



Investigating catchment-scale hysteretic behaviour of nutrients at annual and individual storm time-resolutions.

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The European Water Framework Directive (WFD) requires that all water bodies should be maintained at, or raised to, good ecological status, driven by improved integrated catchment management. Therefore, it is necessary to implement cost-effective mitigation strategies to reduce pollution from nutrients and improve overall water quality. If successful mitigation strategies are to be designed then it is imperative that catchment scale responses to environmental and anthropogenic changes are better understood. Against this background, this presentation investigates changes in hysteretic behaviours of nutrients in response to different environmental drivers using high resolution monitoring techniques.

Observations of hysteretic behaviour can provide insights into the dominant flow pathways of pollutants. Therefore, monitoring changes in nutrient hysteresis can provide a useful tool for detecting regime differences or changes within and between catchments. In the UK, the Demonstration Test Catchment (DTC) project has been set up to monitor evidence for improving water quality problems arising specifically from diffuse pollution from agriculture using targeted mitigation experiments and high resolution monitoring. This research platform provides an opportunity to compare storm-driven nutrient behaviour between catchments which have differing geologies, as well as how these behaviours evolve on a seasonal and annual basis. The monitoring to date has included a period of drought, directly followed by extreme wet conditions in the UK and therefore offers opportunities to assess the effect of differences in antecedent conditions on monitored nutrient response to rainfall events.

The study compares the hysteretic behaviour of nutrients, including nitrogen and phosphorus species as well as sediment from a number of storm events of varying magnitudes throughout the 2011-2012 monitoring period in the Hampshire Avon catchment as part of the DTC programme. The investigation focuses on four of the monitored sub-catchments which are all mainly agricultural and underlain by differing geologies. Two sub-catchments are predominately underlain by chalk (Brixton Deverill, River Wylye and Ebbesbourne Wake, River Ebbles) and two are underlain by clay (Prior's Farm and Cool's Cottage, River Sem). Existing metrics such as loop size, shape and area are being used to assess changes in the hysteretic responses through time and in conjunction with varying antecedent conditions, including the recent post-drought period. The study is also examining changes in annual hysteresis patterns from individual storms in order to assess catchment responses to longer-term climatic variabilities. Overall, the work considers the importance of understanding hysteresis in quantifying nutrient loads and estimating the uncertainty and variability in this behaviour. This work therefore provides key insights for future adaptation, planning and water quality management in the UK and continental Europe.