



Spatial analysis of climatic cycles of a detrital aquifer by mean of Indicator Kriging

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In a previous work, spectral analysis was carried out to investigate the climate cycles in a detrital aquifer located in southern Spain. The Vega de Granada aquifer is located in an alluvial plain surrounded by mountains. The aquifer has a superposition of Quaternary sedimentary materials showing a broad range of permeabilities. This aquifer is the receptor of a drainage basin of 2900 km² and has a surface of around 200 km². Its alluvial sediments attain a thickness of 250 m in the middle. The sediment sizes are mainly gravel, sands, silts and clay, with frequent spatial changes. The transmissivity of the range from 40000 m²/day to 100 m²/day and the effective porosity ranging between 1% and 10%. The main inputs into the aquifer come from the infiltration of surface runoff and the infiltration of rainfall water. More than 50 piezometric data series were studied with monthly temporal unit. The studied period has a span of more than 30 years. The main climatic cycles are annual, NAO, ENSO and semiannual. For this study, confidence levels of <90%, 90%, 95%, and 99% were established.

The spatial distribution in the aquifer of climate cycles and their confidence levels were studied by mean Indicator Kriging. This methodology is based on geostatistical non-parametric methods. For this purpose, the confidence levels were codified in indicator variables. Overall, eleven experimental variograms were calculated and it fitted to a spherical model. In this sense, the spatial behavior of the climate cycles is quite similar in all cases.

The estimation results are presented as binary maps that show areas where every cycle appears with a maximum spatial probability. Basically, the interpretation of these maps indicates a close connection to main recharge areas of the aquifer. On the other hand, the changes in permeability in the aquifer are considerable, which may explain in some cases the spatial variations in the spectra calculated.

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