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Two-phase and three-dimensional simulations of complex fluid-sediment transport down a slope and impacting water bodies

Shiva P. Pudasaini (1), Parameshwari Kattel (2), Jeevan Kafle (2), Puskar R. Pokhrel (2), and Khim B. Khattri (2)

(1) University of Bonn, Department of Geodynamics and Geophysics, Bonn, Germany (E-mail: pudasaini@geo.uni-bonn.de), (2) Kathmandu University, School of Science, Dhulikhel, Kavre, GPO Box 6260, Kathmandu, Nepal

We present a technique that simulates transport and flow of a real two-phase fluid (a mixture of fluid and sediment particles) down three-dimensional slopes and channels. This technique combines novel mechanics formulations and modeling into a unified high-resolution framework, providing a unique opportunity to simulate two-phase subearial landslides and debris flows with dynamically changing concentrations of solid particles. This mixture then impacts downslope with particle-laden fluid reservoirs, rivers, fjords, lakes, or oceans. This results in a super tsunami wave in the fluid body, while the submarine debris flow moves along the bathymetry. The same modelling technique can be applied to simulate rock-ice avalanches and turbidity currents with changing physical properties and mechanical responses of the phases that enhances the flow mobility. These results fundamentally advance our present knowledge associated with the complex mechanics and dynamics of multi-phase geophysical mass flows, including the subearial and submarine sediment transport and deposition processes. Our findings contribute significantly to our understanding of mixing and separation between phases, generation and propagation of special solid and fluid structures, and phase-transitions during the flow process. Finally, these results provide new insights into the evolution of morphodynamics of steep mountain slopes and channels.

References

Pudasaini, S. P. A general two-phase debris flow model. Journal of Geophysical Research, 117, F03010, 2012. doi: 10.1029/2011JF002186.

Pudasaini, S. P. and Miller, S. A. A real two-phase submarine debris flow and tsunami. American Institute of Physics Proceedings, 1479, 197-200, 2012. doi: 10.1063/1.4756096.