Geostatistical optimization of water reservoir characterization case of the “Jeffra de Medenine” aquifer system (SE Tunisia)

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ABSTRACT

This study attempts to characterize the organization, geometry and continuity of aquifer systems in a faulted setting, by geostatistical methods. It concerns the “Jeffara de Medenine” aquifers, in South-Eastern Tunisia. The quality of architectural reservoir modelling depends heavily on available data and on the fault network at the origin of its compartmentalization. In our case study, the available data consist mainly of boreholes: (i) usually sparse: the data distribution and density are very uneven within the study area, depending on the aquifers and the river network; (ii) they do not, usually penetrate the entire aquifer formation. Therefore, aquifers situated at a great depth remain unattainable for many drillings, leaving large areas under-informed and (iii) they are supplemented by seismic data which, although of variable quality, provide useful information for building the fault network at a large scale.

To deal with this lack of data, an original geostatistical approach is applied in order to make the best use of the available data: (i) borehole data corresponding to the geological interfaces: these are exact data (equal to) and (ii) information provided by the end of drilling; these are uncertain data using inequalities (less than, greater than, between). The estimation of the Turonian reservoir top (taken as an example in this study) may indeed be constrained by the exact and inequality well values, thus avoiding some inconsistencies during interpolation by kriging under inequality constraints. Fault parameters are also explicitly incorporated in the interpolation procedure. This geostatistical approach is used for depth estimation within the “Jeffara de Medenine” aquifer system and is compared to classical kriging and evaluated through the quality of estimation, the adopted assumptions and method limitations. Thus, estimation procedures can be improved to build geometric models that describe as well as possible the geological reality.

Keywords: Architectural model; Geostatistics; Kriging within equality; Aquifer system; Borehole; Sparse data; Faults

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