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# A Complete Homogenised Seismic Catalogue for Morocco (1406– early 2025)

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## Résumé

A proper probabilistic seismic hazard analysis (PSHA) depends first and foremost on the availability of consistent, long-term catalogues. We represent the first complete homogenised seismic catalogue for the entire territory of Morocco, covering the area between 20° and 39° N latitude and -20° to 5° E longitude and spanning around seven centuries (1406–early 2025). The initial data (24,312 events in total) is compiled from multiple sources (IGN, ISC, CNRST, USGS) to ensure full coverage of the seismic events occurring in and near Morocco. The raw data is cleaned to eliminate events with missing data such as date, time, depth or magnitude. This is followed by duplicated detection and removal using a python algorithm based on time ( $\Delta t$ ) and distance windows ( $\Delta d$ ) filtering. The remaining events were homogenised to moment magnitude ( $M_w$ ) using orthogonal distance regression (ODR) equations derived from regional data, to ensure higher local accuracy than literature-based conversions. Finally, seismicity background noise (events  $< 3.5 M_w$ ) is removed and a declustering algorithm based on Reasenberg's (1985) method was used to remove foreshocks and aftershocks, producing a Poissonian event distribution. The final dataset comprises 17,342 events used to analyse spatio-temporal trends in seismicity. The computation of statistical parameters (Gutenberg–Richter law, seismicity rate, maximum expected magnitude) was conducted using a diameter  $D=50$  km grid. Completeness analysis (Maximum Curvature method) yielded  $M_c = 7.0$  for 1406–1975,  $M_c = 3.6$  from 1980, and  $M_c = 3.5$  from 2008. Moreover, the calculations also reveal spatial variations in b-values: 0.4 in offshore regions west of Morocco, 1.2–1.4 along the High and Middle Atlas, and up to 1.8 in the regions of Fes and Casablanca. These patterns indicate seismic activity "hotspots" and highlight regional differences in seismic activity. This work contributes to a spatially and temporally comprehensive seismicity database for Morocco and provides a reference framework for future earthquake hazard studies.

**Mots-Clés:** Seismic Hazard, PSHA, seismic catalogue, seismicity, Morocco, earthquake

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