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Towards fast large-scale flood simulations using 2D Shallow water modelling with depth-dependant porosity

Vita Ayoub[1,2,3], Carole Delenne[2,3], Patrick Matgen[1], Pascal Finaud-Guyot[2,3], and Renaud Hostache[1]
[1]Luxembourg Institute of Science and Technology, Environmental Research and Innovation Department, Esch-sur-Alzette, Luxembourg
[2]HydroSciences Montpellier, Université de Montpellier, CNRS, IRD, Montpellier, France
[3]Institut national de recherche en sciences et technologies du numérique, Lemon, Montpellier, France

In hydrodynamic modelling, the mesh resolution has a strong impact on run time and result accuracy. Coarser meshes allow faster simulations but often at the cost of accuracy. Conversely, finer meshes offer a better description of complex geometries but require much longer computational time, which makes their use at a large scale challenging. In this context, we aim to assess the potential of a two-dimensional shallow water model with depth-dependant porosity (SW2D-DDP) for flood simulations at a large scale. This modelling approach relies on nesting a sub-grid mesh containing high-resolution topographic and bathymetric data within each computational cell via a so-called depth-dependant storage porosity. It enables therefore faster simulations on rather coarse grids while preserving small-scale topography information. The July 2007 flood event in the Severn River basin (UK) is used as a test case, for which hydrometric measurements and spatial data are available for evaluation. A sensitivity analysis is carried out to investigate the porosity influence on the model performance in comparison with other classical parameters such as boundary conditions.