

Phosphorus dynamics in lowlands streams as a response to climatic hydrological and agricultural land use gradients

General

Four small agricultural streams are compared for hydrological characteristics and phosphorus concentrations in four different forms. Additionally, the effect from two different water sampling strategies is compared and different methods are used to estimate P export. The assessment and conclusion are very general, based on only two years study and need to be more specific and deeper. E.g. What is meant by agricultural intensification? The title suggests agricultural land use and in the discussion the number of livestock units is mentioned. However, there is very poor information about land used and nothing about manure and fertilization use, number cattle and number of inhabitants in the M+M section. It is also very hard to directly compare catchments with different soil types and under two totally contrasting climates. The Danish climate might include snow accumulation and the hydrology is probably much affected by the existence of tile drains. Uruguay may have both summer and winter crops and high production of grass for feeding all year around, while in Denmark summer crops harvested in summer/autumn probably is dominating. Finally environmental regulations are hard to discuss only based on rough modelling of the relative contribution from point sources and diffuse sources. The discussion of sampling technique is clear but overall are too many conclusions based on too little data from just 4 catchments.

Specific comment

Title suggest: Phosphorus concentrations in four lowland streams representing two contrasting climates and agricultural conditions.

Abstract

Line 16 why freshwater? The streams may also reach seas - Gudenå river reach Kattegatt
Line 17 the word 'intensification' may imply that you have monitored the streams for a long time under which the agriculture has changed.

Line 17 dynamics and dynamics of what?

Line 27 Intensification (of agriculture) had a significant impact on subtropical climate. Should be reformulated. The agriculture is rather a result of the climatic conditions

Line 30 increased contribution .. to P export? or higher concentration of ...P? Please reformulate

Line 32. Sanitary risks are not in focus in this manuscript

Line 33hand, temperate ... One or two streams in temperate climate?

Line 34 farmed stream change to farmed catchment

Line 34 lack of environmental regulations Can this conclusion really be drawn from your study?

Introduction

Line 43 Reference altering components of the hydrological cycle is about irrigation – What about the draining systems in Denmark?

Line 44 several controlling systems Information about those in the current catchments should have been given in the M+M section and discussed

Line 52 Explain how changed land use may alter flashiness,

Line 72 Agricultural land use intensity This is not clear seems that a main difference between the Danish catchments was the proportion of arable land not necessarily the intensity (?)

Line 76 Suggest that you delete 'evaluate the direction and magnitude' and change to compare....

Line 83 Question iii ; a synergistic interaction..... Very vague clear aims/hypothesis are needed

Line 86 Suggest catchment characterization

Lines 103-108 Suggest that as complete information as possible about point sources are given in a Table

M+M

Suggests a special paragraph with statistical methods – It is not clear for me the time-span used for estimating significance between median values. Also explain why median and not mean values were used.

2.2 Suggests Water sampling and water flow measurement

Line 131 10 minutes .. might be expressed: discharge was estimated and stored each 10 minutes

2.3 Laboratory analysis

Line 46 pore size

Line 158 please give any acid and oxidizing agent used

2.4.1 Climate and hydrology

Line 169 variation in water flow or characterization of flow regime rather than 'responsiveness'

176 There are several info about flashiness in a recent paper: Deelstra et al., 2014 Agriculture, Ecosystem and Environment 195, 211-219.

2.4.3 suggest: **Estimates of diffuse and point sources and P export**

Line 195 One method for total P export and two methods for source separation.

2.4.4. Suggest: **Relative contribution of**

Line 242 One method for load and one method for concentration (delete in two ways)

Results

Line 257... Is it possible to compare with long-term precipitation data of the regions?

Line 270 The result that intensively farmed catchments had more flashy water regimes should be further discussed in connection to the different P loads.

Line 281 Relationship could only be expected if the local precipitation was similar and if water sampling took place simultaneously

Line 291 Median concentrations were calculated per year? With just two years you cannot estimate any significance. Give the rationale for using median and not mean values.

Line 308, 314 Too many numerals (H=133.298 and 141.157)

Line 331 Could not be explained in what respect? Incidental P losses following manure application on agriculture land is quite common

Line 334 Isn't the dilution effect primarily a consequence of base-flow contribution and the size of the catchment rather than 'intensive stream'? Do you rather mean intensive agriculture in the catchment?

Line 342 than the other 3 streams (?)

Line 363 What do you mean with field evidence? This is more a discussion point.

Line 367 I do not understand the sentence: .. is repeats itself in the grab concentrations

Line 368 higher SRP contribution should be discussed in connection to soil type and the soil P status

Line 374 of exported total P. A high proportion should have been in SRP form!

Discussion

Line 380 Repeat the figures (0.3 versus 1.0).

Line 386 Bee more precise- extreme in what sense? Warmer in which months? How does it change the crop production, snowmelt periods etc.....

Line 398. Perhaps in Denmark but in many other European countries very poor improvements have taken place to reduce P losses from small point sources such as single household wastewater treatments. How many people, milk-rooms etc. with waste water treatments were included in the studied rural landscapes?

Line 416. Do you mean that the diffuse load is underestimated but the point sources are overestimated for flashy streams with a low base-flow contribution?

Line 425 Vague. Explain 'signs of interaction'. 'Such as lower deviation of LFS-LI estimates seems to be a weak proof. Do you suggest that Intense manure application needs to be considered when planning sampling strategy?

Line 446. Discuss expected contribution of P from anaerobic groundwater. Is this a general overlooked problem?

Line 448 Needs explanation. Were there less drainage, more anaerobic condition and less Fe-bound P in the extensive Danish catchments? The reference Leinweber et al 2002 is missing in the list.

Line 462 Give a reference demonstrating the impact of cattle with direct access to the stream channel.

Line 468 Did you notice such deterioration etc. in the catchment of Uruguay?

Line 475 Rather the opposite – grab sampling may underestimate the diffuse P pollution during high discharge events.

Line 510 Explain further. Do you mean that an enrichment of P is taking place in the very topsoil and is reaching the stream via surface runoff? The reference Derpsch et al., 2010 is missing in the list.

Line 521. Do you have any example from Uruguay with an eutrophied reservoir? If not express your findings as a risk for eutrophication.

Line 524 Explain if the drinking water is mainly from surface water and not from ground water

Line 555 Do you have concern about how catchment models works for small catchments as in the present study and the accuracy with which point sources and groundwater contribution may be estimated?

Conclusions

How much did flow response regulated the TP load (80-90%?) and how much did agricultural management (10-20%?)

Give examples of more precise environmental regulations

How precise do need the models to be? What about other strategies P balances, P surplus P-index etc. mentioned at the end of the discussion?

Figure 2. 'Flashiness is clear' support with FI values. The temperate stream seems quite flashiness too

Figure 3 What is gram samples? Better to combine flashiness with P concentrations directly, now the figure is not necessary

Figure 5-6. Not necessary.