Solving POD-based ROMs combined with Augmented Riemannian solvers applied to 2D SWE

José Luis Gracia[1], Pablo Solán-Fustero[2], Adrián Navas-Montilla[2], Pilar García-Navarro[2]

SUMMARY

ABSTRACT Free surface flows are present in many environmental problems. The shallow water equations (SWE) are broadly used to numerically solve this kind of problems [1]. Among the many numerical methods proposed in the literature, the upwind augmented Roes method [2] offers robust and stable solutions in realistic scenarios when dealing with numerical corrections, such as with entropy fix and wetdry fronts. Proper orthogonal decomposition (POD) based reduced-order modelling (ROM) strategy achieves more efficiency than the standard full-order models (FOMs) in terms of computational cost without losing accuracy. In this work, we analyse the properties and performance of a ROMs for this type of flows [3].

Keywords: Reduced-order modelling, POD methods, snapshots method, computational resources, time extrapolation

AMS Classification: 65M08, 35Q35

References

[1] I. Echeverribar, M. Morales-Hernández, P. Brufau, P. García-Navarro. 2D numerical simulation of unsteady flows for large scale floods prediction in real time. *Adv. Water Resour.* 134 (2019) 103444.

[2] P. García-Navarro and M.E. Vázquez-Cendn. On numerical treatment of the source terms in the shallow water equations. *Comp. Fluids.* 2000, 29, 951979

[3] P. Solán-Fustero, J.L. Gracia, A. Navas-Montilla and P. García-Navarro. Development of POD-based Reduced Order Models applied to shallow water equations using augmented Riemann solvers. *Comput. Methods Appl. Mech. Engrg.* 410 (2023) 116038.

[1]IUMA and Department of Applied Mathematics
University of Zaragoza
email: `jlgracia@unizar.es`

[2]Fluid Dynamic Technology, I3A
University of Zaragoza