

## RESCUER W2 TRAINING PROGRAMME

### WORKSHOP 2 UNIZAR ORGANIZATION

March 2025

Total: 6 ECTS (1 ECTS=10h, 60h in total), 10 days, 6h/day

6 -19 March 9h-12h and 14h-17h

#### Content:

1. Numerical models for hydraulic simulation (P. Garcia-Navarro-GHC) 18h (3 days).
  - 6 March: Pilar Garcia-Navarro, Pilar Brufau
    - 9h-12h: Review of one-dimensional hydraulic models and numerical techniques. Examples of steady and unsteady flow simulation.
    - 14h-17h: hands-on session of 1D unsteady flow simulation  
TASK: Modification, compilation and running of a 1DSW code  
ASSESSMENT: Report on this task and the results for a 1D dambreak problem.
  - 7 March: Javier Fernandez-Pato
    - 9h-12h: Review of two-dimensional hydraulic models, numerical techniques and mesh generation. Examples of 2D test case simulation.
    - 14h-17h: hands-on session of 2D unsteady flow simulation  
TASK: Modification, compilation and running of a 2DSW code  
ASSESSMENT: Report on this task and the results for a 2D dambreak problem.
  - 10 March: Sergio Martinez
    - 9h-12h: Review of two-dimensional models and numerical techniques for erodible bed and sediment transport simulation.
    - 14h-17h: hands-on session of unsteady erosive 1D simulation.  
TASK: Modification, compilation and running of a 1DSW code with erodible bed  
ASSESSMENT: Report on this task and the results for a 1D erosive dambreak problem.
2. Transferable skills: (Various speakers, organized by UiB) 6h (1 day)
  - 11 March:
    - 9:15 - 15:00 Academic integrity in searching, reading, and citing.  
Publishing strategy and visibility.  
Register before February 15th  
<https://www.uib.no/en/ub/146805/phd-seminars-writing-searching-and-data-management#course-part-1-session-1-academic-integrity-in-searching-reading-and-citing>
    - ~~19:00 How to make a youtube video (to be confirmed)~~

3. Urban flows (M. Kazolea) 18h (2 days + 1 day). Theory and numerical discretization for hyperbolic conservation laws. Coding development and case studies for urban flooding
- 12 March:
    - 9h-12h: Introduction and review on the solution of the shallow water equations, Focusing on higher order numerical schemes for the shallow water equations
    - 14h-17h: Hands on session: Develop a higher order shallow water code.  
TASK: Implementation, compilation and running of a high order 1DSW code  
ASSESSMENT: Report on this task
  - 13 March:
    - 9h-12h: Porosity models a review
    - 14h-17h: Hands-on session: Developing a simple shallow water code with porosity for urban flooding.  
TASK: Implementation, compilation and running of a 1DSW with porosity code  
ASSESSMENT: Report on this task
  - 14 March:
    - 9h-12h: Advanced numerical schemes/ Explore a 2D code-SLOWS
    - 14h-17h: Presentations of the 3 day's results  
ASSESSMENT: Presentation
4. GPU programming: (R. Garcia (3h), Mario Morales (9h), Sergio Martínez (6h)) (3 days). In-depth study of GPU programming, models, memory structures and performance optimization
- 17 March:
    - 9h-12h: Introduction to GPU programming and architectures. Memory models and management. (Sergio Martinez)  
TASK: Memory management in GPU programming of simple cases  
ASSESSMENT: Report on the task.
    - 14h-17h: Industrial application of GPU codes. (Reinaldo Garcia)
  - 18 March:
    - 9h-12h: Performance optimization strategies. Vectorization, load balancing, profiling. (Mario Morales)
    - 14h-17h: Programming models and abstractions. CUDA, Kokkos, SYCL, OpenMP. Execution spaces and memory spaces. (Mario Morales)  
TASK: Migration from CPU to GPU of a 2DSW code  
ASSESSMENT: Report on this task and the results for a 2D dambreak problem.
  - 19 March:
    - 9h-12h: Migration strategies from CPU to GPU code. Debugging techniques and information. Best practices for scientific computing on GPUs. (Sergio Martinez)
    - 14h-17h: Advanced topics in GPU programming. Multi-GPU programming. (Mario Morales)  
TASK: Migration from CPU to GPU of a 2DSW code  
ASSESSMENT: Report on this task and the results for a 2D dambreak problem.