

## Changes of Temperature Regimes in Khuzestan

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### ABSTRACT

Temperature is one of the most important climate variables that many economic and social plans related to its changes. Because of The importance of this issue, this study investigated the changes of it in the province Khuzestan. Meteorological data that used in this study is mean temperature in annual and seasonal timescale. The study area is Abadan, Ahwaz, Dezful and Omidiye stations. For analyzing the trend, nonparametric Mann-Kendal test is used. The Results show that in annual time scale, at all selected stations, the uptrend is significant. Ahwaz and Omidiye stations, in all seasons, Abadan station in spring, summer and fall and Dezful station in the spring and summer have significantly up trends. However, Dezful in winter and autumn and Abadan station in winter has not been any trend.

**Key Words:** Trend, Temperature, Kendall-Mann test, Khuzestan

### INTRODUCTION

One of the popular methods for analyzing time series of meteorological data is analyzing of presence or absence of trend in them, because of gradual changes in natural and climate change or human activities (Hejam *et al*, 2008). In past half-century, overnight, day and hostelry in Iran increased Respectively 3, 1 and 2 degrees (Masoudian, 2005). The average annual temperature changes are generally indicated that changes in temperature is appearance in Mashhad plain so these changes can be named as climate change (Ebrahimi, 2005). Khoshal and Ghavidel (2008) analyzed minimum and maximum annual data of the absolute temperature by linear regression and Man-Kendall test. The results indicate the absolute minimum temperature does not have sudden and significant changes, while absolute maximum temperature has uptrend (Talebi *et al*, 2011). Azizi and Roshani (2008) examined climate change in the coast of Khazar .In most stations minimum temperature has positive trend and maximum temperature has negative trend. Certainly, time of starting changes is not same. Climate change is a board fluctuation in climate of a region .Now, global warming is part of climate change .It is one of the biggest challenges facing the world today. Rising global temperature, change weather patterns. Rinsing sea level is the consequences of climate change (Khosravi *et al*, 2010). Analyzing trend of monthly temperature in Zahedan indicate that temperature in most of months increase. In the season timescale, autumn and spring have more increasing trend (Tavossi, 2010). Results of Man-Kendall in HajiAbad Basin show that most of annual and monthly parameters of temperature in both stations (Parandak and KarimAbad) have uptrend (Khormizi *et al*, 2011). Alijani *et al* (2011) analyzed annual minimum and maximum temperature and indicate that most part of Iran have changes in both of them. 28 of stations in west ,Northwest, Southwest, Northeast and Central Iran have increasing changes in mean of maximum temperature while Chabahar and Torbat Heydariye

have down trend. Sabziparvar *et al* (2012) analyzed thermal parameters (Minimum, Maximum, Average), by using linear regression and nonparametric Mann-Kendall, in 10 synoptic stations in arid and semiarid regions. Results show that 70% of stations and in mean temperature at least 90% stations have significant positive trend. According to the province, the phenomenon of climate change can be an effective step toward economic development in the province. The purpose of this study was to evaluate temperature trend in order to management of different sources in Khuzestan.

## DATA AND METHODS

Area of Khuzestan is 64075 and located between 29 degree and 57 minutes north latitude from the equator to 33 degrees, zero minutes, 47 degrees, and 40 minutes to 33 minutes of the prime meridian in Southwestern of Iran. The selected station has been the longest Statistics of the other stations. The following table details the selected stations.

**Table1.** Location of selected stations

| Stations | Longitude | Latitude | Height(M) |
|----------|-----------|----------|-----------|
| Abadan   | 48.15     | 30.22    | 6.6       |
| Omidkiye | 49.39     | 30.46    | 34.9      |
| Ahwaz    | 48.4      | 21.2     | 22.5      |
| Dezful   | 48.23     | 32.24    | 143       |

### Descriptive Analysis:

Temperature conditions in selected stations indicate that maximum annual, spring and summer temperature happened in Omidkiye station. Abadan has Maximum temperature of winter. Demartoon index show that all of stations (Abadan=4.3, Ahwaz=6.4&Omidkiye=7.1) except Dezful (11.8) are in arid class while Dezful is in semiarid class.

**Table2.** Daily means temperature in annual and seasonal scale

| Stations | Annual | Winter | Spring | Summer | Autumn |
|----------|--------|--------|--------|--------|--------|
| Abadan   | 25.5   | 15.7   | 30.5   | 35.3   | 20.6   |
| Ahwaz    | 25.4   | 15.3   | 30.4   | 35.6   | 20.4   |
| Omidkiye | 25.7   | 15.4   | 30.8   | 35.8   | 20.7   |
| Dezful   | 24.1   | 13.9   | 28.7   | 34.5   | 19.2   |

To examine trend of changes in Iran, Data of mean temperature in stations that have more than 25-year is statistical data are used. Selected stations have the most complete statistical

data between the other stations in Khuzestan. For analyzing the trend, Mann-Kendall test is used. This test is used for time series that do not follow statistical distributions. The other advantages of this method is that, interact trivial amounts in some of time series (Hejam *et al*, 1387). For drawing time series of sequential  $U(t)$  and  $U'(t)$  are calculated by Man-Kendall .In this method, sequential data of  $U_i$  and  $U'_i$  display graphically. If the values of  $U_i$  and  $U'_i$  on several curves are to each other, there will be no changes or trend. However, where the curves intersect each other, curves exhibit location of starting changes approximately. When the curves cut each other within the range is the time of abrupt change and when they intersect outside the critical range indicate that having trend in time series(Talebi,1390).

## RESULT

Mann Kendall test is used in many studies over the world. It gives acceptable results. According to the results of this study, the province has been associated with a significant increase in temperature. Mann- Kendall test in selected stations have uptrend in annual scale. Here, For sake of abbreviation, Graphs are included in the annual time scale.

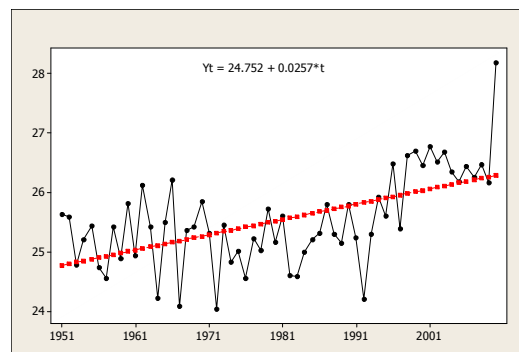


Figure1. Temperature trend of Abadan

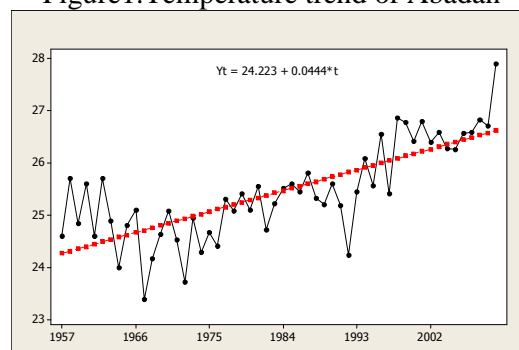


Figure2. Temperature trend of Ahwaz

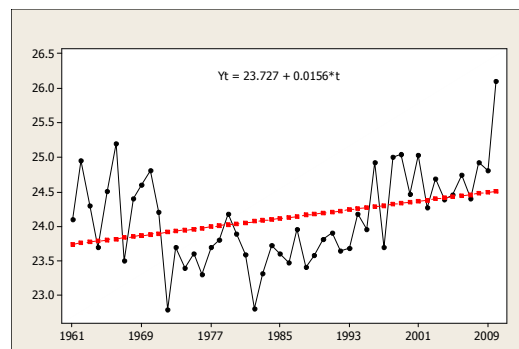


Figure3. Temperature trend of Dezful

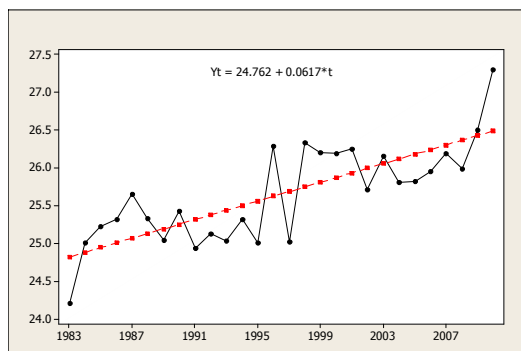


Figure4. Temperature trend of Omidiye

The following table show observed trends, in annual and seasonal time scale:

**Table3.** Trends of station's annual and seasonal time scales

| Stations | Annual | P     | Z    | Winter    | P     | Z    | Spring   | P    | Z    | Summer   | P     | Z    | Autumn    | P     | Z    |
|----------|--------|-------|------|-----------|-------|------|----------|------|------|----------|-------|------|-----------|-------|------|
| Abadan   | 3.16   | 0.00  | 4.07 | Not trend | 0.10  | 1.25 | Up trend | 0.00 | 4.86 | Up trend | 0.00  | 4.33 | Up trend  | 0.00  | 3.16 |
| Ahwaz    | 4.39   | 0.00  | 5.99 | Up trend  | 0.002 | 2.85 | Up trend | 0.00 | 5.66 | Up trend | 0.00  | 6.48 | Up trend  | 0.00  | 4.39 |
| Dezful   | 1.63   | 0.007 | 2.40 | Not trend | 0.22  | 0.74 | Up trend | 0.00 | 3.16 | Up trend | 0.018 | 2.09 | Not trend | 0.05  | 1.63 |
| Omidiye  | 2.66   | 0.00  | 3.69 | Up trend  | 0.01  | 2.31 | Up trend | 0.00 | 3.97 | Up trend | 0.00  | 3.22 | Up trend  | 0.003 | 2.66 |

**Table4.** Seasonal and annual temperature equation

| Stations | Annual              | Winter               | Spring              | Summer             | Autumn             |
|----------|---------------------|----------------------|---------------------|--------------------|--------------------|
| Abadan   | $Y_t=24.75+0.02t$   | $Y_t=15.33+0.012t$   | $Y_t=29.30+0.039t$  | $Y_t=34.38+0.03t$  | $Y_t=19.98+0.02t$  |
| Ahwaz    | $Y_t=24.223+0.04t$  | $Y_t=14.49+0.03t$    | $Y_t=28.96+0.05t$   | $Y_t=34.15+0.05t$  | $Y_t=24.75+0.024t$ |
| Dezful   | $Y_t=23.727+0.015t$ | $Y_t=14.370+0.0691t$ | $Y_t=29.76+0.0716t$ | $Y_t=34.948+0.05t$ | $Y_t=19.98+0.046t$ |
| Omidiye  | $Y_t=24.762+0.06t$  | $Y_t=14.370+0.0691t$ | $Y_t=29.76+0.0716t$ | $Y_t=34.948+0.05t$ | $Y_t=19.98+0.046t$ |

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