LBM/DEM numerical modeling of submerged cohesive granular discharge as a field scenario of sinkhole occurrence in flood condition

Jianhua Fan*†[1,2], Li-Hua Luu[2], Gildas Noury[1], and Pierre Philippe[2]

[1]BRGM (French Geological Survey) – Bureau de Recherches Géologiques et Minières (BRGM) – France
[2]IRSTEA (National Research Institute of Science and Technology for Environment and Agriculture) – Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture - IRSTEA (FRANCE) – France

Abstract

Sinkhole formation caused by human activities or natural hazard has not been completely known, especially because the underground process remains invisible from the surface. Thus, physically understanding the internal evolution and the final collapse is necessary to improve risk assessment. The present 2D numerical modeling studies gravity-driven flow of grains at a sample scale by combining Discrete Element Method (DEM) and Lattice Boltzmann Method (LBM), where DEM is used to deal with the solid phase and LBM for modeling fluid phase. The destabilization of granular sample is simulated for both the case of non-cohesive and cohesive granular layers. Discharge rate related to terminal falling speed of grain vt, ratio of orifice diameter D to grain size d and grain density is investigated. In addition, a parametric analysis of the sinkhole formation is performed.

Keywords: Sinkhole, LBM, DEM, discharge rate, cohesive granular material

*Speaker
†Corresponding author: j.fan@brgm.fr