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Uni- and multi-variable modelling of flood losses: experiences gained from the Secchia river inundation event.

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Flood risk is function of flood hazard and vulnerability, therefore its accurate assessment depends on a reliable quantification of both factors. The scientific literature proposes a number of objective and reliable methods for assessing flood hazard, yet it highlights a limited understanding of the fundamental damage processes. Loss modelling is associated with large uncertainty which is, among other factors, due to a lack of standard procedures; for instance, flood losses are often estimated based on damage models derived in completely different contexts (i.e. different countries or geographical regions) without checking its applicability, or by considering only one explanatory variable (i.e. typically water depth). We consider the Secchia river flood event of January 2014, when a sudden levee-breach caused the inundation of nearly 200 km^2 in Northern Italy. In the aftermath of this event, local authorities collected flood loss data, together with additional information on affected private households and industrial activities (e.g. buildings surface and economic value, number of company's employees and others). Based on these data we implemented and compared a quadratic-regression damage function, with water depth as the only explanatory variable, and a multi-variable model that combines multiple regression trees and considers several explanatory variables (i.e. bagging decision trees). Our results show the importance of data collection revealing that (1) a simple quadratic regression damage function based on empirical data from the study area can be significantly more accurate than literature damage-models derived for a different context and (2) multi-variable modelling may outperform the uni-variable approach, yet it is more difficult to develop and apply due to a much higher demand of detailed data.