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Editorial

Advances in River Hydraulic Characterization

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The characterization of river hydraulics is very important for the definition of many problems connected with flood and morphodynamical models, including the stability of banks, slopes and sediments transport. These physical aspects are often closely related to the observation scale of hydraulic phenomena. The latter has significant value both for the channel and basin scale. This coupling of scales is now possible due to, for example, modern LiDAR detection techniques, in which topographic surveys (DEMs) are predominant, as well as other topographical survey techniques. River scale hydraulic phenomena and their field measurements represent a new paradigm towards the development of computational procedures for the spatio-temporal scale representation of complex hydraulic phenomena.

This Special Issue aims to emphasize new numerical techniques and physical measurements in the field of hydraulic observations at laboratory, channel, and basin scale.

Applying channel scale, He et al. [1] analyzed the effect of physical factors on the growth of *Chlorella vulgaris* on enriched media by the use of orthogonal analysis and response surface methodology. In this context, rivers are also viewed as biological coupled systems, and in particular, this study shows that the growth of *C. vulgaris* can be regulated by changing physical conditions simultaneously, and the optimization of physical conditions can be applied to biomass production, algae prediction, and acid water treatment in rivers [1].

By the use of channel scale, Licciardello et al. [2] introduced a stream hydro-morphological evaluation, analysis, and monitoring system procedure called IDRAIM, which allows us, on the basis of a number of physically based geomorphological descriptors, us to determine the overall state of physical 'equilibrium' of a river. This is a study case of Dittaino River (Eastern Sicily, Italy). It is very important, because the assessment of a river's ecological status, including its hydro-morphological and morphological dynamics, which can be used for the implementation of design models and interventions integrating protection and environmental requalification, requires the evaluation of hydro-morphological state changes. As such, the IDRAIM procedure could help in sustainable river management [2].

Rivers also affect urban drainage scales. The transition from confluence situations can highlight critical elements for an adequate design and management. In this context, Zhang and Lin [3] conducted an experimental study on the influence of drastically varying discharge ratios on bed topography and flow structure at urban channel confluences. This study showed that the drastic change in discharge ratio causes secondary scouring to the equilibrium bed topography in the confluence area. The bed surface in the sand hole, a sand bar drops, and the sediment are transported downstream. In this experiment, although local sand hole and sand ridge were formed in the flow recovery zone downstream, the results may be more suitable for urban channel confluence with relatively large width–depth ratio and small- and medium-sized natural channel confluences [3].

At basin scale, Primavera and Florio [4] introduced a new fixed mass algorithm that allows direct determination of the multi-fractal spectrum of a river network. The hybrid procedure, based on parallel computation, makes possible the direct estimation of the multifractal spectrum and the exponents of the singularities, without going through the Legendre transforms. By correctly estimating the scale exponents, i.e., the right-hand

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side of a spectrum, the maximum singularity index to be used in flood prediction models can be correctly estimated. MIUH (multifractal instantaneous unit hydrograph) is based exclusively on this parameter, so a technique that drastically reduces the computation time of multifractal spectra allows to validate real-time prediction flood procedures based on geomorphological descriptors [4].

Costabile et al. [5] investigated the effects of DEM depression filling on river drainage patterns and surface runoff generated by 2D rain-on-grid scenarios. The analysis, which is interesting from the point of view of morphological scaling, offers criteria for defining scaling effects from the transition of grid-channels to hydraulically active channels. The core of these transitions is based on models characterized by shallow water equations [5].

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