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Water surface elevation from the upcoming SWOT mission under different flows conditions

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The upcoming SWOT (Surface Water and Ocean Topography) satellite mission will provide unprecedented bi-dimensional observations of terrestrial water surface heights along rivers wider than 100m. Despite the literature reports several activities showing possible uses of SWOT products, potential and limitations of satellite observations still remain poorly understood and investigated. We present one of the first analyses regarding the spatial observation of water surface elevation expected from SWOT for a 140 km reach of the middle-lower portion of the Po River, in Northern Italy. The river stretch is characterized by a main channel varying from 100-500 m in width and a floodplain delimited by a system of major embankments that can be as wide as 5 km. The reconstruction of the hydraulic behavior of the Po River is performed by means of a quasi-2D model built with detailed topographic and bathymetric information (LiDAR, 2m resolution), while the simulation of remotely sensed hydrometric data is performed with a SWOT simulator that mimics the satellite sensor characteristics. Referring to water surface elevations associated with different flow conditions (maximum, minimum and average flow) this work characterizes the spatial observations provided by SWOT and highlights the strengths and limitations of the expected products. The analysis provides a robust reference for spatial water observations that will be available from SWOT and assesses possible effects of river embankments, river width and river topography under different hydraulic conditions. Results of the study characterize the expected accuracy of the upcoming SWOT mission and provide additional insights towards the appropriate exploitation of future hydrological observations.