Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

HTT08-04 Room:415 Time:April 29 17:00-17:15

Comparative analysis of knickpoint extraction using semi-automatic and automatic methods

ZAHRA, Tuba[1*] ; PAUDEL, Uttam[1] ; HAYAKAWA, Yuichi S.[2] ; OGUCHI, Takashi[2]

[1]Graduate School of Frontier Science, The University of Tokyo, [2]Center for Spatial Information Science

Extraction of knickpoints (or knickzones) from a DEM has gained immense significance in studies of fluvial erosion and/or slope failures because of their geomorphological significance. Previously, knickpoint extraction from a DEM included a vector-based semi-automatic, but somewhat tedious and time-consuming data processing because GIS and spreadsheet software were separately used. Raster-based Python scripting, developed in our study and deployed in the form of a toolset, can automate the processes making the extraction of knickpoints automatically, fast and user friendly. Both the methods are based on the assumption that the slope gradient along a bedrock river changes with change in measurement length and any locally steep segment of the riverbed may then be considered a knickpoint. The relative steepness index R_d or the rate of decrease of gradient along the measurement length is calculated by solving a linear regression equation, $G_d = ad + b$ where, G_d (m m^{-1}) is the stream gradient at a point and d (m) is the measure distance, while a and b are coefficients and $-a$ is regarded as R_d which means the rate of gradient decrease with increasing d. In the former method G_d is measured at the mid-point of a segment of variable length d along longitudinal stream profiles where; $G_d = (e_1 - e_2) / d$ where, e_1 and e_2 are elevations at both ends of the segment, thereby analyzing both the upstream and the downstream segments along a stream. The automated Python processing, however, follows a slightly different approach from the one previously used and thus requires a comparative analysis of the two prior to its future use. The methods differ in the calculation of the stream gradient G_d; the former employs both the upstream and downstream elevations $d/2$ apart, whereas the latter uses the elevation at the point and d downstream. In this study, the Python toolset has been applied to a 10-m DEM of a mountainous region near Mount Ontake in the Northern Japanese Alps. The results were then compared and validated with the previous method. In order to study the fluvial characteristics of the knickpoints, analysis were confined only to the stream locations, the results of which provide insights into morphological developments of the watersheds.

Keywords: automatic extraction, DEM, knickpoints, Python