Recognition of Weather Types in Ardabil Synoptic Station and its Relationship With Atmospheric Circulation Patterns

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Introduction
Determination of weather types as one of the goals of Synoptic climatology is identification of similar weathers variables. Hence, weather types in fact visualize air masses. In other words, a weather type is a different set of atmospheric characteristics which is different from other series. Today, identification of weather type based on climatic variables is one of the important tools for climatologists to understand about the weather and climactic problems & disasters due to atmospheric circulations. On the other hand, the weather types are associated with surface events and by identification of these, environmental phenomena such as floods, pollution, pests, etc, are predictable. Many of the processes concerned with environmental problems, are affected by atmospheric circulations. Since in synoptic studies, the relationship between changes in atmospheric circulation patterns and environmental phenomena and processes are reviewed, the results of these studies could lead to explain and predict phenomena and environmental conditions.

Research Methodology
In this paper, in order to determine and investigate the synoptic weather types in Ardabil synoptic station, 18 climatic variables such as wet and dry bulb temperature, relative humidity, direction & speed of wind (for 03, 09 & 15 GMT) mean of rainfall, maximum and minimum of temperature belong to Ardebil synoptic station in years 1978 – 2005 have been used. 9918 days has had complete data of the above variables. First, a P Matrix (9918×18) created and then the data standardize process has been performed. On this Matrix, by using cluster analysis, weather types of this station have recognized. based on correlations, 6 days selected as representative days of 6 synoptic types in Ardabil synoptic station. So, in these representative days, climatic characteristics of sea level pressure and 500 hecto-pascal geopotential height maps were investigated.

Discussion and Results
In this study, using the climatic data of years 1978-2005 of Ardabil synoptic station and performing the cluster analysis by Ward method on standardized data, six weather types were identified.
Including: 1) Warm and dry, windy 2) Very warm with low rainfall 3) Very cool & rainy 4) Cool and dry, windy 5) Moderate 6) Warm & wet. At first, these types were located in 2 clusters (warm and cool). Types 1, 2 and 6 belong to the warm cluster and types 3, 4 and 5 belong to the cold cluster. It seems that the obtained weather types for this station almost represent spatial and temporal climatic conditions of this station. The results showed that type 1 is the most discordant type. Types 3 and 2, respectively, have the highest and lowest rainfall. The coldest and warmest types of the station are types 3 and 2. Type No. 6 has the best representation day with a 95 percent correlation with the other day and it had the longest duration among other types. Types 1 and 4 are the windiest types respectively. Type 6 (which belongs to the warm season), has the most and type No 1 has the lowest frequency of occurrence of weather types. In winter, the Siberian high pressure in north of Iran and the unstable mid-latitude out of tropical flow causes the influx of high-latitude cold weathers on the northwest of Iran. Consequently, the cold weather types in winter influenced more by controller planetary factors of station than local factors. In other seasons of the year, the effective air mass enters in to the region mainly from the northern regions and affects on its climate. In total, in this station, the frequency of warm types is more than cold ones (53.8 vs. 46.2 percent). Among the studied types, types 1 and 5 have more moderate climatic conditions than types 2 and 6 (warm types) and types 3 and 4 (cold types). Investigation of 500 hpa level and sea level patterns of representative days of weather types, showed the Influx of cold air of upper latitudes by Siberian & European high pressures and low pressure of Iceland on station and existance of high pressure closed center of Azores on center of Iran. In general, study of ground level and 500 hpa atmospheric circulation patterns, justified cold types (types 3, 4 and 5) more than warm types (types 1, 2 and 6). Although in warm types, especially types 2 and 6, the arrangement of atmospheric circulation patterns play a decisive role in the occurrence of these weather types, Since weather types of each area are related with the occurrence of environmental phenomena, therefore the discovery and analysis of this relationship can take important steps in preventing and dealing with these phenomena.

Conclusion

The results of cluster analysis showed that there are 6 weather types in Ardabil synoptic station; 1- Warm and dry, windy. 2- Very warm with low rainfall. 3- Very cool & rainy. 4- Cool and dry, windy. 5- Moderate. 6- Warm & wet. Statistical analysis shows that number 5 (moderate) and 6 (warm & wet) types were active in 29.5 & 17.5 percent of the year respectively and considered as the dominant types of Ardabil station. Weather Type 3 has the most precipitation & the least temperature and weather type 2 has the highest temperature & the least precipitation. weather type 1 has the most inharmonious & windy. The warm & wet type of weather has the longest term among the other types of weather. The results of synoptic analysis of weather types show that in Ardabil synoptic station,each of weather types are related to a special atmospheric circulation pattern. The cold flows of high latitudes creates by Siberian & European high pressures, high altitude of Azores, west & southwest winds are the main atmospheric patterns in sea level pressure and 500 hecto-pascal geopotential height maps.

Keywords: Ardabil synoptic station, Cluster analyze, Synoptic analyze, Weather type.
References