Hydrology and Earth System Sciences Discussions

Interactive comment on "The nitrate export in subtropical mountainous catchment: implication for land use change impact" *by* J.-C. Huang et al.

Anonymous Referee #2

Received and published: 4 February 2011

This paper presents a comprehensive 2 year dataset of nitrate concentrations in 16 watersheds (partly nested) of Taiwan. The total loads from each catchment are related to landuse, in particularly to active an in-active farms. The conclusions that the farms in this region severely affect nitrate concentrations of the stream (10 -100 time higher N concentrations than under pristine conditions), most importantly due to very high N fertilizer inputs, and will do so for a long time after the farms have been expropriated are well supported by the date and the performed analyses. These conclusions are not new but deserve to be emphasized because of the unique location of the study area, high up in the mountains with seasonal typhoon events, the ecological richness of the area and the excessive use of N-fertilizers by farmers.

The nitrate dataset of the 16 catchments is really nice and is well suited for publication in HESS. However, the presentation of the data and the performed analyses need to be substantially improved before publication. Many of the sentences do not make sense to me, because of strange words (for example title). In the specific comments I listed a few, but by far not all. Please pay more attention to the text. Also the analyses of nitrate loads could be greatly improved to do justice to the high quality dataset presented (although this would not affect the conclusions because of the very clear observed nitrate load signals).

For example: At location Y1, discharges were measured (daily?) and nitrate concentrations were measured twice a week and every 3 hours during typhoon events. This is a good dataset that nicely represents the temporal variations in both discharge and nitrate concentrations. This dataset allows for linear interpolation of both discharge and nitrate concentrations to 3 hourly values (smallest sampling interval of N) and to use these interpolated functions to estimate the total nitrate loads for this location as accurately as possible. However, the authors used simulated discharges and binned all the nitrate concentration measurements to calculate an average concentration for the entire period, or an average flow weighted concentration, to estimate the total load. This way they do not take into account the difference in sampling intervals between the measurements and effectively oversample the typhoon events. Although the rating curve method does not have problems with oversampling during typhoon events, a fixed relation between discharge and concentration was nowhere observed.

My suggestion would be to calculate as accurately as possible the nitrate load for locations (Y1,k1, with best quality data) based on all measurements via linear interpolation (as described above). Than subsample monthly concentrations from these dataset (like the monthly interval of most other catchments) and see which calculation method performed best if you would only have monthly values. If there is no "best", at least this will give a better representation of the uncertainties involved in load estimation from monthly values. Even for the monthly concentration values a linear interpolation

between monthly values might be most accurate.

Because the typhoon events are the special feature of these catchments, I would be really interested to know how much of the yearly load is transported during typhoon events. For the detailed datasets of Y1, C2, C7 and K1 this analysis is easily performed. Also here the differences between cultivated and un-cultivated areas are interesting.

Some specific comments: I do not understand the title, please rephrase

Abstract: Be consistent throughout the paper: Use kg-N/km2/yr everywhere. Even in abstract you used many forms.

You often use the word "baseline" throughout the paper, which to me is confusing

P9295,Line 13: I do not understand what Dumont pointed out: Intensive agriculture in low latitude areas, or Intensive agriculture and low latitude areas (what do you mean by "and")?

P9295, Line 28: it is recognized by whom? Ref. And how does the amount of rainfall affect vulnerability of ecosystems?

P9296, line 3: what do you mean by delineation of protected areas, delineation into what?

P9296, line 7: attempted to investigate → investigated

Line 13, baseline for land management?

Line 25: rephrase

I find the subdivision in active and inactive vegetation confusing: Better to use active and inactive farms:

P9297,line 17: rephrase

Line 19: delineation of subwatershed: probably you mean: delineation into subwater-

C4990

sheds, but this kind of errors makes the reader confused.

First paragraph Section 2.2 is confusing, regular versus two weekly/ monthly, please rewrite

Section 2.3: report discharge measurement frequency, model timestep. Also: how did you apply the parameter sets for C1 and Y1 to the other catchments. Is landuse a parameter of the model, or is it just by area?

Eq 4. I would include sample interval, to prevent oversampling of typhoon values. Better yet I would prefer linear interpolation of nitrate measurements.

Eq 6. In the conclusions you state that the large rainfall amounts during the typhoon season, makes this catchment special. Although average concentrations are not larger than elsewhere, the total load is large because of high discharge volumes. In this equation to distinguish between 2007 and 2008 I would also expect the total discharge of the corresponding year (k expressed in Kg/m3/Km2/Y) Not every year has the same amount of discharge and thus the same load. Why or why not?

P9302, Line 2: the trial and error method →a trial..

P9303, Line 2: K1 revealed an opposite pattern: Please better explain the "opposite" . I see extremely elevated concentrations in K1 during Typhoon, Much stronger than in Y1, but concentrations in K1 during typhoon still do not reach the lowest levels of Y1.

P9305, Line 9. I do not understand why a dilution effect would point to leaching of nitrate towards groundwater.

Line 17: as flooding? Please rewrite

Page 9306,line 4 Please rewrite

You completely repeat table 7 in text

Page 9308,line 25 MO3->NO3

C4991

Page 9313, Table 1: Average slopes of 76 degrees are only suited for rock climbing. Probably you mean %

Page 9318 Table 6: Boyer et al., 2002 is not in reference list. The paper of Boyer et al, 1997, which is in the ref. list, does not contain any Nitrate data.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 9293, 2010.

C4992