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Impact of Flood Water Infiltration on Groundwater Quality: the Role of the vadose Zone

E. Bethge, U. Mohrlok
Institute for Hydromechanics, Universität Karlsruhe (TH) (bethge@ifh.uka.de)

Besides the structural damages that are caused by flood events the high pollutant concentration in the flood wave can have long term impacts for societies by contaminant infiltration into the groundwater. The vulnerability of the water resources in the river plains are supposed to increase in the last decade while river renaturation projects have been accomplished to improve flood protection. With the presented approach a tool to calculate the risk of groundwater contamination by flood water infiltration and contaminant transport through the vadose zone will be developed. By specifying the risk of groundwater contamination the need for further protection of the drinking water resources in the flood plains can be evaluated. Processing a risk assessment for a groundwater contamination means linking the hydraulic and chemical properties of flood events (e.g. surface water depth, contaminant concentration) to the top soil protection capacity in the flooded part of the catchment area. To assess the impact of flood events on the groundwater quality the contaminant mass flux into the groundwater has to be investigated, which is a function of soil properties (e.g. soil texture, sorption capacity) and the hydraulic boundary conditions in the flood plains (e.g. surface water- and groundwater depth). The spatial interaction of these parameters and their uncertainties have to be considered for a reliable risk analysis. For a planned flood water retention area top- and subsoil transport properties (e.g. profile geometry, parameters of water retention curve, sorption coefficients) and their uncertainties have been mapped. Within a GIS environment the soil data have been arranged with information about surface water and groundwater depth during flood events to provide the hydraulic boundary condition for the infiltration and contaminant transport calculations. The risk of exceedance of a predefined contaminant concentration at the groundwater table is investigated by sampling based risk analysis techniques (Monte Carlo simulation). Computational effective evaluation methods based von analytical

solutions have been developed, which take into account vertical soil heterogeneity and macroporous flow and transport through the soil. The developed approach can be incorporated into common GIS environment where it serves than as decision support system, to quantitatively evaluate possible groundwater contamination by flood water infiltration.