

# Study of Temperature Changes in Fars Province

A. Gandomkar, R. Dehghani

**Abstract**—Climate change is a phenomenon has been based on the available evidence from a very long time ago and now its existence is very probable. The speed and nature of climate parameters changes at the middle of twentieth century has been different and its quickness more than the before and its trend changed to some extent comparing to the past. Climate change issue now regarded as not only one of the most common scientific topic but also a social political one, is not a new issue. Climate change is a complicated atmospheric oceanic phenomenon on a global scale and long-term. Precipitation pattern change, fast decrease of snow-covered resources and its rapid melting, increased evaporation, the occurrence of destroying floods, water shortage crisis, severe reduction at the rate of harvesting agricultural products and, so on are all the significant of climate change. To cope with this phenomenon, its consequences and events in which public instruction is the most important but it may be climate that no significant cant and effective action has been done so far. The present article is included a part of one survey about climate change in Fars. The study area having annually mean temperature 14 and precipitation 320 mm .23 stations inside the basin with a common 37 year statistical period have been applied to the meteorology data (1974-2010). Man-kendal and change factor methods are two statistical methods, applying them, the trend of changes and the annual mean average temperature and the annual minimum mean temperature were studied by using them. Based on time series for each parameter, the annual mean average temperature and the mean of annual maximum temperature have a rising trend so that this trend is clearer to the mean of annual maximum temperature.

**Keywords**—Climate change, Coefficient Variation, Fars province, Man-Kendal method.

## I. INTRODUCTION

**G**REENHOUSE gases emission has significant function changed the global climate and this phenomenon will continue in the future. Nowadays, scientific community has addressed the greenhouse gases emission as the most important cause of the global average temperature increase (around half degree C since 1970).and the change of hydrologic cycle involving earths widen tropical belt. [1] Climate change and global temperature increases caused drought developments and their continuation and also this change makes a precipitation distribution steadily and influences on the water resources. Climate change is regarded as a big challenge especially if it causes more frequent and steady droughts and demand growth for the water and its shortage .This challenge is involves a wide range of aspects [2].

A. Gandomkar, Najafabad Branch, Islamic Azad University, Najafabad, Iran (phone: +989133254097; e-mail: aagandomkar@yahoo.com).

R. Dehghani, Najafabad Branch, Islamic Azad University (e-mail: dehghaniraziye@yahoo.com).

Climate changes is one of the most important factors affecting on the water resources and the process of urban developing and the management of metropolitans so that precipitation and temperature rates changes as two important factors on climate may encounter the water resources and consequently the urban management with a crisis [3].

According to the current estimates, Iran, air temperature rises between 1.5 to 4.5 C averages and this issue will impact on precipitation rate, energy needs, water resources availability, agricultural products and coastal regions [4]. Recently, two issues studied in England are climate change reduction and energy security. Meanwhile, developing policies of the government resulted in supporting the implementation of new nuclear power as a part of national energy combination program in the future to prevent pollutant energy consumption and Exothermic. In this article, the quality is also regarded as stimuli for energy and show that climate change may cause nuclear energy generation. [5] Climate changes have an effect on the structure of the marine population and draw the attention toward them .There are some approaches to forecast these effects indicating that the community reaction may be anticipated from the population reactions .The most important effect of climate change influences on the marine population community is the water surface change that with respect to the community reactions it may possible to determine the climate change [6]. Recent analyses show the effect of climate change and greenhouse gases on the tourism as well. The most obvious response to the climate change is short term and slow trips; slow trip may be served more by the tourists and as a simple strategy for lowering the effect of carbon and greenhouse gases considered at tourism industry [7]. Climate changes, urban and rural regions development ,lands changes and intensive utilization from natural resources during the last decades caused a change in the hydrologic features and conditions of drainage basins and then the hydrologic regime of the rivers has been exposed to the change. [8]

The aim of this survey is to study the temperature trend and the quality of variability in Fars province.

## II.METHODOLOGY

The desired research within Fars province with an area around 133 thousand square kilometers has allocated approximately 1.8 percent of the country's total area.

Fars province is located South of Iran. Mean temperature in this province is 17.5 C and mean precipitation 312 mm .this province is limited to Isfahan from the North, Hormozgan from the South, Kerman and Yazd from the East and Booshehr and Yasooj from the West. One of the features of this province is its high climate variation and according to the obtained

results in determining the climate by Copan method all six mentioned climate classifications in this model are observed in this province.

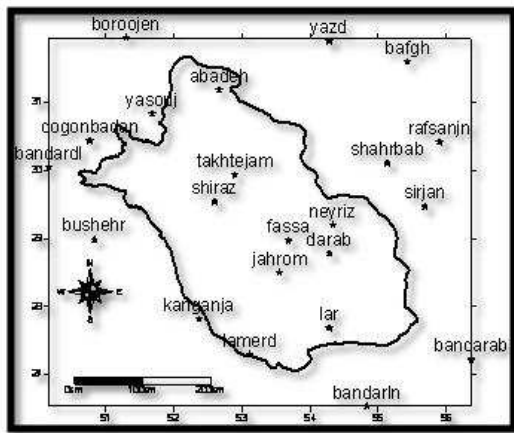


Fig. 1 Location of synoptic stations in relation to Fars province

This research, 26 station inside the province (Abadeh, Takhtejamshid, Shirz, Fasa, Neyriz, Darab, Lar and Lamerd) and outside the province (Yazd, Bafgh, Rafsanjan, Shahr babak, Sirjan, Bandarabas, Bandare lengeh, Kangan, Booshehr, Bandare Genaveh, Bandare Deylam, Dogonbadan, Yasoj and Broojen) were selected with a 37 years common statistical period (1974-2010)

In this research, Man-Kendal method has been applied and the annual mean average temperature, annual minimum mean temperature and annual maximum mean temperature parameters analyzed.

Man-Kendal:

$$S = (\sum P - \sum Q) \quad (1)$$

$$\text{Variance} = \frac{n(n-1)(2n+5)}{18} \quad (2)$$

$$Z = \frac{(S-1)}{\text{Variance}} \quad (3)$$

Based on Man-Kendal method and applying above formula for each parameter, the following results have been obtained:

Annual mean average temperature: Resulted rate+1 showing an increase and significant trend of the annual mean average temperature.

Annual minimum mean temperature: Resulted rate+1 showing and that trend of minimum mean temperature is increased significantly to some extent.

Annual maximum mean temperature: Resulted rate+1 showing an increase and significant the trend of annual maximum mean temperature.

The standard deviation (SD) of the desired parameters were calculated and finally their variability coefficient also obtained using the following relation: [9]

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} \quad (4)$$

$$CV = \frac{100SD}{\bar{x}} \quad (5)$$

The obtained rate of this coefficient for annual mean average temperature had 0.317 change, annual minimum mean temperature 0.746 and annual maximum mean temperature 1.476 in which this rate wasn't a critical change but reliable.

### III. DISCUSSION

To study the trend of temperature changes during a 37 year statistical period, Man-Kendal method and the variability coefficient of time series diagram have applied. Their results show that the annual mean average temperature and the annual maximum mean temperature have had a positive and rising trend in Fars province and also this increase has been more during the recent years. The annual minimum average temperature has no unique trend. The results obtained are similar at time series and Man-Kendal method.

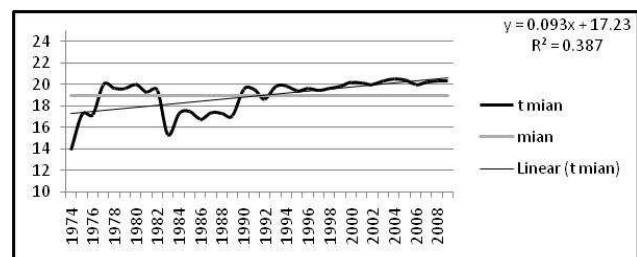


Fig. 2 Time series diagram showing the annual mean average the temperature during a 37 year statistical period in Fars province

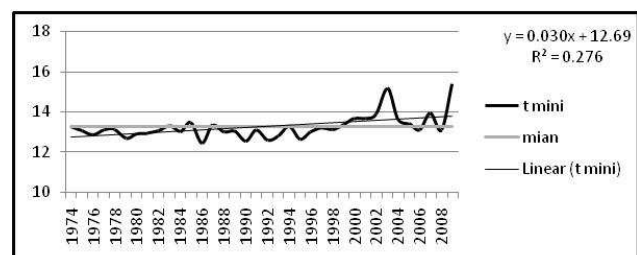


Fig. 3 Time series diagram showing the annual minimum mean temperature during a 37 year statistical period in Fars province

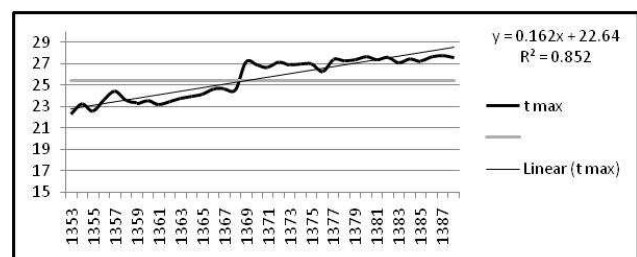


Fig. 4 Time series diagram showing the annual maximum mean temperature during a 37 year statistical period in Fars province

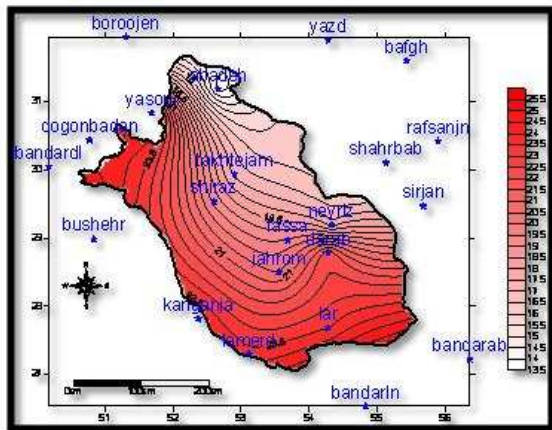


Fig. 5 Annual minimum mean average temperature

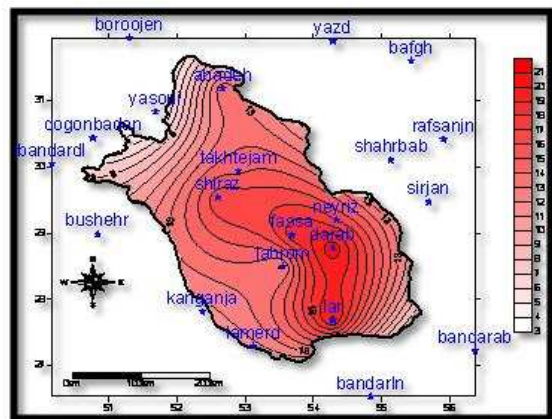


Fig. 6 Annual maximum mean average temperature

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## IV. CONCLUSION

Change and global temperature increases caused drought developments and their continuation and also this change makes a precipitation distribution steadily and influences on the water resources. Climate change is regarded as a big challenge especially if it causes more frequent and steady droughts and demand growth for the water and its shortage. This challenge involves a wide range of aspects. Studying time series diagram shows a rising and increased trend of this parameter during the studying statistical period. Studying time series diagram of the annual minimum mean temperature doesn't show a unique trend. Studying time series diagram of the annual maximum mean temperature shows a rising and increased trend of this parameter during the studying statistical period. To study the trend of temperature changes during a 37 year statistical period, Man-Kendal method and the variability coefficient of time series diagram have been applied. The results show that the annual mean average temperature and the annual maximum mean temperature have had a positive and rising trend in Fars province and also this increase has been more during the recent years. The annual minimum average temperature has no unique trend. The results obtained are similar at time series and Man-Kendal method.