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Influence of observation scale on the hydrodynamic analysis of well tests in a fractured reservoir *(Terrieu site, Montpellier, France)*

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In naturally fractured reservoirs, well tests constitute a very powerful tool to characterize the efficiency and connectivity of main flow paths such as fractures or conduits. When several wells are available for the experiment, interference tests provide outstanding information on the heterogeneity of the flow network properties. Usually, the key issue for predicting the spatial organisation of the field permeability is related to the observation of both the fracture and flow networks at different scales.

This paper documents results obtained from experiments conducted in an exceptional site located in Beriasian fractured limestone (Terrieu experimental laboratory, South France). One pumping well (well A) and twenty observation wells (with a regular pattern and a 5 m average spacing) have been drilled in a 500 m^2area. Another production well (well B) is also available, located 5 km away from the observation wells on Terrieu site. Using these equipments, two interference tests were conducted separately, and water table was surveyed in the twenty boreholes in the Terrieu, using a new version of divers.

Results, observations and conclusions

Observations during the interference test performed at the local scale (pumping in well A) show two types of hydrodynamic responses: 1) fast and high drawdown for some wells, 2) delayed and weak drawdown for others. The first group of wells is directly connected to the well through open and very permeable fractures, while the second group belongs to parts of the reservoir that feed the main flow paths via a low permeable flow network.

Water table evolution during the interference test at large scale (pumping in well B) show very interesting hydrodynamic responses. Although the 20 observation wells can be considered at the same location in this scale (5km distance from well B), three types of hydrodynamic responses can be distinguished: 1) rapid and high drawdown with a similar feature than in well B but with a delay of about 10 minutes, 2) drawdown that illustrate a delayed and smoothed response, 3) responses with a delay of about 30 minutes, and a very low amplitude in the response. As well as for the local scale interference, it may be assumed that a rapid and high amplitude pressure response is related to very permeable and well connected fractures and conduits that constitute the main flow paths.

Comparison between results obtained from the two experiments demonstrate that there is not any direct relationship between the hydrodynamic response related to large scale and small scale interference tests. Indeed, the calculated hydrodynamic properties that control the amplitude and celerity of the pressure signal observed at one scale cannot be used to predict the behaviour at the other scale. Consequently, the pattern of the couple producing well–observation well, and the scale at which this pattern is considered, have a prevailing role on the reservoir response. The characterisation of the efficiency and connectivity of fractures involved in the flow network should take into account these parameters before delivering any conclusion.