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Upscaling the influence of microtopography when modelling overland flow and soil erosion

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In the context of a very shallow flow, the spatial distribution of the flow is highly influenced by the micro-topography. When the land is partly covered with water (due to the micro-topography), the local velocity of flow in local oriented depression may exceed the threshold for soil erosion on the contrary of their average value over a large grid. Nevertheless, explicit representation of the micro-topography in computational modelling requires a high spatial resolution of land surface which is not often available. The prediction using a large grid can be improved by the calibration of friction coefficient but in many case, the result is unsatisfied. Some indicators are proposed to integrate these local surface variation into numerical computation of the shallow water equation; for each cell, we use the proportion of wetted area as a microtopography indicator. For the case of erosion, the system is coupled to the sediment transport equations. In a such context, an additional equation describing the micro-topography evolution caused by erosion is introduced. Finally, the numerical scheme of Godunov-type for this model and their validations is presented.

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