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Hydrology and Earth System Sciences Discussions

Interactive comment on "Prediction of dissolved reactive phosphorus losses from small agricultural catchments: calibration and validation of a parsimonious model" *by* C. Hahn et al.

C. Hahn et al.

claudia.hahn@env.ethz.ch

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Thank you for your feedback and comments!

We tried to describe also the P-part of the model as detailed as possible. We also describe how we collected the soil-P data on which the simulations are based, but we did not present them for reasons of space. You are right that it might indeed be helpful to have these data. We will include them as supplementary information. Soil P concentrations did vary between sites. How we collected information on the soil-P status of fields in the catchment is however described in section 2.3.1.

Previous studies as well as our observations in the Stägbach catchment showed that

the DRP concentrations of the runoff at the catchment outlet in fact increased with increasing discharge (Gächter et al., 1996; Lazzarotto et al., 2005). Our conclusion - supported by process-oriented studies (Stamm et al., 1998; Stamm et al., 2002) - was that fast P-transport is associated with fast flow in form of surface runoff and preferential flow in our catchment (high DRP concentrations during base flow as reported in (Lazzarotto et al., 2005) have turned out to be losses from a garden center and have been mitigated). The model accounts for this association by assuming that fast flow mobilizes surface soil P where such flow is generated. The DRP concentration of the runoff is determined by the P concentration of this soil.

We agree that soil management as well as freezing of plant material can influence P-losses. We did not account for that in the model however, because the empirical data by cantonal authorities monitoring the streams for decades clearly demonstrated that the main P losses generally occur between May and October. Hence, freezing of plant material can be ruled out as a dominant process in our system. Data on P losses from manured plots from our region also demonstrate that DRP concentrations are low during the winter month (see data for long periods after manure applications in (Withers et al., 2003) for the Sempach sites).

Large parts of the catchments and sub-catchments are tile drained. So, as you point out, fast flow occurs in form of surface runoff as well as fast flow through discharge from tile drains, and preferential flow plays an important role here. The model does not explicitly account for tile drains and connectivity. It assumes that if runoff is generated from a certain area, it will also reach the stream. Nevertheless, most high risk areas predicted by the model were located in the immediate vicinity of the streams, and only few areas further away from the streams were also classified as very high risk areas. The contributions of these areas to the simulated P-losses from the catchment may in fact be attributed at least partially to the drainage systems. We will add a sentence to point out that there are some high risk areas located farther away from the streams which may contribute to catchment runoff and P export via drainage systems.

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Thank you for your feedback to the paper.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 1465, 2013.