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Forecasting Strong Subsequent Earthquakes in Greece Using NESTORE Machine Learning Algorithm

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It is widely known that large earthquakes are followed by aftershocks that can affect numerous facilities in a city and worsen the damage already suffered by vulnerable structures. In this study, we apply NESTORE machine learning algorithm to Greek seismicity to forecast the occurrence of a strong earthquake after a mainshock. The method is based on extracting features used for machine learning and analyzing them at increasing time intervals from the mainshock, to show the evolution of knowledge over time. The features describe the characteristics of seismicity during a cluster. NESTORE classifies clusters into two classes, type A or type B, depending on the magnitude of the strongest aftershock. To define a cluster, a window-based technique was applied, using Uhrhammer's (1986) law. We used the AUTH earthquake catalogue between 1995 and 2022 over a large area of Greece to analyze a sufficiently large number of clusters. The good overall performance of NESTORE in Greece evidenced the algorithm's ability to automatically adapt to the area under study. The best performance was obtained for a time interval of 6 hours after the main earthquake, which makes the method particularly attractive for application in the field of early warning, as it allows estimating the probability of a future hazardous earthquake occurring after a strong initial event.

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