchment with comparable stage-discharge information.