



What Are The Impacts Of Transient Flows On Colloid Mobilization And Retention In Macroporous Soils ?

Eric Michel, Samer Majdalani, Romain van den Bogaert, Sophie Cornu,
Liliana Di Pietro

► To cite this version:

Eric Michel, Samer Majdalani, Romain van den Bogaert, Sophie Cornu, Liliana Di Pietro. What Are The Impacts Of Transient Flows On Colloid Mobilization And Retention In Macroporous Soils ?. 1. PROTINUS international workshop: “ How to unravel the interactions between soil structure and soil functions? ”, Jul 2015, Grenoble, France. hal-01603530

HAL Id: hal-01603530

<https://hal.science/hal-01603530>

Submitted on 5 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

What Are The Impacts Of Transient Flows On Colloid Mobilization And Retention In Macroporous Soils ?

Michel E^{1,2*}, Majdalani S³, van den Bogaert R^{1,4}, Cornu S⁴, Di Pietro L^{1,2}

¹ UMR1114 EMMAH, INRA, Avignon, F-84000, France

² UMR1114 EMMAH, UAPV, Avignon, F-84000, France

³ UMR5569 Hydrosience Montpellier, Université Montpellier 2, F-34000, Montpellier, France

⁴ UR1119 GSE, INRA, Aix en Provence, F-13100, France

Colloidal particle naturally occurring in the soil can act as vectors of adsorbed pollutants from the soil surface to the groundwater. Although much effort has been devoted to understand and model the mobilization and retention mechanisms of colloids in soils, most of the studies have focused on single rains or irrigation events, while in field conditions soils undergo successions of rain and drying cycles.

We performed long series of successive irrigations on undisturbed macroporous soil columns, and monitored the concentration, in the column effluents of (i) natural soil colloids (SC) mobilized inside the soil and (ii) labeled colloids (LC) brought with the irrigation water. All irrigation events were in every respect identical (duration, intensity, water chemistry) but were separated by irrigation Interruption Durations (ID) of increasing length.

We found that the amount of leached SC and LC was much affected by the irrigation interruption duration. As the ID before the irrigations increased, the amount of leached SC increased, reached a maximum value and decreased. Maximum SC leaching occurred for IDs of about 250 hours and was up to an order of magnitude higher than leaching recorded at the shortest and longest IDs. Interestingly, the fraction of LC recovered at the column outlet also increased with ID, but leveled out for IDs greater than about 250 hours.

We showed that SC and LC leaching variations are (indirectly) linked to water content variations in the active macropores and proposed a mechanistic model to account for the SC leaching variations. It is based on the hypothesis that non-uniform water loss from the macropore walls during an irrigation interruption induces differential capillary stresses that weaken the structure of the walls and promotes colloid mobilization during the passage of a new infiltration front. The model reproduces well the experimental results and has been validated with data obtained in different experimental conditions. Finally, we discuss how the model can also reproduce the observed variations of LC retention.