



New insights from 1901-2023 Mw7.5+ subduction interface earthquakes catalog revisited: SubQuake2

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Earthquakes occurring along subduction interfaces account for most of the seismic energy released at the Earth's surface. To better understand the mechanisms involved, it is essential to compile an exhaustive catalog of these events. In this study, we have documented 201 $M_w7.5+$ events between 1900 and 2023 in a catalog called Subquake 2.0 (SQ2). This new catalog represents a significant update to the one published in 2018 by van Rijnsingen and colleagues.

We developed an automatic procedure to detect events that are strong candidates for earthquakes nucleated along the subduction interface. This procedure exploits both the ISC-GEM catalog and the Slab2.0 model, taking into account the uncertainties associated with positions, for determining the probability that the event occurred within some specific distance to the slab. Guided by this automatic selection, a thorough and comprehensive bibliographic review of each event allowed us to remove 30 events from the previous release (Subquake 1.0) and add 49 new ones.

The $M_w7.5+$ subduction earthquake frequency varies little between 1901 and 2023 (one event every 212 days in average), still there are some slight variations. Consistent with previous studies, we identify two bursts of $M_w8.5+$ events during 1946-1965 and 2004-2011 periods. Furthermore, we confirm that some subduction zones hosted more $M_w7.5+$ earthquakes than others during the 1901-2023 period. For example, regions such as West Sunda, Japan-Kuril-Kamchatka, Aleutian-Alaska, Central and South America or Melanesia exhibit higher seismic activity levels in contrast to zones like the Mediterranean, Ryukyus, SE Asia, Tonga-Kermadec, Cascades, Lesser Antilles or South Sandwich on the other.

We assembled the rupture envelopes for 77% of SQ2 events, with more than half involving asperities – defined here as patches that slipped by more than 50% of the maximum estimated slip. This dataset will enable us to carry out a large number of tests on the characteristics of the most/least frequently ruptured zones.

This new database will be soon available through the submap web tool (submap.fr).