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Wetland hydrology

title: **Equivalent density flow model of the Fuente de Piedra Lagoon hydrogeological system (Spain)**

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The Fuente de Piedra lagoon (Malaga, Spain), has a high ecological value, being an important nesting site for flamingos in the Mediterranean basin, is nature reserve and is included in the Ramsar Convention. The lagoon has a closed basin and a complex hydrogeological system due to the extreme variability between the densities of the shallow aquifer freshwater, brackish water and deep and shallow brines present in the basin and the lagoon. The basin is located in the external zones of the Betic Cordillera, in the so-called Chaotic Subbetic Complex (CSC), made up of sedimentary series Subbetic source, whose age is between the Trias and lower Miocene. It presents a very complex and deformed internal structure, transformed in a chaotic brecciated mass set (Fig. 1a) without internal coherence.

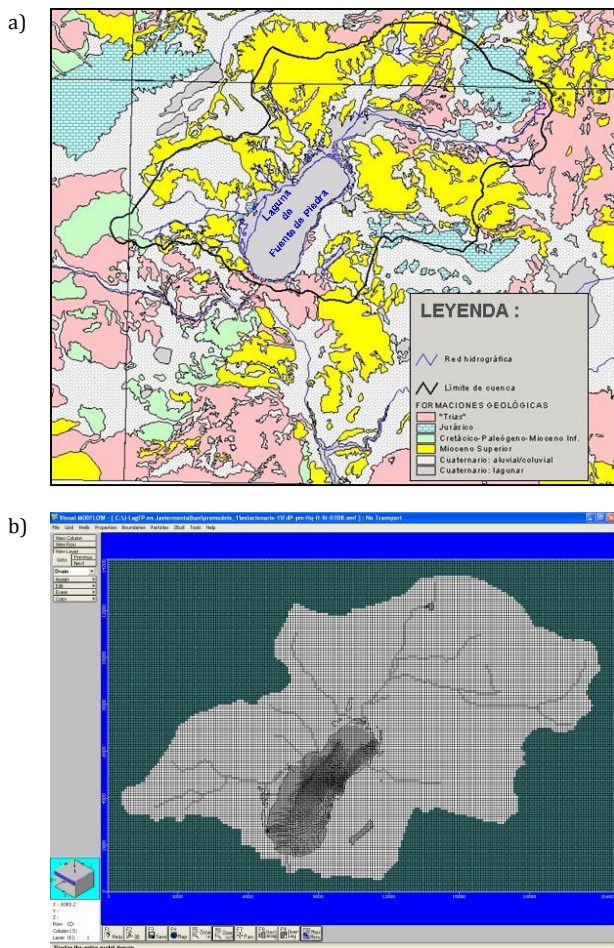


Figure 1. a) Geology of Fuente de Piedra lagoon; b) Levels associated with the condition of drain to the bed of the lagoon.

The hydrological conceptual model (Fig. 2) is made up of three sets of flows that are stratified by their density: 1. A surface flow system consisting of materials from the upper Miocene, Quaternary sediments and blocks of Jurassic limestones and dolomites. Its area coincides with the closed basin surface. 2. An intermediate flow system that would circulate through the low per-

meability materials from the marly-gypsum matrix and in CSC blocks of limestones and dolomites. Although its exact extent is unknown, he can be considered coincident with the superficial system, without making an obvious error of conceptualization. 3. A deep karst system that would develop into massive accumulations of evaporites and gypsum in CSC. Its extent is regional. These systems discharge into the lagoon of Fuente de Piedra.

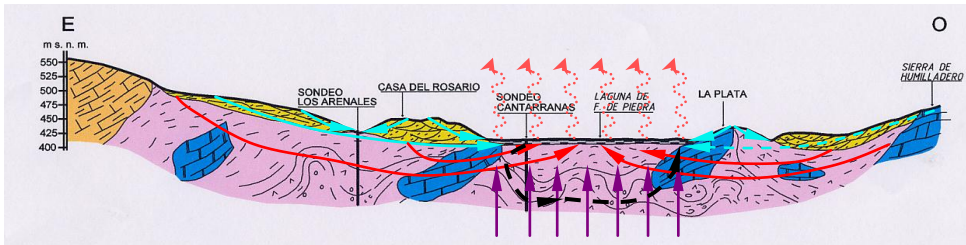


Figure 2. Conceptual model. Genesis brine: process evaporative + evolution hydrogeochemistry + factor lithology.

This paper presents an equivalent density flow pre-modeling of this hydrogeological system, which represents in steady regime the average situation of the hydrological year 2007/08 and the transitional regime of that hydrologic year. It has been implemented in the widely used code MODFLOW. The main objective is to analyze some numerical aspects for the further development of a variable density model of the system. A secondary objective is the study of the "performance" of the equivalent levels boundary conditions associated with the: the preset level, H_{eq} , which represents the piezometric charge of deep and karstified brine levels, and the condition of drain, $C_h (H_{eq} - h)$ (Fig. 1b), assigned to the bed of the lagoon where is the shallow brine.

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