

Salinity distribution in different coastal aquifers of southwest Bangladesh

Md. Mizanur Rahman Sarker^{1,2}, Marc Van Camp¹, Mazedra Islam^{1,2}, Nasir Ahmed³, Md. Masud Karim³, Kristine Walraevens¹

¹Laboratory for Applied Geology and Hydrogeology, Department of Geology, Ghent University, Ghent, Belgium

²Jahangirnagar University, Savar, Dhaka, Bangladesh

³Bangladesh Atomic Energy Commission, Isotope Hydrology Division, Institute of Nuclear Science and Technology, Savar, Dhaka, Bangladesh

ABSTRACT

The groundwater in the southwestern part of Bangladesh is mainly used for domestic and agricultural purposes. Groundwater abstraction is intense during the dry season causing the depletion of groundwater over the years. Regionally, groundwater flows from the north and discharges into the Bay of Bengal in the south. In the northern part, the rivers are effluent, but the opposite scenario is observed in the southern part because of high evapotranspiration of groundwater. The subsurface consists of sequences of deltaic sediments with alternation of more sandy and clayey sections in which several aquifer layers can be recognized. These are upper shallow (<100 m), lower shallow (100-200 m) and deep aquifer (>200 m). This research examined the results of a study that has mapped the salinity dissemination in different aquifers up to a depth of 300 m in a region flanking the Bay of Bengal in the south. This study is based mainly on the hydrochemistry and Cl/Br ratios of the water samples to investigate the origin of salinity. Different stages of freshening and salinization processes have been observed in aquifers from the different main water types based on hydrochemistry. The soft NaHCO₃ type is the dominant fresh water in the deep aquifer having Cl concentrations mostly below 100 mg/l, in which the fresh/salt water interface is forced far to the south. This aquifer seems to contain normal but old, connate seawater in the south, and based on stable isotope analyses the freshening water that comes from the north was infiltrated in a warmer period, may be the Holocene maximum. Salinity is a main problem in shallow aquifers and the water is mostly brackish NaCl type having Cl concentrations around 8000 mg/l. The Cl/Br ratios of the sampled waters indicate that the salinity in the deep aquifer is mixing with old connate seawater. The shallow aquifers salinity do not originate from the same source or direct seawater intrusion, but are derived from the dissolution of evaporite salts. A strong seasonal precipitation pattern must have influenced the formation of salts in a tidal flat topography. Seawater has evaporated from the inundated depressions and gullies leaving salt precipitate during long dry season with high evaporation rate. Later on, the formed salts have been dissolved by subsequent heavy rains in wet season, and the salty solution has infiltrated in the subsoil, recharging groundwater.