Geophysical Research Abstracts
Vol. 16, EGU2014-14702, 2014
EGU General Assembly 2014

Changes of soil hydraulic properties from long-term irrigation with desalted brackish groundwater

Javier Valdes-Abellan (1), Joaquin Jiménez-Martínez (), and Lucila Candela ()

(1) Dept of Civil Engineering, University of Alicante, Alicante, Spain (javier.valdes@ua.es), (2) Geosciences Rennes, UMR 6118 CNRS, Université de Rennes I. Rennes, France (joaquin.jimenez-martinez@univ-rennes1.fr), (3) Dept of Geotechnical Engineering and Geoscience, UPC, Barcelona Spain (lucila.candela@upc.edu)

Long term effects on soil from desalted water irrigation have been assessed in an experimental plot (9 x 5 m2) under semi-arid climate located in Alicante (SE Spain). Water flux monitoring, from volumetric water content and soil pressure head, was performed from two different monitoring strategies. Also, field scale dispersivity was estimated through a BrLi tracer test and by inverse modelling with HYDRUS. Finally, a reactive and multicomponent transport model was developed using HP1 software, coupling of HYDRUS with PHREEQC.
From soil profile characterization, three layers were identified, being calcite the most important mineral of the soil solid phase in all them, followed by quartz and gypsum, the latest in low concentration.
Reactive transport modelling of major ions supply by irrigation water was performed with the HP1 code. Temporal and spatial variability of saturated hydraulic conductivity were included in the computational process. Chemical results for each time step (precipitation/dissolution of minerals) were used to compute changes in soil porosity and consequently in the hydraulic conductivity, which is used in the following computational time step.
Simulations were performed along a 30 years period. Results from field data show that an increase in porosity and saturated hydraulic conductivity can be expected due to the slow but continuous dissolution of gypsum. Calcite dissolution is expected at the root zone (where partial pressure of CO_2 is higher) and precipitation occurs below the root zone, where CO_2 partial pressure decreases due to the reduction of biological activity.
From the baseline case, three different scenarios were proposed: (i) gypsum free profile, (ii) rain-fed irrigation, and (iii) lower CO_2 partial pressure at the root zone. For the gypsum free soil profile scenario, the important precipitation of calcite produced below the root zone is not counteract by the gypsum dissolution, which may lead to significant reduction of hydraulic conductivity under the root zone and also on the recharge rate. Results of rain-red scenario show small changes on hydraulic conductivity, and lower CO_2 pressure at the root zone reduces significantly the calcite dissolution and later precipitation.