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Patterns in routinely collected, high frequency water quality data in rivers supplying drinking water treatment works.

Josie Ashe (1,2), Emilie Grand-Clement (2,3), David J. Luscombe (2), Hugh Graham (2), Dragan A. Savic (1,4), and Richard E. Brazier (2)

(1) Centre for Water Systems, College of Engineering, Mathematics & Physical Sciences, University of Exeter, Exeter, UK (j.ashe@exeter.ac.uk), (2) Geography, College of Life and Environmental Sciences, University of Exeter, Exeter, UK, (3) South West Water, Exeter, UK, (4) KWR Water Cycle Research Institute, Nieuwegein, The Netherlands

The increased use of high temporal resolution in-stream sensors, deployed operationally in industry or for research, produces a large volume of high frequency data. Records generated may contain information value additional to the original purpose, which is not generally explored; and so the full value of these large datasets is rarely realised. Records are available at a frequency and volume that increases the visibility of previously hidden patterns. Alongside targeted research, these data may provide additional insight into hydrochemical behaviour in rivers, and therefore support an improved understanding of both landscape and in-stream processes which can affect drinking water resources.

This study investigates the relationships between high frequency water quality parameters and rainfall-runoff driven water quality events in rivers within predominantly rural catchments in the UK. The research improves understanding of the pattern-processes information content of routine data collected from high frequency in-situ sensors in the context of the potential impact on drinking water treatment. The catchments investigated were selected as part of a wider programme of interventions and monitoring for drinking water protection, including farm advise and landscape restoration.

Archives for in-situ sensors operated as part of drinking water source monitoring and treatment over the period of the study (2012 - ongoing) contain records for water quality indicators (including; ammonia, colour, conductivity, dissolved oxygen, pH, turbidity) at 5 minute frequency. Additional data (flow, stage, rainfall) from the environmental regulator and from targeted research-based monitoring by the authors were also obtained. The time series datasets were quality controlled using a series of filters written and adapted in R. This was followed by the identification and extraction of rainfall-runoff driven water quality events, which was automated using a base flow separation recursive digital filter and threshold based rainfall-runoff pairing script. A range of visualisation and multivariate techniques were used to identify and investigate patterns, with a focus on hysteresis and both long term and abrupt changes in recorded colour and turbidity.