Numerical methods for nonconservative hyperbolic systems. Application to shallow water models.

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Resumen

Many geophysical flows can be modeled by variants of the shallow water equations. In their simplest form, these equations model the flow of a thin layer of homogeneous fluid that evolves in a region whose boundaries (the bottom and shoreline) are explicitly known. Due to the homogeneity assumption, stratified fluids, which appear frequently in geophysical applications (as in estuarine systems, marine density flows, etc.) cannot be simulated by means of standard shallow water models. Nevertheless, an alternative to costly 3D free-surface models is given by multilayer shallow water models, in which two or more superposed layers of shallow water with different densities are considered. Extensions of single or multilayer shallow water systems are also useful to model sedimentary flows, hyperpycnal plumes, floods, tsunamis, avalanches, river mouths and junctions, estuarine circulation, marine flows through straits and passages, etc.

In most cases, these models can be written as first order nonconservative hyperbolic systems. The numerical approximation of the solutions of this kind of systems present some important difficulties. In this talk, the recent advances of a project whose goal is to develop Finite Volume numerical schemes that handle correctly with these difficulties will be presented. Finally, some applications to real flows will be shown.