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Research Paper

Modeling and Predicting of Changes Maximum Temperature of Shiraz for the Future Climate Period

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ABSTRACT: *The main purpose of the modeling of time series observations f a particular order is time-dependent according to their predictions to be made for the future. The main purpose of time series analysis and forecasting by the model changes. Study and modeling to predict future climate change, peak temperature of Shiraz for the period (2011-2020) is using box models and Junkies. At the beginning of the study to avoid biasing the final polls and the final ten years Series to predict and verify the model was abandoned. Mean and variance of the series of static tests was to establish order in the series, the series is not static. Conduct an annual series of high pass filter (the difference) was removed and acf graphs andidentify the model was based on the difference pacf series model ARIMA = (3,2,1) were chosen. The fitted model was selected and finally go through the analysis of residuals was examined and its validity was confirmed. Finally, after several stages and a more comprehensive model is fitted, the minimum mean square error, the model predictions were tested and the prototype that was set aside for*
Testing the predictions made.
Correlation between actual and predicted values was in full. This behavior was predicted in the series.
Keywords: *modeling, forecasting, temperature, Shiraz, ARIMA*

I. INTRODUCTION

In the classical sense, the model is the symbol of the fact that the most important features of the real world as a whole and simply states that(Asakereh, 2009).New technical modeling to describe, dating, reproduce and predict that the range is used by climatologists. In this way, climate controlled conditions and real-world events and the desired mode image comes to size. Thus, understanding the intricacies of the climate system is possible.The main purpose of the special order to allow time series modeling time-dependent views.They are based on predictions can be made for the future(farajzadeh , 2007). The main aim of the analysis of time series and forecasting its future trends Find.Temporal variability of climate in several models, including models of trend, seasonal, cyclical and random is done.Temporal variability of climate survey is in the field of climatology. Climate survey, mainly in the sense of measure, measurement, analysis and quantitative forecasting of climatic factors It results used. Detection of climatic elements to help study climatic elements may be time series.Series, a sequence of measurements of small amounts during periods of time(Jalali&kargar, 2011). Temperature as one of the most crucial elements of climate, is a good indicator for tracking climate change.Temperature in the energy cycle, water cycle with undeniable effects on human and natural processes (including the supply of water for each area) and changes in environmental planning, economic and social determinant is the log.The extensive use of temperature data, has led in recent decades to study the long-term temperature fluctuations (trend) and short term (eg annual cycles), including climatologists be of interest to geographers(jahanbakshasl&babapoor, 2003).

II. BACKGROUND RESEARCH

Method to determine the temperature time series is used in several studies. "Turkish and Partners" (1996), variability of the annual average temperature in Turkey studied.The results showed that the temperature

increase in Eastern Anatolia and Turkey is decreasing in coastal areas."Leith and Picosto" (1996) Aotorgerosomodels used in the study of temperature changes by using the longest time series examined.Their study showed that the significant variability in annual scales of decades there."SenZekai " (1998) emphasized the importance of sample size to determine climate change, pointing out that the presence of autocorrelation in climate data such as temperature, Arima of the most prestigious modeling methods for studying climate change."Box and Jenkins" (1976) due to its Cumulative integrated moving average model in their study, the autocorrelation in the data having the effect of climate have a season or trend."Mishra and Deesa" (2005) using ARIMA models and SARIMA and also using the Standardized Precipitation Index (SPI) attempted to forecast droughts and came to the conclusion that these models show a good fit to the observations."Momanyi" (2009) Monthly rainfall data from Amman airport to the station during the period from 1992 to 1999 using ARIMA model examined.The result Doo models (1,1,0) and (1,0,0) through which it was able to predict monthly rainfall for ten years.In the country, "Turabi" (1380) using time series ARIMA model five flagship station in five climatic region of Iran between 1951 to 1995 studied and concluded that the minimum and maximum temperature except for semi-arid areas warm Iran in other areas have changed."Taheri" (1998) modeling and predictions of temperature and precipitation eleven weather station using autoregressive moving average multiplicative model is done by the end of 2000."Jahanbakhsh and Babapoor" (2002) using ARIMA model Tabriz average monthly temperature for a period of 40 years old. Seasonal-beat pattern (0,1,1), (0,0,1) ARIMA elected as a computational model based on the average monthly temperature predicted Tabriz to 2010."Jalaliand karghar" (2011) Modeling annual temperature Bushehr station using ARIMA model was done using the computational model (1,1,0) for 20 years with 95% confidence intervals were forecast temperature changes.The aim of this study is to model and predict future climate change for the period of maximum temperature Shiraz (2020-2011) using the Box and Jenkins models are.

III. MATERIALS AND METHODS

For this study, data of the maximum temperature of Shiraz during the period 1951 to 2010 were used station,As the remaining part of the series was dropped for the final test results,After testing the model and its accuracy in estimating the temperature will be added to the series.Since the study is based on analysis of time series analysis in the time domain is a discrete time series, so data should Firstly, continuity and non-random characteristics.Thus, the sampling of the data should be investigated. If random data, regardless of the modeling process in throughput.Non-randomness of time through a series of tests determined RunTest. If the amount is less than 0.05 PValue results of this test, the randomness of the series should be rejected.Non-randomness of the series means that it is possible to set a model and predict future behavior it. The first step in analyzing time series to determine the continuity of the time series.In other words, time series should be continued. The second and most important step, stagnation set time. A set time, when Mana is static and does not change the probability rules governing the process time and the process remains in statistical equilibrium(Khorami&bozorgnia, 2007).So overall, stationary time series variance should be(Bozorgnia, 2002).If the variance of non-stationary series is the perfect solution for stationary use conversion box is _Kaks and if the average is not static, the difference between the series is used,Differential operator using a time series is done backward. The operator acted when the index it as one unit backwards.In practice, with one or two non-stationary time series to the series of static differential can be converted. Based on backward differential operator is as follows:

$$\nabla x_t = x_t - x_{t-1} = x_t - B(x_t) = (1-B)x_t$$

It can be the difference operator written as follows:

$$\nabla^d = (1-B)^d .$$

If the time-series change over time of an increase in the proportion of the variance means that the series is not static.Therefore, it should be appropriate to the static conversion of the variance.If a series is at variance and in Naaysta mean, variance, it must first be static(Shahabfar,2001).In total variance to convert the Box and Cox power conversion used(Leite&Peixoto,1996).

$$T(x_t) = x_t^{(\lambda)} = \frac{x_t^{(\lambda)} - 1}{\lambda}$$

An important feature is that usually sequential in time series observations are not independent and it is right that we should study the dependence between the observations and the model becomes.To investigate the dependence of the correlation function and partial autocorrelation function is used.The delay is the correlation between the observed correlation function K that K unit of time with each other. Autocorrelation function (ACF) Pk show that it is as follows(Soltani& Others,2007).

$$\rho_k = \frac{\mathrm{cov}(x_t, x_{t+k})}{\mathrm{var}(x_t)} = \frac{\gamma(k)}{\gamma(o)}$$

In this equation Pkautocovariance coefficient K is in delay. Autocovariance coefficient depends on the size of the unit of measurement xt.PK estimates derived from a sample of n equal to Rk show. Correlation of sample data is used to detect possible patterns productive.Rk graph the correlation journalist called the delay k. This graph data generator is used for pattern recognition possible.Partial autocorrelation coefficient (PACF) and at

the correlation between xt+ k is after $x_{t+1}, x_{t+2}, \ldots, x_{t+k-1}$ adjustment for variables.

The correlation function with the ϕ_{kk} show. This data is used productively function in pattern recognition possible. Partial autocorrelation function between variables Xt, Xt k can be expressed as follows(Soltani& Others, 2007).

$$\phi_{kk} = \frac{\mathrm{cov}[(x_t - \hat{x}_t).(x_{t+k} - \hat{x}_{t+k})]}{\sqrt{\mathrm{var}(x_t - \hat{x}_t)}\sqrt{\mathrm{var}(x_{t+k} - \hat{x}_{t+k}}}$$

In addition to continued, sampling and stagnation of a series shall be no process. To remove the existing data should high-pass filters (High Pass) can be used.Differencing is also considered as one of these filters. This filter, high pass frequency and low frequency (long-term behavior or processes) are eliminated.Differential series, which means the removal process is done using the backward operator. Staticism mean that previously described, does not mean that the trend in the series.Models Box - Jenkins time series model that antibiotic residues are derived from linear filter. Box-Jenkins models are two general forms that include:ARIMA (ARIMA (p, d, q)) and Arima multiplicative. (ARIMA (p, d, q) (P, D, Q) S) p times q AR and MA degree and is differencing d times.P and q moving average parameters and non-seasonal Aotograsio. d the offense is non-seasonal differencing the time series used in the static.

Form a non-seasonal ARIMA can be written as follows:

$$ARIMA(p.d.q): \phi(B)(1-B)^d Z_t = \theta(B)\varepsilon_t$$

After identifying the experimental model, the model parameters to be estimated.Algvsa time series follows an iterative procedure that starts with pattern recognition and parameter estimates.At this stage the fitted model parameters, were estimated. After identifying the model and its parameters, it should be clear that this model test.Study on the occasion of the model should be such that it does not endanger model. The study analyzed two methods of residuals for the model fitted to the data and analysis models that are more parameter is used, both of which are complementary.So after fit any pattern to the series, it is advisable to try the rest of the difference between the observations and the fitted values is to be executed. The model is considered appropriate that the following condition for it to be(Soltani& Others, 2007).

1. The normality of residuals (residual) 2. homogeneity of variance model, 3. independence residues

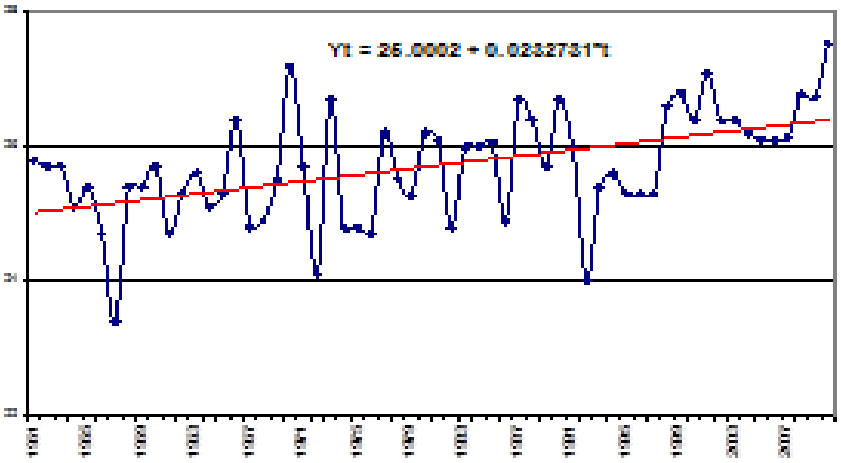
The results of these analyzes are inadequate if the proposed model, another model should be considered. But if following the above steps into two or more suitable model achieved and the remaining analysis to determine which model is better than not enough, then other methods including information criteria need to be Akadeyik(Prasad&Singh, 1998).

IV. RESEARCH FINDINGS

First Run Test test series was random or non-random and non-random series were determined according to the results of the series.The next step is to determine whether trends in data series of statistics was used nonparametric Mann-Kendall and Sense Stampitour,In addition to identifying trends and bounds up and down gradient of the z values obtained for the series.The results are shown in Table 1 nonparametric statistics is ready. According to statistics used and both upper and lower bound on confidence level of 99% of the annual series and its direction for the series is increasing.Orientation of the upper and lower bounds in Figure 1 also confirmed this point. After determining the trend graph stationary or non-stationary time series for the series was drawn to the series is released.

Table (1) Analysis process Shiraz maximum temperature based on nonparametric statistics

Time series	Test Z	Signific	Q	Qmin99	Qmax99	Qmin95	Qmax95	B
ANNUAL	3.78	***	0.022	0.008	0.037	0.011	0.032	25.17



Figure(1). The annual trend of maximum temperature gradient graphs based on nonparametric statistics Sense

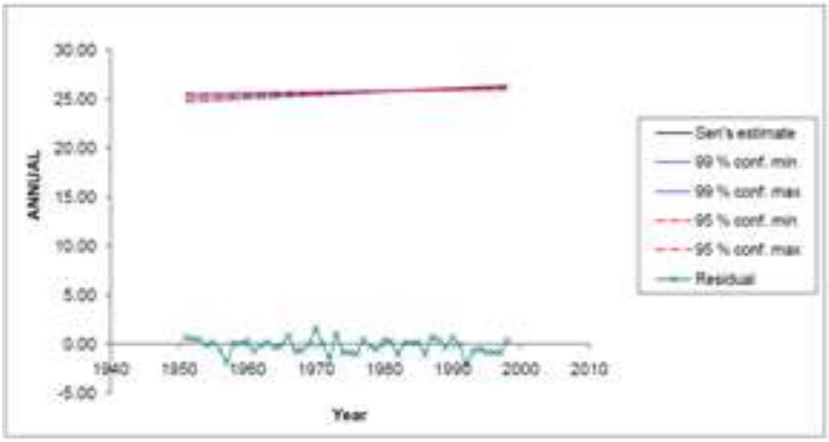
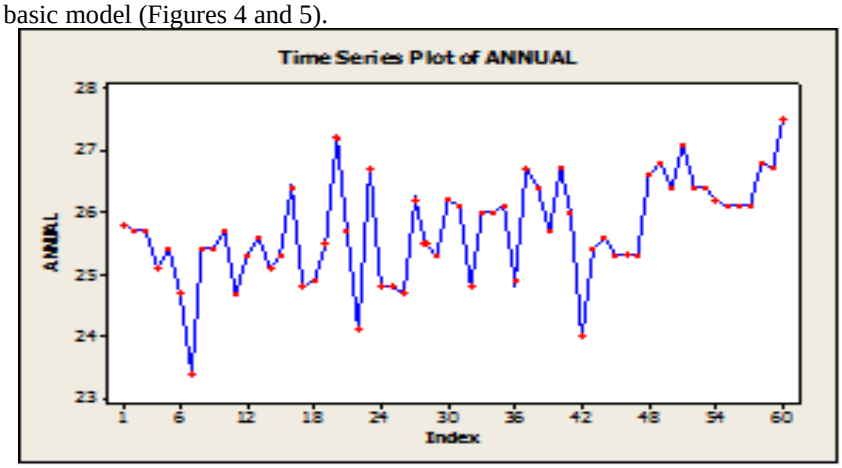


Figure (2). The maximum temperature curve and line fitted to it

Non-stationary time series graph also confirms the series. In addition to the static variance time series graph Bartletts test is used.In the next step should be an annual process to be removed from the time series. Differencing times a year, the series has resulted in the removal process (Figure 3).After removal of an annual process, ACF and PACF diagrams were drawn for the series by differencing the time series to be paid by them to recognize the basic model (Figures 4 and 5).



Figure(3) .thecharttime series maximum temperature Shiraz station

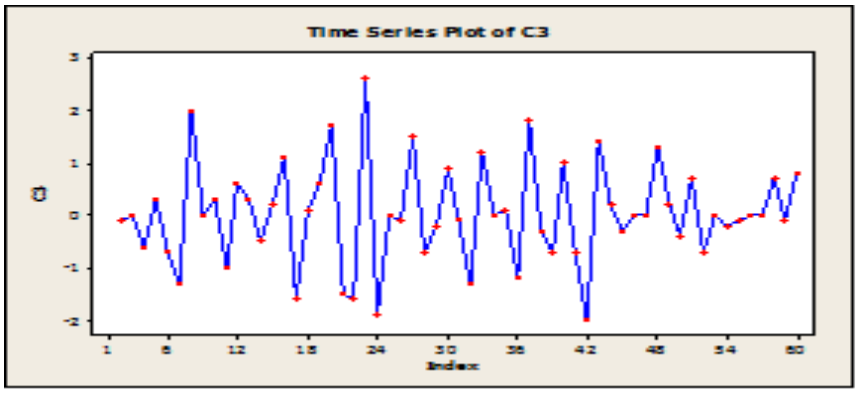


Figure (4). Chart differencing series with the order of one

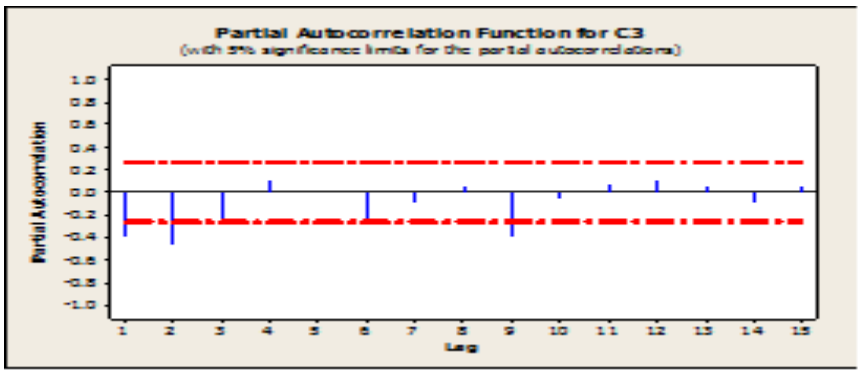


Figure (5). PACF graph time series by differencing

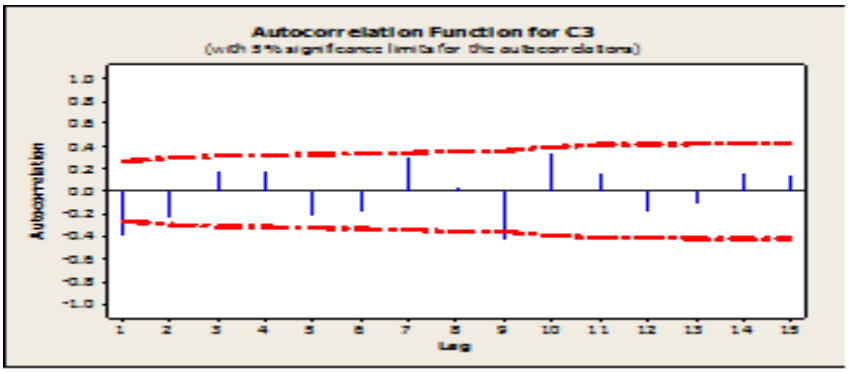


Figure (6). ACF graph time series by differencing

ACF graphs and charts of q times p times determined PACF. D is the order of differencing. Now that the components of the model was extracted for ARIMA model can be written as follows:
ARIMA(p,d,q)=(3,1,2)

Next, the obtained medal for the series should be fitted,But first about the presence or absence of a definite trend in the decision-making model.To do this, we fitted the model with constant term, And then according to the statistics t and p - value on the presence or absence of the constant term in the model to decide.According to Table 2, the model parameters fitted to the time series, can be seen,The t-statistic is less than 2, and does not need to be a constant term in the model. The p - value is more than 0/50.Therefore, the null hypothesis can not be excluded and means the absence of a definite trend in the model. The next step will be judged on the parameters of the model.In this step, if the p - value in each component of the model is fitted over 0/50,Should it be reduced once again the model was fitted with new orders.As can be seen in Table 2, the p - value in all model parameters is less than 0/50.

Table 2 .paramtrhay model (3,1,2)

Type		Coef	SE Coef	T	P
AR	**1**	-0.9143	0.1683	-5.43	0.000
AR	**2**	-1.1690	0.0868	-13.47	0.000

AR	**3**	-0.5058	0.1455	-3.48	0.001
MA	**1**	-0.3253	0.1465	-2.22	0.031
MA	**2**	-0.7448	0.1269	-5.87	0.000
Constant		0.1007	0.2026	0.50	0.621

In the next step should be to review the occasion of the fitted model and comprehensive fitting it. To do this, as I mentioned earlier, the two methods complement each other is used.In this study, analysis of residuals that is more commonly used. This analysis will help the remaining charts and also pert monto test is performed.To check the assumption of normality of residuals remaining normal probability graph (Figure 7) and the remaining histograms (Figure 8) were drawn.In normal probability plots, areas along the diagonal line that extends between the two is indicative of a normal distribution. Distribution histograms with a normal distribution data shows a column of values.

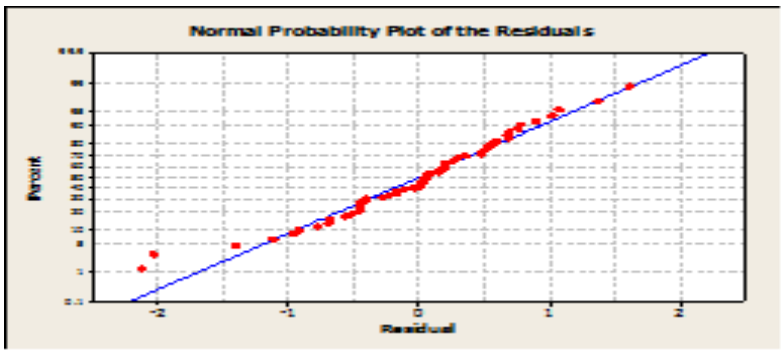


Figure (7). Normal probability plots remnants of the fitted model

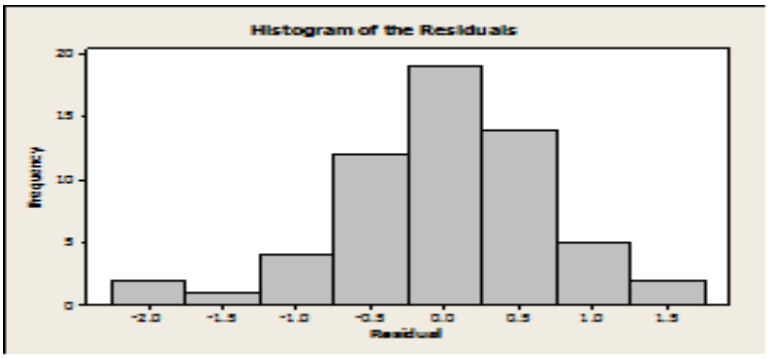


Figure (8). The remaining histograms of the fitted model

To search for ACF and PACF plot remains the supposed independence of residuals were drawn.Looking at the charts you can see that none of the correlations are not significant,Which in turn means the remaining uncorrelated random and is(Figures 9 and 10).If appropriate fitted model, expected residual graph against time around the horizontal zero dispersion process rectangular without care.If you like the behavior of the graph the behavior of a random process with zero mean and variance as constant, then it can be fitted model was approved. According to the diagram in the model is confirmed the authenticity of the fitted model.

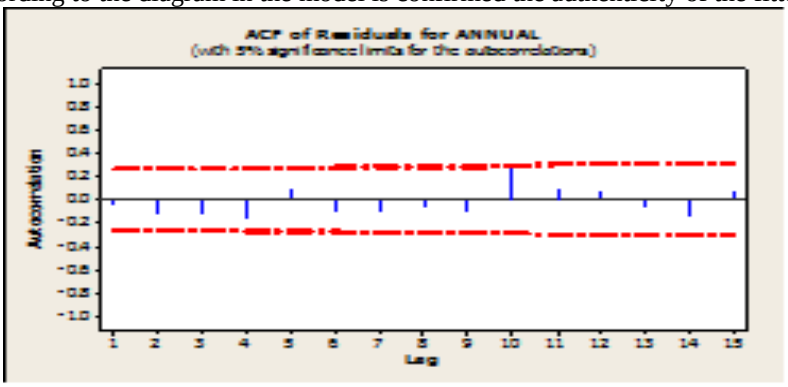


Figure (9). ACF diagram of Syrians remaining maximum temperature Shiraz

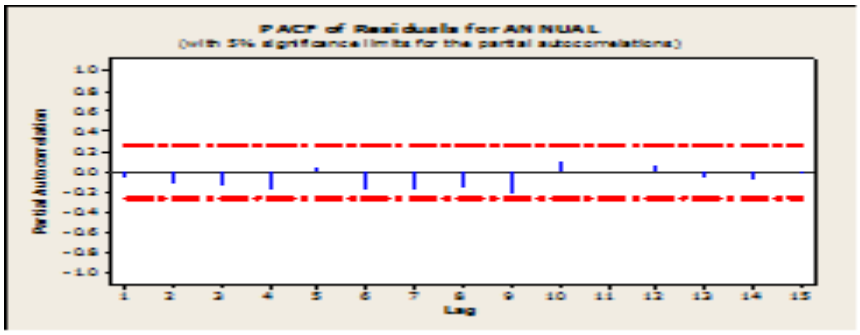
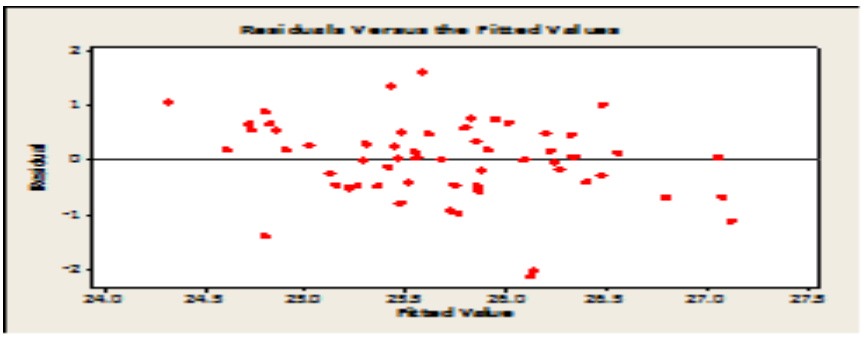


Figure (10). PACF graph of Syrians remaining maximum temperature Shiraz



(Figure 11). The remaining charts in front of the fitted values

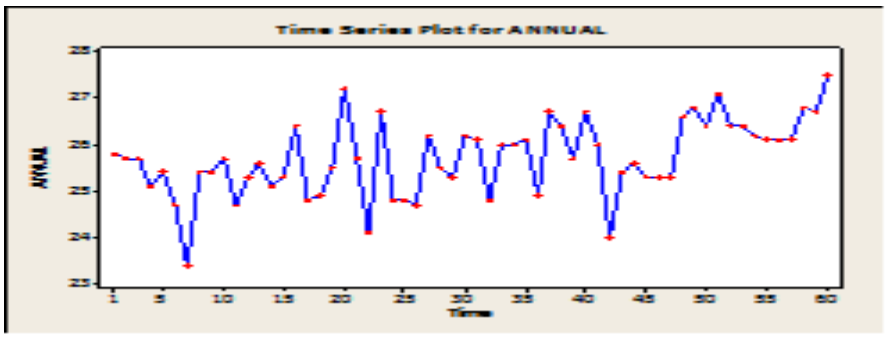


Figure (12). The remaining graph over time

Alternatively and more formal for the occasion which model is based on the autocorrelation of the residuals Perth-coat test results are summarized in Table 3 is that. As you can see is the p - value for all is delayed more than 0/50.

Table 3. The results of the tests Perth –mantoo

Lag	**12**	**24**	**36**	**48**
Chi-Square	**2.7**	**28.8**	**42.1**	**50.3**
DF	**6**	**18**	**30**	**42**
P-Value	**0.059**	**0.051**	**0.070**	**0.177**

A more comprehensive final model fitting that the last ten years was set aside by the place. For the last ten years the series was predicted temperature values and then compare actual and predicted values would be abandoned.The results of the model fitted by remaining in the final round of the series in tables 4 and 5 below.In the final step aside part series is added to the series and forecasting future periods in this study is from 2011 to 2020 were studied. Final prediction model results in Table 6.

Table 4. Pearson correlation between actual sample and the sample predicted by the fitted model

Correlations			
		test	actual
test	Pearson Correlation	1	.906
	Sig. (2-tailed)		.002
	N	10	10
actual	Pearson Correlation	.906	1

	Sig. (2-tailed)	.002	
	N	10	10

Table (5) .Amountsset aside and predicted values

Year	Real	Predicted
2001	26.1	25.9
2002	26.4	26.0
2003	26.4	26.1
2004	26.2	26.1
2005	26.1	26.1
2006	26.1	25.9
2007	26.1	26.0
2008	26.8	26.1
2009	26.7	26.1
2010	27.5	26.1

Table (6) Maximum temperature forecast for Shiraz, 2020

Year	Predicted value	Lower bound	upper bound
2011	27.1	25.6	28.5
2012	27.4	25.8	29.0
2013	27.3	25.5	29.1
2014	27.3	25.3	29.3
2015	27.4	25.1	29.6
2016	27.1	25.6	28.5
2017	27.4	25.8	29.0
2018	27.3	25.5	29.1
2019	27.3	25.3	29.3
2020	27.4	25.1	29.6

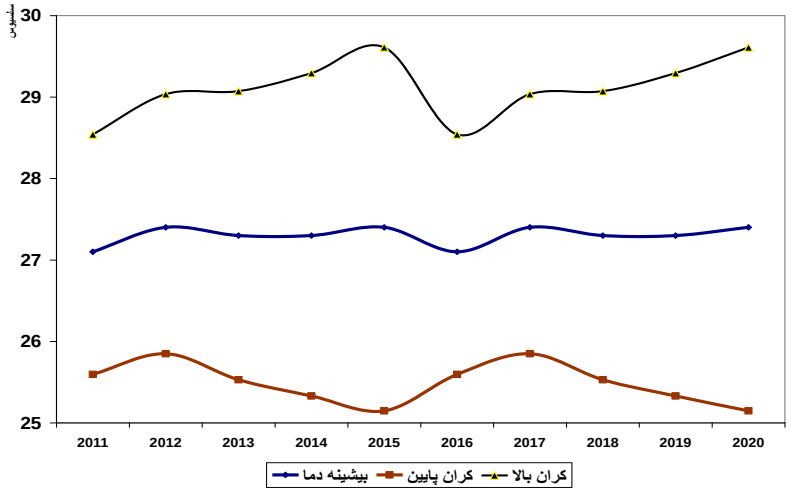


Figure (13). Sri predicted maximum temperature bounds with confidence

V. CONCLUSION

In this research, modeling and forecasting an annual series of maximum temperature of the modeling process Shiraz Box and Jenkins were used.At the beginning of the study to avoid bias validation of the model as well as its ultimate end of the series to predict and evaluate the validity of ten years was set aside.The mean and variance of the static test series was to create order in the series, the series is not stationary.Annual treatment series using high-pass filter (differencing) was eliminated ACF and PACF plots differencing series of criteria were models and model ARIMA (p, d, q) = (3,1,2) was selected.The selected model was fitted and the occasion it through the remainder of the test were analyzed and confirmed its authenticity.predicted the development D.hmbstgy was perfect. The series was predicted future behavior.Finally, after going through multiple steps and more comprehensive analysis model according to a minimum mean square error of prediction model was tested, And a prototype that was set aside for testing to predict.The correlation between actual and predicted level was perfect. The series was predicted future behavior.

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