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Defining the Climate Zones of Turkey for Recent Three Decades by Cluster Analysis

Y. Unal, B. Onol

Istanbul Technical University, Aeronautics and Astronautics Faculty, Department of Meteorology, 34469 Maslak, Istanbul/Turkey (sunal@itu.edu.tr/Phone: +902122853131)

The purpose of this study is objectively to define regions of climatic homogeneity by using cluster analysis. This type of analysis has been successfully used in many related climate research problems. A principal advantage of these approaches is that they directly and quantitatively specify the climate types. On the other hand, the arbitrary determined cluster size and the lack of method in assessment of the statistical significance of the resulting climate divisions limit the usefulness of cluster analysis. Comparison of several hierarchical clustering methods for Turkish climate data showed that cluster methods of Average Distance within the clusters and Ward's produced the most representative statistical results in identifying the climate regions. Since the best clustering approach is the one that minimizes the influences of subsets of data in the clustered regions, sensitivity of the methods of Average Distance within the Clusters and Ward's to subsets of the initial data set was tested. It was found that more climatological stations change cluster membership in the Average Distance method than Ward's method. Hence, the Ward's method gives more cohesive subgroups and stable clusters for the alteration of the number of stations used in clustering (Unal et al, 2003). Therefore, in this study, we adopt Ward's method to delineate the seasonal climate regions, and then seasonal clusters are combined to identify the principal climate zones of Turkey. Data used in this study consist of monthly average temperature and total precipitation for the most recent period of years between 1975 and 2004 over 207 stations. Stations are chosen by considering the completeness of climate data and their representation of Turkey's geographic variability. They have considerably uniform distribution over Turkey. Within 30-years period, stations have no more than 5 month missing data, and the existing missing data are estimated by using the linear interpolation using the data of preceding and following years. Then, station data are

carefully examined to identify non-homogeneities. The Standard Normal Homogeneity Test is applied to each station before cluster analysis. Ward's clustering method is employed to monthly total precipitation and average temperature data on seasonal basis. The shortcoming of the traditional clustering is that clusters are constrained to the non-overlapping regions. Seasonal basis classification is able to create transitional climatic regimes so that the classification is improved by producing the overlapping regions. Results are compared to the climate regions of Unal et al.(2003) defined by the period of 1951-98.