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Hydrological characterization of a reclaimed wadi basin in Egypt for water harvesting plan

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In arid regions, the limited rainfall may frequently produce flashfloods, with large volumes of water flowing in the streambed of so called wadi basins. Appropriate wadi management may turn flashfloods into a significant water resource to be used for agricultural purposes. In larger wadi, runoff volumes may be diverted from the stream to crop fields. In smaller wadi systems the infiltration of wadi flows in alluvial-type sediments (so-called transmission losses) represents the main source of water to eventually meet crop requirements. Using rationally this water for agricultural purposes requires to understand the rainfall-runoff behaviour of the wadi basin and the related streambed storage characteristics. In this study, the hydrological behavior of a wadi basin in Egypt (Agarma basin) was assessed. A modeling approach combining a runoff model and a soil-plant-atmosphere model was used to simulate respectively the amount of water stored in the wady stream bed after a single rainfall event and the depletion of the stored water by evapotranspiration in the period between two subsequent rainfall events. The study was based on a large data set collected in two years in the Agarma sub-basin of the Wadi Kharrouba in Egypt. The database was used as input for both a surface runoff hydrological model and a soil-plant-atmosphere model to understand the behavior of the wadi in question and the potential of its stream bed for agricultural exploitation. Specifically, the model KINEROS2 was used for predicting runoff and average transmission losses (water on average stored in the porous medium of the terraces artificially developed in the stream bed) during a single rainfall event. Being an event-based model, the KINEROS model does not account for evapotranspiration or soil water movement between rainfall events. Thus, to describe unsaturated wadi bed behavior in the time intervals between two subsequent rainfall-runoff events, in this study we applied a numerical agro-hydrological model (FLOWS-HAGES - FLOw of Water and Solutes in Heterogeneous AGri-Environmental Systems)
Overall, the methodology allowed to quantify the volumes of water infiltrating in the wadi alluvial beds for each rainfall event and thus the water potentially available for crops at the end of the rain season. The results confirmed the importance of having distributed water storage measurements available, in addition to basin outlet discharges, to improve model predictive capability.