



Short course **2D and 3D Modeling of Flow and River Morphodynamics using TELEMAC**

August 28-August 30, 2015, Iquitos, PERU

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Lecturers: Dr. P. Tassi^{1,2}, Dr. R. Ata^{1,2}, Dr. K. El Kadi Abderrezzak^{1,2}, Dr. A. Mendoza³, and Dr. E.J. Langendoen⁴

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Language of instruction: English (Spanish support is provided)

Pre-requisite: Basic principles of open channel flow, sediment transport mechanics, river morphologic adjustment, and (optionally) computer programming

Contents: TELEMAC-MASCARET is an integrated suite of solvers for use in the field of free-surface flow and sediment transport. Having been used in the context of many studies throughout the world, it has become a major standard in its field. TELEMAC-MASCARET was made “open source” in 2010 to be freely available to the whole community of consultants and researchers. Anyone can therefore take advantage of TELEMAC-MASCARET and assess its performance.

This course covers a broad range of modeling techniques for fluvial processes using the TELEMAC-MASCARET suite of computer models. Lectures will provide both theoretical background and practical aspects of modeling river hydrodynamics, sediment transport processes, and river morphodynamics. Introductory topics, which can be grasped by students without a background in numerical methods, will be followed by advanced topics such as mesh optimization, selection of numerical schemes, turbulence modeling, flow and sediment interactions, and bank erosion and meander planform adjustment.

The capabilities and benefits of the TELEMAC-MASCARET modeling system will be shown by hands-on application using data sets acquired on real rivers.

For more information about TELEMAC-MASCARET see the website www.opentelemac.org.

Learning outcomes: After completion of the short course, the students are expected to:

- Generate a computational mesh from a topographic data set using pre-processing software.
- Be able to create input files to execute Telemac2D, Telemac3D, Sisyphe, and Meandre.
- Assess the impact of imposed flow and/or sediment supply conditions on near- and far-field river hydrodynamics.
- Assess the impact of imposed flow and/or sediment supply conditions on near- and far-field river morphodynamics.

- Be able to analyze and visualize TELEMAC-MASCARET output files using third party charting and data analysis software.

Calendar

Friday, August 28: General Introduction and Hydrodynamics

- 10:00 – 11:00 Introduction of TELEMAC-MASCARET: General presentation of the Telemac system, theoretical presentation of the governing equations and their mathematical properties, numerical aspects (finite elements, finite volumes, advection schemes, characteristics etc.)
- 11:00 – 12:00 Steering of Telemac-2D and 3D: description of input/output files, unstructured meshes, boundary conditions, options of a run, post-processing of results
- 12:00 – 14:00 Lunch
- 14:00 – 15:00 Steering of Telemac-2D and 3D (continued): use of BlueKenue, generation of geometry and boundary condition files. Run of Telemac cases.
- 15:00 – 17:00 post-processing of results and some advanced features: programming of user subroutines, parallelism, coupling of codes (mainly with Sisyphe)

Saturday, August 29: Sediment Transport Mechanics and Bed Morphodynamics

- 9:00 – 9:30 Introduction to the morphodynamic module Sisyphe
- 9:30 – 10:30 Bed load sediment transport. Influence of secondary currents and bed slope effects.
- 10:30 – 11:30 Suspended sediment transport.
- 11:30 – 12:00 Non-uniform sediment transport.
- 12:00 – 14:00 Lunch
- 14:00 – 15:00 Influence of waves on sediment transport processes.
- 15:00 – 16:00 Cohesive sediment transport.
- 16:00 – 17:00 Introduction to 3D sediment transport modelling.

Sunday, August 30: Bank Erosion and Meander Migration Modeling

- 09:00 – 10:00 Lectures on the theory of bank erosion mechanics and meander planform evolution
- 10:00 – 10:15 Introduction of Meandre module
- 10:15 – 11:00 Mesh setup
- 11:00 – 12:00 Model execution setup
- 12:00 – 14:00 Lunch
- 14:00 – 15:30 Post-processing of results
- 15:30 – 16:00 Q&A

Bibliography

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- Langendoen EJ, Mendoza A., Abad J.D., Tassi P., Wang D., Ata R., El kadi Abderrezzak K., Hervouet J.-M. Improved numerical modeling of morphodynamics of rivers with steep banks. *Adv Water Resources* (2015), <http://dx.doi.org/10.1016/j.advwatres.2015.04.002>
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- Villaret, C., Hervouet, J-M., Kopmann, R., Merkel, U., Davies, A.G. 2013. Morphodynamic modeling using the Telemac finite-element system. *Computers and Geosciences*, 53: 105-113.
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