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Numerical modelling of the Socompa avalanche using a numerical model taking into account the complex 3d topography effects

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A new mathematical and numerical model is presented here where the curvature tensor related to the topography is completely taken into account in the framework of the long wave approximation, Bouchut et Westdickenberg [2004]; Mangeney et al. [2006]. After some tests on a simplified topography (slope with constant angle, exponential angle...), the effect of the different terms involving the curvature tensor is studied in the particular case of the avalanche occurring on the Socompa volcano located in Chile . About 7,200 years ago an earthquake triggered failure of Socompa's western flank, generating a major avalanche. The volume of displaced material was ten times greater than Mount St. Helens (estimated at 25 km3 of fragmented blocks and 11 km3 of Toreva blocks) and formed a deposit which now covers about 500 square kilometers, Kelfoun and Druitt [2005]. The change of direction of the avalanche during its emplacement due to the underlying topography provides a very good paradigm to study topographic effect and validate the numerical model. Furthermore the data on the deposit allows to study the effect of different flow laws used in the model to obtain the best fit as possible.

The numerical results are compared to those obtained by Kelfoun and Druitt [2005] using a different numerical and mathematical model also based on the depth-averaged granular flow equations. The forces acting on the granular mass during the flow and arrest phase are studied in details providing insight on the relative importance of gravity, inertia, friction and curvature effects during these catastrophic event.

References

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