TIME SERIES ANALYSIS TO DETECT CLIMATE CHANGE

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EXPERTISE THESIS ABSTRACT

Within the scope of this thesis, it was not aimed to prepare scenario-based future predictions as performed in such projects as Climate Change Impact on Water Resources Project (SYGM, 2016), Climate Change Projections for Turkey with New Scenarios (MGM, 2015), but to reveal the climatic changes for each basin using observation data.

In this study, monthly total rainfall, monthly average temperature, monthly maximum temperature, monthly minimum temperature and monthly maximum rainfall data for the period of 1963-2015 obtained from the Turkish State Meteorological Services for the purpose of determining the station and basin based climatic changes. Statistical tests were applied to the annual total flow data for the period of 1973-2012 obtained from the State Hydraulics Works. Firstly, 4 different homogeneity tests including Standard Normal Homogeneity Test, Pettitt Test, Buishand Test and Von Neumann Test were used to determine whether the time series of stations are homogenous. At the 99% confidence interval, if the outcomes of 2 of 4 homogeneity tests were homogeneous for a time series, then it marked as usable and used in station based analysis. Approximately %90 of annual total rainfall and monthly maximum / minimum temperature and monthly maximum rainfall time series was found homogeneous, while 65% of annual average temperature time series was found as inhomogeneous.

Statistical significant trends in homogeneous time series obtained in previous chapter were determined at the 95% confidence interval using the Mann-Kendall nonparametric test, which includes a correction factor for data sets having serial correlation. The intensity of the trends found (change per time) was found using Sen's Slope Estimator method. Statistically significant increases were found in the Central and Eastern Anatolia Regions for the average annual temperatures at the 95% confidence interval. In total annual precipitation, significant increasing trends were found in eastern part of the Black Sea, while decreasing trends observed in Central Anatolia and Eastern Anatolia regions and especially in Southeastern Anatolia Region. In monthly maximum temperatures, the highest slope value was calculated as 0.11oC / year in the Aegean, Marmara, Eastern and Southeastern Anatolia Regions in winter. In minimum

temperatures, the highest slope value was calculated in winter as 0.18oC / year. According to the trend analysis applied to the minimum temperatures representing night temperatures, downward trend were found in the Marmara region and while upward trends were found in east of the country. Especially in monthly minimum temperature of January and February, the significant upward trends in both eastern and western regions of Turkey are remarkable. According to the trend analysis results, in maximum monthly precipitation of December, May and June, decreasing trends were found for many stations throughout Turkey. However, in Black Sea region and especially in the western and eastern part of Anatolia, increasing trends were found in maximum monthly precipitation of January, February, July and August.

In order to find significant trends for each basin, it was required to obtain single basin specific data sets for each variable of mean temperature, total precipitation, maximum temperature, minimum temperature and maximum precipitation. In this study, Thiessen polygons method was used to obtain single data sets for each of 25 basins, then modified Mann-Kendall trend test and Sen's Slope Estimator method applied to those data sets. According to the results of the trend analysis, significant increasing trends in annual mean temperature were found in all basins. The highest slope was calculated for Van Lake, Aras and Konya Closed Basins. In the annual total precipitation, statistically significant decreasing trends were found in Batı Akdeniz, Doğu Akdeniz, Fırat-Dicle, Gediz, Konya and Susurluk Basins. If the trends in temperature and precipitation are evaluated together, it can be said that changes in weather patterns indicate the climate change in these six basins. Trends in annual total flow values of these basins have been examined in order to arrive at a clearer picture for these six basins with climate change indication. It has been determined that the flow values of the Susurluk and West Mediterranean Basin are only decreasing trends in parallel with the changes in temperature and precipitation. According to this result, it can be said more clearly that climate change is happening in the two of these six basins.

Key Words: climate change, station based, basin based, homogeneity analysis, trend analysis, Mann-Kendall, Sen's Slope Method