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The Benefit of Multi-Mission Altimetry Series for the Calibration of Hydraulic Models

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The growing availability of satellite altimetric time series during last decades has fostered their use in many hydrological and hydraulic applications. However, the use of remotely sensed water level series still remains hampered by the limited temporal resolution that characterizes each sensor (i.e. revisit time varying from 10 to 35 days), as well as by the accuracy of different instrumentation adopted for monitoring inland water. As a consequence, each sensor is characterized by distinctive potentials and limitations that constrain its use for hydrological applications. In this study we refer to a stretch of about 140 km of the Po River (the longest Italian river) in order to investigate the performance of different altimetry series for the calibration of a quasi-2d model built with detailed topographic information. The usefulness of remotely sensed water surface elevation is tested using data collected by different altimetry missions (i.e. ERS-2, ENVISAT, TOPEX/Poseidon, JASON-2 and SARAL/Altika) by investigating the effect of (i) record length (i.e. number of satellite measurements provided by a given sensor at a specific satellite track) and (ii) data uncertainty (i.e. altimetry measurements errors). Since the relatively poor time resolution of satellites constrains the operational use of altimetric time series, in this study we also investigate the use of multi-mission altimetry series obtained by merging datasets sensed by different sensors over the study area. Benefits of the highest temporal frequency of multi-mission series are tested by calibrating the quasi-2d model referring in turn to original satellite series and multi-mission datasets. Jason-2 and ENVISAT outperform other sensors, ensuring the reliability on the calibration process for shorter time series. The multi-mission dataset appears particularly reliable and suitable for the calibration of hydraulic model. If short time periods are considered, the performance of the multi-mission dataset are better than any of the single altimetry product. For long time periods, results are similar to those provided by Jason-2. Overall, this study results in a very good agreement between satellite altimetry and in-situ observations for all the series, leading to the conclusion that satellite data are suited for calibrating hydraulic models. Moreover, our methods also allow to assess the effect of the uncertainty of altimetry products.