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Sensitivity of flood losses to terrain elevation uncertainties and buildings representation

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High resolution digital terrain models (DTMs) based on LiDAR surveys are increasingly available and provide a crucial information for flood models and damage assessment. In dense urban areas, terrain models should be capable of adequately representing the streets-buildings pattern. However, the presence of buildings can produce ambiguities and elevation errors in the terrain model and also affects the flood propagation. This work investigates the role of high-resolution DTM uncertainties and buildings representation on the estimation of urban flood losses. Four different terrain representations are used to generate a computational mesh to run a 2D flood model for three inundation scenarios with different severities. The most complex terrain model is obtained merging the information of the LiDAR DTM with elevation points taking into account the uncertainties of both. A flood damage model based on stage-damage curves is used to estimate monetary losses to structures at the single building scale. Flood maps and flood losses are then compared for each terrain representation. The application of the method to an Italian urban district shows that (i) significant uncertainties affect the high-resolution DTM, (ii) different sources of elevation data can be merged to obtain a more reliable terrain model (iii) in dense urban settlements remarkable differences are observed in flood extent, water depths and losses depending on terrain representation.