

Draining a ditch irrigated area to mitigate low flows in a small lowland catchment of the mid-latitudes

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Decreasing groundwater levels in many parts of the federal state of Brandenburg and decreasing low flows in Central Europe have created a need for adaption measures to stabilize the water balance and to increase low flows. The objective of this study was to estimate the impact of ditch water level management on stream-aquifer interactions by analyzing a ditch structure already existing in a small lowland catchment of the mid-latitudes. At the investigated ditch system water levels, runoff and precipitation was monitored between 2010 and 2012. The water balance of the ditch irrigated area and fluxes between the subsurface and the adjacent stream were modeled for three runoff recession periods using the Hydrus-2D software package. Five scenarios of different antecedent water levels in the ditch irrigation system were examined. The results showed that subsurface flow to the stream was closely related to the difference between the water level in the ditch system and the stream. Evapotranspiration during the growing season additionally reduced base flow. It was crucial to stop irrigation during a recession period to decrease water withdrawal from the stream and enhance base flow by draining the irrigated area. Mean fluxes to the stream were between 0.04 and 0.64 ls⁻¹ for the first 20 days of the low-flow periods. This only slightly increased the flow in the stream, which was in mean 57 ls⁻¹ during the period with the lowest flows. Larger areas where ditch irrigation is adapted or a combination with other measures are necessary in order to effectively increase flows in mesoscale catchments. Ditch water levels should be increased as much as possible to assure high base flow during subsequent low flow periods. Clearly, this contradicts current land use and environmental protection. Thus, this study can be used as basis for a discussion on possible fluctuations in water levels in such areas and subsequently possible effects considering current land use have to be evaluated on catchment scale.