CATTANEO Giona (2023): Porous media layered structure shapes solutes transport

Abstract

Concern about pollution and water quality has made the transport of solutes in the subsurface and groundwater an increasingly studied topic of interest (Dagan, 1987). The knowledge of the transport and the fate of contaminants is necessary to design strategies for the prevention of pollution and this is necessary also for the development of strategies for the remediation of contaminated soils and aquifers (Brusseau, 1994).

We developed a system to be able to study the difference between transport in a homogeneous porous medium, characterised by glass spheres of the same size, and transport in a heterogeneous porous medium characterised by several channels that are homogeneous within themselves, but each containing a set of glass spheres of different sizes. To study transport, we used the BreakThrough Curve (BTC) as a quantity and we were able to verify that transport in homogeneous conditions follows the model that is described by the Advection-Dispersion Equation (ADE), while transport in heterogeneous conditions can be explained by a different model that is based on the stochastic stream-tube model, with transport then characterised by the weighted sum of the arrival times of transport in each channel.

In this study, we have therefore analysed the transport of a mixture of MilliQ water and Methylene blue, and it is a work that can be improved and investigated with further experiments, changing the type of fluid, or changing other initial conditions.