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PRECAUTIONS FOR THE PREVENTION OF GLOBAL WARMING, CLIMATE CHANGE AND OTHER ENVIRONMENTAL PROBLEMS: THE CASE OF EASTERN BLACK SEA REGION CITIES

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Abstract

In the Eastern Black Sea Region of Turkey, the rate of surface water flow can reach up to 80-90% because of high precipitation rate and the sloping land character as well as the fact that the soil is saturated and evaporation is low. However, the fact that the river valleys are usually, narrow and irregular, causes another negative situation in terms of flood risk. Under these circumstances, at the region where floods happen every 5 years without exceptions, high amounts of rainfall which occurs in short durations causes important damage and casualties as well as damaging the infrastructure. When the meteorological data obtained between 1961-2013 from meteorological stations located at Eastern Black Sea cities is statistically evaluated (with Mann-Kendall statistic method and regression analysis), it can be seen that a global climate change creates a serious risk at the region (Trabzon, Giresun, Rize and Artvin). Rainfall and river flow relationships have been examined with this warming at the region and by considering the dimensions of the ongoing Hydro-electric power plant construction work built as alternative energy resource in the energy sector, a relationship was tried to be established between the today and future of these power plants and Eco-Tourism.

In this presentation, it has been discussed what the potential ecological effects of global warming could be on nature and nature tourism and what precautions could be taken in order to minimize the negative effects of climate change on the tourism sector.

Keywords: Climate, Climate Change, Eastern Black Sea Region, Environment, Tourism, Eco-Tourism, Renewable Energy, HEP

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1. INTRODUCTION

Climate and Climate Change: Climate is the average of weather conditions in a place called the average calculated over time and region. The branch of science that studies climate is called climatology. The factors that determine the climate in a region are temperature, wind, humidity, pressure in the air and how they change in day and year.

In this concept, it is important to know that climate and weather events are two different events. Climate change is generally due to long-term and slow-developing atmospheric events with global and local impacts of change in climate conditions regardless of climate. It is described. Weather events "short term, sudden changes and a certain air including" is defined as.

Snowfall, storm, drought and other incidents that we see in daily life are examples of weather events. Climate change will not take place in a short time such as entry or exit to the ice age and the effects that can last for a long time can be given as an example.

2. GEOGRAPHICAL CHARACTERISTICS OF THE STUDY AREA

In the Eastern Black Sea Region, meteorological stations are operated in three different ways: small stations (automatic observation stations), large climate stations and synoptic stations. The meteorological data in this study was taken from the large stations in the provincial centers. Figure 1 between the position of the Eurasian continent and Eastern Turkey Turkey shows the position of the Black Sea coast yl.

Figure 1. The eastern Black Sea region (Üçüncü, O.)

The distribution of precipitation in the Eastern Black Sea Region, where this study is carried out, varies greatly at some points. In this difference, elevation, view, air masses, orographic characteristics and location-related effects. In the analysis of the data in the provinces where the study was conducted, the average annual precipitation heights were; 846.5 mm in the province of Trabzon, 1286.1 mm in the province of Giresun, 2268.6 mm in the province of Rize and 716.0 mm in Artvin province. In the region where the study is carried out, the most rainfall occurs in winter and the least rainfall occurs in summer.

3. MATERIAL AND METHOD

In order to examine the change in temperature (^{0}C) and precipitation heights (mm) between 1961-2013 in the Eastern Black Sea Region, the data of the observatory station in Trabzon, Giresun, Rize and Artvin provincial centers were examined.

3.1. Regression Trend Analysis

The regression analysis is used to determine the relationship between two or more variables, including causal relationships. In addition, it is a method which is characterized by a mathematical model which is formed in order to make estimations about the subject. The Linear Regression test is a parametric test that assumes normal distribution of data.

3.2. Mann- Kendall (MK) Test

The level of significance of this test is generally predicted for bi-directional confidence intervals with a probability of 0.10 (α = 10%) and 0.05 (α = 5%) in most engineering applications.

4. STATISTICAL STUDY FOR EASTERN BLACK SEA PROVINCES

4.1. Trabzon Province

Figure 2 shows the time series of the average annual average temperature of Trabzon between 1961-2013. For many years the average temperature of summer season was calculated as 22.3^{o}C.

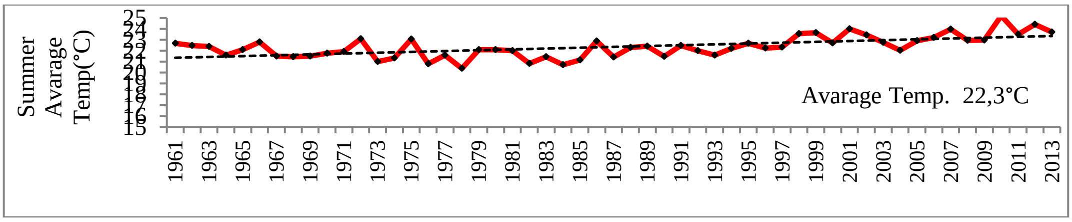

Figure 2. The average temperature-year series of summer season in Trabzon Province.

The graph in Figure 3 shows the minimum temperature change for the summer season of Trabzon in 1961-2013 period. The average summer temperature minimum temperature values for many years are 15.7° C.

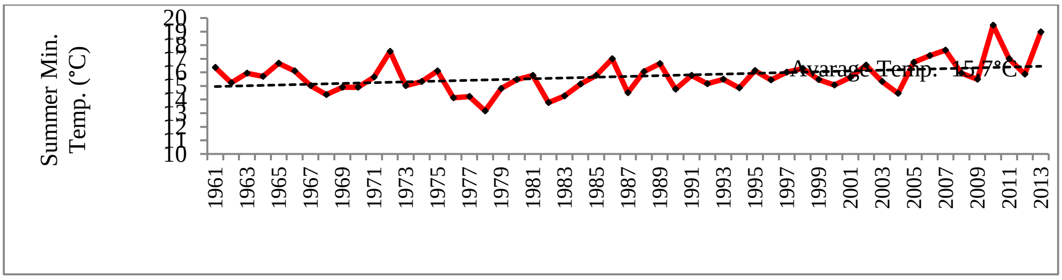

Figure 3. Summer season minimum temperature-year series in Trabzon Province.

4.2. Rize Province

The graph in Figure 4 shows the annual maximum temperature average for many years in the period 1961-2013 of Rize Province. The average monthly maximum temperature values for this period are 24.9°C.

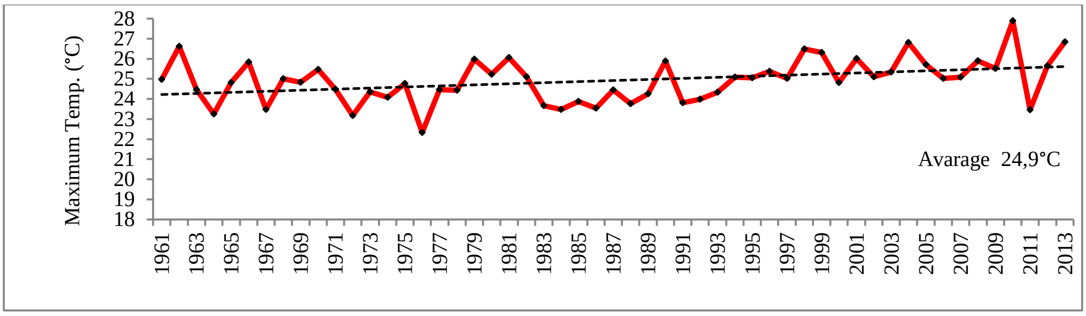

Figure 4. Rize Province annual maximum temperature-year series.

The graph in Figure 5 shows the annual maximum temperature average for the summer years of Rize province in 1961-2013 period. The average summer temperature of this period is 29.4°C.

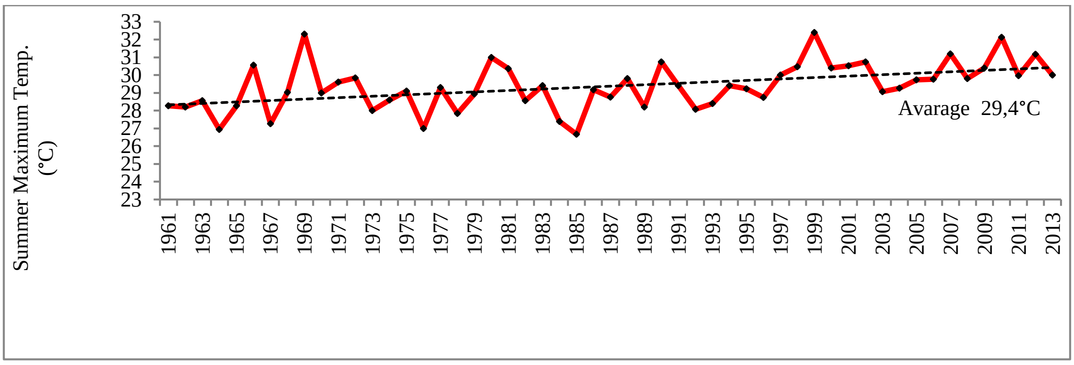

Figure 5. Rize summertime maximum temperature Mann-Kendall statistic.

The graph in Figure 6 shows the average autumn maximum temperature for many years in the period 1961-2013 of Rize Province. The average of the maximum temperature values for the autumn of this period is 25.9°C.

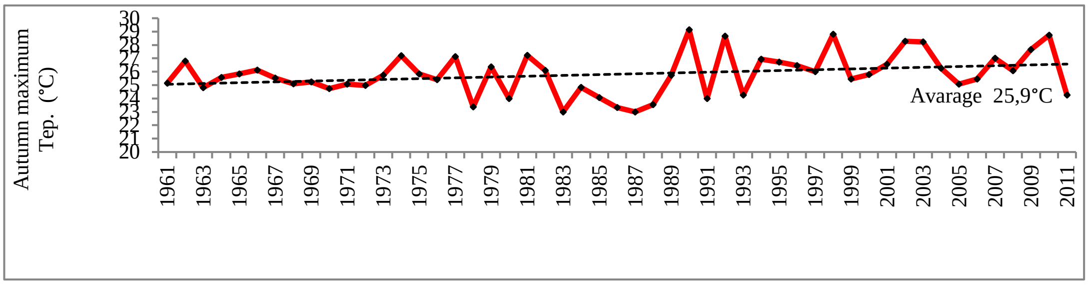

Figure 6. Rize Province autumn season maximum temperature-year series.

The graph in Figure 7 shows the average annual minimum temperature of Rize Province in 1961-2013 period.

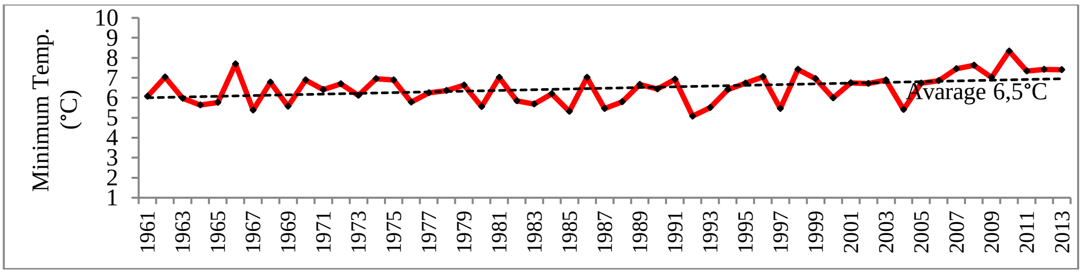

Figure 7. Rize Province minimum temperature-year series.

The graph in Figure 8 shows the average annual minimum temperature for the summer season of 1961-2013 in Rize Province. The average minimum temperature values for this period are 15.0°C.

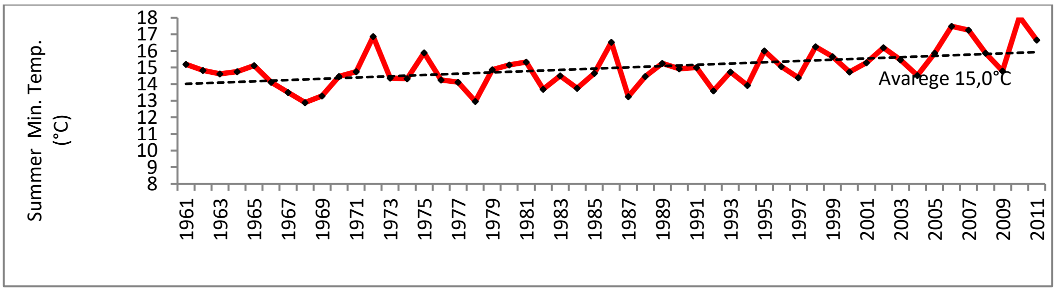

Figure 8. Rize Province summer minimum temperature-year series.

The chart in Figure 9 shows the average annual minimum temperature of the autumn season in the period 1961-2013 of Rize Province. The average minimum temperature for this period is 8.1°C.

The graph in Figure 10 shows the annual average temperature values of Rize Province in the period of 1961-2013. The average temperature values of this period are 14.2°C.

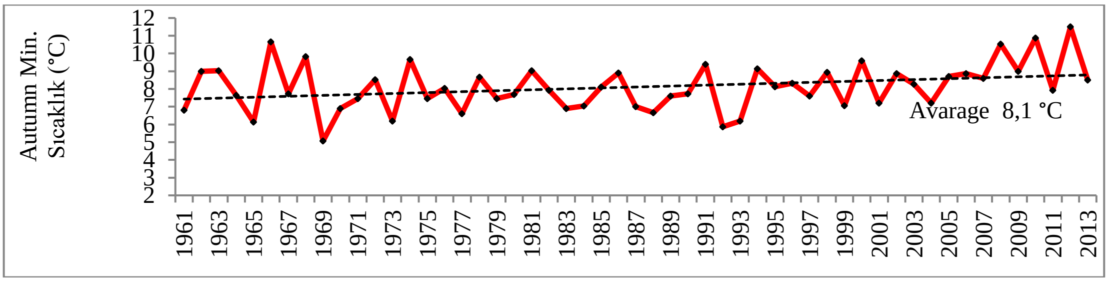

Figure 9. Rize Province autumn season minimum temperature-year series.

Figure 10 Rize Province autumn season minimum temperature Mann-Kendall statistics.

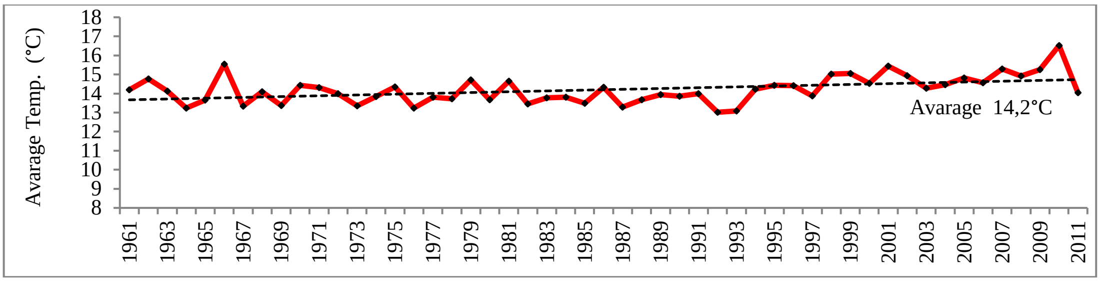

Figure 10. Rize Province average temperature-year series.

The graph in Figure 11 shows the annual average temperature values of the summer season of 1961-2013 in Rize province. The average annual temperature of the summer period of this period is 22.1°C.

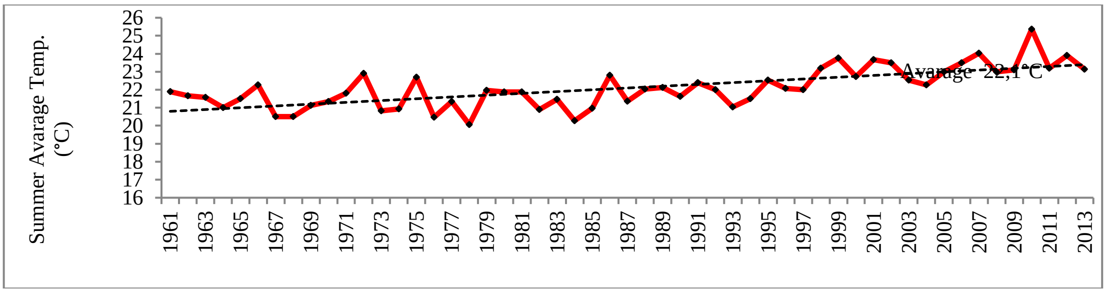

Figure 11. Rize Province summer season average temperature-year series.

The graph in Figure 12 shows the change in the average annual temperature values of the autumn season in the period 1961-2013 of Rize Province. The average annual average temperature of the autumn season of this period is 15.8°C.

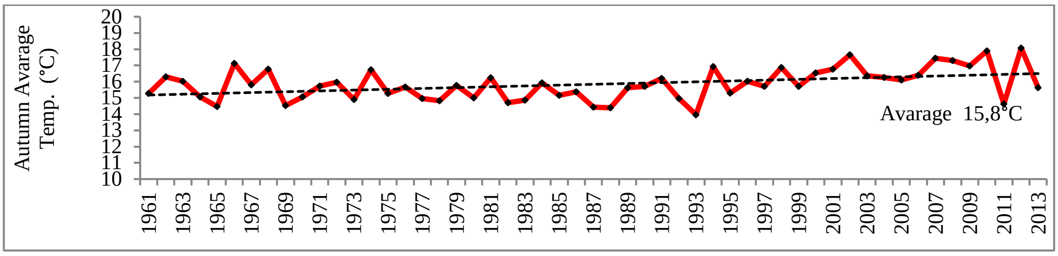

Figure 12. Rize Province autumn season average temperature-year time series.

Figure 13 shows that the annual total rainfall in the autumn season of the province of Rize has been on an upward trend for many years.

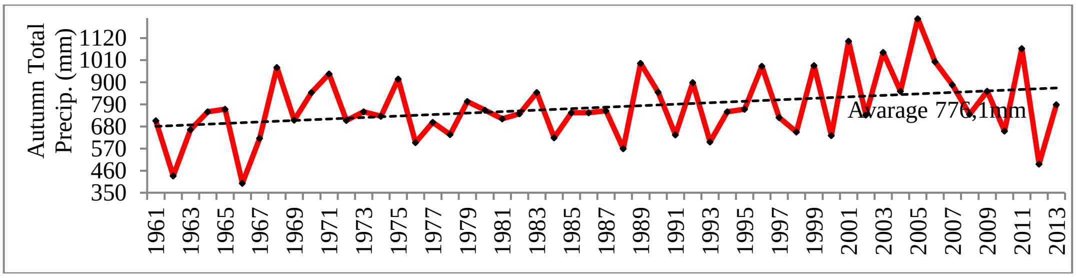

Figure 13. Rize Province autumn season total rainfall amount-year series.

4.3. Giresun Province

The graph in Figure 14 shows the average annual minimum temperature of Giresun in 1961-2013 period. The average annual minimum temperature for this period is 7.2°C.

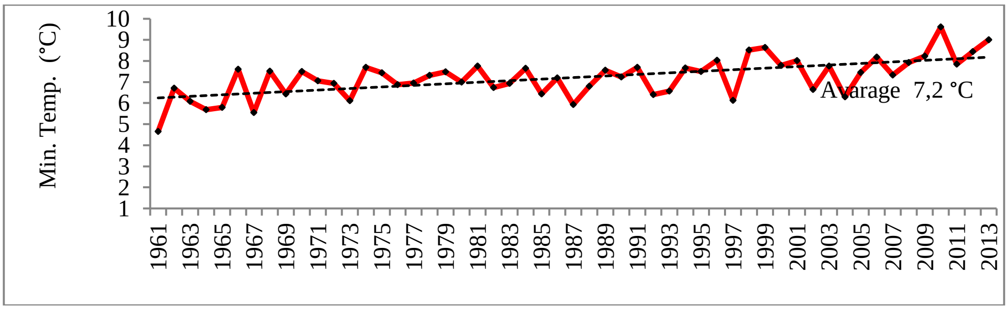

Figure 14. Giresun Province minimum temperature-year series.

The graph in Figure 15 shows the change in the minimum temperature values of the summer months of Giresun province in the period 1961-2013.

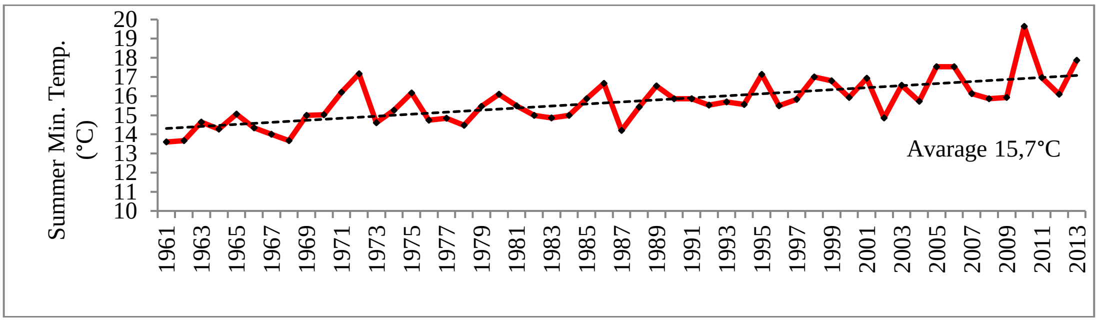

Figure 15. Giresun Province summer season minimum temperature-year series.

The graph in Figure 15 shows the change in the annual minimum temperature values of the winter years of Giresun in 1961-2013.

Figure 16 shows the variation of the annual minimum temperature values of the spring season of Giresun Province in the period of 1961-2013 for long years. The graph in Figure 17 shows the change in the minimum temperature values of the autumn season yearly in Giresun province 1961-2013 period. The average annual minimum temperature of the autumn season is 8.9^{o}C.

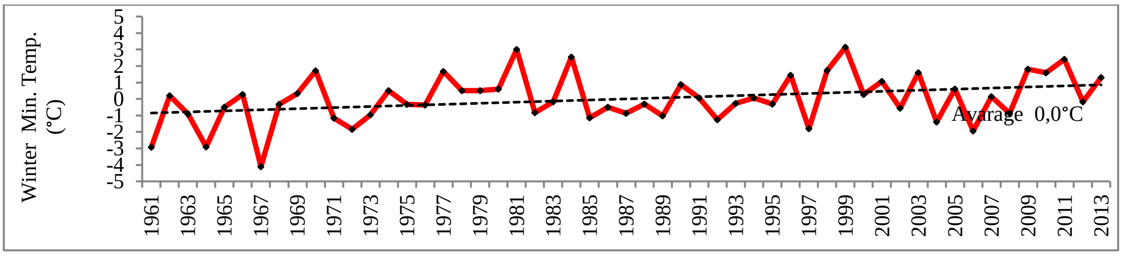

Figure 16. Giresun Province winter season minimum temperature-year series.

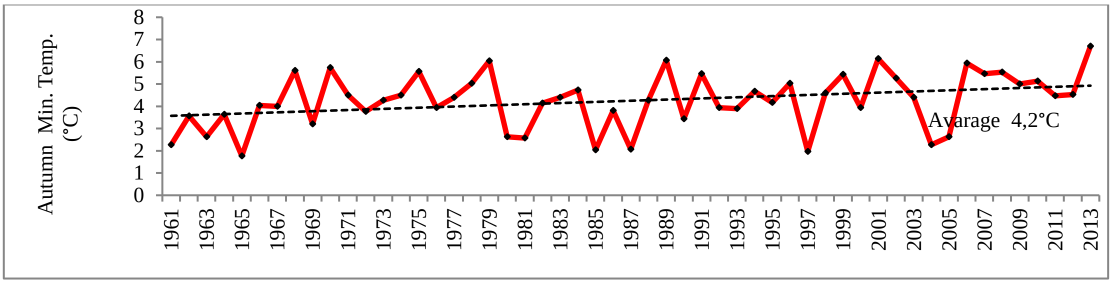

Figure 17. Giresun Province spring season minimum temperature-year series.

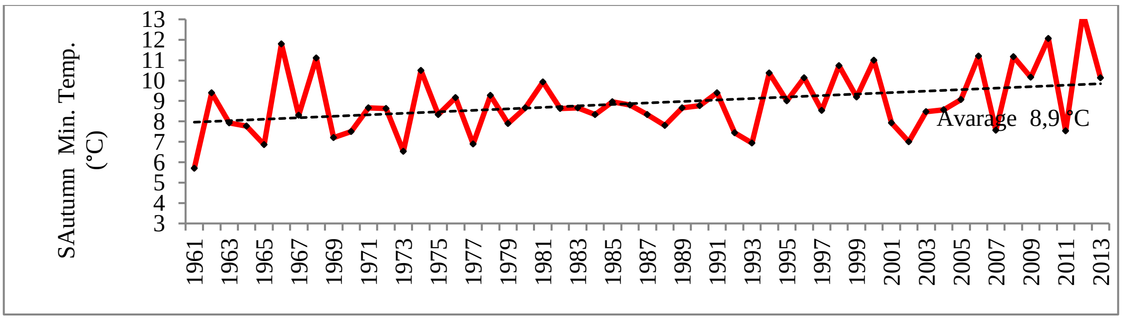

Figure 18. Giresun Province autumn season minimum temperature-year series.

The graph in Figure 18 shows the change in the annual average temperature values for long years in Giresun province 1961-2013 period.

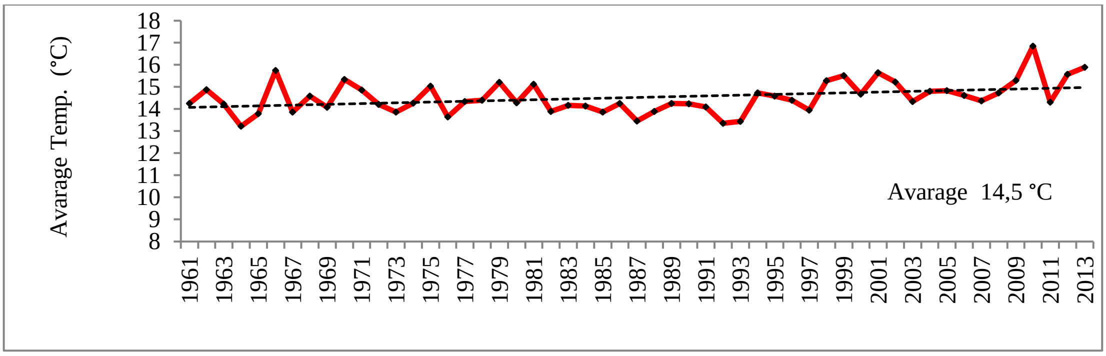

Figure 19. The average temperature-year series of Giresun Province.

The graph in Figure 19 shows the annual average temperature values of the summer years of Giresun in the period 1961-2013. The average annual temperature of the summer period of this period is 22.1°C.

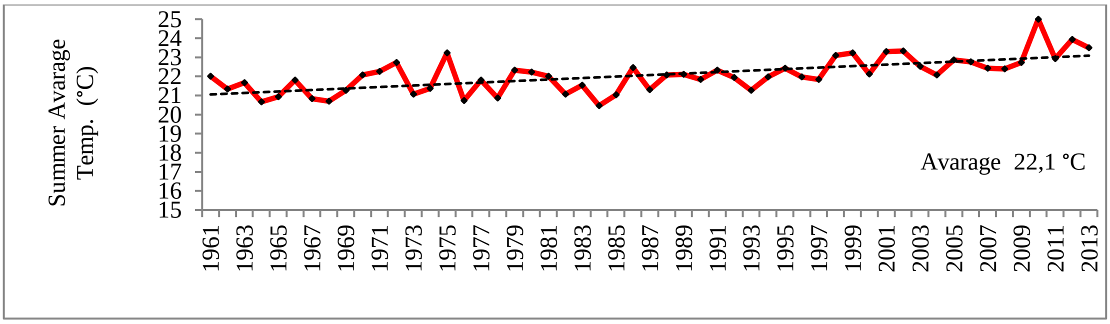

Figure 20. The average temperature-year series in the summer of Giresun.

The graph in Figure 20 shows the change in the average annual temperature values of the autumn season for long years in Giresun province 1961-2013 period. The average annual temperature of the autumn season is 16.3°C.

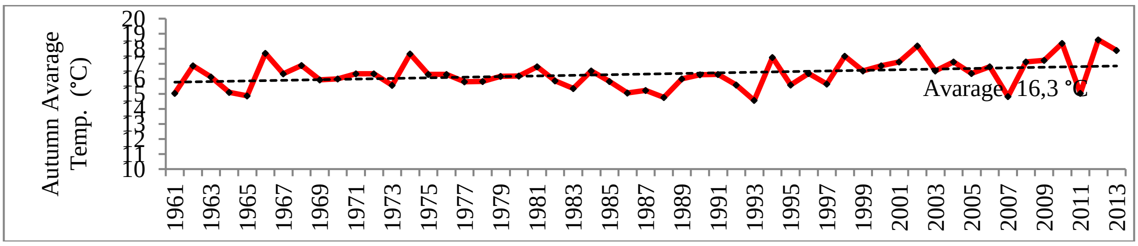

Figure 21. The average temperature-year series of the fall season of Giresun Province.

The graph in Figure 21 shows that the annual total rainfall in Giresun Province has a tendency to increase for many years.

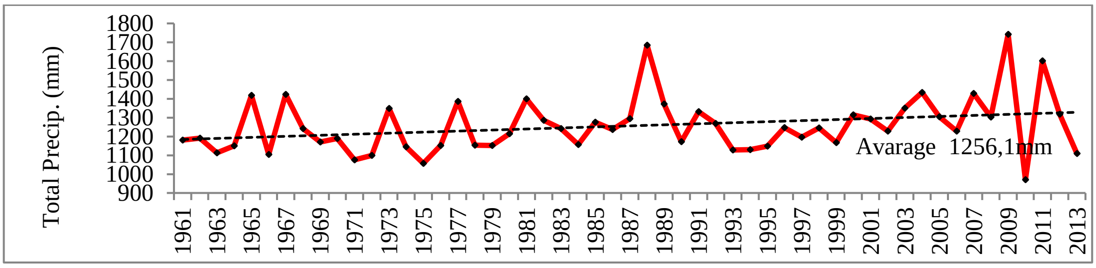

Figure 22. Annual total precipitation in Giresun province-year series.

The graph in Figure 23 shows that the annual total rainfall in Giresun Province has an increasing trend over the years.

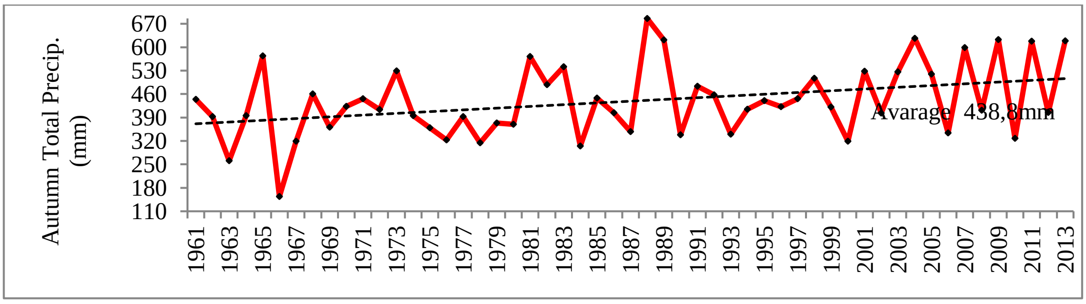

Figure 23. Yearly total rainfall in Giresun Province.

4.4. Artvin Province

The graph in Figure 24 shows the change in the minimum temperature values of the summer year of Artvin in the period 1961-2013. Average annual minimum temperature values for this period are 11.6°C.

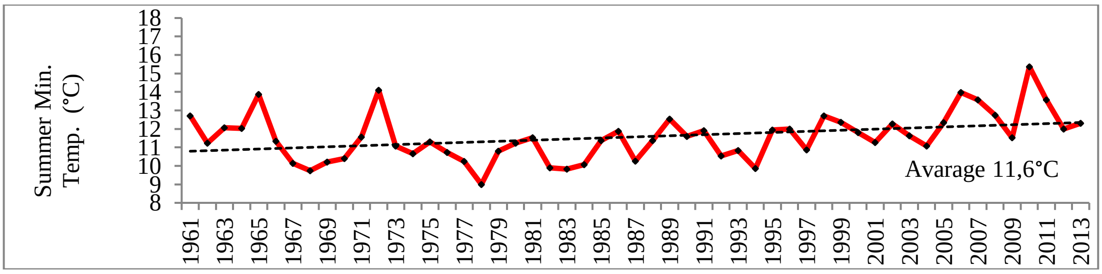

Figure 24. Artvin Province summer season minimum temperature-year series.

The graph in Figure 24 shows the change in the average annual temperature values of summer season of Artvin in the period 1961-2013. The average annual temperature of the summer period of this period.

The graph in Figure 25 shows average annual temperature values is 20.0°C.

Figure 26 shows that the annual total rainfall in Artvin Province in the summer of the tendency to increase for many years.

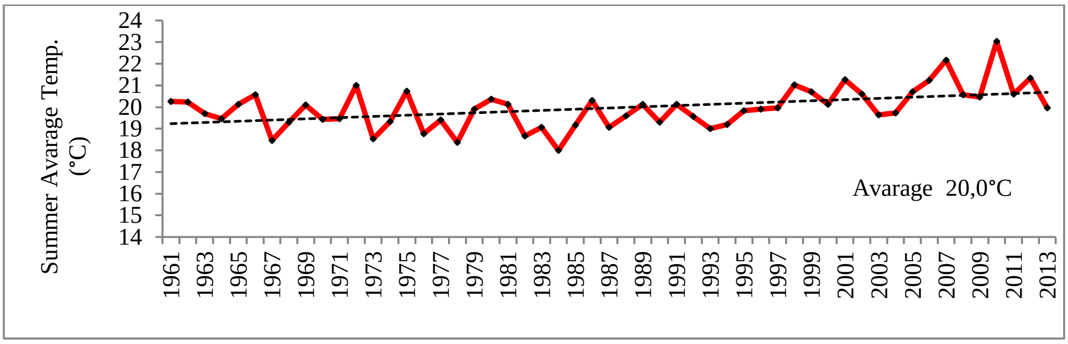

Figure 25. Artvin province summer season average temperature-year series.

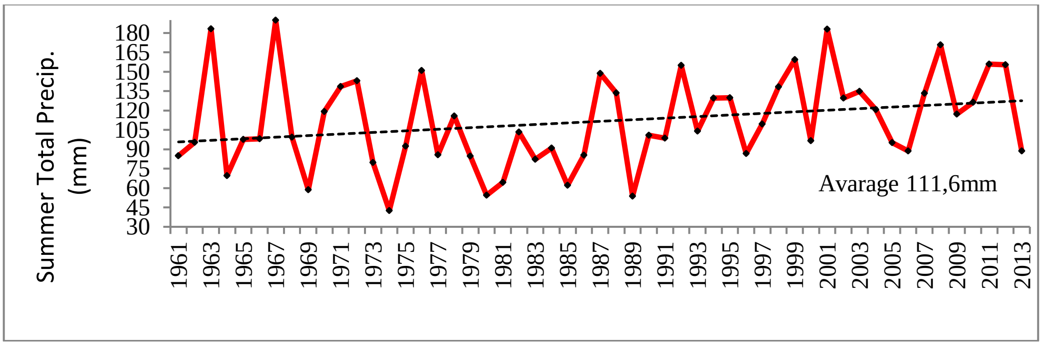

Figure 26. Artvin province total summer season total rainfall-year series.

5. RESULTS

The annual average of minimum temperature values in Giresun Province has a tendency to increase in the time series of values which are both long-term average and all seasons. The increase trend started in summer minimum temperatures in 1988 and was observed in different seasons until 2003 in all seasons. The average temperature for the same years, the average temperature in summer and autumn months are also in an increasing trend. The increase trend in average temperature and autumn average temperature for many years 2008; The average temperature of summer season began in 1998. In addition, there is an increasing trend in the total annual rainfall and the total rainfall in the autumn months for many years.

There is an increasing trend in the time series of minimum, maximum and average temperatures for summer and autumn seasons in Rize Province. In addition, the annual maximum, minimum and average temperature values of the long years of the time series is also a growing trend is seen. This increase trend in temperature values started in the early 2000s. It is concluded that the values of u (t) values are above the critical value1,96 when the graphs of MS statistics are examined. Therefore, the upward trend is significant in the 95% confidence interval according to the MK statistics. The rainfall in the same city has an increasing trend in the fall season. It has been determined that the trend has been continuing until 1989.

In Artvin province, it is determined that there is an increasing tendency in summer and total precipitation in summer and minimum temperatures. This increase trend in temperature and rainfall values started in the early 2000s. When the statistics of the MK statistics are examined, it is seen that the values of u (t) are above the critical value of 1.96. Therefore, the upward trend is a significant result in the 95% confidence interval according to the MK statistics. When the significance values in Mann-Kendall Trend graphs are examined according to the seasons, the following inferences are reached;

It is observed that there is a significant trend in Giresun province in the spring season minimum temperature trends. In general, it was found that positive temperatures were observed in the 52-year period of 1961-2013 period. These positive trends, which are seen in the positive direction, indicate the increase in night temperatures at minimum temperatures. That is, it is concluded that the radiative cooling is suppressed by the greenhouse effect. This increase in temperatures indicates that global warming is effective in spring.

Trends in autumn data also tend to increase. Besides the minimum and average temperature data in Giresun province, there is an increasing trend in total rainfall values. In the regions where precipitation increases with temperatures, precipitation will be shorter but more severe. This situation will increase the severity of erosion. At the same time, such a situation that may occur in the sowing period will cause damage to the sowing lands. The increase trend in the average temperature data of the autumn season in Rize province will increase the temperature of Td (saturation point) in this season when the precipitation increases and this will cause decreases in the amount of precipitation in this period.

When the distribution of trends in winter temperature minimum temperature data is examined, it is seen that there is a positive meaningful trend in Giresun province. This situation will cause changes in the rainfall types seen in winter time. For example, when the rain falls, the number of floods and floods will increase.

6. CONCLUSION AND RECOMMENDATIONS

As a result, the provision of social welfare and the sustainability of daily life in order to ensure the sustainability of water resources in terms of quantity and quality is sufficient to be sufficient. Nowadays, water resources are under pressure by various factors such as population growth, consumption habits and changes in land use. Climate change has been added to these factors in the last century. In summary, since water resources are under pressure with population, consumption rate and climate change effects, the most effective way to reduce these negative effects is to increase the water potential by means of pollution prevention, technological means and saving methods, and to put emphasis on the policies that lower the demand.

These rates should be lowered in the Eastern Anatolia Region, where the loss rates are up to 80%. The use of gray water is an application that has significant returns in the metropolitan cities, where water consumption amounts and unit water prices are high. The use of gray water should be encouraged in the regions located on the south and south west coast, where it is expected to be adversely affected by the effects of climate change. In the use of gray water, especially in new housing projects and industrial facilities, dissemination activities are of great importance. Considering the rainwater harvest as regions, priority should be given to Black Sea Region, Aegean and Marmara Region; especially with the savings to be made to the workplaces will reduce water consumption and financial return will be high. In other regions, the yol invaluable olduğ feature of water has been highlighted and it can be said that all these investments are economical when they are taken from the perspective that can be evaluated with non-cost components.

When the re-use of rainwater in the basins is examined, Antalya and East Black Sea Basin come to the fore. With the effects of climate change, it is expected to increase in the precipitation of these basins. Reducing the amount of rainfall that may cause floods and storing them for later non-rainy days will reduce the negative effects of climate change. In addition, it is estimated that the effects of climate change and tourism pressure and forest fires will increase during the summer. It is possible to use the rain water collected in this basin in order to combat forest fires. Although the North Aegean, Gediz, Büyük Menderes, Burdur and Seyhan Basins in the south and southwest regions, which are sensitive to the effects of climate change, are in the middle ranks of rainfall, their priority should be put forward.

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