Determination of greenhouse gasses in al-Nahrawan suburban by geomatics technique

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Abstract. Climate change is now more important than before, based on many evidence, humans were affecting on changing Earth's climate. The atmosphere and oceans have warmed, by sea-level rise, a strong decline in Arctic ice sea, and other climate-related changes. The aim of this study was to calculate some important greenhousse gasses concentration such as CO_2, CH_4, N_2O in AL-Nahrawan suburban – Baghdad city -Iraq. Geographic Information System (GIS) was utilized to map greenhouse gasses dispersion in AL-Nahrawan bricks factory. From GIS distribution maps for CO_2, CH_4, N_2O, it was found that the value of these gasses were changed from one location to another according to the quantity of fuel used in bricks factory, Where the value of emitted CO_2 ranged from (695 -854 tones), value of N_2O ranged from (1.905 - 2.318 tones), and finally value of CH_4 ranged from (0.286 - 0.347 tones).

1 Introduction

For a deeper understanding of climate change, it is essential to distinguish between weather and climate as they are mutually exclusive events that affect in a complex way human presence and activities on the earth. Weather is the state of the atmosphere above a given place at a specific time. It is the day-to-day state of the atmosphere in terms of air temperature and moisture, cloud covering, relative humidity. Weather is derived from the chaotic nature of the atmosphere and is unstable as it is affected by perturbations.

Climate on the other hand is described as average weather over a defined time period. Weather is a scientific concept. It deals with statistics such as the average of all-weather events, or over a long period of time (normally 30 years). Weather has a very limited predictability effect and could be directly perceived by people while climate cannot [1]. Climate is what you expect and weather is what you get. Climate varies from place to place, depending on latitude, distance to the sea vegetation, presence or absence of mountains or other geographic factors. Climate also varies in time, from season to season, year to year, decade to decade or on much longer scales such as the ice ages. The statistical significant variations of the mean state of the climate or of its variability, typically persisting for decades or longer have been referred to as "climate change" [2].

1.1 Climate change

Climate Change Refers to any change in climate over time, whether due to natural variability or as a result of human activity. [3] Climate change is nowadays recognized as one of the most challenging and complex problem facing the globe. [4] Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use**.** **[**5**]** Without the natural greenhouse effect, the average temperature at Earth's surface would be below the freezing point of water. Thus, Earth's natural greenhouse effect makes life as we know it possible. However, human activities, primarily the burning of fossil fuels and clearing

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of forests, have greatly intensified the natural greenhouse effect, causing global warming. Global climate change has resulted primarily from the accumulation of Carbon Dioxide (CO_2) and other greenhouse gases (GHGs) in the atmosphere over the last 150 years [6].

2 Greenhouse gasses

The most important greenhouse gasses are:

2.1 Carbon dioxide (CO_2)

Carbon Dioxide (CO_2) is the most common G HG emitted by human activities in terms of the quantity released and total impact on global warming. The main effects of Carbon Dioxide in the atmosphere are its contribution in the greenhouse effect, global warming, acid rain, and maintaining the PH of rain water. It is one of the end products of burning of fossil fuels like coal, natural gas and petroleum [7].

2.2 Methane (CH_4)

Methane is emitted by natural sources such as wetlands, as well as human activities such as leakage from natural gas systems and the raising of livestock. Natural processes in soil and chemical reactions in the atmosphere help remove CH_4 from the atmosphere. Methane's lifetime in the atmosphere is much shorter than Carbon Dioxide (CO_2), but CH_4 is more efficient at trapping radiation than CO_2 [8]. The IPCC Fifth Assessment Report determined that Methane in the Earth's atmosphere is an important greenhouse gas with a global warming potential of 34 compared to CO_2 over a 100-year period.

2.3 Geographic information system

Geographical Information System (GIS) is a modern powerful tool that facilitates linking spatial data to non-spatial information, obviously, the use of GIS has become essential in providing boundary conditions to the air quality models [11]. GIS technology allows us to locate where pollutants are coming from and monitor those areas for change to conserve the quality of our air, the major goal of GIS ito represent the complicated geographic phenomena in digital model [12]

2.4 Nitrous oxide (N_2O)

Nitrous Oxide (N_2O) is nonflammable, colorless gas with pleasant, sweet odor and taste. Also called Dinitrogen Monoxide or more commonly laughing gas. When inhaled, it produces relaxation, and a reduced sensibility to pain [9] Nitrous Oxide is generated as a byproduct during the production of Nitric Acid, which is used to make synthetic commercial fertilizer, and in the production of adipic acid, which is used to make fibers, like Nylon, and other synthetic products [10] .

3 Materials and methods

3.1 Study area

Baghdad city is the political capital of Iraq, situated on the banks of Tigris River at the northwest end of the alluvial plain. It covers 4555km^2 which represented 1% from total area of Iraq (435052 km^2) [13] Fig (1) AL-Nahrawan suburban is located in the south – east part of Baghdad city.it lies about 65 km from it .It was created in 1988 and its population is about 150000, its originally an agricultural area that transformed lately into city. [14] The study area contain (172) factory of brick which considered the main reason for air pollution in that area.

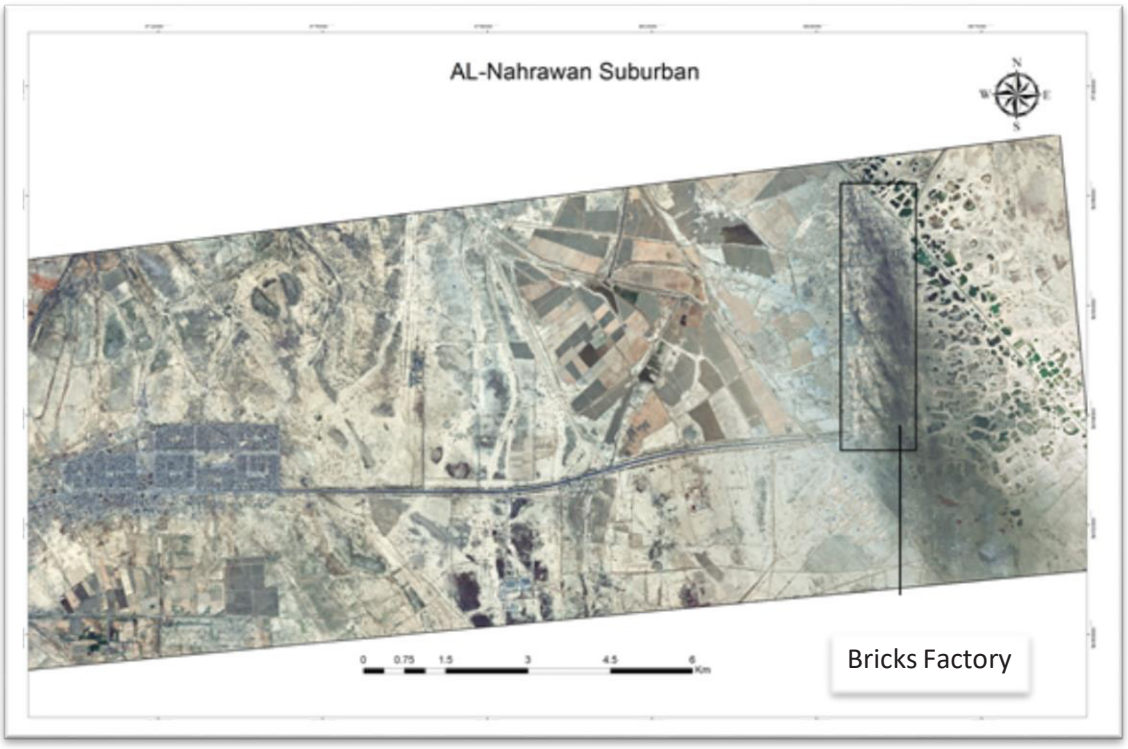

Figure (1): Study area

Mathematical model of climate change

$$Eij = \frac{Q_i \times EC_i \times EF_{ijoxec}}{1000}$$

Where: -

E_{ij} is the emissions of gas type (j), (Carbon Dioxide, Methane or Nitrous Oxide, from fuel type (i) (CO_2-e tons).

Q_i is the quantity of fuel type (i) (kiloliters) combusted for stationary energy purposes.

EC_i is the energy content factor of fuel type (i) (gigajoules per kiloliter) for stationary energy purposes, according to Table (1). If Q_i is measured in gigajoules, then EC_i is 1.

EF_{ijoxec} is the emission factor for each gas type (j) (which includes the effect of an oxidation factor) for fuel type (i) (kilograms CO_2-e per gigajoule) according to **Table 1**

Table 1: Standard for Fuel combustion emission factors - liquid fuels and certain petroleum based products for stationary energy purposes [15].

Fuel Combusted	Energy content factor (GJ/kL unless otherwise indicated	Emission factor kg CO2-e/GJ (relevant oxidation factors incorporated)		
		CO_2	CH_4	N_2O
Petroleum based oils (other than petroleum based oil used as fuel, eg lubricants	38.8	27.9	0.0	0.0
Petroleum based greases	38.8	27.9	0.0	0.0
Crude oil including crude oil condensates	45.3 GJ/t	68.9	0.06	0.2
Other natural gas liquids	45.3 GJ/t	60.4	0.06	0.2
Gasoline (other than for use as fuel in an aircraft)	34.2	66.7	0.2	0.2
Gasoline for use as fuel in an aircraft (avgas)	33.1	66.3	0.2	0.2
Kerosene (other than for use as fuel in an aircraft)	37.5	68.2	0.01	0.2
Kerosene for use as fuel in an aircraft (avtur)	36.8	68.9	0.01	0.2
Heating oil	37.3	68.8	0.02	0.2
Diesel oil	38.6	69.2	0.1	0.2
Fuel oil	39.7	72.9	0.03	0.2
Liquefied aromatic hydrocarbons	34.4	69.0	0.02	0.2
Solvents if mineral turpentine or white Spirits	34.4	69.0	0.02	0.2
Liquefied petroleum gas	25.7	59.6	0.1	0.2
Naphtha	31.4	69.0	0.00	0.02
Petroleum coke	34.2 GJ/t	90.8	0.06	0.2
Refinery gas and liquids	42.9 GJ/t	54.2	0.02	0.03
Refinery coke	34.2 GJ/t	90.8	0.06	0.2
Petroleum based products other than mentioned in the items above	34.4	69.0	0.02	0.2
Biodiesel	34.6	0.0	0.06	0.2
Ethanol for use as a fuel in an internal combustion engine	23.4	0.0	0.06	0.2
Biofuels other than those mentioned in the items above	23.4	0.0	0.06	0.2

4 Results

For the purposes of computing emissions of greenhouse gases (Carbon Dioxide, Methane and Nitrous Oxide) in tones of CO_2-e is estimated as follows; (the fuel used in computations is fuel oil). And the quantity of fuel used different from brick factory to another and we have four groups of quantity used, so by applying the equation that mention in the above section the emission of (CO_2, CH_4, N_2O) shown in the tables (2, 3, 4).

Table (2, 3, 4) show the result of greenhouse gasses emission for each quantity of oil

Table 2: Emission of CO_2 for each quantity of oil

Quantity of oil (Q_i) (kiloliters)	**Emission of CO_2 (t CO_2-e)**
292	**854.086**
270	**781.415**
247	**714.850**
240	**694.591**

Table 3: Emission of N_2O for each quantity of oil

Quantity of oil (Q_i) (kiloliters)	**Emission of N_2 O (t CO_2-e)**
292	**2.3185**
270	**2.1438**
247	**1.96118**
240	**1.9056**

Table 4: Emission of CH_4 for each quantity of oil

Quantity of oil (Q_i) (kiloliters)	**Emission of CH_4 (t CO_2-e)**
292	**0.3477**
270	**0.3215**
247	**0.29417**
240	**0.28584**

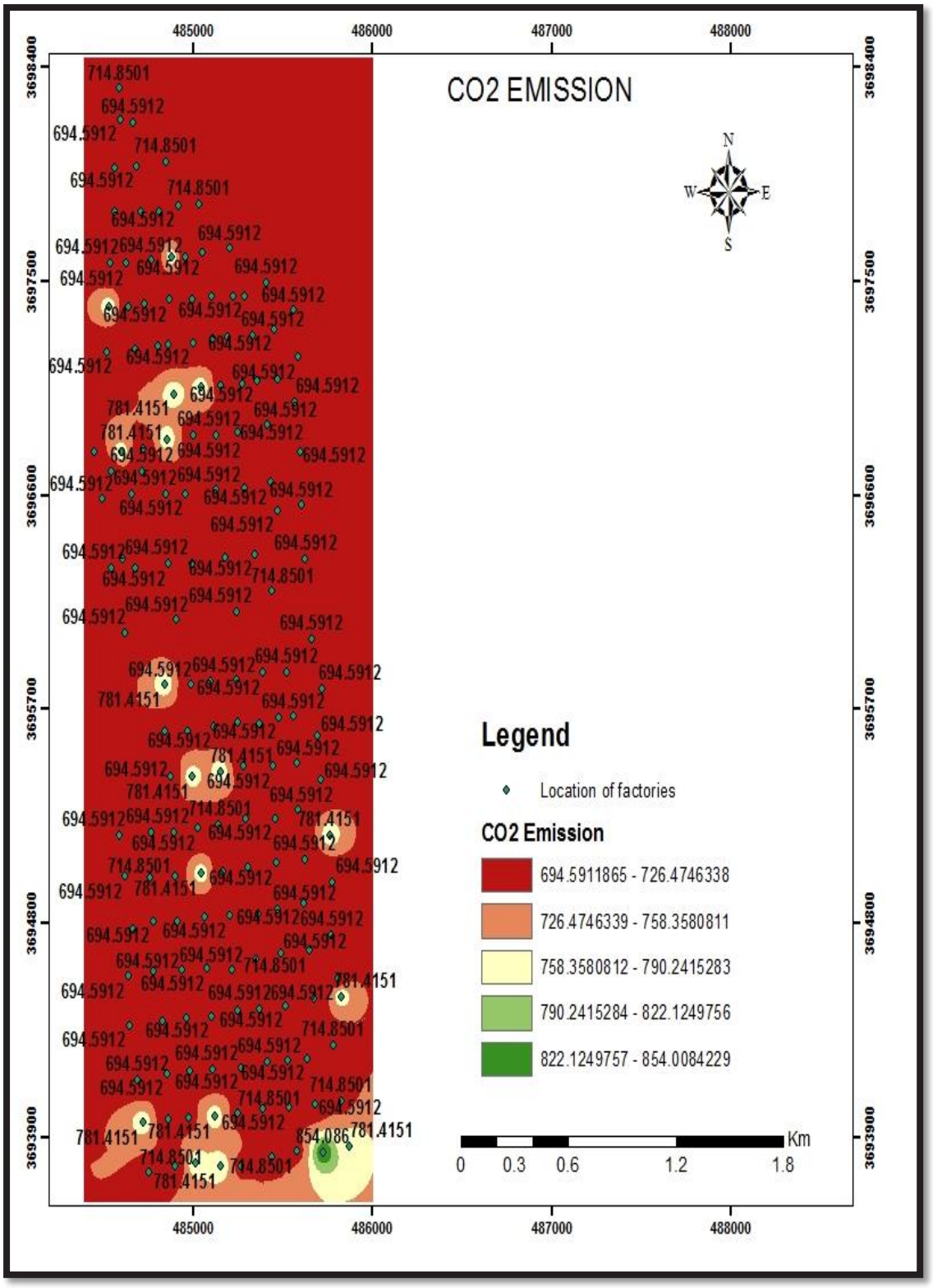

Figure (2): distribution of brick factory with emission factor for CO_2.

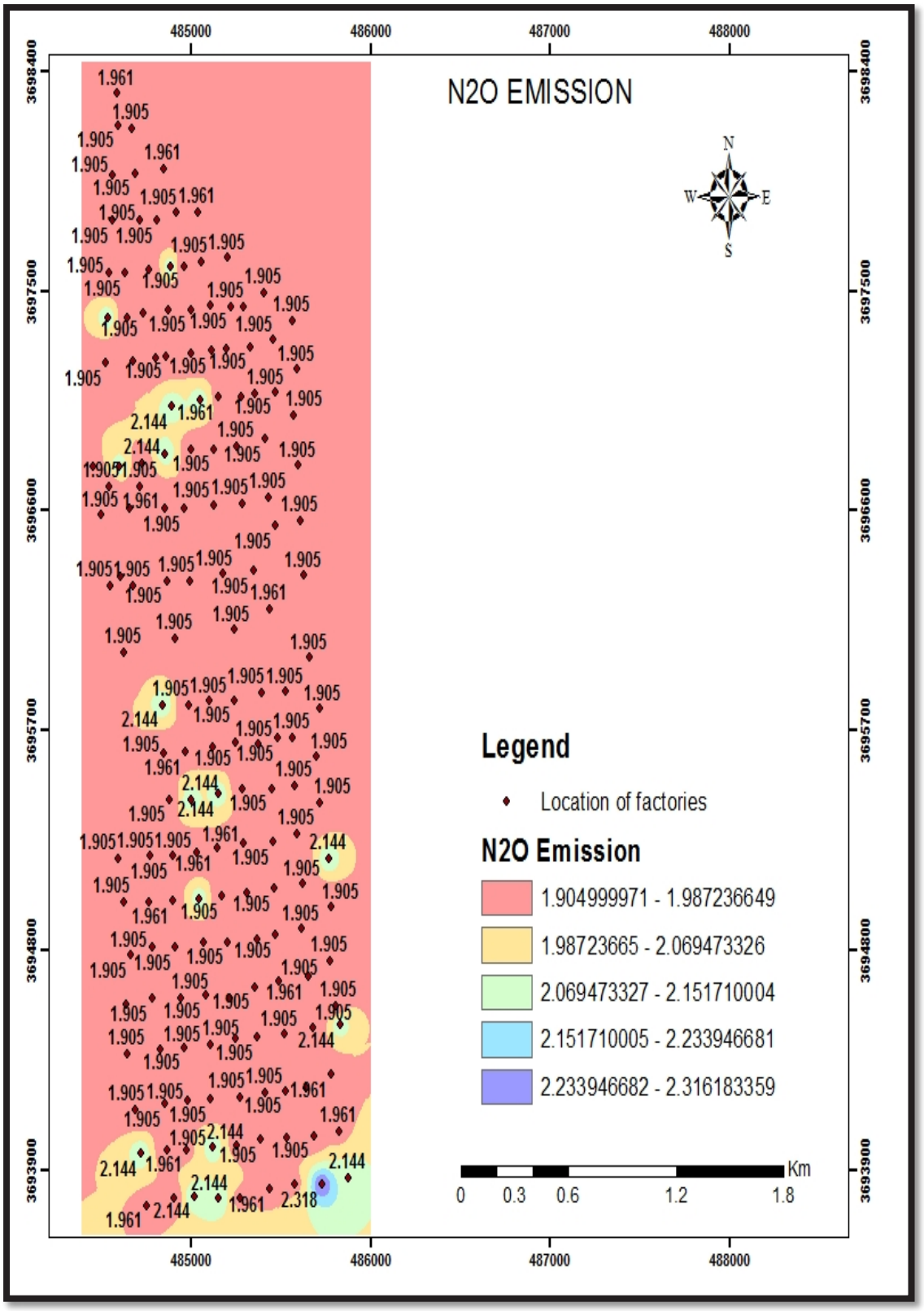

Figure (3): distribution of brick factory with emission factor for N_2O

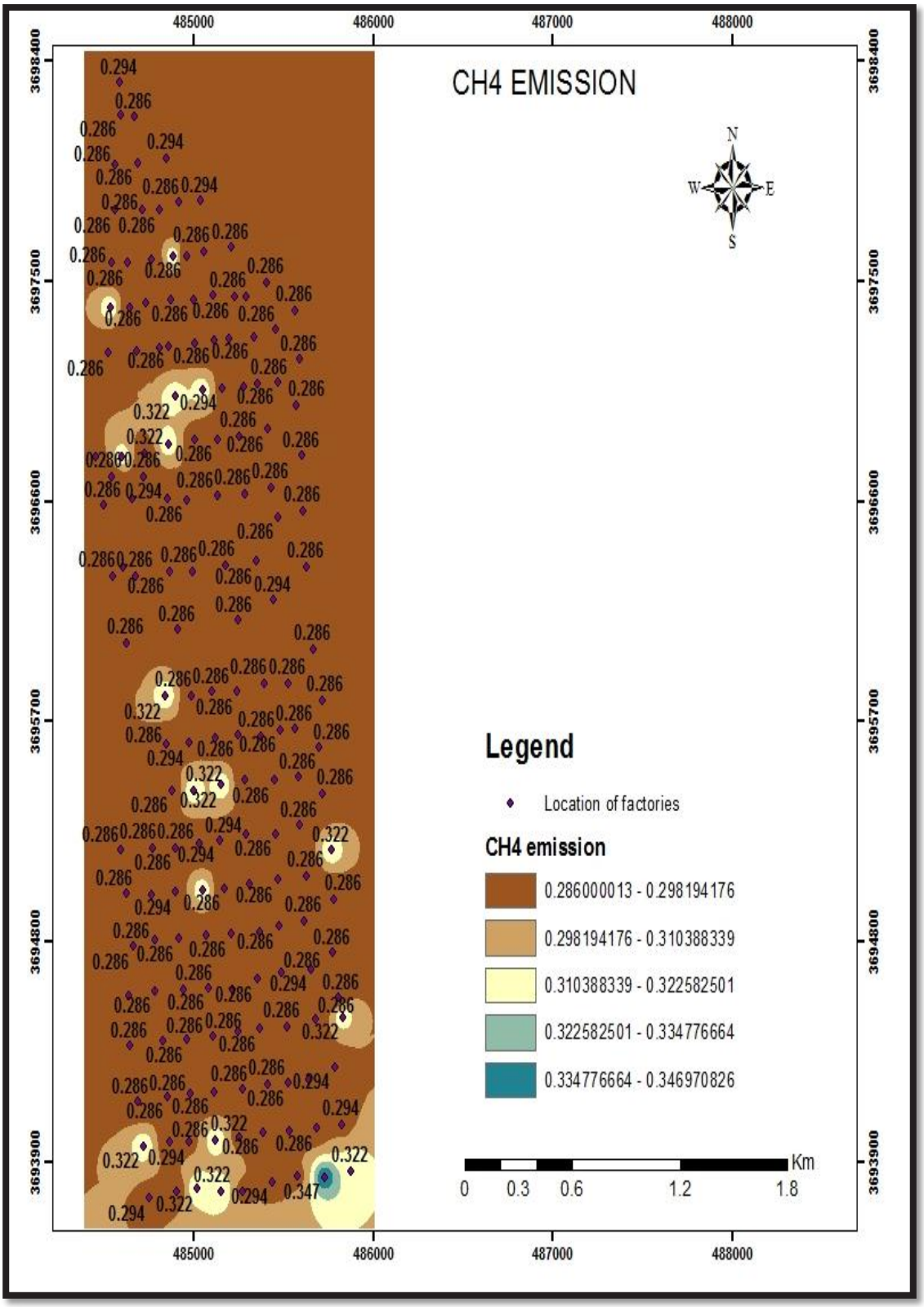

Figure (4): distribution of brick factory with emission factor for CH_4

5 Conclusions

By using geomatics technique (remote sensing then identifying areas of influence by using GIS is proved to be a good efficiency in the quick identification of contaminants and prepared it for environmental decision maker. There are a lot of gasses that influence in the climate change but here we discussed the most important gasses influence on the change in climate. The values of climate change gasses (CO_2, N_2O, and CH_4) that have been calculated from the formula of emission have different value according to the quantity of fuel used in each brick factory. Where the value of CO_2 ranged from (695 - 854 tones), value of N_2O ranged from (1.905 - 2.318 tones), and finally value of CH_4 ranged from (0.286 -0.347 tones).

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