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NUMERICAL STUDY OF THE COMBINED INFLUENCE OF WATER PONDING AND WATER EXCHANGE BETWEEN SURFACE WATER AND GROUNDWATER ON THE TIME DEPENDENT WATER CONTENT OF THE VADOZE ZONE OF THE ALLUVIAL AQUIFER AT THE ERSTEIN POLDER SITE

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Summary. The Erstein polder is a research site having a surface area of about 600 ha, which is located 30 km in the south of the Strasbourg town center. Equipped with a large number of measuring probes (suction cups, piezometers, limnimeters), it permits to study both controlled water ponding situations (during the floods of the Rhine river) and the water exchange between rivers located on the polder site and the groundwater. The purpose of the present study is to build up a 3D numerical flow model using FEFLOW to simulate the combined influence of water ponding and water exchange between surface water and groundwater on the time dependent water content of the vadose zone of the alluvial aquifer. Based on an existing numerical flow model for the saturated zone of the Erstein polder site, the first step concerns the quantification of hydrodynamic parameters (formulated in the Richards equation) in order to represent appropriately the water infiltration from the soil surface to the groundwater. For example, the Van Genuchten parameters (αVG, nVG) are estimated from both the grain-size distribution and the laboratory measurements conducted on soil samples at four locations. Concerning the modeling of the water exchange between rivers and groundwater, field data are used to estimate the conductivities and thicknesses of the colmation layer and the reference hydraulic heads for each transect of the main rivers located on the polder site. Based on the regional boundary condition of the developed 3D saturated-unsaturated flow model, numerical simulations of the transient flow were conducted for the hydrological years 2003 and 2004. Two essential events happened in 2004: in January, floodplains occurred during four days and the water discharge in the ancient transects of the rivers giessen appeared during one day in June. The calculated fluctuations of both the groundwater level and the water content of the vadose zone are then compared to field measurements. The results of our analysis will clarify which part of water flux is generated by water ponding and water exchange between surface water and groundwater.