

Sediment gravity flow by the computer simulation

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[Introduction]

The sediment gravity flow is classified by the supporting system into the turbidity current, fluidized flow, liquified flow, grain flow and debris flow. The dynamic mechanism of the solid grain motion and fluid flow surround the grains have much unknown factors. To reveal these, it is required to simulate the grain motion in fluid flow by considering the dynamic influence on each grain particle. Then we have developed the new simulation technique which treats the fluid flow and the particle motion simultaneously by coupling the Lattice Boltzmann Method and the Discrete Element Method.

[Methodology]

Lattice Boltzmann method (LBM) is a numerical method for the fluid flow, whose feature is an approximation of fluid as an assembly of virtual particles, not continuum. It is suitable for this research because this method can easily calculate the fluid flow even in the changing boundary shape. The fluid velocity, density, and pressure are calculated around the solid particles (grains) under the non slip boundary condition in LBM. The effects to the fluid from the particles can be simulated because the fluid velocity on the surface of particles is fit to the particle velocity in this condition. The force on the particles is divided into two types; 1) solid - fluid interaction force, and 2) solid - solid interaction force. The former force is estimated using the fluid density and the relative velocity between the fluid and solid particles. The latter generates in the collision with other particles. It is treated by springs and dashpots, which is called discrete element method (DEM). Using these forces, the particles move by Newton's law.

[Sediment gravity flow]

We were successfully in performing the various sediment gravity flow by the different grain size distribution, grain arrangement, and angular of the slope, using the computer simulation. It is confirmed that grains are carried far away under the condition of fluid existence. The final sedimentary structures are varied in each model by the influence of the fluid vortex.

[Conclusions and further studies]

This study suggests the various sediment gravity flows can easily be reconstructed by the computer simulation. The additional simulation can reveal the mechanism of the reversely grading and the water escape structure from the viewpoint of the dynamics.