Introduction to Modeling River Flow and Morphodynamics within the IRIC Interface

October 12-13, 2016, Ho Chi Minh City Institute of Technology, Ho Chi Minh, Vietnam

This class covers a broad spectrum of river modeling techniques within the International River Interface Cooperative (iRIC) public-domain modeling interface. The course will be taught in a workshop format starting with basic data input and stepping through the processes of grid generation, model execution, visualization, and verification. The interface incorporates a variety of computational modeling approaches including finite difference and finite volume models using both structured and unstructured coordinate systems; only a subset of the available techniques will be covered in this short class. Basic principles will be briefly covered, but the emphasis of this short course is hands-on application using data sets for realistic problems on real rivers and hill slopes. For the class at Ho Chi Minh City Institute of Technology, the students will learn about and use the following:

FaSTMECH: Quasi-steady, quasi- three-dimensional model for river flow with morphodynamics. Useful for long river reaches where high grid resolution is required for water-surface elevations and velocities, flood predictions, bed morphology changes, and habitat assessments.
NaysCube: Fully three-dimensional nonhydrostatic model for flow and bed deformation in rivers. Excellent for treating detailed flow and sediment dynamics around complex structures, including the effects of turbulence-driven secondary flows.
STORM: Model for flow and inundation within an unstructured grid framework using a finite volume formulation. Useful for complex domains with multiple inflows and outflows, especially in cases of rapidly varied flow as in dam breaks or flash flooding of initially dry domains.
Morpho2DH: Hillslope model for the generation and propagation of debris flows. Useful for delineating high-risk areas and for hindcasting failure volumes and debris flow characteristics based on observed displacements. Can also be used as a 2d flow and morphodynamics model for clear water flows.

Other iRIC models including River2d, NaysFlood and NaysEddy will also be briefly described.

Students should bring a laptop with at least 4 GB of ram and a few gigs of empty hard disk space. The system was designed for use with current 64bit PC operating systems or PC emulators on Macs. Users will need to have software installation capabilities on their laptops, so check with your administrator if necessary. Installations for 32bit PCs will also be provided. Bring data sets with topography, water-surface elevations, and any other data if you would like some assistance with your own projects. All software is freely provided and in the public domain.

Class Schedule

<u>Wednesday, October 12</u>

<u>8:00</u>   Introduction to the iRIC interface and solvers with iRIC demonstration

<u>9:00</u>   Data requirements and importing data (FaSTMECH Tutorial 1, Exercise 1)

<u>9:45</u>   Break

<u>10:00</u>   Generating simple grids and mapping data on to them (FaSTMECH Tutorial 1, Exercise 2)

<u>11:00</u>   Description of FaSTMECH 2d and 3d, approximations and methods

<u>11:30</u>   Running solvers and visualizing results (FaSTMECH Tutorial 1, Exercise 3)

<u>12:15</u>   Lunch Break

<u>1:15</u>   Introduction to NaysCube for three-dimensional modeling of flow and morphodynamics

<u>1:45</u>   Computing three-dimensional flow in a real river (NaysCube Tutorial 1)

<u>3:00</u>   Break

<u>3:15</u>   Computing three-d flow and morphodynamics for a real river (NaysCube Tutorial 2)

<u>4:15</u>   Computing secondary flows of the second kind (NaysCube Tutorial 3)

<u>5:00</u>   End

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Thursday, October 13

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<u>8:00</u>	Introduction to SToRM in iRIC, approximations and methods
<u>8:45</u>	Modeling flow in the Green River (SToRM Tutorial 1)
<u>10:00</u>	Break
<u>10:15</u>	Modeling flow lateral separation eddies in the Colorado River (SToRM Tutorial 2)
<u>11:00</u>	James River Inundation Model (SToRM Tutorial 3)
<u>12:00</u>	Lunch Break
<u>13:00</u>	Introduction to Morpho2DH, debris flows and mud flows
<u>13:45</u>	Computing debris/mud flows (Morpho2DH Tutorial 1)
<u>15:00</u>	Break
<u>15:15</u>	Computing bed deformation with bed material load (Morpho2DH Tutorial 2)
<u>17:00</u>	End