Research Paper

Hydrogeomorphology, Vol. 9, No. 30, Spring 2022, pp (21-24)

Received: 2021.12.13
Accepted: 2022.03.07

Identification of Semi-automatic Landforms Using Object-oriented Processing, Digital Elevation Model and Satellite Imagery

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1-Introduction

Geomorphology is a science that studies how landforms are formed (Hogt, 2007: 148). Earth as a part of the contact surface is the main field of geomorphological studies and it is obvious that its accurate knowledge and study play an important role in the analysis and modeling of landforms and geomorphological processes (Poor Baqer et al. 2015: 370). Landforms represent processes that affect past and present land surface features and provide important information about the characteristics and potentials of the earth (Sulbak and Etzelmol, 2000: 36). The shape of the earth, like landforms, affects water flow, sediment transport, soil production, and climate determination at local and regional scales. In addition, natural phenomena such as vegetation are directly affected by landform patterns and their relative position among landscapes. And Stroble, 2001: 13). Identification and classification of landforms is one of the most important goals and one of the basic tasks in preparing geomorphological maps (Shayan et al. 2012: 21). Landform identification and land classification based on them can be used in various sciences. Identifying the most specific geometric shapes of geomorphic phenomena is one of the most important things defined by nature. A digital elevation model is a digital or three-dimensional model of the surface of the earth, the moon, or other planets that is usually prepared to represent the earth's roughness using altitude data. This model can be used to analyze the topography and shape of lands (Bishop and Schroeder, 2000: 181). One of the derivatives of the digital elevation model is that it can be used to derive geomorphological parameters and use it to classify landforms. Properties depend on the basic characteristics of the earth such as slope, height, tangential curvature, curvature of the index surface, etc. (Wilson and Galant, 2000: 75). These features can be used to classify landforms.

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2-Methodology

In this study, in order to identify and accurately extract the landforms in the study area from Sentinel-2 images with a spatial resolution of 10 m with derivatives of DEM layer (slope layer, slope direction layer, curvature layer, cumulative flow layer and elevation layer) as well as segmentation. In this area, segmentation was performed using multi segmentation method. In this segmentation, the height layer was given a value of 3, the curvature layer was given a value of 2, and the other layers were given a value of 1. Composition of homogeneity criterion, Shape 0.7, Compactness 0.3 and scale parameter 50 were considered then, using Layer Values, Geometry and assign class algorithms, landforms located in the western and southwestern slopes of Zagros (Aligudarz city area) were classified. Also, the algorithms that had the highest degree of membership in the classification and extraction of land features were considered as effective factors in the classification. Since the input data in eCognition software is DEM derivatives, this section provides a brief description of DEM derivatives. In this study, 5 main derivatives of 12.5 m DEM of ALOS satellite (slope layer, slope direction layer, curvature layer, cumulative flow layer and altitude layer) have been used. Sentinel-2 satellite imagery and NDVI vegetation index were also used as auxiliary layers.

3- Results and Discussion

Finally, the amount of area related to each of the landforms is determined in terms of square meters. After object-oriented classification, 8 landforms were extracted. As indicated, eight types of landforms were identified in the area as slopes, ridges, water zones, precipices, peaks, ridges, low plains, and high plains. The ridge landforms form the largest part of the region and are the dominant landforms of the region and have a good distribution in different parts, but the peak landforms with a minimum area constitute only a limited part of the study area. After object-oriented classification in eCognation software environment to evaluate the accuracy of each classification using GPS device randomly collected ground truth points and by implementing the removed control points, statistical parameters of accuracy evaluation including kappa coefficient and overall map accuracy were extracted.

4- Conclusions

At present, studies for planning on landforms, landscapes and land use at all national, regional, regional and local levels are considered as one of the levers of sustainable development. According to these considerations, landform and land surface shapes and its preparation can be considered as the basis of land planning studies. Digital mapping of the shape of the earth can be done in different cases. Optical data such as satellite imagery and aerial photographs often contain variable (spectral) values for different

cases. Scenes are less affected by DEMs due to differences in light conditions and, consequently, larger or smaller differences in contrasts, and are therefore comparable across scenes (at least for similar spatial resolutions). This feature may be useful for developing solutions to existing demand. In this study, we tried to identify landforms in the study area using a semi-automatic method and ground data. The main issue that should be considered in the extraction of landforms should be the contract of recognizing their morphometrics, defining this feature in the software and obtaining the optimal scale for segmentation. In fact, the user experience and expertise in this method is very important as a semi-automatic method. Having a digital model with high spatial resolution such as 12.5 meters greatly improved the ability to extract landforms and the possibility of determining the boundaries of landforms was done with high accuracy. Comparison of the obtained results and visual interpretation of Sentinel-2 satellite images with a resolution of 10 meters and Google Earth images show that the use of Layer Values and Geometry algorithms and assign class commands in eCognition software has been able to estimate the objectives of the research. In this study, with a semi-automatic approach and using object-oriented processing and Sentinel-2 satellite images, landforms of Dez River catchment area located in the western and southwestern slopes of Zagros (Aligudarz city area) were extracted. Eight types of landforms were identified in the region as slopes, ridges, water zones, precipices, peaks, ridges, low plains and high plains. The ridge landforms form the largest part of the region and are the dominant landforms of the region and have a good distribution in different parts, but the peak landforms with a minimum area constitute only a limited part of the study area. was presented. Also, to ensure the correctness ratio of the classified image, its accuracy should be evaluated. In this study, the classification accuracy evaluation including kappa coefficient of 0.87 and overall map accuracy of 91.71% was extracted.

Keywords: Classification, Landform, Digital Elevation Model, Object Oriented, Zagros Mountains

5-References

Huggett RJ (2007). Fundamentals of Geomorphology. Routledge, London, UK.448p.

Poor Baqer Kurdi, Qanavati, Karam, Saffari; Seyed Mehdi, Ezatollah, Amir, Amir (2015). Application of spectral image segmentation methods in the identification and separation of alluvial fans of Yazd-Ardakan basin, Journal of Natural Geography Research, 47(3), Fall 2015, pp. 383-367.

Etzelmüller, B. Sulebak, J.S. (2000). Developments in the Use of Digital Elevation Models in Periglacial Geomorphology and Glaciology, Physische Geographie, 41: 35–58. Baatz, M. Hoffmann, C. & Willhauck,

Blaschke, T. & Strobl, J. (2001). What's wrong with pixels? Some recent developments interfacing remote sensing and GIS. GIS – Zeitschrift für Geoinformations systeme 6:12-17.

Siavash, Shayan, Mojtaba, Yamani, Manouchehr Farajzadeh, Ali Ahmadabadi (2012). Supervised Classification of Geomorphological Landforms of Dry Areas Using Geomorphometric Parameters (Case Study: Maranjab Region), *Quarterly Journal of Surveillance and GIS*, Fourth Year, No. 14), Pp. 19-28.

Bishop, MP. & Shroder, JF. (2000). Remote sensing and geomorphometric assessment of topographic complexity and erosion dynamics in the Nanga Parbat massif. Geological Society London, Special Publication, 170: 181-199.

Wilson, JP. & Gallant, JC. (2000). Terrain analysis principles and applications. ISBN 0-471-32188-5, John Wiley and Sons, Inc.