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Specific calibration and uncertainty evaluation for flood propagation models by using distributed information

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Hydraulic models are an essential tool in many fields, e.g. civil engineering, flood hazard and risk assessments, evaluation of flood control measures, etc. Nowadays there are many models of different complexity regarding the mathematical foundation and spatial dimensions available, and most of them are comparatively easy to operate due to sophisticated tools for model setup and control. However, the calibration of these models is still underdeveloped in contrast to other models like e.g. hydrological models or models used in ecosystem analysis. This has basically two reasons. First, the lack of relevant data necessary for the model calibration. Indeed, flood events are very rarely monitored due to the disturbances inflicted by them and the lack of appropriate measuring equipment. The second reason is related to the choice of a suitable performance measures for calibrating and to evaluate model predictions in a credible and consistent way (and to reduce the uncertainty).

This study takes a well documented flood event in November 2012 in Paglia river basin (Central Italy). For this area a detailed description of the main channel morphology, obtained from an accurate topographical surveys and by a DEM with spatial resolution of 2 m, and several points within the floodplain areas, in which the maximum water level has been measured, were available for the post-event analysis. On basis of these information two-dimensional inertial finite element hydraulic model was set up and calibrated using different performance measures. Manning roughness coefficients obtained from the different calibrations were then used for the delineation of inundation maps including also uncertainty. The water levels of three hydrometric stations and flooded area extensions, derived by video recording the day after the flood event, have been used for the validation of the model.