Hydrol. Earth Syst. Sci. Discuss., 10, C164–C167, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C164/2013/

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.

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Received and published: 28 February 2013

Thank you for your comments and corrections regarding the typing error and the figure captions.

1. Yes, the DRP concentration associated with baseflow was fixed to 0.05 mg/L. This value was chosen because DRP concentrations around this value ($\sim$ 0.05 mg/L) were observed during baseflow conditions in the Kleine Aa catchment draining into Lake Sempach (Lazzarotto et al., 2005) as well as in the Stägbach catchment that drains into Lake Baldegg.

2. The model does not calculate the DRP concentration at the catchment outlet but

directly the DRP load. It calculates the DRP concentration in runoff from each pixel, then the DRP load for each pixel and from that the DRP load at the catchment outlet. Hence, we directly compare what is observed with what is simulated. The underprediction of runoff from the Stägbach catchment at the end of July can in fact be attributed to insufficient quality of the rainfall data for this event, as mentioned on page 1482. The high spatial variability of rainfall during storm events and hence the difficulty to get reliable estimates of rainfall intensity could also be responsible for the underprediction of discharge in the Lippenrütibach catchment.

3. Only the hydrological part of the model was calibrated, using discharge data from the four calibration catchments that drain into Lake Sempach. Discharge was measured by means of limnigraphs at the catchment outlets. In addition a pressure transducer measured the water level in the Lippenrütibach at hourly intervals. The level data were transformed into discharge using level-discharge curves. The P model was not calibrated, but only validated, using data collected at the outlet of the Lippenrütibach catchment. Samples were taken every 22 days for 24 hours at low flow conditions. In addition, discharge from the Lippenrütibach was collected every 60 minutes since January 1998.

4. The model was designed to simulate diffuse P losses. Point sources - mainly waste water treatment plants (WWTPs) - have a completely different loss behavior. The P loads from WWTPs vary much less in time. Accordingly, runoff events may cause lower concentrations due to dilution effects. This has been observed in our study area in the 1980s. Since no WWTPs discharge into these (small) streams anymore, we can neglect this process.

5. We prefer to keep the information given in section 3.3 because it will serve readers not already familiar with the topic. Furthermore, we think that this information is particularly important to understand the spatial model validation.

6. We neglected runoff from forested areas because runoff from forests was not found

to play an important role in P export by Lazzarotto et al. (2006). Changes in forest cover by less than 20 % of a catchment area were not found to have an effect on stream flow by Bosch and Hewlett (1982), and forested areas cover less than 20 % of the area of our catchments. In addition, we think that it is justified to assume that runoff from forests generally responds much slower to rainfall events (due to interception) than runoff from agricultural and urban areas. Thus, we assumed that the error introduced by neglecting runoff from forests would not be larger than errors and uncertainties resulting from a runoff model for the forested area for which we had no adequate data to calibrate and validate it with sufficient reliability.

Answers to specific comments: Regarding equation (6): Instead of the “proportional to” operator we could have also used “=”. The publications Lazzarotto (2005) and Lazzarotto et al. (2006) provide a figure to better understand the threshold calculation. Figure 2C shows the total range of the DRP loads measured and simulated on a non-log scale. The two simulation bands presented in Figures 2 to 5 are the 10 % and 90 % quantiles of the simulation results and represent the range of the predicted values. We will state this in the figure captions. Thank you for pointing out these unclarities.

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