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The first world Catalog of Earthquake-Rotated Objects (EROs): outline, statistical analyses, outlook

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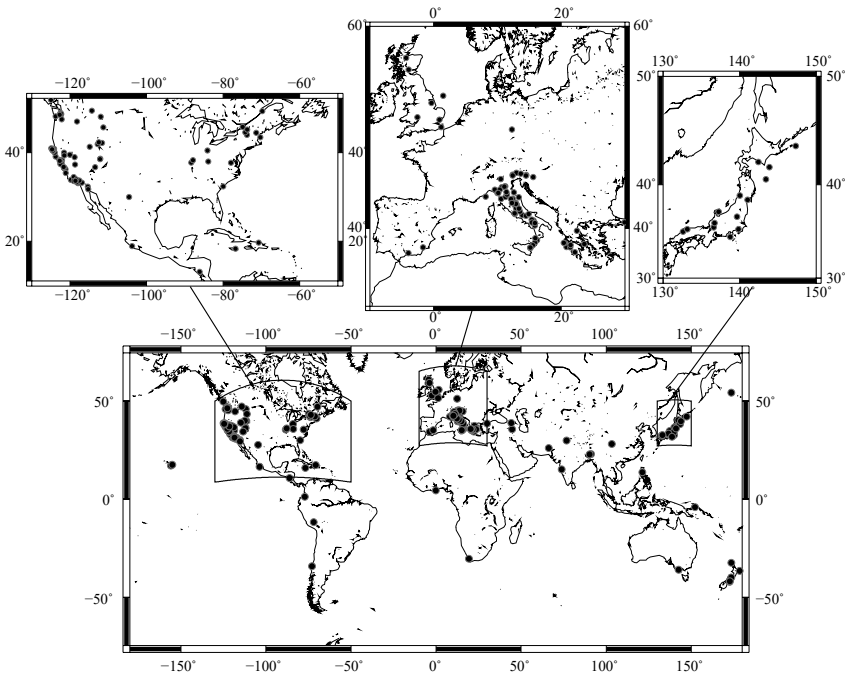
We present the first world catalog of Earthquake-Rotated Objects (EROs). The catalog is composed of 2151 EROs originated during 199 earthquakes which occurred between 1349 and 2014. The catalog is organized into two tables which contain information about the source earthquakes and about the observed EROs, respectively. EROs are observed to occur following earthquakes in the Mw range 4.0-8.3 at localities marked by intensities in the interval I=3.5 (Medvedev-Sponhauer-Karnik scale, MSK) I=11 (Modified Mercalli scale, MMI), and at epicentral distances as far as 445 kilometers.

Qualitative and quantitative statistical analyses of the catalog provide interesting clues to address possible relations between EROs occurrence and a number of customary seismological observables such as magnitude, intensity, epicentral distance, fault orientation. We find that there is a strong evidence of a clear log-linear dependence of the epicentral distance, to which an ERO can be observed, on the magnitude Mw of the source event. We note that the probability to observe EROs near the epicentral area (D<10km) inversely decreases with the earthquake magnitude, and that for large earthquakes (M8+) this probability remains significant (around 30%) beyond 100 kilometers from the epicenter.



Unexpectedly, we do not find significant relations between EROs occurrence and epicentral intensity, possibly because of high dispersion of intensity values. The data analyzed in the present study identifies degree 6 as the lowest intensity for rotations occurrence, differently from the main macroseismic scales that indicate the EROs as a diagnostic of larger intensity degrees. This outcome could suggest the need for revision and updating of the diagnostics indicated in the intensity scales.

Figure 1: Map of location of the 199 events that originated the EROs.

As for the focal mechanisms of the seismic events, we find higher probabilities to observe rotations beyond 10 km distance from the epicenter of a thrust faulting earthquake than for a normal faulting earthquake. This probability reverses beyond 50 and beyond 100 km distance, especially for high-magnitude seismic events. We suggest that the utilization of the present catalog will contribute to a better understanding of the mechanism that induces the EROs occurrence, and ultimately support important insights to potential end-users of the EROs Catalog in the fields of historical seismology and earthquake engineering.