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Sensitivity and Uncertainty Analysis of EPIC to Simulate Phosphorus Loss from Agricultural Land in Ontario

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Phosphorus (P) losses from non-point sources through runoff and tile drain flow into water bodies play a significant role in eutrophication. Currently, there are many well-established models to describe P loss, however, there are still many deficiencies for modelling P loss. The Environmental Policy Integrated Climate model (EPIC) has been used to simulate the P loss from runoff and subsurface drainage based on experimental data from 2008 to 2011 at Harrow, Ontario. Global sensitivity analysis was used to determine the preferential parameters at this specific location. And the Generalised Likelihood Uncertainty Estimation model (GLUE) was used for calibration and uncertainty analysis. Hydraulic parameters showed low contribution to the model output uncertainty, such as saturated hydraulic conductivity, soil water content at field capacity and wilting point, which may reveal the incapacity of EPIC to simulate P loss from subsurface drainage due to underestimation of P leaching through the soil. The possible reason is that EPIC places too much weight on soil mixing to simulate P downward transport. Another possible mechanism was because estimation of P leaching was defined as the ratio of soil labile P concentration to P concentration in percolating water, which is partly depending on the accuracy of initial soil labile P. Estimation accuracy of the initial concentration of soil labile P and P sorption coefficient (PSP) are crucial for the correctness of EPIC simulations. Site specific determination of labile P and PSP derived on soil properties based on pedotransfer functions would increase the accuracy of EPIC to simulate P loss from runoff and subsurface drainage.