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NUMERICAL SIMULATION OF STREAM/AQUIFER INTERACTIONS IN SEMI-ARID REGIONS

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Abstract. Stream/aquifer interactions play a critical role in the hydrology of semiarid regions. Recharge originating from rapid floods contributes to the overall water budget and particularly to the sustainability of riparian ecosystems. To determine the amount of water that is being exchanged at any time at any given location between an open channel and its surrounding aquifer poses a problem that not only has attracted the interest of the scientific community but also has many environmental implications. On one hand, depletion of streamflows and wetlands due to groundwater withdrawals often affects transient surface water flows, which in turn, are critical to sustain protected flora and wildlife. On the other hand, poorly drained soils due to a malfunctioning drainage system may result in a build up of the water table that can impact the productivity of irrigated land. Field, analytical and numerical methods, or a combination of them, are commonly used to study stream/aquifer interactions. Numerical simulation is usually performed either with a single model or two models sequentially coupled. In the latter case, the groundwater flow equations and the open channel flow equations or an approximation of them, are solved with single or multiple time steps. Coupling two standard models is a modeling practice successfully tested in different scientific fields. The rationale of such an approach is usually to combine the strengths of each model to numerically solve a practical problem for which no single model is fully suitable. A semi-automatic strategy to link KINEROS2 to MODFLOW is presented and preliminary results from a real case application are reviewed. In addition, the open source, highly tested and widely known HEC-RAS computer
program is linked to MODFLOW in an iterative way (not fully automated yet) in order to improve the drain flow–aquifer discharge problem available in MODFLOW. The main objective of the approach is to obtain a more physically realistic hydraulic profile in channel drains within a regional groundwater flow system.