H129-005 **Room: 201A** **Time: May 20 15:00-15:15**

Analysis material movement phenomenon in soil by Continuous time random walk and Advection-diffusion equation

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Recently soil and ground water pollution is getting more important in our society. It also becomes important to predict migration of pollutants for economic and risk engineering. Advection dispersion equation (ADE) has been used generally for a long time about migration prediction of whole groundwater of contaminant. But it has been found out that ADE does not always reproduce actual concentration distributions because of the tailing phenomena and the scale-dependent dispersion coefficient. However, it was not understood how these phenomena are occurred. Thus it is important to elucidate an unknown part and predict it correctly. The continuous time random walk (CTRW) tries to solve those problems and is proposed from Hatano[1] and Berkowitz[2] as a new alternative model for ADE. In a previous study, Bijeljic and Blunt[3] shows that material transport in the geologic media changes from behavior of CTRW into that of ADE, theoretically, according to the distance and the Peclet number. In the present study, we perform a series of sandbox test, and thereby investigate those experimentally. It is a large-scale experiment that we can observe the solute behavior over as much as 8 meters. The relationship between ADE and CTRW was considered.

The CTRW is defined based on a one-dimensional random walk. The probability of existence of a random walker corresponds to the concentration of a pollutant. The particle leaves the origin and moves to a constant distance to the right or to the left in probability p or q=1-p per unit time. CTRW model follows the distribution of time to stay at a site before a particle jumped. It is called as the waiting-time, t, distribution $f(t)=At^{-a}$.

The experimental conditions are as follows. The sandbox was filled Tohoku silica #6(the mean particle diameter is 0.34mm) by an automatic sand hopper into the sandbox of 260mm ∗height 300mm ∗length 7600mm. The NaCl aqueous solution as the tracer (mass concentration is 0.5%) is poured into saturated soil continuously with a constant head difference. We measured the concentration by EC sensors, which were installed at the location of 0.1m, 0.2m, 0.5m, 1.0m, 1.5m, 2.0m, 3.0m, 4.0m, 5.0m, 6.0m, 6.5m, 7.0m, and 7.5m. Hydraulic gradient of experiment is three patterns, 30/800, 9/800 and 1/800. Other experimental conditions are as follows. Porosity 0.30˜0.55 (from the Kozeny equation and the Hazen equation); the bulk density 1.532g/cm^3. The whole experiments are performed at 22 deg C of homoeothermic condition, thus we can exclude the influence of the temperature. The experimental setup is shown a figure.

All of our experimental results, that are the breakthrough curves, show anomalous behavior. Therefore, we try to fit the breakthrough curves both ADE and CTRW. We found that CTRW fits better the experimental results than ADE. With regard to the relation between ADE and CTRW, we found that the dispersion coefficient approaches to a constant value after about 5m down stream.

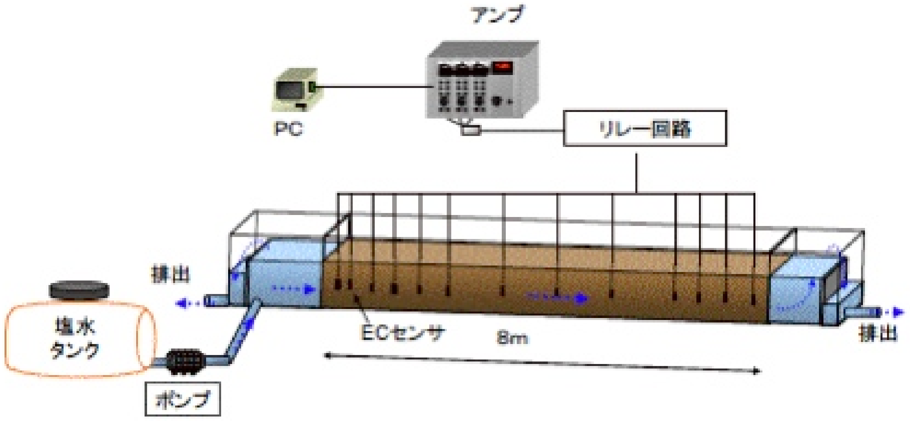
The anomalous diffusion in the geologic media was inspected by large-scale (about 8m) tracer experiment. The relation between CTRW and ADE was studied with regard to the Peclet number and the dispersion coefficient.

References.

[1] Hatano, Y., and N. Hatano (1998), Dispersive transport of ions in column experiments: An explanation of long-tailed profiles, Water Resour. Res., Vol34(5), 1027-1033.

[2] Berkowitz, B. and Scher, H.: On characterization of anomalous dispersion in porous and fractured media, Water Resour. Res., Vol.31 (6), pp.1461-1466, 1995.

[3] Bijeljic B. and M. J. Blunt: Pore-scale modeling and continuous time random walk analysis of dispersion in porous media, Water Resour. Res., Vol 42, W01202, doi: 10.1029/2005WR004578.



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