



Analysis of Synoptic Weather Types and Its Influence on Precipitation in the Marmara Region (NW Turkey)

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In this study, we investigated the relationship between synoptic weather types and rainfall patterns in the Marmara region, northwestern part of Turkey. For this purpose, the automated Lamb weather type classification method was applied to the NCEP/NCAR reanalysis daily mean sea level pressure data for the period between 2001 and 2010. Ten synoptic weather types were found that represent the 90% of the synoptic patterns that affect the Marmara region. Based on the annual frequency analysis, mainly six synoptic weather types, 24% (NorthEast), 21% (North), 11% (South), 9% (SouthWest), 7% (Anticyclonic), 5% (Cyclonic), were found dominant in the region. Multiple comparison tests suggest that (i.e. Bonferroni test) northerly patterns (i.e. North and NorthEast) have statistically significantly higher percentages as compared to the southerly (i.e. South and SouthWest) and the rest of the patterns (i.e. Anticyclonic and Cyclonic).

During winter months, N- and NE-patterns observed less frequently than the annual frequencies of them, 18% and 13% of the period, respectively. On the other hand, due to the formation of the low pressure center located over the central Mediterranean Sea, S- and SW-patterns were observed more frequently than their annual mean frequencies, 16% and 17%, respectively.

During summer months, N- and NE-patterns become dominant in the region, and they constitute about three quarters of the period, 25% and 44%, respectively. The low pressure center located over central Anatolia and Black Sea brings moist and cool air to the region, preventing excessive heating during the summer season. Cyclonic patterns observed less frequent during the winter and fall months, about 3%. They become more frequent during the summer season, 9% as a result of the shifting of the subtropical jet stream to the south, and the seasonal movement of the Basra low pressure toward the inner and northern parts of the Anatolian peninsula. On the other hand, Anticyclonic patterns are more common in the fall season 11% due to the expansion of spatial extent of the anticyclone center located over the Caspian Sea.

Daily precipitation records for the period of between 2001 and 2010 belong to 14 meteorological stations in the region were investigated to understand the influence of synoptic weather types on precipitation. Based on daily precipitation records, about one-third of the NE-patterns result in precipitation which is slightly larger than patterns from other directions. The corresponding values for SW-, N- and S-patterns are 29%, 25% and 25%, respectively.

Northerly patterns (N and NE) causes more frequent precipitation on the northern and eastern parts of the region. On the other hand, southerly patterns (S and SW) are more influential and cause more frequent precipitation on the south and northwestern parts of the region. Therefore, frequency of synoptic weather types and daily precipitation records suggest that precipitation regimes are of a different nature in northern and southern parts of the Marmara region.

Keywords Synoptic weather types; Marmara Region; Lamb classification; Rainfall patterns