Using a simple analytical solution to asses the distribution of Radon and Radium isotopes in a coastal aquifer

M. DIEGO-FELIU[1]*, M. SAALTINK[2,3], A. FOLCH[2,3], L. MARTÍNEZ-PÉREZ[2,3,4], T. GOYETCHE[2,3,4], A. ALORDA-KLEINGLASS[1], V. RODELLAS[1], J. GARCIA-ORELLANA[1]

[1] ICTA, UAB, Bellaterra, E-08193, Spain (*correspondence: marc.diego@uab.cat)
[2] Department of Civil and Environmental Engineering, UPC, Barcelona, 08034, Spain
[3] Hydrogeology Group, UPC-CSIC, Barcelona, 08034, Spain
[4] Institute of Environmental Assessment and Water Research, CSIC, Barcelona, 08034, Spain

Radon and Radium isotopes (^{222}Rn, $T_{1/2}$=3.8 days, ^{223}Ra, $T_{1/2}$=11.4 days; ^{224}Ra, $T_{1/2}$=3.66 days; ^{228}Ra, $T_{1/2}$=5.75 years; ^{226}Ra, $T_{1/2}$=1620 years) have been extensively used to evaluate land-ocean interaction processes due to their proprieties. In coastal aquifers, the distribution of Rn and Ra isotopes concentrations strongly depend on geological context (e.g. lithology, U and Th content, porosity, grain size), salinity (i.e. cationic exchange processes), groundwater transit times, physical processes (i.e. recoil from alpha decay, ingrowth, and decay of the radionuclides) among other geochemical processes (e.g. precipitation with Fe and Mn oxides). Furthermore, the dynamics of coastal aquifers (e.g. submarine groundwater discharge, seawater intrusion) highly influence the spatial distribution of Rn and Ra isotopes. A detailed understanding of their distributions in coastal aquifers may thus provide some insights into the temporal and spatial variability of these coastal processes.

The aim of this study is to asses the processes that determine the Rn and Ra isotopes distribution in coastal aquifers: groundwater transit times, retardation coefficients and recoil from alpha decay using a simple analytical solution that integrates all isotopes of a decay chain into one formulation.

The evolution of Ra and Rn concentrations have been monitored over two years by means of groundwater sampling, geochemical and geophysical methods in 9 partially screened piezometers from a coastal alluvial aquifer located in the lowest part of the Argentona ephemeral stream (NE of Barcelona city, Spain). The results of the monitored Rn and Ra concentrations, together with the implementation of the analytical solution reveal that alpha recoil and groundwater transit times processes play a prominent role on regulating the concentration of these radionuclides in the coastal aquifer.