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Area-differentiated modelling of P-fluxes in heterogeneous macroscale river basins

B. Tetzlaff (1), F. Wendland (1) and P. Kreins (2)

(1) Research Centre Jülich, Programme Group Systems Analysis and Technological Evaluation, D-52425 Jülich
(2) Federal Agricultural Research Centre, Institute of Rural Studies, Bundesallee 50, D-38116 Braunschweig
(b.tetzlaff@fz-juelich.de / Fax: +49 2461 612540 / Phone: +49 2461 613648)

The authors were involved in an interdisciplinary research project named 'REGFLUD' commissioned by the Federal German Research Ministry 2001-2004. One aim of 'REGFLUD' is to develop policy options concerning P reduction measurements and to predict their effects on the basis of an integrated model system. This includes the agri-environmental sector model RAUMIS, the water balance model GROWA and a newly developed model DiPhos for the analysis of the diffuse phosphate flux.

In the contribution the features of the DiPhos model will be described and results of its application to two study sites presented. The study sites are the River Ems catchment (12900 km^2) and parts of the River Rhine catchment (12200 km^2). DiPhos allows the quantification of the mean long-term total-P entries from diffuse sources to surface waters via artificial drainage, baseflow, wash-off, erosion and from sealed urban surfaces. The consideration of all these pathways means a pre-requisite for the simulation of the entire P-transfer from land to water in macroscale river catchments, consisting out of both upland and lowland regions.

The spatial discretization of the river catchments is based on so-called phosphotopes, critical source areas contributing to the P-flux of the entire catchment and formed by the coincidence of dominant parameters. A range of phosphotopes is defined for every pathway. Higly-resolved data sets with a scale of about 1:50000 form the basis for the parameter quantification.

The modelling results of the mean long-term P-flux show a range between 0,2 and

more than 15 kg P/(ha*a). The very low P-entries represent background values, while the “hot spots” result from agricultural used raised bog areas with installed tile and pipe drainage systems or from areas with high erosion potential and access to flow-paths. The results are validated for sub-catchments with calculated loads. This step implies the consideration of point sources and retention processes in the channel.

The area-differentiated results allow efficient deriving of reduction measures taking into account the phosphotope properties. The high P-outflow from raised bogs can be tackled by landuse changes or rewetting measures. For controlling erosion-related inputs various erosion reduction measures are proposed. Details and examples will be given in an oral presentation.