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Can hydrodynamic models be implemented and calibrated on the basis of remotely sensed data only?

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The implementation and calibration of hydrodynamic models are often constrained by the amount of available data (such as topographic and hydraulic data) which may be absent (e.g. in remote areas) or not sufficient to build accurate and trustable models. Nevertheless, the greater availability of remote sensing data (e.g. altimetry data, radar imageries, etc.) stimulates the scientific community to resort to these new data sources for overcoming these limits. The present study analyzes the potential of remotely sensed data, i.e. (i) Shuttle Radar Topography Mission (SRTM; a freely available global Digital Elevation Model with a resolution of 90 m) and (ii) satellite altimetry data (i.e. ERS and ENVISAT data), for a complete implementation and calibration of a one-dimensional (1D) hydrodynamic model. The test site is represented by ∼140 km stretch of the Po river (the longest Italian river) where both traditional and remotely sensed topographical and hydrometric data are available. Adopting the SRTM data for representing the riverbed and floodplain morphology, the study investigates the performances of different 1D models in which the geometry of the main channel, which is generally submerged and cannot be remotely surveyed, is reconstructed on the basis of different approaches. The model calibrations are performed referring to long satellite altimetry timeseries (∼16 years of observations), while the simulation results are compared with those obtained by means of a quasi-2D model implemented with detailed topographical data (i.e. airborne LiDAR available on the study area). The results of the study are encouraging and show the possibility to implement and calibrate a reliable 1D model referring exclusively to low-resolution DEM (e.g. SRTM) and remotely sensed water surface data (i.e. ERS and ENVISAT). The 1D model is particularly accurate for describing high-flow and flood events (i.e. root mean square error equal to 0.11 m) and comparable with traditionally implemented models.