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Plan form changes of Gumara River channel over 50 years (Upper Blue Nile basin, Ethiopia)

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Channel plan form changes were investigated along the 65 km long Gumara River in Lake Tana basin (Ethiopia) by overlaying information from aerial photographs and SPOT imagery. Two sets of aerial photographs (1957 and 1980) were scanned, and then orthorectified in ENVI 4.2 environment. Recent channel plan form information was extracted from SPOT images of 2006. ERDAS 2010 and ArcGIS 10.1 tools were used for the data preparation and analysis. The information on river plan form changes spans from 1957 to 2006 (49 years), during which time the Gumara catchment has been subjected to changes in land use/cover and increasing water abstraction, which may have affected its hydrogeomorphology. The results indicated that the lower reach of Gumara at its mouth has undergone major plan form changes. A delta of 1.12 km² was created between 1957 and 1980 and additional 1.00 km² land has been created between 1980 and 2006. The sinuosity of the plan form changed only slightly through the study period: 1.78 in 1957, 1.76 in 1980, and 1.81 in 2006. Comparison of cross sections at the hydrological gauging station showed that the river bed aggraded in the order of 1.5 m to 2.5 m for the period 1963-2009. The trend analysis of stream flow of Gumara River versus rainfall in the catchment also indicated that the bed level of the Gumara river at its gauging station has risen. From field observations, the impact of direct human interventions was identified. The building of artificial levees along the river banks has contributed to huge deposition in the river bed. At locations where intensive irrigation takes place in the floodplain, seepage water through the banks created river bank failure and modifications in plan form. The unstable segments of the river reach were identified and will be further analysed.