**Abstract**

Earthquake clustering is a fundamental component of seismicity that reflects various forms of earthquake triggering mechanisms. Zaliapin and Ben-Zion (SRL, 2021) introduced a simple and robust measure of space-time clustering, using the receiver operating characteristic (ROC) diagram, that allows dissecting effects related to concentration of events around a heterogeneous regional fault network (marginal space distribution of events) from coupled space-time fluctuations (joint space-time distribution). The work applies the clustering measure of Zaliapin and Ben-Zion (SRL, 2021) to examine additional regions (see Data).

- Extends the analysis to a more general measure of seismic rate that can account systematically examines general and coupled space-time clustering of raw and declustered catalogs.

**Methodology**

Receiver operating characteristic (ROC) diagrams were used to assess the inhomogeneity of the space-time distribution of seismicity in the regions of this study in a systematic way. These ROC diagrams were used to produce a single measure of space-time clustering, the Gini coefficient (G) which is an efficient and stable measurement of earthquake clustering. The coefficient G may assume values between 0 and 1. A value of G close to 1 indicates a large portion of events are concentrated in a small fraction of the examined space-time volume.

More formally, we partition the examined space-time area into voxels with space dimension \( \Delta \) and time size \( w \), and measure seismic activity within a voxel centered at location \( x \) at time \( t \) by \( \Sigma (x,t) = 10^{m0} \), where the summation is taken over all events within the voxel. \( m \) is a parameter, and \( m0 \) is the event magnitude. Notice that \( m = 0 \) corresponds to counting events, \( m = 1 \) approximates the faultbreak area, and \( m = 3/2 \) corresponds to the seismic moment. We only examine voxels with the time-integrated value of \( \Sigma \) being larger than a threshold \( \Sigma_c \) (in this work, \( \Sigma_c = 0 \)).

First, we evaluate the general clustering. Here, the ROC diagram is a plot of the fraction of the examined non-empty voxels (x-axis) vs. the weighted fraction of the examined non-empty voxels. The weights are determined by the factorized space-time rates of background events: \( J(x,t) = S(x)T(t) \), where \( S(x) \) is the marginal space rate of the background events (that reflects regional space heterogeneities related to the fault network), and \( T(t) \) is the marginal time rate of events (that reflects possible marginal temporal heterogeneities, which are negligible in most of the examined cases). Declustering is done by the method of Zaliapin and Ben-Zion (JGR, 2020).

**Results**

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