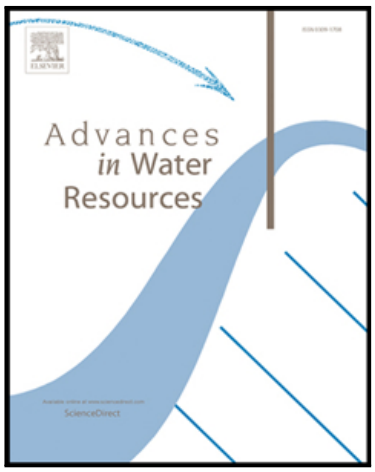

River banks and channel axis curvature: effects on the longitudinal dispersion in alluvial rivers

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River banks and channel axis curvature: effects on the longitudinal dispersion in alluvial rivers

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Abstract

The fate and transport of soluble contaminants released in natural streams are strongly dependent on the spatial variations of the flow field and of the bed topography. These variations are essentially related to the presence of the channel banks and the planform configuration of the channel. Large velocity gradients arise near to the channel banks, where the flow depth decreases to zero. Moreover, single thread alluvial rivers are seldom straight, and usually exhibit meandering planforms and a bed topography that deviates from the plane configuration. Channel axis curvature and movable bed deformations drive secondary helical currents which enhance both cross sectional velocity gradients and transverse mixing, thus crucially influencing longitudinal dispersion. The present contribution sets up a rational framework which, assuming mild sloping banks and taking advantage of the weakly meandering character often exhibited by natural streams, leads to an analytical estimate of the contribution to longitudinal dispersion associated with spatial non-uniformities of the flow field. The resulting relationship stands from a physics-based modeling of the behaviour of natural rivers, and expresses the bend averaged longitudinal dispersion coefficient as a function of the relevant hydraulic and morphologic parameters. The

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