



Received: 13/12/2024

Accepted: 11/02/2025

Doi : <https://doi.org/10.71787/1071787/ntigs.2025.1193369>

Analysis of Hydroclimatology Changes in the Ajichay River Basin (Talkheh Rud)

Ali Sajed

Ph.,D Student Climatology, Department of Geography, Najafabad Branch, Islamic Azad University,
Najafabad, Iran

Amir Gandomkar¹

Department of Geography, Najafabad Branch, Islamic Azad University, Najafabad, Iran

Mohsen Bagheri Bodagh Abadi

Soil and Water Research Institute, Agricultural Research, Education and Extension Organization, Karaj,
Iran

Abstract

Considering the important and essential role of rivers in the economy, industry, and agriculture, mismanagement of these resources and incorrect usage of surface water, it prompted us to survey the negative impacts of climate change on water resources which has caused and will continue drought and various environmental impacts that effects in the ajichay river basin. This research was only concentrated on the ajichai river basin due to the large area of the Urmia Lake basin for this study area. The present study examines the effects and influencing factors on rainfall and river discharge of the ajichay . The discharge river and precipitation data were studied in the ajichay river basin in east azerbaijan province at monthly, seasonal, and annual scales from 1969 to 2017. The nonparametric Mann-Kendall statistical test was used to survey and analyze the presence or absence of trend. Additionally, the correlation coefficient and coefficient of determination were utilized using linear regression and coefficient of variation in the XLSTAT software. The results of river discharge analysis in the ajichay river basin indicate that the river has been a downward sloping trend at annual scale in the Vanyar station. A significant downward trend was also observed in river discharge data at the seasonal scale during autumn, winter, and spring which the most severe trend in winter is with 95% confidence level and an 86% correlation coefficient. However, the data have mutation in the winter but there is no a specific trend for the summer.

Keywords: Trend, River Discharge, Mann-Kendall, Ajichay River Basin



Received: 13/12/2024

Accepted: 11/02/2025

Extended Abstract

Introduction

Lake Urmia is the largest inland lake in the country, and in recent years, its water level has significantly decreased. Climate change, persistent droughts, expansion of cultivated land, land use changes, and dam construction are recognized as the reasons for these problems. However, fewer scientific documents and evidence have been provided. Due to the vastness of the Urmia Lake basin, only the Ajichay basin was considered for the study area, as it may have experienced the most changes in this regard. The Takhteh River, known as "Ajichay" in Turkish, is one of the most important internal rivers flowing in East Azerbaijan Province. This river is also one of the largest sources of inflow water to Lake Urmia.

Data and Method

In this study, long-term data (at least 30 years) from meteorological and hydrometric stations located in the Ajichay river basin were utilized. The average annual precipitation in the Takhteh River basin is approximately 355 mm, and the average annual discharge of the Takhteh River is 392,000,000 cubic meters. Seventeen hydrometric stations have been installed on the Takhteh River and its tributaries, three of which are on the main branch. One of the very important hydrological issues is the calculation of the maximum probable precipitation for the design of large dams. Since 1950, precipitation amounts have been calculated for the design of large structures. The application of maximum probable precipitation for the design of water structures with high risk or damage has a history of about a hundred years. The unavailability of reliable discharge data in dam design or reservoir construction has led to increased attention to precipitation data and the optimization of precipitation data for dam and water structure design.

Results and Discussion

The Ajichay river basin, as one of the important basins in Iran, holds significant economic and social importance. The provision of water for agriculture, drinking, and industry in this region is directly dependent on the hydrological status of this basin. In recent years, climate changes and human activities such as land use changes, excessive groundwater extraction, and dam construction have caused significant changes in the hydroclimatological components of this basin. The analysis of discharge in the Ajichay river basin indicates that the flow of the Ajichay River has shown a downward trend at the Vanyar station on an annual scale, with a steep slope. A significant downward trend in discharge data has also been observed seasonally in autumn, winter, and spring, with the most severe trend occurring in winter, showing a 95% confidence level and an 86% correlation coefficient. However, in winter, the data exhibit fluctuations, and no specific trend is anticipated for summer.



Received: 13/12/2024

Accepted: 11/02/2025

Conclusion

The results of this research indicate a strong and inverse relationship between the discharge of the Ajichay River and the increase in global warming. This study revealed that the changes in the time series of discharge in the Ajichay river basin show a downward trend, indicating a continuous reduction in discharge over the long term. This performance clearly demonstrates that as global warming continues to rise, the discharge of this river has consistently remained below its long-term average. Furthermore, if the trend of global warming continues in this manner, the average annual discharge of this river will reach its lowest point in the future, and a return to normal discharge levels for the Ajichay River seems unlikely. Given the rising temperatures in this region, reduced precipitation, and increased evaporation are also expected.

References

- 1) Alijani., B. (2009). *Synoptic climatology*. Samt Publications. (In Persian)
- 2) Asakereh., H. (2007). *Climate change*. Zanzan University Press. (In Persian)
- 3) Azizi., Q. & Hanafi., A. (2010). Estimation of maximum probable precipitation (PMP) for the Ajichay basin using synoptic methods. *Geographic Studies of Arid Regions*, 1(2), 55-71. (In Persian)
- 4) Bahrami., A. (2013). Analysis of long-term trends in precipitation and discharge in the western Lake Urmia. *Journal of Watershed Management Research*, 4(8), 57-43. (In Persian)
- 5) Baroun., A. Zahorian Pordel., M. Lashkari., H. Shakiba., A. & Mohammadi., Z. (2025). Identification of heat waves in Khuzestan Province and analysis of the role of the Arabian high pressure in their formation. *New Ideas in the Geographical Sciences*, 8(3), 1-20. (In Persian)
- 6) Birsan , Marius-Victor, Dumitrescu , Alexandru, Magdalena Micu , Dana, Cheval, Sorin, 2014, Changes in annual temperature extremes in the Carpathians since AD 1961, *Nat Hazards*, 74:1899–1910.
- 7) Booij, M.J., Tollenaar, D., van Beek, E., Kwadijk, J. C.J. (2011). Simulating Impacts of Climate Change on River Discharges in the Nile Basin, *Physics and Chemistry of the Earth*, 36(13), 696-709.
- 8) Borhani Daryan., A. & Hatami Mojomard., Sh. (2015). *Application of data-driven models in watershed management: Lake Urmia*. Ministry of Science, Research and Technology, K.N. Toosi University of Technology, Faculty of Civil Engineering. (In Persian)
- 9) Chen, H.; Yang, J.; Ding, Y.; Tan, C.; He, Q.; Wang, Y.; Qin, J.; Tang, F.; Ge, Q.(2022) Variation in Extreme Temperature and Its Instability in China. *Atmosphere Journal*, 13(19).
- 10) Esfandiari Darabad., F. (2013). Statistical detection of the impact of global warming on the anomalies of discharge in the Aras River basin. *Quantitative Geomorphology Research*, 4, 60-43. (In Persian)
- 11) Fazli Fard., P. Sheikhan., V. Sadoddin., A. & Hessari. (2019). Analysis of trends in precipitation and discharge in the Urmia Lake basin over the past four decades. *Journal of Water and Soil Science*, 29(4). (In Persian)
- 12) Fischer, T, Gemmer, M, Luliu, L, Buda, S. (2010). Temperature and precipitation trends and dryness pattern in the Zhujiang River Basin, south china, 2007-1961, *Quaternary International*, pp 1-11.
- 13) Gadedjisso-Tossou, A.; Adjegan, K.I.; Kablan, A.K.M. (2021). Rainfall and Temperature Trend Analysis by Mann–Kendall Test and Significance for Rainfed Cereal Yields in Northern Togo, *Sci*, 3(17), 1-20.
- 14) Geographic Organization of Armed Forces (2001). *Geographic culture of Tabriz County*, First Edition, Geographic Organization of Armed Forces. (In Persian)
- 15) Ghavidel Rahimi., Y. (2010). Statistical detection of the effect of global warming on annual precipitation anomalies in Jolfa using artificial neural networks. *Geography and Environmental Planning*, 38(2), 82-65. (In Persian)
- 16) Imani Amirabad., S. Farokhnia., A. Morid., S. & Roozbehani., R. (2020). Analysis of temporal-spatial trends of temperature and precipitation in the Tasht-Bakhtagan basin. *Amir Kabir Civil Engineering*



Received: 13/12/2024

Accepted: 11/02/2025

- journal, 52(11), 2931-2944. (In Persian)
- 17) Jahadi Esfanjani., N. & Ghorbani., M. A. (2015). Analysis of trends in precipitation and discharge at the Doost Bigloo and Samiān stations in the Qara Su river basin. *Geography and Planning*, 19(52), 63-43. (In Persian)
 - 18) Kananian., R. Fakhrifard., A. Ghorbani., M.A. & Din Pajoo., Y. (2019). Analysis of gradual and rapid changes in hydroclimatic factors in the watershed (Case study: Leghavan Chay basin). *Journal of Water and Soil Science*, 29(1). (In Persian)
 - 19) Khamidov, Sardor, Li, Zhi, Nasirova, Makhliyo, Pulatov, Bakhtiyor, Pulatov, Alim (2023). *Assessment of temperature and precipitation trends in Kashkadarya, Uzbekistan*, E3S Web of Conferences 365, 01005.
 - 20) Kliengchuay, W., Mingkhwan, R., Kiangkoo, N. et al. (2024). Analyzing temperature, humidity, and precipitation trends in six regions of Thailand using innovative trend analysis. *Sci Journal*, Rep 14, 7800.
 - 21) Maroofi., S. & Tabari., H. (2011). Detection of trends in the discharge of the Maroon River using parametric and non-parametric methods. *Journal of Geographic Research*, 62(2), 17119-17141. (In Persian)
 - 22) Noori., M. Morid., S. Karimi., N. & Gholami., H. (2021). Spatial and temporal changes in temperature and precipitation trends in the transboundary Aras basin. *Iranian Water Resources Research*, 17(3), 104-117. (In Persian)
 - 23) Rahimi., L. Dehghani., A. Ghorbani., K. & Abdolhosseini., M. (2014). Analysis of trends in total discharge and base discharge at the Araz Kuseh hydrometric station in the Golestan Province. *Journal of Water and Soil Conservation Research*, 21(2). (In Persian)
 - 24) Rezaei., A. (2009). Investigating the effect of expanding rain-fed lands on the trend of annual flood discharge changes: A case study of the Qizil Ozan basin. *Water and Watershed Management Engineering*, 2(1), 11-17. (In Persian)
 - 25) Salnikov, V.; Talanov, Y.; Polyakova, S.; Assylbekova, A.; Kauazov, A.; Bultekov, N.; Musralinova, G.; Kissebayev, D.; Beldeubayev, Y (2023). An Assessment of the Present Trends in Temperature and Precipitation Extremes in Kazakhstan. *Climate Journal*, 11(2), 33.
 - 26) Sooreh., E. Zangeneh., M.S. & Karamat., A. (2025). Analysis of drought trends using satellite images (Case study: West Azerbaijan Province). *Journal of New Ideas in the Geographical Sciences*, 3(7), 19-38. (In Persian)
 - 27) Zhen, Yu, Xilin, Li (2015). Recent trends in daily temperature extremes over northeastern China (1960–2011), *Quaternary International*, 380–381, 35–48.