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Application of hierarchical clustering technique for numerical tectonic regionalization of the Zagros (Iran): an unsupervised pattern recognition

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Hierarchical clustering technique is fundamentally a method data exploration and identifying the patterns inherent in a data set. This numerical pattern recognition technique involves the recognition of pattern and grouping structure in data where no a priori classification exists. This paper attempts to present a general quantitative pattern based on hierarchical clustering technique for tectonic regionalization of the Zagros in order to presenting and demonstrating the ability of this clustering method as an unsupervised pattern recognition technique to perform a numerical tectonic zoning study. For this purpose, after preparation the multivariate data matrix containing 137 sub-areas and 18 quantitative variables, the relationships among the sub-areas were obtained through cluster analysis using Ward's method, and Euclidean distance as similarity measure. The results, synthesized in a dendrogram, were used for providing a series of automated tectonic zoning maps of the region produced in different levels of similarities that show trends in tectonic evolution of it. In general, the automated tectonic zoning maps presented in this study show good agreement with the overall geological and quantitative works. However, in the present study some new findings about the tectonic nature of the region have been obtained. This study simply presents the necessity and usefulness of hierarchical cluster analysis, as an appropriate statistical pattern recognition technique, for increasing the degree of the objectivity of the regionalization researches in the Earth sciences. Also, it introduces this analytical method a very powerful technique for a meaningful data reduction and interpreting the data and indicate many hidden patterns.