International Journal of Environmental Trends (IJENT)
http://dergipark.gov.tr/ijent
International Journal of Environmental Trends (IJENT)
2024; 8 (1),21-33
ISSN: 2602-4160
Turkish JournalPark ACADEMIC

Research Article

The Effects of Global Climate Change in Nevşehir

Serkan Şahinkaya
Nevşehir Hacı Bektaş Veli University, Department of Environmental Engineering, Nevşehir, Turkey
(*ORCID Number: 0000-0002-0176-4198*)

Abstract

As a result of human activities, the increase in greenhouse gases in the atmosphere has accelerated, especially in the last century. This increase has caused global climate change all over the world. In this study, an attempt was made to determine the effects of climate change by considering the temperature, relative humidity, precipitation, number of rainy days, minimum and average surface temperature and snow thickness data recorded in Nevşehir province, which is located in the arid-semi-arid climate zone, during the last 60 years. According to the results of the study, the minimum, average and maximum temperature values have increased as in the rest of the world. Relative humidity has decreased on average over long years. It was also found that minimum surface temperatures, which are important for agricultural activities, have also tended to increase. In line with these data, snowfall has also decreased. However, when averaged over long years, the amount of precipitation has increased. This occurred despite a decrease in the number of rainy days. It has been found that this increase in rainfall is due to an increase in rain intensity, which increases the risk of flooding. On the other hand, according to the projections made by the IPCC and the General Directorate of Meteorology of the Republic of Turkey, it is concluded that temperatures may increase in the near and distant future, but precipitation may decrease significantly. As a result, it has been found that the effects of global climate change are felt in different regions of the world as well as in Nevşehir province. It is therefore clear that no strategic plans have been made to minimise the impact of global climate change on agriculture, livestock, tourism and water resources, and that action should be taken before it is too late.

Received
17 May 2024

Accepted
13 June 2024

Keywords
Global warming
Climate changing
Greenhouse effect
Nevşehir

Küresel İklim Değişikliğinin Nevşehir'deki Etkileri

Özet

İnsan faaliyetleri sonucunda atmosferdeki sera gazlarının artışı özellikle son yüzyılda hızlandı. Bu artış tüm dünyada küresel iklim değişikliğine neden olmuştur. Bu çalışmada kurak-yarı kurak iklim kuşağında yer alan Nevşehir ilinde son 60 yıl boyunca kaydedilen sıcaklık, nispi nem, yağış, yağışlı gün sayısı, minimum ve ortalama yüzey sıcaklığı ve kar kalınlığı verileri dikkate alınarak iklim değişikliğinin etkileri belirlenmeye çalışılmıştır. Çalışma sonuçlarına göre, minimum, ortalama ve maksimum sıcaklık değerleri tüm dünyada olduğu gibi artış göstermiştir. Bağıl nem ise uzun yıllar boyunca ortalama olarak azalmıştır. Ayrıca tarımsal faaliyetler için önemli olan minimum yüzey sıcaklıklarının da artma eğiliminde olduğu tespit edilmiştir. Bu verilere paralel olarak kar yağışı da azalmıştır. Ancak uzun yılların ortalaması alındığında yağış miktarı artmıştır. Bu durum yağışlı gün sayısındaki azalmaya rağmen gerçekleşmiştir. Yağışlardaki bu artışın, sel riskini artıran yağmur şiddetindeki artıştan kaynaklandığı tespit edilmiştir. Öte yandan IPCC ve Türkiye

Anahtar Kelimeler
Küresel ısınma
İklim değişimi
Sera etkisi
Nevşehir

Cumhuriyeti Meteoroloji Genel Müdürlüğü tarafından yapılan projeksiyonlara göre yakın ve uzak gelecekte sıcaklıkların artabileceği, ancak yağışların önemli ölçüde azalabileceği sonucuna varılmıştır. Sonuç olarak, küresel iklim değişikliğinin etkilerinin Nevşehir ilinde olduğu gibi dünyanın farklı bölgelerinde de hissedildiği tespit edilmiştir. Bu nedenle küresel iklim değişikliğinin tarım, hayvancılık, turizm ve su kaynakları üzerindeki etkilerini en aza indirecek stratejik planların yapılmadığı ve çok geç olmadan harekete geçilmesi gerektiği açıktır.

International Journal of Environmental Trends, *8* (1), 21-33. DOI: not now possible

[1] Corresponding Author Email: serkansahinkaya@nevsehir.edu.tr

INTRODUCTION

Global climate change is the increase in average temperatures around the world as a result of the accumulation of greenhouse gases in the atmosphere [1]. Global climate change can be caused by human activities and natural processes [2]. However, the increase since the industrial revolution is due to human activities [1] such as energy production, industry, transport, agriculture and forestry. Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitroxide (N_2O), hydrofluoro carbons (HFCs), perfluoro carbons (PFCs) and sulfur hexafluoride (SF_6) [3]. These greenhouse gases trap some of the sun's radiation in the atmosphere and reflect it back to the Earth's surface. This causes the average temperature of the Earth to rise, leading to global warming and climate change. The increase in greenhouse gas emissions into the atmosphere is linked to industrial activities and the use of fossil fuels, particularly in developed and developing countries (Figures 1 and 2) [4, 5].

Figure 1 shows the sectoral distribution of greenhouse gas emissions produced in Turkey between 1990 and 2016 in terms of CO_2 equivalents. As can be seen from Figure 1, greenhouse gas emissions in Turkey, a developing country, have been increasing year by year. The main source of emissions produced in Turkey is energy production. This is due to the fact that Turkey relies mainly on fossil fuels such as coal and natural gas for energy production. The second major source of emissions is industrial activities. In terms of GHG emissions, Turkey is a typical example of a developing country. Figure 2 compares the CO_2 emissions of countries on a global scale. As can be seen from Figure 2, developed and developing countries are responsible for almost all man-made CO_2 emissions as a result of their energy production, industrial activities, transport, agriculture, etc. Figure 3 shows the increase in global CO_2 emissions from fossil fuel use and industry between 1850 and 2022. This figure shows how dramatic the increase in anthropogenic CO_2 emissions has been since the Industrial Revolution. Related to all these issues, Figure 4 shows the low, mean and high temperature anomaly of land and sea temperatures in 2024 compared to 1850. It shows that the temperature on the Earth's surface increased by about 1.09 ºC in the years 2011-2020 compared to the years 1850-1900. The temperature of the oceans will increase by 0.88 ºC. This increase is due to the release of greenhouse gases as a result of human activities. And it is this increase of only 1.09 ºC that is the main reason for the anomalies we are seeing in weather events today.

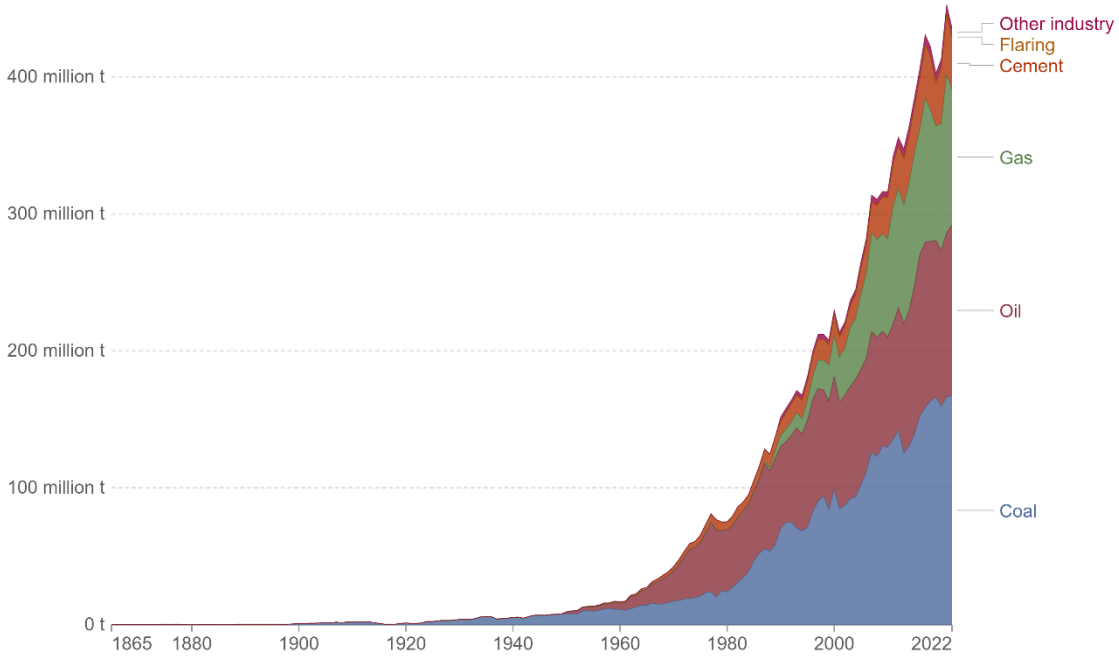

Figure 1. Total greenhouse gase emissions by sectors in Turkey (measured in tonnes of carbon dioxide equvalents) [4].

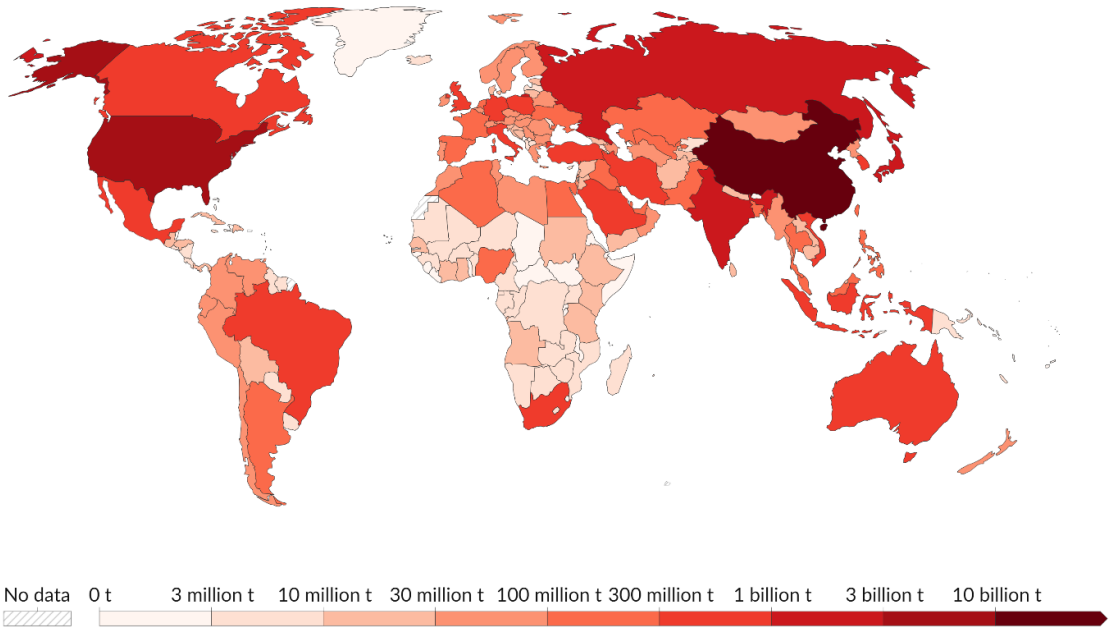

Figure 2. Carbon dioxide (CO_2) emissions from fossil fuels and industry in 2022 (land-use change is not included) [5].

Figure 3. Carbon dioxide (CO_2) emissions from fossil fuels and industry in the World [6].

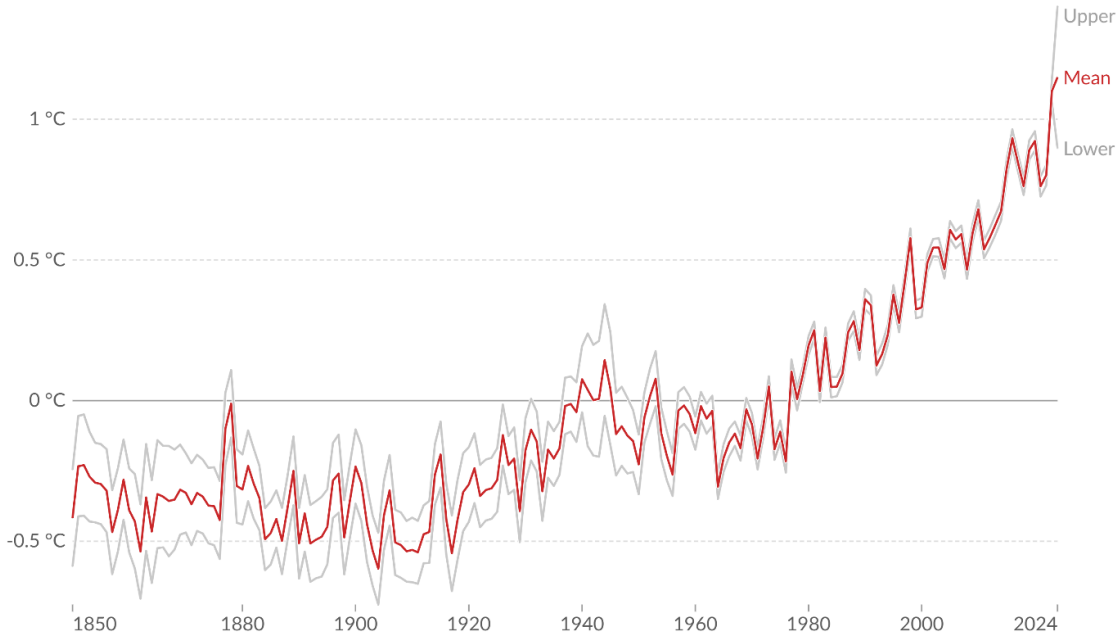

Figure 4. Global average temperature anomaly [7].

The effects of human-induced global climate change have been increasingly felt around the world over the last century [1]. Rising temperatures, shifting climatic zones, changing precipitation patterns, melting glaciers, rising sea levels, extinction of some species and more extreme weather events are some of these impacts [8]. Loss of productivity in the agricultural and livestock sectors, reduction and disappearance of surface water resources, extraction of groundwater to deeper depths, deforestation, extinction of some species and decrease in biodiversity, damage to the ecosystem and extreme weather events such as heavy rainfall, severe storms and droughts can be given as examples of these impacts. In a given region, all or some of these impacts may occur together. In addition to these impacts, climate change also has negative effects on human health. Global climate change can also facilitate the spread of epidemic diseases. It also has a significant impact on the demographic,

economic and social structure through migration movements. In recent years, Turkey has been exposed to a number of extreme weather events caused by climate change. Some of these are listed below:

- Extreme heat waves: Extreme heat waves, which are common during the summer months, especially in the interior and southern regions of Anatolia, have a negative impact on tourism, agriculture and livestock. High temperatures can also pose a risk to human health.
- Heavy rainfall and flooding: Heavy rainfall, especially in winter and spring, causes flooding and inundation. This can cause damage to infrastructure and agricultural land, as well as loss of life and property.
- Drought: Drought is a common problem, especially in Central Anatolia and Southeast Anatolia, where Nevşehir is located. Decreasing rainfall and rising temperatures cause water stress in agricultural areas, reducing water resources and making it difficult to combat drought.
- Storms and cyclones: Severe storms and cyclones may occur from time to time in coastal and inland areas. This situation can particularly affect coastal structures and agricultural areas.
- Scorching hot winds: Occasional hot winds in some regions may increase the risk of forest fires and affect human health.

In order to mitigate and adapt to the effects of climate change, the Government of the Republic of Turkey has developed various policies and projects. These include diversifying and increasing renewable energy sources, improving energy efficiency, water conservation and forestry projects, and measures to reduce greenhouse gas emissions. In addition, steps are being taken to address climate change in the agricultural sector, such as improving irrigation systems and developing drought management strategies. In Turkey, several steps have been taken to combat climate change. These include Climate Change Action Plan [9] and Climate Change Adaptation Strategy and Action Plan [10], investments in renewable energy, forestry and reforestation projects, energy efficiency policies, and climate change research and information sharing.

The aim of this study was to determine the effects of global climate change in Nevşehir province. Therefore, within the framework of the study, the minimum, average and maximum temperature, minimum and average surface temperature, relative humidity, precipitation, number of rainy days and snow thickness data recorded in Nevşehir Province during the last 60 years were analysed in the context of global climate change. In addition, the risks that may be caused by the changes in these parameters in different sectors in the future are also mentioned.

MATERIAL AND METHOD

The city of Nevşehir is located in the Central Anatolian region of Turkey between 38° 12' and 39° 20' north latitude and 34° 11' and 35° 06' east longitude. The city is located in the Cappadocia region, which is known for its historical and natural beauties. The centre of the province is also called Nevsehir. The area of Nevsehir is approximately 5500 km² and with a population of 315994 inhabitants, it is one of the medium-sized provinces of Turkey. Nevşehir has an arid-semi-arid climate. Winters are cold and rainy and summers are hot and dry. However, the special geographical structure of Cappadocia is one of the factors that influence the climate of the province. The economy of Nevşehir is based on sectors such as agriculture, livestock, tourism and mining. Agricultural products include wheat, barley, grapes, potatoes, garlic, apples and vegetables. Natural grasslands and pastures throughout the province provide a suitable environment for small ruminants such as sheep. These aspects make agriculture and livestock farming a serious source of income for rural areas. Nevşehir also attracts attention with its historical and cultural heritage. Due to the unique geographical structure and historical richness of Cappadocia, tourism plays a very important role in the province's economy. Historical settlements, underground cities, churches and fairy chimneys in the Cappadocia region are included in the UNESCO World Heritage List. In addition, historical buildings and museums in the province also attract the attention of visitors. The effects of global climate change and the risks it poses should be taken into account.

The climatic data used in the study are minimum, average and maximum temperature, above-ground minimum and average minimum temperature, relative humidity, precipitation, number of rainy days and snow depth. The data were recorded by the climate stations in Nevşehir city centre. These data were obtained from Nevşehir Meteorological Directorate and their scientific evaluation was carried out.

RESULT AND DISCUSSION

The study first analysed the long-term average of measured temperature values between 1959 and 2023 and the long-term averages of monthly maximum and minimum values recorded in the measurements. The graphs of these data are shown in Figures 5, 6 and 7. In these graphs it can be seen that there is an increase in both the average temperature value and the measured minimum and maximum temperature values as an average of many years. These results recorded in Nevşehir province are consistent with the data shown in Figures 1, 2, 3 and 4. In other words, the average temperature increase caused by the increase in greenhouse gas emissions at the global level is also being experienced in Nevşehir. In order to prevent the temperature increase, greenhouse gas emissions must be controlled on a global scale. If greenhouse gas emissions continue to increase, the temperature will inevitably rise even more. On the other hand, according to various projections in the IPCC Sixth Assessment Report (published in 2022) [11], there will be an increase of about 1.5-2°C by 2050 and 2-4°C by 2100 in the near future. Similarly, according to the projections made by the General Directorate of Meteorology of the Republic of Turkey with the dynamic downscaling method of the regional climate model RegCM4.3.4 according to the RCP4.5 scenario from the GFDL-ESM2M global climate model data of the General Directorate of Meteorology, Turkey is expected to experience an increase of up to 2 ºC between 2016 and 2040, between 2 - 5 ºC between 2041 and 2070 and between 2071 and 2099 [12]. According to the projections made by the General Directorate of Meteorology with the dynamic downscaling method of the regional climate model RegCM4.3.4 according to the RCP8.5 scenario from the GFDL-ESM2M global climate model data of the General Directorate of Meteorology, Turkey is expected to experience an increase of about 1-1.5 ºC between 2016-2040, 2-3 ºC between 2041-2070 and more than 5 ºC between 2071-2099 [12]. According to the projections of the IPCC and the General Directorate of Meteorology, it is clear that these temperature increases will occur if greenhouse gas emissions are not reduced on a global scale. But how prepared are Turkey and Nevşehir for such a temperature rise? As temperatures continue to rise, Nevşehir, like Turkey as a whole, may experience a decrease in water resources, an increase in erosion, a decrease in agricultural yields, a decrease in livestock productivity, a decrease in outdoor work productivity, and extreme weather events. In addition, the impact of rising temperatures on tourism should be studied in detail. Because the increase in temperature may cause a change in the seasonality of tourism, stress and health problems among tourists, outdoor activities such as horse riding, atv tours, and a decrease in demand for alternative tourism areas such as nature tourism and ecotourism. Another important issue is the need for drinking and potable water throughout the season for tourist facilities, and the intensive energy demands of infrastructure facilities, especially for cooling.

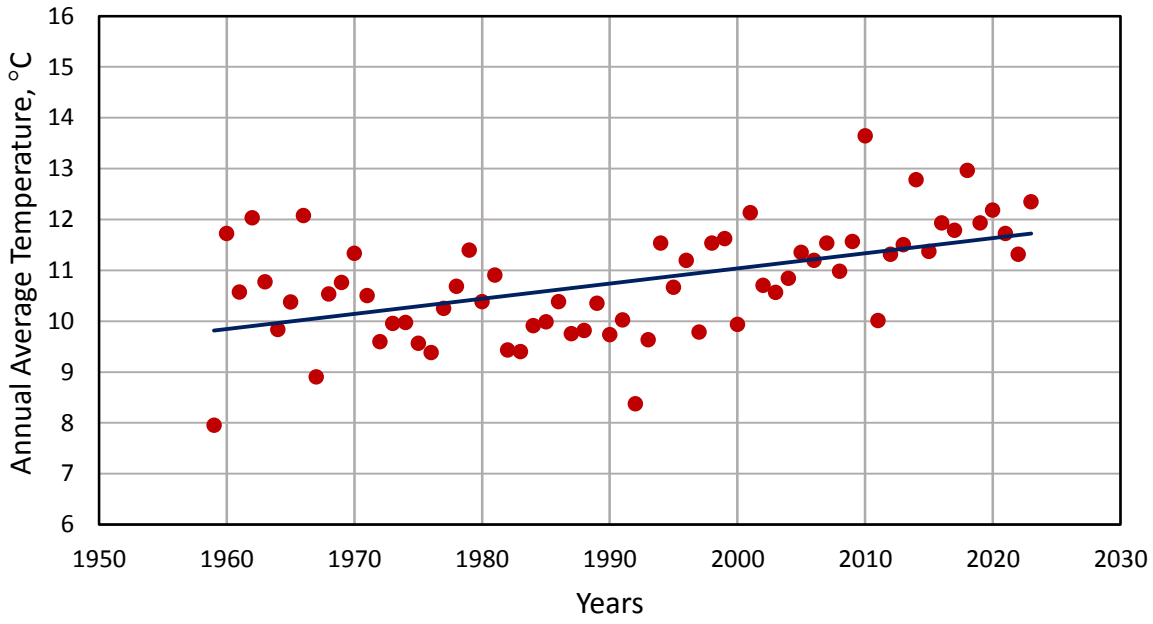

Figure 5. Change of the average annual temperature over the years.

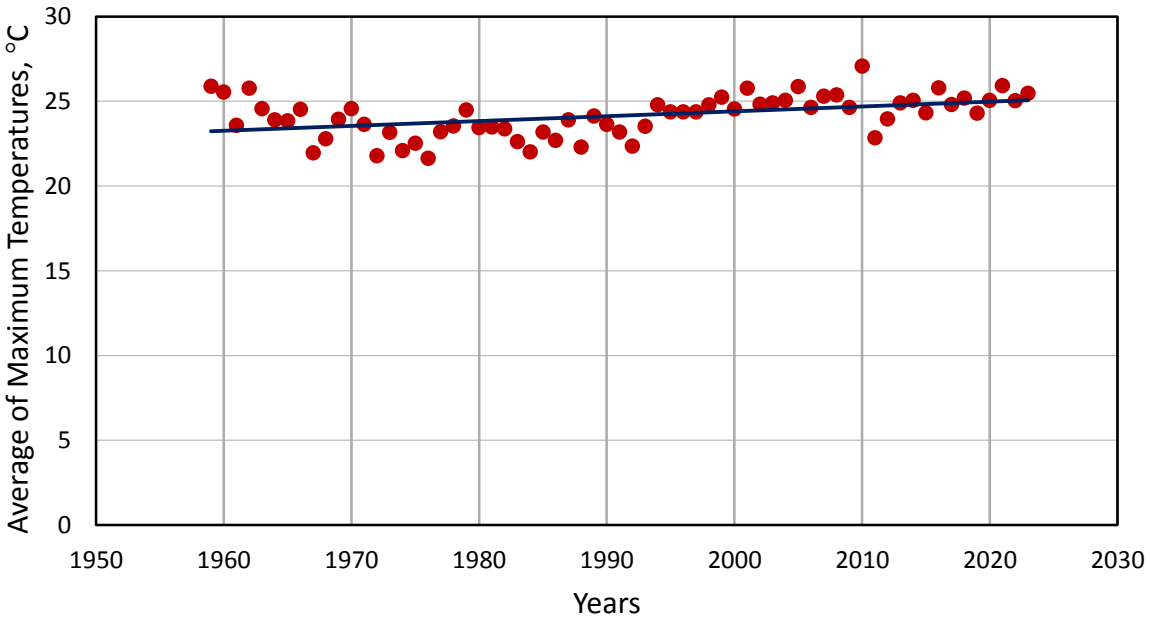

Figure 6. Change of the average annual maximum temperature over the years.

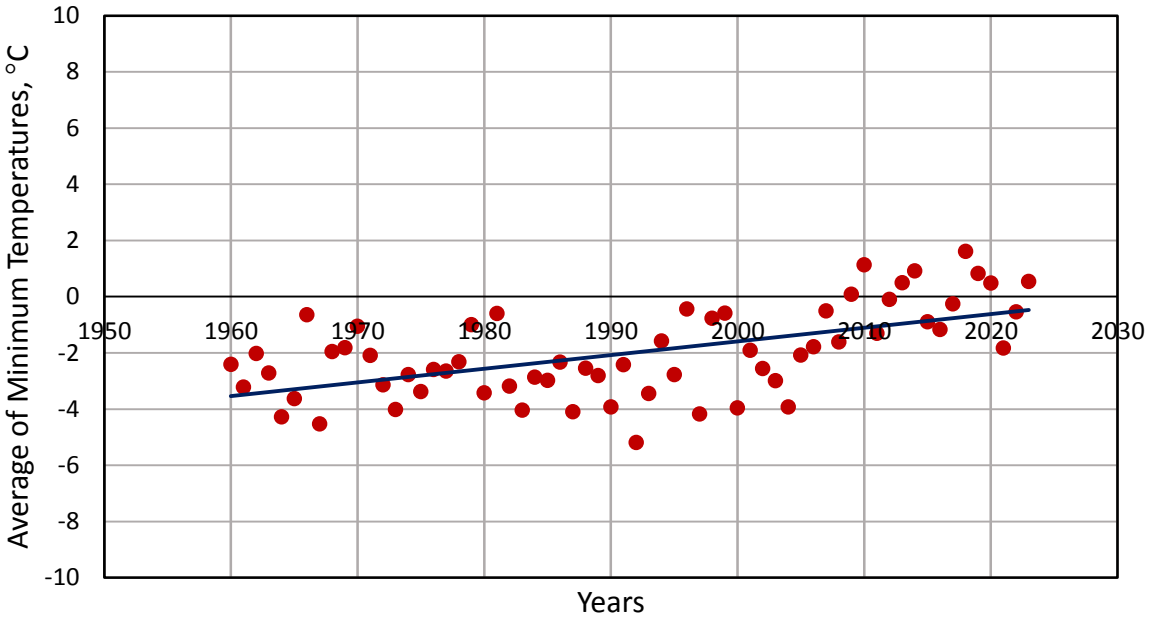

Figure 7. Change of the average annual minimum temperature over the years.

The accumulation of greenhouse gases in the atmosphere causes temperatures to rise. Another consequence of rising temperatures is a change in the amount of water vapour in the atmosphere. Relative humidity, which depends on factors such as temperature and pressure, is the ratio of water vapour in the atmosphere to the available water vapour capacity. In other words, climate change affects relative humidity by affecting the amount of water vapour in the atmosphere as temperature increases. This effect of climate change varies regionally. As shown in Figure 8, the relative humidity value in Nevşehir has a decreasing trend between 1960 and 2023. This situation will increase its effect with the increase in temperature, especially in arid or semi-arid regions in the interior of Turkey. On the other hand, in humid regions such as coastal regions, an increase in relative humidity is observed as more water vapour is retained in the atmosphere with the effect of increasing temperature and evaporation. The importance of relative humidity is that it also affects precipitation regimes with the effect of global climate change. With this effect of climate change, while some regions will receive more precipitation, other regions will experience drought and water scarcity. This increase in average temperature and relative humidity will also reduce soil moisture by affecting the type, amount and pattern of

precipitation. The consequences of the change in relative humidity will inevitably lead to a reduction in rainfall, a decrease in water resources, an increase in soil erosion and a loss in agricultural and livestock yields.

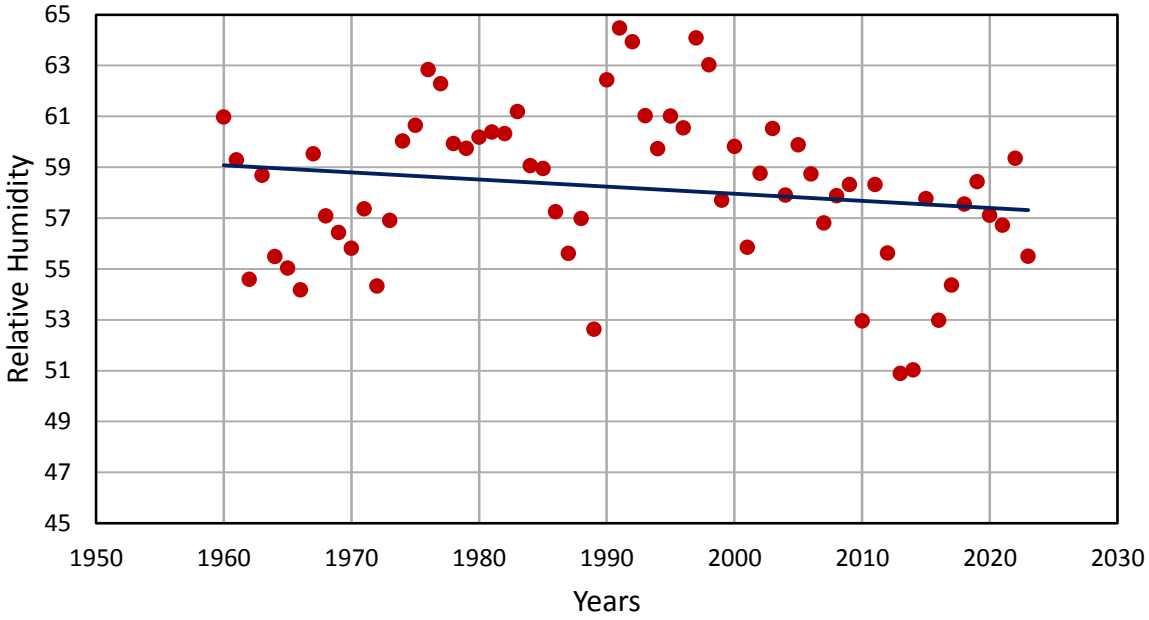

Figure 8. Changes in annual relative humidity over the years.

Climate change has complex effects on the type, pattern, amount and intensity of precipitation. The effects of climate change on precipitation are due to the effects on the hydrological cycle as a result of the effects on temperature and relative humidity. Figure 8 shows that the relative humidity in Nevşehir has decreased. Figure 9 shows the total annual precipitation and the long-term average of these data. Analysing Figure 9, it can be seen that although the amount of precipitation in Nevşehir between 1959 and 2023 fluctuates from year to year, the total amount of precipitation tends to increase. However, the analysis of Figure 10 shows that the number of monthly rainy days tends to decrease over time between 1959 and 2023. All these results show that the increasing amount of precipitation is not generalised and, considering the decreasing number of precipitation events, it is concluded that the intensity of precipitation also tends to increase. Figure 11 shows the increase in precipitation intensity. For these reasons, the increase in precipitation intensity in Nevşehir in the coming years as a result of global warming will cause flooding and inundation problems as extreme weather events. These disasters, such as floods and inundations, will not only cause direct losses such as damage to agricultural land and infrastructure facilities, but will also lead to a decrease in income from agriculture, livestock and tourism, which are the main sources of income for the town, and an increase in insurance costs. In the long term, these problems may even lead to a fall in the price of damaged and/or unproductive land, agricultural warehouses, buildings and tourist facilities. For this reason, measures such as flood management plans, strengthening infrastructure systems, rain harvesting, reviewing tourism facilities for possible flooding and flooding are important. On the other hand, Figure 12 shows the average monthly rainfall based on the data between 1959 and 2023. According to this graph, Nevşehir receives the most rainfall in May and April. This result shows that the month of May receives very heavy rainfall, defined in the range of 51 - 75 mm. On the other hand, except for the summer months, which is the dry season, the months of January, February, March, April, October, November and December were found to receive heavy rainfall defined in the range of 21 - 50 mm. According to the projections of the dynamic downscaling method of the regional climate model RegCM4.3.4 according to the RCP4.5 scenario from the data of the global climate model GFDL-ESM2M carried out by the General Directorate of Meteorology, it has been determined that there may be a partial increase in precipitation in the spring and winter months and a decrease in precipitation in the summer and autumn months in Nevşehir by 2040 [12]. Between 2041 and 2070, precipitation may increase by up to 10% in winter months, decrease by up to 10% in autumn months, decrease by up to 20% in spring months and decrease by about 30% in summer months [12]. Between 2071 and 2099, precipitation may increase by up to 10% in winter months, decrease by up to 20% in autumn and spring months, and decrease by about 20% in summer months [12]. According to the projections of the dynamic downscaling method of the regional climate model RegCM4.3.4 according to the RCP8.5 scenario of the global climate model GFDL-ESM2M of the General Directorate of Meteorology, there could be a decrease of up to 30% between 2016 and 2040, a decrease of up to 40% between 2041 and 2070 and a decrease of up to 50% between 2071 and 2099 [12]. According to these projections, it is necessary to prepare plans and

projects such as water resources planning, water conservation, reuse of treated wastewater, reuse of water in industry, rain harvesting, revision of treatment facilities for both human use and agriculture, livestock and tourism sectors against the possibility of water stress and drought for the near and distant future in Nevşehir.

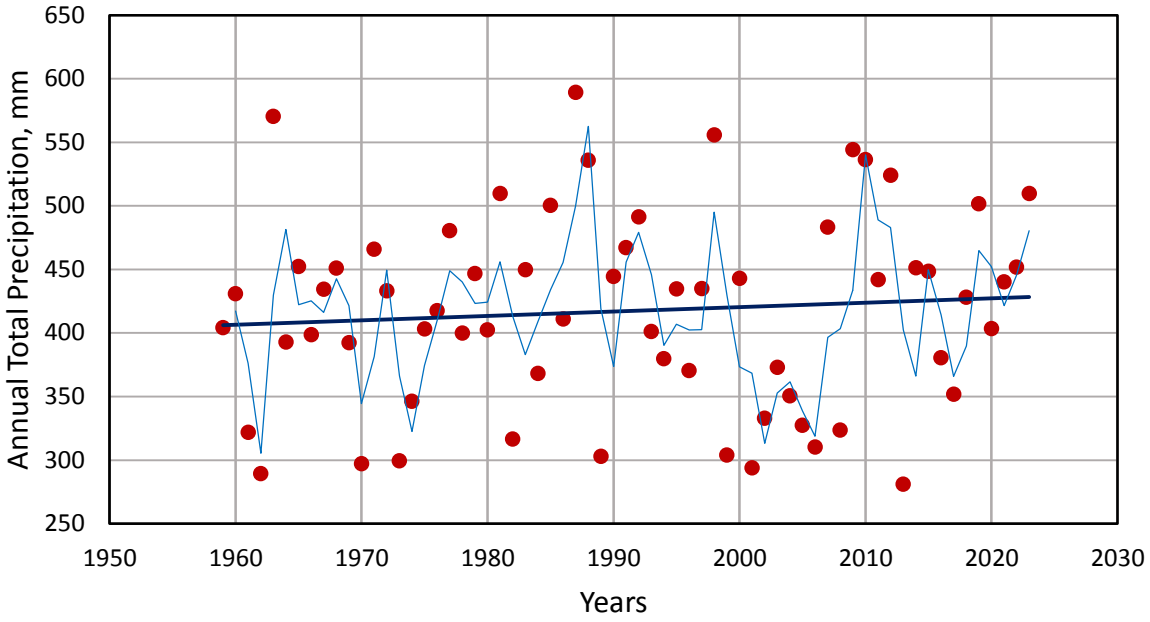

Figure 9. Annual total rainfall amounts between 1959 - 2023.

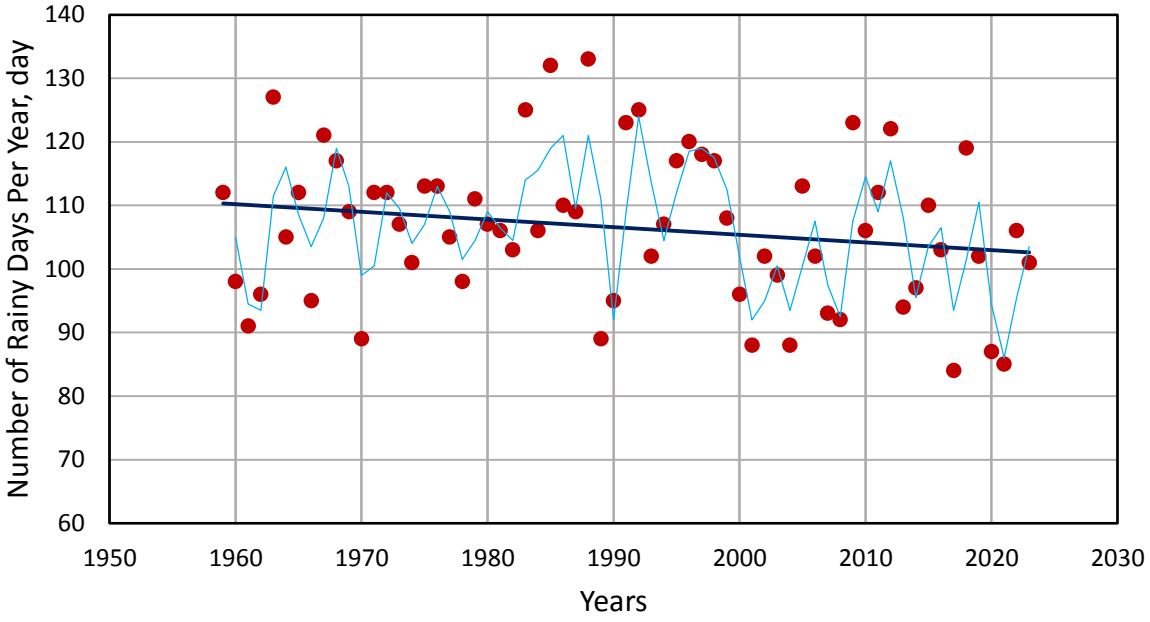

Figure 10. The number of rainy days per year.

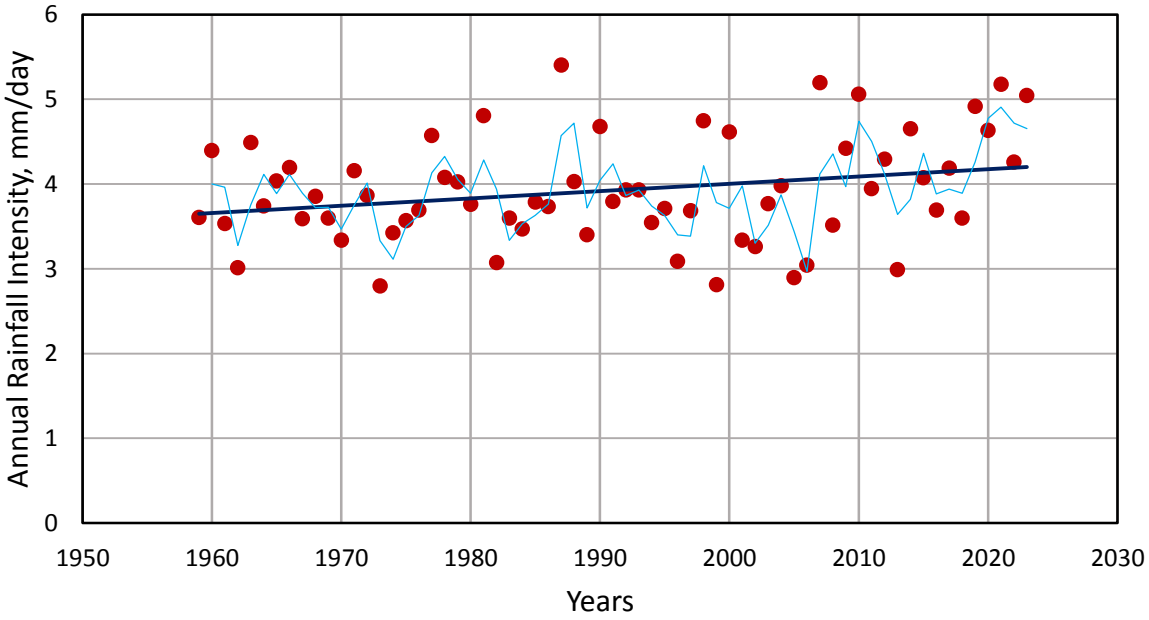

Figure 11. Change in the annual rainfal intensity (mm/day).

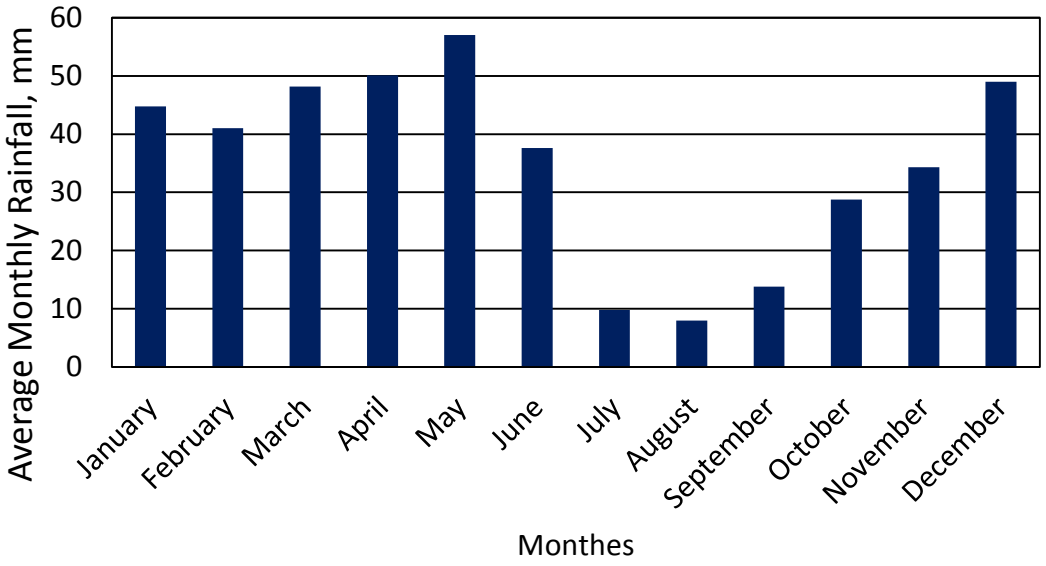

Figure 12. Change in average monthly rainfall amounts (mm) between 1959-2023.

Similar to the above results, Figures 13 and 14 show the variation in above ground temperature values. Figure 13 shows the averages of the minimum values measured above ground. Figure 14 shows the minimum values measured each month between 1961 and 2016. In both graphs it can be seen that there is an increase in the instantaneous minimum and average minimum temperature above ground. The reasons for this result are: population growth in Nevşehir, increase in energy consumption in the city, increase in industrial activities, expansion of heat absorbing and emitting surfaces such as concrete and asphalt, relatively limited area of green spaces in the city and urban heat island effect compared to rural areas. Possible consequences of the increase in above-ground temperatures may be decrease in air quality in the city, decrease in efficiency of agricultural production, decrease in water resources and economic losses in animal husbandry due to these reasons.

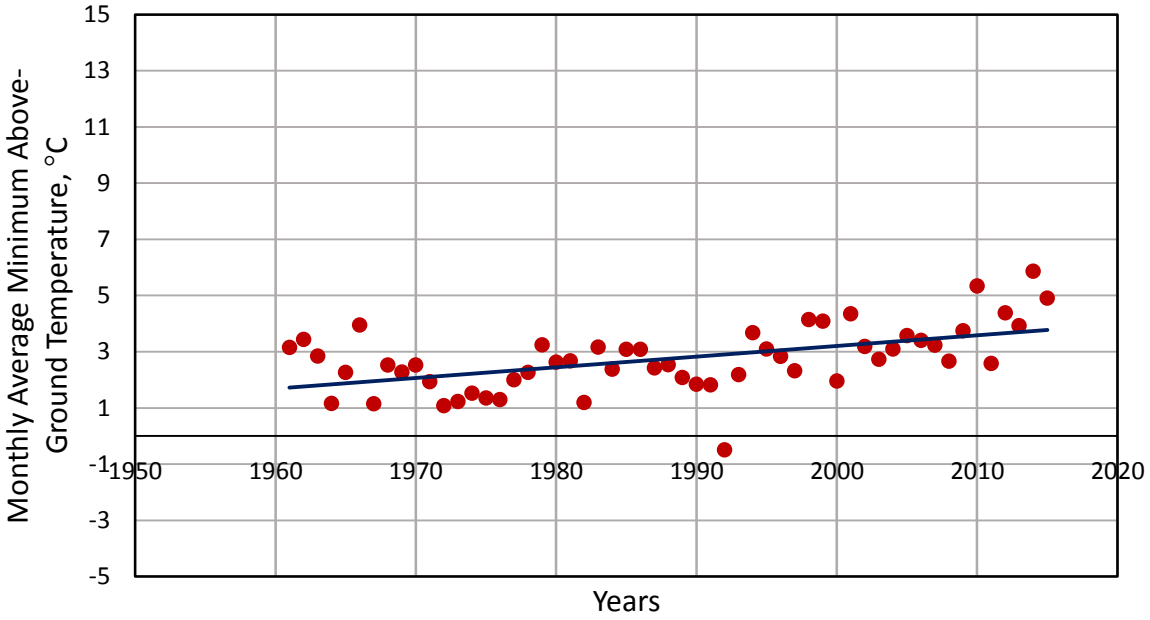

Figure 13. The annual average of the above-ground minimum temperature.

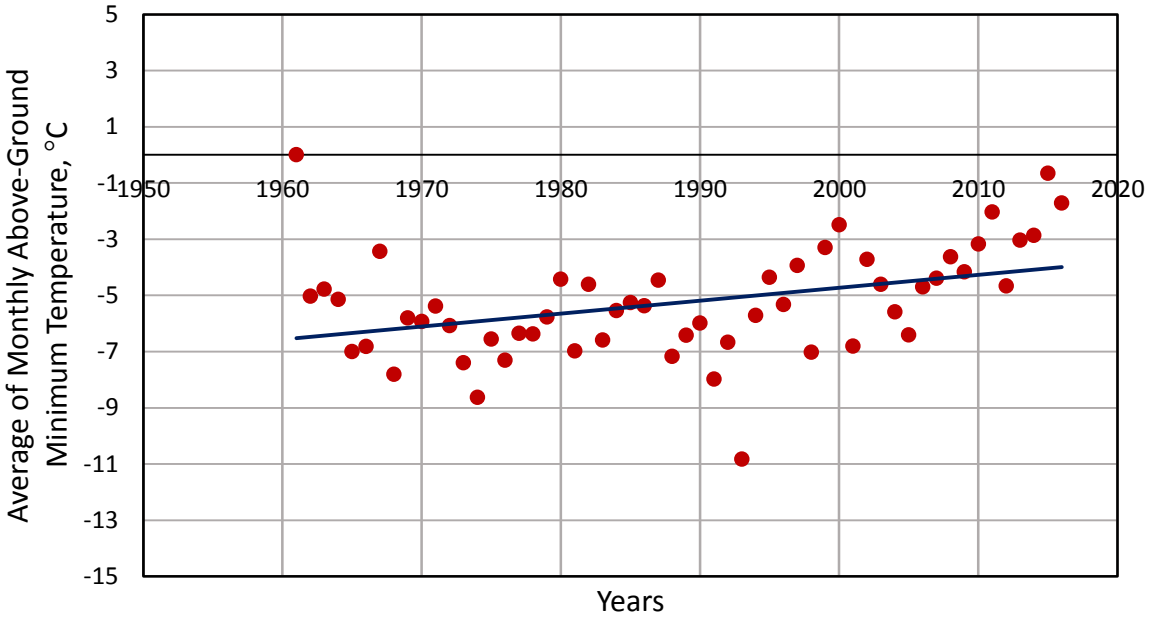

Figure 14. The annual average of the above-ground minimum temperature.

As explained in the previous sections, climate change due to the accumulation of greenhouse gases in the atmosphere causes the average temperature to rise. In this case, it affects snowfall and snow thickness. Figure 15 shows the annual averages of maximum monthly snow depth between 1960 and 2018. As can be seen from this figure, the thickness of the snow falling in Nevşehir, i.e. the snowfall, tends to decrease. The reason for this is that the type of precipitation, the amount and the intensity of snowfall decrease as the average temperature increases. In addition, the snow melts faster as the air temperature rises. On the other hand, this changing situation will lead to a decrease in groundwater and surface water resources in Nevşehir and a decrease in agricultural production efficiency. As a result of the gradual depletion of groundwater and the fact that more and more water is being abstracted each year as the population grows, the existing drinking water treatment facilities may become inadequate over time. These impacts of climate change need to be studied separately for Nevşehir.

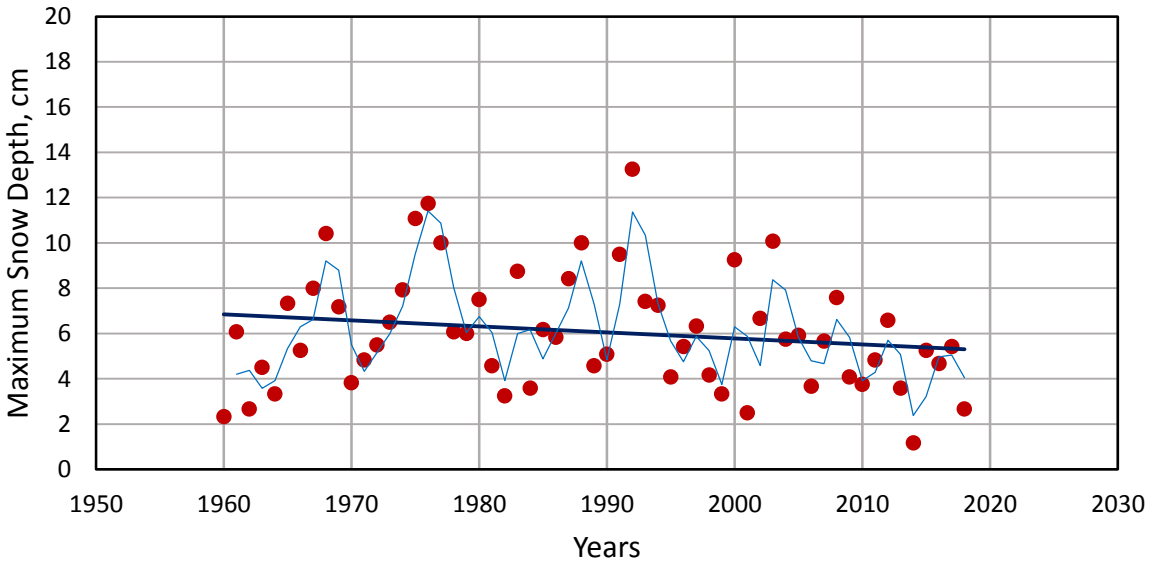

Figure 15. Change in the average of monthly measured maximum snow thickness values.

CONCLUSION

This study for Nevşehir province attempted to determine the effects of climate change on temperature and precipitation using data from the last 60 years. As a result of the study, it was found that the annual minimum, average and maximum temperatures tended to increase. It was found that this increase in air temperature is reflected as an increase in minimum surface temperatures. Furthermore, according to the projections of the IPCC and the General Directorate of Meteorology of the Republic of Turkey, the temperature increase will reach critical levels in the near and distant future. It was found that the relative humidity in Nevşehir is decreasing. However, despite the decrease in the number of rainy days in Nevşehir, the total annual rainfall rain has increased. This result, considering the long-term averages, leads to an increase in the intensity of precipitation from year to year. Finally, the measured monthly maximum snow depths were also found to be thinner when long-term averages were analysed. In conclusion, considering the temperature, humidity, precipitation and snow thickness data, it is clear that global climate change is also being experienced in Nevşehir province, which is located in a semi-arid climate zone. Furthermore, according to the projections of the IPCC and the General Directorate of Meteorology of the Republic of Turkey, rainfall is expected to decrease by 20% in the near future and by 50% in the distant future. For these reasons, some of the measures that can be taken in Nevşehir Province in order to be less affected by global climate change, apart from measures to reduce emissions, are as follows;

- Protecting water resources,
- Rainwater harvesting,
- Flood planning,
- Wastewater reuse,
- Reuse of grey water,
- Water conservation in industrial plants,
- Reducing losses and leaks in the city's water network,
- Implementation of integrated water management taking into account the phenomenon of climate change,
- Development of sustainable agriculture and livestock farming,
- Water planning in agriculture,
- Water and crop management planning in agriculture,
- Identifying the impact of climate change on agricultural products produced from traditional seeds,
- Development of pastures for livestock farming,
- Land consolidation for agriculture,
- Preventing illegal use of groundwater,
- Developing erosion control and monitoring projects,
- Making disaster management plans such as drought and flood,

- Developing plans against forest fires,
- Giving priority to renewable energy sources,
- Strengthening energy infrastructure,
- Improving public transportation to reduce greenhouse gas emissions,
- Monitoring the impact of climate change on the ecosystem,
- Implementing sustainable resource and waste management,
- Avoiding overtourism,
- Assessing alternative tourism options,
- Developing and implementing climate change adaptation strategies in the tourism,
- Expansion of forest areas,
- Expansion of green areas with trees that consume less water in accordance with the soil structure of the region,
- Planting alternative species in green areas instead of plants such as grass that consume a lot of water,
- Continuous monitoring of the impact of climate change on the above-mentioned sectors.

ACKNOWLEDGMENT

The author would like to thank the Nevsehir Meteorological Directorate of the Republic of Turkey for sharing climate data.

REFERENCES

[1] Kadıoğlu, M. Bildiğiniz Havaların Sonu: Küresel İklim Değişimi ve Türkiye. Güncel Yayıncılık, İstanbul, 2001.
[2] Kadıoglu, M. 99 sayfada Küresel İklim Değişimi. İş Bankası Kültür Yayınları, İstanbul, 2007.
[3] Şahin, G., Onurbaş Avcıoğlu, A. Greenhouse Gases and Carbon Footprint in Agricultural Production. Journal of Agricultural Machinery Science, 2016, 12 (3), 157-162.
[4] Global Carbon Budget (2023) – with major processing by Our World in Data. "Cement – GCB". Global Carbon Project, "Global Carbon Budget".
[5] Ritchie, H., Rosado, P. and Roser, M. (2023) - "Per capita, national, historical: how do countries compare on CO2 metrics?" Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2-emissions-metrics [Online Resource, available at 17.05.2024].
[6] Ritchie, H. and Roser, M. (2020) - "CO_2 emissions" Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2-emissions [Online Resource, available at 17.05.2024].
[7] Met Office Hadley Centre (2023) – processed by Our World in Data. "Lower" [dataset]. Met Office Hadley Centre, "HadCRUT5 HadCRUT.5.0.2.0" Retrieved from: https://ourworldindata.org/co2-and-greenhouse-gas-emissions [Online Resource, available at 17.05.2024].
[8] IPCC, 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.
[9] T.R. Ministry of Environment and Urbanization, General Directory of Environmental Management, Clımate Change Actıon Plan, Retrieved from: https://webdosya.csb.gov.tr/db/iklim/editordosya/file/eylem%20planlari/iklim_degisikligi_eylem_plani_EN_2014.pdf [Online Resource, available at 17.05.2024].
[10] T.R. Ministry of Environment and Urbanization, General Directory of Environmental Management, Adaptation Strategy and Action Plan, Retrieved from: https://webdosya.csb.gov.tr/db/iklim/editordosya/file/eylem%20planlari/uyum_stratejisi_eylem_plani_EN_Final.pdf [Online Resource, available at 17.05.2024].
[11] IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.
[12] T.R. Meteoroloji Genel Müdürlüğü, Yeni Senaryolar İle Türkiye İklim Projeksiyonları Ve İklim Değişikliği, Akçakaya, A., Sümer, U.M., Demircan, M., Demir, Ö., Atay, H., Eskioğlu, O., Gürkan, H., Yazıcı , B., Kocatürk, A., Şensoy, S., Bölük, E., Arabacı, H., Açar, Y., Ekici, M., Yağan, S., Çukurçayır, F. Meteoroloji Genel Müdürlüğü Matbaası, Ankara, 2015. Retrieved from: https://www.mgm.gov.tr/files/iklim/iklim-degisikligi-projeksiyon2015.pdf [Online Resource, available at 17.05.2024].