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Risk of Compound Flooding from Coastal and Fluvial Floods over Northwestern Europe

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Floods affect around 2.3 billion people globally, more than any other natural disasters, and their global expected annual average losses in the built environment are estimated to about US$ 104 billion. These impacts are especially evident in densely populated low lying coastal cities, which are at risk of flooding from multiple drivers, such as a simultaneous occurrence of extreme river discharge and either high coastal water levels due to high tide or storm surges. When fluvial and coastal floods occur simultaneously or successively, extreme impacts might be produced, even when either extreme in isolation would not be considered as particularly severe. Review of the literature suggests that most of the studies to date focus on events from high tide flooding and storm surges alone or compound flooding from coastal and river floods over relatively small regions. Very few studies have considered the risk of compound flooding over Northwestern Europe taking into account high coastal water levels, storm surges and inland river flooding. Here we examine the hypothesis that a univariate approach may not be adequate to characterize the fluvial flood risk if there are compounding effects. An approach is presented to characterize the joint risk of compound flooding and delineate the severity of extreme events by examining the spatial interdependencies of underlying variables, especially at the tails of the bivariate distributions.