Extent of Seawater Intrusion and Identification of Freshwater Zones in the Coastal Aquifer of Puri District, India: A Geochemical Approch

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Seawater intrusion into the coastal aquifer is a major problem in many coastal areas of the world. In the present study, geochemical signatures of the groundwater were used i) to determine the extent of seawater intrusion into the coastal aquifer, and ii) to demarkate the potential freshwater zones in the coastal areas. For this purpose, sixty-eight groundwater samples were collected from various dug/tube wells, located upto 10 km landward stretch from the coast of Puri district, Odisha (India). Various physico-chemical parameters such as Electical Condictivity (EC), Total Dissolved Solids (TDS), pH etc. were measured in-situ, while the major ion concentrations in collecetd groundwater samples were analysed in the laboratory. Around 56% of the collected water samples show EC values higher than the WHO prescribed limit for drinking water (1500 µs/cm) and can be catagorised as brackish water type [1]. Dominance of Na^+ and Cl^- among all other ions in collected water samples indicates influence of seawater in modifying the water chemistry of the groundwater. More than 75% of samples show Cl^-/HCO_3^- ratio higher than 0.5 indicating slight to strong influence of seawater intrusion [2]. Furthermore, around 66% of the water samples fall in the seawater-mixing field, when plotted in the Gibbs plot (TDS vs $Cl/(Cl+HCO_3)$) [3]. The proportion of mixing has been calculated from the hydrochemistry of collected groundwater samples. It is found that a minimum 3% mixing of seawater with the freshwater is suffiecient to give rise to EC values higher than 1500 µs/cm, thus makes it unstutable for drinking purposes. It is also interesting to note that the seawater extends upto 5-7 kms in the inland areas, however, the freshwater occurs at places very near to the coast. These freshwater pockets are located at the paleochanels existing in the area. The tracing of the web of paleochannels may prove an important tool for exploring fresh groundwater in seawater intruded coastal areas.

[1] Freeze & Cherry (1979) Groundwater, Prentice-Hall. [2] Najib et al. (2017) J. Contam. Hydrol., 1-13. [3] Ghesquière et al. (2015) J. Hydrol. Reg. Stud. 4, 246–266.