A Feasibility Assessment on Monitoring Ungauged Mekong River Tributaries Using SWOT Satellite data

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SUMMARY

Accurate flood forecasting in complex systems such as the Mekong River, stretching 5000 km from China through Myanmar, Laos, Thailand, Cambodia, and Vietnam, is essential for protecting communities and infrastructure. Flood dynamics in the Mekong River are strongly influenced by tributary inflows, particularly during the wet season (May to October). Conventional in-situ gauge networks are often confined to the mainstream, leaving these critical, often inaccessible, tributary contributions unmonitored which leads to uncertainty in regional flood forecasting models. This feasibility study evaluates the utility of Surface Water and Ocean Topography (SWOT) satellite data for addressing critical observational gaps in the Mekong region. Launched in 2022, SWOT's wide-swath Ka-band radar interferometry is designed to provide 2D maps of water surface elevation for rivers that are 100m across or more. However, many Mekong River tributaries are narrower which may result in water surface elevation values that are contaminated by vegetation and terrain features. In this study, a comprehensive regional assessment is conducted which consists of 12 Mekong tributaries in Thailand, selected for complex morphology and remote locations that inhibit the use of conventional ground-based measurements and nadir satellite altimetry. The developed methodology successfully captures seasonal water level patterns across all tributaries including case studies during the 2024 flood events, where the river channel is as narrow as 30m. Bridging critical observational gaps using SWOT directly serves community needs and responds to calls for action outlined in the United Nations Sustainable Development Goals (UNSDGs); particularly SDG 6 (Clean Water) and SDG 13 (Climate Action).