Analysis of Linear Features in Related to Structure and Lithology in Kermanshah Region Using Digital Elevation Model

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Abstract: In this paper, geomorphic characteristics of Zagros in Kermanshah region by emphasize on stream networks have been studied in two basins that called Gharasoo and Merek. An approach for the consistent application digital terrain analysis methods was used to identify tectonic phenomena and lithology from geomorphology features. Linear features were represented by digital elevation models, described an interpreted in terms of structural geology and geomorphology. Digital terrain model was carried out by means of the combined use of digital drainage network analysis 2) digital morphometry 3) spatial and statistical analysis and 4) digital elevation model methods such as shaded relief models. Drainage network analysis is fundamental tool in tectonic geomorphology. Angle and azimuth of drainage network segments represent geomorphologic characteristic valleys. The obtained streams networks are overlain on geology map. Compared between the Azimuth of Drainage network and shaded relief model of the region indicated that there is close relation between valley lineaments and geology and lithology constructions of Zagros relief in studied field. Valley networks shapes and patterns have been used to represent geomorphologic structure of relief. As if, the effect of clear and hidden factors of earth was observable. River knots with walls of grabens and structural hollows. In addition, was studied the effect of fault on Azimuth of waterways extension. Distribution of geographical directions of waterways is subject to main axis of basins and symmetry and asymmetry in basins area. Another results of this research are discover the new patterns of location for waterways grid in related to linear valleys, linear zeniths, linear fractures.

Key words: Azimuth angle . Geomorphology . Kermanshah . Shaded relief . Valley networks

INTRODUCTION

Zagros Mountains have various shapes of erosion in Kermanshah province (west of Iran). Linear features such as Valley lines are the most interested morphology, which shows environmental hidden and clear factors. Characteristics of valley line include length, orientation, spatial distribution are describing by azimuth angle and internal angle. To discover patterns of valley lines structure, this research was designed. In the present case study lineament, orientation and internal angle between segments were analyzed. Two lineament extraction procedures were applied in this study: 1) an automatic procedure digital drainage extraction to identify valley and ridgelines and 2) determining Azimuth angles of valley segments. Most of the former studies used shaded relief models either alone [1] or in combination with drainage networks, azimuth of streams. Tree-dimensional view has been used for morphometric investigation. Digital geomorphology is the integration of three components: Structural geology, geomorphology and digital terrain analysis. There is however a gap between structural geology and digital terrain analysis. The objective of this study is to provide an overview of methods for the extraction of geomorphology features from DEM and to develop a systematic procedure for the application of these methods to morphometric terrains analysis. Structural and lithological discontinuities in rocks most often result in linear morphological features. The main geomorphic characteristics of linear features are orientation and length short and long valley or asymmetric geometry of slope across valley can result from tectonic influences on the morphology. Orientation of valley toward a certain point can be determined by azimuth of valley segment [2-4]. Most of the above morphological, such as linear valley, asymmetric slopes and depression may be caused by secondary processes or can be associated with lithology differences erosion [5, 6]. For example angular statistics (rose diagrams) are used for analysis of orientation distribution in the study area. Fluvial
drainage networks are the most common indicators which their patterns reflects often the regional or even the local lithological and tectonic framework in this region [7, 8].

The analysis of topographic features that had used in geomorphology and aerial photographs formerly, has came to new stage with growth and extension of new instrument and methods for making of morphologic breadth model recently [9-12]. The extension of digital elevation data and information has provided morphological analyses [13, 14]. The morphologic analysis of features especially valley linear had a lot of application in erosion and structural analyses [15-19]. Valley networks are considerable as main linear morphology structure of land surface [20, 21]. 2-linear structure of waterways is reflection of morphology factors actions on the surface of earth.

MATERIALS AND METHODS

Digital elevation model with 90 meter pixel, geology of studied region, ARCGIS software, photoshope software, Excel and a Grapher Golden soft were used to obtained stream valley. For omitting of vertical rough, a whole series of preprocess actions have done on elevation model [22, 23]. After preparing the primary model, secondary data obtained from it. The direction of flow and valley were obtained from model by Hydro functions in ARCGIS software and by using of strahler method [24, 25]. Geology layer was obtained by transferring lithologic areas mosaic to tracing paper. The geology layer was scanned to obtained numerical data. Some roughs of scand image were adjusted by Photoshop software, and then vectorize operation was done in geologic areas. After the earth determined as a source and RMS mistaken computed, descriptive specifications of petrology units added to Information bank of considerable layer. To recognize the structural units and region main faults, one layer that called shaded relief was produced by DEM model with analyst spatial. The extension of faults and direction of their axis within structural grabens are recognizable by it [26-28]. Amount of Azimuth for lineaments segments with various grades were assessed in comparison with north.

Digital Elevation Models (DEMs) are a useful data source for the automatic delineation of flow paths and

Fig. 1: location of Kermanshah province and position of structural and erosive features can be seen on shaded relief model. An anticlinal axis has been eroded by differential erosion factors, its result has been developed an extended valley, anomaly in drainage streams. For example a stream that drains MEREK valley in the end of it suddenly turn to opposite aspect. There are many short valleys with different orientation, which are associated with asymmetric slopes.
flow networks for hydrologic modeling. Digital representation of the flow networks are central to distributed hydrologic models because it encodes the model element linkages through which flow is routed to the outlet. Although field mapping is acknowledged as the most accurate way to determine channel networks and drainage density, it is often impractical, especially for large watersheds and DEM derived flow networks then provide a useful surrogate for channel or valley networks [29].

In other word, distribution of networks is subject to earth and climate condition that are depend on degree if transformation and geomorphic changes of earth [30-32]. This subject has caused that design and patterns of streams and valleys are different from place to place. Recently, to address this question various instruments such as geography Information system can be used [33]. The streams layer was obtained from DEM and after that, orientation of valley segments were calculated by Arcview extention (Azimuth calculation) including azimuth segments and internal angles of them.

Stream patterns and their basins have been made under the effect of erosion and structural factors. Main structural strength in this region caused huge morphologic features produce in region (Fig. 1).

General direction of hydrographic networks follows structural big graben that is named DEZPHOOL, which is located in south of KERMANSHA and southwest of Iran. As if wide part of province placed in hydrographic networks that are drained to this graben. Furthermore, there are many local graben where some stream is jointed each together. For example two streams that are named MEREK and GHARASOO have been jointed to each other in south of HASHILAN marsh. Several horst and graben have been observed that indicated this area has been affected by many faults. Some features have been suddenly revealed without any relation with adjacent relief.

One of the local graben is located in south of BISETOON mountain, where two main stream valley lines are jointed to each other. GHARASOO stream was drained from west and Gasamiab stream comes from east. It is expected that the orientation valley networks generally correspond to the downhill dominant flow direction. We measure the azimuth representative of the network and compare it with local topographic gradient at various scales. We found good agreement between the local azimuth valley networks and structural and litho logical units in this region. Valley networks in this area show variability in their properties. One class of valley networks are very long and other class are often short. The rugged in southwest of PARAW mountain and morphology of MAHIDASHT valley are seen in middel of them.

**RESULTS AND DISCUSSION**

The basement rocks in the Kermanshah area are early Triassic to Cretaceous limestone massive rocks and Radiolarit formation made up dominantly of inter layered marls and silica limestone. Overlying cretaceous sediment are Pleistocene clastic sediments deposited interglacial intervals. On this structure different pattern of valley networks have been seen. Some of them are very interested. For example, gradient slope of valley MEREK is reversed comparatively to other valley in this region. Its stream suddenly turns right with an angle about 180 degrees in northwest of Kermanshah. Indeed valley MEREK is an erosion anticlinal axis which in the cenomanian anticlinal axis [5]. The stream simulation of the Zagros fold and thrust represents two-pattern valley, one was made from erodible flych rocks. MEREK valley is located between inner fold cores (cretaceous carbonates) and Asmary carbonates that both are resistant. Drainage patterns in this region response to folding, thrusting and rock-type variations and flows to opposite boundary. This kind of valley pattern is unique, because MEREK stream cut in and out of anticlinal axis at the end of it. Some stream pattern have been affected by faults within MEREK valley, similarly main truck, small streams represent an anomaly in orientaion (Fig. 2).

Valley lineaments (order2) have extended toward south, southwest, west and northwest aspects. We have understood from angles of valley segments. Valleys are few between degrees 25 to 270. Valley lineaments often tendency toward south.

The main ZAGROS fault is a regional system in west of Iran. The availability of new database allows the refinement and improvement of the knowledge and understanding tectonic system. To assess ploicene-Quaternary tectonic signatures, this study constructed a digital elevation model (SRTM). This provides a continues view of the topography.

Streams channels transverse to the fault scarp were measured to examine development valley lineaments. This scarp is believed to have been crated by Holocene movements; low order channels transverse to scarps can illustrate drainage response on a basin specific scale. The results have been obtained from analysis shaded relief, show tectonic influence on order 1 orientation. Order’s1 streams are approximately transverse to main and minor faults at GhARASOO intermediate basin (Fig. 3). As well as a high order stream is transverse to faults and drain to east (MEREK stream at North West
Fig. 2: A distribution stream order 1 in MEREK valley, which is extracted from DEM and its azimuth, was calculated. Stream order 1 are very little at aspect between 90 to 226 degree, the valley networks often are extended at north, northeast and northwest aspects (A). Azimuth of valley networks (stream order 2) in MEREK Basin, have extended in quarter 1 and 4, in quarter 3 and 2 valley lineaments are few (B).

Fig. 3: Azimuth of valley in GHARASOO intermediate basin show different pattern. Orientation of valley (order 1 to 3) dominantly is northeast and southwest (A, B, C). The rest valleys have orientation toward south and southeast (D, E)
Kerman shah). Orientation of low order stream or valley networks relative to faults are expressed as major indicators of different structure and lithological changes. These changes are included fault height, long faults, grabens and differential resistance rock in two basins. The comparison of orientation of valley networks specific order 1 streams in each two-location show topographic and geomorphologic responses to various tectonic events and the significance of position on fluvial response. The ZAGROS fault system and KERMANSHAH faults have shaped the drainage networks in the GHARASOO intermediate basin as lateral movement dominates canyon and vertical uplift features transverse channels. The response of canyons 1, 2 and 3 has dominated modern geomorphology of the fault bounded basin and its development through various transversly movements. As shown by Fig. 3 A through E progressive rights lateral shift has caused in rose diagrams as well as increase order of streams. In the front of mountains PARAO and BISTOON a low resistance rocks and a line fault was located. Thus, trunk streams that were located on this struture suddenly turn to east along the faults features. This trunk stream was well established and responded to direction of faults and lithologic resistance. In other word we found some features that indicates effects faults on orientation of low order streams or valley networks in two basin, for example in GHARASOO basin low order stream are more effected by structural factors. Conversely in MEREK basin higher order stream are affected by faults. One of the signatures is stream jointed with right angle to higher trunk (Fig. 2A-E).

**CONCLUSION**

Low order drainage in GHARASOO intermediate basin have responded to tectonic movements. The fault systems and associated features with them such as horst and graben in north of KERMANSHAH city were established in two sides of PARAO. Mountain, thus valley lineament (order1) relative to these flank have two dominate orientation opposite to each other (Fig. 3a). As mentioned at MEREK basin various orientations have been seen. Streams order 1 are distributed on different aspects but at the GHARASOO basin are not. There are not any horst and graben there, but trunk is parallel to strike-slip fault, nearly in middle of valley, (also this valley is named MEREK plain because it is much extended). The higher stream order is jointed to main trunk with right angle. Rocks with the high ability of erosion have high amount of segment that produce by rivers and their processes.

**REFERENCES**

13. Missing
29. Missing