Rajendra K Ray, Hydrol Current Res 2014, 5:4
http://dx.doi.org/10.4172/2157-7587.S1.012

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Hydrology & Meteorology
September 15-16, 2014 Hyderabad International Convention Centre, India

Comparative study and improvement of shallow-water models

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Free-surface water flows can be seen in many real life flow situations such as river and lake hydrodynamics, surface irrigation, tides, dam break flows, as well as estuarine and coastal circulation. Many of these flows involve complex flow behaviours, irregular flow domains, rapid variation of bottom topography and moving boundaries in which wetting and drying of variable topography occurs. The prediction of flooding due to a storm surge, dam break, or overtopped levee is crucial for disaster management. Wave run-up estimates are needed for beach and coastal structure design. Descriptions of inundation, in both estuarine tidal flats and riverine flood plains, are keys to predicting the transport of suspended and dissolved substances. Satisfactory numerical simulations of these processes are very challenging tasks. In this seminar the author shall present two numerical models to study free-surface water flows. The first numerical model is Unstructured Finite-Volume Methods (UFVM). This method not only ensure mass conservation, an important property in computing fluid flows, but also the best possible fitting of computing meshes into the studied domain boundaries. Author will discuss the development of the model and its numerical validation and finally its application to study Malpasset Dam break (France, 1959) event. The second numerical model is Navier-Stokes Multi Phase Model (NSMP). This is a two-phase sediment transport model. Author will discuss the development of the model and its application to study the dynamics of Turbidity Maximum (TM), in the Gironde Estuary (France).

Biography

Rajendra K Ray has completed his PhD in 2009 from Department of Mathematics, Indian Institute of Technology, Guwahati. He did his Postdoctoral studies from Indian Institute of Science, Bangalore and from University Paris-Est., France. After that he joined IIT Mandi as an Assistant Professor in the School of Basic Sciences and he is still working there. He has published more than 10 papers in reputed journals and developed number of efficient numerical methods for solving complex fluid flow problems. His research interests are development of efficient and higher order accurate Numerical Methods for PDEs and its application to CFD, Image processing, composite materials and related fields.

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