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Hydrological behavior of the confined Aba'ala graben along the western margin of the Danakil depression, Northern Ethiopia

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Abstract

Marginal grabens are considered as major development corridors in Ethiopia. Despite the increasing pressure on water resources, the hydrological behavior of marginal grabens is poorly documented to develop management options. Here we investigate the hydrological behavior of Aba'ala marginal graben (553 km^2) along the western margin of the Danakil depression. We implemented rain gauges, pressure transducers, and staff gauges at representative rivers to collect the required data. Transect studies across the escarpments were undertaken to understand the runoff mechanisms. We developed rating curves and hydrographs for each gauging station to analyze the discharges. The study shows that seasonal rainfall is erratic that led to $27.6x10^6m^3$ of runoff in 2016. About 88% of the river discharges took place in the form of flash floods between July and August. Furthermore, travertine dams situated in the upper catchment of Murga and Aba'ala Rivers indicate the position of springs that recharge the productive graben bottom. However, about $25.2x10^6m^3$ volume of water is lost through the single outlet from the marginal graben bottom. Moreover, high evapotranspiration rates make the available moisture insufficient for crop production in the graben bottom. Therefore, partitioning of flash and regular floods could improve onsite water productivity in the confined Aba'ala marginal graben.