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Seawater intrusion in a randomly heterogeneous coastal aquifer under multiple pumping scenarios

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We analyze the impact of system heterogeneity and groundwater withdrawal on seawater intrusion (SWI) phenomena in coastal aquifers. Our study is set in the coastal aquifer of the Argentona river basin, in the Maresme region of Catalonia (Spain). We conceptualize the aquifer as a three-dimensional porous medium, where the distribution of log-permeability is described as a random process of space. A suite of numerical Monte Carlo simulations of transient, three-dimensional, variable-density flow and solute transport are performed. Diverse withdrawal schemes, designed by varying the screen location along the vertical direction and the distance of the wellbore from the coastline, are considered. The extent of the SWI is analyzed by considering isoconcentration curves and global dimensionless quantities. Heterogeneity yields a reduction of the average penetration length at the bottom of the aquifer and in an overall enlargement of the region where fresh and salt-water mix. The effects induced by pumping on the size and shape of the seawater wedge are analyzed as a function of the position of the well with respect to the location of the mixing zone which is in place prior to pumping.