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Spatiotemporal migration patterns of rivers across the Himalayan foreland basin

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Rivers are one of the most dynamic features on the Earth's surface. Over time, river channels migrate across its floodplain either gradually or rapidly in response to erosion, accretion, sediment transport, or high-water flow events, respectively. These lateral migrations of the river channel could be detrimental to the human settlements, infrastructure, and ecological elements in the floodplain region. Indo-Gangetic plain is the world's largest alluvial tract, drained by rivers such as Ganga, Brahmaputra, Indus, and their tributaries. Most of these rivers are known to be very dynamic and have the potential of affecting a large population. Previous studies focused on individual rivers to understand the spatiotemporal patterns of channel migration. However, regional-scale analysis becomes necessary to understand the large-scale controls on river dynamics and determine their response to future climate change and anthropogenic activities. This study intends to map and measure migration rates of all the major river channels in the Himalayan foreland basin using Landsat imagery from 1990 to 2020. We generated annual active channel binary masks from Landsat imagery using Google Earth Engine. We delineated the centerline of channels and calculated channel migration rates between consecutive years using the RivMAP toolbox in MATLAB. Here we show that the elevation difference between the river channel and its floodplain acts as a spatial constraint and controls the relationship between channel patterns and migration rates. Channel segments with higher elevation differences correspond to less channel movement and vice versa. Additionally, we explore the effects of anthropogenic activities on river dynamics in the study area.