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Braided river dynamics in relation to floods in the Raya graben (Northern Ethiopia)

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In this study, the impact of flash floods on channel width was investigated for two braided rivers (Etu and Hara) in the Raya graben (Ethiopia). Event peak discharges were measured using crest-stage gages at calibrated cross-sections (bridges near the escarpment footslope) in the rainy season of 2013 and 2014. In order to investigate the changes in channel morphology along the rivers, 15 monitoring sites were established 0.05 to 1.5 km downstream from the hydrometric stations. Decadal channel width change was analyzed over the period 1965 - 2014 using aerial photos and SPOT satellite images. Results show that there was a weak positive correlation between weighted average daily precipitation and magnitude of peak flood ($R2 = 0.08$, $p = 0.02$, $n = 57$). Specific (peak) runoff coefficient (Cp) tends to increase towards the end of the rainy season (average of 0.11 ± 0.11 in July, 0.15 ± 0.14 in August, 0.19 ± 0.06 in September). This is most probably related to high infiltration capacity at the beginning of the rainy season and lower at the end. In the short term (2013 & 2014), average channel widenings of 3.4 m in Etu (9 monitoring sites) and 3.7 m in Hara river (6 monitoring sites) were recorded. At the decadal scale, there was widening of 45 m (0.9 m per year) in Hara and 8 m (0.2 m per year) in Etu river. There was a positive correlation between event peak discharge and changes in river width ($R2 = 0.12$, $p = 0.006$, $n = 58$). Riparian vegetation and sand embankments give significantly stronger resistance to bank erosion than croplands ($F = 23$, $Fcrit = 3$, $p<0.0001$). Because the widening of the channels grabs farmlands, channel stabilization activities should also focus on enhancing vegetation cover in the riparian zones of braided river reaches.

Key terms: channel width, dryland, braided river, flood event, Rift Valley