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River bathymetry estimation and hydrodynamic modelling based on SRTM and satellite altimetry products

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The greater availability of remote sensing data stimulates the scientific community to resort to these new data sources in order to pursue a greater spatial coverage of hydraulic models, even in remote and data-sparse areas. However, the accuracy of hydrological and hydraulic models performed in absence of measured topography data suffers from the lack of knowledge of the river bathymetry, which cannot be directly inferred from satellite instruments. This work, adopting the SRTM (Shuttle Radar Topography Mission, 30 and 90m resolution) for representing the riverbed and floodplain morphology, tests two different procedures for inferring the river bathymetry under the water surface level, thus enhancing the accuracy of space-borne digital elevation model and its suitability for hydraulic applications. Referring to a river stretch of about 140 km of the Po river, the study investigates the suitability of 1) altimetry data (i.e. ERS-2 and ENVISAT) and 2) SRTM-based river cross-sections modified according to two approaches (Channel Bankfull depth (CB) and Slope-Break (SB) approach), for the implementation and calibration of 1D numerical models. Simulation results are compared with those obtained by means of a quasi-2D model implemented with detailed topographical data (i.e. airborne LiDAR), and show that both SRTM-based models based on CB and SB approaches appear accurate enough to reproduce the hydrometric regime of the river stretch. In particular, despite the SB approach does not require any field data, it provides efficiency values (NSs) and errors of the same order of LiDAR-based model. Even though the accuracy of SRTM-based models is still not adequate for detailed analysis, the study further emphasizes the suitability of space-borne topography data (e.g. SRTM), combined with remotely sensed altimetry data (i.e. ERS-2 and ENVISAT), for the implementation of large-scale analysis (i.e. global flood risk analysis), even in absence of field measurements.