Seawater intrusion dynamics monitoring with geophysical techniques combination

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ABSTRACT

The characterization of saline water interface and understanding its hydrodynamics is a key issue to understand submarine groundwater discharge (SGD) and the role of seawater intrusion (SWI) in the management of groundwater resources in coastal areas. With the objective of testing and comparing different methods of characterization and monitoring the saline water interface, a new experimental site has been constructed north of Barcelona city (Spain) in the lowest part of an alluvial aquifer. The site, between 30 and 90 m from the seashore comprises 16 shallow piezometers organized in nests of three with depths ranging between 15 and 25 m and 4 solitary piezometers.

The deepest piezometers of each nest and the solitary piezometers are equipped with electrodes every 75 cm in order to perform cross-hole electrical resistivity tomography (CHERT). This technique allows representing a vertical cross section perpendicular to the sea where the fresh-salt water interphase can be inferred due to the resistivity contrast between the saline and fresh water. All piezometers are also equipped with Fiber Optic (FO) cable to perform distributed temperature measurements. Two fiber optic cable lines of around 600 m length each were installed around all boreholes. FO allows measuring temperature at 25 cm resolution along the installed line where the thermal effect of the different boundary conditions may be identified. These two methods are complemented with downhole electrical conductivity logging in a borehole in the middle of the study site, allowing measuring pore fluid conductivity changes at high temporal resolution (every 10 min).

In this presentation we present two snapshots of the data obtained with these techniques in June and September 2015. These techniques give information than helps to understand the SWI characteristics at different spatial and temporal scales. However, its combination helps to understand better the hydrodynamics of the seawater interface, which may have relevant

implications to understand biogeochemical cycles and improve groundwater resources management in coastal environments.

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