

Analysis of river profiles and knickpoint distribution in relation to slope failures

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The topographically diverse, mountainous watersheds of Japan are prone to frequent mass movements including slope failures and debris flows. Hillslopes there are constantly modified by slope failures induced by frequent rainfall and earthquakes to achieve dynamic equilibrium. A river course and surrounding hillslopes are coupled in terms of local erosion. The relationship between slope of a river longitudinal profile versus drainage area and that between the slopes versus profile curvature has often been used to study landform development. Here, a 10 m DEM of a mountainous region near Mount Ontake in the Northern Japanese Alps was chosen for this analysis. This highlights the separation between incised and aggraded reaches, and the analysis of river longitudinal profiles and knickpoint distribution are performed. The location of knickpoints is a significant boundary condition for fluvial and slope processes: knickpoints set the base level of erosion in reaches upstream of knickpoints, while incision in reaches downstream of knickpoints may influence failures in surrounding slopes. This study has provided insight into how intense erosion at knickpoints and related slope failures affect morphological development of mountainous watersheds.

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