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Numerical-Modelling and Earth-Observations for Dynamic Management of Old Brahmaputra Offtake

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The Old Brahmaputra River (OBR) provides water to the mega city Dhaka and for navigation. Due to large morphological changes in the Jamuna River, the shape and elevation of the OBR offtake were deposited. The braided Jamuna River's morphological changes have caused the offtake area of the OBR to be unstable to provide less water than demand. The Old Brahmaputra River is the lifeline of the Jamalpur-Mymensingh region of Bangladesh and serves various ecosystem services such as a source of drinking and domestic water, irrigation, fisheries, navigation and so on. The study aims to assess the morphological characteristics of the OBR offtake and to develop suitable offtake management options through structural and non-structural interventions. Furthermore, innovative dredging options will be explored in the river reach to ensure sufficient flow in the dry season at the OBR and its distributaries along with other water usage. Ecosystem services in the river are also tackled. In this context, the offtake management options are simulated with mathematical models to find a sustainable option to stabilize the offtake and ensure dry-season flow in the river for sustaining ecosystem services.
A new approach has been developed to retrodict a former bed topography with the support of satellite images. The quasi-3D numerical model is hydrodynamically calibrated at two locations (Bahadurabad and Chilmari). In addition to that, the model is calibrated in terms of sediment transport capacity for morphology. The Engelund-Hansen sediment transport formula has been modified to best fit the measured sediment transport data. Furthermore, many simulations have been conducted to capture deposition and erosion of the flooding and drying locations within the river. Simulation results at these locations are used as key performance indicators (KPIs), obtaining information for them via earth observation data. After this process, the best model setting is selected to declare that the model is fit for purpose.
The quasi-3D fit-for-purpose model is used to perform several scenarios to assess the effect of various measures and interventions on the offtake functioning. These measures are selected upon stakeholder sessions that are conducted for the purpose to collect all the possible options. Selected measures and a combination of measures are implemented in the model and tested (e.g. moderate dredging, aggressive dredging, use of geo-tubes, bank fixation and guide walls, and development of a second offtake).
The results illustrate that the measures do increase the volume of inflow discharges of the OB River. However, the optimal strategy must be selected based on the intervention strategies' demand and tractability. This has to be further investigated to ensure the selected strategy has minimum impact on people, the planet and prosperity.