Hydrodynamic Salts Dispersivity Model in the Delta of Wadi El Arish, North Sinai, Egypt

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ABSTRACT

Delta of Wadi El Arish is suffering from encroachment of seawater due to the over exploitation of groundwater from the Quaternary aquifer. Continuous deterioration of the limited sole resources of water (groundwater) is expected for both quantitatively and qualitatively measures. Our objective in the current study is to develop complete mathematical model in order to describe the transport in subsurface of salts dissolved in the water that occupies the void space. These dissolved salts determine the groundwater quality. Hydrodynamic salts dispersivity model is constructed to carry out the mass balance of water and salts and the interrelationship of physical processes affecting on the salts mass transport in the Quaternary aquifer in the Delta of Wadi ElArish. The rate of chemical reactions in the groundwater and delineating of seawater-fresh groundwater interface are defined. The obtained results indicate that the effective porosity varies from 0.02 to 0.3. An increase of dissolved salts from about 0.1 kg/m^3 to 2.5 kg/m^3 in some localities while other decrease from 0.1 kg/m^3 to 1 kg/m^3 is recorded in other localities. The retarded velocity varies from 0.003m/day to 2m/day. The mechanical dispersion coefficients vary from <5 m^2/day to 120 m^2/day. Furthermore, different variations of hydrodynamic salts dispersivities are indicated, where the value of Peclet number ranges from 0.4 to > 40. Slow and fast reactions are detected. The proposed model expressed seawater-fresh groundwater interface and travel time variations of miscible and groundwater salt particles for the Quaternary aquifer in the Delta of Wadi El Arish area.