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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Can controlled drainage control agricultural nutrient emissions? Evidence from a BACI experiment combined with a dual isotope approach" *by* M. V. Carstensen et al.

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This paper presents a solid study on the effects of controlled drainage on nutrient losses from an agricultural field. The paper is well written and well structured.

I have one major comment. The authors conclude that the water discharge and nitrate losses to surface water via the subsurface drainage system has considerably reduced after implementing controlled drainage. This raises the question where this water and nitrate goes instead. There was no influence on the harvest yield, so probably no extra evapotranspiration and crop uptake. Denitrification was also not markedly enhanced. The authors report that no overland flow was observed. The water and nitrate must have infiltrated to the upper groundwater. From there, the fate remains uncertain. The

extra nitrate load may have polluted the deeper groundwater resources. In this case, pollution swapping did occur; less nitrate loss to surface water, more nitrate loss to groundwater. The other option is an enhanced shallow groundwater flow towards the surface water. In this case, there is no reduction of the nitrate load to surface water.

The uncertainty about the fate of nitrate is described in the discussion (p7 L11-21) and in the conclusion (p9 L6-11). However, this crucial aspect is missing in the abstract, which only presents the positive effects of controlled drainage. In the discussion, I would expect a more thorough discussion about the potential negative effects. Furthermore, an evaluation of the research methodology could be added to the discussion. How can the total effects of controlled drainage be quantified in future studies? The authors only suggest tracer additions and 3D modelling (p7L18-19). Could more intensive hydrological and chemical monitoring of different flow routes also add to this? A sentence evaluating the monitoring setup could also be added to the abstract and the conclusions.

Minor comments: P1L12: 'For the first time': it's unclear what exactly was for the first time. A controlled drainage pilot in Denmark? A controlled drainage pilot on a field with winter crops? Controlled drainage as mitigation for nitrate losses? Etc.

P2L45: In addition to anoxic conditions, you also need organic matter or pyrite for denitrification.

P2L13-17: These 'hypotheses' are formulated here as questions. Replace hypotheses with research questions?

P4L27-30: Higher and more fluctuation groundwater levels due to more evenly distributed precipitation events?

P4L32:"The implementation. . .(Table 1)" I don't understand how this follows from table 1.

P4L33-35: Could you add more information about the regulation level management of

the controlled drainage system? This should be part of section 2.

P4L35: 5 cm per day? Why per day?

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