Submission code: N7RVZ6JM75

See this and other abstracts on our website: https://home.sbgf.org.br/Pages/resumos.php

Seismic Hazard Assessment for Northeast Brazil: A Probabilistic Approach

Aderson Nascimento (Federal University of Rio Grande do Norte), José Augusto Silva da Fonsêca (Federal University of Rio Grande do Norte), Stanis■aw Lasocki (Institute of Geophysics; Polish Academy of Sciences)

Seismic Hazard Assessment for Northeast Brazil: A Probabilistic Approach

Introduction

Stable continental regions, though characterised by lower seismicity than plate-boundary zones, can still experience moderate-sized earthquakes capable of causing significant damage due to low attenuation of seismic waves. Northeast Brazil is among South America's most seismically active stable continental areas, with historical events (e.g., João Câmara-RN 1986, Irauçuba-CE 1991, Amargosa-BA 2020) producing felt ground motions and occasional structural damage. Given the limited instrumental record (~300 yr) and evidence from paleoseismology of larger prehistoric events (M 5.5–6.0), a robust seismic hazard assessment is essential for informed building design and risk mitigation.

Method and/or Theory

We performed a Probabilistic Seismic Hazard Analysis (PSHA) for Northeast Brazil using an updated regional earthquake catalogue processed for magnitude completeness (Mc) via maximum curvature, goodness-of-fit, and modified goodness-of-fit methods. After Poisson declustering (Gardner–Knopoff, Reasenberg), two source models were delineated based on clustering of independent events and regional tectonics. Magnitude recurrence was modelled with truncated Gutenberg–Richter and nonparametric kernel distributions, tested via Anderson–Darling statistics. Epistemic uncertainties in source characterisation, magnitude distribution, and GMPE selection were addressed through a logic-tree framework. Hazard curves and uniform hazard spectra were computed for the capitals of Northeast Brazil and selected critical facilities, with seismic hazard disaggregation performed to identify dominant magnitude-distance contributions.

Results and Conclusions

For a 10% probability of exceedance in 50 years, peak ground acceleration (PGA) is < 0.01 g across most of the region, increasing to 0.01–0.04 g in the northeastern part, and peaking at 0.10–0.26 g around the four most active source zones. Uniform hazard spectra exhibit a spectral peak at 0.1 s typically in the 0.01–0.08 g and 0.005-0.39 g range for the capitals and critical facilities, respectively. Disaggregation reveals that seismic hazards for critical facilities are predominantly caused by events of M 4.5–5.5 at distances of up to 150 km. While most of Northeast Brazil complies with the current Brazilian seismic code (NBR 15421:2023), specific areas show significantly higher seismic hazard. These include northwest and northeast Ceará, eastern Rio Grande do Norte, and eastern Pernambuco, where seismic intensities may reach levels VI to VIII. Such conditions suggest a potential vulnerability of older or poorly constructed buildings, reinforcing the importance of incorporating regional hazard assessments for guiding seismic risk management. These findings may also serve as a technical basis for revising the national seismic code to reflect better localised hazard conditions across Northeast Brazil.