



STUDY THE DUST STORM IN IRAQ USING DATA OBSERVATION AND GIS TECHNIQUES

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ABSTRACT

Based on the dust storms data and weather parameters in four meteorological stations in Iraq, we analyzed the annual number of dust storms days for many years as well as their correlation with temperature, precipitation, relative humidity, the results showed that the relation between annual dust storms days number with precipitation and relative humidity were inverse, while the relation between dust storm days number with temperature was ejective. GIS was also used to estimate the number of dust storm days by means of spatial analysis based on input values for several stations in several regions of Iraq and produce maps for the estimated number days of all kind of dust storm.

KEY WORDS: dust storms, meteorological stations, GIS.

INTRODUCTION

A sand and/or dust storm (sand storm) is a meteorological phenomenon common in arid and semi-arid regions. Dust storms arise when a gust front or other strong wind blows loose sand and dirt from a dry surface. Particles are transported by siltation and suspension, a process that moves soil from one place and deposits it in another^[1]. The term sand storm is used most often in the context of desert sandstorms, especially in the deserts, or places where sand is a more prevalent soil type than dirt or rock, when, in addition to fine particles obscuring visibility, a considerable amount of larger sand particles are blown closer to the surface. The term dust storm is more likely to be used when finer particles are blown long distances, especially when the dust storm affects urban areas^[2]. Dust storm formation is determined by a number of factors including dryness, wind field, soil type, and precipitation, with precipitation being the most essential factor.

Suspended Dust

The atoms are suspended in the air with the wind speed most often being quiet or light and the vision varies from (1-5) Km. these dust particles are dry and stay in the air for a few days. The suspended dust is the last stage of dust storms and rising dust^[3].

Rising Dust

Rising dust particles with wind speed are usually moderate and sometimes active and the visibility is 1000 m or It occurs due to the biological instability resulting from the activity of the rising pregnancy currents due to day heating, because of wind activity at any time during the night or day and minutes of dust rise when the winds of speed

(25km / h) and this type of dust does not move to distant distances^[3].

Dust storm

Is the minimum range of vision below 1000 m and the wind speed is more than 7 m/s. Dust storms can be defined from a geographical point of view as a cloud of mobile dust with which Increase in density of soil Research

reduces the vision range of 1 km with a speed of wind 7 m/s or more^[3].

Dust storms and atmospheric elements affecting their replication

Dust storms occur in areas characterized by drought, and lack of rainfall include Large areas of the world, including the Arab world in general and a large part of the population in particular, and the existence of Dust is stuck in the atmosphere and at different altitudes depend on the intensity of the wind movement and the wind^[4]. In general, the phenomenon of dust storms in an area is subject to highly complex physiological factors that begin with nature Soil in the region and surrounding areas, and pass the various human activities, and ends with factors Interlocking air^[5], where dust was analyzed and showed the relationship of dust velocity And the direction of wind accompanying it in addition to explaining the impact of dust in the rain in light of the extraction of the correlation function between them^[6], which found a relationship of inverse correlation between dust frequency and annual rainfall, and found a high correlation between rainfall and dust in Baghdad. The phenomenon of dust can occur in the event of stability of the atmosphere, or in the case of instability .In The state of the stability of the atmosphere generates dust when thermal coups predominate at a height of (500-1000), because the air falls from the upper layers^[7]. In the case of instability of the atmosphere, the dust is raised by cold air fronts when passing over Deserts are associated with the air depressions and thus increase the speed of the wind, which in turn is spreading Atoms of dust on a large area and high elevations of the surface of the earth^[7]. Temperature is the most important component of climate in terms of its direct effecting on Atmospheric pressure, air wind movement, and cloud formation, precipitation and evaporation rate. Relative humidity is associated with the phenomenon of dust storms through an inverse relationship between relative humidity and temperature .This leaves the soil with a certain amount of moisture due to low temperatures, making it more cohesive^[8]. And therefore

the low rates of dust storms in winter and wind is also a mechanical means of transport Thermal energy and water vapor and the resulting changes in weather phenomena between different region .Rain is one of the most critical elements of the climate in limiting and minimizing the impact of dust storms ^[9].

Air elements data and study sites

In this study, the data recorded in four climatic stations belonging to General Organization for meteorological and

Seismic Monitoring (Baghdad, Basrah, Mosul and Rutbah) and for several years And to identify the impact of air element Selected in the repetition of dust storms and also calculated the correlation coefficient between these elements and also we used the software of Arc- GIS to estimate the number of days of Suspended ,rising, dust storms for the different Iraqi regions.

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' |

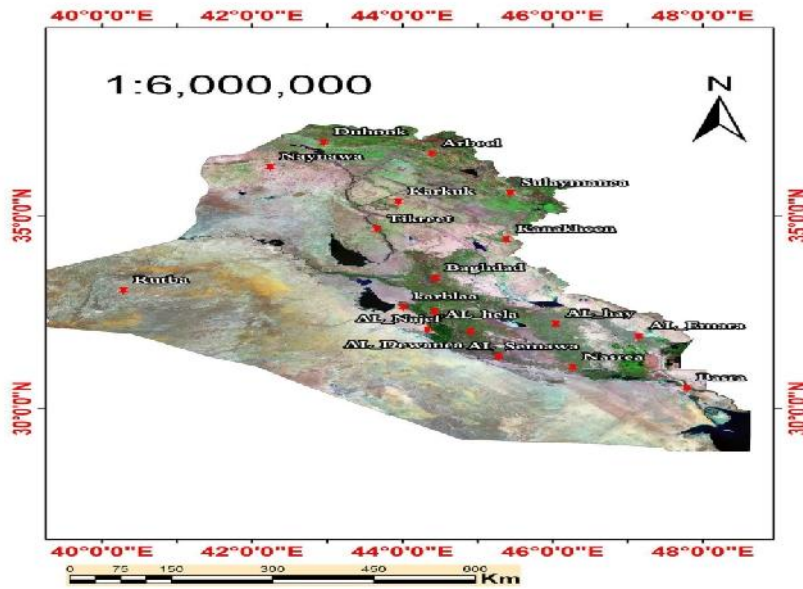


FIGURE 1: Administrative map of Iraq

RESULTS & DISSUASION

Annual effect of atmospheric elements on dust storms Air elements play an important role in limiting and minimizing the impact of dust storms and annual change will be studied For the number of days of dust storms with each of the annual rate of rainfall, relative humidity and temperature, Also calculate the annual correlation coefficients values by using Pearson correlation

coefficient (Pearson correlation) To show how closely each is related to dust storms.

Annual change the number of days of dust storms with rates of rainfall

The next figures show the relationship of numbers of dust storms with rates of rainfall for many years and for four stations.

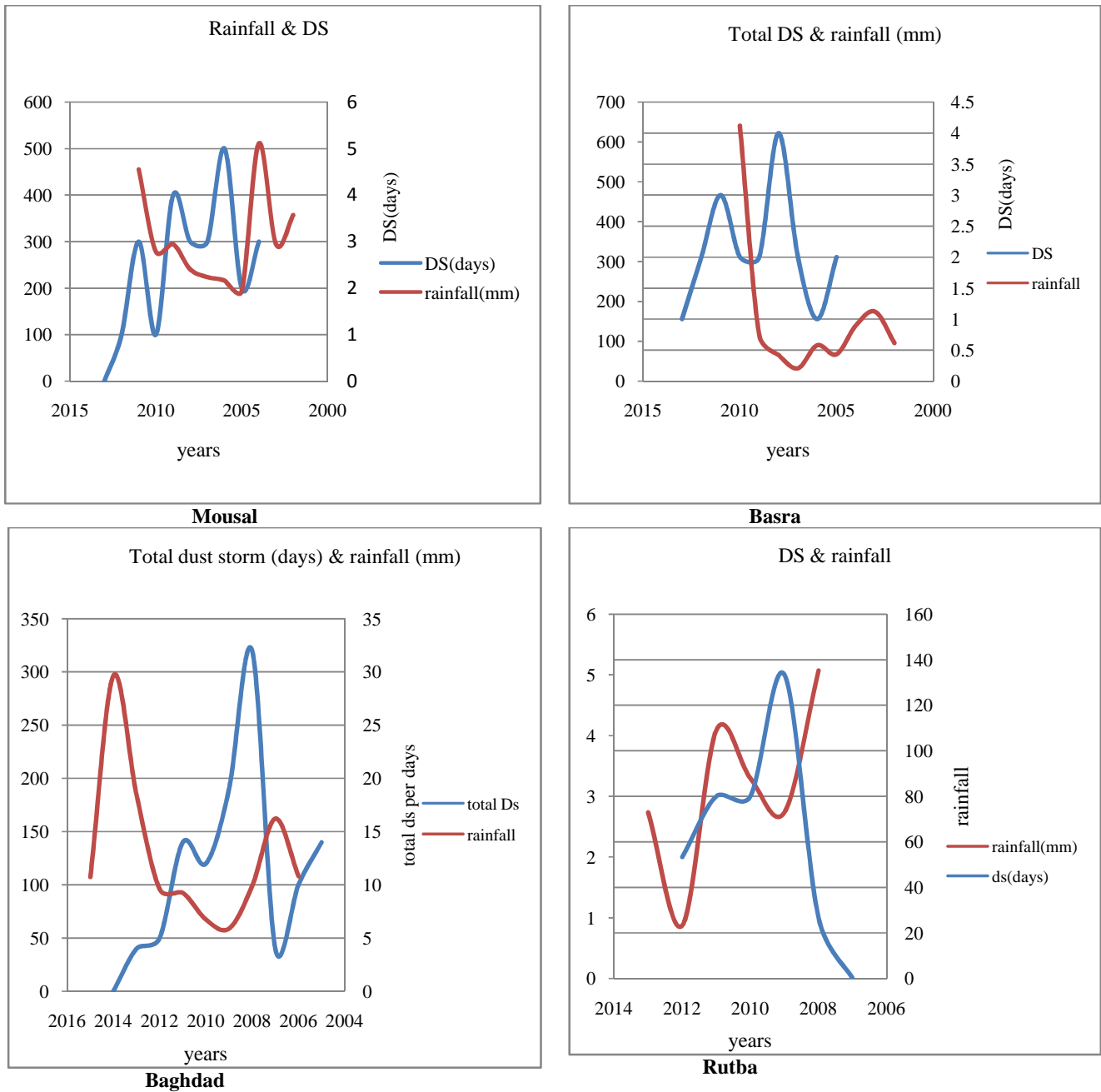
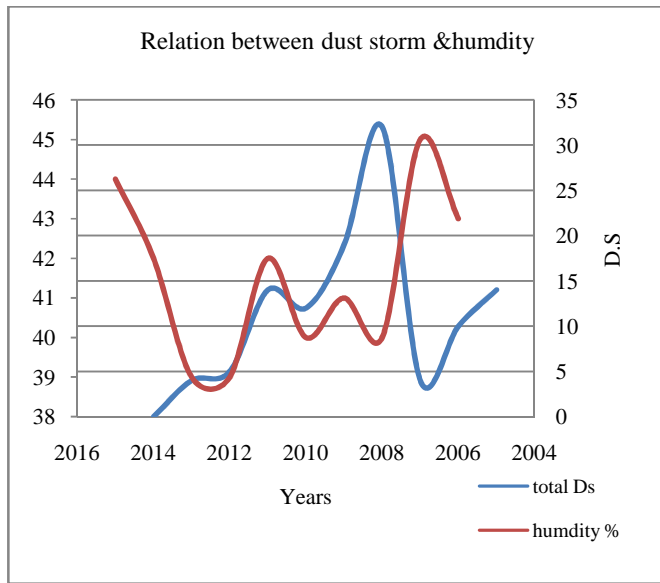


FIGURE 2: Show the relation between dust storms (days) with rainfall (mm)

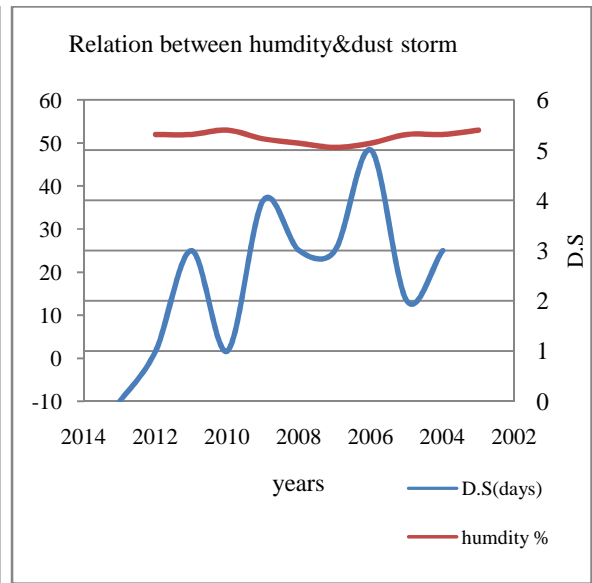
Where those figures show the inverse relationship between the number of days of dust storms and the annual rainfall rates of four stations. This reverse relationship is clearly shown by the correlation coefficient, where correlation coefficients (Pearson coefficient) are shown to have negative values as follows (Basra -0.11977), (Baghdad-0.28594) , (Rutba -0.34486), (Mousal 0.008567).

Annual change the number of days of dust storms with relative humidity

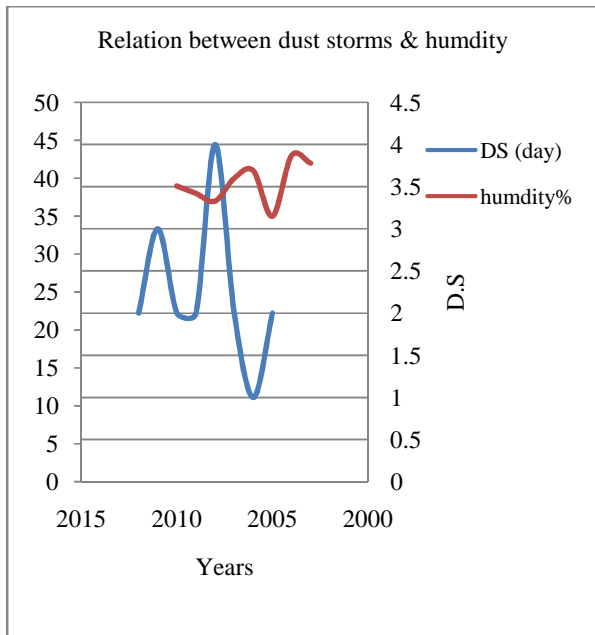
The following figure shows the annual change of dust storms with relative humidity at study stations over several years.



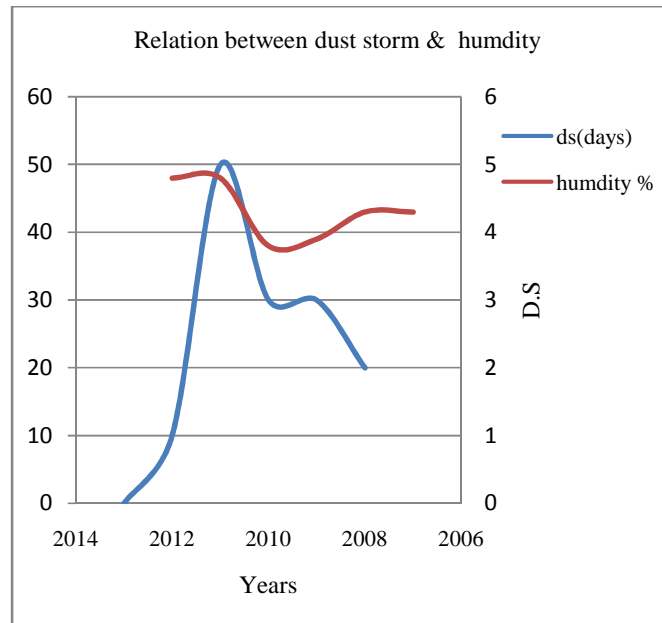
Baghdad



Musal



Basra



Rutba

FIGURE 3: Show the relation between dust storms (days) with humidity

Where we notice an increase in the number of days of dust storms in stations low relative humidity is recorded, while these storms are lower in high-temperature stations. This conclusion is clear from the calculation of correlation coefficients, which were as follows (Baghdad -0.34082), (musal -0.16361), (basra -0.10566), (rutba -0.33048). Where all the values were negative, proving the inverse relationship between moisture and dust storms.

Annual change the number of days of dust storms with average temperature

The following figure shows the annual change in the number of days of dust storms with temperature in the four stations selected, where we observe an increase in the number of dust storms in Stations with high temperature.

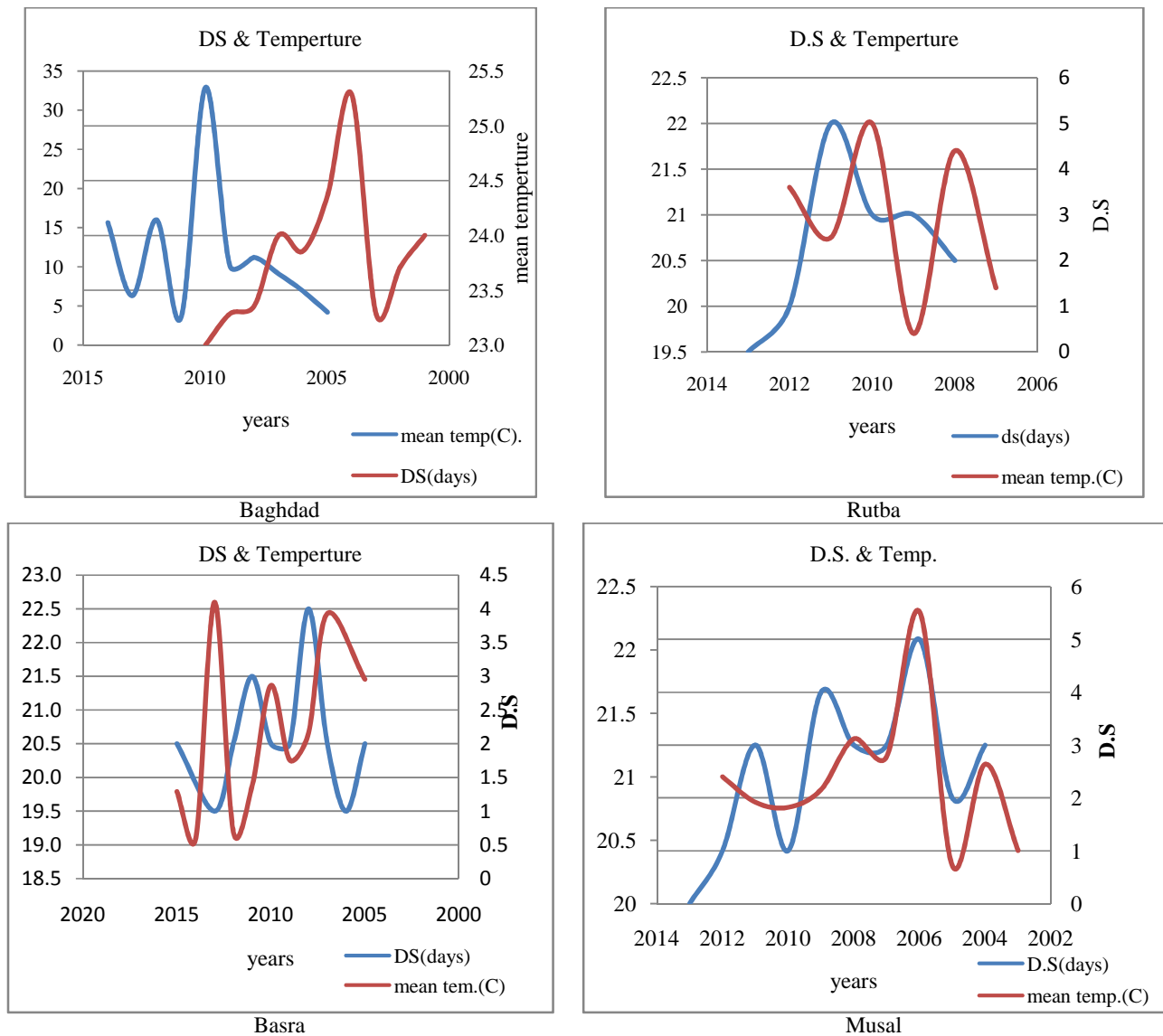


FIGURE 4: show the relation between dust storms (days) with temperature °C.

In order to find The correlation between the mean temperature and dust storms was analyzed The temperature in the same periods in the four stations and the calculation of correlation coefficient found that the effect of the rate temperature on the number of days of dust storms is generally a positive relationship in stations (Baghdad 0.157831) ,(rutba 0.278330479) , (musal 154510834) , but in (basra 0.278330479) Perhaps because of the high relative humidity and since the humidity is inversely proportional to the dust storms this generates anomaly with the correlation coefficient so it was negative value.

Estimate the number of days of Suspended, rising, dust storms for the different Iraqi regions by using spatial interpolation methods

The choice of interpolation methods depends on the information available. We will use three types of spatial interpolation methods, The climate data at 11 weather stations numbers of days of suspended, rising, and dust storms measurement were taken at different places of Iraq. The reviewed techniques include Spline, Inverse Distance Weighting (IDW) and Kriging interpolations. Spatial interpolation is widely used for creating continuous data when data are collected at discrete locations (points). Statistical evaluation of the resulting continuous surfaces indicates that there is a little deference between the ability of appreciation of the three methods of interpolation. We will see at the next maps producing by arcgis programmer.

Study the dust storm with GIS techniques

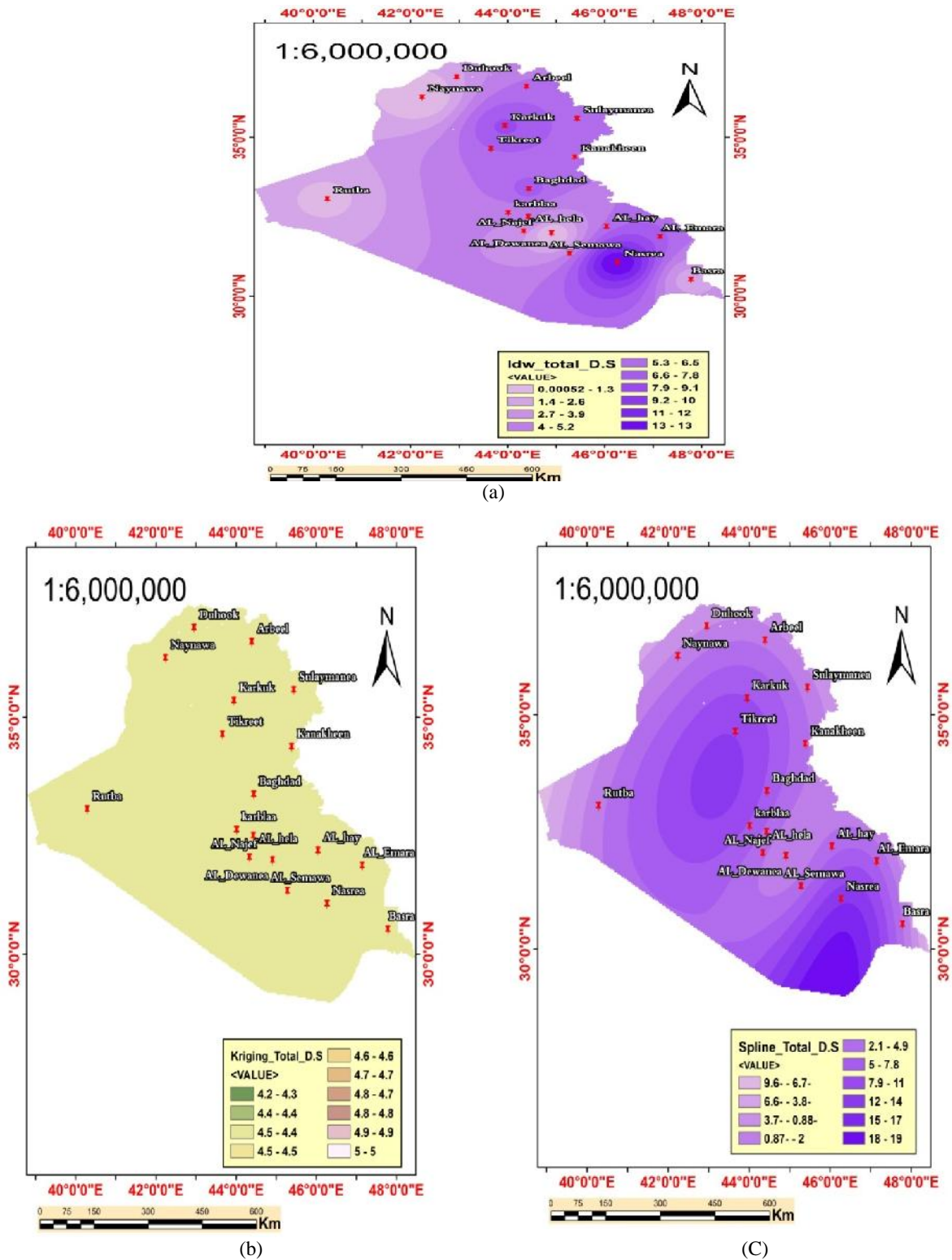


FIGURE 5: Estimated maps the number of dust storm by three methods of spatial interpolation a) IDW b) kriging c) spline

The following maps for the estimate the Suspended dust:

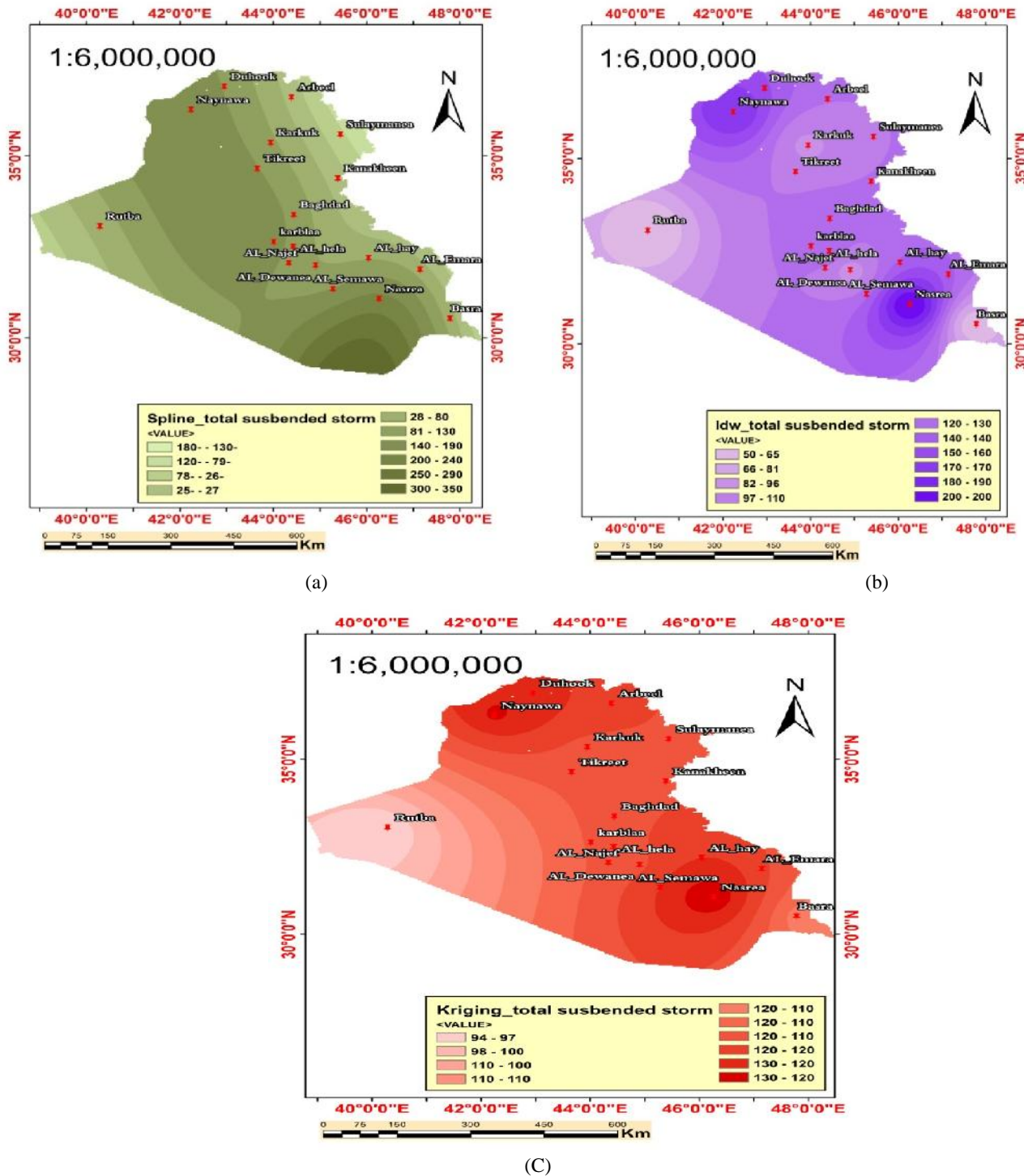


FIGURE 6: Estimated maps the number of suspended dust by three methods of spatial interpolation a) spline b) IDW c) kriging

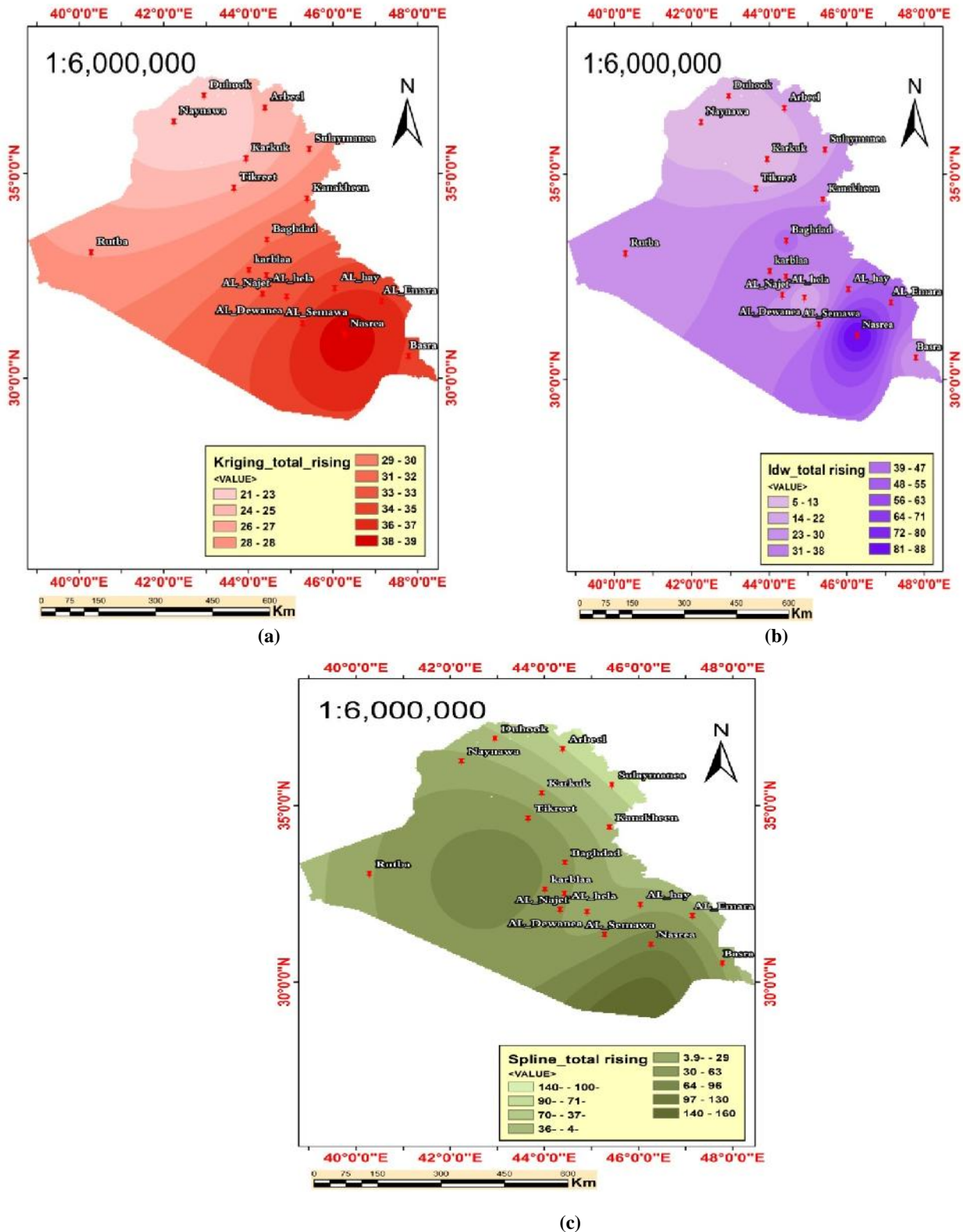


FIGURE 7: Estimated maps the number of suspended rising dust by three methods of spatial interpolation a) kriging b) IDW c) spline

CONCLUSION

The relationship between the annual rates of rainfall and relative humidity with the annual rate of the number dust storm days were inversely related to all studied stations, while the relationship was positive between annual rates of

temperature and with the annual mean of dust storm days in Stations studied, Some exceptions may be due to reasons that some dust storms may be originating outside the station or coming from outside Iraq and may also be due to the influence of other factors. Also In this work,

three methods of interpolation have been compared through implementation of the number of days of Suspended, rising, dust storms for the different Iraqi regions from same climate stations which can provide a map of estimation dust storms. In general, these methods showed spatial variation. This study shows that the kriging is most likely to produce the best estimation of a continuous surface of the number of days of Suspended, rising, dust storms for the different Iraqi regions followed by IDW, and then Spline. Accuracy in the number of days of Suspended, rising, dust storms depends mainly on the input data that have been taken from the climate stations in the study area, and in general, we note that there are not enough number of climate stations, and is highly recommended to increase the number of these stations. In general, these methods gave the close results, although there is little difference between the methods and the other, especially between IDW and Kriging.

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