Application of Geomorphic Indices in Evaluating Active Neotectonic Activities in Bayeh Anticline; Eyven-e Qarb, Ilam

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Extended Abstract

Introduction:

The Zagros mountain belt represents one of the most active collisional orogens on Earth. The Zagros sector known as the Simply Folded Belt is characterized by the widespread occurrence of anticlinal ridges formed in hard rocks onto which erosion landforms such as fossil fluvial paths are preserved. The relief of the Zagros mountain belt is strongly controlled by variable resistance of the outcropping rocks to erosion. Studies of Quaternary and present-day tectonic activates are mainly based on geomorphologic, geologic, geodetic and seismologic data. Tectonic geomorphology analyses are the best integrated to provide useful insights into the tectonic processes controlling active deformation. In regions affected by low or moderate tectonic deformation rates, geomorphologic and geologic data provide some of the best approaches to detect and characterize active tectonics. Recent and active tectonics may affect geomorphology as a useful method for identifying fold activity in terms of its lateral and vertical growth.

However, geomorphic indices might change as a function of tectonic tilting and/or uplifting, as well as lithological characteristics, thus their interpretation might be troublesome (Keller and Pinter, 1996).

In addition, the efficiency of geomorphic indices for recognizing tectonically controlled landforms varies from method to method and from area to area, resulting inconclusive interpretations. Therefore, approaching geomorphic indices based on a multiscale analysis (i.e., rivers, drainage basins and sectors of relief) integrated with geological data has been recommended for detecting tectonically controlled landscapes (e.g., El Hamdouni et al., 2008; Mahmood and Gloaguen, 2012; Andreani et al., 2014; Scotti et al., 2014; Owono et al., 2016). The study area is located southwest of the Zarneh, Eyvan-e Qarb, Ilam in the folded Zagros tectonically active region.

Materials & Methods:

The main aim of this paper is to evaluate the active tectonics in Bayeh Anticline. In this study the influence of tectonic activities in the Bayeh Anticline was well demonstrated and analyzed using various relevant parameters of eight geomorphic indices such as: Ratio of Valley Floor Width to Valley Height (VF), Aspect Ratio (AR), Mountain front facet (FMF), Mountain front sinuosity (SMF), Fold Symmetry Index (FSI), Fold Front Sinuosity (FFS), Percentage dissected mountain fronts (FD), Percentage undissected escarpments (EU), topographic and geological maps, satellite imageries, digital elevation model (DEM 12.5m) data in a GIS platform, with several field works.

Results & Discussion:

According to the findings obtained for the studied geomorphic indices in the Bayeh anticline, it was determined that this anticline had a young structure and the tectonic forces continued in it and has not yet evolved.

Results show that values of SMF index in Bayeh anticline is equal with 1.14. Vf is defined as the ratio of the width of the valley floor to its average height. The value of Vf is calculated for the main valleys that cross mountain fronts of the study area. The values of Vf index in Bayeh anticline is 0.40. Fold front sinuosity (FFS) index, used as a proxy for the age of the fold structures. This index calculated as the actual length of the fold front/ fold length. Older structures, having been exposed to subaerial weathering processes for longer, will have a higher FFS values. Value of FFS index in Bayeh anticline is 1.07. Folds identified from satellite image analysis were categorized using geomorphological indices

aspect ratio and fold symmetry index calculated from fold width, hinge length and forelimb width measured off a contour map, generated from the DEM tiles. Both aspect ratio index (AR): (hinge length: fold width) and fold symmetry index (FSI): (width of forelimb: half-width) can be used to separate fold types and were calculated for each fold. A perfectly symmetric fold will have a symmetry index of unity, whereas an asymmetric fold will have a lower symmetry and therefore a lower value of the fold symmetry index will be calculated. Values of AR and FSI indexes in Bayeh anticline are equal with 0.63, and 4.34, respectively. The Percentage dissected mountain fronts (FD) index is define the parts of a mountain front that has been dissected into distinct facets. Most tectonically active mountain fronts tend to be less dissected, i.e. low FD values. Value of FD index in Bayeh anticline is equal with 0.27. The Percentage undissected escarpments (EU) index is define the parts of a mountain front that has not been dissected. Most tectonically active mountain fronts show laterally continuous undissected escarpments, i.e. high EU values. The value of EU index in Bayeh anticline is 0.78. The Percentage faceting along mountain fronts (FMF) index is define the parts of a mountain front that has well defined triangular facets, using the ratio of the cumulative lengths of facets to overall mountain front length. Tectonically active fronts display prominent, large facets that are generated and/or maintained by recurrent faulting along the base of the escarpments, i.e. high percentage faceting. The value of FMF index in Bayeh anticline is 273.36.

In addition to the calculated numerical values for these indices, the geomorphological evidence in the study area including linear, straight and fault steep mountain fronts, V-shaped and deep valleys, larger triangular facets with longer base length, shorter and steeper slope, the high values of the Percentage Undissected Escarpments (EU) and low values of the Percentage Dissected Mountain Fronts (FD) in the southwest slope, indicates the more active tectonic condition in this section the anticline.

Conclusion:

The geomorphic indices can be useful for detecting tectonic reliefs formed even during late deformation stages in everywhere. The final relative results depicted a good understanding of the existing tectonic of the any area. The output of this work revealed the significance of using different datasets from various sources and their overlay in a GIS platform for assessing the relative tectonic activity in the Bayeh Anticline or elsewhere.

Keywords: Bayeh Anticline, Neotectonic Activities, Geomorphic Indices, Geomorphological Evidence, Eyvan-e Qarb.