

Numerical Modeling of Variable-Density Flow and Mass Transport in the Unsaturated-Saturated Aquifer under Ambient Groundwater Flow Conditions

*Jiaqi Liu^{1,2}, Tomochika Tokunaga¹

1. Department of Environment Systems, Graduate School of Frontier Sciences, The University of Tokyo, 2. Research Fellow of Japan Society for the Promotion of Science

Groundwater contamination problems associated with variable-density flow and mass transport in the unsaturated-saturated aquifer commonly exist in the natural environment. Systematic understanding of the mechanism of density-induced mixing processes is vital for predicting the fate and transport of pollutants in the aquifer and protecting the groundwater resources. Liu et al. (2015) numerically investigated the transport process of solute through the unsaturated-saturated aquifer system, with a focus on the impacts of the hydraulic parameters of the unsaturated soil on the process. However, Liu et al. (2015) assumed no groundwater flow condition which may not be the case in the real world situation. Therefore, this study investigated the influence of ambient groundwater flow conditions on the mass transport in the unsaturated-saturated aquifer by a 2-D numerical groundwater modeling. Sensitivity analysis was conducted to examine the influence of the groundwater flow velocity, the unsaturated zone properties, the soil hydraulic parameters, and the mass input rate on the modeling results.

Keywords: Variable-density flow and mass transport, Unsaturated-saturated aquifer, Ambient groundwater flow conditions, Numerical modelling