Engineering and Technology Journal
Journal homepage: engtechjournal.org

The Study Air temperature Annual Rates Effect for Urban of Baghdad City by Using Remote Sensing Data Techniques

Ali K. Mohammed Ali [a]*, **Fouad K. Mashee Al Ramahi** [b],

[a] Department of Physics, College of Science, University of Baghdad, Baghdad, Iraq.

[b] Remote Sensing Unit, College of Science, University of Baghdad, Baghdad, Iraq..

*Corresponding author.

Submitted: 25/08/2019 Accepted: 31/12/2019 Published: 25/07/2020

K E Y W O R D S

Air Temperature, IDW Technique, Satellite Imagery Data, Climate Variables, ArcGIS Tools.

A B S T R A C T

Within a short amount of years, urban land in Baghdad governorate increased as a result of the improvement of the economic factor of human beings, the speedy enlargement Buildings method brought many negative climate issues, for instance, the violent modification of land use and the growth UHI, which led to a decrease in vegetation cover, where influenced the temperature averages, Accordingly, we conducted the following study to find solutions, From 2008 to 2018, Landsat Information 5 and 8 were adopted in this analysis, show that urbanization is increasing rapidly aswell as the impact of degrees Temperature in this change, was the source of temperature data (ECMWF) for the province of the study, and the results of the method (IDW) used for temperature mapping showed a change in the rates of temperature in urban areas, where the decline of vegetation impact on temperature rates, As well as commercial activities developed by people, which occupied some agricultural land, which led to negative results ,Several previous kinds of research show that the developed lands by humans will affect the local climate. The satellites used were Landsat 5 and 8, where the images of the study area were taken by these satellites during the study period and were entered into a program (ArcGIS) for the objective of modification and clear output. From the information obtained from the results, there is an inverse correlation between increasing urbanization and air temperature rates and positive correlation with solar radiation and wind speed. We conclude from this information that the development of green lands without good coordination will affect the local environment.

How to cite this article: A. K. Mohammed Ali and F. K. Mashee Al Ramahi, "The study air temperature annual rates effect for urban of Baghdad city by using remote sensing data techniques," Engineering and Technology Journal, Vol. 38, Part B, No. 02, pp. 66-73, 2020.
DOI: https://doi.org/10.30684/etj.v38i2B.532

1. Introduction

Widening urbanization commonly leads to a significant alteration in the atmospheric and surface properties, subsequently generates an urban negative climate. It produces a UHI, a status in which the predominant surface temperature in an urban zone is commonly rising than the surface temperature in a neighboring rural zone, with large temperature variation during nighttime than within midday. The

influence of the urban thermal island is increasingly becoming an international concern, as around half of the world's human inhabitance lives in the urban regions and the people leaving rural to the urban regions proceed. The UHI affected the climate in urban zones by, for example, permutation surface temperature and rain also, and consequently affects population Comfort. For instance, an increased hesitation of heatwaves in urban zones leads to heat-linked malady and It produces negative effects. Thus, in the last period, numerous projects on UHI With attention besides the health of the population, the objective of this project is to employ remote sensing techniques and Geographic Information Systems to evaluate the impacts of Expansion of buildings, On the air temperature Values [1]. The international breadth of the city's population has brought about a growing request for more residence space, ensue from several negative effects like accelerated Urbanization growth, urban growth, and elevated carbon effects. Higher levels of CO2 exit damage, along with massive low green areas, affect Air temperature rates and local air fineness, having immediate consequences for local population health and well-being. Interpreted the influences of people's emissions on Air temperature rates in the urban land and observed that urban heat causes a larger temperature range, from rural areas that output a powerful inward influx of urban-breeze spreading. Consequently, this boosts the advection of ozone from the nearby into the residential areas, however, it is recognized that ozone-Abundant in the air may lead to a collection of adverse health impacts [2]. Period and cost and urban evolution, especially the growth of commercial factories and warehouses in agricultural areas near urban areas, for a period while been seen as a mark of local monetary lack. A layout in urban evolution is checked here using Landsat imagery. Remote sensing is a Modern method and gives scientific results, and is thence, progressively applied for the evaluation of urban expansion. Observed remote sensing and GIs are useful in detecting the LULC changes. In town, generally, information which is provided from Landsat imagery so active in mapping and detecting a variety of Land categories in order to plan .moreover, using RS, and combine it with GIS can be used to obtain climate information. Via mixing the information provided from RS and GIS to analyzing and classification the LULC variation modality during the time will be likely and variation would be found [3].

2. The boundaries of the Study Area

The study area is the capital of Iraq located along the Tigris River with its administrative borders between longitude (33.452°N and 33.184°N) and longitude (44.189°E to 44.576°E) It is the largest city in Iraq with a population of nearly 8 million people, consisting of several cities, Rashida in the north, Rasheed in the south, Nasir and salam in the west and wihda in the east [4]. Figure 1.

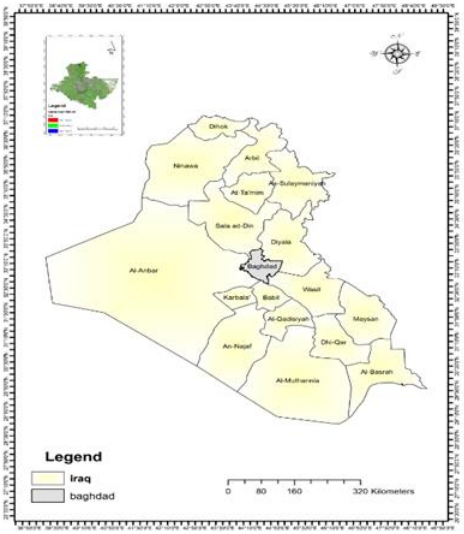

Figure 1: Illustration; of the location of the study area Baghdad Capital of Iraq

3. Data Source

The air temperature observation data obtained from The European Centre for Medium-Range Weather Forecasts (ECMWF) distributed in the areas of Baghdad, In the form of points, each point represents an atmospheric observation station with equal distances and for ten years, the Landsat 8 and 5 were used in this research, [5] as Figure 2 and Table 1.

Table 1: Landsat satellite imagery Data used in the search

Landsat 5	Landsat 8	source	Temperature Rates	source
Band 7	Band 7	USGS	March	ECMWF
Band 4	Band 5	USGS	March	ECMWF
Band 2	Band 3	USGS	March	ECMWF

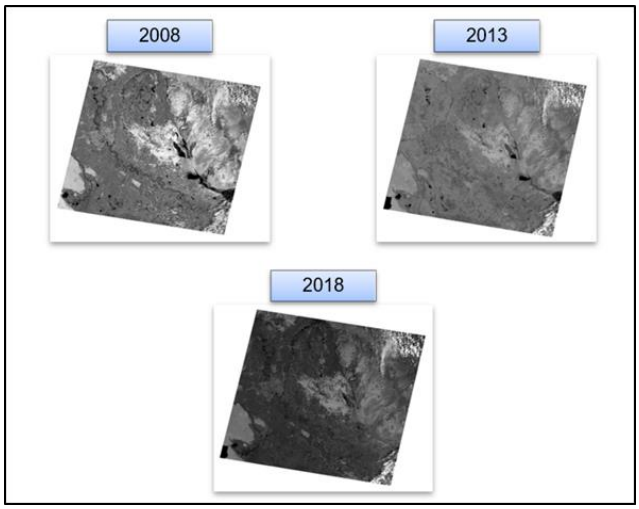

Figure 2: Illustration; Landsat satellite image study area and for three time periods

4. Data Pre-Processing

In this paper, satellite images of the years 2008 (Landsat 5) and 2018 (Landsat 8) It was introduced into the ArcGIS program. Subsequently, Satellite information was primarily controlled in terms of radiometric, and clouds effects corrections, thereafter, The output of satellite images is clear for study [6]. (Figure 3).

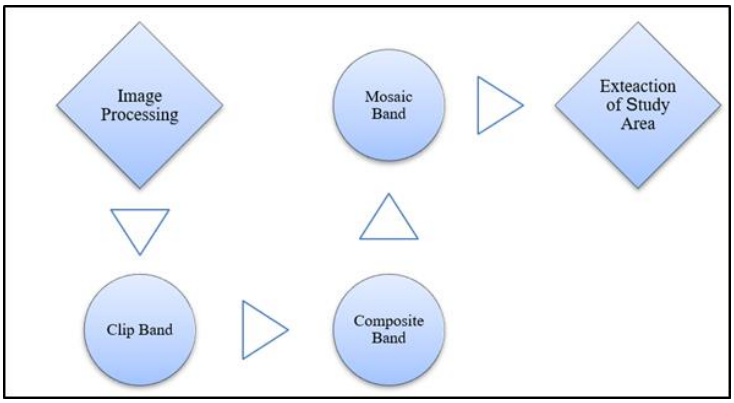

Figure 3: Illustration; Steps to work on satellite images of the study area

5. Impacts of Environmental Changes

Increased carbon dioxide in the air has resulted in a change in the temperature rates, and led to the impact of local climate, as a result of human activities such as factories, generators, and heaters, because of which increased drought, local climate change will lead to different geographical areas, led to the degradation of plants that affect Temperatures, especially in warm areas, must be taken care of by urban plants for the climate [7].

6. Temperature Rates

The air temperature is the amount of energy actually present in the air [8], where the air temperature in urban areas differs from rural areas. Table (2) and figure (4) show the average temperature in March and during the study period.

Table 2: Temperature rates during the research time period of the study area

year	Temperature Rates (C deg)	Month
2008	24.309	March
2013	23.214	March
2018	23.305	March

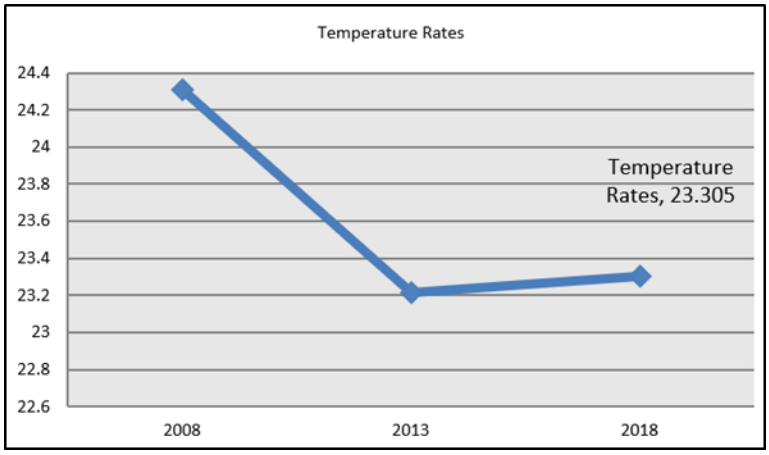

Figure 4: Illustration; the variation in temperature rates

7. Solar Radiation

Solar radiation is defined as the radiative energy emitted by the sun from long distances in all directions and reaches a small amount to the Earth's surface due to the processes of absorption and scattering in the atmosphere. As the table (3), [9]. And Figure 5.

Table 3: Solar radiation rates during the research period

Year	Solar Radiation	Year	Solar Radiation
2008	8.091666667	2014	8.533333333
2009	7.925	2015	17.075
2010	8.516666667	2016	8.9
2011	8.591666667	2017	9.136363636
2012	8.275	2018	8.5
2013	8.55	average	9.281336088

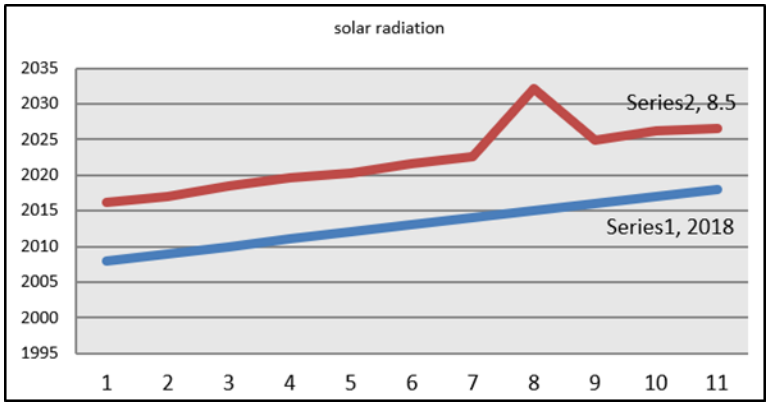

Figure 5: Illustration; the variation in Solar radiation annual rate

8. Wind Speed

The wind is defined as the horizontal movement of wind caused by the difference of pressure between the layers of air, so the air moves from the high-pressure layer to the low-pressure layer, bringing with it climatic factors such as relative humidity and temperature. As the Table 4 and Figure 6, [10].

Table 4: Wind speed rates during the research period

year	wind speed
2008	3.012
2009	3.412
2010	3.321
2011	3.462
2012	3.045
2013	3.034
2014	3.654
2015	3.527
2016	3.041
2017	3.028
2018	3.342
average	3.261636364

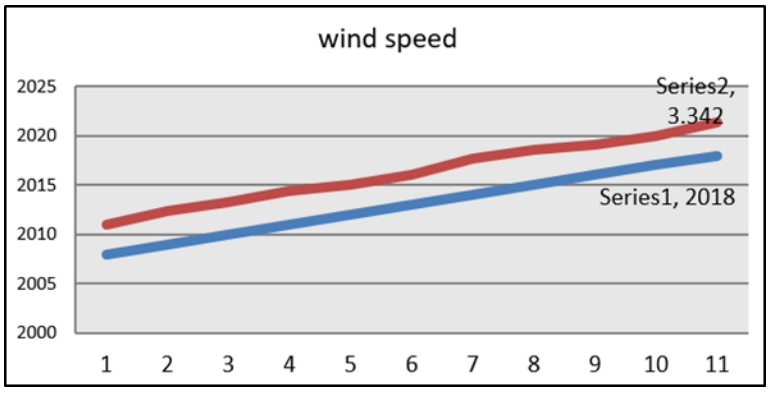

Figure 6: Illustration; the variation in Wind speed annual rate

9. Built-up Area Extraction

(NDI) has been effective for mapping urban Land uses Landsat -5 Thematic Mapper information And also Landsat-8 Operational Land Imager information,[11]. Figure 7 and Table 5, as in equation (1).

$$NDI = \frac{blue - NIR}{blue + NIR} \quad (1)$$

Table 5: NDI Index Values

year	Area m²	Area %	satellite
2008	946026900	18.10%	Landsat 5
2013	1087958700	20.80%	Landsat 5
2018	1271033100	24.30%	Landsat 8

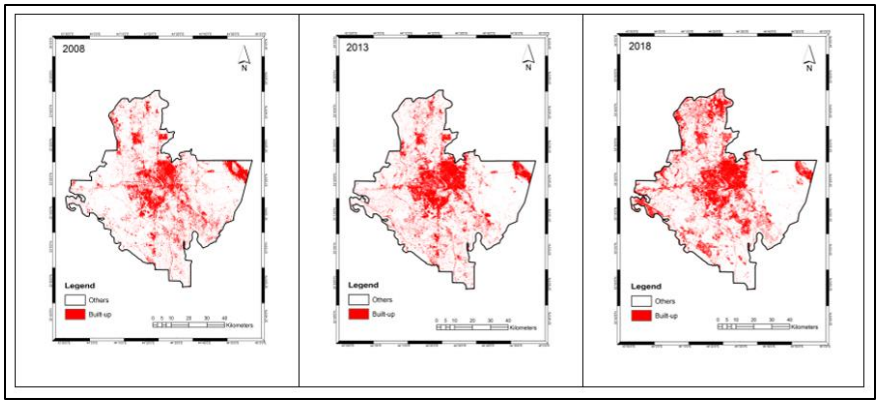

Figure 7: Illustration; IND maps during the search period

10. Interpolation Method

The combined information from the source was utilized to generate models of Air temperature apportionment (isothermal maps) and identify areas by color, Where, the inverse distance weighting method was used in this research show Figure 8, [12].

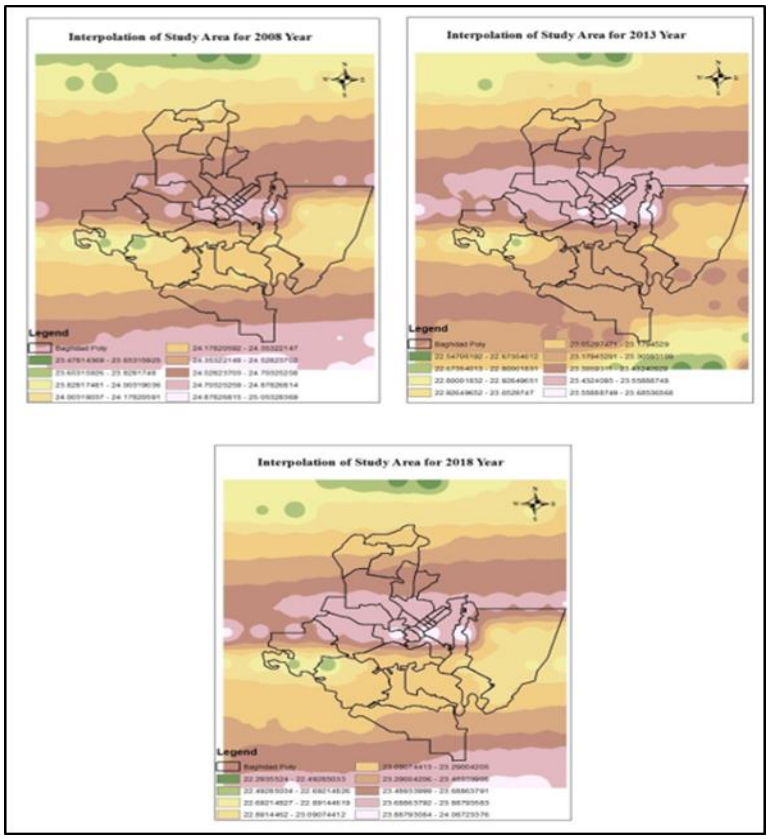

Figure 8: Illustration; IDW maps techniques during the search Time period (2008, 2013 and 2018)

11. Results and Discussion

Table 6 shows the relationships between Air temperature rates and growing urban. The statistically agreeable Values denote the various behaviors' of each Expansion urban associated with different seasons and different times With Air temperature. Therefore, the evolution in agricultural land has affected the change in air temperature, In 2008 the urbanization area was 946026900m² and the air temperature was 24.309 (C deg) in March. The following table shows that the urban area continues to increase, which affected the decline of agricultural land which plays a role in cooling the areas where through maps (IDW) shows that the air temperature in urban areas is greater than agricultural areas, where in 2018, which reached the urban area 1271033100m² Observe the highest concentration of temperature in urban areas, Figure 9 shows the relationship between air temperature and urbanization.

Table 6: Built-up areas and temperature rates

year	Temperature Rates (C deg)	Area m²	Month
2008	24.309	946026900	March
2013	23.214	1087958700	March
2018	23.305	1271033100	March

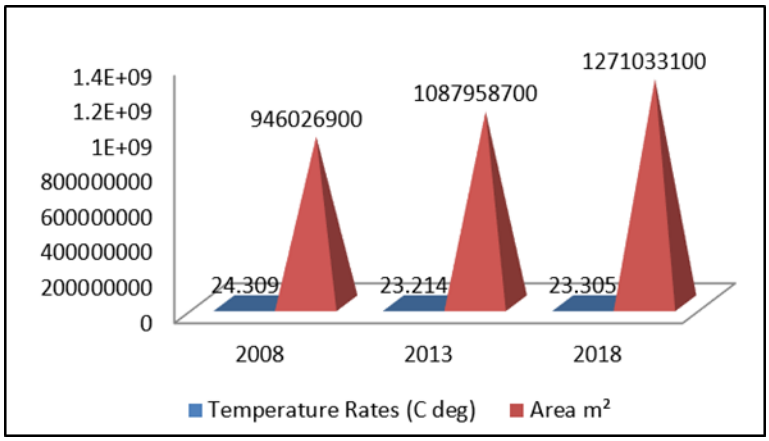

Figure 9: Shows the effect of urbanization on average temperature

12. Conclusion

This search integrated the Satellite Imaging technique with Air temperature data, studied into the relationship between the urban effect and Air temperature from both temporal and spatial fields, and interpreted the major controlling factors of the urban expansion effect by statistical analysis. The search results are as follows: 1) In 2008 the rate of urbanization was 18.10%, which is the lowest during the research period and also with the least space for urbanization where maps (IDW) showed that temperatures were lower in urban areas due to the activity of agricultural land. 2) We concluded by researching a positive relationship between temperature, solar radiation and wind speed, 3) Air temperature rates increased in 2013 and 2018 with increasing urbanization areas and decreasing plant categories, resulting in land degradation and consequently impact on temperature rates through a greater reflection of solar radiation.

References

[1] H. Zhang, "Using satellite remote sensing, field observations and WRF/single-layer urban canopy model simulation to analyze the Oklahoma city UHI effect," (p. 69). Master's Theses. Department of Meteorology and Climate Science. A Jose State University, 2015.

[2] M. Vuckovic, "Potential of urban densification to mitigate the effects of heat island in Vienna, Austria.," Journal of environmental sciences. vol.6, no.86, p.12, 2019.

[3] D. Raza, "Satellite Based surveillance of LULC with deliberation on urban land," Journal of Geography & Natural Disasters, vol.9, no.1, p.8, 2019.

[4] M. T. Mahmoud, "Climatic effects of baghdad air pollution with auto exhaust for 1996-2006 using GIS," (p. 218). Master's Theses, University of Baghdad, Department of Geography, 2008.

[5] WANG, "The relationship between land use, land cover change, and the heat island effect in Xi'an city, china," Journal of Applied Ecology and Environmental Research, vol.17, no.4, p.12, 2019.

[6] M. Bozorgi, "Spatiotemporal monitoring of the thermal environment in Isfahan metropolitan area," Journal of Environmental Risk Assessment and Remediation, vol.3, no.1, p.10, 2019.

[7] R. Grote, "Functional traits of urban trees: air pollution mitigation potential," Journal of Frontiers in Ecology and the Environment, vol.10, no.102, p.8, 2016.

[8] M. S. Hachim, "Assessment of pollution by ozone and its causes in diurnal urban Baghdad atmosphere," (p. 66). Master's Theses, Mustansiriya University, Department of Atmospheric Sciences, 2015.

[9] F. H. Mahmood and G. S. Al-Hassany, "Study global solar radiation based on sunshine hours in Iraq," Iraqi Journal of Science, 55, 4A, 1663-1674, 2014.

[10] M. N. Abd and G. S. Al-Hassany, "Estimation of average of global solar radiation depending on sunshine duration hours for Iraqi metrological stations," Iraqi Journal of Science, 60, 12, 2019.

[11] S. Vigneshwaran, "Etraction of built-up area using high resolution sentinel-2a and google satellite imagery," International Conference on Geomatics and Geospatial Technology, vol.3, no.5, p5, 2018.

[12] F. K. Mashee and Gh. S. Hadi, "Study the wet region in Anbar province by use remote sensing (RS) and geographic information system (GIS) techniques," Iraqi Journal of Science, Vol. 58, 3A, 1333-1344, 2017.