



HEC-RAS 5.0 Vs. TELEMAC-2D: a model comparison for flood-hazard and flood-risk estimation

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River flooding is considered among the most frequent catastrophic events causing dramatic consequences in terms of loss of human life and economic damages. Therefore, the flood-hazard and flood-risk management appear nowadays the fundamental activities that public bodies and authorities in charge have to implement in order to reduce human and socio-economic losses. In this context, our study specifically refers to a flood event occurred on January 19, 2014, along the Secchia River (a tributary of the Po River; North Italy), with the aim of evaluating the suitability of different numerical tools for the reproduction of the flood dynamics. During this specific event a failure on the main embankment caused the overflowing of an overall volume of about $40 \cdot 10^6$ m³ within 48 hours inundating nearly 200 km² of the floodplain area. Thus, our study aims at reproducing the inundation dynamics using two different fully bi-dimensional (2D) hydrodynamic models, both based on Saint-Venant equations: Telemac-2D and HEC-RAS 5.0 (Beta version). The former (Telemac-2D) is a widely employed and well known 2D model adopting a finite-element scheme based on triangular elements, while the latter, HEC-RAS 5.0, is the first, recently released, version of a coupled 1D-2D model that enables one to simulate river and floodplains interactions through a finite-volume scheme. Taking advantage of the historical observations, we investigate the suitability of the new 1D-2D model in reproducing the flood patterns testing its performance in case of different mesh resolutions (i.e. cell dimension ranging from 50 m to 200 m) and Digital Elevation Model accuracy (i.e. DEM resolution varying from 1 m to 50 m). Models' performances are thus compared with real observations in terms of flood patterns (i.e. overall flood extent and flood dynamics) and flood-hazard indexes (such as water depth, flow velocity, impulse, etc.). Finally, we compare the accuracy of both models on the reconstruction of recorded flood damages. This study, representing one of the few evaluation analyses concerning the new HEC-RAS 5.0 model, provides useful elements to stakeholders and operators to move towards a deeper and more accurate flood-hazard and flood-risk estimation.