Geophysical Research Abstracts, Vol. 9, 06166, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06166

Mobilization of mobile particles and organic contaminants in alluvial top soils during flood events

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Flood events may enhance the mobility of particles and contaminants accumulated in floodplain soils und thus pose a severe thread for river and groundwater resources. To elucidate the processes which control the contaminant release under prevailing water saturated conditions we run soil column experiments. Flood events were simulated by imposing multiple flow interrupts of variable duration. The soil material originated from a contaminated site of an alluvial topsoil layer of the Elbe catchment at Muldenstein, Germany. The effluent was analyzed for DOC (dissolved organic carbon), turbidity, PAHs (polycyclic aromatic hydrocarbons), pH, EC (electric conductivity), Eh (redox potential), CO_2, iron, manganese, calcium and magnesium.

Compared to steady state flow we found increased values turbidity, EC, DOC, inorganic materials and PAH after flow interrupts. Concomitantly, the redox potential of the effluent dropped markedly compared to the level of the inflow solution. The high concentrations leveled off after a few pore volumes have been exchanged. We interpret these as the consequence of microbial degradation processes: Long term flow interrupts results in the exhaustive consumption of readily availably electron acceptors like oxygen and nitrate. This favors the microbial utilization of iron- and manganese-oxides. Besides soil organic matter, these oxides are important cementing agents. Microbial consumption will thus not only result in the reduction of iron and manganese, but concomitantly in the disintegration of soil aggregates. Once the flow is resumed, these materials are exported from the column.

Seasonal flood events of river bank and floodplain soils will result in the freeing and

release of particels and contaminants. In flodplain soils with high contaminant loadings, the risk of groundwater and river pollution due to microbial mediated reductive processes has to be considered in the flood management of river-catchment systems.