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Large-scale spatial characterization of a karst aquifer by combination of periodic and non-periodic responses (Lez aquifer, France)

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Spatial characterization of the hydraulic properties in the subsurface is an extensively studied problematic. Inverse problems allow to image those properties by interpreting the information from a dataset of field measurements with a chosen physical formulation of fluxes in a numerical distributed model. However, karst media characterization remains a complex task, due to the fact that the matrix and conduits entities generate a highly contrasted distribution of property values. Thus, one needs to employ an inversion method able to represent this contrast and also use data providing information on the localization of the conduits network and its connectivity.

We propose a large-scale 2-D application of characterization of the Lez aquifer in southern France, covering a surface of about 400 km². We take advantages of long-terms measurements within the framework of the MEDYCYSS observation site, part of the Karst observatory network (www.snokarst.org) initiated by the French institute INSU/CNRS. Drawdown signals measured in 14 wells incorporating a periodic response due to a daily pumping at the aquifers spring were thus considered for this study. The periodic responses can provide connectivity information between wells in the inversion process, while non-periodic responses will permit to better assess the large-scale property values of the whole hydrosystem. A Cellular Automata-based Deterministic Inversion (CADI) is used to generate a contrasted property field able to reproduce the measured signals in the 2-D distributed numerical model. This application is led with responses obtained at a high water-table level and also at a lower level in order to highlight the change in connectivity and flow paths mobilized at different depths.