

GEOSTATISTICAL MODELLING OF A COASTAL AQUIFER USING THE RESPONSE TO TIDAL FLUCTUATIONS AS CALIBRATION DATA.

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Abstract

Head fluctuations at coastal wells caused by tidal fluctuations may be a cheap way to provide aquifer scale effective hydraulic diffusivity and heterogeneity patterns. In this work, we present the methodology to do it both for ideal conditions (homogeneous, straight coastline), using analytical solutions, and general heterogeneous conditions, using geostatistical inversion. We apply the methodology to hydrogeological modelling of a small contaminated zone near the coast of Tarragona (Spain). Characterization of hydraulic properties is a necessary step for the posterior remediation design. The aquifer is composed by a high-conductive anthropogenic filling, placed over a quaternary gravel conglomerate; an important peculiarity of the studied area is the presence of shallow artificial structures which affect groundwater flow and contaminant transport. The resulting heterogeneity of hydraulic properties suggested the choice of a geostatistical model. The response to sea-level fluctuations provided a broad coverage of the area of study and was used as calibration data, jointly with the response to two injection tests. The three data sets were analyzed simultaneously by means of a modification of the pilot points method, which allows accommodating complex heterogeneity patterns and seeks both model fit and plausible estimation. The resulting model yields excellent fit of not only head data, but also concentration data that had not been used during calibration.