Hydrol. Earth Syst. Sci. Discuss., 2, S822–S823, 2005
www.copernicus.org/EGU/hess/hessd/2/S822/
European Geosciences Union

Hydrology and Earth System Sciences Discussions

Interactive comment on "Distributed hydrological modeling of total dissolved phosphorus transport in an agricultural landscape, part II: dissolved phosphorus transport" *by* W. D. Hively et al.

Anonymous Referee #1

Received and published: 12 October 2005

The major aim of the paper is to develop a model enabling TDP transport to be predicted from small watersheds, when the saturation excess runoff mechanism is the dominant hydrologic process. The paper is of interest for the readership of HESS and well written. Outcomes of the model application are discussed in relation to environmental tests for soil P and the potential for control of P loss to surface water. The authors argue that overall runoff seems to be the dominant TDP loading source factor. I have suspicion that the model, albeit relatively parsimonious with respect to the number of calibrated parameters, can hardly be validated. The overall agreement between observed and predicted time series of TDP load could be only very site- and data-specific. In its present form, the model appears rather weak when simulating hydrologic transport processes that occur just in the part of subsurface where P is most

relevant. When applied to chemical fertilizer or slurry form, P becomes bound to amorphous aluminium and iron oxides in the uppermost soil horizons, thereby impeding its vertical mobility via leaching. Higher concentrations of soil P available for lateral transport to the stream are thus located in the macroporous shallow subsurface zone. That zone represents a potential preferential path for rapid hydrologic transport following rainfall events. On the other hand, macroporous flow process is also difficult to be modeled adequately. Many studies have reported that large amounts of P flowing out from a watershed can result from a limited number of discharge events within rather short time scales. This occurrence has been observed in the present study. However, an in-depth analysis is desirable on how P reaches the stream of the study watershed. What may seem just a trivial distinction between overland flow and shallow subsurface flow, as dominant P transport pathway, is in fact a significant one. This is chiefly due to the different source areas pertinent to each of them. Variable saturated area overland flow often occurs close to toeslope, whereas shallow subsurface flow is potentially active throughout the watershed. The hydrologic component of the model proposed does not help in evaluating the relative contribute to the P-flux from the different flow pathways.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 1581, 2005.