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Assessment of phosphorus transfer from agricultural lands to the surface water in France: definition of connectivity indices

M. Delmas (1), C. Gascuel-Odoux (2), O. Cerdan (3), D. Arrouays (1), and J.M. Mouchel (4)

(1) INRA, infosol, Orléans, France (magalie.delmas@orleans.inra.fr), (2) INRA, UMR 1069, Soil Agro and hydroSystem, Rennes, France, (3) BRGM, RIS, Orléans, France, (4) UMR Sisyphe 7619, University Paris 6, 4 place Jussieu, France

Diffuse phosphorus (P) transfer from agricultural lands to surface water contributes to eutrophication. It has increased attention in the last decades, notably due to a real improvement of water treatment from urban areas which induce a higher relative part of agricultural sources. Methodologies focusing on P transfer from agricultural areas to rivers are thus required, particularly for water quality assessments at large scale, as a part of the implementation of the EU Water Framework Directive. In this context, a methodology is presented which aims to investigate what is the fraction of hillslope P production which reaches the river systems, and finally, to better identify the origin of P observed in rivers.

The proposed model combines mobilisation and transfer processes: P and soil particles are firstly mobilised by water erosion, and then they are delivered via surface and sub-surface flow pathways to the river network. The method takes into account the spatial distribution of major properties that control the mobilisation of P by soil erosion and its transfer to the water bodies. Description of P transfer is based on the establishment of connectivity indicators which describe hillslope flow pathways, potential retention, attempting to link basin characteristics to a prediction of phosphorus exports in rivers. The model is calibrated and validated with phosphorus fluxes calculated in French rivers.

This study provides insight in the identification of the most influent soil particles and P redistribution processes on the total P fluxes, and the difference between various types of basins.