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Flood induced channel morphodynamics variability of a braided river system in the lower Brahmaputra river basin, India

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The high and low flood events in a braided river system cause perpetual changes in the channel morphodynamics and make it difficult to understand a channel response. Therefore, the management of braided channel morphodynamics becomes a challenging issue for flood mitigations and river restoration purposes. The lower Brahmaputra river basin has the world's most extensive braided river system, and every year it confronts reoccurring monsoon driven flooding causing widespread flood inundation and changes in channel morphodynamics. Such adequate conditions promise a natural laboratory to understand dynamics channel morphodynamics changes with high and low flood events. The present work integrates the mutual effects of varying channel area, width and sinuosity, and sediment bar area along a braided channel reach in the selected reach in the Brahmaputra River in thirty events during high discharge months of 2018, 2019 and 2020. To observe detailed channel morphodynamics changes, we developed 100 grids with a width of ~6.25 km enclosing the selected reach. These grids are maintained stationary for each year and were used to extract the Brahmaputra River channel area (BRCA) and Brahmaputra River sediment bar area (BRSBA) and average Brahmaputra River channel width (BRCW) for each grid. We developed a site-specific Google Earth Engine algorithm to delineate the channel and sediment bar in the selected reach to perform supervised classification on Sentinel-1 SAR GRD and Sentinel-2 level-1C.

The results show that grids upstream of the selected reach have a high BRCA, BRSBA and BRCW, and these grids are located around high clustered flood inundated hotspot regions. We also found that the world's largest river island (Majuli) is also located in this zone. In the present study, we also observe that if we consider BRCA, BRCW and BRSBA for the same event, the BRSBA has a high correlation with the BRCW compared to the BRCA. Further, we compared the impact of the sinuosity on BRCA, BRCW and BRSBA of regular and influential flood events. During influential events, the sinuosity has only a good impact on the BRCA, and during regular events, it has a higher impact on BRCA and BRSBA. We conclude that in the braided river system of the Brahmaputra River, the channel and bar area and channel width are highly correlated during flood

events, and the channel sinuosity also controls channel and bar area and channel width during regular and influential flood events.