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CREATE MAPS FOR TEMPERATURE DISTRIBUTION IN IRAQ USING ARC –GIS TECHNIQUES

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ABSTRACT
In this presents work three spatial interpolation methods are used to create maps for the distribution the max and min temperature for some provinces in Iraq. The input data which used in this work are collected for eleven weather station located at discrete places in Iraq. These collected data obtained from the Iraqi metrological organization and seismology. The reviewed techniques include Spline, Inverse Distance Weighting (IDW) and Kriging interpolations. U sing the collected data in Arc-GIS software to prepare maps distribution for max and min. the resulting continuous surfaces of producing indicates that there is a little difference between the ability of appreciation of the three methods of interpolation, with Kriging the best performance in general. Also Microsoft excel was used to study and show the annual averages of max and min temperatures for four stations (Baghdad , Basra , Mosul , Rutba) for many years (2014-2005).

KEYWORD: spatial interpolation methods, ArcGIS, Iraqi climate

INTRODUCTION

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. Remote sensing is used in numerous fields, including geography, land surveying and most Earth Science disciplines (for example, hydrology, ecology[1] , oceanography, glaciology, geology); it also has military, intelligence, commercial, economic, planning, and humanitarian applications[2]. In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (*e.g.* electromagnetic radiation). It may be split into "active" remote sensing (*i.e.*, when a signal is emitted by a satellite or aircraft and its reflection by the object is detected by the sensor) and "passive" remote sensing (*i.e.*, when the reflection of sunlight is detected by the sensor). [3]. Spatial analysis is the process of manipulating spatial information to extract new information and meaning from the original data. Usually spatial analysis is carried out with a Geographic Information System (GIS). A GIS usually provides spatial analysis tools for calculating feature statistics and carrying out geoprocessing activities as data interpolation[4].

Iraq Climate

The average temperatures in Iraq range from higher than 48 degree C in July and August to below freezing in January. A majority of the rainfall occurs from December through April and is more abundant in the mountainous region and may reach 100 centimeters a year in some places[5].

The summer months are marked by two kinds of wind phenomena: the southern and southeasterly sharqi, a dry, dusty wind with occasional gusts to eighty kilometers an hour, occurs from April to early June and again from late September through November; the shamal, a steady wind from the north and northwest, prevails from mid-June to mid-September. Very dry air which accompanies the shamal permits intensive sun heating of the land surface but also provides some cooling effect. Dust storms accompany these winds and may rise to height of several thousand meters, causing hazardous flying conditions and closing airports for brief periods of time[6] .

Interpolation Methods

Interpolation is the process of using points with known values or sample points to estimate values at other unknown points. It can be used to predict unknown values for any geographic point data, such as elevation, rainfall, chemical concentrations, noise levels, and so on. The available interpolation methods are listed below[7].

INVERSE DISTANCE WEIGHTED (IDW)

The Inverse Distance Weighting interpolator assumes that each input point has a local influence that diminishes with distance [8].

$$Z(X,Y) - \frac{\sum_{i=1}^{n}\left[\frac{Z_i}{d_i^{\,p}}\right]}{\sum_{i-1}^{n}\left[\frac{1}{d_i^{\,p}}\right]} \qquad (1)$$

$$Z(X,Y) \quad \sum \lambda_i \bullet Z_i \xrightarrow{With} \sum \lambda_i \quad 1 \qquad (2)$$

Where: is the plan metric distance between the reference point and the i^{th} interpolation point; i.e. *id*

$$d_i = \sqrt{(X_i - X)^2 + (Y_i - Y)^2} \quad (3)$$

Kriging

Kriging is a statistical technique that posits a certain statistical model for the data[9].

All kriging estimators are but variants of the basic linear regression estimator defined as:

SPLINE

The SPLINE method can be thought of as fitting a rubber-sheeted surface through the known points using a mathematical function. [10].

$$y = \frac{xi-x}{xi-xi-1} * yi - 1 + \frac{x-xi-1}{xi-xi-1} * yi \quad (4)$$

METHODOLOGY

In this section it was used ArcGIS technique to create maps for distribution of min and max temperature in Iraq .also micro software excel was used to show the annual averages of min and max temperatures at four stations .

The temperature data used for this application were collected at eleven climate stations are located in eleven rovinces of Iraq. These stations are sporadically distributed within the study area a concentration in the central city. The requirements data which are used from (January).Depending on the data collection at the climate station, these data are measurements of the air temperature a derived temperature from maximum and minimum monthly temperature records.

- Satellite image of Iraq.
- Software used such as ArcGIS and Microsoft office excels.

TABLE 1: geographical location of climate station in Iraq

station	Longitude	latitude
Mosul	42° 41'	36° 19'
Arbil	44°	36° 11 '
sulaymania	45° 26'	35° 32'
Kirkuk	44° 23'	35° 28'
Baghdad	44° 25 '	33° 19'
Rutba	40° 17'	33° 02'
Al hai	46° 02'	32° 01'
Diwaniya	44° 59'	31° 59'
Nasiriya	46° 14'	31° 03'
Basra	47° 50'	30° 30'
Duhok	42° 41'	37° 08'

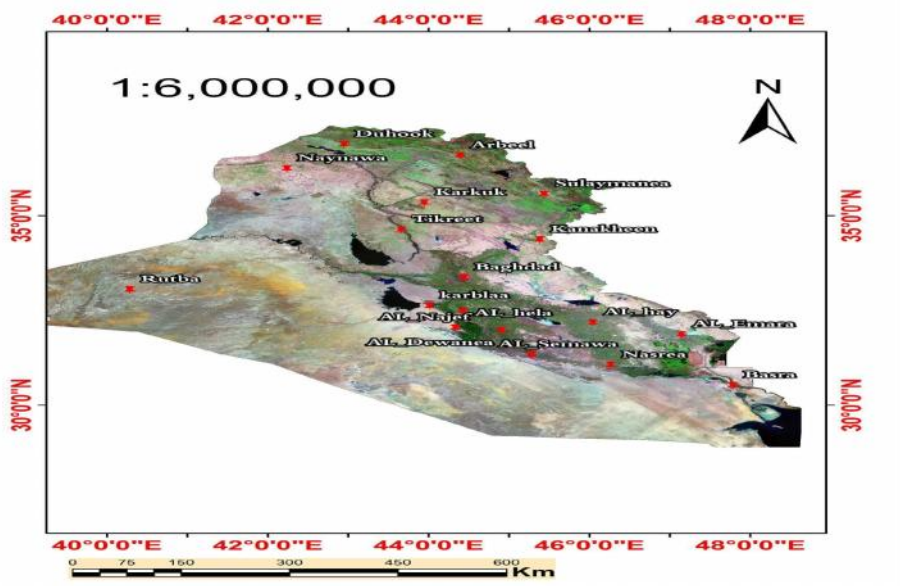

FIGURE 1: show the location of provinces in Iraq

RESULTS & DISSUASION

Maximum temperature

Figure (2)is shown by IDW surface, this surface shows more variety in the western area and is not smooth, which is one of the common characteristics of a spline surface from this show the max temperature at southern and western parts of Iraq and min temperature at the middle and north and eastern parts.

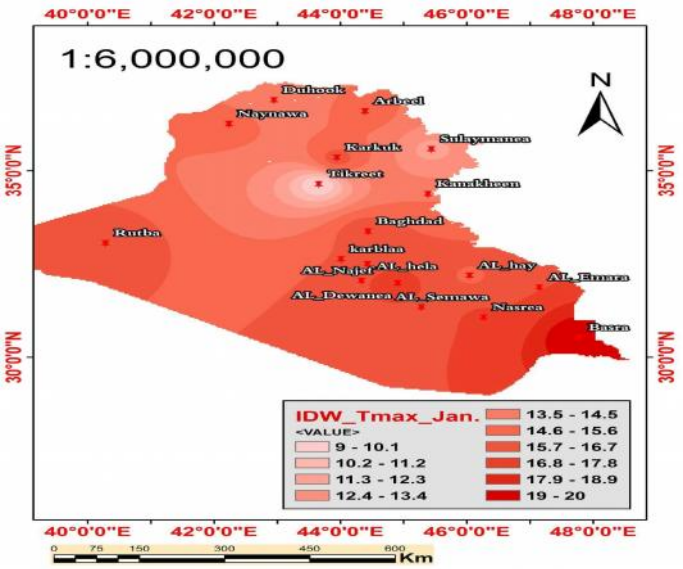

FIGURE 2: show the result of IDW method for max temperature

While figure (3) producing the smooth created by spline function which offers the correct temperature trends for the region. It shows the cooler area in north and west-north of the study area while the remaining part of the area where the temperatures are higher. The input parameters for the spline method are the input sample points, the interpolation attribute (temperature), regularized, the weight, and output cell size.

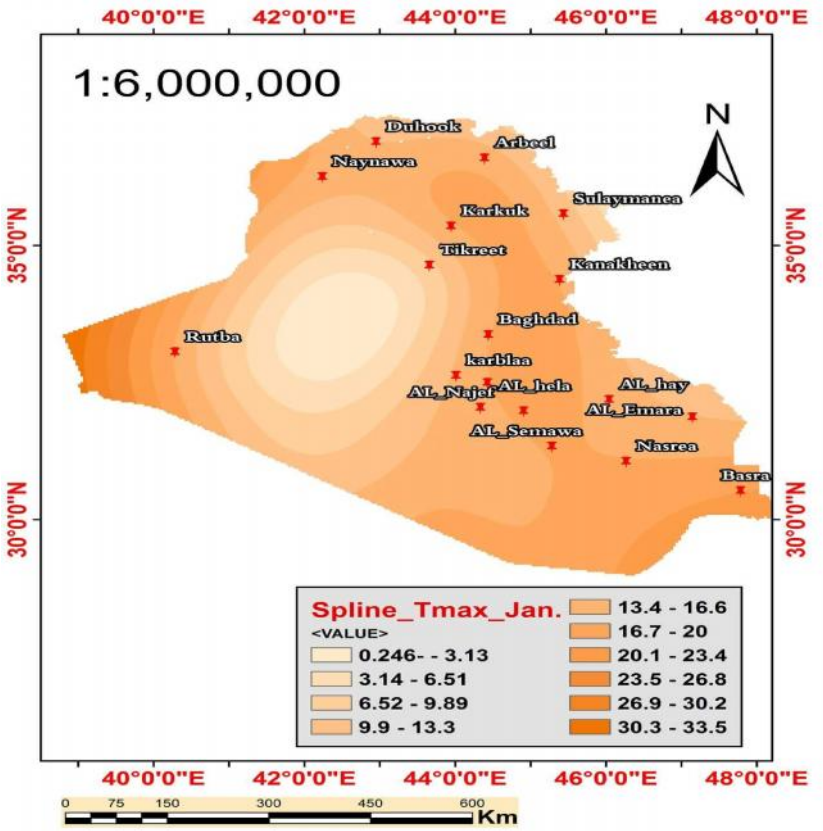

FIGURE 3: show the result of spline method for max temperature

Figure (4) shows the Kriging surface, there is more variation within the west side which are more coherent with reality than other modeled surfaces (IDW and Spline).

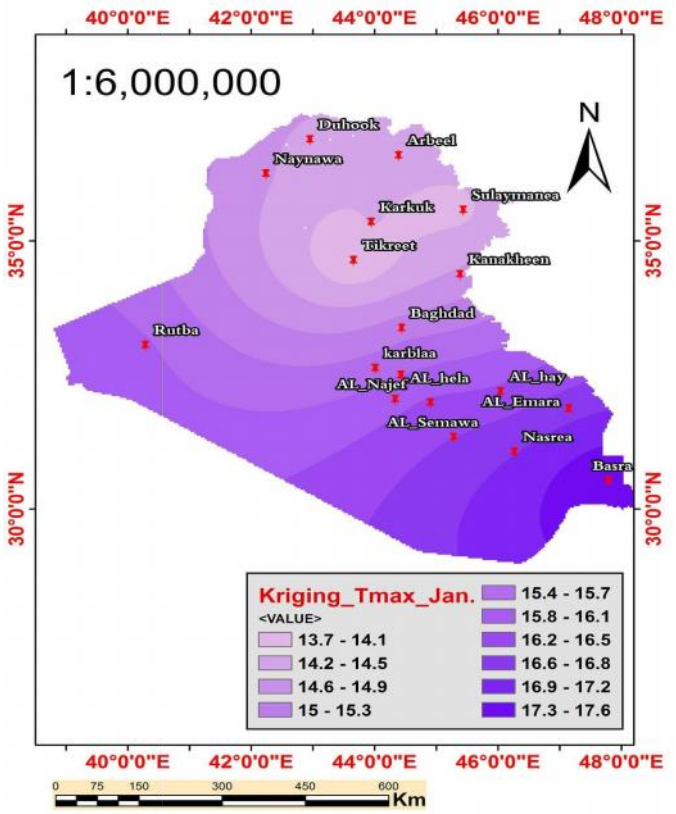

FIGURE 4: show result of kriging method for max temperature map

At the next figure shows the annual averages of max temperatures at four stations(Basra, Rutba, Mosul and Baghdad) in different places in Iraq for teen years (2005-2014), as we see from below figure the highest temperatures always be at Basra then in Baghdad And different temperatures at other stations.

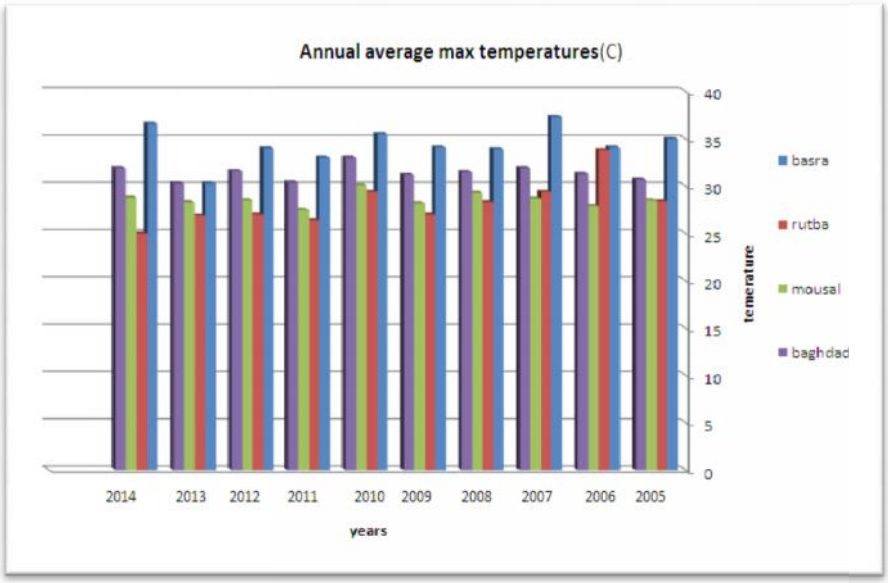

FIGURE 5: Annual averages of max temperatures in four stations in Iraq

Minimum temperature

From applying the three interpolation methods at minimum temperatures, the results that can be obtained which illustrated in the next figures, producing the same results (ID Wand Kriging have the same estimating temperatures while the Spline has little difference), but when using spatial profiles method for these interpolations the same results obtaining.

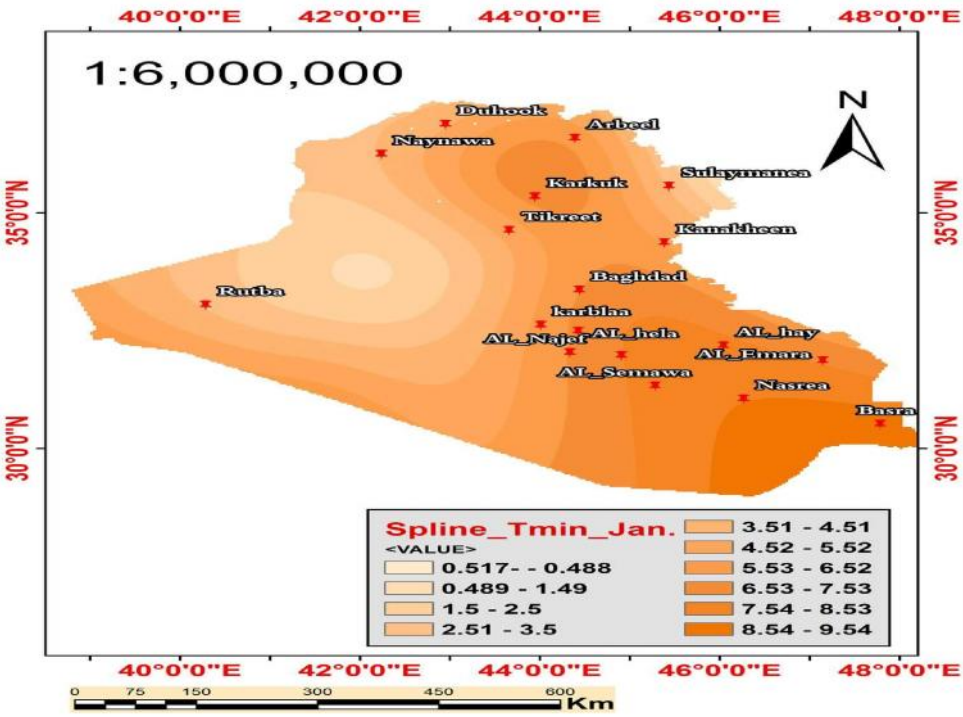

FIGURE 6: show the result of spline method for max temperature

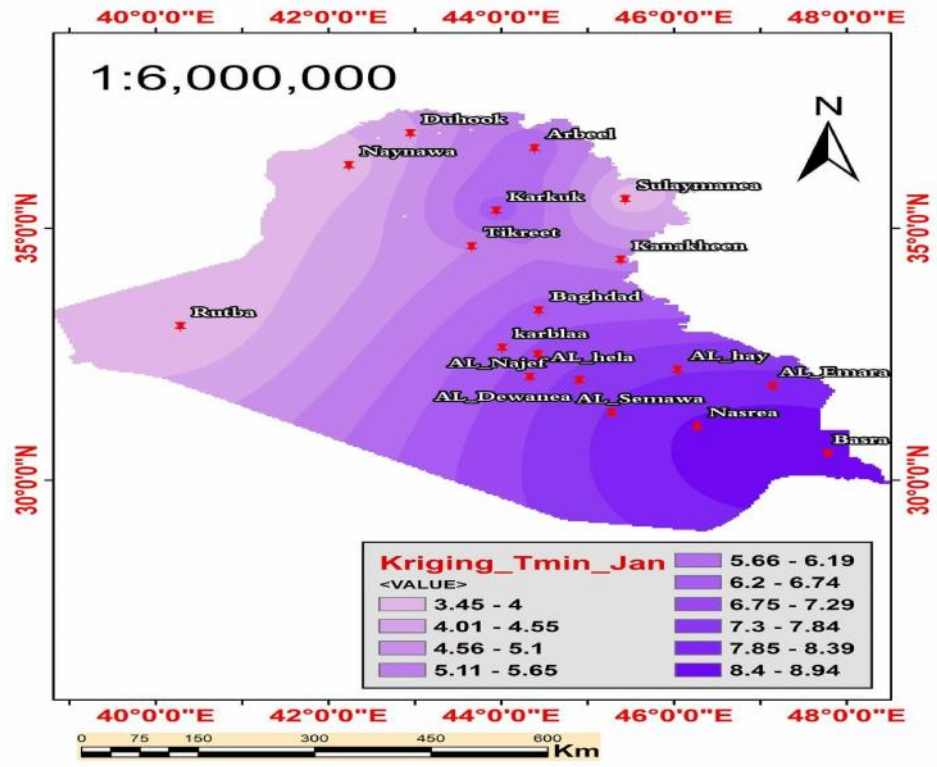

FIGURE 7: show result of kriging method for min temperature map.

At figure (8) shows the annual averages of min temperatures at four stations (Basra, Rutba, Mosul and Baghdad) in different places in Iraq for teen years (2005-2014), as we see from below figure the highest temperatures always be at Basra then in Baghdad And the temperatures are somewhat convergent in the Mosul and the Rutba.

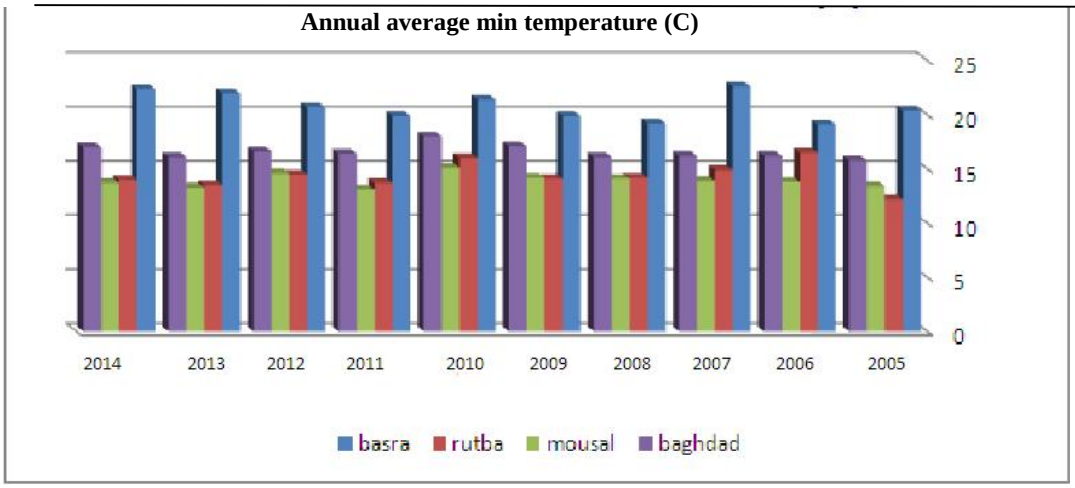

FIGURE 8: annual averages of min temperatures in Iraq

CONCLUSION

After preparing the maps of distribution for max and min temperatures of Iraq it noticed that the maps prepared by kriging are the best spatial interpolation methods because it gives us distribution for max and min temperatures more reality and closer to the real temperatures. In general there is a little variation in the prepared maps in the three interpolations but as said kriging is the best. From the annual temperature for max and min showed that Basra has highest temperatures then lowest in Baghdad and nearly the similar degrees in Rutba and Mosul.

REFERENCES

[1]. Giacomo Capizzi, Grazia Lo Sciuto, Marcin Wozniak, Robertas Damasevicius (2016) A Clustering Based System for Automated Oil Spill Detection by Satellite Remote Sensing, ICAISC (2): 613-623.

[2]. Schowengerdt, Robert, A. (2007) Remote sensing: models and methods for image processing (3rd ed.). Academic Press. p. 2. ISBN 978-0-12-369407-2.

[3]. Schott, John Robert (2007) Remote sensing: the image chain approach (2nd ed.). Oxford University Press. p. 1. ISBN 978-0-19-517817-3.

[4]. Yan. Ha, Henry, A. Nixb, Mike F., Hutchinsonb, and Trevor H. Boothc (2005) Spatial Interpolation of Monthly Mean Climate Data for China". a Research Institute of Forestry, Chinese Academy of Forestry, Beijing, 100091, Peoples Republic of China. bCenter for Resource and Environmental Studies, Australian National University, Canberra ACT 2000, Australia. Csiro Forestry and Forest Products, PO Box, Kingston, Canberra ACT 2004, Australia, International Journal of Climatology, Int.J. Climatol. 25:1369-1379.

[5]. FAO (2003) towards sustainable agricultural development in Iraq: The Transition from Relief, Rehabilitation and Reconstruction to Development. pp: 222.

[6]. Asraa K. Abdul-Kareem, Amani I. Al-Timim and Kais Al-Jumaily (2013) Estimated the Seasonal Change of Temperature in Iraq Using GIS Techniques". *Iraqi Journal of Science, 2013, Vol 54, No.4, pp: 975-982*.

[7]. Szentimrey, T., Bihari, Z. & Szalai, S. (2007) Comparison of Geostatistical and Meteorological Interpolation Methods (What is What?). In: H. Dobesch et al (Ed.) Spatial interpolation for climate data: the use of GIS in climatology and meteorology pp**.** 45-56.

[8]. http://pro.arcgis.com/en/pro-app/help/analysis/ geo sta tistical-analyst/how-inverse-distance-weighted-interpolation-works.htm. 2017.

[9]. Emery, X. (2005) "Simple and Ordinary Multigaussian Kriging for Estimating Recoverable Reserves". *Mathematical Geology*. **37**(3): 295–319. doi: 10.1007/s11004-005-1560-6.

[10]. Azpurua, M. and Dos Ramos K. (2010) A comparison of spatial interpolation methods for estimation of average electromagnetic field magnitude", Progress In Electromagnetic Research M, Vol. 14, 135–145,