Geophysical Research Abstracts
Vol. 19, EGU2017-7460, 2017
EGU General Assembly 2017

Assessing river regime alteration due to flood detention structures in dry and semi-dry regions

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In dry and semi-dry climate, flood detention structures are used for flood control and managed aquifer recharge. These damps basin runoff response decreasing the maximum flows and increasing the runoff duration through wet seasons. In this study, a framework to quantify the role of flood detention dams in headwater tributaries on total water balance of major basin and alteration of flow pattern in the main river has been presented. The study contains four main subroutines: rainfall-runoff model, reservoir flood routing, river analysis system and seepage analysis. The flood hydrographs with different return periods are estimated based on the climatic data and geomorphology of headwater basin. River flow analysis below the flood detention structure is carried out for two unsteady flow scenarios, first with the hydrographs of natural system (as pre-impact: quick flood with significant peak flow) and second the routed hydrographs due to detention process in the reservoir (as post-impact: damped flood lower peak with longer duration time). Two sets of dynamic water surface along the river (from the location of detention structure (x=0) to the confluence point with main river (x=L) are developed based on two hydrologic conditions as results of river analysis system. The results of framework define the impact of flood detention structure by comparing the timing, magnitude and variability of flow. The Kamal Abad artificial groundwater recharge in Mahrloo Lake basin in Southern Iran was selected as case study to demonstrate the application of the created framework. Through the probability analysis, the return period for hydrological drought would be compared in pre and post impact condition. The results clearly showed how embankments influence floods in tributaries and in some cases the flow reduced significantly and disappears in tributaries.