# On a new derivation of the Saint-Venant-Exner model with energy balance

E.D. Fernández-Nieto[*], T. Morales de Luna[†],
G. Narbona-Reina[*], J.D. Zabsonré[‡]

**Abstract**

In this work a Saint-Venant-Exner model is deduced from an asymptotic analysis of the Navier-Stokes equations. As usual, two characteristic times are considered for fluid and sediment layers, taking into account that the hydrodynamic time scale is smaller that the bed evolution time scale. Thus, a shallow-water derivation for the fluid layer is developed and a lubrication Reynolds equation is searched for the sediment layer. The model also consider the mass transference between the static and the moving sediment layers, so as a Mohr-Coulomb law.

One of the improvements of this deduction is that the derived model accounts with an associated energy balance, a property that the classical SVE models do not have. As a consequence, we deduce how to modify slightly the classical SVE system in order to account with a dissipative energy balance. Moreover, the model contains a modification to be incorporated to the gravitational term in order to take into account arbitrary sloping beds. Several numerical test will be presented in order to show such differences.

# References

[1] F. Charru. Interface boundary value problem for the Navier-Stokes equations in thin domains. J. Differential Equations (208): 449-493, (2005).

[2] E.D. Fernández-Nieto, T. Morales de Luna, G. Narbona-Reina, J.D. Zabsonré. Formal deduction of the Saint-Venant-Exner model including arbitrarily sloping sediment beds and associated energy. ESAIM: Math. Mod. Nun. Anal.*(to appear)*, doi: 10.1051/m2an/2016018, (2016).

[3] A.C. Fowler, N. Kopteva, C. Oakley. The formation of river channel. SIAM J. App. Math. 67, 1016-1040, (2007).

---
[*]Dpto. Matemática Aplicada I, Universidad de Sevilla, Spain. edofer@us.es, gnarbona@us.es

[†]Dpto. Matemáticas, Universidad de Córdoba, Spain, tomas.morales@uco.es

[‡]Dpt. Mathématiques, Université polytechnique de Bobo-Dioulasso, Burkina Faso. jzabsonre@gmail.com