Geophysical Research Abstracts,
Vol. 11, EGU2009-12517, 2009
EGU General Assembly 2009

Influence of roughness bottom on the dynamics of a buoyant cloud : application to a powder avalanche

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A powder avalanche is referred to as a turbulent flow of snow particles in air. In the past such avalanches have been modelled by buoyant cloud in a watertank: buoyant clouds flow along an inclined plane from a small immersed tank with a release gate (injection is of short duration). The powder avalanches are simulated by a heavy fluid (salt water + colorant or kaolin) which is dispersing in a lighter one. Such experiments allow studies for the influence of roughness bottoms on the dynamics of a buoyant clouds.
The authors studied the flows of buoyant clouds on an uniform slope of 20° with different roughness: smooth PVC, abrasive paper, bottom covered with glued particles of PMMA or with glued glass beads of different sizes arranged in a compact way. The released volume varies between 2 to 4 liters and the density of salted water is 1.2. Two cameras are used to obtain the height together with the front velocity.
Inside the study area the front velocity is approximately constant and the height of the clouds varies linearly with the distance from the released gate as usually observed in previous experiments. So for each roughness a front velocity and height growth can be defined.
It was shown from the experiments that: As the bottom increases in roughness, the front speed increases and the height growth decreases. Nevertheless the height of glued elements does not seem to be the most appropriate parameter to characterize the roughness.