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# Analysis of the seismicity preceding large earthquakes

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The most common earthquake forecasting models assume that the magnitude of the next earthquake is independent from the past. This feature is probably one of the most severe limitations of the capability to forecast large earthquakes. In this work, we investigate empirically on this specific aspect, exploring whether variations in seismicity in the space-time-magnitude domain encode some information on the size of the future earthquakes. For this purpose, and to verify the stability of the findings, we consider seismic catalogs covering quite different space-time-magnitude windows, such as the Alto Tiberina Near Fault Observatory (TABOO) catalogue, the California and Japanese seismic catalog.
Our method is inspired by the statistical methodology proposed by Baiesi & Paczuski (2004) and elaborated by Zaliapin et al. (2008) to distinguish between triggered and background earthquakes, based on a pairwise nearest-neighbor metric defined by properly rescaled temporal and spatial distances. We generalize the method to a metric based on the k-nearest-neighbors that allows us to consider the overall space-time-magnitude distribution of k-earthquakes, which are the strongly correlated ancestors of a target event. Finally, we analyze the statistical properties of the clusters composed by the target event and its k-nearest-neighbors.
In essence, the main goal of this study is to verify if different classes of target event magnitudes are characterized by distinctive "k-foreshocks" distributions. The final step is to show how the findings of this work may (or not) improve the skill of existing earthquake forecasting models.