1 Experimental setup

1.1 Soil composition

The soil used in this work was a calcareous loamy sand. For the heterogeneous experiment, washed sea sand was also used. Soil texture was evaluated by a hydrometer experiment (based on Stock's law). The percentages of sand, silt and clay in each of the soils are presented in Table S1.

Table S1. Texture of the porous media

Soil	Sand (%)	Silt (%)	Clay (%)
Loam	93.2	4.1	2.7
Sea sand	99.8	0.2	0

1.2 Column packing

The air-dried soils were passed through a $< 250 \mu m$ sieve. For the homogeneous profile, $310g$ of soil was packed in the column with a packed bulk density of $1.37 g/cm^3$. For the heterogeneous profile, a $3\ cm$ layer of sand was packed between the two middle electrodes. The total weight of soil compacted was $312g$ and the packed bulk density was $1.379 g/cm^3$. After the packing, columns were saturated from the bottom with the background $NaCl$ solution until the EC of the outflow solution was equal to that of the inflow.

2 Chemical measurement comparison between the homogeneous and heterogeneous profiles
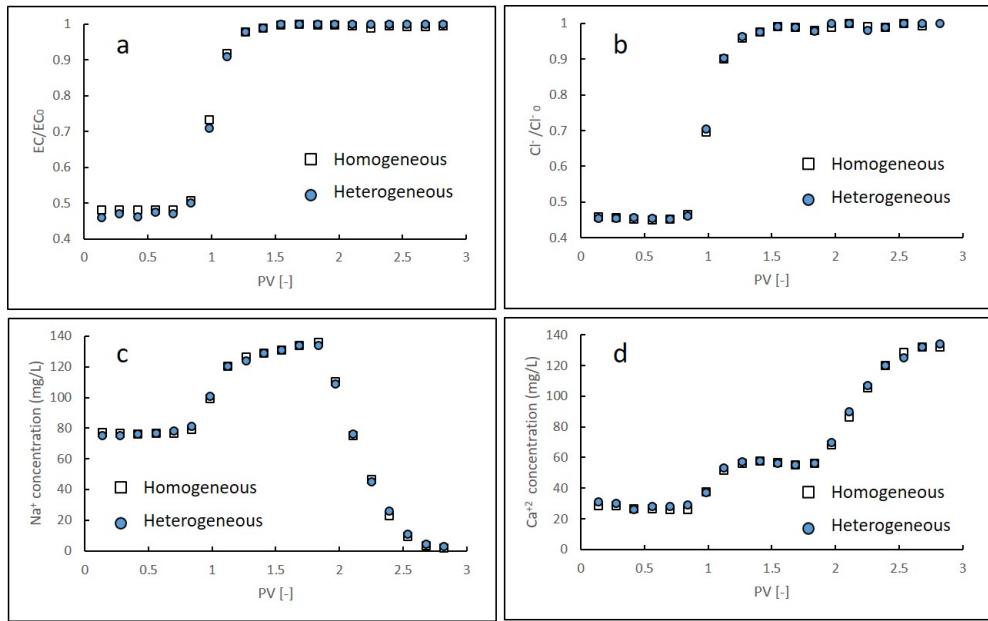
Figure S1. A comparison between the homogeneous and heterogeneous profiles (presented versus PV): (a) $\frac{EC}{EC_0}[-]$, (b) $\frac{Cl^-}{Cl_0^-}[-]$, (c)Na^+ concentrations (mg/L) and (d) Ca^{2+} concentrations (mg/L)

3 Raw SIP spectra
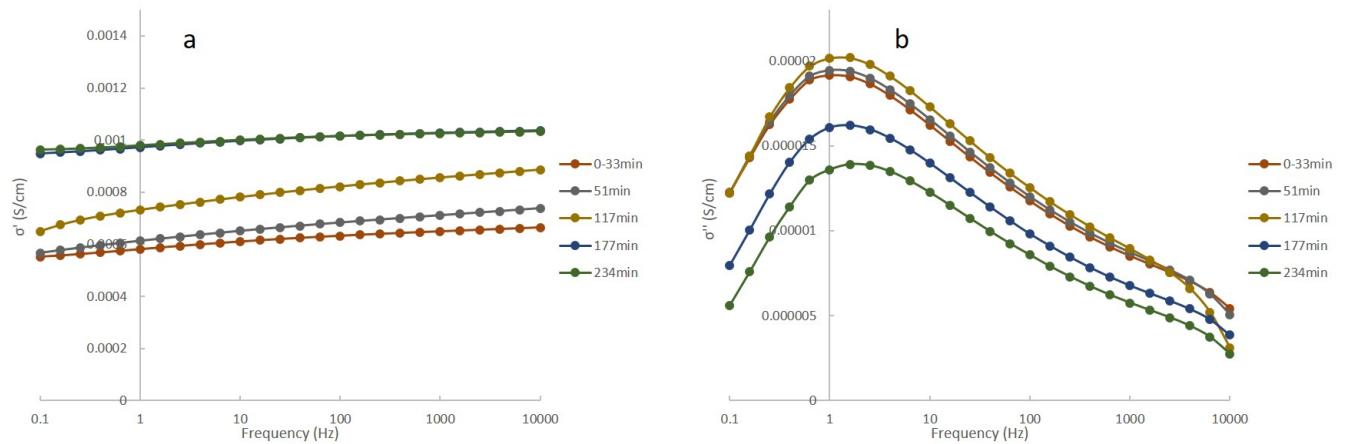
Figure S2. Real (a) and imaginary (b) conductivity versus frequency at the range of 0.1-10,000Hz