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Uncertainty assessment of a dominant-process catchment model of dissolved phosphorus transfer

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To improve understanding and prediction of Soluble Reactive Phosphorus (SRP) transfer in agricultural headwater catchments, we developed a parsimonious topography-based hydrologic model coupled with a soil biogeochemistry sub-model. The model structure aims to capture the dominant hydrological and biogeochemical processes identified from multiscale observations in a research catchment (Kervidy-Naizin, 5 km^2). Groundwater fluctuations, responsible for the connection of soil SRP production zones to the stream, were simulated with a fully-distributed hydrologic model at 20 m resolution. The spatial variability of the soil phosphorus status and the temporal variability of soil moisture and temperature, which had previously been identified as key controlling factor of SRP solubilisation in soils, were included as part of an empirical soil biogeochemistry sub-model. The modelling approach included an analysis of the information contained in the calibration data and propagation of uncertainty in model predictions using a GLUE "limits of acceptability" framework. Overall, the model appeared to perform well given the uncertainty in the observational data. The role of hydrological connectivity via groundwater fluctuation, and the role of increased SRP solubilisation following dry/hot periods were captured well. We conclude that in the absence of near continuous monitoring, the amount of information contained in the data is limited hence parsimonious models are more relevant than highly parameterised models.