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Dynamic visualization of water flow heterogeneous porous media by X-rays Computed Tomography

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X-rays Computed Tomography (CT) is a powerful technique for noninvasive measurement of static object internal structure. Dynamic visualization by CT, especially of fluid flow into porous media, is still limited by its low temporal resolution. To do so, a compromise has to be found between fluid flow velocity and CT acquisition time. Furthermore, an efficient image analysis method is necessary. In this work, we followed the water transport in 3 dimensions by CT imaging across a double-porosity media constituted of two distinct materials, i.e. sand and porous clay spheres, with contrasted hydraulic conductivity. The CT acquisition parameters were adjusted to the water pore velocity so that we succeeded to register the water front displacement per time range of 30 min. We also used the image subtraction method to extract water distribution evolution with time with a space resolution of 60 μm. Both time and space resolution are relatively high compared to other dynamic studies. The water content profiles analyzed by CT showed that convective transport occurred mainly in the sand matrix while the transport in the clay spheres was mainly diffusive. These results are consistent with macroscopic experiments in columns, the latest showing that water transport in the double –porosity media occurred in non equilibrium.