# Seismic hazard for NE Brazil revealed by probabilistic analysis

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## Abstract

The Northeast Region of Brazil is one of the most seismic active areas in the intra-plate portion of South America. In this area, moderate-size earthquakes are relatively frequent. They can pose significant hazards (e.g., ground vibrations) that, in turn, have been observed to generate notable effects, since light damage to the collapse of ill-constructed buildings. In this regard, when combined with buildings vulnerability and exposure, the analysis of seismic hazard plays a crucial role in mitigating its effects on society, depending on three components: source, path, and site. In this work, we present the results of the Probabilistic Analysis of the source component of the seismic hazard for NE Brazil. For this purpose, we used the events from the Brazilian Earthquake Catalogue (SISBRA) to estimate the completeness magnitude and remove seismic precursors and aftershocks. Then, we selected four areas of higher seismicity, coincident to previous studied seismic zones in NE Brazil, for performing our analysis: 1 - Acaraú, 2 – NW and 3 - E Potiguar Basin (PoB) and 4 – reactivated segments of Pernambuco Lineament (PeL). For each seismic zone, magnitude distributions were evaluated with respect to the exponentiality adequacy, i.e., the Gutenberg-Richter law, by means of statistical tests. For the only one which exponentiality was rejected, the Acaraú seismic zone, we modeled its magnitude distribution by using nonparametric Adaptive Kernel Estimator. Both parametric and nonparametric magnitude distributions were modelled considering a maximum magnitude = 6.6 $m_R$, based on the upper bound of a 95 % confidence interval for the standard normal distribution of paleoearthquake sizes. Considering the Poisson model for earthquake occurrence in time distribution, we express our seismic hazard analysis in terms of mean return period, maximum credible magnitude, and exceedance probability. Our results suggest, within our four seismic zones, mean return periods in the range of 8.70 - 17.19 years for a 4 $m_R$ event; 62.97 – 152.58 years for a 5 $m_R$ event; 313.20 – 1756.24 years for a 6 $m_R$ event. In addition, Maximum credible magnitudes correspond to event sizes varying from 5.8 $m_R$ to 6.4 $m_R$ for a period length of 1000 years. Nevertheless, earthquake occurrence expectations vary between 5.5 $m_R$ and 6.2 $m_R$ for a 10% probability of exceedance in 50 years.