Geophysical Research Abstracts
Vol. 17, EGU2015-1031-1, 2015
EGU General Assembly 2015

Comparison of two methods of phosphorus transport modelling in large areas

Barbora Jáchymová (1), Josef Krása (1), and Jakub Borovec (2)

(1) Department of Irrigation, Drainage and Landscape Engineering, CTU Prague, Prague, Czech Republic (barbora.janotova@fsv.cvut.cz), (2) Biology Centre of Academy of Science of the Czech Republic, Institute of Hydrobiology, České Budějovice, Czech Republic (jborovec@hbu.cas.cz)

Water erosion is a natural process of soil surface disturbance by rainfall and surface runoff. Phosphorus transported by surface runoff is followed by eutrophication of water bodies and water quality issues. The problem rises with climate change and increasing climate extremity. Agriculture soil, infrastructure and water quality protection have to be ensured by suitable legislative measures. The efficiency of these measures can be proved by suitable mathematical modeling of the soil erosion and nutrient transport to watercourses and water bodies.
Research provided by the Department of Irrigation Drainage and Landscape Engineering FCE CTU is focused on the water erosion modeling, including nutrients transport. This research comprises either experimental rainfall-runoff and erosion events measuring or using mathematical models for calculation of runoff and erosion intensity in small and larger basins. The long-term erosion intensity on the area of 32 thousand square kilometers has been calculated using the empiric model WATEM/SEDEM. Within the project (QI102A265) the methodology for the dissolved phosphorus transport direct determination has been derived (Borovec et al., 2012; Jan et al., 2013). Only total soluble P affects actual water eutrophication. Phosphorus can be released, temporarily retained or permanently locked up, depending on the particles composition and the water body and sediment conditions. According the new methodology phosphorus desorption from the sediment particles is defined by actual dissolved P concentration within the stream and the available P (defined by Mehlich III test) in the source agricultural fields. This article presents the comparison between the indirect determination of the transported dissolved phosphorus using the equation of Sharpley (1995), based on usually used enrichment ratio and assumed share of the dissolved phosphorus in the total transported phosphorus during erosion event, and the direct determination of the transported dissolved phosphorus amount, based on the newly derived methodology. Study areas (four catchments of dozens of km sq) were chosen for their different characteristic (land-use, average slope, average altitude, P concentration in the soil) which influence rainfall-runoff behavior. Modelled results were compared with data measured during synthetic rainfall-runoff events using rainfall simulator.
Results show, that the two presented methods provide similar results in intensively agriculturally used regions, when the commonly considered dissolved phosphorus share value of 5 % was used. The agreements of the methods was observed for three studied areas with significant average erosion intensity (above 4 t.ha-1.year-1). In the catchment with low erosion intensity (0.5 t.ha-1.year-1) the indirect method underestimates dissolved phosphorus amount transported in watercourses.

This research is supported by grants: SGS14/180/OHK1/3T/11 Rainfall-runoff, erosion and transport processes – experimental research and QJ330118 „Using Remote Sensing for Monitoring of Soil Degradation by Erosion“.

BOROVEC, J., JAN, J., HEJZLAR, J., KRÁSA, J., ROSENDORF, P. (2012). Eutrophication potential of eroded particles in water reservoirs. In: Kosour, D. (ed.), Proceedings of Conference Water reservoirs 2012, 26. – 27. 9. 2012, Brno, The Czech Republic. Brno: pp. 57–61.

JAN, J., BOROVEC, J., KOPÁČEK, J., HEJZLAR, J. (2013). What do results of common sequential fractionation and single-step extractions tell us about P binding with Fe and al compounds in non-calcareous sediments? Water Research, 2013, 47 (2): 547–557.

SHARPLEY A. N.: Dependence of runoff phosphorus on extractable soil phosphorus. J. Environ. Qual., 1995, 24, 920-926.