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A conceptual model of the coastal aquifer of the Andarax Delta (SE Spain)

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GEOLOGICAL AND HYDROGEOLOGICAL FEATURES

The coastal detritic aquifer of the Andarax delta is quite small (16 km^2 in area, with an average thickness of 80 m). Like many other Mediterranean aquifers, it dates from the Plioquaternary and comprises alternating sands, gravels and lutites, making a highly heterogeneous aquifer with intergranular porosity. In the vertical plane, this type of aquifer can correspond to a number of theoretical models (Custodio, 2002). As an initial approximation, the delta can be considered as a partially leaky aquifer, with a thin water table aquifer overlying a much thicker, confined aquifer (Jorreto et al., 2009).

There is a wealth of data available from various sources for this aquifer. In terms of its geology, the surface of the delta has been mapped, and there are borehole logs as well as local stratigraphic analyses. All these have contributed to establishing the type of aquifer materials, the boundaries of the aquifer, its geometry and stratigraphic architecture, all of which are determining factors for defining its hydrogeology (Clarke, 2004). Also, we used electrical resistivity tomography from the ground surface (Ogilvy et al., 2009) as well as several logs of gamma ray, water temperature and electrical conductivity in boreholes already existing in the area. All these data have enabled a better understanding of the geological detail of the delta deposits.

The hydrogeological database was derived from a detailed inventory of water points and from the analyses of water sample. Also available were time series of piezometric level, as well as water temperature and electrical conductivity in various boreholes at different depths through the aquifer. Other data of interest were also considered, including climate data, river flow and groundwater flow in the detritic aquifer of the Lower Andarax as sources of recharge; historical piezometric data, cycles and magnitude of marine tides and pumped extractions of fresh and saline water. Other analytical tools were applied to represent the data graphically, such as spatial interpolation and geostatistics (maps of piezometry, isocontents and geometry of the freshwater-saltwater contact).

By integrating all of the geological, geophysical, hydrogeological and hydrochemical data a conceptual model is proposed for the Andarax coastal detritic aquifer. This clear model considers all the elements that influence the evolution of the groundwater, which is highly dependent on the type and disposition of the strata, on recharge, extractions and marine phenomena.

FINAL COMMENTS

The definition of a conceptual model of the Andarax deltaic aquifer is of great relevance in both the short and medium term. In the short term, it represents the actual scenario of intensive saltwater extractions (1200 L/s) from close to the coastline to supply a desalination plant. The model indicates marked impacts on the dynamics and geochemistry of the aquifer, particularly on the freshwater-saltwater contact, with diverse consequences on the quality and the quantity of the resource ("freshwater" intrusion, possible repercussions on freshwater users of the aquifer, subsidence, and others). Careful spatial and temporal planning of the extractions will largely abate these drawbacks. The hypothetical scenario in the medium to long term concerns the rise in sea level due to global warming, and the particular impacts that this could have in this coastal aquifer, which management strategies must attempt to minimise.

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REFERENCES

Clarke J.D.A., 2004: *Influence of Fluvial Architecture Assumptions on Aquifer Models: Lessons from the Lower Balonne, Southern Queensland*. In: Roach I.C. ed. Regolith 2004. CRC LEME, pp. 62–66.

Custodio E., 2002: *Coastal Aquifers as Important Natural Hydrogeological Structures*. In: Groundwater and Human Development, Massone (Eds), Bocanegra, Martínes, p: 1905–1918.

Jorreto S., Pulido-Bosch A., Gisbert J., Sánchez-Martos F., Frances I., 2009: *The fresh water-seawater contact in coastal aquifers supporting intensive pumped seawater extractions: A case study*. C. R. Geoscience 341: 993–1002.

Ogilvy R.D., Meldrum P.I., Kuras O., Wilkinson P.B., Chambers J.E., Sen M., Pulido-Bosch A., Gisbert J., Jorreto S., Frances I., Tsourlos P., 2009: *Automated monitoring of coastal aquifers with electrical resistivity tomography*. Near Surface Geophysics 7 (5-6): 367–375.

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