

# ***Interactive comment on “High-resolution monitoring of catchment nutrient response to the end of the 2011–2012 drought in England, captured by the demonstration test catchments” by F. N. Outram et al.***

## **Anonymous Referee #2**

Received and published: 13 January 2014

This paper uses high-frequency nutrient monitoring data to characterise responses to a major rainfall event across 3 contrasting catchments. I really like the concept of examining hysteresis behaviour to the same storm event across the UK, and it is a really novel use of the detailed data generated by the DTC catchments. This paper is original, of interest to an international audience, and generally well written. However, it would require some corrections and restructuring before I could recommend publication.

General comments

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1) The paper is very overlong and contains much repetition. It needs to be much more focussed and more clearly structured. The introduction in particular needs to be greatly reduced and refocused. Much of the text is justifying the DTC project. This has probably been presented elsewhere in other papers, and should be kept to a minimum here. A large section of the introduction describes the storm event from a meteorological perspective, which is not needed to support this study. Much of this is repeated in the Methods anyway, and the text in the Introduction should be removed. The intro contains other descriptions of methodology and site descriptions that should also be omitted.

Once the above items have been removed, the remaining Introduction is very weak, and there is a real need to put this study into context. This should be done by including a brief review of similar hysteresis studies. The authors state (probably correctly) that no previous studies have captured hysteresis patterns at high frequency in catchments across the UK. However, there are lots of studies that have captured storms at multiple sites across catchments, and also studies that have studied hysteresis at single sites at high monitoring frequencies. Suggested references include -

Bowes, M.J., Smith, J.T., Neal, C., 2009. The value of high-resolution nutrient monitoring: A case study of the River Frome, Dorset, UK. *J. Hydrol.* 378, 82-96.

House, W.A., Warwick, M.S., 1998. Hysteresis of the solute concentration/discharge relationship in rivers during storms. *Water Research* 32, 2279-2290.

Ide, J., Haga, H., Chiwa, M., Otsuki, K., 2008. Effects of antecedent rain history on particulate phosphorus loss from a small forested watershed of Japanese cypress (*Chamaecyparis obtusa*). *J. Hydrol.* 352, 322-335.

McKee, L., Eyre, B., Hossain, S., 2000. Intra- and interannual export of nitrogen and phosphorus in the subtropical Richmond River catchment, Australia. *Hydrol. Process.* 14, 1787-1809.

Siwek, J., Siwek, J.P., Āzelazny, M., 2013. Environmental and land use factors affecting phosphate hysteresis patterns of stream water during flood events (Carpathian Foothills, Poland). *Hydrol. Process.* 27, 3674-3684.

Stutter, M.I., Langan, S.J., Cooper, R.J., 2008. Spatial contributions of diffuse inputs and within-channel processes to the form of stream water phosphorus over storm events. *J. Hydrol.* 350, 203-214.

2) There is no mention of how the Hach phosphate chemistry and probe data was quality checked. As the study is wholly reliant on this time series data, its quality is vital. Were these automated data corrected using analysis data from spot samples? How were the probes calibrated? How often?

3) The paper structure is very confusing. There is lots of discussion within the Results section, but then many observations are left unexplored. I think the readers (and the authors) would benefit from having a combined results and discussion section, if that is allowed within the format of this journal. The conclusion is really just another summary of the manuscript, and adds nothing to the paper. The conclusion should state why this work is worthy of publication.

### Specific comments

Title: (and throughout). High resolution could refer to either spatial or temporal resolution. Replace with high temporal resolution or high frequency.

Demonstration Test Catchments should be capitalised.

Abstract Page 15122, line 9. Studying one extreme storm event after a prolonged drought does not indicate the size of the nutrient pools in the catchments (unless they became exhausted). The study would need to extend across multiple events for an extended time period to quantify this pool(i.e. until exhaustion was actually observed). Please remove this statement

Line 26. How are point sources “increasingly controlled”? Replace with “Improved

nutrient removal at WWTPs are reducing point source inputs”.

Page 15123, line 24 to 15124, line 28. Delete paragraphs.

15125. Line 5 (and throughout) Change resolution to frequency

Line 6 – 16. Delete (Repeated in Methods)

Line 19 – 26. Delete (should be in methods)

Section 2.2. Give brief method descriptions for the nitrate and phosphate analysis. How was the data quality controlled? Is this data raw, or is it corrected against spot sample analysis?

Section 2.3. Greatly reduce word count or delete. The study only requires data on the timing and quantity of rainfall to each catchment, which is given in Figure 3. Results. There is lots of discussion of (some of) the results here, and I think a combined Result and Discussion section would be most appropriate.

Section 3.1, line 16. Not true. The Eden responded to the rainfall event on the 12th April.

Line 23-25. Delete the meteorological causes of the rainfall events.

Page 15129, line 21. Doesn't the dilution of the nitrate concentration imply that there is little diffuse nitrate input to the Avon either from throughflow and overland flow? This result suggests groundwater input domination.

line 26. There is no evidence that the nitrate input to the river is by throughflow (although I agree it might be). The authors need to add lots of caveats with their speculations on nutrient sources.

15130, line 2. Delete “during this event”.

Line 17. There are 2 major sources that seem to be ignored within this paper; groundwater inputs (for the Avon and Wensum) and storage of phosphate within the bed

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sediments. These major inputs would explain why nitrate is diluted during storm events i.e. the loops have a negative gradient, and why P and ammonium respond so quickly to produce clockwise hysteresis.

15131 line 17. See comments above.

Line 25. To interpret this observation correctly, the reader (and author) needs to know the nitrate concentration of the ground water. Please provide for the Wensum and Avon.

15135, line 20. Should it be left of the plot?

15137. Line 6. Are there any sewage treatment works in the catchments? If so, please give details in the study area descriptions. If so, how does this change your interpretation of the results?

15141, line 9-21. Repetition. Delete.

15143. Line 25-26. What ongoing research? Is there a reference? Is it future work within DTC?

Line 27. Delete temporal.

Section 5. Delete summary of findings within this section. These are already given previously and in the abstract.

Figure 1. Remove shading for London. It looks like one of the study catchments.

Figure 2. Delete. This meteorological data is not required.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 15119, 2013.

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