Predication of Surface Water Quality Due to Climate Change based on Sea Level Rise

Mr. L. Iyappan , Hemalatha. S
[1,2]Department of Civil Engineering
Tagore Engineering College
Rathinamangalam, Chennai, Tamil Nadu, India

***Abstract:-* Sea level rise and storm surges, would lead to salt water intrusion in the coastal areas, impacting agriculture, degrading ground water quality, contaminating drinking water. Coastal line Thiruvanmiyur to Mahabalipuram is a largely residential area and situated along the coastal line of Bay of Bagal.In this study area 30 water samples were collected 10km from the coastal line and physico- chemical parameter are determined as per Bureau Indian Standards. In order to suit the water for drinking purposes, The selected physic-chemical parameters were pH, TDS, Total hardness (TH), anions like Ca, Mg, Na and K and cations like So_4,NO_3,Cl_2 and F. In the present study, the physico chemical characteristics of groundwater of the study area are assessed to know the Ground water quality.The technique has been used to develop maps showing spatial variation of specific water quality parameter.the spatial variation of maps of these groundwater quality parameters are derived and integrated through interpolation technique in GIS. Groundwater quality parameters derived have intergrated to generate showing spatial distribution various water quality parameters using IWD (Inverse Distance Weighed) spatial interpolation technique with Q-GIS software.**

Keywords:-* GIS, Interpolation Technique, Water quality index, Water quality parameters.

INTRODUCTION

Water is indispensable for life, but its availability at a sustainable quality and quantity is threatened by many factors, of which climate plays a leading role. The Intergovernmental Panel on Climate Change (IPCC) defines climate as “the average weather in terms of the mean and its variability over a certain time-span and a certain area” and a statistically significant variation of the mean state of the climate or of its variability lasting for decades or longer, is referred to as climate change.

Evidence is mounting that we are in a period of climate change brought about by increasing atmospheric concentrations of greenhouse gases. Climate change can have profound effects on the hydrologic cycle through precipitation, evapotranspiration, and soil moisture with increasing temperatures.

The Intergovernmental Panel on Climate Change (IPCC) estimates that the global mean surface temperature has increased 0.6 ± 0.2 °C since 1861, and predicts an increase of 2 to 4°C over the next 100 years. Global sea levels have risen between 10 and 25 cm since the late 19th century. As a direct consequence of warmer temperatures, the hydrologic cycle will undergo significant impact with accompanying changes in the rates of precipitation and evaporation. Predictions include higher incidences of severe weather events, a higher likelihood of flooding, and more droughts.

These physically-based numerical models simulate synoptic-scale climate and hydrological processes, and are forced with greenhouse gas and aerosol emission scenarios. ensure that the predictive elements from a GCM are realistic; a statistical downscaling technique should be employed to bridge the local- and synoptic-scale processes. Variations in these parameters determine the amount of water that reaches the surface, evaporates or transpires back to the atmosphere, becomes stored as snow or ice, infiltrates into the groundwater system.

II. MATERIALS AND METHODS

A. Study Area

The study area is located Chennai district Mahabalipuram is located in India at the longitude of 80.14 and latitude of 12.37. Thiruvanmiyur is located in India at the longitude of 80.26 and latitude of 12.98. Mahabalipuram is located nearly south side to Thriuvanmiyur .the given south direction from Mahabalipuram is only approximate. Chennai district formerly known as madras district is the smallest of all district in the state, but has the highest human density.

B. Collection of Water Samples

The selected sites for the investigations are Thiruvanmiyur to Mahabalipuram Road.The water samples were collected from the Bore wells without the presence of bubbles using cleaned air tight plastic bottles. The collected groundwater samples were immediately stored in a refrigerator to avoid contaminations at 5°C. The groundwater samples collected in the month of October 2016. The various physico-chemical analyses were carried out for the collected samples in the Environmental Engineering Laboratory.

C. Experimental Analysis

To know the exact conditions of the groundwater it is very much essential to go for water sampling and testing for the various parameters such as like pH was measured with the help of pH meter, electrical conductivity (EC) was measured with the help of an electrical conductivity meter which in turn used to calculate the TDS, anions like Ca, Mg, Na and K and cations like HCO_3, Cl_2,

SO_4, and NO_3 and F were measured as per the standard procedure stipulated by APHA.The values of these physico-chemical parameters obtained from groundwater of different areas are used to determine the suitability of groundwater for drinking purpose. The drinking water standard is used for checking the groundwater suitability for drinking purposes.s

D.Water Quality Index

Water quality is the condition of the water body or water resource in relation to its designated uses. It can be defined in qualitative and/or quantitative terms. The need for expressing water quality in a format that is simple and easily understood by common people has been recognized and experts have designed the term Water Quality Index (WQI). The WQI takes the complex scientific information and synthesizes into a single number between zero and 100, by normalizing the observed values to subjective rating curves. It summarizes the relative changes in the underlying group of the water-quality variable. A number of algorithms (models) for calculating WQI have been developed and reported in the literature.

III. RESULTSANDDISCUSSIONS

Various physico-chemical parameters in a groundwater were analyzed for the parameters pH, TDS, total hardness (TH), anions like Ca, Mg, Na and K, and cations like SO_4, NO_3, Cl_2, HCO_3, and F and the results are discussed below.

TABLE 1 DRINKING WATER QUALITY STANDARDS

Parameters	Standards (IS:10500, revision 2003)
PH	6.5-8
Calcium (Ca)	75
Magnesium (Mg)	30
Sodium (Na)	200
Potassium (K)	10
Bicarbonate (HCO_3)	200
Sulphate (SO_4)	200
Chloride (Cl)	250
Nitrate (NO_3)	50
Fluoride (F)	1.5
TDS	600
Total hardness as $CaCO_3$	200

TABLE 2 STATISTICAL ANALYSES FOR THE SELECTED SAMPLES

S.No.	Parameters	Min.	Max.
1	Turbidity	0.1	9
2	TDS	180	180
3	Calcium (Ca)	22	140
4	Magnesium (Mg)	6	88
5	Total Hardness	46	580
6	Chloride (Cl)	18	582
7	Ammonical N	0.02	5.6
8	Albuminoid N	0.02	2.8
9	Oxygen Abosorbed	0.27	6.39
9	PH	6.8	8.8
10	Alkalinity to methyl orange	108	384
11	Sulphate (SO4)	6	495
12	Phosphate (PO4)	0.01	1
13	Fluoride(F)	0.1	1
14	Specific Conductance	285	2590

pH

Quantitative measure strength of the acidity or alkalinity of a solution is defined as the negative common logarithm of the concentration of hydrogen ions [H+] in moles/l pH = log [H+]. The pH value was measured by a pH meter. The pH is now defined in electrochemical terms. The pH value observed from the samples collected ranges between 6.8 and 8.8 for all selected wells of the study area. The results indicated that which falls within the BIS drinking water quality standard limit.

Total dissolved solids (TDS)

TDS is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. Total dissolved solids are normally discussed only for freshwater systems, as salinity includes some of the ions constituting the definition of TDS. TDS is not generally considered a primary pollutant, but it is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants. In this study, the TDS of selected wells ranged from180 to 1685mg/l, which exceeds the standard value of 600 mg/l (Table 1).

Total Hardness

The total hardness in water samples ranges between 46 to 580mg/l and This hardness is as the result of the dissolution of limestone deposit, which may be present underneath the study areas produce calcium carbonate ($CaCO_3$), yields excess concentration of hardness. Therefore, it may probably conclude that this limestone deposit is considered responsible for this.

Calcium

The calcium in groundwater samples of 30 selected places varied from 22 to 140 mg/l (Table 2), indicates, the calcium value is exceeding the desirable range as per the standard (Table 1). The above variation of calcium is due to the presence of higher concentration of gypsum / limestone beneath the good point and due to mixing of tannery industry wastewater into the groundwater storage reservoir.

Magnesium

Magnesium is one of the most common elements in the earth's crust. It is present in all natural waters. It is an important contributor to water hardness. All study area has more magnesium concentration varied from 6 to 88 mg/l (Table 2), indicates the magnesium concentration is not higher than the desirable limits (Table 1). The presence of dolomites and mafic minerals (amphibole) in rocks beneath the groundwater also produce the excess magnesium in groundwater.

Chloride

The chloride concentration in the study area varies from 18 to 582 mg/l (Table 2). which is greater than the permissible limit (Table 1). Chloride in drinking-water originates from natural sources, sewage and industrial effluents, urban runoff containing de-icing salt and saline intrusion. Excessive chloride concentrations increase rates of corrosion of metals in the distribution system depending on the alkalinity of the water. This can lead to increased concentrations of metals in the supply No health-base guideline value is proposed for chloride in drinking-water. However, chloride concentrations in excess of about 250 mg/l can give rise to detectable taste in water.

Sulphate

Sulphate occurs in water as the inorganic sulphate salts as well as dissolved gas (H_2S). Sulphate is not a noxious substance although the high sulphate concentration in the water may have a laxative effect. The water samples taken from the study area varied from 6 to 495mg/l (Table 2) and which is lesser than the permissible limit of 200mg/l as per the standard (Table 1). The variation signifies the differential dissolution of gypsum, which is predicted to be underneath the wells

Fluoride

Fluoride in drinking-water will be an invaluable reference source for all those concerned with the management of drinking-water containing fluoride and the health effects arising from its consumption, including water sector managers and practitioners as well as health sector staff at policy and implementation levels. The water samples taken from the study area varied from 0.1to 1 mg/l (Table 2) which is lesser than the permissible limit of1.5mg/l as per the standard (Table 1).

CONCLUSION

The groundwater quality was accessed nearby the places of Thiruvanmiyur to Mahabalipuram, Chennai, Tamil Nadu, and India. In order to suit the groundwater for drinking purpose, compared the value of selected parameters like pH, TDS, total hardness (TH), anions like Ca and Mg, and cations like SO_4, Cl_2, and F with the value of corresponding parameters in BIS drinking water quality standard. .

The physico-chemical study of the groundwater systems, The results of Water quality indicated that the groundwater is not fit for drinking purpose, but it can be used for drinking purpose after treatment.

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