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Retrieving river discharge from SWOT-like data time-series : a sample of rivers types

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The future Surface Water and Ocean Topography (SWOT) mission would provide new cartographic measurements of ocean surface and inland water surfaces dynamics, and especially river height, width and slope. The highlight of SWOT will be its almost global coverage and temporal revisits on the order of 1 to 4 times per 22 - days repeat cycle [1]. The estimation of hydraulic parameters from water surface observations is still an open question. Several methods have recently been proposed for retrieving river discharge from SWOT data ([2, 3, 4]). The method introduced by [2] and used in the present study is based on Manning equation. The first step consists in retrieving an equivalent bathymetry profile for a river given one in situ depth measurement and SWOT like data of the water surface, that is to say water elevation, free surface slope and width. From this equivalent bathymetry, the second step consists in solving mass and Manning equation in the least square sense. Nevertheless, for cases where no in situ measurement of water depth is available, it is still possible to solve a system formed by mass and Manning equations in the least square sense (or with other methods such as Bayesian ones, see e.g. [3]). The approach is tested with synthetic data generated from hydraulic models for several river reaches around the world (cf. [5]). We show that a good a priori knowledge of bathymetry and roughness is required for such methods. The identifiability of the roughness geometry couple is also investigated for different space time sampling and hydraulic regimes. Indeed, the knowledge of effective hydraulic representation and limitations might be a cornerstone in identifications of hydraulic or hydrologic variables through data assimilation chains.

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