Pre-Conference SHORT COURSE 1

Process-based mathematical modelling of bio-morphodynamics

Trento, September 15 – 16, 2017

Course aims:

The course is meant as an introduction for researchers who are interested in developing and using mathematical models to study quantitatively eco-geomorphic interactions in river systems.

At the end of the course, participants should:
- have learned the basic phenomenology of the main biophysical processes governing the interaction among flow, sediment transport and riparian vegetation in river and estuarine environments,
- have acquired the basic tools to develop their own modelling research on biomorphodynamic interactions in rivers.

Anticipated participants

PhD students, post docs, young researchers with interest in biomorphodynamic modelling.

Instructors

Paolo Perona, University of Edinburgh, UK; Walter Bertoldi, University of Trento, IT; Carlo Camporeale, Politechnic of Torino, IT, together with seminar inputs (G. Stecca, F. Caponi, A. Siviglia, M. Toffolon)

Figure: example outcome from a numerical biomorphodynamic model simulating the mutual interactions among flow, sediment transport and riparian vegetation.

Course structure
The course is composed by four half-day modules:

1) Key biophysical processes of interaction among flow, sediment transport and riparian vegetation (W. Bertoldi)
   a. Phenomenological, process-based description
   b. Relevant time and spatial scales of river morphodynamics and riparian vegetation growth and decay
   c. Mathematical laws (effect of vegetation on sediment mobility and flow roughness; effect of channel morphology and hydrology on riparian vegetation dynamics

2) Principles of stochastic modelling (C. Camporeale)
   a. General concepts on stochastic processes
   b. Noise-driven dynamical systems
   c. Three examples of applications in the stochastic modeling of riparian vegetation

3) Belowground biomass and uprooting by flow (P. Perona)
   a. Introduction on below-ground biomass dynamics in riverine corridors
   b. Root growth and response to perturbation
   c. Mechanical anchoring and resistance to uprooting
   d. Uprooting by flow and related modelling
   e. Lab and field scale experimental techniques

4) Examples of analytical and numerical ecomorphodynamic models and their applications

   Guest seminars:
   a. G. Stecca (University of Trento, IT, and NIWA, NZ): *Modelling vegetation-driven morphodynamics in braided rivers*
   b. F. Caponi, A. Siviglia (VAW – ETHZ, CH): *Feedbacks between plant roots and river morphodynamics: a modelling approach*
   c. M. Toffolon (University of Trento, IT): *Modelling ecogeomorphological feedbacks in tidal systems*

Venue
The course will take place at the Department of Civil, Environmental and Mechanical Engineering of the University of Trento: http://www.dicam.unitn.it/en

Registration and fees
To register, follow the link on the registration page of the RCEM website:
http://events.unitn.it/en/rcem17/registration

The registration fee is **170 Euro**, and includes:
- Course material and lectures
- Lunches and coffee breaks for the 2 days of the course
- Bus transfer to Padova on Sunday, September 17, which will foresee field visits in the catchment of the braided Piave River.