

## Human Activities and its Consequences Affect Downstream Tropical River Basins

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**Abstract.** Human interventions in the tropical river basin have profoundly affected hydrological and hydraulic alteration regimes and riverbed elevation change. This study comprehensively explains the downstream responses to hydraulic infrastructure in the Vu Gia Thu Bon River basin (Central Vietnam). Our objective is to provide (i) a scientific foundation for water resource management and (ii) an understanding of the regional effects downstream of human activities. The findings of this study would serve as a scientific basis to tackle water resource-related issues caused by man-made infrastructures over the VGTB River basin. Our findings are summarized:

(1) Dam development is identified as the primary driver of hydrological alterations in downstream regions (Figure 2). Meanwhile, sand mining is the main driver

of riverbed elevation change (Figure 1).

(2) The combined impact of upstream development, sand mining, and water diversions has significantly altered streamflow and water level (Figure 2). It reduced streamflow and heightened saltwater intrusion downstream of the Vu Gia River, adversely affecting water supply and agricultural production (Figure 4).

(3) In the Vu Gia sub-basin, reduced streamflow from 2011 to 2020 has increased drought conditions (Figure 3). Conversely, the Thu Bon River sub-basin experienced a decrease in drought, indicating the need for effective water and infrastructure management.

**Keywords.** Riverbed elevation, Drought, Streamflow, Water level, Salinity intrusion, Agricultural production, Vu Gia Thu Bon River basin.

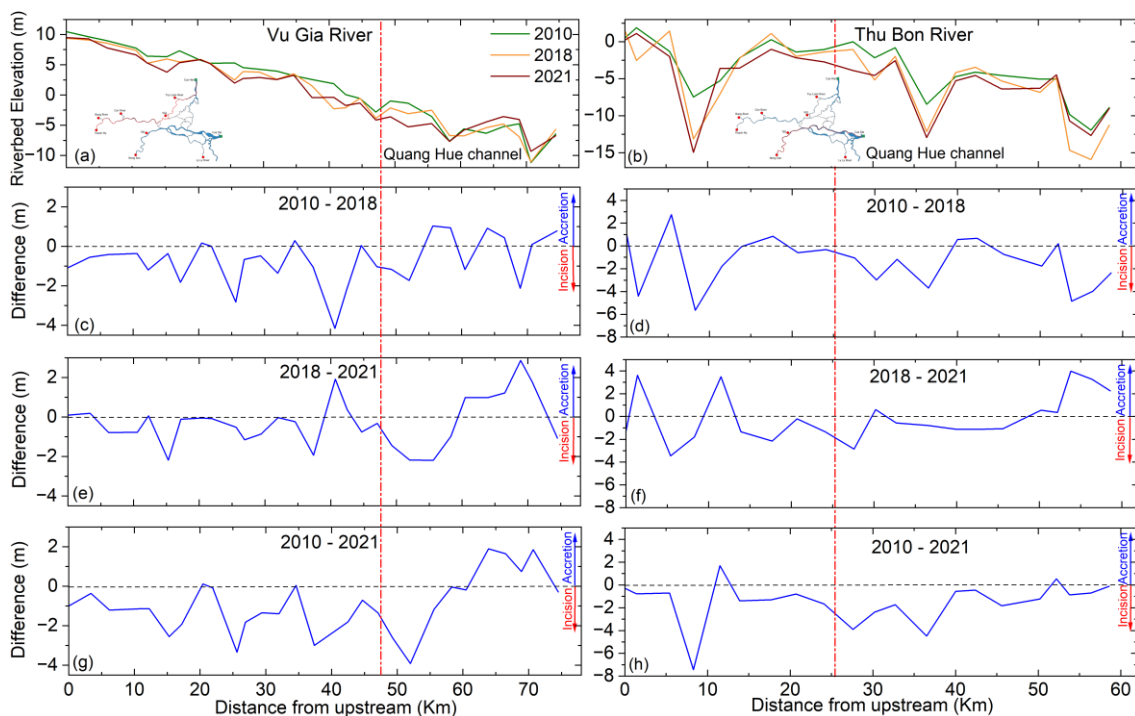


Figure 1. (a) – (b) The Vu Gia and Thu Bon Rivers riverbed elevation in 2010, 2018, and 2021. (c) – (h) The difference in riverbed elevation of two Rivers in the 2010–2018, 2018–2021, and 2010–2021 periods.

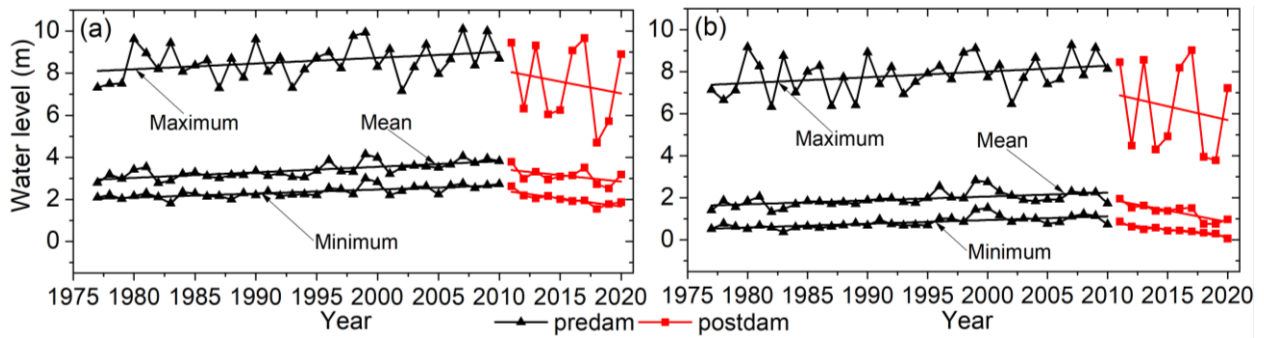


Figure 2. Maximum, mean, and minimum water level trends downstream of (a) Vu Gia River (Ai Nghia station) and (b) Thu Bon River (Giao Thuy station).

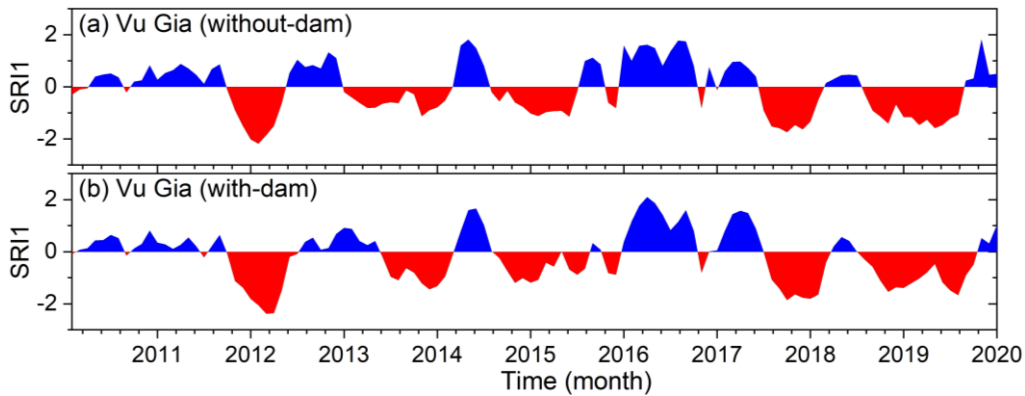


Figure 3. The Standardized Runoff Index (SRI) 1 month from 2011 to 2020 of the Vu Gia River for (a) without-dam and (b) with-dam. Blue is positive, and red is negative.

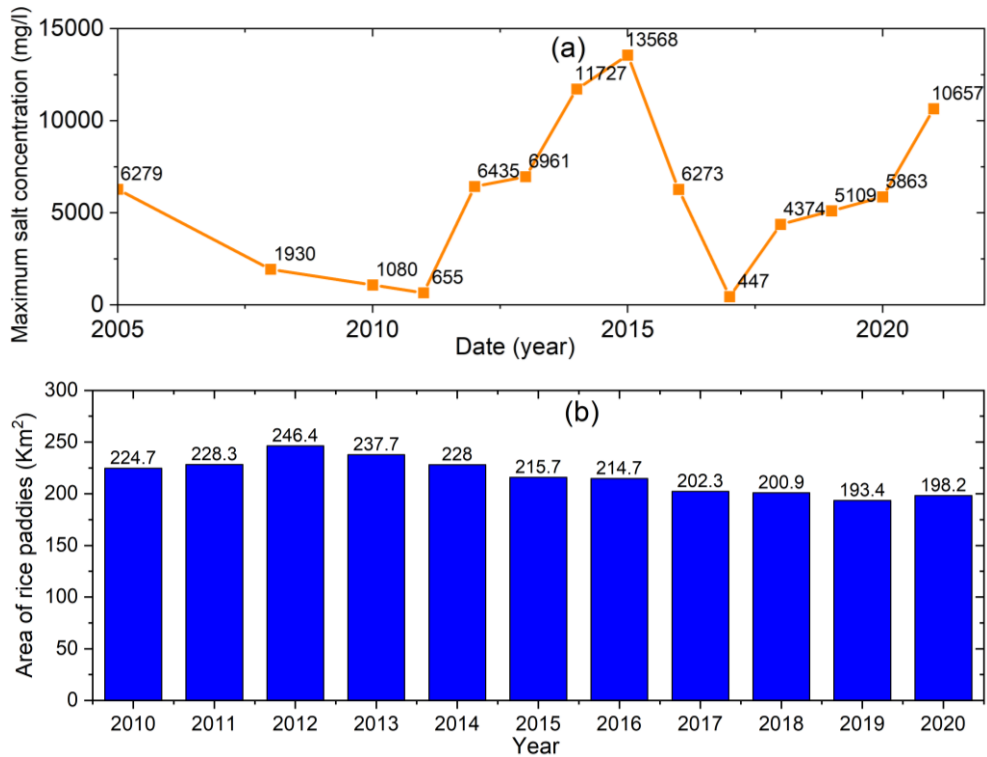


Figure 4. (a) Maximum salt concentration at Cau Do water supply plant intake for Da Nang City. (b) The area of rice paddies of the Vu Gia Thu Bon delta from 2010 to 2020.