Effect of Climate Change on Some Meteorological Data: Batman Example

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Abstract

Increasing Energy need in the global economy and tendency to utilization of poor quality fossil fuels have led to significant changes in world climate in recent years. Nowadays, global climate change has started taking part in the upper parts of the agenda. Human health, ecosystems even climate change evaluated as a problem to cause threat in terms of maintaining the human race have come forefront as basic ıssue of scientists and governments especially in recent years.
In this study, an evaluation has been carried out about meteorological data of Batman Province, which has been developing rapidly in recent years and is located in the Southeastern Anatolian Region where climate change is felt severely. Within this context, meteorological data belonging to the years between 1993 and 2013 were provided by State Meteorology Affairs General Directorate. At twenty-year time, monthly average alterations of data in solar radiations, in wind power and in the amount of precipitation and temperature relations among them have been investigated by means of statistical analyses. As a result of the study, some significant changes in meteorological data of the region searched have been found and suggestions on solutions have been proposed.

Keywords: Global Climate Change, Batman, Temperature, Meteorological Data, Statistical Analyses

1. Introduction

Today, global climate change is one of the most leading issues on the international agenda. Climate change is to be evaluated as a significant problem due to its negative effects which may have the potential to cause threat in terms of the fact that human health will be deteriorated, the ecosystem will be spoiled, agricultural fields and water resources will be polluted, even maintaining human race will be under risk. In particular, in recent years, the issue has become the primary agenda of scientists and governments. In order not to be affected by climate change much, studies have been carried out because climate change is accepted to be in progress in Turkey as well. Legislative regulation that Turkey enacted about global climate change started to act with its signing Kyoto Protocol in 2005 [1]. Turkey's per capita greenhouse gas emission is approximately one-third of OECD countries, while with its 119% of CO2 emissions, which has increased a great deal since 1990, it is the first of the world (Figure 1).

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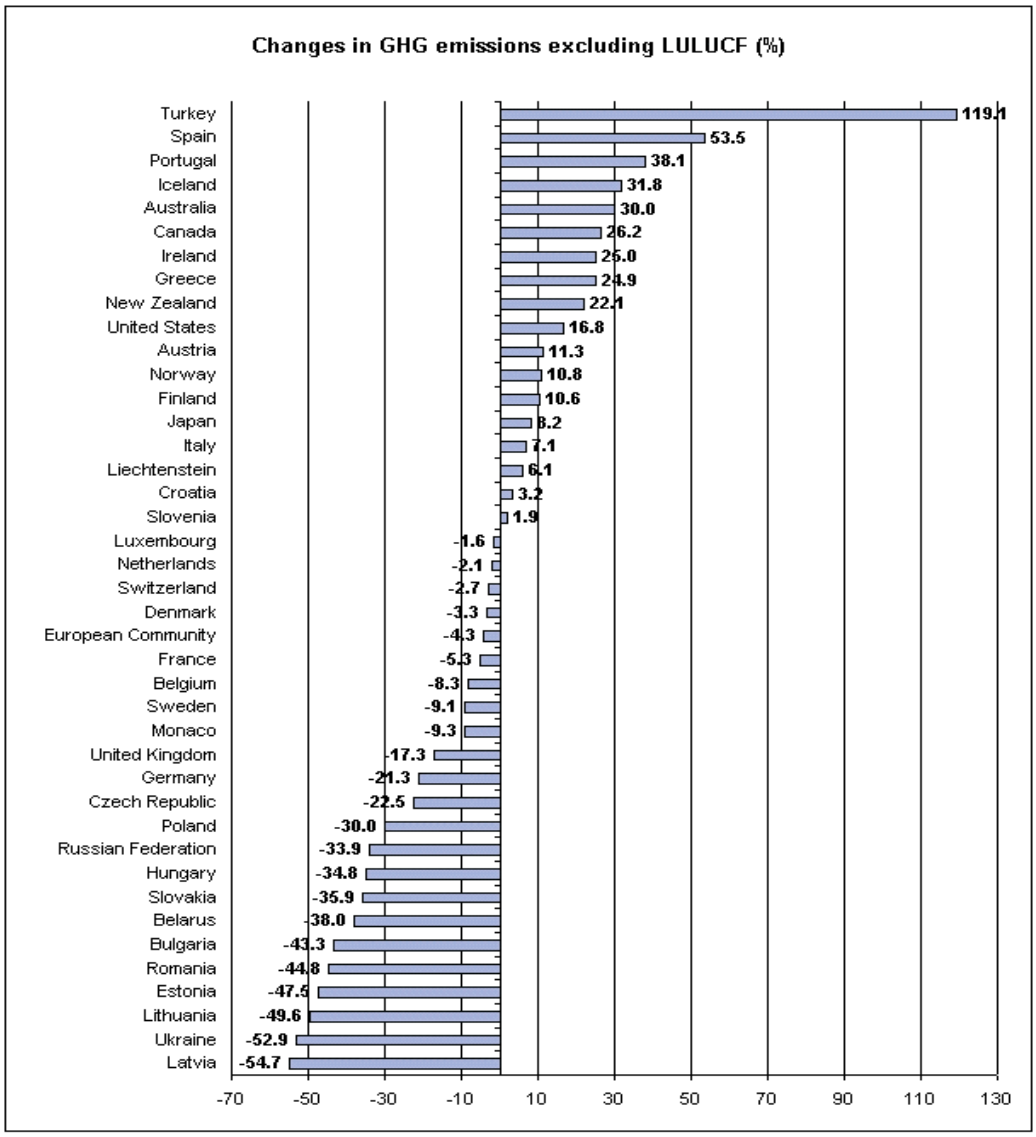

Figure 1 Total Greenhouse Gases Emissions between 1990 and 2007 according to Countries [1]

Since Turkey is a developing and a promising country for development, these values may be ignored; however, it is necessary to lessen these values and to take essential precautions to prevent climate change. The fact that industry and economy develop rapidly increases the demand for energy. Investigations should be carried out about obtaining energy to determine where this energy is provided, how much harm these energy sources can lead to climate after being used. It is a must to increase the renewable energy sources in energy production. In Figure 2, distribution of energy supply of Turkey, according to sources is demonstrated. As can be seen in the figure, it is noticed that utilization of renewable energy sources is low.

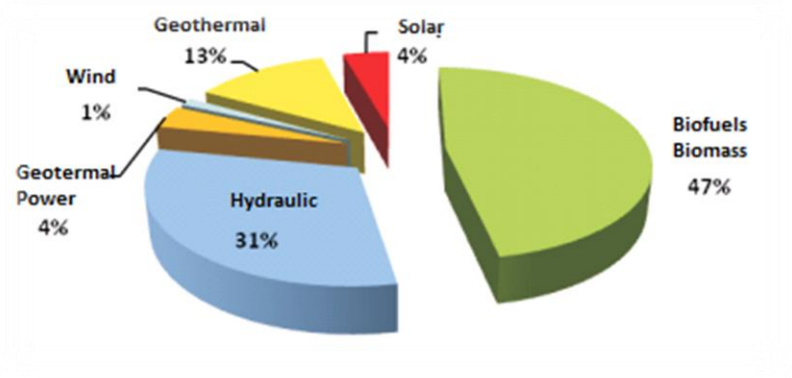

Figure 2 Distribution of Renewable Energy Supply on Sources in Turkey in 2009 [1]

Greenhouse effect can be defined as that the globe is heated more due to the atmospheric gases permeable to solar radiations, while less permeable gases lead to long wave soil radiation [2]. If there were no greenhouse effect, the average temperature on earth would be -18°C. However, now the average temperature on earth is 15°C; therefore, the temperature has increased 33°C as a result of the greenhouse effect. From the end of XIX century until today, it has been known that the average surface temperature of the world has increased between 0.3°C and 0.60°C; and if the necessary precautions are not taken, it is expected that it will be between 1° and 3.5° [3]. In a report published by the Intergovernmental Panel on Climate Change-IPCC in 2007, it is stated that 90% of global climate change stems from human activities; and it is declared that urgent precautions should be taken [4].

Turkey can make a considerable betterment in climate change by taking necessary precautions and carrying out studies about energy policies. For this, it is essential that energy efficiency and renewable energy should be emphasized. When we mention about renewable energies, we encounter solar energy and wind power first and foremost. Solar and wind powers stand out advantageous when their benefit, cost, sustainability and other factors are considered. When the cost and efficiency parameters of wind power are taken into consideration, it will clearly be seen that it is far more ahead of the other renewable energy sources as a commercial product than those which have completed their development phase. By the end of 2008, installed wind power throughout the world was 121.000 MW; and this prevented 158 million tons of carbon dioxide emission. When considered, 47.849 MW wind power potential that Turkey possesses constitutes an important place in energy production. When Turkey's energy potential is checked, it can be observed that it comes second in the European countries. As our country is under the influence of rapid climatic changes like the others; if the capacity utilization of wind power increases, it will set a solution to decreasing the CO_2 emissions [5].

In his study entitled "Climate Change and Energy Sector", Keskin emphasized climate change in Turkey and its reasons and policies developed to prevent this problem; and investigated the essential steps to be taken to stop climate change [1].

In their study, they carried out, Sevim and Varlıklı gave an account of global trend about climate change, global developments in wind power market, and the developments in the wind power market in Turkey and utilization of renewable energy sources; and they suggested that wind power should be developed [5].

In his study, Duru examined the climate changes with the effect of computable general equilibrium (CGE) models on Turkish economy at regional, national and global levels. Primarily, plant irrigation model developed for this study to notice the physical effects of climate changes was transformed for the efficient and irrigation requirements. Liberalization of its trade at the national level was investigated. The results show that the negative effects of climate change can be used by means of trade liberalization [6].

In his study entitled "Global Climate Change and Its possible Effects on Turkey", Öztürk examined global climate and climate changes. He determined the possible effects of climate changes occurring due to various reasons in the world especially in Turkey. Consequently, he announced that Turkey was among the countries to be mostly influenced by climate change; and from now on it will be mostly affected and will have major problems with the possibly happening climate changes which will without doubt occur [7].

In formation of greenhouse gases the leading cause of global warming and climate change, energy has 36%, the industry has 24%, forestry has 18%, agriculture has 9% and other resources have 3% shares [8]. It is indicated that the main reason of global warming is greenhouse gases; therefore, it is necessary that CO2, one of the most important greenhouse gases, emissions should be restricted [9].

In a study entitled "The Effect of Climate Change on Solar and Wind Power Potential", after the meteorological measurements belonging to Erzurum province were taken, climate parameters were evaluated; and it was observed that annual solar radiation intensity was 0.13%, sunshine duration was 0.01% and there was a 0.09 % decrease in wind speed [10].

In a study carried out by Bayraç, he indicates that the most important effect of global warming is greenhouse effect; and in order to prevent these effects, it is necessary that several incentives and precautions should be handled within the context of global corporations so that renewable, nuclear and hydrogen energy sources also can be evaluated [3].

In their study entitled "Energy Policies of International Energy Agency Countries Turkey 2001 Investigation", energy production and consumption of Turkey until 2020 was analyzed by Uğurlu and Örçen. In consequence of the study, it is predicted that in primary energy utilization, in the future, coal will come forefront, and oil, natural gas and hydro-power will run today's usage values; and then it will be possible to pass partly to renewable energy sources and nuclear energy. Ministries and related agencies and institutions report on what way and to what extent global warming and climate change will affect the country's energy sources and what kind of studies should be reinforced [11].

In the study entitled "Determination of the effects of Global Climate Changes on precipitation and temperature in Turkey", the effects of climate change on precipitation and temperatures in Turkey were investigated.

The reasons of global warming, and its possible effects on Turkey and studies conducted on the issue in both Turkey and in the world were summarized. Within the context of the Forth Assessment Report prepared in Intergovernmental Climate Change Panel in 2007, the predictions about Turkey were analyzed via Parametric Correlation Coefficient t-test and non-parametric Spearman's Rho test and Mann-Kendall Row correlation test. As a result, it was determined that global climate models of 1971-2000 period were significantly different from precipitation and temperature predictions in Turkey and observed precipitation and temperature values obtained from the Climate Research Unit (CRU).

Similarly, when the precipitation and temperature predictions of 2011 and 2100 period for future models were compared, it was determined that Turkey anticipates various changes in respect to precipitation and temperature [12].

In his study entitled "Global Climate Change problematic and Kyoto Protocol in Terms of Energy, Environment and Sustainable Development: Turkey Analysis" carried out by Ayhan, the attitudes of developed and developing countries and Turkey's towards the Kyoto Protocol signed abd carried out under the surveillance of United Nations and the positive and negative effects of this protocol on these countries were investigated. As a result, it was seen that the protocol was related to whether it will provide a benefit to the economies of these countries and that to be the supporter of this protocol would not make a threat to Turkey's development. If the policies that Turkey will follow within the protocol are applied accurately, it proves that it will contribute the country to decrease the external dependence in energy [13].

2. The Characteristics by Region Investigated

Batman Located in the Turkey's Southeastern Anatolia is a province with less inclination to be called up over the mountains uneven. Mediterranean climate and under the influence of the continental climate of the South East Anatolia region, the summers are long and quite warm through. The rainy and moderately cold winters occur. Rivers in the region are affecting the climate of the region. The average temperature is 30 ° C. The average annual rainfall is around 750 mm [14].

3. Results and Discussions

In this study, meteorological data about Batman province were obtained from State Meteorological Affairs Directorate belonging to the period from 1993 to 2014. Monthly mean values of temperature, cloudiness coefficient, wind speed and amount of precipitation of 22 years were evaluated by temporal functions simultaneously. Monthly total sunshine intensity data were examined by two different time series for 14 years during the periods of 1993-2007.

Monthly total temperature change according to the months in Batman province are given in Figure 3 and their percentile change ratios are given in Figure 4. In the figure, the only change towards positive has been seen in April. Changes belonging to the other months have occurred in negative ways.

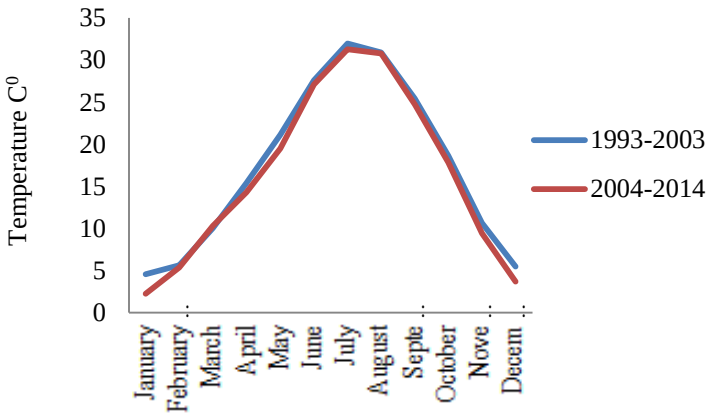

Figure 3. Change in Average Temperature according to Months for Batman Province

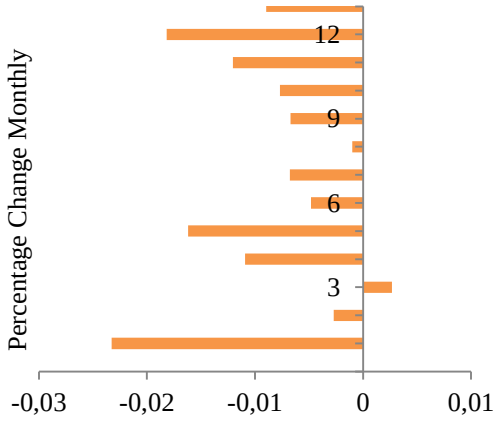

Figure 4. Percentile Temperature Change

Average monthly total cloudiness coefficient change according to Batman province is given in Figure 5, and percentile change rates are given in Figure 6. In the figure, the first change towards positive direction is seen in April. Besides, in the hot season, cloudiness rate increased in June, July, August, September and October, while, in the cold winter season, cloudiness rate was observed to decline.

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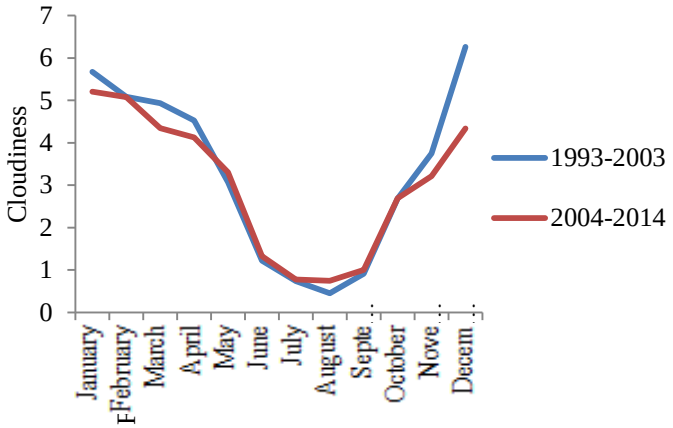

Figure 5. Average Monthly Cloudiness Change according to Months for Batman Province

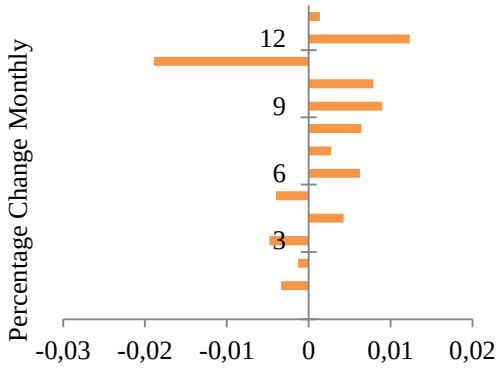

Figure 6. Percentile Cloudiness Change

Average monthly total average wind speed change according to the months in Batman province is given in Figure 7, and percentile change rates are given in Figure 8. In the figure, it is seen that there is a positive change between all months. Besides, this change showed the highest value in spring months. This highest value tends to decline towards winter months.

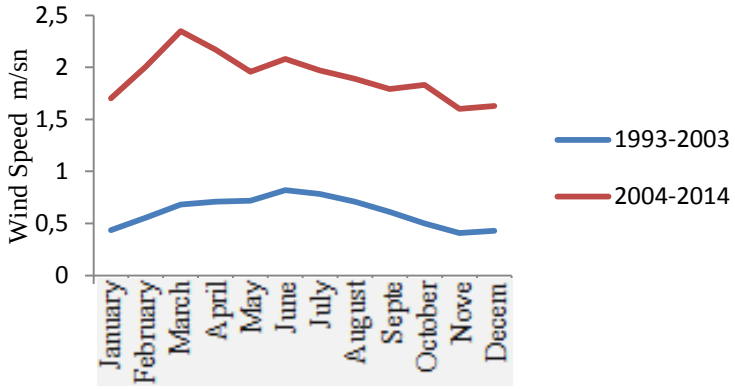

Figure 7. Average Monthly Wind Speed Changes according to Months for Batman Province

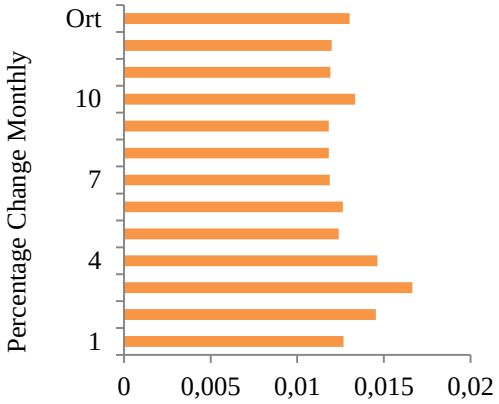

Figure 8. Percentile Wind Speed Changes

Average monthly total average radiation change according to the months in Batman province is given in Figure 9, and percentile change rates are given in Figure 10 In the figure, a positive change between all months is seen. This change shows the highest value in summer months, while it shows the lowest value in winter months.

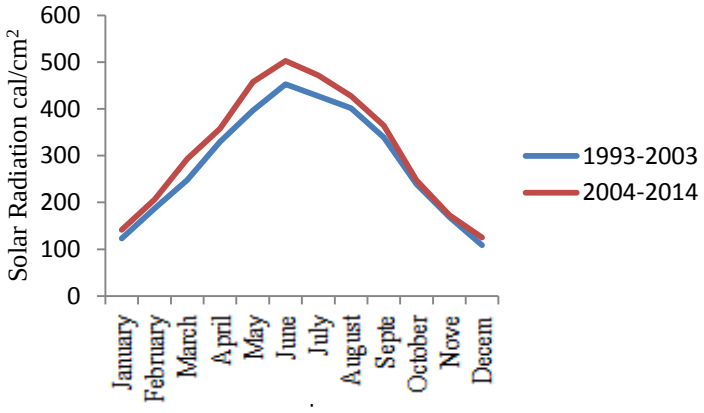

Figure 9. Average Monthly Total Radiation Changes according to Months for Batman Province

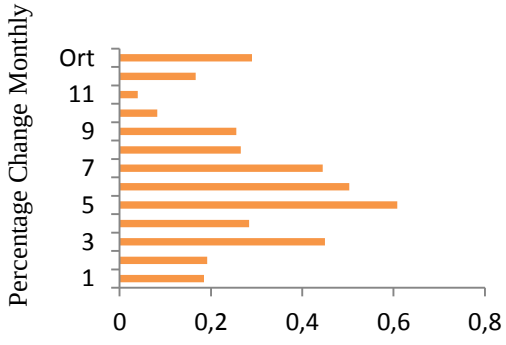

Figure 10. Percentile Radiation Intensity Changes

Average precipitation amount change according to the months in Batman province is given in Figure 11, and percentile change rates are given in Figure 12. In the figure, it is seen that there is a change in a negative direction in the spring months, while there is a clear change in other

months.

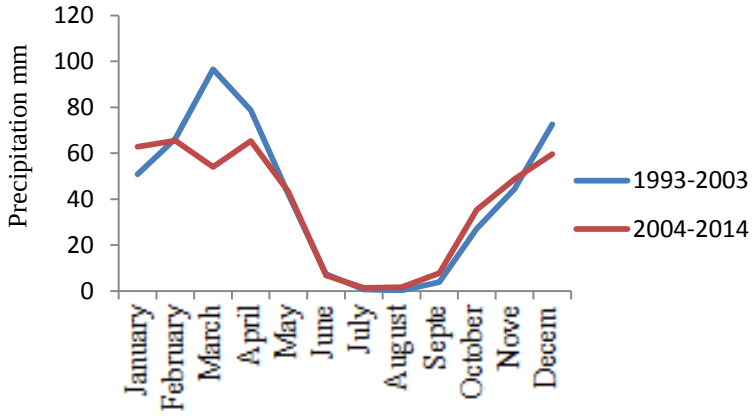

Figure 11. Average monthly precipitation changes according to the months in Batman Province

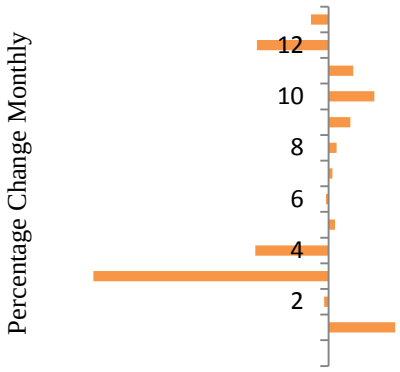

Figure 12. Percentile Precipitation Changes

4. Conclusion

After the evaluation of data belonging to Batman province, changes in averages of temperature, cloudiness, wind, radiation and precipitation amounts were computed and now are given in Table 1. When study field is investigated, monthly average temperature and monthly average precipitation show a change in a negative direction. When cloudiness rate, wind speed and radiation intensity are examined, other meteorological analyzed data display a change in a positive direction. When the analyses are examined, the improvement of temperature in the period is in the negative direction, though this can be considered positive in respect to drought; decrease in precipitation and increase in radiation are two important factors in drought increase.

Table 1. Change rates of Climate Data are belonging to Batman Province

Temperature Change in Average	-0,0089
Cloudiness Change in Average	0,0013
Wind Speed Change in Average	0,0130
Radiation Intensity in Average	0,2896
Precipitation Change in Average	-0,0317

There will be negative social and economic reflections of drought on natural ecosystems. Accordingly, there will be slowing down in national development, finding financing source will be difficult, there will be an increase in risk, new and supplementary water sources will become more expensive and there will be an increase in unemployment due to decrease in production and tax losses. In this case, there will be famine, poverty, and decline in life quality and internal immigration and social unrest. Famine is the most dangerous natural disaster in the world

because of its socioeconomic effects, persistency and difficulty in finding a solution.

Reduction in precipitation will hinder the most important economic incomes of the region that is the reductions in agricultural products and hydroelectric energy production. For this reason, it poses great importance that water basins and agricultural fields be protected. Furthermore, drought may lead to great troubles on the Tigris River flowing from west to east, passing through and then leaving the town, thus drought is clearer and a bigger challenge for the region.

When we examined the studies that the researchers conducted, it is estimated that this uncertainty will continue, although there appear some uncertainties in climate deteriorations and precautions against them are taken. One of the most important reasons of climate change stems from global warming resulting from greenhouse gas emissions in the atmosphere. Turkey is among the countries which are most affected by climate change. It is necessary that essential precautions should be taken in order to decrease the effects of global warming occurring as a result of the need for energy has increased. Climate change affects the nature and environment negatively. Increasing renewable energy sources poses great importance in order to obviate the climate change. Data belonging to the Batman province until 2014 are shown in tables. Dam construction in Batman province is still going on. When the dam is completed, we consider that climate change will display differences in the future. The present study carried out will shed the light of the future studies to be conducted by scientists.

Examples:

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