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Meandering mountain rivers of the western North Pacific cyclone basin

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Meanders commonly emerge along bedrock mountain rivers, revealing a process of lateral channel erosion that is at least as fast as the rate of vertical erosion. Although some incised meanders may inherit their form from an earlier alluvial phase by incision in situ, emergent incised meanders exhibit a suite of features which can only result from active channel migration. These include present-day cutoffs, abandoned strath terrace meander loops, assymetric cross-valley profiles, slip-off slopes, and inward-sloping meander spurs. We will report a remarkable link between emergent incised meandering and the frequency of typhoon strikes in the western north Pacific. We have used satellite imagery and shuttle radar topographic data to map the distribution of emergent incised meanders and to quantify the regional density of mountain river sinuosity, which is a proxy for emergent incised meandering. We have used rain- and river-gauging station data and a 58 year inventory of typhoon tracks to quantify the regional density of typhoon strike frequency, and to show that this is a good proxy for extreme rain events. Our results indicate that emergent incised meandering is most common in typhoon-prone islands such as Shikoku, Taiwan, and northern Luzon, and that for geologically similar terrain, mountain river sinuosity increases linearly with the frequency of typhoon strikes and with rainfall variability. However, mountain river sinuosity does not correlate well with mean annual rainfall. We deduce that extreme rain events accelerate lateral erosion rates in mountain rivers by driving extreme peak discharges, extreme sediment loads, and/or extreme pore fluid pressures in the rocks of the valley walls.