

Evaluation the Trend and Trend Chang Point of Urmia Lake Basin Precipitation

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Introduction: Given the fact that Iran is located in the center of the dryland of earth and is significantly influenced by the deserts of Central Asia and hot dry deserts of Arabia and Africa, is one of the most arid and low rainfall land areas. So is the proper management of water resources is of critical importance. The first step in the proper management of water resources is studying the factors that affected these resources including climate change. In fact climate change is a dynamic process in terms of time and place. Large parts of the Earth's climate as part of their normal variability in short-term and long-term experience. Short-term climate changes due to the difference in terms of average annual values of specific climate variables in average periods such as 30 years. Causes and effects of regional climate change in several parts of the world have been widely studied from various aspects. Among hydrological parameters, precipitation is the most important parameter in the complex hydrologic cycle. Follow the phenomenon of global warming on the Earth's surface, the rainfall pattern has changed. Trends of rainfall in different parts of the world have been studied by many researchers. Due to climate change in Iran and climate change in the Basin of Urmia Lake it seems that evaluation the trend of monthly and annual precipitation and its time of change point in the basin of Urmia Lake changes is important. The goal of this study is evaluating the trend and time of the change point trend of monthly and annual precipitation of rain gage stations in Urmia Lake basin.

Material and methods: Lake Urmia is the focus of surplus accumulation of surface currents all the rivers of the basin, with an area of approximately 5750 square kilometers and the average elevation of 1276 m above sea level and is located in the middle of the northern basin. Around of Lake Urmia there are 16 wetlands with an area of 5 to 120 hectares (some have dried up) that mostly have sweet or salty and fresh water and a high value of ecosystems. Urmia Lake Basin is situated in eastern of 44-14 to 47-53 and north of 40-35 to 30-38 coordinates. Urmia Lake Basin rainfall changes is 220 to 900 mm and have mean precipitation about 263 mm that added in central parts of the basin to the highlands.

Trend analysis: The aim of process test is to specify whether an ascending or a descending trend exists in data series. Since parametric tests have some assumptions including normality, stability, and independence of variables, where most of these assumptions do not apply to hydrologic variables, the nonparametric methods are more preferred in meteorological and hydrological studies. The nonparametric methods are less sensitive to extreme values compared to parametric tests in the examination of trends. Nonparametric tests can also be utilized for data time series regardless of linearity or nonlinearity of the trend (Khalili et al. 2014). One of the most well-known nonparametric tests is Mann-Kendall test (Mann 1945; Kendall 1975).

The modified Mann-Kendall test (MMK): The main assumption of Mann-Kendall test is that the sample data has no significant autocorrelation. However, some hydrological series might have a significant autocorrelation coefficient. When a series has a positive autocorrelation coefficient, there is an increased chance for Mann-Kendall test to reveal the existence of a trend in this series. In this case, the null hypothesis i.e. lack of trend is rejected, yet this hypothesis should not actually be. The modified Mann-Kendall test was presented by Hamed and Rao (1998) and has been used by Kumar et al (2009) for the analysis of the trend of Indian rivers. In this method, the effect of all significant autocorrelation coefficients is removed from the time series and is applied to a series whose autocorrelation coefficients are significant in one or more cases.

Change point test: Pettitt test is a non-parametric test that was developed in 1979 by Pettit. The method is used in order to find change points in a time series (Salarijazi et al 2012). In this study, the statistic was used to find a sudden change in temperature data. This statistic is a test with rank basis and without a distribution in order to detect significant changes in the mean of the time series and it is important when there is no assumption about the

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change time.

Results and discussion: In this study the trend of monthly and annual precipitation of rain gage stations that located in Urmia Lake basin were investigated using modified Mann-Kendall test. Z values of case study were calculated in two monthly and annual scales. The results of evaluation the trend of precipitation of rain gage stations of Urmia Lake basin showed that in October, December, January, February and March (five months of the year) the trend of precipitation is decreasing and the mean of Z values showed the less than zero values. In April and May there is no sensible changing in precipitation trend. Also the results showed that the March, April and May have a low failure rate and February, December and July have a most of change point of monthly precipitation data. About 60 percentages of the time of change point in precipitation trend are between 1992 and 1998. Also the results showed that two months of May and November there is no changing point in west Urmia Lake rain gage stations. In annual scale the time of changing trend is between 1992 and 1998.

Conclusion: The results of evaluation the trend of Lake Urmia precipitations showed that the Urmia Lake basin has a combination of decreasing and increasing trend in studied time period. The decreasing trend in precipitation often seen in west stations of the basin and west and south-west of Urmia Lake. The increasing trend also seen in south and north-east of Urmia Lake basin. Also the results of zoning the Z values of Mann-Kendall test showed that in annual scale the regions that influenced by polar-continental air mass that they entered Iran have a decreasing trend.

Keywords: Climate Change, Modified Mann-Kendall, Pettitt Test, Zoning

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