Geophysical Research Abstracts
Vol. 21, EGU2019-14236, 2019
EGU General Assembly 2019

A long-term experiment for monitoring saltwater intrusion dynamics using time-lapse cross-hole ERT

Andrea Palacios (1,2), Juanjo Ledo (3), Niklas Linde (4), Fabian Bellmunt (3), David Bosch (3), Laura del Val (2), Albert Folch (2), Linda Luquot (5), Laura Martínez (1), Philippe Pezard (6), and Jesús Carrera (1)

(1) Institute of Environmental Assessment and Water Research, CSIC, Barcelona, Spain, (2) Department of Civil and Environmental Engineering (DECA), Universitat Politécnica de Catalunya, Barcelona, Spain, (3) Institut de Recerca Geomodels, Universitat de Barcelona, Spain, (4) Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland, (5) Hydrosciences Montpellier (HSM), CNRS, IRD, Univ. Montpellier, Montpellier, France, (6) Laboratoire Géosciences Montpellier, UMR 5243, Montpellier, France

Monitoring water salinity is critical for the management of water resources in coastal aquifers, because groundwater is exposed to and threatened by saltwater intrusion (SWI). The electrical conductivity (EC) of water is highly and positively correlated to water salinity, and pore water electrical conductivity contributes to the bulk electrical conductivity of rocks. Consequently, measurements of bulk EC are indirect measurements of water EC, and thus, of water salinity. Surface electrical resistivity tomography (ERT) is widely used for obtaining bulk EC models because it is minimally invasive and provides high spatial coverage, but it is also strongly affected by low resolution at depth. We hypothesize that the use of CHERT (cross-hole ERT) can partly overcome this resolution limitation since the electrodes are at depth, and the model will not lose resolution in the zone of interest. We have tested this hypothesis at the Argentona site, a highly instrumented site for the study of SWI and submarine groundwater discharge (SGD), located 40 km northeast of Barcelona. Five boreholes, equipped with permanent electrodes, allow the monitoring of SWI dynamics on a transect perpendicular to the coastline. The obtained bulk EC models prove that CHERT is, indeed, superior to surface ERT in terms of resolution and accuracy when measuring bulk EC. After two years of monitoring using CHERT, we observe long- and short-term variability in SWI related to seasonal dynamics, aquifer salinization attributed to long-term drought, and aquifer responses to meteorological phenomena such as heavy rains and storms. By comparing CHERT results with water EC from water samples and with bulk EC from electromagnetic logging tools, we conclude that CHERT is a reliable tool for monitoring SWI dynamics.

Acknowledgements
This work was funded by the project CGL2016-77122-C2-1-R/2-R of the Spanish Government. We would like to thank SIMMAR (Serveis Integrals de Manteniment del Maresme) and the Consell Comarcal del Maresme in the construction of the research site. This project also received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie Grant Agreement No 722028.