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A new methodological proposal for improving flood risk mapping using geostatistical techniques in Central-Western Spain

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The bathymetry of the riverbed is essential in flood risk assessment at large rivers, and yet its acquisition is a slow process and endowed with a high budget economic. Moreover, recent research works have shown the importance of improving the geometrical characterization inside the riverbed, which is an issue due to the inability of light to penetrate water bodies. So, most of LiDAR techniques allow us for high resolution surface topography data but not for water occupied river channels. This, apart from making these jobs more difficult, sometimes generates the renouncement of it, using the topography of the water sheet as a riverbed, or the simplification of river channel configuration (trapezoidal transversal sections) which frequently generate an overestimation of flood zones. To overcome these deficiencies, a novel methodological approach has been developed to simulate this bathymetry using simplified models. The proposed approach is based upon the calibration of the flow roughness parameters (Manning´s n value) inside the riverbed. The use of abnormally low Manning´s n values has made it possible to reproduce both the extent of the flooded area and the water depth value within it in an acceptable manner: first results from hydrodynamic modelling of 500-year return period peak flow show the reduction of the water depth average error from 50-75 cm to only about 10 cm; and a direct economic flood damage differences reduction from 25-30% to values of about 5%.

The present work proposes to go further with these investigations and perform a robust geostatistical analysis of hydrodynamic modelling outputs obtained with modified Manning's n values. The methodology scheme is to characterize the spatial distribution of the results and its spatial correlation with other variables, as the distance to the riverbank or flow rates (for different return periods), through variogram models. This quantitative statistical description of the floodable areas, depending on the Manning's n value model used and the return period considered, could be used to perform geostatistical simulations that allow to quantify the spatial uncertainties associated to the studied models; as well as to calibrate the optimal spatial distribution of modified Manning's n values inside the riverbed. These findings will be analysed as guidelines to construct more robust and reliable flood risk estimations; and can be applied to many other study cases around the world, saving analysis time and execution costs, but without

losing its scientific rigour.