FEM 2013
M.S. YALIN MEMORIAL **Mini-Colloquium on Fluvial Eco-Hydraulics and Morphodynamics: new insigths and challenges**
28-29 November, 2013 Palermo, Italy

CHOOSING A MODEL FOR SHALLOW WATER SIMULATIONS; WHAT DOES IT REALLY MATTER?

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The choice between 1D or 2D, diffusive or complete models for shallow water simulations has usually been based on the simple model sought after accuracy and computational speed. A more careful analysis is carried on to estimate all advantages and disadvantages of the different approaches. This analysis shows that 1D and diffusive models can lead some times to more accurate results than 2D or complete models. One reason to prefer diffusive models to the complete ones is that the effect of ground elevation input error on the estimated water depths is shown to be smaller in the first case than in the second one. Unless river section geometry is exactly known, like in the case of weirs or bridge peers, it can be more convenient to solve the diffusive form of the Saint Venant equation than the complete one.

The choice of a 2D model allows a much better reconstruction of the velocity field on the flooded plain area, but can lead to a much worse reconstruction of the resistance law inside the main river section. It can be easily shown that solving a 2D model inside the river bed area, when the vertically averaged velocity has a constant direction, is equivalent to solve a 1D model where the discharge in each section is computed as the sum of independent discharges, each one crossing the trace of each 2D element along the given section. This is equivalent to neglect the turbulence forces due to vortices with vertical axis. An optimal combination of 1D and 2D, diffusive and complete models should sought after to get the best possible model performance in real conditions.