Two-Layer and Saint-Venant-Exner models for bedload sediment transport

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Saint-Venant-Exner models are commonly used in the literature to describe the bed-load phenomena in sediment transport problems (see [3, 5]). The known Saint-Venant-Exner model can then be seen as a simplification of a two-layer shallow-water model. In particular it is assumed a given discharge for the sediment layer, so the model for the bed-load transport reduces to a mass conservation equation.

In this talk we present a two-layer shallow water model for bed-load sediment transport. Where, for the upper layer, we consider non-hydrostatic effects (see [1] and [4]).

The proposed model converges to a Saint-Venant-Exner type model when the velocity of the sediment layer is lower than the velocity of the fluid, or similarly, when the ratio between the hydrodynamic and the morphodynamic time is small. Moreover, we proof that, by setting the definition of the friction forces, the solid transport discharge of the Saint-Venant-Exner model at which it converges can be prescribed. For example, we can set a configuration where the model converges to the generalization of the Meyer-Peter&Müller model proposed in [2].

Finally, the numerical approximation of the model and several numerical tests will be presented.

References

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