Estimation Monthly Mean, Temperature using Correlation Formula in different provinces in Iraq

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ABSTRACT

In this study, we proposed a simple models to estimate monthly mean temperature using long term measured data for 9 meteorological stations in Iraq. The models based on fourth order polynomial degree correlation formula, the coefficients of the models were determined by considering root mean square error (RMSE), Modeling index (d) and correlation coefficient(r). There are seen that the models have a good agreement with long term measured data. The proposed models would be useful for farmers and agriculture applications, also can be implemented to other region in Iraq.

Key words: temperature, Baghdad, Modeling, meteorology, atmosphere.

تقدير المتوسط الشهري لدرجة الحرارة باستخدام صيغ الأرتباط في محافظات مختلفة في العراق

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الملخص

في هذا الدراسة تم اقتراح نماذج مبسطة لتقدير القيم الشهرية لمعدلات درجات الحرارة وذلك بأستخدام بيانات شهرية لتسعة محطات انوائية في العراق. النماذج اسست على معادلات من الدرجة الرابعة وثوابت هذه النماذج حددت بأعتماد معامل النمذجة(d) ومعدل الجذر التربيعي للخطأ (R.M.S.E) ومعاملات الارتباط(r) وقد أظهرت هذه النماذج توافقاً مع البيانات المقاسة فعلياً . ان النماذج المقترحة مفيدة للمزارعين وللتطبيقات الزراعية وكذلك يمكن توظيفها في مجالات اخرى وعلى مناطق اخرى في العراق

الكلمات المفتاحية: درجة الحرارة , بغداد , نمذجة , الأرصاد الجوي , جو.

INTROUDUCTION

The weather data such as air temperature, relative humidity and solar radiation are main input in the energy analysis , simulation and design of many engineering systems. The formatting of the meteorological data required depends on the objective of the study and the form of the analysis and simulation package or tool. There are many studies dealing with modeling of the meteorological data. (1) suggested an equation to calculate hourly ambient temperature from monthly average in Turkey. (2) presented models for generating hourly series of solar radiation and air temperature values. A new method was developed to present the daily and yearly variation of temperature for northern Cyprus by (3). A statistical method to generate synthetic weather data as an alternative to use of historical data proposed by(4). (5) presented empirical regression models for the meteorological data measured in Kuwait during 1985,1986 and 1987 and they developed empirical equation for expressing monthly average of daily measurements as a function of month of the year by employing least- square linear regression analysis. (6) Used a linear regression model to generate meteorological data collected in Dhahran city, Saudia Arabia. (7) Reported mathematical equations for the daily variation of the air temperatures for solar system in Turkey. The air temperature has a direct impact on many industrial and economic processes. Thus many studies have been carried out to understand such as relations, for example the influence of temperature in energy consumption has widely analyzed in past, (8) ; (9) ; (10); (11) proposes a fuzzy reference

model for daily air temperature which used to improve and simplify many applications such as demand forecasting.

MODEL VALIDATION

Pearson correlation coefficients (r) were calculated since this is a routine measure of correlation in past model comparisons ,However, good correlation coefficient do not automatically indicate good model accuracy (12), therefore, additional statically parameters were used to assess model performance. An" index of agreement" or modeling index (d) was calculated with the following expression:

$$D= 1- \left| \frac{\sum_{i=1}^{n}(x_i - y_i)}{\sum_{i=1}^{n}(|x_i - \bar{x}_i| + |y_i - \bar{x}_i|)^2} \right| \qquad (1.1)$$

where x_i are the measured and y_i are the modeled values, The value of (d) will vary between zero and one, with a value of indicating perfect model agreement (Willmott 1982) .

The RMSD is the measure of the variation of the predicted value around the measured value which is defined as follows:

$$RMSD = \left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i - y_i}{y_i}\right)^2\right]^{0.5} \qquad (1.2)$$

The RMSD is always positive; however a zero is ideal. It may be noted that a few large variations of the calculated amount of radiation from the measured value can substantially increase RMSD (Willmott, 1982).

Where x_i are the observed value and y_i are the corresponding modeled values The main objective of the present study is to obtain simple models for monthly mean air temperature as a general formula for estimation the maintained meteorological parameters in Iraq validation of the models was performed for 10 provinces of Iraq for which monthly temperature records

are available. The coefficients of the recommended models were determined using the monthly data measured during at least 15 year for Amara, Kirkuk , Najaf , Kerbala ,Baji, Kaem , station and 18 years for Basrah , Mousul and Baghdad station .

RESULTS AND DISCUSSION

The general form of the Fourth order polynomial degree correlation Formula can be defined as:

$$y=a_0+ a_1x+ a_2x^2+ a_3x^3+ a_4x^4 \qquad (1.3)$$

Where a_0,a_1 ,a_2 ,a_3 and a_4 are the polynomial constants , which is determined by means of statically testes for each location separately . The values of root mean square error (R.M.S.E) and correlation coefficient (r) of the equation obtained were calculated for each location considered in this work.

Table 1 presents the information of geographical location (latitude and longitude), elevation and the period of the records for each province separately

It can be seen from table 2 that the correlation coefficients (r) are in the range of 0.941 and 0.983 this means that the equations obtained represent generally the measured data very satisfactorily. For all provinces the correlation is excellent the root mean square errors (R.M.S.E) between 2.61 and 3.02 throughout Iraqi meteorological stations.

Figures (1) to (3) represent the variation of monthly mean temperature for each city separately.

In this study we used the correlation coefficient (r) between the measured data and obtained by the fourth order polynomial degree equation. The correlation coefficients are ranged 0.941 and 0.0.983 for kaem and Najaf respectively But this detent mean that The efficiency and accuracy of the model in kaem station is worse than in Najaf station, therefore we employee the modulating index (d) in order to assess the proposed models performance, and According

to these statistical parameter we can consider The Najaf station model has the highest accuracy (d = 0.956) and the lowest modeling index appears in Beaji station model (d=0.925).

In the last part of this study we compare the mean values of temperatures for 18 years with calculated values by Baghdad station model; both are shown in figure (4). there are no significant differences between the measured and calculated values with slight over estimation for Augusts, September, October, November and December and Slight under estimation for the months January, February, March, April, May, June and July .From the statically tests we examine these values and we found that the sundered devotion of the measured values is larger than the calculated values, From Figure (1) and (3) we can notice that the distribution is not Gaussian distribution and the peak values in all Figures tend to be in July in spite of the earth receive the peak value of solar energy during tune but the peak temperature records be in July, the scientific interception of this case because there is a lay time between received solar energy and its effect appearing

CONCLUSION

A simple mathematical models on 4^{th} order polynomial degree correlation formulae were proposed for monthly mean , temperature to simulate the seasonal behavior of temperature which have single parameter (month of the year). The models for monthly mean, temperature were implemented for nine provinces of Iraq temperature records are available.

The parameters of the proposed models were determined using at least 12 years long term measured data. An evaluation of the predicted monthly mean, temperature for the nine cities have been conducted in the present study the suggested model provided an excellent predictive method for monthly mean temperature.

The comparison of the prediction with the tabulated values proved that the suggested model could be use successfully model. For the monthly averages temperature in Iraq. An accurate monthly temperature models are needed for many applications in agriculture and forestry. It

has been found that the 4th order polynomial formula gives excellent fitting and very good regression.

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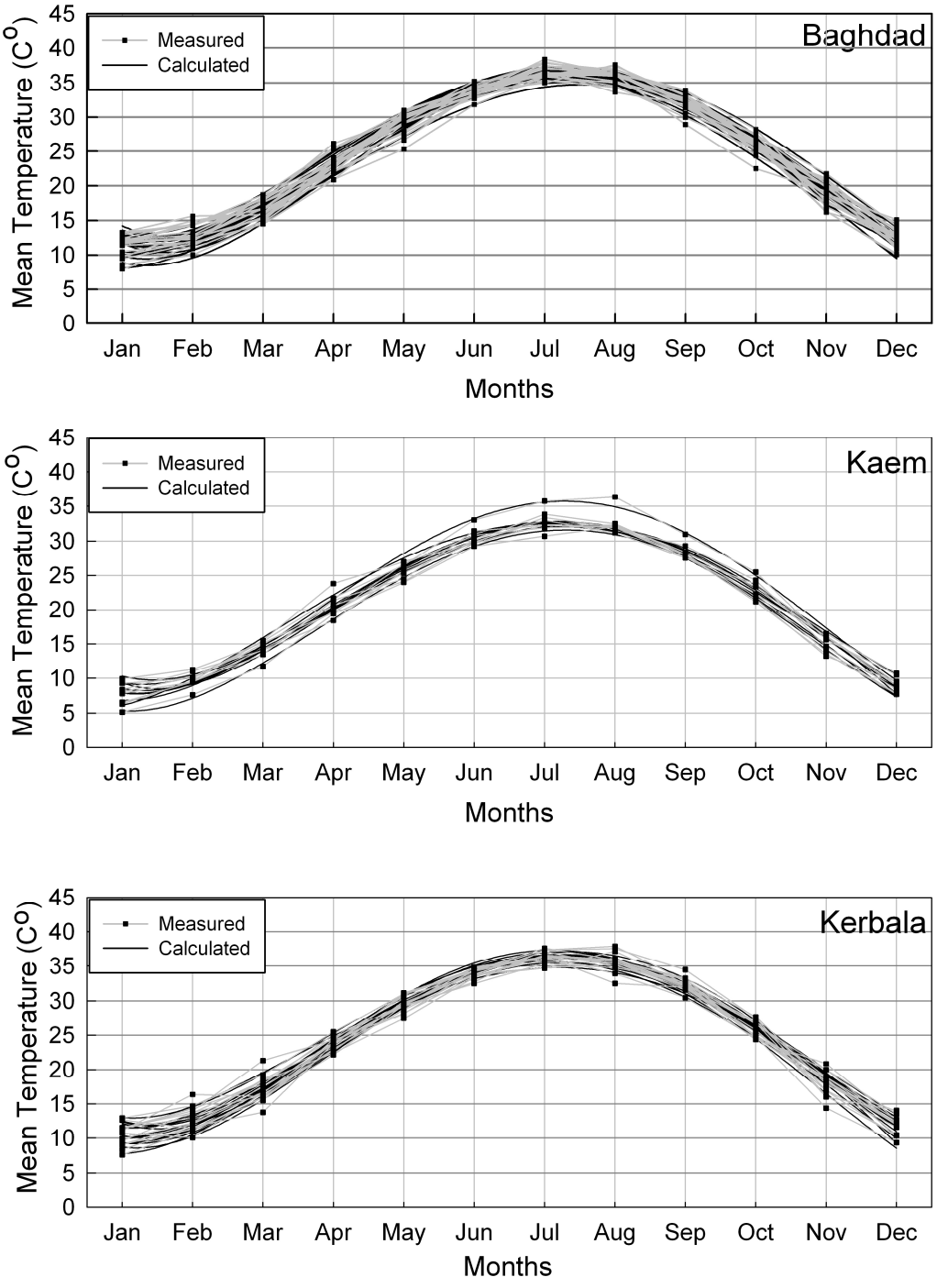
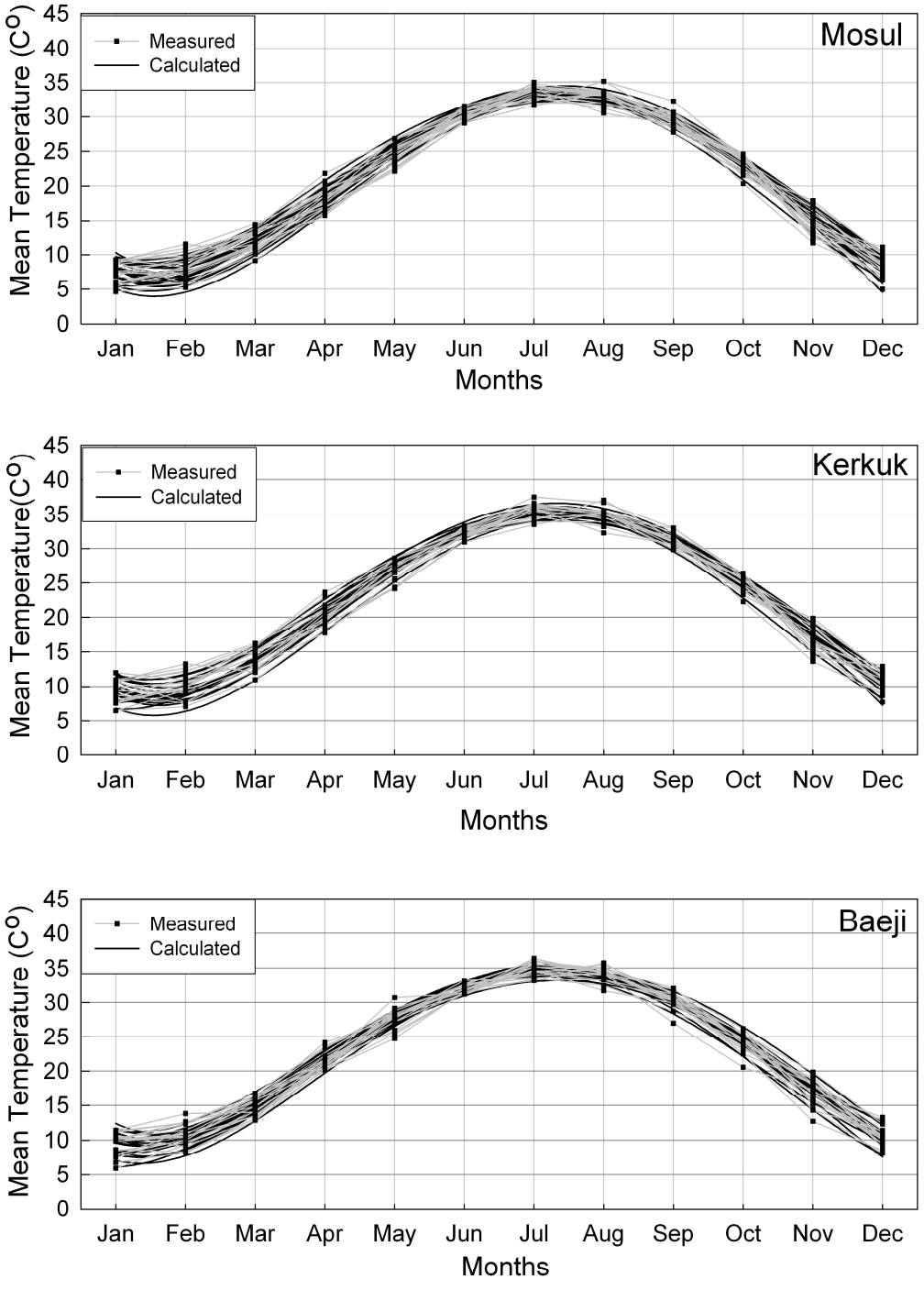
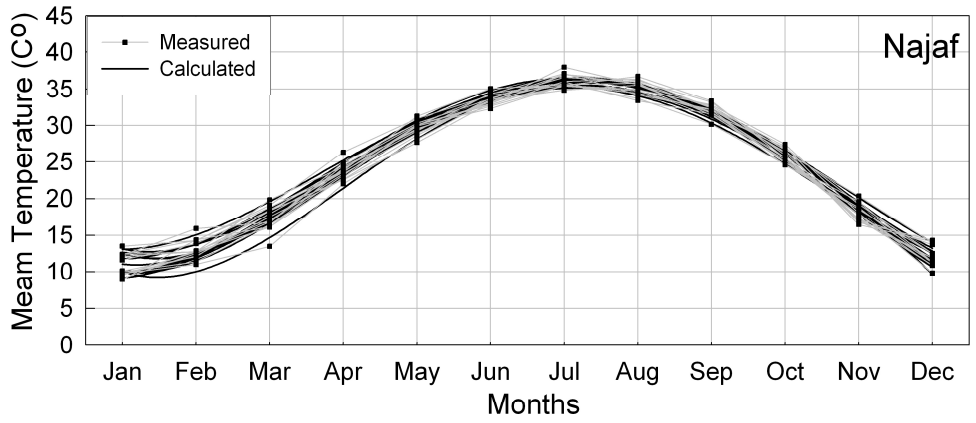
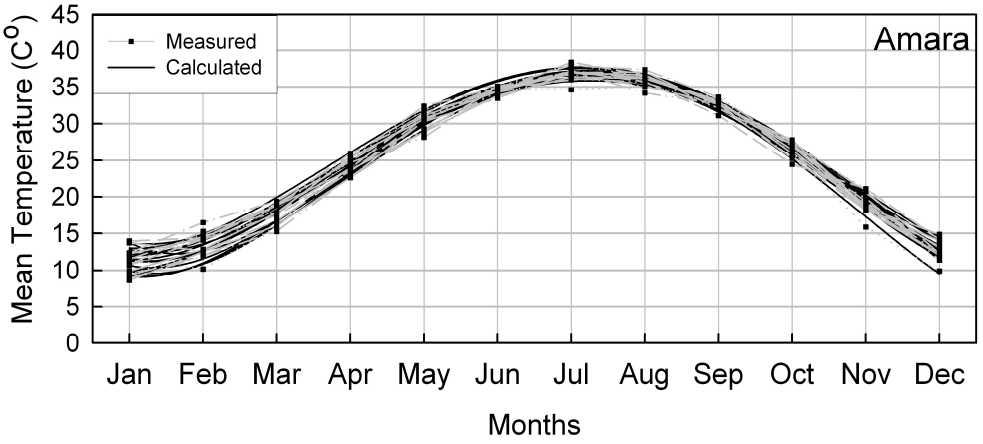


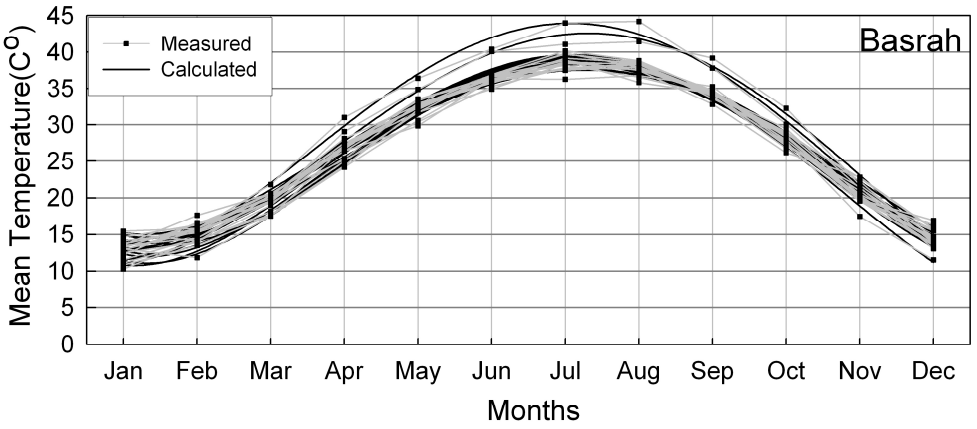
Figture(1) : Comparisom of monthly mean Temperature with model Output for Baghdad, keam and Kerbala stations



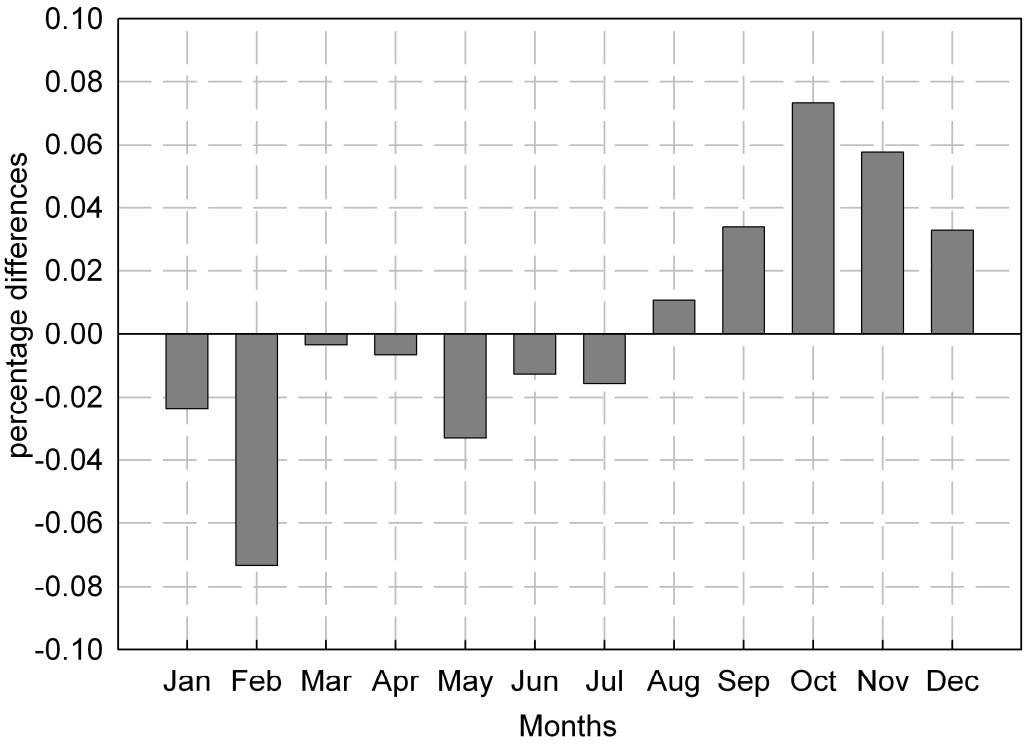
Figture(2) : Comparisom of monthly mean Temperature with model Output for Mosul, Kerkuk and Baeji stations







Figure(3) : Comparisom of monthly mean Temperature with model Output for Najaf, Amara and Basrah stations



Figture 4: the percentage differences between the calculated and measured monthly mean temperature of 18 years in Baghdad city.

Table 1: Periods of monthly mean temperature database and basic information for Meteorological stations.

Station	Longitude (E°)	Latitude (N°)	Elevation (meter)	Total Years
Amara	47.10	31.51	7.5	15
Baghdad	43.34	33.14	34.1	16
Baeji	43.29	44.56	115	14
Basrah	47.47	30.34	2.4	12
Kaem	41.11	34.02	138.5	13

Kerbala	44.01	33.37	29	14
Kirkuk	44.24	35.28	330.4	12
Mosul	43.09	36.19	333.5	12
Najaf	44.19	32.01	50	14

Table 2: the coefficients and statically values for monthly mean temperature

Station	A_o	a_1	a_2	a_3	a_4	RMSE	d	r
Amara	12.52	-8.51	4.44	-0.52	0.017	2.88	0.939	0.953
Baghdad	18.19	-11.08	5.16	-0.62	0.023	2.65	0.944	0.974
Baeji	15.98	-11	5.19	-0.60	0.020	2.89	0.925	0.956
Basra	17.97	-8.96	4.72	-0.56	0.019	2.98	0.928	0.948
Kaem	12.52	-8.51	4.44	-0.52	0.017	2.82	0.913	0.941
Karbala	15.16	-8.49	4.52	-0.53	0.018	2.71	0.932	0.963
Kirkuk	17.92	-13.51	5. 85	-0.66	0.022	2.96	0.940	0.950
Mosul	16.06	-13.23	5.71	-0.64	0.021	3.02	0.939	0.962
Najaf	15.51	-8.43	4.45	-0.53	0.018	2.61	0.956	0.983