

Impacts of anthropogenic activities on the sediment budget in the Vu Gia Thu Bon River basin, Central Vietnam

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Abstract. The Vu Gia Thu Bon (VGTB) River basin plays a vital role in water resources in the central region of Vietnam. However, over the recent decades, dam construction and sand mining have increasingly affected the sediment budget and morphological changes. Therefore, assessing the impact of human activities on sediment budget and riverbed elevation can provide scientific insight to understand the morphological changes and complex hydrological variability and develop strategies for VGTB River basin management and sustainability. This study assessed the long-term spatiotemporal changes of sediment load and morphology using data historically collected from 1996 to 2020 and from four detailed bathymetric surveys in 2010, 2015, 2018, and 2021,

combined with results from hydrological SWAT further to clarify the changes of dams upstream and sand mining. The total riverbed incision volume during 2010–2021 was -63.30 Mm^3 , on average $-5.30 \text{ Mm}^3/\text{yr}$. We find that the riverbed elevation changes from downstream dams on Vu Gia and Thu Bon Rivers by 68 km and 74 km, respectively. The study's results provided valuable insights into the effects of anthropogenic activities on the flow regime, sediment budget, and riverbed elevation. These changes in hydrological processes are invested in understanding water level changes and saline intrusion better

Keywords. Dams, Sand mining, Sediment budget, Riverbed elevation, Vu Gia Thu Bon River basin.

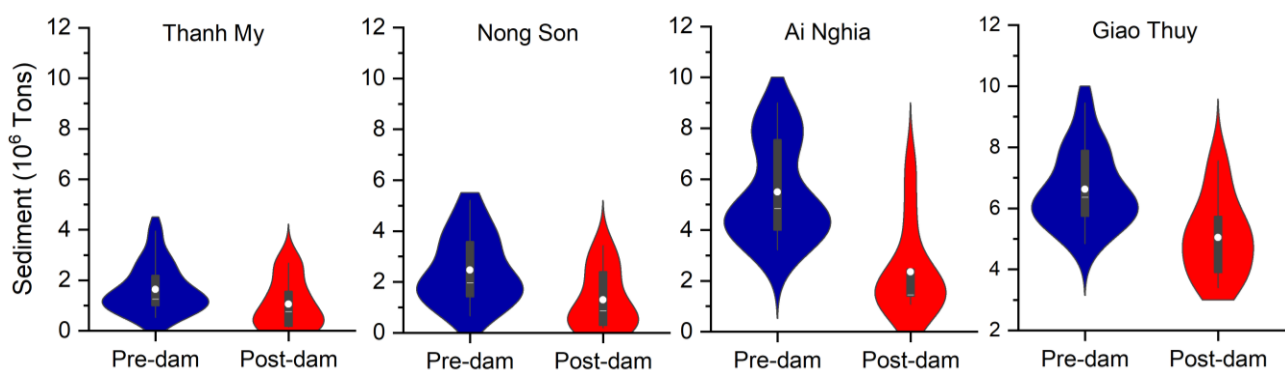


Figure 1. The violins represent kernel density plots of annual sediment at Thanh My, Nong Son, Ai Nghia, and Giao Thuy stations in two periods, pre-dam (1996–2010), post-dam (2011–2020). The black lines represent box-whisker plots, the white point the mean, and the white line the median.

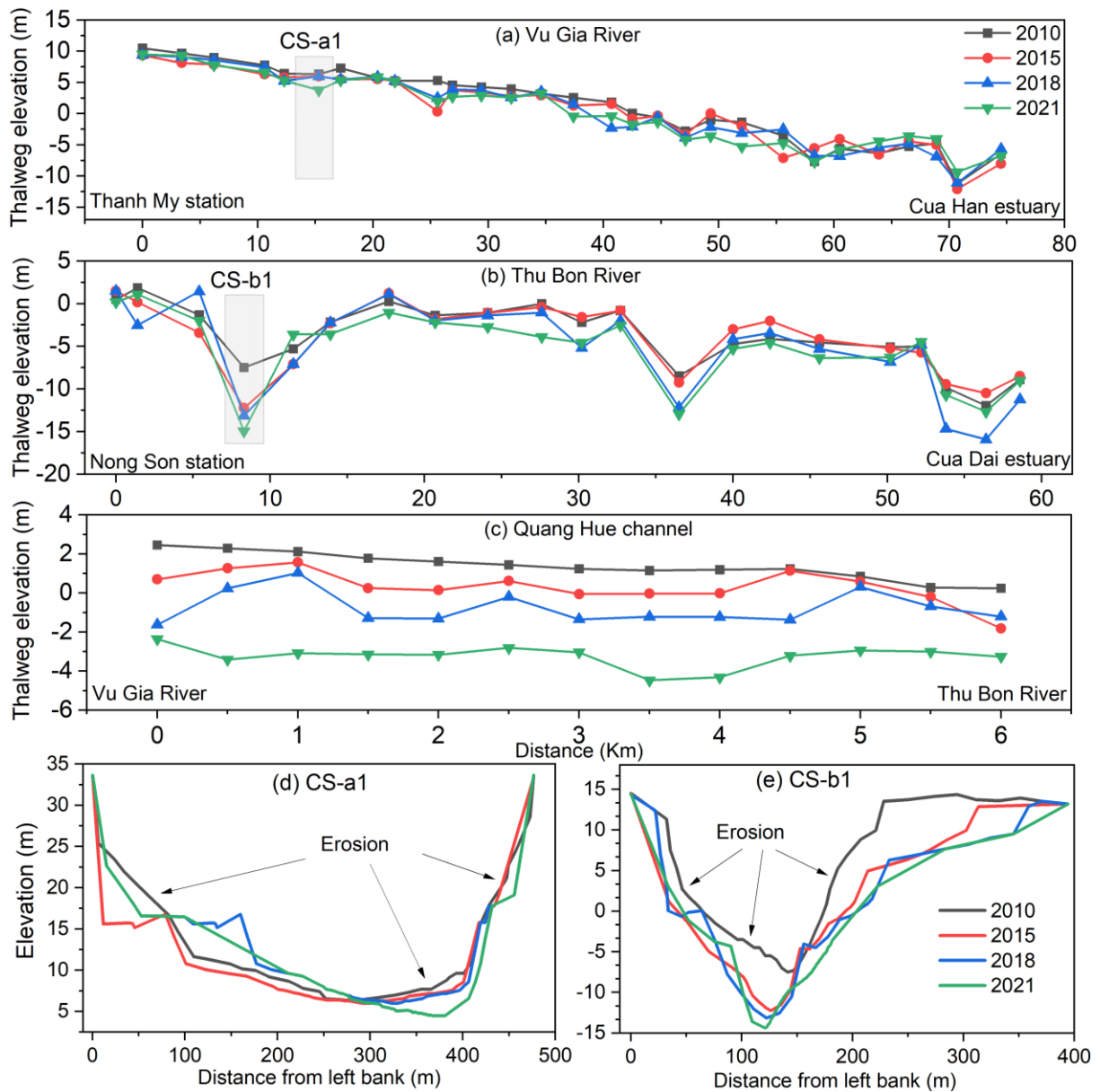


Figure 2. (a) Thalweg elevation of Vu Gia River from Thanh My station to Cua Han estuary, (b) Thalweg elevation of Thu Bon River from Nong Son station to Cua Dai estuary, (c) Thalweg elevation of Quang Hue channel connected between Vu Gia River and Thu Bon River, (d) The elevation of cross-section CS-a1 on Vu Gia River, (e) The elevation of cross-section CS-b1 on Thu Bon River.

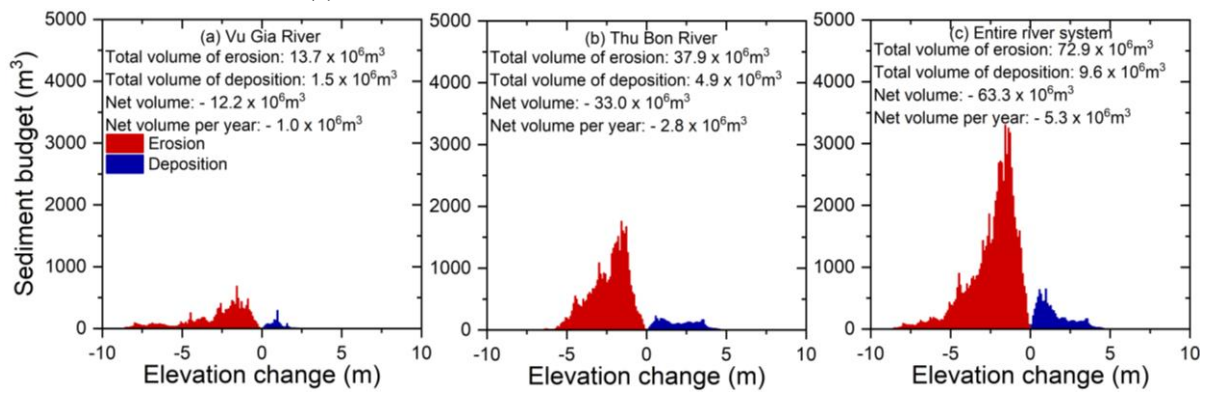


Figure 3. Diagrams showing the sediment budget changes with elevation from 2010 to 2021 in the (a) Vu Gia River, (b) Thu Bon River, and (c) entire VGTB River system.