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Using likelihood tests to derive space-time windows for catalog declustering: Application to the 2020 European Seismic Hazard Model (ESHM20)

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The quality of a seismogenic source model in the framework of probabilistic seismic hazard assessment (PSHA) is determined by its statistical agreement with the observed rates of past and future earthquakes. Such evaluations are of great importance, because they can be used for parameter sensitivity analysis that is quantifying the impact of modeling choices on the estimation of seismic activity rates.

We present a testing environment for Pan-European earthquake rate forecasts in terms of spatial extent, spatial bin size, target magnitudes and target event time horizons. We describe our likelihood consistency and comparison test metrics that are all selected from and based on lessons learned from the Collaboratory for the Study of Earthquake Predictability.

We apply those metrics to the ongoing development process of ESHM20 seismogenic source models (SERA, Joint Research Activities JRA3). In this contribution, we focus on assessing the impact of declustering choices on the estimation of earthquake activity rates. PSHA commonly relies on window-based declustering techniques. We use our testing environment to (1) evaluate all published previously used space-time windows and (2) propose new European space and time windows. The forecasts based on our proposed windows pass all likelihood consistency tests while the number of available mainshocks is maximized.