

Interactive comment on “High frequency monitoring of water fluxes and nutrient loads to assess the effects of controlled drainage on water storage and nutrient transport” by J. C. Rozemeijer et al.

Anonymous Referee #3

Received and published: 9 August 2015

General comments

This manuscript addresses the effects of controlled drainage on transport of nutrients, phosphorus and water for a small agricultural field. The field was monitored by groundwater head sampling, drain flow and precipitation measurements and water samples. The field setup was constructed so that surface/subsurface flow and groundwater flow was separated from the drain water at the outflow. The study shows that no significant effect of controlled drainage occurred in terms of reduced nutrient losses. However,

[Full Screen / Esc](#)

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[Interactive Discussion](#)

[Discussion Paper](#)



the drain discharge was reduced resulting in a reduction of phosphorus loads.

The manuscript does address a topic relevant for the readership of HESS. However, it is not completely clear in what sense the study contributes with significant novel methods, results or conclusions. Generally the strongest part of the paper is found to be the considerations regarding how controlled drainage can be implemented and the different challenges with conducting controlled drainage in harmony with farming practice (for instance suggestions of larger manure storage capacity). Therefore, in order to strengthen the manuscript the discussion could be re-structured so that more focus is on the experiences gained from this study. For instance the discussion of the importance of also controlling drain overflow close to the stream/ditch as well as the timing of when to initiate and stop controlled drainage dependent on season, weather conditions and farming practice could be elaborated. Most of these issues are already mentioned, but they could be elaborated as this is the strongest part of the study. These issues could also be highlighted in the abstract.

It seems as if the manuscript has been slightly rushed and it is strongly recommended that the entire manuscript is checked thoroughly for grammatical and general language mistakes as well as wrong sentence syntax.

Specific comments

Generally throughout the manuscript there is an excessive use of the rather informal “we”, and it is suggested that the authors rephrase sentences containing “we” to more proper formal language. Some examples are given below.

The authors should be consistent in their use of past and present tense, especially in the results section. Some examples are given below, but the entire manuscript should be adjusted.

Some parts of the results section rely on work already published (e.g. the SorbiCell results, hydraulic conductivity measurements and water balance issues), hence it is

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[Interactive Discussion](#)

[Discussion Paper](#)



recommended that these parts and references are taken out of the results section, or used in a more direct way by referring specifically to results that can support this present study (examples given below).

P 6276-line 13: In the abstract the term “all relevant hydrological and chemical parameters...” is somewhat confusing, since the reader will immediately ask which parameters are considered relevant? It is suggested that the authors rephrase this sentence so that it is precisely stated at least which type of hydrological and chemical parameters.

P 6278 – line 6: The authors again use the non-specific term “all relevant parameters”. It is recommended to list the parameters instead, as it is most likely up for discussion which parameters are needed to accurately assess the complete hydrological and hydrochemical response.

P 6278 – line 19: No need for the repeated reference to Wösten et al. (1985).

P6279 – line 3 to 9: For some reason the text changes to past tense, please correct to present.

P 6279 – line 21: Is the ditch 43.5 m wide or long? Please elaborate in the text.

P 6279 – line 22: What is meant by the “eastern ditch”? From the figure it looks like there is only one ditch running more or less north – south? Do the authors mean the eastern side of the ditch? Please elaborate and change accordingly in the text.

P 6279 – line 23 and 26: What is meant by “in-stream”? The reservoirs are built in the same ditch as where drain water is discharging to, right? not in a separate stream? Please clarify in the text.

P 6280 – line 2 to 5: The authors write that the drain flow is measured via the vessel when a maximum level is reached. During the drainage period, how long time does it in general take for this maximum level to be reached? Do you have flow measurements representing water discharging on average during an hour, a day, a week, or? I find this

[Full Screen / Esc](#)

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[Interactive Discussion](#)

[Discussion Paper](#)



information important as it has a significant impact on the precision of the estimated flow rates.

P 6280 – line 5: Please refer to the locations on figure 1.

P 6280 – line 17- 21: With which resolution do these SorbiCell-samplers give NO₃-N concentrations? Is it hourly concentrations, composite sampling or something else? Generally if the authors wish to include the SorbiCell measurements, you should describe briefly in the manuscript how they are working and why you are using them. Why are the cells useful compared to the other drain water sampling you are performing? When referring to another paper for a test or comparison, it is recommended to refer to the specific results; otherwise the reference is not of much use for the reader. What did Rozemeijer et al. (2010) find? Where the cells better than conventional sampling? And is that why you chose to use them?

P 6281 – line 5 to 6: Why do you write roughly instead of just showing the exact periods where the overflow levels were adjusted? Why are you using different overflow levels? Are you not concerned that changing the overflow levels also changes the hydrology? Is it for instance possible, that you lose water to neighboring fields when the levels are at the highest?

P 6281 – line 7: The sentence starting with “However,.. ” seems somewhat disconnected or not finished. It is recommended to delete or rephrase it.

P 6281- line 9 to 12: You mentioned the different cases where the overflow levels were lowered. However, it is not really clear from the text how much you lowered it? I suppose you lowered it down to the original drain level? Please elaborate in text.

P 6281 – line 14 to 16: It is recommended that this section is deleted, as the headings in the subsequent sections explain what the main content is.

P 6281 – line 19 to 23: It is suggested that this section is either deleted or rephrased as it just repeats what can be seen in the figure. Instead it is recommended that the

Full Screen / Esc

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Interactive Discussion

Discussion Paper



authors explain the most important message that the figure illustrates.

P 6281 to 6282 – line 24 to 4: Here you touch the subject I addressed above regarding the reasoning behind the different drainage levels. However, it is not clear in the text how you chose these specific levels, and why you for instance changed the level from 20 cm to 50 cm in December 2009? Why did you not just use the same level, except when farming practice required a lowering?

P 6282 – line 10 to 12: The importance of this sentence is not clear. You state that total precipitation was lower in the reference period than in the period of controlled drainage. Hence, I do not see how this indicates that the higher gw levels in the period of controlled drainage are due to the increased overflow level? As I understand it: If more precipitation fell in the period of controlled drainage and if you also see higher gw levels in that period, then the higher gw levels can both be due to more precipitation and the increased drainage level. So, that the less precipitation fell in the control period is not indicating that the higher gw levels in the drainage period are caused by the elevated overflow levels? Or do I misunderstand something? Could you please elaborate also in the text, or delete the section.

P 6282 – line 13: A groundwater (gw) level cannot be long? Do you mean that the gw levels are above land surface for longer time periods? Please correct and clarify in the text.

P 6282 – line 14: Did you actually observe an increase in ponding and overflow water? You stated earlier that you measure overland flow, so could you please discuss whether these measurements support this?

P 6282 – line 5 to 19: The authors shift between using past and present tense. In general the figures show something, i.e. present tense when you refer to a figure. However, for instance when you refer to the gw levels then they were above the tube drain level, i.e. past tense. Please adjust to correct use of past and present tense.

HESSD

12, C3035–C3043, 2015

Interactive
Comment

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Interactive Discussion

Discussion Paper

P 6283 - line 1 to 3: It is suggested that this section is rephrased, as the information is not important, the text just repeats the table. Instead write what the main message is, and then refer to the table in brackets. There is no need to repeat what can be directly seen in figures or tables instead help the reader deduce the main message from the table or figure.

P 6283 – line 17 to 19: You state that the net influx from regional gw flow is needed to close the water balance, but that it cannot be measured. So how did you solve this problem?

P 6283 – line 19 to 21: Please delete this section or refer to some specific results of relevance for the present study.

P 6283 – line 25: Which “other differences” do you refer to? Please elaborate and be more precise.

P 6283 – line 26: You write that the gw levels rose during the reference period, but it is not clear how you come to this conclusion. In figure 5 it is seen that the gw levels both rise and fall in the reference period, so what do you mean by saying that the gw levels rose during the reference period? Do you mean the average gw level or? This issue also applies to the following section in the text.

P 6284 – line 4 to 9: Please rephrase this section. I assume you are making comparisons with the reference periods? However, when you for instance write that something is significantly lower, you need to write what you compare with.

P 6285 – line 6 to 8: Same comment as for P 6281 – line 19 to 23 (above).

P 6286-line 12: A reference to at least one example of “the frequently shown and modelled drainage concept” would be appropriate at this point.

P 6286 – line 18: Do you mean that the infiltrating water contains nitrate and oxygen? As it is written now it says that the nitrate and oxygen are containing infiltrating water. Please rephrase to correct English syntax.

Figure 1: I do not see any explanation to the naming B and D and the dots they are placed next to, neither in the manuscript text nor in the figure text. I assume they represent the locations of gw level recordings? Please add an explanation at least in the figure caption.

Figure 4. I find it somewhat misleading that you write “Drains up/down” on the figure, as it is not the drains you are moving up or down, but the overflow level. This could be changed in the figure.

Figure 5: Generally avoid using the term “The figure shows...” or “The plot gives...” in figure captions, as it is obvious that the text is linked to the figure. Be short and concise and only elaborate on issues that are not already explained on the figure. It is recommended that the symbol for precipitation and drain flux/discharge is deleted on the figure, and just explained in the text, as the symbols coincide with the symbols for the gw levels. Please use the correct abbreviation for meters above sea level on the y-axis (m.a.s.l.).

Figure 9: This figure could be considered left out, as it is already explained in the text. It is probably not very surprising the the gw head curvature between drains can vary significantly among individual fields due to soil type, drainage system, drainage depth, precipitation, hydraulic conductivity and connectivity with underlying gw reservoirs etc. The fact that more steep curvatures are the ones most often seen in connection with modelling studies is probably due to the difficulties that arise if small curvatures should be modelled, rather than evidence for steep curvatures occurring more often than the less steep ones.

Figure 10: This figure could be left out, as it does not really contribute with significant information. The figure just depicts the commonly known schematic response in the gw hydraulic head due to a change in gw level close to a gw gaining stream, with the largest effect observed furthest away from the stream.

Technical corrections

P 6276 – line 14: Please delete “field” just before “water”.

P 6276 – line 15: Please delete “We” and rephrase to more formal sentence. Please avoid use of we as much as possible.

P 6277 – line 28: Please rephrase to more formal language (avoid using “we”).

P 6278 – line 2: Use singular “period”.

P 6278 – line 4: Please avoid using “we”.

P 6278 – line 23: Please avoid using “we”.

P 6278 – line 26: Please use correct abbreviation for meters above sea level (m.a.s.l.).

P 6279 – line 13: Please avoid using “we”.

P 6279 – line 15: Please use the genitive correct: farmers’ if more than one farmer, farmer’s if only one farmer.

P 6280 – line 15: Please delete “analyze” before “method”.

P6282 – line 9: Please delete “the” before “transect”.

P6282 – line 22: Replace “ephemerally” with “ephemeral” or replace with for instance “for a shorter period”.

P 6282 – line 27: Improper sentence syntax, replace “taken down” with “lowered” and rephrase “at two moments. . .”, e.g. “. . .were lowered with 50 cm at two instances. . .”

P 8284 – line 26: improper use of “dropping”, replace with for instance “lowering”.

P 6285 – line 2: Rephrase sentence starting with “This figure shows”, it is not the figure that shows something, it is data.

P 6285 – line 9: Please replace “ratio’s” with “ratios”.

P 6285 – line 22: Improper use of the word “dropping”. Replace with for instance

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[Printer-friendly Version](#)

[Interactive Discussion](#)

[Discussion Paper](#)



“lowering”. (the same goes for line 25).

P 6286 – line 13 to 15: Please rephrase sentence or replace “by” with another word, as “by” is used three times in the same sentence.

P 6288 – line 24: Please delete “of” before “continuous”.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 6275, 2015.

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Interactive
Comment

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Interactive Discussion

Discussion Paper

C3043

