Geophysical Research Abstracts
Vol. 12, EGU2010-870, 2010
EGU General Assembly 2010

Calibration of hydraulic models: effects of rating-curve uncertainty

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This research focuses on the uncertainty of rating-curves and how this uncertainty propagates to Manning's roughness coefficient during the calibration of numerical hydraulic models. Rating-curves, relating stage and flow discharge, are traditionally used for describing boundary conditions. The uncertainty associated with rating-curves is often neglected, and generally considered to be less important than other factors (see e.g., Di Baldassarre and Montanari, HESS, 2009). We performed a series of simulation experiments aimed at: (1) quantitatively assessing the uncertainty of the curves; (2) investigating its effects on the calibration of Manning's roughness coefficient. We used a quasi-bidimensional (quasi-2D) model of the middle-lower reach of the River Po (Northern Italy) to simulate 10 different historical flood events for the hydrometric river cross-section located in Cremona. Using the simulated data, we mimicked 15 measurement campaigns for each flood event and we corrupted the discharge data values according to the indications on measurement campaigns and errors reported in the literature (i.e., EU. ISO EN 748, 1997). We then constructed the 90% confidence interval for the synthetic curves.
Then, we performed an additional set of model runs downstream of the Cremona's cross-section to assess how the uncertainty of rating curves affects the estimated Manning coefficients during the calibration phase. The results of the study show that the variation of Manning's roughness coefficient resulting from the rating-curve uncertainty is significant. This variation is analysed and discussed relative to the variability of Manning's coefficient reported in the literature for different channel conditions characterising lower reaches of large natural streams.