

The Influence of Seawater on the Chemical Composition of Groundwater in a Small Island: The Example of Manukan Island, East Malaysia

Abstract

Manukan Island in Sabah, Malaysia, is characterized as a small, unique island where groundwater is a major source for domestic water and other water-related activities. Hydrochemical studies were carried out in the island with the objective of identifying the influence of seawater on the chemical composition of groundwater in Manukan Island via ionic ratios and saturation states. From the calculated ionic ratios, the chemical composition of groundwater in the study area in general is influenced by seawater intrusion. The Na/Cl ratios ranged from 0.10-2.70, implying that the fresh groundwater in Manukan Island was affected by the seawater signature. Values close to ratio of seawater indicate a recent intrusion of seawater into the aquifer. Saturation index values show that the cation exchange process is found to control the concentration of calcium, magnesium, and sodium in the groundwater by precipitation of carbonate minerals as an extended effect from the mixing of seawater and fresh groundwater from its aquifer. The findings show that even though the Manukan Island aquifer is surrounded by seawater and is vulnerable to seawater intrusion attributed to its physical characteristics, it is also heavily affected by human activity related to groundwater abstraction. The data clearly indicate that seawater intrusion is the main contributor to salinity enrichment in the study area.