Hydrol. Earth Syst. Sci. Discuss., 9, C2867–C2871, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C2867/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "From existing in situ, high-resolution measurement technologies to lab-on-a-chip – the future of water quality monitoring?" *by* A. J. Wade et al.

Anonymous Referee #3

Received and published: 10 July 2012

This is a well-written paper in which the authors present a novel and thought provoking study that I believe is of wide interest and worthy of publication.

Unfortunately, the title of the paper is not appropriate. While the authors' results may motivate the need for new water quality monitoring technologies, I cannot see that this is the primary focus of the paper. The authors have presented a novel and important study of high frequency variability in nutrient dynamics in two urban UK rivers. This study considerably expands our knowledge base about short term variability in riverine nutrient concentrations. As the authors note, all previous research on high frequency

variability in water quality time series has focused on rural catchments. Adding time series from urban rivers adds significantly to our overall understanding of riverine water quality and the greater than previously expected impact of sewage treatment works.

The authors claim the high frequency time series display "seemingly chaotic" (p 6459 l 11) behavior. If by this, they mean 1/f spectral scaling, it would be most informative if they could present these results. It would be interesting to see if point source inputs such as are found on their study sites change the slope of the power spectra.

From what I can tell, the authors have made a thorough review of high frequency water quality monitoring programs in the UK and Ireland. However, they may also wish to refer to Ferrant et al. 2012 "Continuous measurement of nitrate concentration in a highly event-responsive agricultural catchment in south-west of France: is the gain of information useful?" Hydrological Processes for a French perspective.

It would be helpful if the authors adopted consistent naming conventions for their sites. It is confusing to have the sites referred to as Cut, Bray or Cut at Bray and Enborne, Brimpton or Enborne at Brimpton. I realize that all site names are provided in the map in Figure 2 but it is inconvenient to have to keep referring to it.

The discussion of the INCA models on p 6480 l 1-24 was confusing and perhaps unnecessary. My understanding is that INCA is a daily time step model. It seems unfair to expect a daily time step model to reproduce sub-daily phenomena. If a process-based deterministic model were run on an appropriate time step, do the authors believe it would reproduce the observed time series? It also seems a little odd to suggest using a complex, daily time step model like INCA to reproduce annual mean concentrations. Would a simpler export-coefficient approach be more useful? Is there any evidence to suggest that the structure of current bucket type models precludes simulation of fractal noise sensu Kirchner et al. (2000) or can this failure be ascribed to inappropriate model parameterization?

I have a great deal of difficulty with sections 5.4 and 5.5 and suggest they be removed

from the revised version. While it is refreshing to see an explicit recognition of the difficulties inherent in collecting high quality water chemistry data, it is not clear to me that this discussion is necessary in the peer-reviewed literature. While I agree with the authors that current monitoring technologies are less than ideal, and that so-called "lab on a chip" technologies may revolutionize water quality monitoring, I would like to see more firm evidence of "lab on a chip" technology being successfully deployed outside the lab.

If sections 5.4 and 5.5 were removed, the abstract could end with the statement on p 6459 l 24 that "These results highlight the utility of sub-daily water quality measurements". Sections 2.2 and 3.2 could be deleted as it does not seem that any results from the Kennet at Clatford are presented. It seems that the Kennet site is only described to give context for the difficulties described in section 5.4, p 6482 l 21 – p 6483 l 4.

Some of the most important results the authors present are in table 1. I would like it if they could focus more on these results and their implications for monitoring programs. In my experience, the chemical flux estimates for many regulatory programs (i.e. OSPAR and the WFD) are based on monthly or biweekly chemical samples. Table 1 shows some of the difficulties that may result from fixed time sampling. It would be most informative if the authors could expand their analysis to present maximum and minimum estimated loads based on the different temporal resolution of sampling schemes. Presenting the maximum and minimum estimated loads from the 7 different weekly sampling possibilities and similar analyses for fortnightly and monthly resolution data would be extremely important for putting into context and providing possible estimates of uncertainty of loads based on fixed time sampling.

Minor concerns:

I would rather the authors refer to nitrate as NO3- instead of NO3 and NH4 as NH4+

P 6476 l17 – should be ". . . Kennet where streamwater . . ."

The authors made significant attempts to reduce algal growth in their sampling systems. Was there any evidence of biofilm growth or fouling?

Summary

1. Does the paper address relevant scientific questions within the scope of HESS? - YES

2. Does the paper present novel concepts, ideas, tools, or data? - YES

3. Are substantial conclusions reached? - YES

4. Are the scientific methods and assumptions valid and clearly outlined? - YES

5. Are the results sufficient to support the interpretations and conclusions? - YES

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? - YES

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? - YES

8. Does the title clearly reflect the contents of the paper? - NO

9. Does the abstract provide a concise and complete summary? - YES

10. Is the overall presentation well structured and clear? - YES

11. Is the language fluent and precise? - YES

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? -YES

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? – YES, sections 2.2,3.2,5.4 and 5.5 could be eliminated

14. Are the number and quality of references appropriate? - YES

15. Is the amount and quality of supplementary material appropriate – N/A

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 6457, 2012.