Probabilistic assessment of increased flooding vulnerability in Christchurch after the Canterbury 2010-2011 sequence

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ABSTRACT: Major earthquakes can cause extensive transformations to the land underlying cities and/or to the built environment, leading to decreased capacity in natural and built drainage systems and, as a consequence, to Increased Flooding Vulnerability (IFV). This has been the case for Christchurch city in New Zealand, which experienced the 2010-2011 Canterbury Earthquake Sequence, followed by high flood heights in many urban areas during a series of rainfall events occurred in March-April 2014. This paper presents an extension of a recently developed simulation tool for civil infrastructures, to the probabilistic assessment of the earthquake-altered flooding risk on the built environment. In particular, the focus is on the IFV caused by the earthquake-induced damage to the Christchurch pipeline storm water network, which was analysed at both connectivity and capacity levels. The probabilistic analysis was carried out through a plain Monte Carlo simulation, where the uncertainty affecting several key parameters was accounted for. Final analysis results are presented in terms of map and cumulative distribution of flood height, which is in fact an impact metric of great interest for infrastructure owners and emergency managers.