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Utilization of LIDAR DEMs in assessing active degree of strike-slip faults in Japanese mountains

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We analyzed the relationships between channel offset and other geomorphic properties to evaluate the geomorphic response to activity of strike-slip faults in Japanese mountains. Seven active strike-slip faults with various slip rates ranging from ~0.01 mm/yr to ~10 mm/yr were examined using airborne LiDAR (Light Detection and Ranging)-derived high-resolution DEMs (Digital Elevation Models). Channel offsets were automatically extracted by introducing a threshold of deflection degree, which allows us to distinguish tectonic channel offsets from non-tectonic fluctuation of channel flows. Analyses of channel offsets revealed positively linear relationships (with slopes a) between offset amounts and stream length, watershed area and watershed volume, due to accumulation of offset with watershed evolution. Further, the slopes a show positive correlations with slip rate, and thus may be used as criteria to roughly evaluate the level of activity on strike-slip faults. Our result also revealed the influence of hillslope angle to a, suggesting that erosion factor is needed to be taken into account when strictly constrain slip rate from a. Our study may provide a new approach for quantitatively assessing activity of the strike-slip faults with no chronological information such as those in mountainous and arid regions.

Keywords: strike-slip fault, active degree, LiDAR DEM, watershed, channel offset, erosion rate