Trend analysis of Hydro-Meteorological variables of Sistan and Bluchistan

Abstract

Meteorological parameters are changing in time and space for many reasons. These changes should be investigated based on available observations through statistical methods. The trend analysis is the most important statistical method used widely around the world for assessing the potential effects of climate change on time series of meteorological variables such as temperature, rainfall, river flow. The aim of this study was to evaluate the long-term trend of annual, seasonal and monthly minimum temperature, maximum temperature, precipitation, wind speed, minimum and maximum relative humidity, vapor pressure, evapotranspiration and river discharge through parametric (linear regression)and non-parametric (Mann-Kendall, Theil-Sen and Spearman) statistical methods at the confidence level of 95% and 99%. In this study, data from synoptic (1973-2014) and hydrometric (1350-1390) stations in Sistan and Baluchistan province were used. According to the results, the minimum temperature in most of the stations and the maximum temperature at some stations have increased significantly. Wind speed and sunshine hours have increased significantly for some stations while they have decreased significantly for a few months. Minimum and minimum relative humidity and vapor pressure have decreased significantly (at both 1% and 5% significance level) in most cases except for Chabahar station. Although a non-significant trend was seen for precipitation in most cases, there is a decreasing trend for spring precipitation for only three stations. For evapotranspiration a downward trend was seen for Saravan and Chabahar stations. The results of trend analysis for the Energy Department's stations showed an increasing trend in temperature for 40% of the stations. Also there is a non-significant decline in precipitation for most stations. River discharge except for Bampour channel station, which showed a significant ($p \leq 0.01$) decrease in all seasons, showed no significant trend. Among statistical methods used, parametric linear regression method could detect more significant trend for variables having a normal frequency distribution. The non-parametric Mann-Kendall and Theil-Sen tests showed similar results in most cases. Spearman method resulted in more significant trends in monthly scale than Man-Kendall method. Overall it can be said that the assumption of climate change occurrence in Sistan-Baluchistan province has been strengthened.

Key words: Trend, Mann-Kendall, Theil-Sen, Spearman, linear regression, Meteorological variables, Sistan and Baluchistn

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