Introduction to Modeling River Flow and Morphodynamics within the iRIC Interface

December 4 – 5 2019, Porto Alegre, Brazil

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 Hanoi, 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.

Nays2DH: Fully unsteady, two-dimensional model for river flow and morphodynamics incorporating sophisticated turbulence treatments and advection schemes to ensure good treatment of unsteadiness effects. Useful for a wide spectrum of river problems including bed response to structures (spur dikes, etc), bar formation and evolution, spatial grain size sorting, and bank erosion.

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.

Students should bring a laptop with at least 4 GB of ram and a few giga of empty hard disk space. The system was designed for use with current 64bit Windows operating systems or Windows emulators on Macs. Users will need to have software installation capabilities on their laptops, so check with your administrator if necessary. All software is freely provided and in the public domain. Students should bring a mouse, too.

Class Schedule

Wednesday, December 4

9:30	Introduction to the iRIC interface and solvers with iRIC demonstration Jon Nelson
10:30	Break
10:45	Data requirements and importing data (FaSTMECH Tutorial 1, Exercise 1) Jon Nelson
11:15	Generating simple grids and mapping data on to them (FaSTMECH Tutorial 1, Exercise 2) Jon Nelson
12:15	Lunch Break
13:30	Description of FaSTMECH 2d and 3d, approximations and methods Jon Nelson
14:00	Running solvers and visualizing results (FaSTMECH Tutorial 1, Exercise 3) Jon Nelson
14:45	Break
15:00	Green River flow computation and introduction to calibration and spatially variable roughness (FaSTMECH Tutorial 2) Jon Nelson
16:30	End

Thursday, December 5

9:00	Description of Nays2DH approximations and methods Yasuyuki Shimizu
10:00	Flow simulation for a simple channel with structures (Nays2DH Tutorial 1) Yasuyuki Shimizu
10:45	Calculation of morphologic change in a simple meander bend (Nay2DH Tutorial 2) Yasuyuki Shimizu
12:00	Lunch Break
13:00	Flow and morphodynamics in a real river (Nays2DH Tutorial 3) Yasuyuki Shimizu
14:15	Break
14:30	Introduction to Morpho2DH, debris flows and mud flows Hiroshi Takebayashi
15:00	Computing debris/mud flows (Morpho2DH Tutorial 1 & 2) Hiroshi Takebayashi
17:00	End