Winter 7-1-2020

MODELING FLUORIDE CONTAMINATION IN GROUNDWATER AND ITS SPATIAL ASSOCIATION: AN INDIAN PERSPECTIVE

Arundhati Mohanty

ABSTRACT

The effects of fluoride on groundwater have been studied earlier, but all those studies have been area specific. This study expanded its boundaries, and covered the entire Indian sub-continent with over eight lakh ground water samples(gws) using random-sampling for pre- and post-monsoon data, rainfall data, lithology of India, and various other statistics as its data. The main objective of this study was to model fluoride contamination in groundwater along with its spatial association using different spatial analyst tools, interpolation tools etc in ArcGIS 10.6.1, in order to understand the trend of fluoride contamination in various parts of India and to analyze the impact and extent of fluoride and contamination in groundwater leading to various human health hazards.

With the gws data, interpolated layers of different attributes were made, statistics of valued data points, scatter plots were drawn. Lithological map was made using raw data (NRSC archive), similarly lineaments map was also built. Rainfall data of the past decade (March 2012- March 2020) on daily time-step was collected and curated as such that map could be built where temporal variation could be seen. All maps were made using various spatial analyst tools, geoprocessing tools etc. Lastly all these were made into different layers, and merged together so as to function as a single layer, in order to carry a regression model, using GWR tool (geographic weighted regression) to understand the trend, as to how each layer affects the fluoride content and vice-versa.

Major observations were that Fluoride concentrations were in the permissible range (0.6 – 1.5 mg/L) in most of India except in major parts of Gujarat, where fluoride concentrations increased further post-monsoon, parts of Uttar Pradesh had fluoride concentrations in the hazardous zone (>10mg/L) in the West coast (South Kerala, parts of Maharashtra, also Andaman and Nicobar islands) increased substantially, whereas in the states of Chhattisgarh and Jharkhand (East Central India) it decreased noticeably post monsoon. Hardness of ground

water across India was mostly in the range of >180 mg/L, i.e. very hard. Along the West coast, entire north eastern region, along the East coast, states of West Bengal, Odisha, parts of Andhra Pradesh, Parts of Jammu & Kashmir and Himachal Pradesh, ground water samples had less hardness which decreased further post monsoon. In Rajasthan and Andhra Pradesh, there was a drastic drop in hardness value post monsoon, it went from being more than180 mg/L to somewhere between 60-120 mg/L (very hard to moderate), whereas in parts of Maharashtra, hardness increased.