

The inconsistency in erosion rates of Taiwan Island over timescales

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Taiwan Island is characterised by extremely high erosion rates and rapid mass wasting because of active tectonics and a high typhoon frequency. Different from large river systems, deep landslides triggered by strong storms/typhoons and earthquakes dominate the sediment-removal processes in Taiwan mountainous rivers. In consideration of the rapid response of mountainous river systems to external perturbations, their denudation processes may play an important role in regulating the global carbon cycle over glacial-deglacial timescales.

In this contribution, we compile erosion rates of Taiwan Island calculated by different methods, including gauge-measured sediment loads, in situ ¹⁰Be and thermochronometry. It is noteworthy that large spatial and temporal variations of erosion rates are observed in Taiwan. Overall, there is a relatively consistent spatial pattern of erosion rates measured by different methods, yielding higher erosion rates in South and East Taiwan.

However, the inconsistency in erosion rates of Taiwan Island exists between different timescales/studies. The in situ ¹⁰Be-derived denudation rates (area-average: 2.7 mm/yr) seem to be much lower than gauging-derived erosion rates (area-average: 3.7-6.7 mm/yr) and million-year scale exhumation rates (4-8 mm/yr for the Central Range in recent 0.5 Myr). Some possibilities were mentioned before, including enhanced human activities and the difference in sensitivity to mass-wasting events between methods. Nevertheless, when extremely high Holocene incision rates (>5 mm/yr) and modern uplift rates (10-15 mm/yr in the Central Range) are also taken into account, another more plausible explanation is that some proxies (e.g. in situ ¹⁰Be) may not be suitable for determining erosion rates in Taiwan Island due to the complex geological background, and thus underestimate the real erosion rates on a certain timescale. Hence, more precise and comprehensive research approaches are required for quantitatively constraining the weathering and erosion processes in Taiwan.