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Assessment of the Effects of Climate Change on the Mobility and Distribution of Metals and Pathogens at the River Basin Scale

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Anticipated climate change will most likely affect the mobility and distribution of contaminants, such as metals and pathogens, in soil, groundwater and surface water, ultimately affecting terrestrial and aquatic ecosystems, as well as public health. For example, temperature-induced changes in soil structure may affect species composition, thereby promoting the transport of toxic substances, such as copper and cadmium, and pathogenic microorganisms. In the framework of a project to assess the effects of climate change on the concentrations and fluxes of metals and pathogens at the catchment scale, a dynamic, spatially distributed River Basin Model that integrates catchment-scale transport models will be developed. The River Basin Model will consist of modules describing the transfers and feedbacks between the environmental compartments soil, groundwater and surface water. The innovative aspect of this project involves the development of a novel soil module to include the effects of changing soil organic matter content and composition on the speciation and transport pathways of contaminants. For this purpose, a point-scale soil organic matter and nutrient dynamics model will be linked to a chemical speciation and transport model, which allows a quantitative assessment of climate change effects on the mobility of metals and pathogens in various soil types. The results of this model analyses will be used to parameterize a large-scale soil module to be included in the river basin model. To assess the impact of climate change and changes in land use on the future distributions of contaminant concentrations in the major exposure pathways to man and ecosystems, a selected number of scenarios addressing climate change, agricultural practices (land use change, land management), current policies and mitigation strategies, will be defined. For each scenario, the River Basin Model will be used to project the probability distributions of contaminant concentrations in soil, groundwater and surface water. The River Basin Model will be tested in a moderately-sized river basin in the Netherlands and will feed input to a probabilistic risk assessment model that is being developed in a parallel project.