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The expected of monthly temperature for next climate period of the holy city of Najaf by using Liner Trend analysis

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Key words: climate change, Temperature, Holy Najaf, Iraq

Abstract:

The purpose of this study is to prediction the monthly average of maximum and minimum temperature of the holy city of Najaf for next eleven years (2011-2021), by using the Liner Trend analysis to reveal the nature of the periodic behavior pattern of the monthly average temperature via a series of long time extending from December 1971 to January 2010 (480 months), then hire it to get a model of directional linear regression to predict the average temperature monthly.

The results showed that there are different values of the climate cycle and varied from month to month, it has been shown that there is a trend toward rising rates of heat and that so important for climate change study and desertification phenomenon.

Introduction:

Climate change is one of the major challenges facing Iraq. Potentially, it could have a disastrous effect on the environment and economy, in particular on the agricultural sector. Iraq is located in an arid to semi-arid area where the dominant continental climate is typically cold in winter and hot in summer and characterized by limited rainfall, a high evaporation rate and water scarcity (UNESCO, 2012).

Iraq has been experiencing a number of serious problems that can be traced to climate change. This has been evident in the rapid expansion of the desertification process, increasingly frequent and intense dust storms, prolonged drought conditions, a reduction in rainfall across the country and unprecedented heat waves with temperatures rising above 50°C just last summer (Janabi, 2012). The recorded temperature in Iraq has risen significantly. The average temperature for the period 1988-2007 is higher than the average temperature for the earlier twenty years by 1°C in Baghdad and 1.5°C degrees in Nasiriya south of Baghdad). Similar trends can be seen in the recorded rainfall. For instance, rainfall in Baghdad during the past decade is less than the long-term average by about 50% (excluding the recent rainfall in Baghdad in late December 2012). FAO scientists believe that an increase of 1% in average temperature results in a 10% loss in agricultural productivity. It is therefore hardly surprising that the productivity of cultivated land in Iraq has declined until domestically produced food meets only 30% of the population's needs (Janabi, 2013). While specific studies to assess the likely impact of climate change on Iraq have not yet been conducted, it is recognized that the country is particularly vulnerable due to its geographical and hydrological peculiarities.

The aim of this case study to expected monthly temperature for next climate period of the holy city of Najaf as part of Iraq that exposure to desertification phenomenon.

Data collection and analysis:

Monthly averages of maximum and minimum temperature for the province of Najaf for the period among 1971 - 2010 was used to conduction this study, the

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source of this information was the General Authority for meteorological and seismic monitoring.

Statistical software Minitab-11 (using the time series and linear regression analysis **LRA**) was used to analysis this data and using the technique of forecasting for the last session of the climate (11 years old).

The directional analysis method is series time that looks at the phenomenon of a certain time, or looking for the content of periodic in the series of temporal phenomenon studied (Barry and. Perry, 1973). The previous study used the harmonic style in the study of climate (such as Shulman and Leblang ,1974; Horn and Bryson, 1960; Scott and M. Shulman,1979; Al-Ohaidib study,1992; and Al-Klaiba, 2003), while the study of Al-Khalidi (2002) has been used time series analysis using ARIMA..

The statistical prediction model was built on the Information for 40 years (between 1971 to 2010), includes 480 months, and the sequence of first month onwards.

Results and discussion:

The temperature plays a key role in many physical, chemical, and biological processes that affect on the dynamic of interactions, metabolic and physiological processes of biota, such as growth, photosynthesis, respiration, transpiration and absorption of water and nutrients (Dale, 1986 , and Smith, 2004).

Table (1) showed that the lowest and highest of maximum and minimum temperature in the period of 1971-2010, the results showed that the max and min of temperature were recorded in eighties, and nineties of the last century and the beginning of the current century, the highly variation and extremisms in temperature leading to loss of the cover plants and affecting on surviving of species and finally leading to desertification and stormy, the pivotal role played by environmental temperature in determining the distribution patterns of ectothermic species is manifested by the frequency with which species replacement patterns reflect latitudinal and vertical thermal gradients (Somero, 2010). For an organism to be successful in any given environment, each factor that affects the organism must remain within its tolerance range for that organism. If any factor exceeds the minimum or maximum tolerance of that organism, it will fail to thrive (Shelford law, 1931), and that so clear in a lot of areas of holy Najaf government.

Figure 1, and 2 showed that the monthly average of the maximum and minimum changes in temperature that recorded and expected during 1971-2021 period in holy Najaf, while figure 3 showed the annually change in temperature during the study period. The results absorbed that the temperature tend to rising during the next ten years that may be because of the effects of global warming.

The effects of global warming are also leading to observed changes in many other climate and environmental aspects of the Earth system. The last decade has seen an exceptional number of extreme heat waves around the world with consequential severe impacts (IBRD, 2012) and that agree with this study. Human-induced climate change since the 1960s has increased the frequency and intensity of heat waves and thus also likely exacerbated their societal impacts. In some climatic regions, extreme precipitation and drought have increased in intensity and/or frequency with a likely human influence. An example of a recent extreme heat wave is the Russian heat wave of 2010, which had very significant adverse consequences. Preliminary estimates for the 2010 heat wave in Russia put the death toll at 55,000, annual crop failure at about

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25 percent, burned areas at more than 1 million hectares, and economic losses at about US$15 billion (Lau and Kim, 2012).

Table 1: The average of maximum and minimum values of temperature during 1971-2010.

Month		**Max. Tem. Recorded (1971-2010)**		**Min. Tem. Recorded (1971-2010)**	
		Value (˚C)	**Year**	**Value(˚C)**	**Year**
Jan	lowest	13.1	1983	2.2	1992
	highest	21.8	2010	8.7	1994
Feb	lowest	14.8	1982	3.4	1997
	highest	23.2	2010	10.5	2009
Mar	lowest	14	1978	7.4	1992
	highest	30.9	2008	15.2	2008
Apr	lowest	28.3	1971	14.8	1992
	highest	34.6	2008	21.7	2004
May	lowest	33.7	1972	20.4	1981
	highest	42.3	2007	25.3	2007
Jun	lowest	39.2	1988	23.7	1982
	highest	45.6	2005	29.5	1998
Jul	lowest	42.1	1988	26.3	1985
	highest	47.3	2008	31.5	2000
Aug	lowest	39.7	1984	24.3	1984
	highest	47.2	2008	31.7	2010
Sep	lowest	38.6	1980	14.1	1985
	highest	43.2	2007	27.6	2010
Oct	lowest	29.9	1977	16.1	1977
	highest	43	1976	22.1	2010
Nov	lowest	20.2	1982	7.2	1978
	highest	28.3	1998	17.9	2004
Dec	lowest	29.3	1992	3.3	1972
	highest	34.3	2010	9.8	1996

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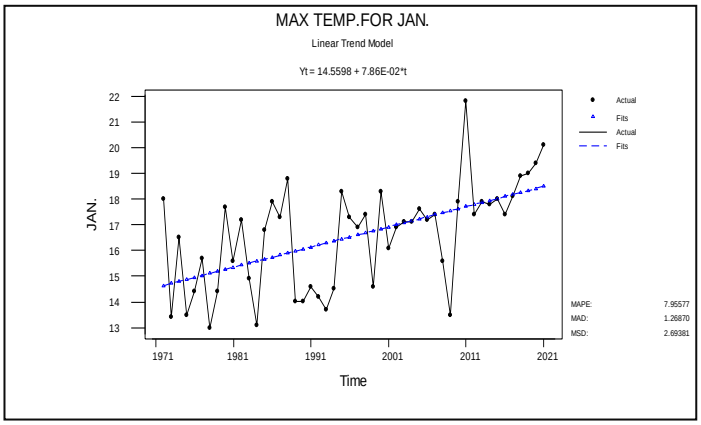

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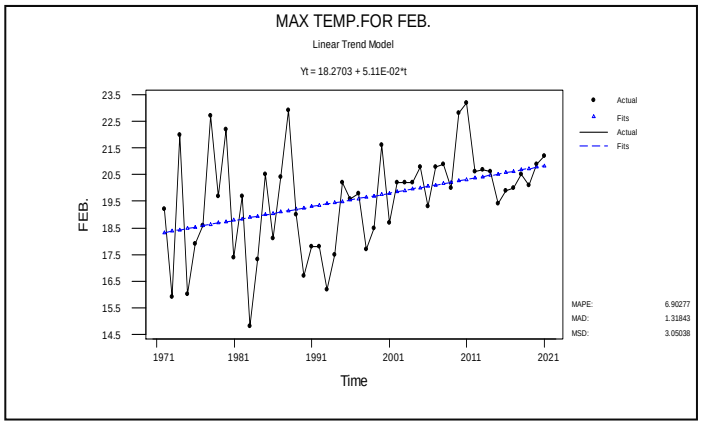

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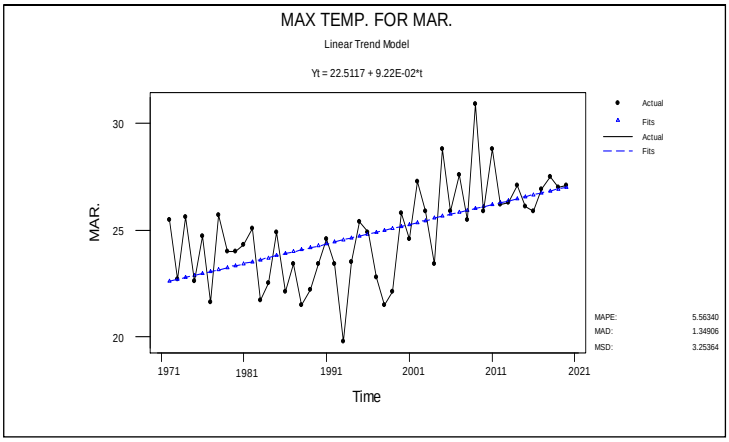

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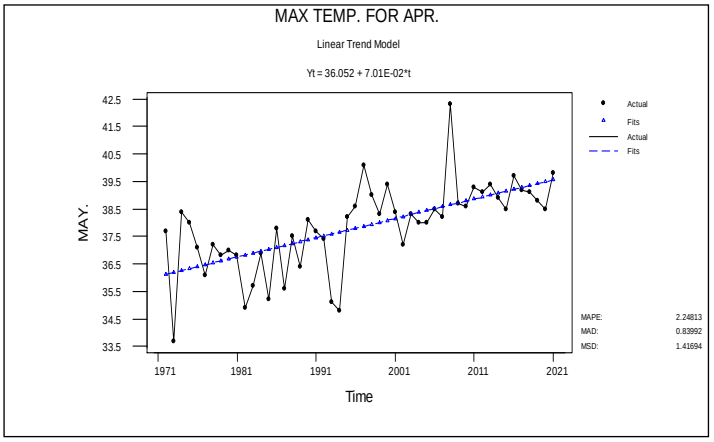

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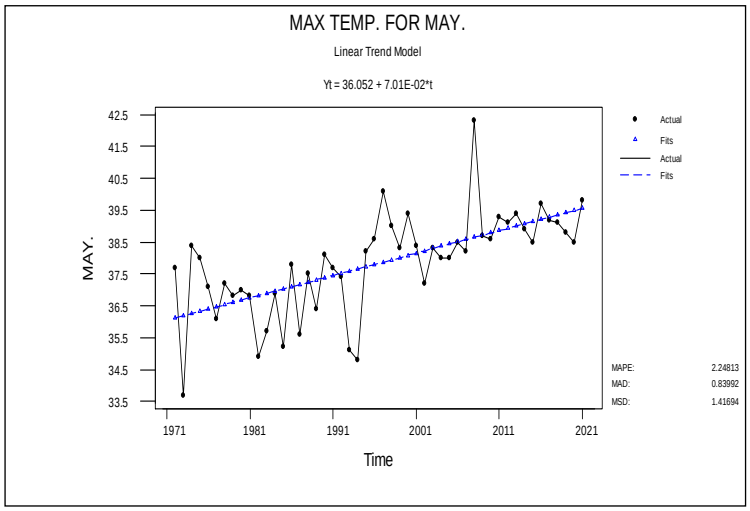

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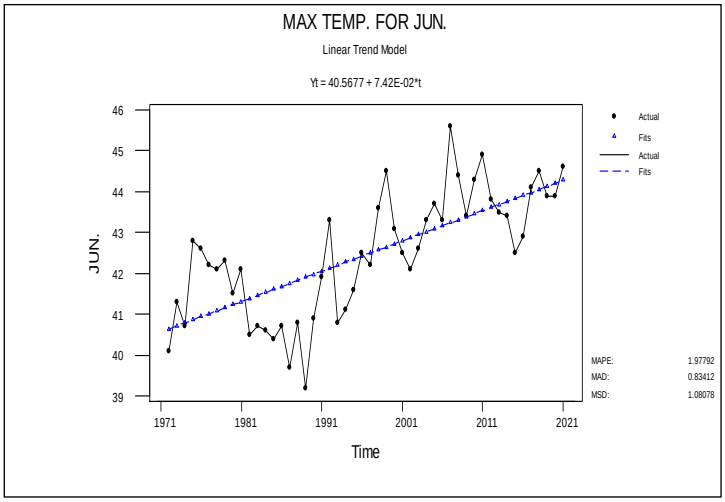

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Figure 1: The monthly average of maximum changes in temperature that recorded and expected during 1971-2021 period in holy Najaf.

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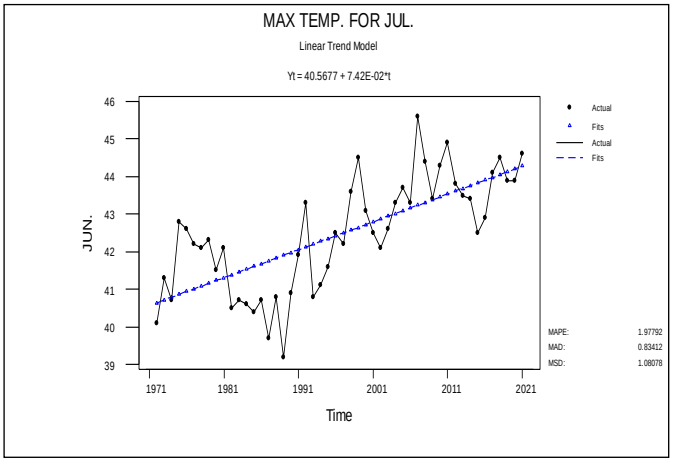

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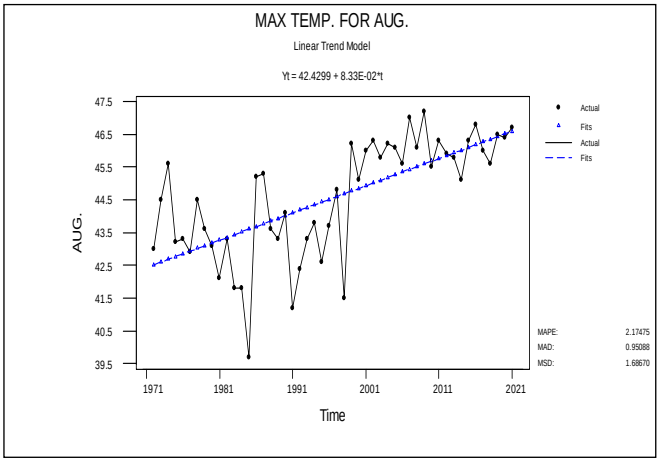

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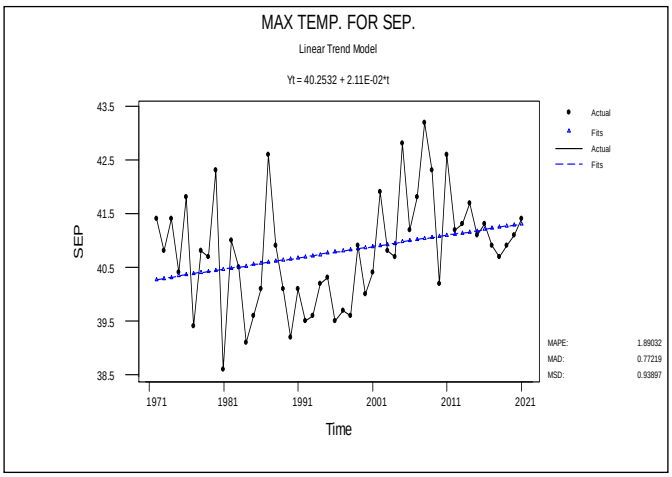

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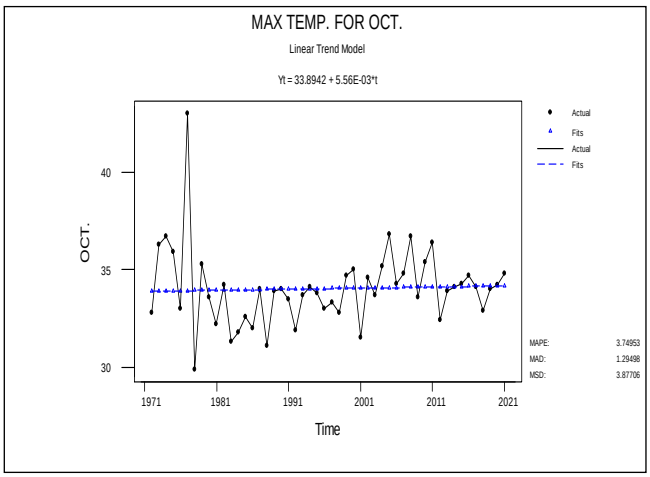

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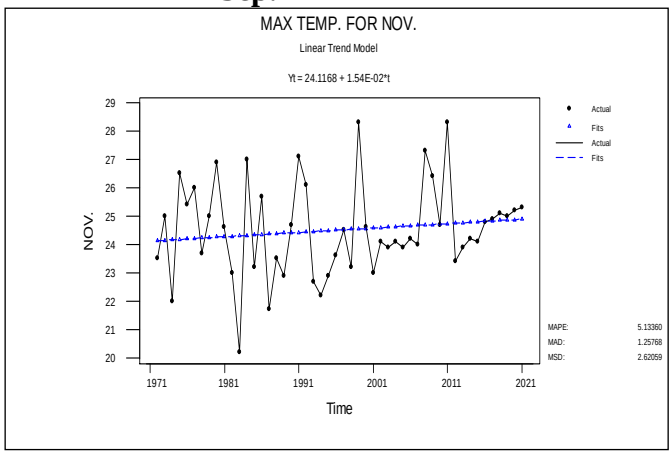

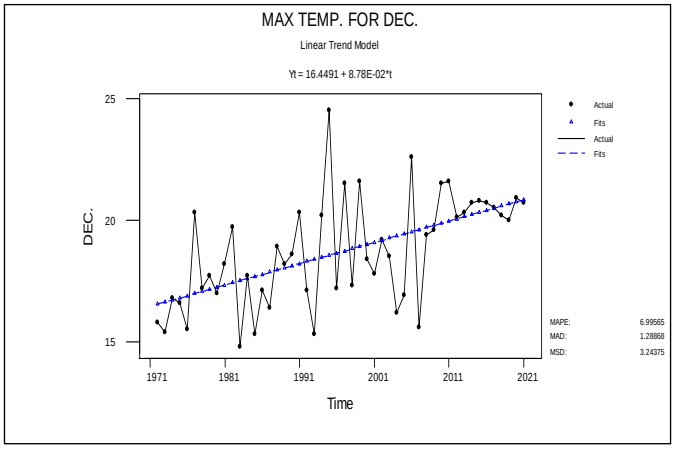

Figure 1 continued.

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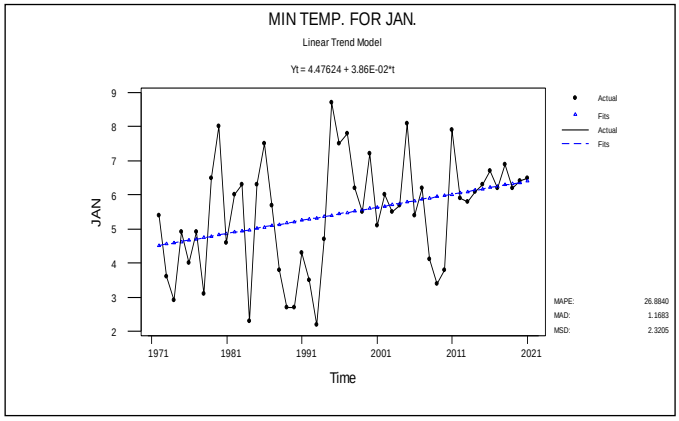

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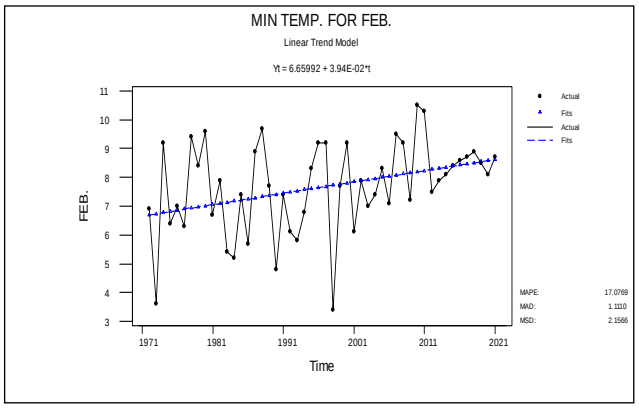

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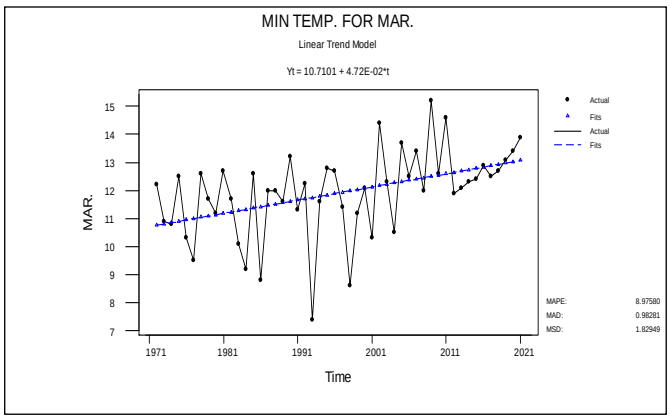

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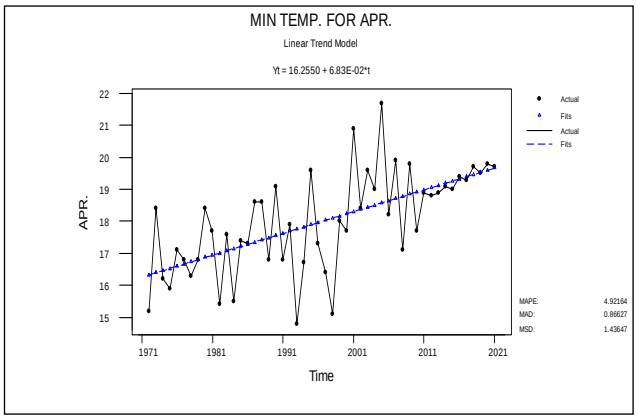

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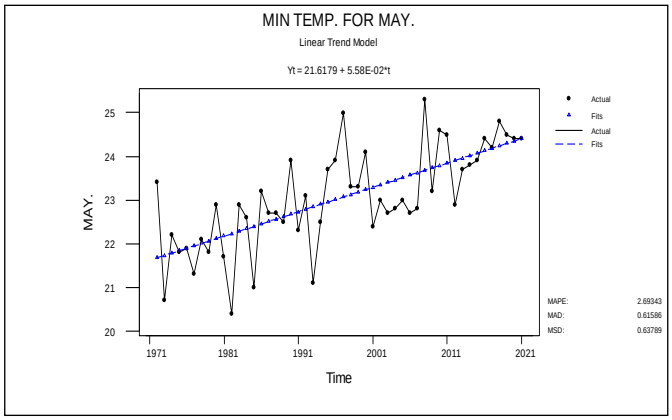

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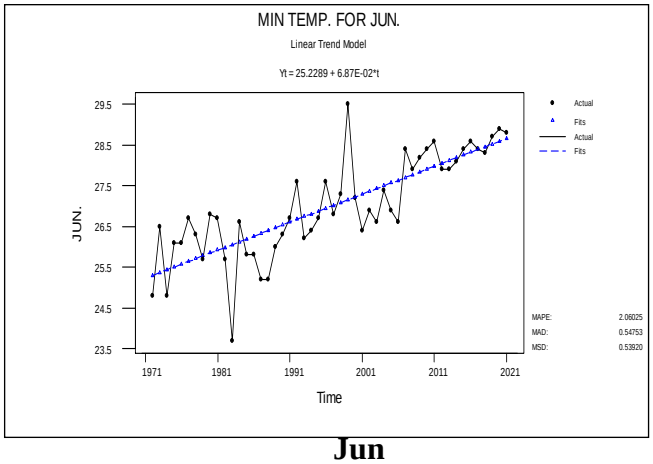

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Figure 2: The monthly average of minimum changes in temperature that recorded and expected during 1971-2021 period in holy Najaf.

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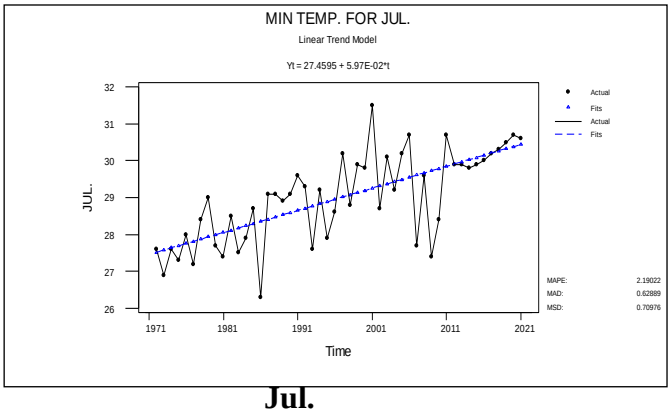

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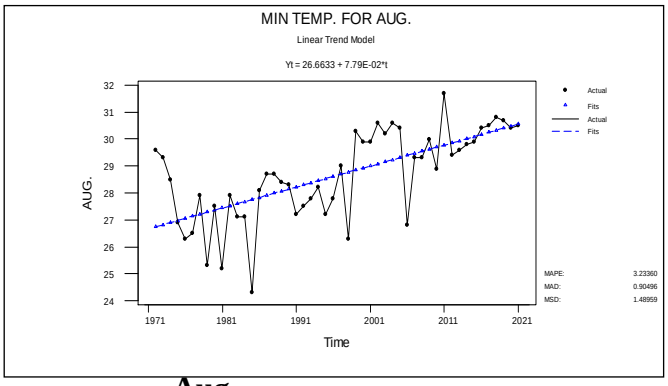

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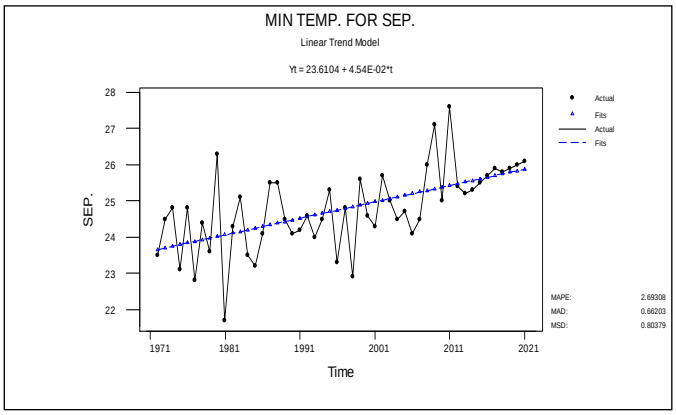

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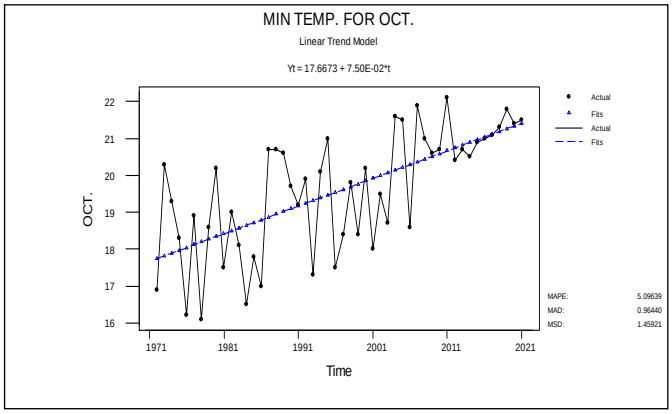

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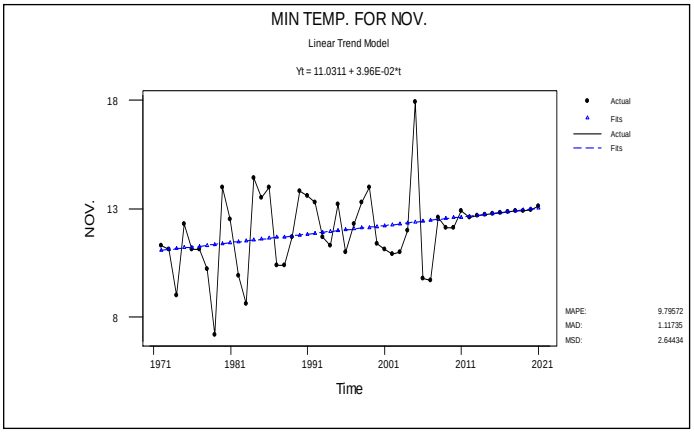

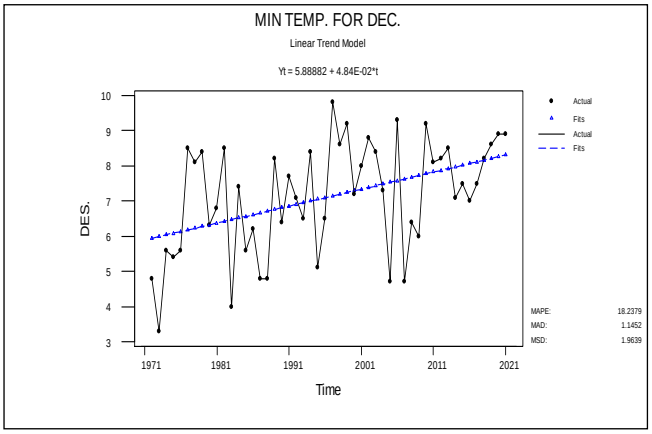

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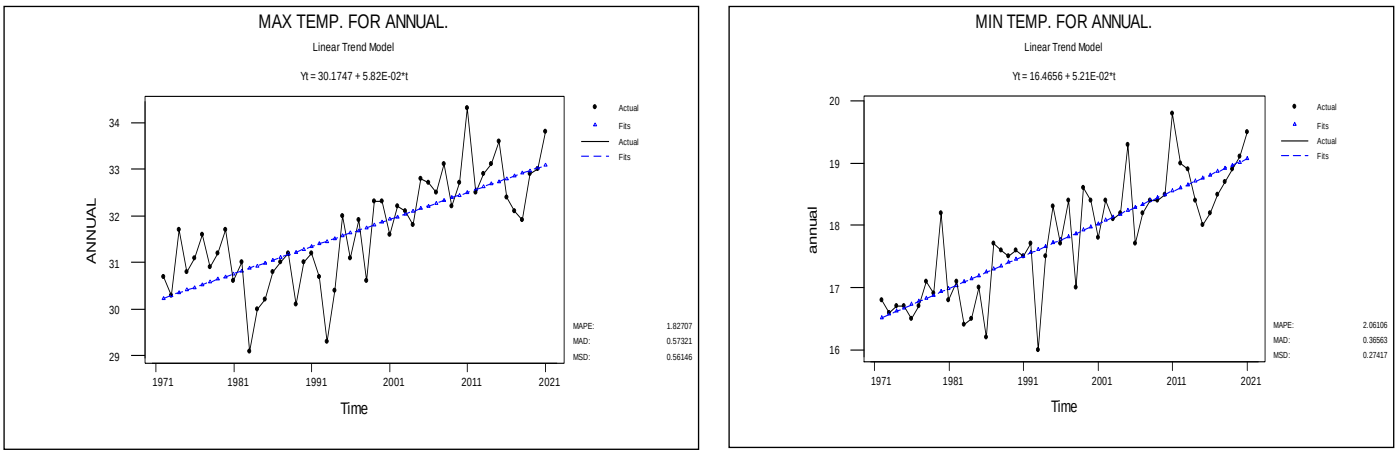

A **B**

Figure 3: the annually average of minimum (A) and maximum (B) changes in temperature that recorded and expected during 1971-2021 period in holy Najaf.

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