**Title**

Water Level Monitoring in the Karnali River, Nepal: Evaluating Satellite SAR Altimetry Techniques through Field Observations

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**Abstract**

Rivers play a crucial role in shaping landscapes and supporting ecosystems. This is demonstrated by the tiger habitats in and around Bardia National Park in West-Nepal, which rely on the Karnali River. This study contributes to a larger effort aimed at sustainably managing these tiger habitats. Monitoring the rivers in this remote area is challenging, suggesting a role for remote sensing. An exploration is presented regarding the potential of satellite synthetic aperture radar altimetry (sat-SARA) for monitoring rivers situated in diverse topographic landscapes. Focusing on the Bheri, Karnali, and Geruwa Rivers, the applicability of sat-SARA techniques for water level monitoring, multiple channel identification, and channel activation detection was evaluated. For deriving water surface heights from sat-SARA data, an empirical Gaussian retracker was used. The findings are promising. While resulting water level variations align with field observations, complementary in-situ measurements are imperative for a comprehensive evaluation. Additionally, the study reveals the potential for identifying multiple channels from sat-SARA return signals, extending to channel classification and detecting channel activation. Leveraging the labour-intensive nature of sat-SARA data processing, the technique holds great promise for monitoring rivers in remote and difficult-to-access landscapes. Therewith, this study contributes to advancing the understanding of the hydrodynamics of the Lower Karnali River and opens doors for sat-SARA applications for river monitoring in challenging terrains.