

Characterization and prediction of Groundwater quality using Multiple Linear Regressions and Correlation Analysis in Sagar Island, West Bengal, India.

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A methodology for characterizing ground water quality and study of statistical interrelationship between effective parameters in groundwater quality in Sagar Island, West Bengal, India using physico-chemical data that include multiple regression modeling and correlations analysis. Multiple regression analysis is used to determine the sources of variation between parameters. The present study area is an Island in the Ganges delta, lying on the continental shelf of Bay of Bengal. The whole population largely depends on existing groundwater wells for their domestic need. Eighty six representative groundwater samples collected during pre-monsoon (May) and post-monsoon (October) periods were subjected to comprehensive physico-chemical analysis. For determination of groundwater quality, parameters of specific electrical conductance (EC), sodium (Na^+), potassium (K^+), calcium (Ca^{++}), magnesium (Mg^{++}), chloride (Cl^-), carbonate (CO_3^{--}), bi-carbonate (HCO_3^-), and sulphate (SO_4^{--}) were used. Using software, multiple linear regressions (MLR) relationship between each of parameters was determined for the pre-monsoon and post-monsoon. The relationship between parameters by MLR showed that Sodium (Na^+) had the strong positive correlation with bi-carbonate (HCO_3^-) and calcium (Ca^{++}) ($R=0.93$, $F=39.3$). Also bi-carbonate (HCO_3^-) showed strong positive correlation with Sodium (Na^+), chlorine (Cl^-) and Magnesium (Mg^{2+}) ($R=0.92$, $F=36.7$) and there was strong positive significant correlation between sodium (Na^+), potassium (K^+), calcium (Ca^{++}), chloride (Cl^-), bi-carbonate (HCO_3^-) and sulphate (SO_4^{--}) with specific electrical conductance (EC) ($R=0.92$, $F=10.7$). The relationship between parameters by MLR and model of pooling data were validated based on RMSE, efficiency, correlation coefficient and R^2 value with the next year pre-monsoon and post monsoon. Validation results indicated that these models were able to estimate EC, bi-carbonate (HCO_3^-), and Na^+ with an acceptable accuracy. The study also reveals that the groundwater quality has changed significantly with time (seasons).