Hydrol. Earth Syst. Sci. Discuss., 12, C88–C92, 2015
www.hydrol-earth-syst-sci-discuss.net/12/C88/2015/

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Quantifying the nutrient flux within a lowland karstic catchment" *by* T. McCormack et al.

Anonymous Referee #2

Received and published: 9 February 2015

The study introduces nutrient flux estimates for a karstic lowland catchment in Ireland. Monthly samples of alkalinity and nutrient concentrations were taken for 3 years, to compare with modelled hydraulic behaviour of turloughs and modelled nutrient fluxes. Nutrient inputs were separated to allogenic/autogenic loads for the whole catchment. From the comparison of modelled conservative behaviour and the observations unexpected loss processes were detected for both P and N in some turloughs. The findings were used to assess the nutrient output from local agriculture on the recipient estuary.

GENERAL REMARKS

The manuscript is based on an very interesting dataset. In my opinion the novelty of this study compared to the Gill et al. (2013) and McCormack et al. (2014) studies

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

is that alkalinity samples are used to highlight the contrasting hydraulic behaviour of different turloughs and that nutrient samples are compared to modelled conservative behaviour to assess internal nutrient loss rates. Unfortunately, these two points are quite weakly supported by the manuscript, probably due to the limitations imposed by the sparse sampling frequency.

First, the dynamics of both alkalinity and nutrients were only shown as time-series, occasionally besides stage or discharge (Figs. 4-8). However, this kind of presentation makes it difficult to identify the patterns hypothesised in the text. Plotting the water quality results against the hydraulics would provide a better way to see the suggested nonlinear or hysteresis responses.

Second, the intrinsic variability of water quality parameters was neglected entirely. Local TN and TP samples seem to have a significant variability that is not explained by the hydraulic load and thus the model (Figs. 5-6). This by far exceeds the extent of loss processes detected by comparing the measured fluxes to the results of the conservative modelling, making the loss estimates very uncertain and even questionable. Therefore, it would be worth to make a quantitative assessment of the unexplained variability and present the retention figures relative to the outcome (if they are still meaningful).

SPECIFIC REMARKS:

P 95 L 20: As it's 2015 now (and was almost 2015 when the manuscript was submitted), it would be preferable to actualise this statement. If there are no recent data on whether the good quality status was reached or not, at least the distant perspective could be removed from the ponderation on water quality.

P 96 L 4: People who haven't been to Ireland will not know that 'Co.' stands for 'County' and it's an Irish administrative unit.

P 96 and onwards: Although these places, mountains and rivers have beautiful Irish

HESSD
12, C88–C92, 2015

names, in my opinion the text would be more concise and much easier to read if these appeared only on first mention or when they have definite distinguishing power. A good practice would be to extend the abbreviated river names appearing in 4.1.1 to the whole text. In addition, as the Slieve Aughty Mountains and the Gort Lowlands are the only mountains and lowlands appearing in the text, respectively, they could be referred to as simple as 'mountains' and 'lowlands' after the first introduction.

P 97 L 1-7: Probably too many directives are mentioned here. In a scientific sense it would be enough to state that ecology in turloughs is special and threatened and to add one reference.

P 98 L 1-2: I am puzzled by the meaning of 'faster discharge rates'. Do you mean 'higher discharge'?

P 98 L 9-10: The phrase 'source of nutrients into the ... catchment is ... agricultural' is somewhat complicated. A simpler way of saying this would be 'Most of the allogenic nutrient load comes from agricultural sources'.

P 98 L 19 and onwards: Equipment and software vendors are usually identified by referencing their city and country after the name, just like: 'Walingford Software (Wallingford, UK)'. This is especially important when the name is so general that it would be difficult to search for it on the web, just like in the case of 'Environmental Measurement Ltd.' on page 99.

P 99 L 1-2: What does 'nutrient behaviours of water' mean?

P 99 L 25: Please explain the 'mid-section velocity depth surveying method' or supply a reference.

P 101 Eq 1: It is strange to see dM_{sj}/dt for an external source term. Why not use a flux/load notation directly? The concept that M_{sj} would be the cumulated load seems to be strange somehow.

P 101 Eq 2: C was capital in Eq 1., small in Eq 2., but I guess that they both stand for

HESSD
12, C88–C92, 2015

concentration.

P 109 L 1-15: This should be removed or placed into the introduction in a shortened form, because these are not conclusions.

Fig 3: This figure could be united with Fig 1, where the extensive legend is anyway too small to read.

Fig 5-Fig 7: You shouldn't connect observation points with lines because the sampling was too rare compared to the potential variability (especially for TN), so lines suggest a false pattern. Based on Fig 4 alkalinity varies more slowly, so there a connecting spline is less misleading.

Fig 7: It would have been more educative to plot C besides volume, instead of the mass flux, because then the dependence between the two factors would be weaker than in the present setup, and the reader could more clearly recognise the suggested dilution pattern (page 107) in the affected turloughs. As the labels are too small now due to the large amount of information shown, it would be enough to plot some selected sites from the diluting and non-diluting categories.

Fig 9-10: The modelled time-dependence of C causes only a tiny distortion compared to the time-invariant $L(t) = C_{\mathsf{const}} \cdot Q(t)$ model (L: load). The difference is comparable to the accuracy of modelled Q(t) based on Gill et al. (2013). So is it finally worth to bother with the time-dynamics of C? What are those downward pointing spikes in modelled C(t)?

Fig 11: I think that this figure is rather speculative for 3 reasons: First, samples are quite sparse, so it is misleading to connect them with a spline. Second, the proposed retention is very small compared to the intrinsic variability of TN (with this sampling frequency), which suggests that the estimate may be very uncertain. Third, denitrification does not fully explain the behaviour suggested by the lines: why does the concentration rise with about half of the previous decrease after B?

HESSD

12, C88–C92, 2015

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 93, 2015.