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.

Anonymous Referee #2

Received and published: 30 May 2013

General comments. The paper "Prediction of dissolved losses from small agricultural catchments: calibration and validation of a parsimonious model" by C. Hahn et al" is based on previous developments of the RRP model, edited by Lazzarotto and co-authors (2005). The main objective is to evaluate the confidence of RRP simulations and its applicability to other catchments. The paper addresses several key topics of diffuse P modeling that are relevant to the diagnosis of the agricultural pressure and the definition of mitigation options. This includes the delimitation of CSAs responsible for DRP losses and the discrimination of incidental and excess-P origins of DRP. It proposes also an original development for the evaluation of spatial uncertainties of

model outputs.

Specific comments. Calibration. 1) The calibration and confidence analysis of the model is performed on water discharge, not on P losses, though P is the main focus of the model. The authors should test the performance of the P module.

2) As stated before in open discussion, the P outputs must be expressed and evaluated in concentration units, not in flows, considering the dependence on water discharge.

3) The estimation of the performance of the model must be analyzed from the distribution of residues (that appear to be strongly biased from fig 2-5). Such bias should be discussed, not just deplored (L 10-13, p 1481). Notably I wonder if linearity is appropriate to describe both low (eq. 3) and high flows (eq. 10 and subsequent uses of the parameter eta). The emptying rate of a reservoir is (from Bernoulli's equation) a function of the square root of water depth. Such behavior should be considered and tested to improve the model's performance for low flow events. It is also well known that N and P do not share the same behavior, since for the latter various species may be exchanged during high flow events. The determination of parameter eta is therefore questionable (L.25, p1473). In particular it is possible that DRP loads increase as water levels rise and saturated zones are extended. Such situations should be favorable to leaching of organic P, reduction of Fe-PO4, as well as desorption from eroded material. Thus the proportionality between eta and lambda (eq. 1) should be questioned, and better, tested.

4) The contribution of incidental losses may be quite high (1/5 to $\frac{1}{2}$ of total P losses, L10-p1483). This result depends on the value attributed to parameter h of eq.13. First this value must be discussed and second, without an adequate determination of the model's sensitivity to parameter variation, it seems difficult to draw conclusions about the origin of DRP. Such evaluation is however important, considering operational issues.

5) The number of HRUs is fixed at 3, stating that forest impact is limited. This must be

verified (or fully justified), considering that natural background noise should be included in the P budget, especially when forests have high topographical indexes.

6) Why are calibration results discussed for only one catchment (LIP) of the calibration set ?

Validation. The fact that version 2 improves LIP but not Stäg results and conversely version 3 Stäg but not LIP is not discussed. It is questionable why better results are obtained when the % of well and poorly drained soil are similar (cf table 2). How can the authors explain such responses; what are the practical consequences for the implementation of RRP?

Field measurements. Section 3 should be removed, its interest is limited as the assumptions underlying the model have been fully discussed in previous studies for RRP development.

Technical corrections. 1) Please give units simultaneously with variable and parameter definition. 2) What are the hypotheses for parameter distribution (Table 1). Uniform, Normal, other ? Justify please. 3) Differentiate lower and upper confidence limits in figures 2-5 , instead of two red lines.

_____