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A new method for apportionnement of diffuse nutrient sources of surface water contamination

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Surface water quality has improved slightly in many regions of the Netherlands during the last decades, due to a reduction of the nutrient loads from point sources, but in most areas the concentrations do not meet the targets to comply with the objectives of the Water Framework Directive. Leaching from agricultural soils is currently the largest source. Quantitative insight into the contribution of the various land management related sources is necessary to discuss the responsibility of different authorities to further improve the quality. Such an understanding is also needed to assess the effects of mitigation measures.

The STONE model was developed in 1998- 2000 aiming at the assessment of the effectiveness of Dutch policy measures to reduce nutrient loads to groundwater and surface waters from agricultural land. The process oriented model simulates the carbon, nitrogen and phosphorus cycles in soil and is capable to calculate N and P fluxes to surface waters. Due to the nature of the interdependent soil transformation processes, straight forward model runs don't yield in the relative contribution of the use of fertilizers and other diffuse sources to the total diffuse loads to surface waters.

A new method was developed to reveal the relative contribution to surface water contamination of resp. the actual fertilization practise, the historical fertilizer excesses, the atmospheric deposition rates, the inputs by upward seeping water flow, the inputs by infiltrated surface water during summer time in polders and the natural soil release. The method is based on a linear proxy model of the STONE model. The coefficients were derived from the results of a sensitivity analysis.

At the national level, the diffuse nitrogen and phosphorus load on surface waters due to the actual fertilization practise amounts to resp. 64% and 48% of the total diffuse loads from agricultural land. Deposition, the input by upward seeping water and the input by infiltrated surface water in polders amounts to less than 5% each. The release from soils, including the effect of historical nutrient surpluses, amounts to resp. 27% and 45% of nitrogen and phosphorus load from agricultural land. The method allows for a further distinction in the relative source contributions per land use, soil type and groundwater regime class.

Although agriculture is one of the main contributors to surface water contamination, diminishing manure and fertilizer inputs will not result to a short time contamination reduction due to the long memory of the soil.