

The dataset presents the Deterministic Global Seismic Hazard (DGS99) map based on the largest observed earthquake within each $0.5^\circ \times 0.5^\circ$ cell during 1900–1999. It is obtained using all shallow-depth (≤ 70 km) earthquakes with magnitudes $M \geq 4.5$ that occurred in 1900–1999, selected from the U.S. Geological Survey Advanced National Seismic System (ANSS) Comprehensive Catalog of Earthquake Events and Products (<https://earthquake.usgs.gov/data/comcat>), accessed on 10 November 2025. This catalog consists of 92,814 events is subject to deterministic transformation. The algorithm of the transform iteratively propagates the maximum observed earthquake magnitude to nearby epicenters within a magnitude-dependent radius $R(M) = \exp(M - 2.5)$ km, producing a deterministic seismic hazard assessment in terms of maximum expected magnitude. The choice of magnitude-dependent radius corresponds to the scaling of the earthquake preparation zone relative to earthquake source dimensions (Dobrovolsky et al., 1979; Ismail-Zadeh & Kossobokov, 2021).

The transform of the input catalog into the output catalog of the same size is performed in three steps:

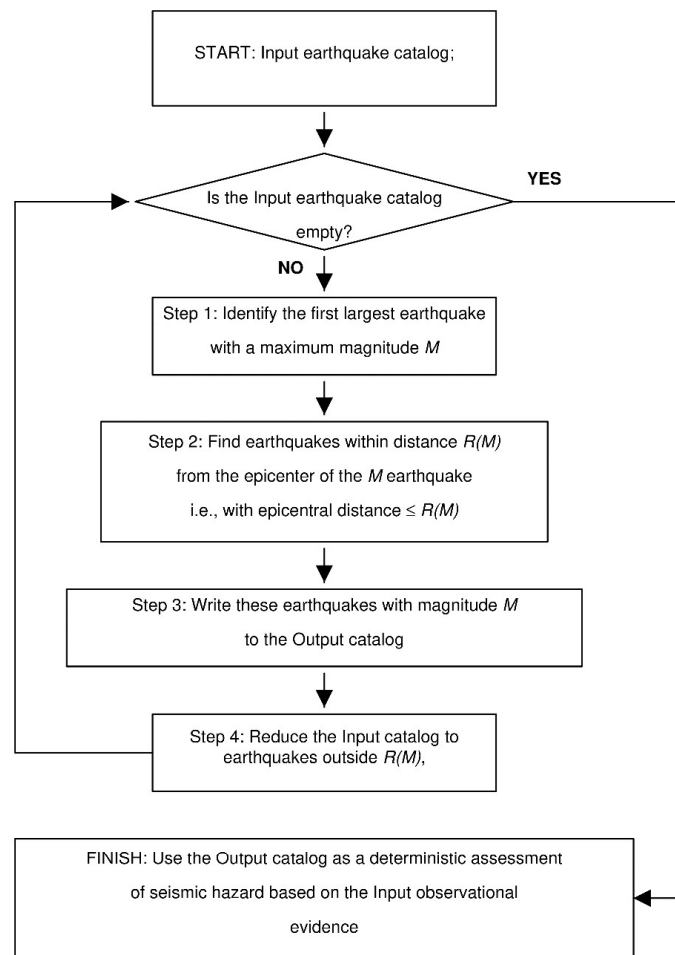
Step 1: Find the first largest earthquake of magnitude M in the catalog;

Step 2: Substitute the magnitudes of the quakes at $R(M)$ or less distance from its epicenter with M in the output transform catalog;

Step 3: Return to Step 1 with the iterated catalog of the quakes outside $R(M)$ on Step 2 or FINISH if the iterated catalog is empty;

FINISH: Consider the output transform catalog to map a simple common sense actual seismic hazard based on the pure seismic evidence.

The algorithm is illustrated by the following flowchart.



The dataset DGSH99.csv resulted from application of the algorithm to the above mentioned catalog of 92,814 events and presents a global geographic grid map with a spatial resolution of $0.5^\circ \times 0.5^\circ$.

The DGSH99.csv file contains three columns:

- lat: latitude of the center of the grid cell;
- lon: longitude of the center of the grid cell;
- value: the largest earthquake magnitude in the grid cell derived from the output catalog or NaN, if the cell is empty.

References

- Dobrovolsky, I.P., Zubkov, S.I., & Miachkin, V.I. (1979). Estimation of the size of earthquake preparation zones. *Pure Appl. Geophys.* 117, 1025–1044. <https://doi.org/10.1007/BF00876083>
- Ismail-Zadeh, A., & Kossobokov, V. (2021). Earthquake Prediction, M8 Algorithm. *Encyclopedia of Solid Earth Geophysics. Encyclopedia of Earth Sciences Series / H. Gupta (ed)*. Springer, Cham, 204–208. https://doi.org/10.1007/978-3-030-10475-7_157-1