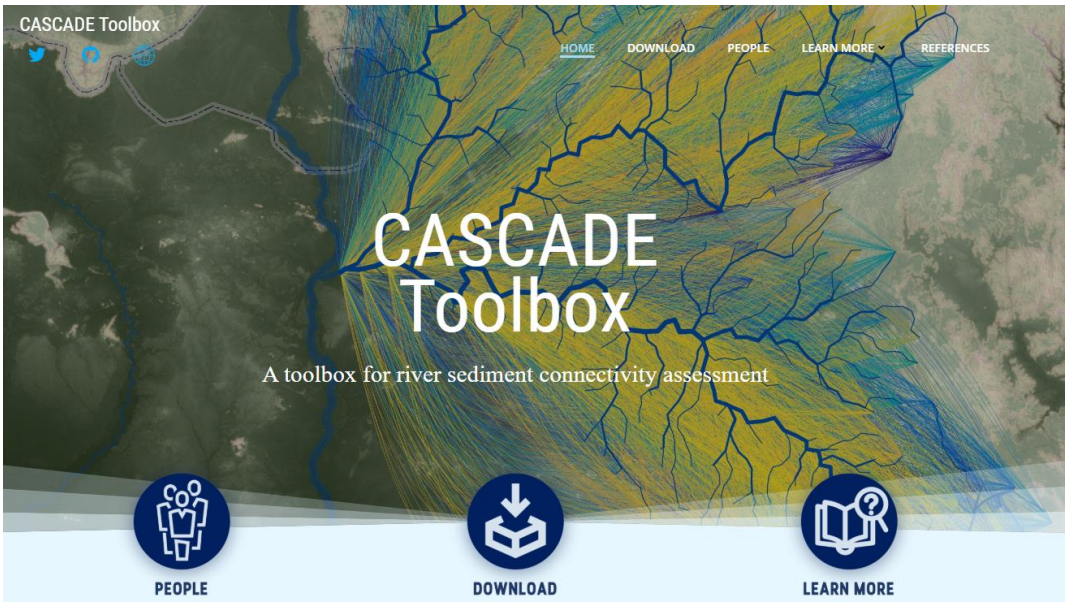
Linking sediment connectivity and fluvial processes to inform management

(Proposer:Dr. Simone Bizzi)



Sediment connectivity in rivers is a fundamental property directly linked to fluvial processes evolution and eco-system services availability (Fryirs, 2013). Modelling network-scale sediment connectivity and its response to anthropic alterations, such as dams, river maintenance or land-use changes, is key to better comprehend river processes and to inform river basin management. CASCADE (CAtchment Sediment Connectivity And Delivery) is a modeling framework for network-scale sediment connectivity assessment, which combines concepts of graph theory with empirical sediment transport formulas to quantify sediment transfers between the many sediment sources and sinks in a river network (R. J. P. Schmitt et al., 2018a; Tangi et al., 2019). Improved numerical efficiency compared to traditional hydrodynamic models enables application to large river networks, stochastic simulations of sediment connectivity, and screening impacts of many infrastructure portfolios (R. Schmitt et al., 2018b; R. J. P. Schmitt et al., 2019).

This project aims to apply CASCADE to a large Italian basin (e.g., Tagliamento basin or the Po basin). In the selected case study remote sensing technologies and field works will be undertaken to characterize geomorphic properties of channel types present along the river network, to assess recent river historical channel trajectories (50-100 years) and, in selected reaches, to collect information on sediment transport and associated sediment size distribution. These datasets will be used to initialize and validate the CASCADE model. Project objectives then can be so summarize: i) create a sediment connectivity assessment of the analyzed basin implementing the CASCADE model; ii) quantify the physical link between availability of sediment in terms of amount and type (simulated by CASCADE) and channel type and processes observed along the network; iii) use this newly derived knowledge to infer future scenarios of river status under different sediment management measures such as to predict effects of restoration measures, dam and river barriers siting or removal, sediment reintroduction and flood mitigation measures. This type of assessment is supposed to provide basin scale understanding to support sediment management strategies in the context of the Water Framework Directive (2000/60/ec), Flood Directive (2007/60/ec) and modern river management in general.

Method: i) Use and development of the model CASCADE (for more information see www.cascademodel.org); ii) Geomorphic analysis of river network by the use of historical satellite and aerial orthophotos, specific software such as QGIS and Python will be used to apply machine learning techniques to analyze available data; iii) Drone acquisitions and field work to measures

sediment fluxes will be carried out in specific reaches to derive: hyperspatial DEM, orthophotos, Dem of Difference (DoD), Sediment budget, grain size distribution maps and estimates of sediment transport.

Possible collaborations: University of Trento (Italy); Politecnico di Milano (Italy); University of Bolzano (Italy); ISPRA (Italy); CNRS University of Lyon (France); Durham University (UK); Stanford University (USA); Berkeley University (USA).

Available funds: DOR funds; these funds will cover field work, drone acquisitions, and workshop/conference attendance, while several data (e.g. remotely sensed images, DTMs) are already available.

References:

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