

Statistical Monitoring and Early Forecasting of Earthquake Sequence: Case Studies after the 2019 M6.4 Searles Valley Earthquake, California.

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This manuscript considers the possible implementation of operational short-term forecasting and analysis using a real-time hypocenter catalog of ongoing seismic activity anywhere, by reviewing case-studies of the aftershocks of M6.4 Searles Valley earthquake before the M7.1 Ridgecrest earthquake.

First, the short-term prediction of spatiotemporal activity should be carried out in real time, along with the background seismic activity in a wide region for obtaining the secular probabilities of large earthquakes; we display some snapshots from the continuous forecasts during the Ridgecrest earthquake sequence for monitoring how the activity grows or migrates with time.

Additionally, we have found that the area in and around the rupture zone in southern California had a very high background rate. Second, we need to evaluate whether or not a first strong earthquake may be a foreshock of a further large earthquake; the rupture region had one of the highest such probabilities in southern California.

Third, short-term probability forecast of early aftershocks are much desired despite bad conditions for data acquisition; actually, the aftershocks of the M6.4 Searles Valley event had significantly high probabilities of having a larger main shock shortly, like the foreshock sequence of the 2016 M7.4 Kumamoto earthquake, Japan.

Finally, de-trending the temporal activity of the entire aftershocks by stretching and shrinking according to the rate of the Omori-Utsu formula or ETAS model, we observe the spatiotemporal distribution where the patterns may be abnormal, such as relative quiescence, relative activation, or migrating activity. Such anomalies should be recorded and listed for the future evaluation of the probability of a possible precursor before a large aftershock or a nearby new rupture; here, an example of such anomalies in the aftershocks before the M7.1 Ridgecrest earthquake is considered.

Keywords: Hierarchical space-time ETAS model, Foreshock probabilities, Real-time aftershock probability forecast, Space-time heterogeneity of aftershock activity, Ridgecrest earthquake sequence

