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The relative intensity (RI) method for forecasting earthquakes applied to worldwide seismicity

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The relative intensity (RI) method can be used to forecast future large earthquakes in a specified region. This method is based on the assumption that future large earthquakes will occur where the average seismicity rate has a value greater than a prescribed threshold. In the method, the seismogenic area is subdivided into cells of an equal size. In each cell the rate of occurrence of earthquakes is computed for a given training time period. The resulting cells with seismicity above a given threshold define "hotspots" where large earthquakes are forecast to occur in a specified forecast period. The output is a map of "hotspot" areas. To analyze the performance of the method, the worldwide earthquake catalog (ANSS catalog) is studied retrospectively for various training and forecasting time intervals, magnitude cutoffs, and cell sizes. The skill score test applied to the data is based on the relative operating characteristic (ROC) diagram approach, which is similar to a Molchan diagram analysis. The ROC diagram is a plot of the hit rate (the fraction of "hotspot" cells that have a forecast earthquake over the total number of cells with actual earthquakes) versus the false alarm rate (the fraction of the forecast cells that do not have earthquakes over the total number of cells with no actual earthquakes in them). The ROC diagram points are computed for all values of the intensity threshold used to define the "hotspot" cells on the intensity map. The area between the ROC diagram curve and the random forecast curve defines a skill score. Optimal forecast strategies (variations in magnitudes, time intervals, cell sizes) are obtained for worldwide seismicity and discussed in terms of earthquake forecasting.