

The Interplay between Tidal Fluctuations and Physical Heterogeneity on Seawater Intrusion

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The interaction between temporal fluctuations (i.e., tidal fluctuations), physical heterogeneity and local dispersion processes mainly controls the width of the mixing zone in seawater intrusion problems. Heterogeneity causes the toe of the salt-water interface to recede while increasing both the width and slope of the mixing zone. Yet, the role of temporal fluctuations, inducing an increase of the longitudinal as well as the transverse effective dispersion processes in complex geological formations, is still largely unknown. Here, we used a combined numerical and experimental approach to investigate the impact of the joint effects of tidal fluctuations and heterogeneity in coastal aquifer. Seawater intrusion experiments were conducted in an intermediate-scale sand box filled with three different mixtures of quartz sands. The spatial distribution of the sand is well-known and follows a complex heterogeneous structure model. The TRANSDENS seawater intrusion code was used to simulate the experimental observations. Results demonstrate that neglecting the joint effect of the tidal fluctuation and heterogeneity produces an inaccurate evaluation of the saltwater intrusion process.

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