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Study of bi-dispersity and dynamic fragmentation on rigid barrier under centrifuge modelling

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Geophysical flows are stress-dependent phenomena and consist of particles with wide range of sizes. Bi-dispersity, two different particle sizes, is the basic requirement for grain-size segregation. This process facilitates accumulation of boulders at the flow front, which generate sharp impulses and fragments upon impacting a rigid barrier. Such impulses and fragmentation strongly influence the dynamic response of rigid barrier and energy dissipation of kinetic energy. Centrifuge modelling was adopted to capture the stress-dependent nature of geophysical flows. A set of experiments was conducted to discern the effects of bi-dispersity and dynamic fragmentation on the dynamic response of a rigid barrier. The volume fraction of the bi-disperse flows was held constant, while the diameter of the small particles, normalized by diameter of the large particles, was varied as 0.08, 0.26 and 0.56. Two high speed cameras were installed to capture the impact mechanism from top and side view. Impact load was measured by a load cell instrumented on the modelled rigid barrier. Dynamic fragmentation was studied through collection of fragments after impact. Breakage parameters and particle size distribution curves were adopted to characterize the dynamic fragmentation mechanism.