

# An implicit-explicit strategy for Exner model with Grass equation for sediment evolution

M. J. Castro-Diaz <sup>\*</sup>; E. Macca <sup>†</sup>; G. Russo <sup>‡</sup>

The aim of this talk is introduce an Implicit-Explicit (IMEX) strategy to compute the sediment evolution [1, 2] in the Exner model for sediment transport [3] in Shallow Water system and improve both stability and efficiency. In this model there are several time scales. One associated with the temporal evolution of the sediment, generally very long with a much slower velocity; one related to the velocity of free-surface waves, generally very fast that implies an hard restriction in the time step; and one related to the velocity of the fluid with. Unfortunately, as known, an explicit method implies a strong stability restriction due to the velocity of the free-surface wave. This restriction involves in a very long computation time that could be reduced neglecting the free-surface waves behaviour and looking at the sediment evolution. The objective is to drastically improve the efficiency in the computation of the evolution of the sediment by treating water waves implicitly, thus allowing much larger time steps than the one allowed by standard CFL condition on explicit schemes.

## References

- [1] S. Boscarino and L. Pareschi and G. Russo *A unified IMEX Runge-Kutta approach for hyperbolic systems with multiscale relaxation*, SIAM J. Numer. Anal., 55 (4), (2017), pp. 2085-2109.
- [2] M. Castro and E. D. Fernández-Nieto and A. M. Ferreiro *Sediment transport models in shallow water equations and numerical approach by high order finite volume methods*, Comput. & Fluids, 37(3), (2008), pp. 299-316.
- [3] A. J. Grass *Sediments transport by waves and currents*, SERC London Cent Mar Technol, Report No. FL29, (1981).

---

<sup>\*</sup>Departamento de Análisis Matemático, Universidad de Málaga. Email: mjcastro@uma.es

<sup>†</sup>Department of Mathematics and Computer Science, University of Catania. Email: emanuele.macca@phd.unict.it

<sup>‡</sup>Department of Mathematics and Computer Science, University of Catania . Email: russo@dmi.unict.it