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A Stochastic Approach to Coastal Multi-hazard Risk Analysis in South Korea

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Recently, natural hazards have been more unpredictable with increasing frequency and strength due to climate change. Especially, coastal areas are becoming especially more vulnerable to future climate change impacts such as such as sea level rise and extreme weather events. This is a pertinent issue in the case of South Korea, as it is a peninsula where many large cities are located along the coastal areas. Thus, a series of hazard prevention plans are necessary for the coastal areas, and the first step would be to find risk areas. The objective of this study is to find vulnerable areas that could be damaged by coastal hazards caused by typhoon and heavy rainfall. Coastal multi-hazard risk analysis was implemented by using Naïve-Bayes classifier model, which is a stochastic-statistics method. Based on Bayes' Rule, the prior probability is used to estimate posterior probability. The variables used for the analysis were collected and selected based on previous literature reviews: tide, significant wave height, elevation, slope, rainfall. These variables were used to evaluate the posterior probability of coastal flooding events based on the Naïve-Bayes classifier model. Spatial scope of the research was set up as 1km from the coastline according to the 'coastal management law' in Korea. The results of risk analysis ranged from 0 to 1, where a higher probability indicates areas at higher risk of two extreme climate events, tide and heavy rainfall, occurring together. According to the result of the study, almost 98% of coastal areas were estimated from 0.0 to 0.2, and the most vulnerable area was estimated to 0.93. Some areas on the south coast were a little more vulnerable than east and west. In conclusion, the research is significant for finding potential flooding vulnerable area in the coastal zone, and the method could be applied in coastal planning like the Integrated Coastal Zone Management (ICZM) of Korea considering the future climate impacts.