

Diverse Erosion and Weathering Patterns in Mountainous River Basins of Southeast Asia

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What factors account for the coupling and decoupling of physical erosion and chemical weathering in earth surface processes remain unclear, and more field observations from diverse settings are required. Mountainous rivers, with drainage basins smaller than 1,000 km² and headwaters above 1,000 m, make up less than 10% of the land area draining into oceans but contribute 15% of water, 45% of sediment, and 30% of dissolved solids globally. The East Asian continental margin is featured by intense river-sea interactions, and includes three types of mountainous river systems: those in tropical Hainan Island, in tectonically active Taiwan Island, and in relatively stable terrain of southeast China. This study focuses on these three river systems, using in-situ ¹⁰Be to calculate denudation rates and geochemical analysis to assess chemical weathering intensity. The findings show that denudation rates in SE China and Hainan Island are relatively low, ranging from 28.6 to 79.1 m/Myr. In contrast, Taiwan's denudation rates are much higher, ranging from 1,000 to 6,000 m/Myr. Eastern Taiwan shows greater variation and higher rates, with a maximum of 5,679.8 m/Myr, compared to western Taiwan's highest of 4,882.9 m/Myr. Tectonic collision and fault activity in Taiwan are the primary factors behind these differences, with geomorphic factors playing a secondary role. Regarding silicate weathering, Taiwan's rivers show significantly lower weathering intensity (CIA average of 64) compared to the rivers in mainland and Hainan Island (CIA average of 81). Despite the favorable climate, intense denudation and fast sediment transport in Taiwan leads to a weathering-limited pattern.