



Review on impacts of climate change on water resources in Turkey

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Abstract

Climate change has an impact on precipitation and temperature. The geographical availability of water resources is significantly impacted by these changes. Due to its location in the Mediterranean Basin, Turkey is expected to suffer greatly from the negative consequences of climate change, notably in terms of its water supplies. examine the climate change situation in Turkey, the impact of Turkey's greenhouse gas emissions on temperature and precipitation, the possible impact of climate change on water resources, and the impacts of sea level rise and floods. examples from the nation and strategies for adjusting to the effects of climate change.

Introduction

According to the Intergovernmental Panel on Climate Change Assessment Report [1], there is evidence that human activity is primarily to blame for the majority of the warming that has been recorded over the past 50 years. The 21st century is likely to see more climate change due to the anticipated accumulation of greenhouse gases in the atmosphere. Furthermore, global warming is expected to have a significant impact on river basin hydrology and water resources. Because temperature determines the fraction of precipitation that falls as snow and the timing of snowmelt, basins with a high proportion of runoff driven by snowmelt will be especially vulnerable to global warming. Few individual and regional research on the effects of climate change on Turkey's water resources have been published. The broader picture of the situation in Turkey, however, had not before been looked at in the literature. As a result, the purpose of this article is to examine, using prior studies in the field, how climate change is affecting Turkey's water resources on a national scale.

Material and Method

Greenhouse gas emissions in Turkey

Between 1990 and 2008, Turkey's total greenhouse gas emissions increased steadily. The 2008 emissions (365.5 million tons) were 96.0% (nearly double) higher than the 1990 emissions (187.03 million tons). By 2008, the emissions from the energy sector accounted for 75.8% of total emissions, waste disposal accounted for 9.3%, and industrial processes accounted for 8.1% of total emissions. Land use and land use change, as well as forestry, which serve as carbon dioxide sinks, should be considered in greenhouse gas emissions. The steady increase in greenhouse gases from 1990 to 2008 was primarily due to changes in the energy sector and industrial processes [2].

Effects of climate change on temperature and precipitation

Climate change has an impact on water availability, as well as its quality and distribution. Changes in runoff and the source of a region's renewable water supply are the direct result of temperature-driven changes in precipitation and evaporation. Because of the presence of several climatic regions, Turkey can be considered a country that is extremely vulnerable to the effects of climate change. However, for a relatively large country with a diverse climate like Turkey, it is important to consider local conditions rather than the entire country. Desertification threatens arid and semi-arid regions such as Middle and Southeast Anatolia. The semi-humid Aegean and Mediterranean regions, on the other hand, will be affected due to a lack of water resources. Because of climatic differences, different regions of the country will be affected differently. Changes in temperature and precipitation are both important components of climate change. Similarly, to global temperature changes, mean ambient temperatures in Turkey tend to rise. Turkey's mean temperature has steadily increased with a trend of 0.64°C/100 years [3]. A statistical analysis of rainfall in Turkey between 1930 and 1993 revealed that area averaged annual rainfall decreased slightly during this period, though the decreasing trend in annual rainfall was statistically significant in some of the country's stations located in the Mediterranean region. However, precipitation has decreased more pronouncedly since the 1990s. In the last 25 years, precipitation in the Mediterranean Basin has decreased by 20% [4]. It is also expected that the decreasing trend will continue, with a significant drop in precipitation in Turkey's semi-arid Mediterranean, Aegean, and Central Anatolian regions, as well as an increase in mean annual temperatures. The annual mean temperature increase in Turkey is expected to be around 2-3 degrees Celsius until the end of the twenty-first century. Precipitation generally decreases along the Aegean and Mediterranean coasts while increasing along the Black Sea coast [5]. According to IPCC scenarios, a 20% decrease in precipitation is predicted in both winter and summer months in Turkey during the twenty-first century.

Effect of climate change on water resources potential in Turkey

In Turkey, the average annual precipitation is 643 mm, which equates to 501 billion m³ of water. Evaporation consumes 274 billion m³. 158 billion m³ of water forms the surface flows, while 69 billion m³ feeds groundwater, 28 billion m³ of which rejoins the surface waters. Including the 7 billion m³ of water imported from other countries, the country's renewable water potential is 234 billion m³. Annual precipitation is expected to fall to 325 billion m³ by 2050, with surface flow falling to 130 billion m³ from the current value of 193 billion m³ [6]. River water temperature appeared to be increasing linearly at a mean annual rate of about 0.2 °C. Warmer water, in addition to having a higher potential for evaporation, can result in lower dissolved oxygen concentrations in surface waters [7]. As a result, rising temperatures degrade both the quality and quantity of river water, Climate change is also expected to affect the relative amounts of snow and rain, as well as the timing of snowmelt and runoff. Climate change may cause a shift from snow to rain, increasing the likelihood of flooding early in the year and reducing water availability.

Results

The paper summarizes Turkey's situation in terms of climate change's impact on water resources. There have been few studies in the past that focused on specific regions. According to these studies, climate change will have a negative impact on water availability in Turkey overall. However, the majority of the country's hydrological basins have yet to be evaluated. A large-scale research project is needed to thoroughly examine the impact of climate change on water resources at the local level, taking into account all meteorological regions and hydrological basins in the country. Although some adaptation measures have been implemented in recent years. A more thorough investigation will yield stronger regulations that could serve as a model for other nations in the area.

Discussion

Predicting the effects of climate change, as well as effective mitigation and adaptation strategies, is critical for ensuring sustainable water management. The emission of greenhouse gases is the driving force behind climate change. As a result, greater efforts should be made to reduce emissions and develop new technologies to combat climate change. Groundwater must be protected, and its use and upkeep must be adapted to climate change. Artificial groundwater recharge is a critical alternative or supplement to the preservation or restoration of natural infiltration conditions.

Conclusion

The results showed that:

1. Compared to now, decreased precipitation will result in significantly lower inflow, with the peak monthly inflow occurring earlier than now.
2. The ratio of water withdrawal to discharge will increase due to the effects of global warming (decreased discharge), though it is possible to meet future water demand using the water resources system.
3. Water scarcity will result from the effects of global warming and increased demand for water.

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