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Weathering, erosion and fluvial transfers of particulate and dissolved materials from the Taiwan orogen

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Systematic monitoring of river loads helps refine and extend the map of internal dynamics and external feedbacks in Earth's surface and near-surface system. Our focus is on Taiwan where hillslope mass wasting and fluvial sediment transport are driven by earthquakes and cyclonic storms. The biggest trigger events cause instantaneous erosion and seed a weakness in the landscape that is removed over time in predictable fashion. This gives rise to patterns of erosion that can not be understood in terms of bulk characteristics of climate, such as average annual precipitation. Instead, these patterns reflect the distribution and history of seismicity and extreme precipitation. For example, the 1999 Mw 7.6 Chi-Chi earthquake has resulted in elevated rates of sediment transport that decayed to normal values over seven years since the earthquake. Very large typhoons, with enhanced precipitation due to a monsoonal feed, have caused a similar, temporary deviation from normal catchment dynamics. Crucially, these events do not only mobilize large quantities of clastic sediment, but they also harvest particulate organic carbon (POC) from rock mass, soils and the biosphere. In Taiwan, most non-fossil POC is carried in hyperpycnal storm floods. This may promote rapid burial and preservation of POC in turbidites, representing a draw down of CO2 from the atmosphere that is potentially larger than that by silicate weathering in the same domain. Oxidation of fossil POC during exhumation and surface transport could offset this effect, but in Taiwan the rate of preservation of fossil POC is extremely high, due to rapid erosion and short fluvial transfer paths. Meanwhile, coarse woody debris flushed from the Taiwan mountains is probably not buried efficiently in geological deposits, representing a concentrated flux of nutrients to coastal and marine environments instead.