



Compound Flood Potential from Co-occurrence of River Discharge and Storm Surge in Croatia

Nino Krvavica^{1,2}, Marta Marija Bilić¹, and Igor Ružić¹

¹University of Rijeka, Faculty of Civil Engineering, Rijeka, Croatia (nino.krvavica@uniri.hr)

²University of Rijeka, Center for Artificial Intelligence and Cybersecurity, Rijeka, Croatia

Coastal areas are becoming increasingly vulnerable due to climate change. These regions are exposed to various sources of flooding, such as high sea levels, river discharge and heavy rainfall. Our study focuses on understanding compound flooding from storm surges and river discharge in Croatia. This is the first study on compound floods in this country. For this purpose, we analysed the time series of water levels and discharges from hydrological stations located along ten major coastal rivers. Since there are only a limited number of tide gauges in Croatia, we combined measured data with numerical reanalyses. The sea level data for the entire Adriatic Sea were obtained from the Copernicus Marine Service (Mediterranean Sea Physics Reanalysis) and were then corrected using machine learning and measured data.

Previous studies have shown that neglecting seasonal variations in river discharge and storm surges could lead to a significant underestimation of the expected annual damage from compound floods. Different seasons bring distinct weather and river discharge patterns that influence the probability and severity of compound floods. To address this, our study investigated seasonal correlation and co-occurrence by analysing the monthly maximum values. By examining each season in detail, we uncovered the variations in the compound flood potential index.

This analysis provides a more comprehensive understanding of compound floods in Croatia, which is crucial for risk assessment and risk management. Finally, we mapped the correlation coefficients, the number of co-occurrences and the compound flood potential index along the Croatian coast and organised the results in a GIS database. These maps will improve our ability to systematically select the most vulnerable areas where the risk of compound flooding should be analysed at the local level.