Macroscopic modelling of floods over urban areas

Marseille, France, September 2000

Flash floods in urban areas, in Mediterranean countries but also in England, China, ...
Numerical modelling allows preparedness for future events.


Nîmes, France, October 1988

2 approaches are available for hydraulic studies :

Guangzhou, China, June 2005

2D modelling

Good description of the flow, but large data needs and computational times in case of extended study area.

1D modelling

Not adapted for the simulation of urban singularities (crossroads, squares, ...)

Boscastle, England, August 2004

A new modelling approach : macroscopic modelling

Urban areas are described using statistical properties rather than by defining each building individually

→ possibility to use large cells in the meshing

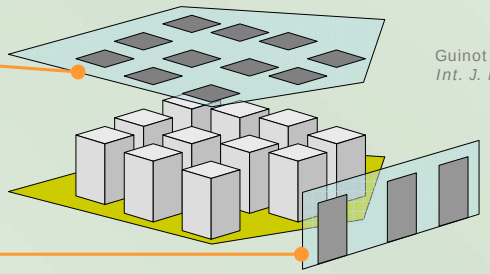
→ reduced computational time

Modified shallow water equations

storage porosity

$$\frac{\partial}{\partial t}(\phi \mathbf{U}) + \frac{\partial}{\partial x}(\phi \mathbf{F}) + \frac{\partial}{\partial y}(\phi \mathbf{G}) = \mathbf{S}$$

exchange porosity

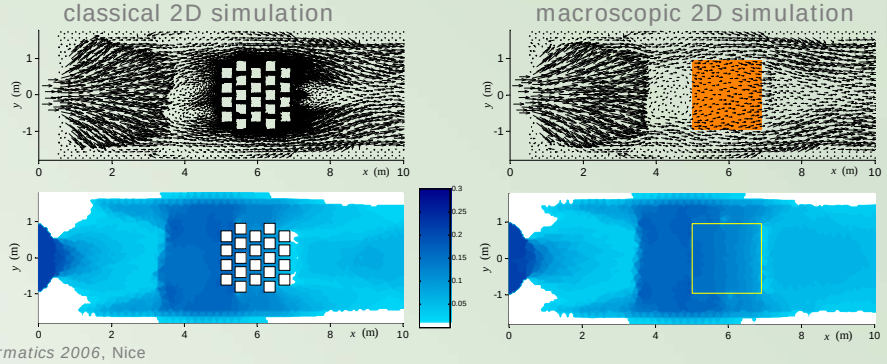


Guinot & Soares-Frazão, *Int. J. Numer. Meth. Fluids* 2006

Experimental validation over a scale model

Idealized city model in a large canal, dam break flow

classical 2D simulation | macroscopic 2D simulation



Compared with the classical 2D simulation, the macroscopic simulation allows :

- a good description of the flow at a large scale
- smaller computational times (2 to 10 times faster)

Lhomme, Soares-Frazão, Guinot, Zech, *Proceedings HydroInformatics 2006*, Nice

The macroscopic simulation is equivalent to the classical 2D simulation at a large scale with a lower computational cost.

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