Climate driven chain reaction of rainfall-runoff-geomorphologic dynamics in small mountainous rivers in Taiwan

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The IPCC has hypothesized that the average global temperature might increase by 1.5 – 6.0° by 2100 in the absence of CO2 emission control. Such temperature increases can be expected to impact on many earth system processes, particularly the hydrologic cycle. Tropical cyclone (typhoon) must be seen as a double-edged sword for the water resources of Taiwan and the western tropical-subtropical Pacific region. For Taiwan, the entire island would face serious drought in the following dry season (typhoon rain accounts for ~50% of the annual rainfall and ~75% of the annual water discharge) without the heavy rainfall from typhoons in the wet season. However, typhoons inevitably result in fatal disasters, such as floods, landslides, and debris flows, not to mention problems of sanitation and associated disease epidemics after the floods. The signature of warming climate may reduce the frequency yet increase intensity of tropical cyclone, causing more intense rainfall subsequently creating problems for soil and water conservation and management, particularly for countries around this region, where typhoons frequently occur. Here we present qualitative and quantitative evidence from Taiwan for the changing characteristics of rainfall-runoff patterns and the associated geomorphic response under a changing climate. A climate-driven hydro-geomorphologic chain reaction is likely forming not only threatening lives by generating hazards, but also degrades the water and land resources. Some signals generated by climate warning might not currently be strong enough to test statistically due to insufficiently long datasets. However, the importance of such signals should be recognized before it is too late.

Keyword: rainfall; runoff; erosion; sediment yield; landslides; typhoon; Taiwan