Temperature as tracer for fresh/salt water interface monitoring

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ABSTRACT

Sea-water intrusion (SWI) is the most frequent threat to coastal aquifers. A singular poorly-understood feature of SWI is the mixing zone between fresh and seawater. We believe that understanding of the temporal and spatial scales of mixing at this zone are fundamental to improving prediction of seawater-freshwater mixing

We test the use of the temperature contrast between fresh- and sea-water, as tracer for studying the mixing zone dynamics. We monitored the vertical temperature profile across the interface with Fibre Optic Distributed Temperature Sensing (FODTS). Based on natural differences in temperature, FODTS is used as passive sensor to monitor the SWI position and dynamics in a Mediterranean aquifer along a full year.

The thermal responses were validated through comparison of temperature and electrical conductivity, and illustrate the relationship between the SWI position and the temperature distribution. The relation varied seasonally, due to change in thermal contrast between end members, and by the scale of the targeted dynamics. For example, for small scale processes, like astronomic tides, thermal distribution does not reflect the subtle dynamics followed by solutes concentrations at the SWI.