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Heat Wave Tendency in the Western Part of Turkey and Its Relation to Circulation Patterns

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Climate change is one of the most important global issues today due to the rapid increase in greenhouse gasses as a result of industrialization. As a result of changes of climate system components, extreme variations in temperature, humidity and precipitation occur. Since more extreme events such as extreme precipitation and temperature, droughts, flood and heat waves can have catastrophic consequences, forecasting and detailed understanding of the impact of these variations are crucial for the human being. In order to detect climate change impact, this study focuses on heat waves in the western part of Turkey between 1975 and 2006 period.

In this study, the selected region lies west of 30o longitude over Turkey, and the heat waves and their frequency are determined for the months April to October (7 months) between years of 1975 and 2006 on 32 stations located on the western part of Turkey. A certain day is accepted as an extreme day when maximum temperature is above the 85 percentile. Only those days in which maximum temperature exceeds the score of the 85th percentile are counted to build the series representative of heat wave counts in a year. Temperature is combined with humidity and apparent temperature is found for each day for each station. Then the same procedure is repeated for apparent temperature for 32 stations in the period of 32 years. 85% threshold values for temperature are taken as a lower limit for each station, and then heat waves are determined in the time interval between 1975 and 2006 by imposing a constraint such that extreme temperatures prevail at least for three consecutive days.

It is found that in the western part of Turkey, 85% values go beyond 30oC except in the region along the Bosporus since channelling effect along the Bosporus and latitudinal solar radiation variations are controlling factors of daily maximum temperatures. For warm days, general average of relative humidity changes around 60% for this region. Finally, 85% thresholds of apparent temperatures are found between 26 to 37 ˚C. Moreover, trends analyses were performed for number of days in which daily temperature or apparent temperature exceeded their threshold values. The coastal regions have lower values and these values are increasing while going inland part of Turkey since the continental effects are in progress. There is a significant rise across the Black Sea shore and highest values are located at this region. In general there is an increasing temperature tendency for this region in the period between 1975 and 2006. In inland stations, number of extreme temperature days seen in a year is increasing more than the coastal regions. Near the Aegean and Western Mediterranean coasts, probability of occurrence of heat wave in 2000s is increased compare to 1970s. There is positive humidity inclination especially around Marmara region and just the opposite in the south part of western Turkey. The reason of these changes is related to daily temperatures due to the increase of temperatures trough the study period. Trends in heat stress have very similar distribution of temperature trends. Due to moisture contribution, apparent temperature trends especially along the coastal regions are significantly larger than temperature trends. In general there is positive tendency for this period and highest values are located again across the Black Sea shore. Furthermore, trends analyses of number of heat waves reveal that there is an increasing heat wave tendency for this region in the period between 1975 and 2006.

Heat waves are influenced by atmospheric circulation and especially by certain flow patterns. Therefore, in this study relationship between the heat waves and associated circulation patterns affecting the development of the systems near the surface is investigated. Here, by studying the selected heat wave events, it was planned to determine the connection of heat waves with circulation patterns.