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2DH NUMERICAL MODELING OF GEOMORPHIC TRANSIENTS INVOLVING RIVER BANK FAILURE ON UNSTRUCTURED GRIDS

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River bank failure is an important phenomenon in geomorphic processes. Collapse mechanisms, induced by steep slopes of the river bed and banks, deeply affect the bed evolution, together with the more investigated sediment-transport processes. It is, therefore, a need to take them into account in several problems in order to reproduce the physical evidence.

In the present work a new approach for the description of bank-failure mechanisms is integrated in a two-phase morphodynamic model by Greco et al (2012). The geofailure operator guarantees that when the bed slope exceeds a critical angle, the correspondent sediment and pore water becomes part of the bed transport and then follows the dynamic equations of the two-phase flow. In this way the physics of the bank failure can be reasonably reproduced.

The numerical implementation makes use of a triangular non-staggered mesh for discretizing the spatial domain. Unstructured grids are of great utility in representing two-dimensional complex geometries. However, in these grids variables are collocated in cell centers; this makes difficult the definition of a unique value for the cell slope, which is indeed needed for the application of the geofailure operator. In this work an ad-hoc algorithm for reconstructing and evolving in time the cell slope in unstructured triangular cells is also proposed. It is demonstrated to be globally mass-preserving.

The capability of the model of dealing with slope failures in the presence of river banks or steep bedforms is demonstrated reproducing different literature experimental tests.