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Synoptic Analysis of Rainfall in Atrak and Gorganroud Basins (39 Pervasive Rainfall)

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Introduction

Synoptic climatology term was used for the first time in U.S.A Air force at 1940s decade. Their goal of this field is to analyze the previous frequencies of climatic components and forecast the atmospheric condition based on the computations. Synoptic climatology provides useful tools for the researchers in the fields of atmosphere, environment and geography sciences and at the present it is the most rapid way to recognize the relationship between environmental processes and atmospheric cycles. today, the study of relevant different phenomenon of the climate including draughts, severe rainfalls, pollution and storms and . . . by the use of synoptic methods presents a more acceptable results and more reliable predictions. Atrak and Gorganroud are the most important rivers in northeastern part of Iran and Caspian Sea catchment area. Wide farmlands and numerous cities and towns with considerable population and also different water structures including bridges and dams are located in this area and being affected by the discharge fluctuations.

Since the type and rate of rainfalls has an important and determinant role on the catchment area reactions, knowing the dominant Synoptic patterns may be efficient to forecast pervasive rainfalls or heavy rain falls flood discharge and can be considered and used in different economical activities and planning particularly agriculture, transportation, tourism and ...

Research Methodology

This research from objective view is of applied research and is of descriptive-analytical method. The main data were obtained from National Centre of Environmental predictions (NCEP/NCAR) data base. In this research, Environment to Circulation technique is used as the initial principle. It means that circulatory patterns shall provide the criteria which are determined based on the environmental variables. In Synoptic analyses, a combination of qualitative and quantitative methods (using maps and numerical data together) have been used.

The processes of classifying and arranging data are performed by the Excel software and also the data analysis process by the use of descriptive and inferential statistic methods, like the factor analysis and clustering have been performed by SPSS software.

Discussion and Results

In this research, environment to circulation synoptic method has been used in the main initial principle. Among the available stations, Five Synoptic stations were selected with suitable dispersion through analyzing the rainfall data, 39 days with more than 7mm of rainfall which were common in all the stations have been selected as pervasive rainy days. This research has been performed by using daily data of sea level pressure (SLP) which were obtained at the area of 12.5° up to 60° north latitude degree and 5° up to 80° of east longitude degree with spatial resolution of 2.5 arch degrees were obtained from National Centre of Environmental Predictions (NCEP/NCAR). For each day a 21* 30 matrix was formed and the data of each matrix (each day one matrix) is reformed by the Excel software in to a row, from left to right and 39 rows together formed a new matrix with dimension 630* 39.

The pressure data for the rainy days was summarized by factor analysis technique. After deriving the main factors, factor scores were used in clustering as the main data. The clustering technique classifies all the observations based on their distance, so the similar observations are combined together and more similar observation are combined in the next step. In this research, applied hierarchical cluster analysis by using Ward linkage method in SPSS soft ware was applied on factor scores. Finally the main groups have been formed regarding Environment to circulation curves and based on dendrograms curve of earth surface data, 6 synoptic patterns were derived.

Conclusion

The obtained results from analyzing the derived patterns related to earth surface and upper levels of atmosphere are summarized as follows:

Regarding to the derived patterns of sea level maps, the existence of a relatively high pressure center in the west or northwest parts of Iran and a low pressure center was identified in east of Iran for the rainy days. The contact of the centers together (which are considered as the transitive systems based on the type) may be efficient to provide the area rainfall mechanisms beside to increase the pressure gradient.

The role of the Siberian high pressure decreasing the temperature and increasing the pressure gradient is absolutely obvious for two sea level patterns. Also the north eastern mountains of Iran were efficient to improve the high pressure locally on earth but generally the existence of a low pressure in eastern part of Iran or being located between two low pressure and high pressure center as the under study area was the most important earth surface pattern for rainfalls.

The under study area was located in front of or under a trough based on the derived patterns in 500hp level maps in most rainy days which it makes instable conditions and it also provides ascent factor. Furthermore, the existence of a trough on north of Iran was observed in 500 hp level patterns and the main differences are more correlated with the trough axis deviation and also related to its depth.

Keywords: Factor Analysis, Synoptic Patterns, Clustering, Atrak and Gorganroud Basins.

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