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Influence of tidal fluctuations in the water table and methods applied in the calculation of hydrogeological parameters. The case of Motril-Salobreña coastal aquifer

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The hydraulic properties of coastal aquifer are essential for any estimation of groundwater flow with simple calculations or modelling techniques. Usually the application of slug test or tracers test are the techniques selected for solving the uncertainties. Other methods are based on the information associated to the changes induced by tidal fluctuation in coastal zones.

The Tidal Response Method is a simple technique based in two different factors, tidal efficiency factor and time lag of the tidal oscillation regarding to hydraulic head oscillation caused into the aquifer. This method was described for a homogeneous and isotropic confined aquifer; however, it's applicable to unconfined aquifers when the ratio of maximum water table fluctuation and the saturated aquifer thickness is less than 0.02. Moreover, the tidal equations assume that the tidal signal follows a sinusoidal wave, but actually, the tidal wave is a set of simple harmonic components. Due to this, another methods based in the Fourier series have been applied in earlier studies trying to describe the tidal wave. Nevertheless, the Tidal Response Method represents an acceptable and useful technique in the Motril-Salobreña coastal aquifer.

From recently hydraulic head data sets at discharge zone of the Motril-Salobreña aquifer have been calculated transmissivity values using different methods based in the tidal fluctuations and its effects on the hydraulic head. The effects of the tidal oscillation are detected in two boreholes of 132 m and 38 m depth located 300 m to the coastline.

The main difficulties for the application of the method were the consideration of a confined aquifer and the variation of the effect at different depths (that is not included into the tidal equations), but these troubles were solved.

In one hand, the assumption that the storage coefficient (S) in this unconfined aquifer is close to confined aquifers values due to the hydrogeological conditions at high depth and without saturation changes. In the other hand, we have monitored hydraulic head fluctuations due to tidal oscillations in different shallow boreholes close to the shoreline, and comparing with the deep ones.

The calculated values with the tidal efficiency factor in the deep boreholes are about one less order of magnitude regarding to the obtained results with time lag method. Nevertheless, the application of these calculation methods based on tidal response in unconfined aquifers provides knowledge about the characteristics of the discharge zone and groundwater flow patterns, and it may be an easy and profitable alternative to traditional pumping tests.