

Channel Planform and Slackwater Deposits as Indices of Stream Discharge Variance in the Alluvial Mahi River Basin, Western India

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The alluvial river basins of India are important repository of the late Quaternary changes in climate. These fluvial systems are sensitive to rainfall, an important indicator of climate change and respond to the variability in precipitation by altering their planform, channel geometry, and sedimentation pattern which in turn contribute to the landscape evolution. Channel morphology and slackwater deposits are among the few proxies that record variance in discharge and can give indications of palaeoclimate. With this understanding, a study in the alluvial Mahi river basin, western India was carried out to highlight the variations in the stream discharge through the Mid- Late Holocene, historic time and present based on the channel dimensions and the available slackwater deposits. The formation of terraces, the occurrence of point bars above the river bankfull level and the decrease in width to depth ratio of the channel are considered to be the geomorphic responses to change in discharge and estimates were made using the established empirical relations. The study reveals that the bankfull discharge during the Mid- Late Holocene was an order of magnitude higher and during the historic time was about 3 times that of the present day. The channel has changed from wide, large amplitude meander system to smaller meander amplitude and wavelength from Mid- Late Holocene to present. A decrease in the width –depth ratio and also the unit stream power and the bed shear stress is observed through the Late Holocene till present. Relating the discharge to precipitation, it can be inferred based on channel dimensions that there is an overall decreasing trend of precipitation from the Mid- Late Holocene to the present. Further, the variation in the discharges during the Mid- Late Holocene can be inferred from the slackwater deposits. The slackwater deposit study reveals that four phases of flood deposition occurred during the Mid to Late Holocene. The slackwater deposits comprise finer fraction (silt and clay) of the total sediment load carried by the flooded river. These are primarily derived from the gneissic rocks of Aravalli hills, the Deccan basalts and the reworking of the Pleistocene sediment cliffs. Based on the IRSL dates on three units it can be suggested that the first phase occurred prior to 5ka and the second phase at about 4.6 ka. The sediment character and pattern indicate that these have resulted due to repetitive flooding in a regime of high discharge and therefore an intense monsoon. The last two phases occurred between 4.6 ka and 2 ka due to extreme high magnitude floods in a period of low discharge.