The SCARCE Consolider Project on Iberian river basins: The study of sediments

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Introduction: Water resources in Spain are subjected to rising pressures, related to the socioeconomic activities of an increasing human population, expressed by accelerated land use changes, and the specific climate characteristic of Mediterranean countries. Panels on climate change predict a future scenario of increasing frequency of floods and extended droughts in the Iberian Peninsula, mostly in the Mediterranean basin. This will certainly be added to the currently existing problems, and will probably affect the available water resources, their quality, the functioning of associated ecosystems, especially rivers and their aquifers, and the ecosystem services they provide. SCARCE is a project that aims to describe and predict the relevance of global change impacts on water availability, water quality and ecosystem services in Mediterranean river basins of the Iberian Peninsula, as well as their impacts on the human society and economy. SCARCE will analyse different aspects on sediments, such as sediment transport dynamics, rivers morphosedimentary structure and physical habitat, as well as the comparison of sedimentary processes and chemical quality parameters under water scarcity.

Methods: An extensive initial field campaign has been undertaken within the framework of SCARCE. The objective of the fieldwork has been characterizing key hydraulic and sedimentary parameters at 78 selected sites along the four representative basins (Llobregat, Ebro, Júcar and Guadalquivir). In these sites, sediment samples have also been taken for its subsequent chemical analysis.
Reach length is determined based on morphological criteria (e.g. riffle-pool sequence). Measurements have been undertaken on grain-size distribution of river-bed materials, i.e. including both surface and subsurface sediments to identify river armour hence stability, and patches of fine particles. At-a-section hydraulic geometry has been established after measurements on channel cross section and longitudinal gradient; largest moving particles are also measured to assess flow competence at the section. Observations on channel incision and sediment-supply limitation are also taken. For the chemical analysis, sediments samples have been freeze-dried and sieved through 120μm previous to its extraction using the pressurized liquid extraction (PLE) system. Different PLE extraction procedures have been used for the extraction of the different groups of compounds considered in this study (PAHs, polar pesticides, organochlorine pesticides, pharmaceuticals, endocrine disruptors, brominated compounds, perfluorinated compounds, drugs of abuse…).

Initial results: Physical data has been used to derive information of the active and bankfull channel and associated flow depth and shear stress by means of hydraulic modelling with WinXSpro®. Velocity profiles were also obtained to derive flood and representative habitat discharges by means of Hec-Ras ®. Long-term changes of river morphology are being assessed by means of the analysis of available air-photos series (i.e. typical time span ranging from the 1950's to the 2000's). As a result of the chemical monitoring, it has also been possible to determine the real presence of priority and emerging toxicants in Mediterranean river ecosystems in the Iberian Peninsula. Most samples contained traces of organic compounds, reflecting the anthropogenic input from human activities. Both sets of data have been compared to obtain at a first instance the correlation between the main morphosedimentary channel features and the chemical contamination of the Mediterranean rivers under study.

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