
Dispersion, stretching and direct visualization in 3D porous media

Mathieu Souzy^{*1,2,3}, Tanguy Le Borgne², Yves Meheust², Henri Lhuissier³, and Bloen Metzger³

¹Risques, Ecosystèmes, Vulnérabilité, Environnement, Résilience – Aix Marseille Université, Institut National de Recherche pour l’Agriculture, l’Alimentation et l’Environnement : UMR1467, Institut National de Recherche pour l’Agriculture, l’Alimentation et l’Environnement – 3275 Route de Cézanne CS 40061 13182 Aix en Provence Cedex 5, France

²Observatoire des Sciences de l’Univers de Rennes – Université de Rennes, Institut National des Sciences de l’Univers, Université de Rennes 2, Centre National de la Recherche Scientifique, Institut National de Recherche pour l’Agriculture, l’Alimentation et l’Environnement – France

³Institut universitaire des systèmes thermiques industriels – Aix Marseille Université, Centre National de la Recherche Scientifique – France

Résumé

Geomaterial are complex porous material presenting a wide diversity of structures, which set the flow kinematic of any fluid through it. The understanding of the mechanisms controlling the flow kinematics at the pore scale is however decisive to predict and control transport processes (dispersion and mixing). Because of the opaque nature of geomaterial, direct visualizations are particularly challenging in porous material such as soils. However, recent development of experimental techniques including index matching, allow to develop transparent porous media to perform direct visualization of the flow in these artificial materials. I will here discuss about how such approach allows to study porous media composed of randomly packed solid monodisperse spheres, allowing to **directly visualize the flow** within the bulk of the 3-D media, and to investigate how a blob of dye stretches and get mixed when injected within such 3-D porous media. Using Particle Image Velocimetry techniques (PIV), successive scans of the velocity field are used to provide highly resolved experimental reconstruction of the 3-D Eulerian fluid velocity field in the bulk of the porous media. From the **experimentally measured 3D velocity field**, the stretching process (how fluid material line gets elongated within the flow) and the dispersion process (how a blob of dye explores its surrounding media) are characterized, and an explanation for the reported anomalous dispersion will be discussed.

*Intervenant