

Across the Scales of a River Basin

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RESUMEN

A river basin envelops hydraulic processes at a wide range of interdependent temporal (from seconds to years or even centuries) and spatial scales (from grain and reach to basin and landscape, Figure 1). These varying scales often have different control mechanisms, hindering a common theoretical framework (Franca and Brocchini 2015). Commonly, system or process based approaches are used by engineers and scientists. Large-scale system-based models integrate small/medium scale processes in a lumped fashion, whereas process-based analysis is required when the basic conservation equations are explicitly needed. Hydraulic engineers, whose field of activity includes the natural and built patrimony of a river basin, typically work at medium flow scales (e.g. river width, pipe diameter). At these, small processes need to be upscaled, whereas large phenomena impose the boundary conditions for the analysis.



Figura 1 | From grain and reach to basin and landscape, Bombarral (Portugal).

This seminar is structured around the notion of scales in a river basin, including turbulence scales, hydraulic (medium flow) scales and river basin scales. Examples of research at the three different scale ranges are presented: large-scale coherent structures which impose a cyclic variation on bed shear stress; techniques for upscaling turbulent flows, with heterogeneous boundaries, to hydraulic scales; and analysis, at the river basin scale, of a database of daily measurements of suspended sediment concentration and streamflow for identification of the main control processes. The results are discussed in terms of scale interaction and in terms of process- and system-based investigation.

REFERENCIAS

Franca, M.J., Brocchini, M. 2015. Turbulence in Rivers, *in Rivers Physical, Fluvial and Environmental Processes*. Springer: *GeoPlanet: Earth and Planetary Sciences*, 51-78, doi: 10.1007/978-3-319-17719-9_2