



Modeling tools for an Integrated River-Delta-Sea system investigation: the Pan-European Research Infrastructure DANUBIUS-RI philosophy

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The DANUBIUS Research Infrastructure (DANUBIUS-RI) is a new initiative to address the challenges and opportunities of research on large river- sea (RS) systems. DANUBIUS-RI is a distributed pan-European RI that will provide a platform for interdisciplinary research. It will deal with RS investigation through facilities and expertise from a large number of European institutions becoming a 'one-stop shop' for knowledge exchange in managing RS systems, ranging from freshwater to marine research.

Globally, RS systems are complex and dynamic, with huge environmental, social and economic value. They are poorly understood but under increasing pressure through pollution, hydraulic engineering, water supply, energy, flood control and erosion. RS systems in Europe are among the most impacted globally, after centuries of industrialisation, urbanisation and agricultural intensification. Improved understanding is essential to avoid irreversible degradation and for restoration.

DANUBIUS-RI will provide, among a number of other facilities concerning observations, analyses, impacts' evaluation, a modeling node that will provide integrated up-to-date tools, at locations of high scientific importance and opportunity, covering the RS systems – from source (upper parts of rivers – mountain lakes) to the transition with coastal seas. Modeling will be one of the major services provided by DANUBIUS-RI, relying on the inputs from the whole RI.

RS systems are challenging from a modelling point of view, because of the complex morphology and the wide temporal and spatial range of processes occurring. Scale interaction plays a central role, considering the different hydro-eco-morphological processes on the large (basin) and small (local, coast, rivers, lagoons) scale.

Currently, different model applications are made for the different geographical domains, and also for subsets of the processes. For instance there are separate models for rainfall runoff in the catchment, a sewer model for the urban area and a water quality model for the sea. Obviously, the subsystems interact with each other: water flows from the catchments to the rivers and into the sea. The rainfall runoff from the upstream catchment picks up the emissions and the river transports the substances via the estuaries to the sea. In the sea, the substances interact with the marine ecosystem.

The challenge for the modeling of river – sea systems is (1) the integration of models for the geographical domains, (2) the integration of physical, chemical, ecological and socio-economical processes and (3) the exploration and application of new data sources.

The modeling strategy that is starting to be shaped within DANUBIUS-RI will provide relocatable tools and suitable techniques to be efficiently applied in the different geographical areas, integrating the DANUBIUS-RI modeling skills and showing high performance modeling solutions for the investigation of RS systems. Moreover, a technological advanced platform for modeling services, in terms of software and shared data will be created. A preliminary sketch of the organization of the DANUBIUS modeling node and examples of field of action for RS systems investigation will be provided.