Analogue experimental study: the effect of particle concentration on depositional mechanism of pyroclastic flows

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Pyroclastic density current is a multiphase flow of hot pyroclastic particles and gas. The deposits exhibit extremely wide range in depositional volume, outflow distance, particle size, and in depositional structure.

One of the important character in depositional structure is the varieties from stratified to massive facies. It has been generally recognized that these two facies relate to two end-member models of pyroclastic density currnets; pyroclastic surges, in which particles are carried by turbulence, and pyroclastic flows, in which flow dynamics influenced by the interaction between particles. Because these models have been developed based on different assumption for the flow mechanisms, it is difficult to understand the scaling relationship between the assumptions for these models.

The aim of this study is to present the experimental results for the understanding of the linkage between flow and surge, especially focused on the effects of particle concentration on flow dynamics and depositional mechamism.

The analogue experiments used in this study have been carried out with glass beads(volume:50g, density:2.6g/cmˆ3, particle diameter:0.15mm, 0.05mm) and water(volume:200ml).

We observed the suspension region, sedimentation region, and deposit-formed region. The settling velocity of sedimentation region was increased with increasing particle concentration and particle size. The velocity of deposit-formed region was increased with increasing particle concentration. This result was consistent the Stokes' settling velocity of unique particle in infinite fluid which fluid viscosity and density is function of particle concentration.