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Calibration and validation of a 1D model using airborne SAR imagery

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The growing interest in the issues related to flood risk and to its socioeconomic relevance led to the proliferation of sophisticated hydraulic models for predicting river flood inundation. However, it is well known that the use of very complex models and detailed information is onerous in terms of computational effort and involves high costs, so there arises the need to reach a compromise between the costs and benefits. Furthermore, recent studies (see e.g. Horritt and Bates, Journal of Hydrology, 2002) showed that one-dimensional (1D) hydraulic models are suitable for providing an accurate reproduction of the hydraulic behaviour of natural rivers and streams when parameterized with high resolution and accurate topographic data, and when the hydraulic problem at hand is not characterized by specific 2D features (see e.g. inundation caused by dam breaches or levee failures). The study aims at analyzing the applicability of a 1D hydraulic model coupled with a high resolution DTM for predicting the flood inundation processes of a river reach. The results of 1D hydraulic simulations were compared against observed inundation extent retrieved from airborne SAR (Synthetic Aperture Radar) images. In particular, the study focuses on 16 km of the River Severn near Upton-on-Severn, in west-central England. For this river reach, a high quality laser scanning altimetry (LiDAR) and four maps of inundated areas, obtained through airborne SAR images, are available. These inundation maps are used for the calibration/validation of a 1D hydraulic model by using the two Manning's coefficient values (main channel and floodplain) as calibration parameters. The results obtained were compared with analogous results previously obtained by utilizing two-dimensional (2D) hydraulic models (Horritt et al., Hydrological Processes, 2007).