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Research Article

The Relationship between Coronavirus and Atmospheric Pollutants over Iraq

Wedyan G. Nassif[1]
University of Mustansiriyah, College of Science, Department of Atmospheric Science, Baghdad, IRAQ
wedyan.atmsc@uomustansiriyah.edu.iq

Iqbal H. Abdulkareem[2]
University of Babylon, Faculty of Graduate Studies, Babylon, IRAQ
doraqbl@yahoo.com

Osama T. Al-Taai[3]
University of Mustansiriyah, College of Science, Department of Atmospheric Science, IRAQ
osamaaltaai77@uomustansiriyah.edu.iq

Zainab M. Abbood[4]
University of Mustansiriyah, College of Science, Department of Atmospheric Science, IRAQ
zainabatmo@uomustansiriyah.edu.iq

Corresponding author: University of Mustansiriyah, College of Science, Department of Atmospheric Science, IRAQ Email: osamaaltaai77@uomustansiriyah.edu.iq

Abstract

Coronavirus is the most dangerous and fastest virus that appeared in China in 2019 and began to spread in all countries of the world. The relationship between the percentages of polluted gases was studied in conjunction with the spread of the Coronavirus and compared to 2019 on the one hand, and the relationship between the spread of the Coronavirus, high temperatures, and relative humidity. To see how much, it affects an increase or decrease in the number of infections in general. The data for this study, which includes polluting gases (CH4, O3, CO, SO2, NO, and CO) and (temperatures and relative humidity) were taken from the European Center for Medium-Range Weather Forecasts (ECMWF) for the years 2019 and 2020 for several selected stations over Iraq. The results showed, through spatial analysis, a decrease in the percentage of pollutant gases and greenhouse gases compared to last year, as it was observed that the increase in injuries was concentrated in the central and southern regions, especially in the Baghdad regions. Where the highest cases were recorded in the region Area. May 23, 2020, as we note that the number of injuries reached 3263, while the number of deaths reached 62 cases per day, as well as in Najaf and Basra, and decreased in the northern and western regions of Anbar and Salah. Al-Din and Duhok, and it was reported in this study that when the temperature and relative humidity rise together, this will lead to the absence or disappearance of the virus in many regions of Iraq.

Keywords

COVID-19, Relative humidity, Temperature, Pollutants, Iraq

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Introduction

Coronavirus (Covid-19) restricted many human activities, which led to a significant decrease in emissions of polluting gases, including carbon monoxide, carbon dioxide, and other gases harmful to human health (Hashim, 2021). The new Coronavirus appeared in the city of Wuhan, China, and then spread to all parts of the world, and Iraq was among the countries in which this virus spread, which led to the imposition of the necessary measures to limit the increase in the number. several cases of infection, and for this reason, Iraq, like other countries, imposed a curfew and social distancing (Kammona, 2021) and closed industrial facilities, which led to a decrease in human activities and a reduction in polluting emissions harmful to the environment, which led to a clean atmosphere free of toxic gases and harmful to human health (Seo, 2021). Many researchers, including (Casanova, 2010) have studied the effect of the spread of the Corona virus on an increase or decrease in the percentage of polluting gases by comparing it with previous years before the emergence of the Corona pandemic, where the researcher reached several results, including air quality through a decrease in the percentage of polluting gases as a result of factory closures and a lack Use cars that cause high pollution in the air. As for the researcher (Dbouk, 2020), he studied the Effect of Temperature and Relative humidity in containing the spread of the Coronavirus, and the researcher reached several conclusions, including those higher temperatures can reduce the slow transmission of the disease, on the contrary, when the relative humidity increases it promotes the transmission of (Covid-19). It was found through a study presented before (Quraishi, 2020) that weather can affect the survival of the Coronavirus by choosing several different places to know the relationship between low temperatures and high wind speeds on the disappearance or survival of the Coronavirus. The scientist (Mittal, 2020) indicated through the results he reached to preserve the workplace to limit the transmission of the Coronavirus, it is necessary to maintain a great deal on the internal temperature, as it ranges between 20 to 40 degrees Celsius, and the relative humidity ranges from 40% -60%. The researcher (He, 2021) created a program to assess the risks of transmission of the Coronavirus through the air by combining the sports program with common weather factors to reveal how this virus is transmitted. The time series of several climatic variables in addition to the polluting gases were analyzed for several durations to find their effect on the increase in the number of cases of the Corona pandemic (Zoran, 2020). A study conducted by the world (Magazzino, 2020) found the association that occurs after the emergence of the Corona pandemic with different levels of ground ozone. Not only that, but the study also included many dangerous dispersed pollutants whose sources are natural, industrial, or human, and among these gases is nitrogen dioxide.

It was found (Mahato, 2020) that there is a relationship between the presence of polluting gases and the concentration of particles, regardless of the values of these concentrations, which may not increase the number of deaths associated with the Coronavirus, as it works to enhance the transmission of infection through the respiratory system. Through a study conducted in India (Wang, 2020), the researchers found that there is a big difference when comparing the past two years to the period of the emergence of the Corona pandemic strain that there is a significant improvement in air quality and this came in conjunction with the closure of public places and others. And other researchers presented similar studies, including (Lenzen, 2020), where the study proved how the air reached the level of purity completely and the return of environmental and marine life, and the abundance of fish compared to previous years. It is possible to notice that there are economic, social, and health losses in conjunction with the Coronavirus, as large losses have been monitored for the world in general due to the closure of air traffic and maritime navigation. As for pollutants, they have decreased dramatically, this study came by the researcher (Alwan, 2013 & Cucciniello, 2021). A study was conducted by the researcher (Salih, 2021) in evaluating air quality in light of the Corona pandemic in the Italian city of Avellino by comparing air pollution with recent years by selecting several major pollutants that were the main reasons for making this city the worst Italian cities. Study research conducted on the troposphere showed that during the monitoring and evaluation of the density of nitrogen columns during the spread of the Corona pandemic, through the researcher's use of geographic information systems (Nassif, 2020).

Methodology

Data Source and Study Stations

The work was carried out using daily data of gases (CH4, O3, CO, SO2, NO, and CO), temperatures, and relative humidity for two consecutive years 2019 and 2020 (00:00 AM - 12:00 PM) over Iraq (Husam, 2020). Taken from the European Center for Medium-Range Weather Forecasts (ECMWF) (ECMWF, 2020 & Nassif, 2021) where Iraq's climate is characterized by a desert and semi-desert nature, which is represented by high temperatures and evaporation in the summer in the southern region, and rainfall and low temperatures and a rise in relative humidity in winter in the northern region (Muter, 2020).

ArcGIS Version 10.4.1

One of the best ways to understand how the Coronavirus spreads is to analyze the data to study the spatial distributions of this virus and find out the relationship between it and gaseous pollutants all over Iraq. This analysis is important for its usefulness in comparing it with other climate studies and research, so the daily means of pollutants, temperatures, and relative humidity of Iraq were taken for the spatial analysis. By GIS using the Kriging method for interpolation configuration in ArcGIS version 10.4.1 software (Nassif, 2020). The mapping procedure began with converting the geographical coordinates of all sample locations to global Mercator Transverse Coordinates. However, the data is provided to display a connected surface as a visual display. The maps show spatial interpolation (Levesque, 2007).

Results and Discussion

The Total Daily Mean of Pollutant Air Types (CH4, O3, CO, SO2, NO, And CO)

Figures (1 to 5), show the daily total of pollutant gases (CH4, O3, CO, SO2, NO, and CO), and the results, through an analysis of these pollutants for the years 2019 and 2020, showed a significant decrease in the percentage of pollutant gases in the air with the spread of Corona Virus. Where a significant decrease in the percentage of polluting gases that lead to global warming has been observed in some cities and regions as a result of the effects of the spread of the Coronavirus on business, travel, and transportation. The results showed that the percentage of carbon monoxide produced mainly from car use decreased for the year 2020 compared to 2019, as we can see through the drawing that carbon dioxide gas which causes high temperatures also decreased its percentage compared to last year. And the proportion of methane gas has also decreased. These significant declines in nitrogen dioxide, a development related to the decline in car use and industrial activity in general. The spread of the Coronavirus has led to a halt in air transport, not only that but also a decrease in the number of employees who go to work as these factors have led to a decrease in harmful gases emitted from individuals, factories and others The drawing also shows that nitrogen gas has decreased by a large percentage and it is considered a dangerous pollutant gas as well as the cause of high temperatures. Likewise, the decrease in ozone gas reduces pollution, which has a positive effect on the ozone hole for this is in conjunction with the spread of the Coronavirus, that the smoke clouds saturated with nitrogen dioxide that can be seen by satellites have disappeared completely and the density of the second nitrogen oxide gas has decreased. Significantly. Where we notice that the ozone hole began to recover since the beginning of the Coronavirus, and at the same time, the rates of pollution resulting from the combustion of fuels and harmful gases that cause global warming have decreased significantly. We note that 2020 was marked by a decrease in the acidity of rain and smoke fog due to a marked decrease in the percentage of sulfur dioxide gas.

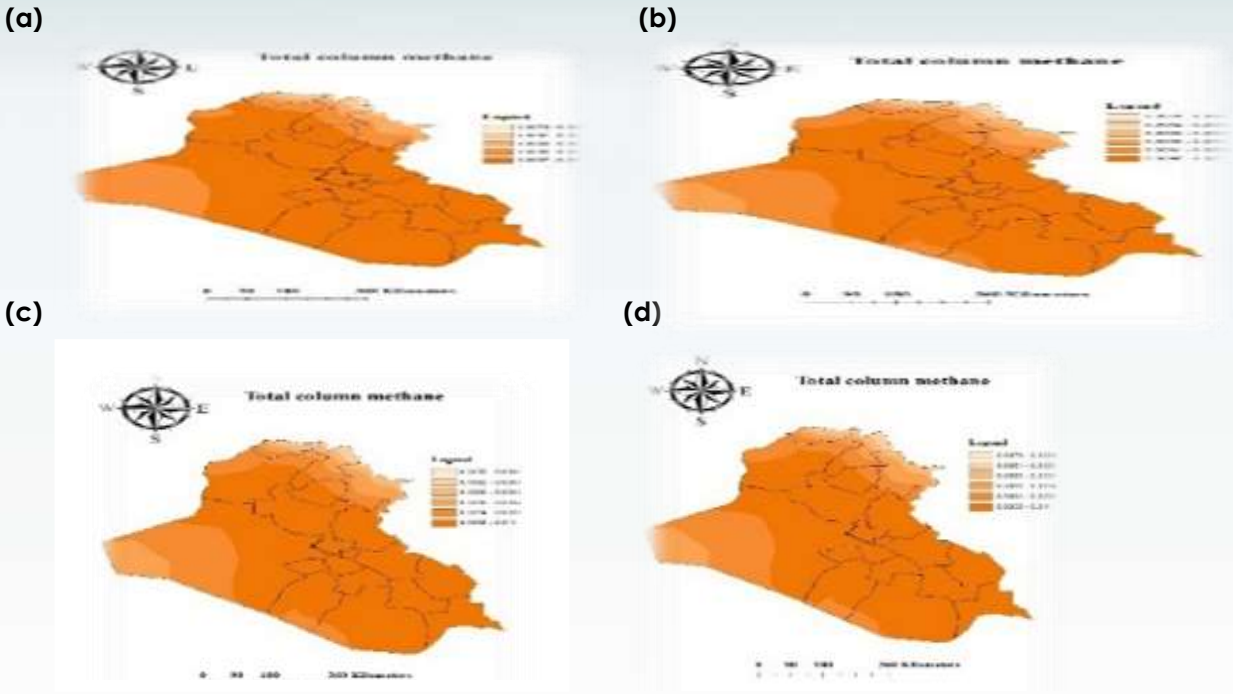

Figure 1. The total daily mean of total column methane kg.m^{-2} over Iraq. a) CH_4 at the time 00:00 am for the year 2019, b) CH_4 at the time 12:00 pm for the year 2019, c) CH_4 at the time 00:00 am for the year 2020, d) CH_4 at the time 12:00 pm for the year 2020.

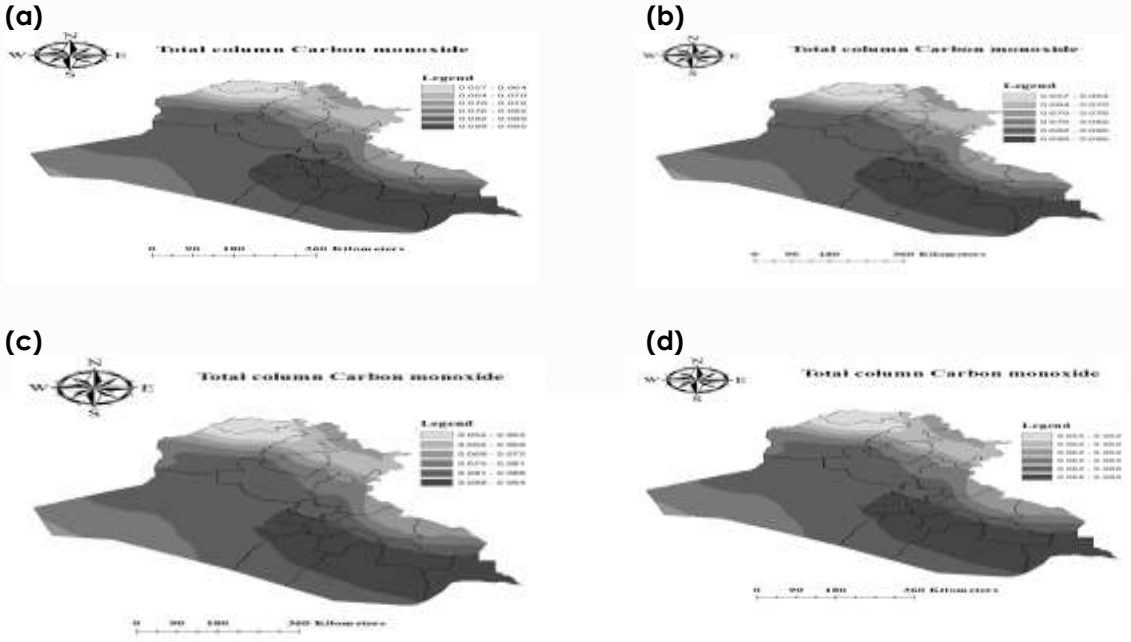

Figure 2. The total daily mean of total column Carbon monoxide kg.m^{-2} over Iraq. a) CO at the time 00:00 am for the year 2019, b) CO at the time 12:00 pm for the year 2019, c) CO at the time 00:00 am for the year 2020, d) CO at the time 12:00 pm for the year 2020.

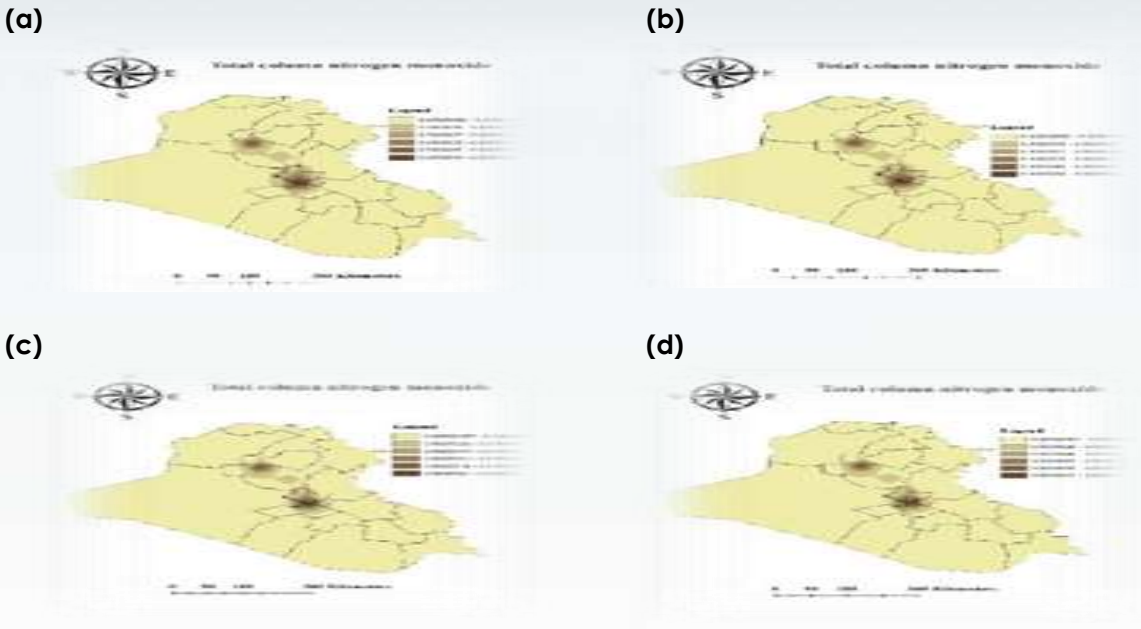

Figure 3. The total Daily mean of Total column nitrogen monoxide kg.m^{-2} over Iraq. a) NO at the time 00:00 am for the year 2019, b) NO at the time 12:00 pm for the year 2019, c) NO at the time 00:00 am for the year 2020, d) NO at the time 12:00 pm for the year 2020.

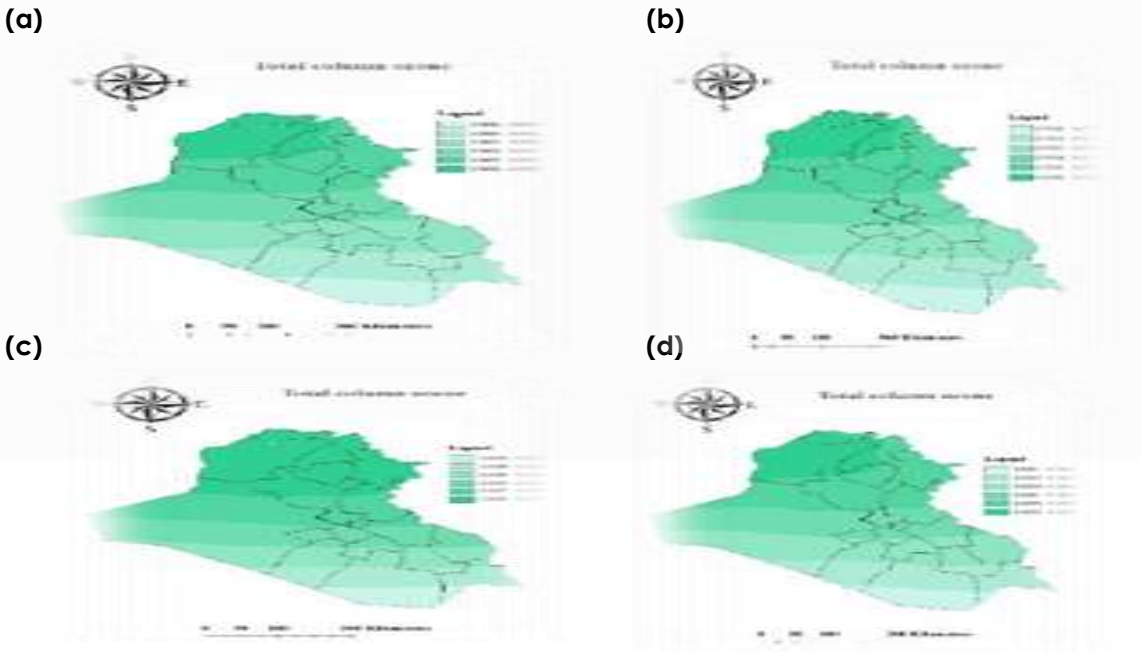

Figure 4. The total Daily mean of Total column ozone kg.m^{-2}over Iraq. a) O_3 at the time 00:00 am for the year 2019, b) O_3 at the time 12:00 pm for the year 2019, c) O_3 at the time 00:00 am for the year 2020, d) O_3 at the time 12:00 pm for the year 2020.

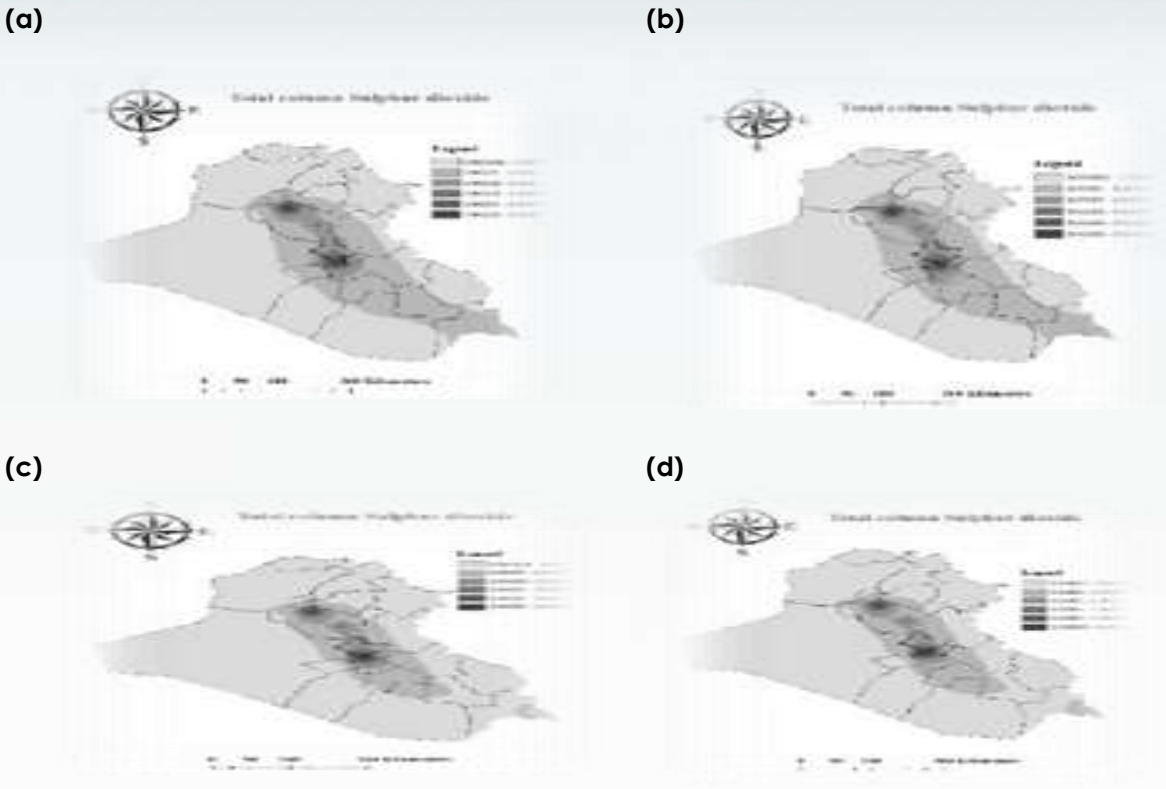

Figure 5. The total daily mean of total column Sulphur dioxide kg.m^{-2}over Iraq. a) SO_2 at the time 00:00 am for the year 2019, b) SO_2 at the time 12:00 pm for the year 2019, c) SO_2 at the time 00:00 am for the year 2020, d) SO_2 at the time 12:00 pm for the year 2020.

The Total Daily Mean of Total Temperatures and Relative Humidity

Figures 6-7 show the daily total of temperatures and relative humidity, as the results showed a relationship between temperatures and relative humidity, as the results of the analysis showed that high temperatures were concentrated in the center and south of the country. General. 2019 with an increase in the percentage of pollutants that lead to global warming, as for the year 2020, high temperatures have been concentrated significantly in the southern region's low relative humidity, which led to the spread of the virus significantly in these areas, where we note that the highest cases of infection with the virus Corona in the central and southern regions. As for the northern regions, it is characterized by the low spread of the Coronavirus. To limit the spread of Coronavirus, high temperatures must be accompanied by a simultaneous rise in humidity, as it can impede the ability of the virus to infect more people, and this may limit the spread of the virus in some areas. The higher the relative humidity the fewer new cases. As the relative humidity approaches 100%, sweat evaporates less quickly into the air, making it difficult for viral droplets to stay in the air and spread among people very quickly. When people sneeze or cough, a cloud of droplets comes out from their noses or mouths, and when the air dries up, the virus in drops does not transmit, so it can be transmitted up to six feet, and this is why this person must be transmitted. Humidity rises with hot weather in the southern parts of the country, as humidity tends to rise at this time of the year. The virus absorbs some moisture from the air, swells, and may fall to the ground, so people are not contagious in more humid conditions.

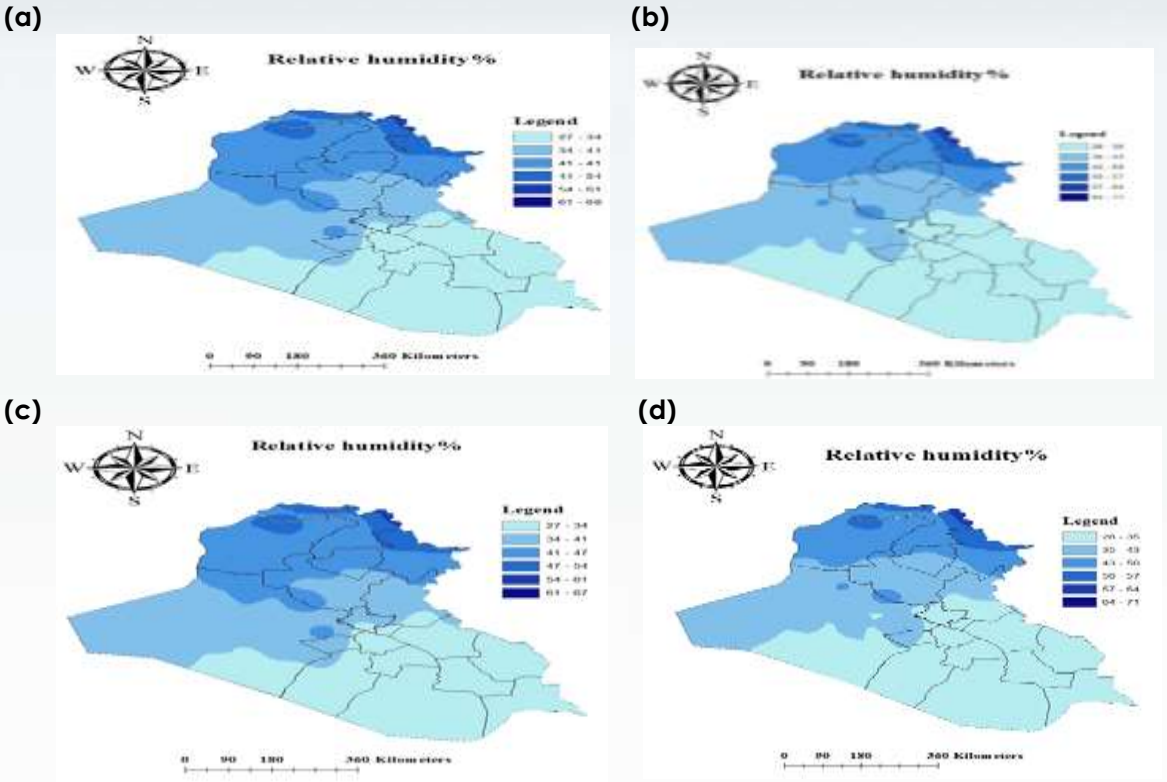

Figure 6. The total daily mean of total relative humidity% over Iraq. a) RH% at the time 00:00 am for the year 2019, b) RH% at the time 12:00 pm for the year 2019, c) RH% at the time 00:00 am for the year 2020, d) RH% at the time 12:00 pm for the year 2020.

The Highest Prevalence Rates of Coronavirus (COVID-19) in Iraq

The highest prevalence rates of coronavirus in Iraq for the day (Dec. 31, 2020), where we note that the number of infections reached 594442 in the central and southern regions in terms of infection rates, as for the number of deaths 12813 cases. Per day, for the daily recovery rates, it reaches 537841cases per day in conjunction with the climatic conditions that affect the spread of Coronavirus in the region, as shown in Figure 8 and Table 1:

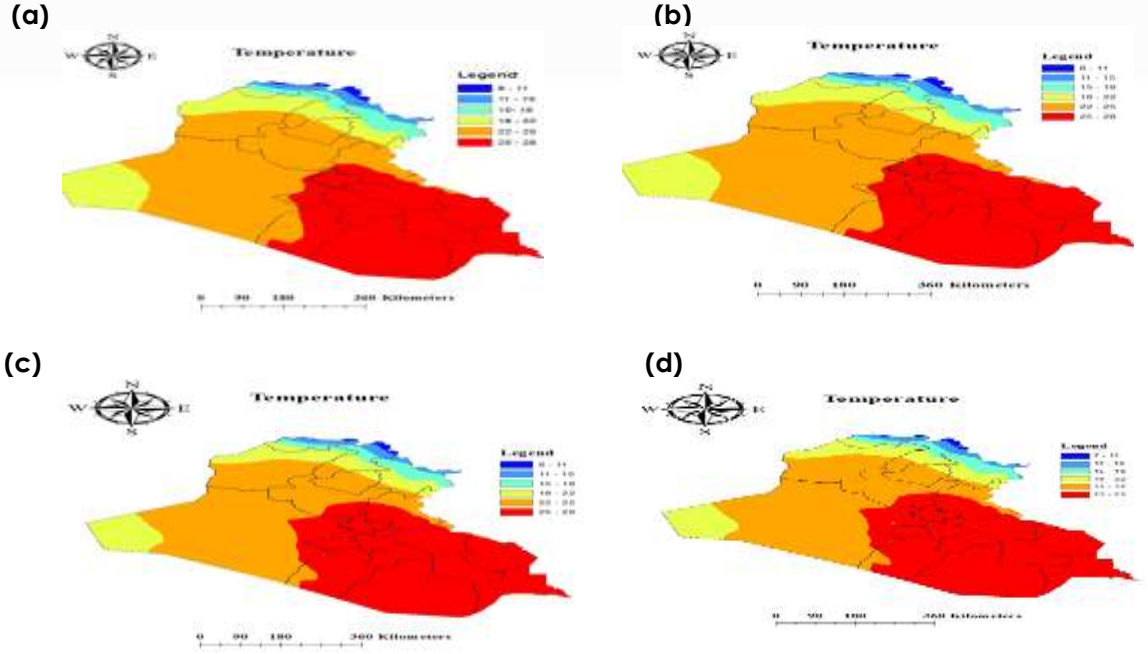

Figure 7. The total daily mean of temperature over Iraq. a) T at the time 00:00 am for the year 2019,

b) T at the time 12:00 pm for the year 2019, c) T at the time 00:00 am for the year 2020, d) T at the time 12:00 pm for the year 2020.

Table 1

The highest prevalence rates of Coronavirus in Iraq.

Date	Injuries	Deaths	Healing
May 30, 2020	6179	205	3110
Jun. 30, 2020	49109	1943	24760
Jul. 31, 2020	124609	4741	87434
Aug. 31, 2020	234934	7042	176602
Sep. 30, 2020	362981	9181	292197
Oct. 31, 2020	472630	10910	399655
30 Nov 2020	552549	12258	480903
31 Dec 2020	594442	12813	537841

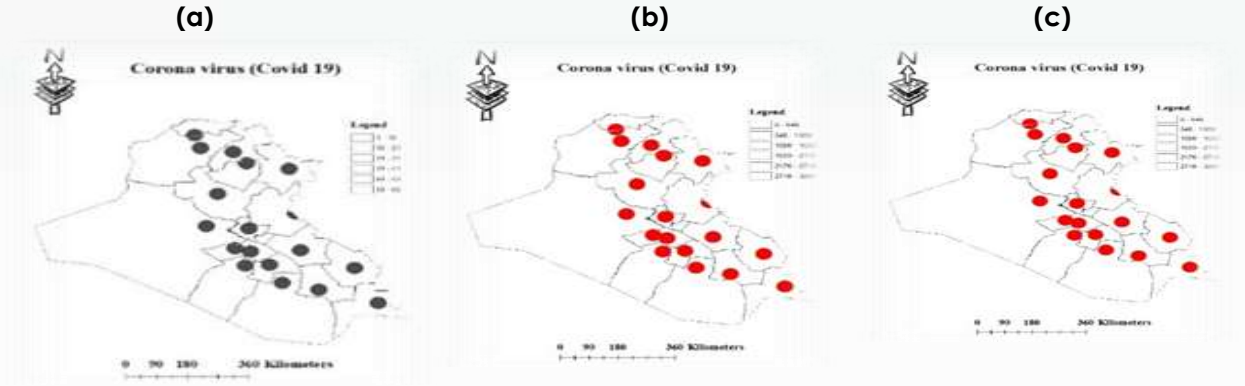

Figure 8. The total Daily mean of the spread of Coronavirus over Iraq. a) Deaths, b) Injuries, c) Healing.

Highest Virus Spread

Figure 9. The highest spread cases of Coronavirus were in Baghdad Station on (May 23, 2020), where we note that the number of infections reached 3263, as for the number of deaths 62 cases per day, as for the recovery rates. A day, 5 cases recovered, and these cases coincide with the climatic conditions in the region.

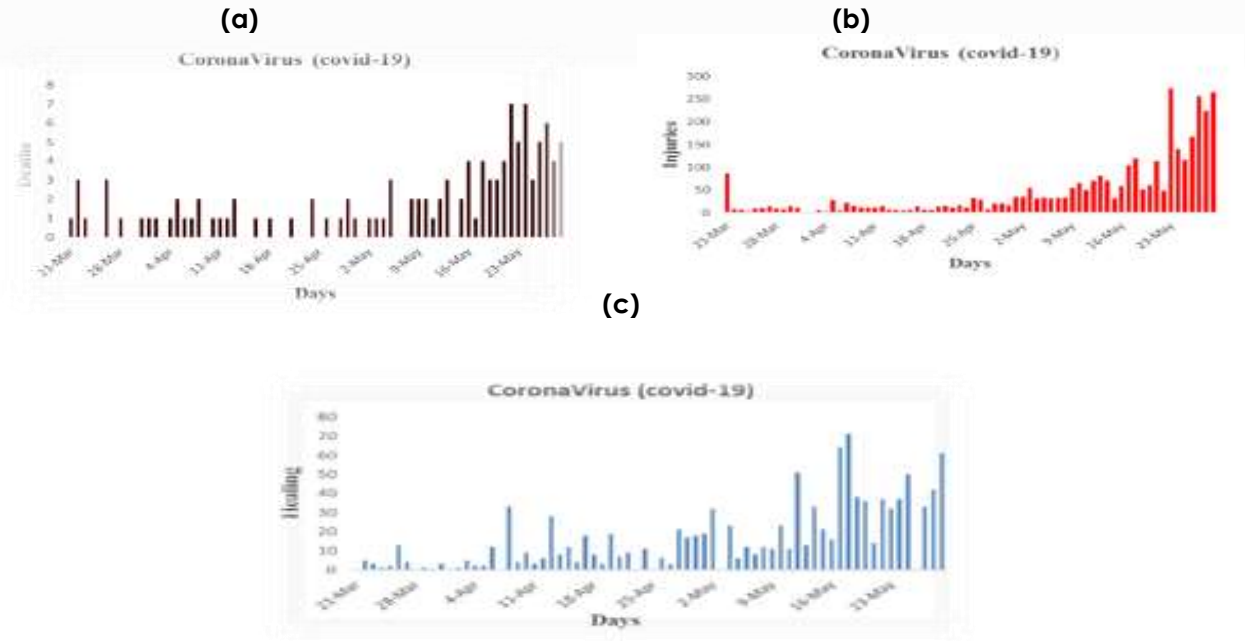

Figure 9. The daily rate of the spread of Coronavirus (case study in Baghdad city). a) Deaths, b) Infections, c) Recovery.

Conclusions

It was found that (Dec. 31, 2020) was the highest rate of infection with coronavirus. On the days those curfews were prohibited, pollutant concentrations were very low due to the lack of human activities. The results showed that the Baghdad area had the highest rate of infection, because it had a high percentage of the population, and therefore the infection was more. The year 2020 is less pollution compared to last year and thus it reduces global warming that leads to a rise in temperature. Coronavirus (Covid-19) restricted many human activities, which led to a significant decrease in emissions of polluting gases, including carbon monoxide, carbon dioxide, and other gases harmful to human health.

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