

# Tentative Spatio-Temporal Correlation Between Indoor Radon Concentration Variations and Moderate Earthquakes in Albania: A Case-Based Statistical Approach

**Irena Dushi<sup>1</sup>, Kozeta Tushe<sup>2</sup>, Merita Xhixha<sup>3</sup>, Kristina Matraku<sup>1</sup>**

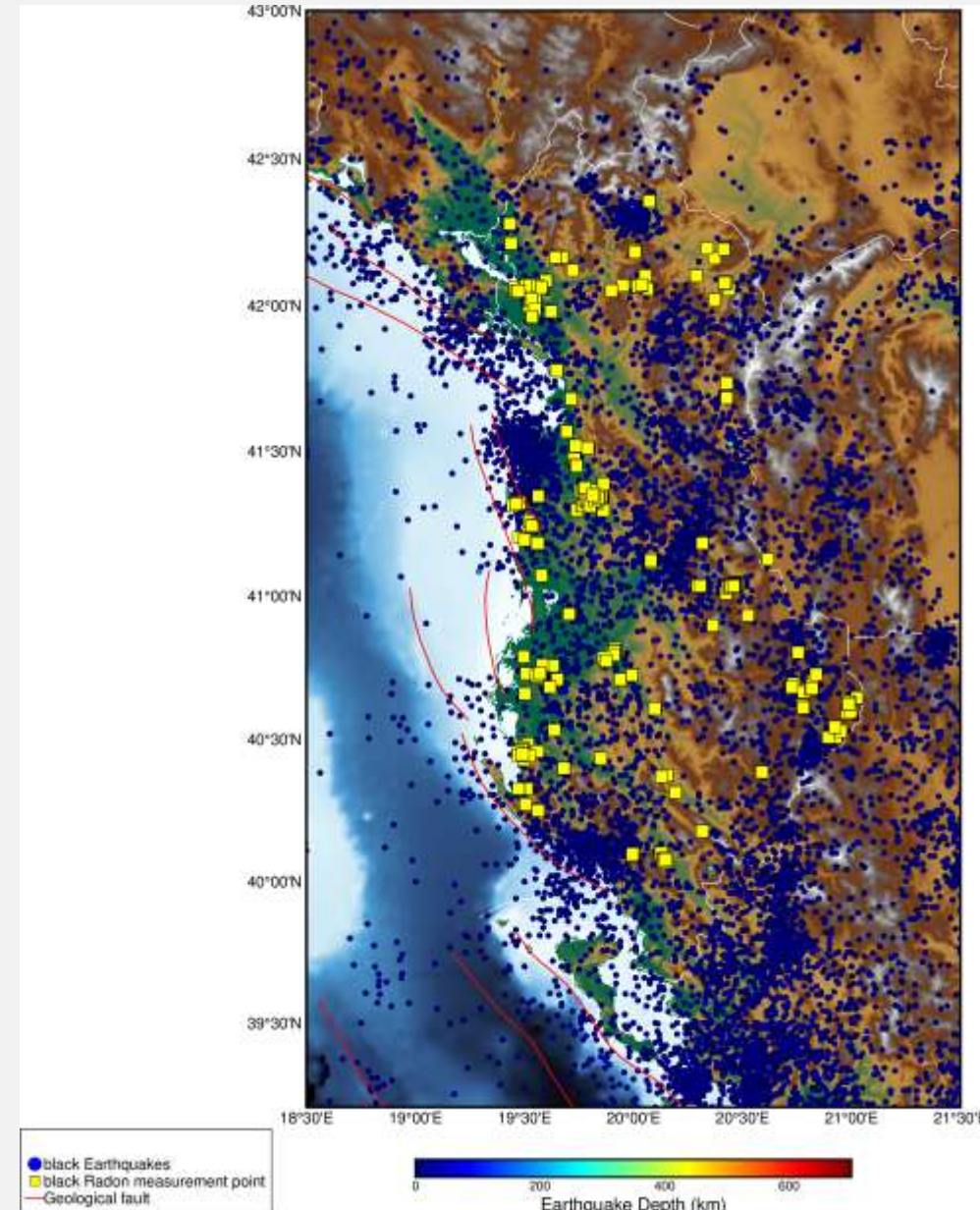
<sup>1</sup> Department of Seismology, Institute of Geosciences, Polytechnic University of Tirana, Albania

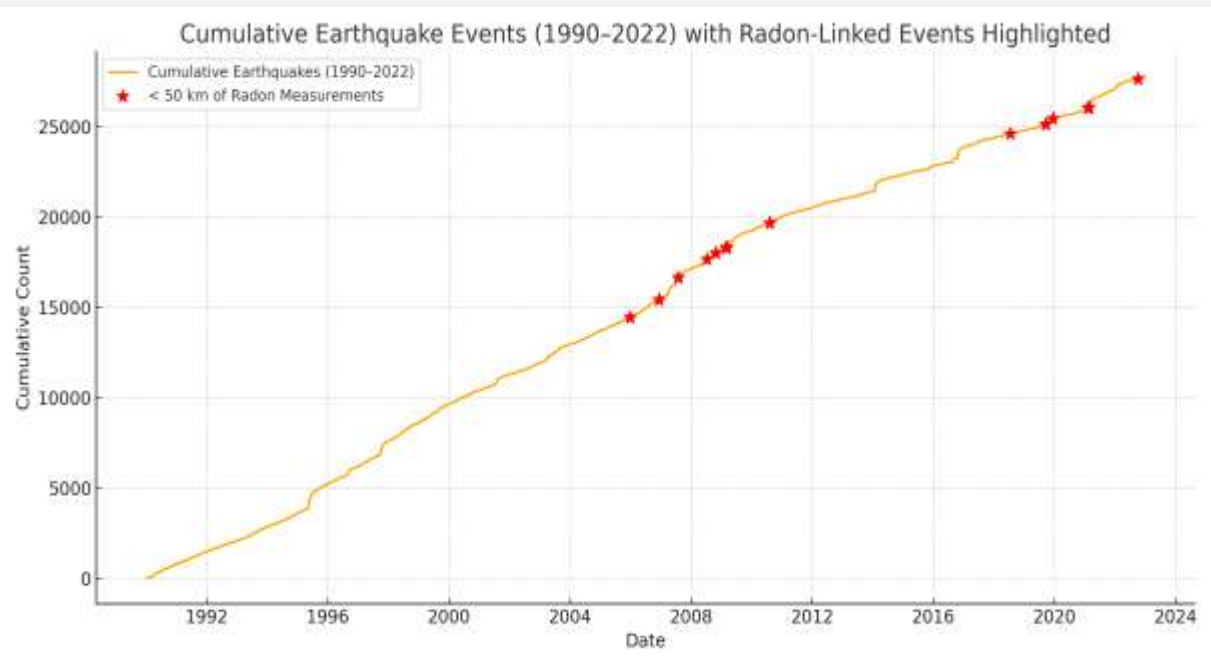
<sup>2</sup> Department of Environmental and Radiation Physics, Institute of Applied Nuclear Physics,  
University of Tirana, Albania

<sup>3</sup> Department of Physics, Faculty of Professional Studies, “Aleksandër Moisiu” University,  
Durrës, Albania

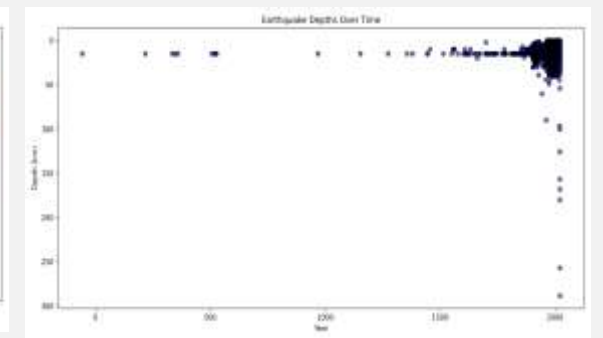
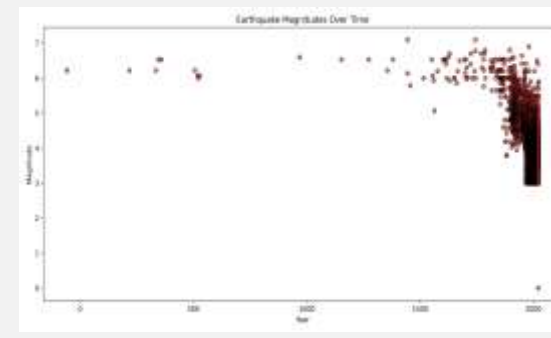
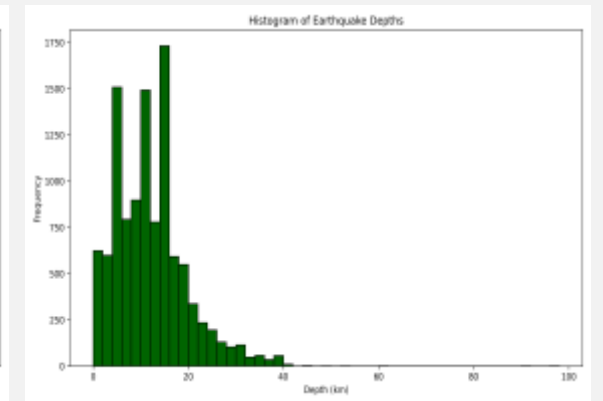
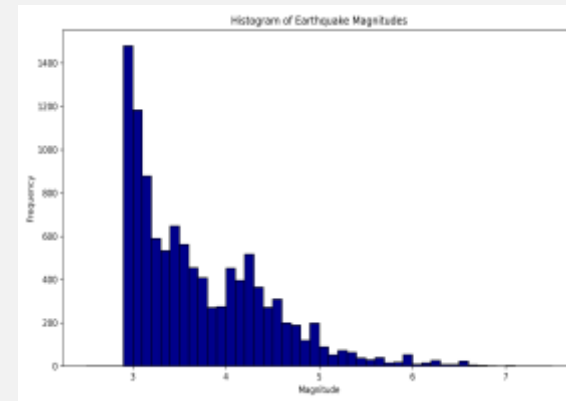
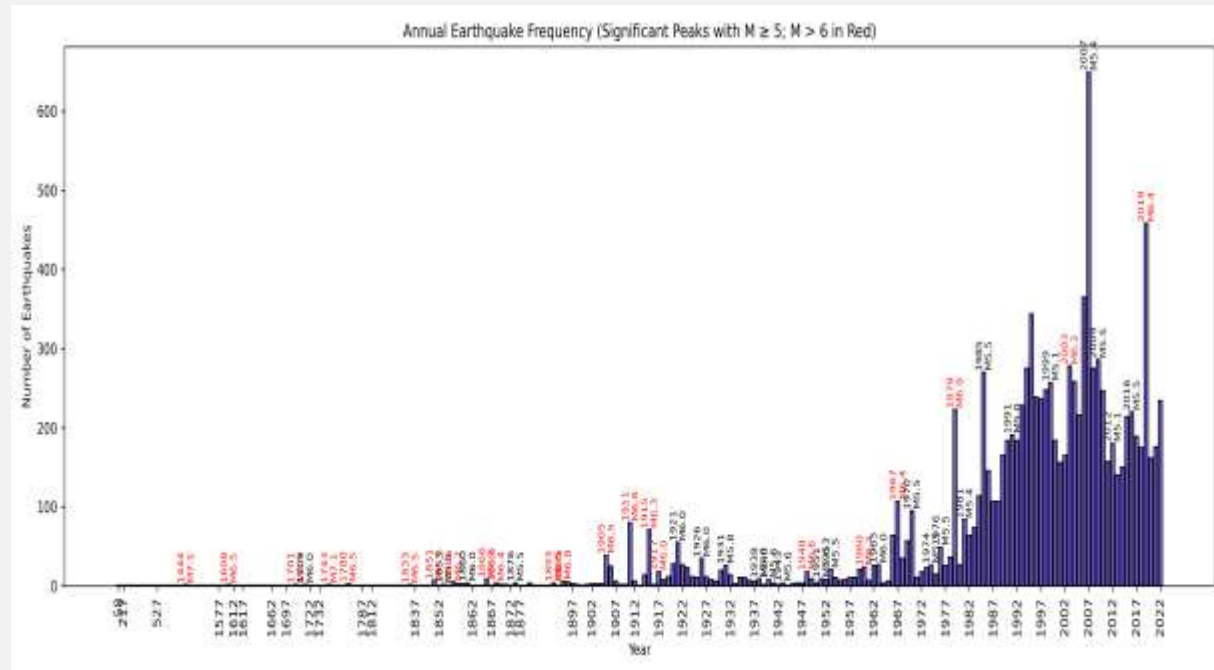
# Introduction

Radon ( $^{222}\text{Rn}$ ), a naturally occurring gas linked to subsurface stress changes, has been investigated as a potential seismic precursor in Albania. This study analyzes indoor radon concentrations from three national campaigns (1999–2000, 2014, 2022) across 50 repeated sites, examining their spatial and temporal correlation with nearby moderate earthquakes ( $M_w \geq 4.0$ ). While only one case (Zall Bastar, 2022) showed clear alignment with an  $M_w 3.7$  event, the overall weak correlation underscores the need for continuous monitoring. These findings support the integration of radon and seismic data for improved hazard assessment in tectonically active regions.



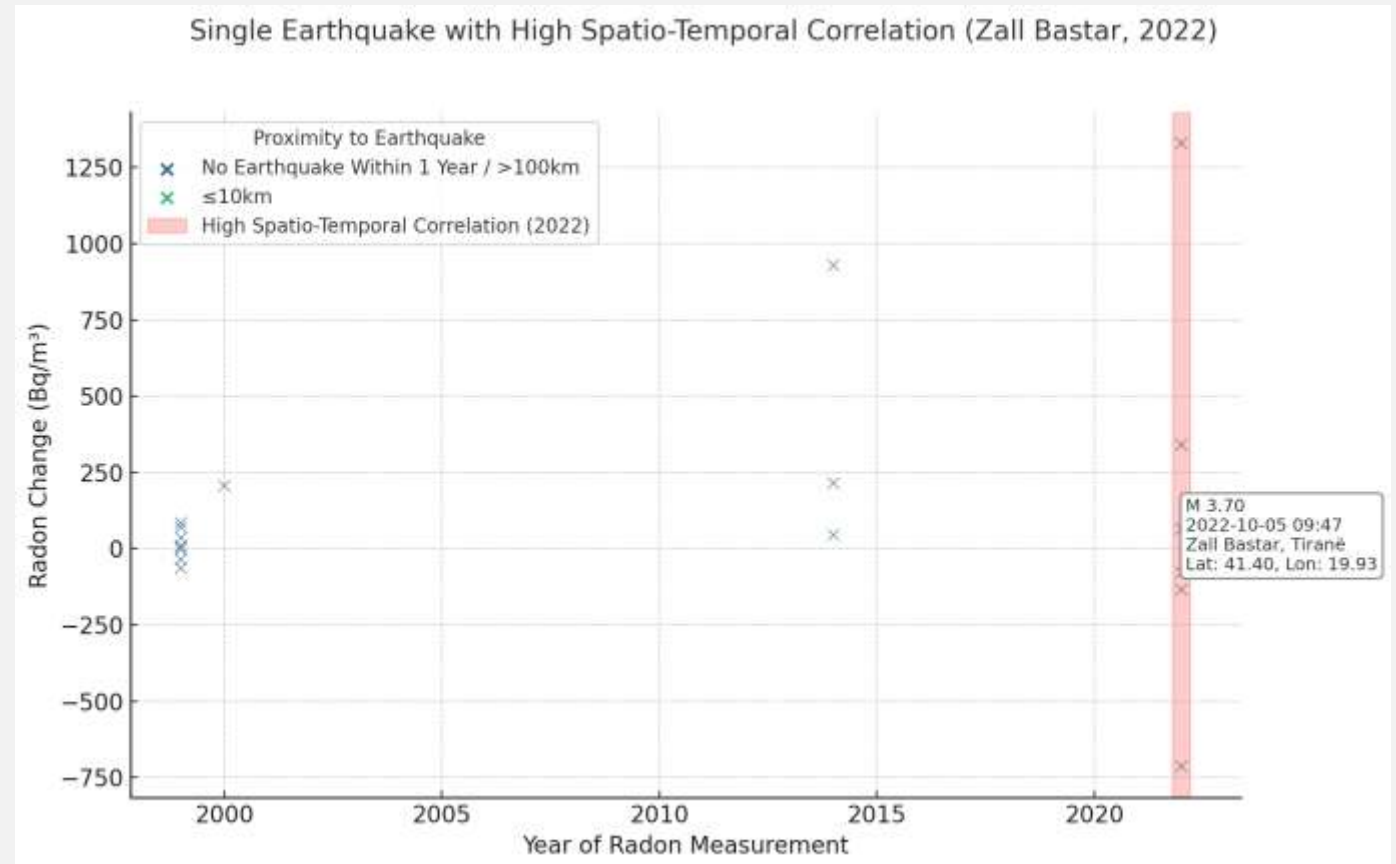
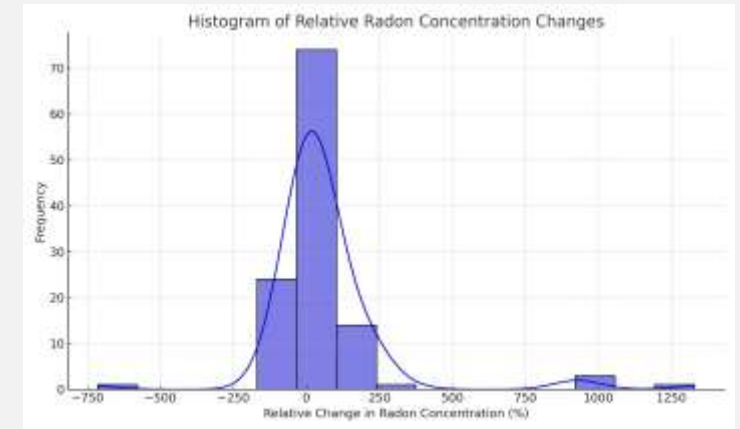
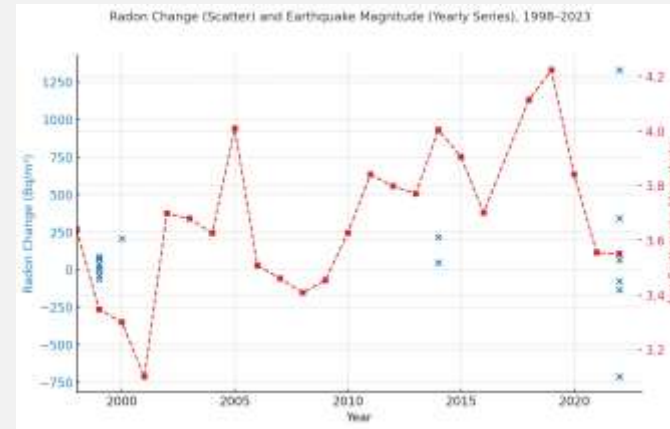


This study analyzes spatial and temporal changes in indoor radon concentrations across Albania and examines possible correlations with nearby moderate earthquakes. Using georeferenced data from three national surveys (1999–2000, 2014, 2022), radon variations were calculated at repeated sites and compared to earthquakes ( $M_w \geq 4.0$ ) occurring within 50 km and 0.2 years. The closest qualifying event was assigned to each anomaly. Processing and visualization were performed in Python, using tools such as pandas, PyGMT, and geopy.



# Results & Discussion

- Results show that most indoor radon anomalies did not coincide with nearby earthquakes; however, one significant case occurred in Zall Bastar, where radon levels rose by +1329 Bq/m<sup>3</sup> (an 800% increase) before a nearby Mw 3.7 event in 2022.
- Across 50 matched sites measured in 1999–2000, 2014, and 2022, radon changes ranged from –70% to +800%, with the majority showing moderate fluctuations.
- The seismic catalogue used includes over 10,000 events (Mw ≥ 2.5) from 58 BCE to 2022, dominated by shallow, moderate earthquakes.
- While the data suggest a potential local radon–seismic link, broad correlations remain limited.
- These results highlight the importance of repeated, georeferenced radon surveys and support the need for continuous, high-resolution monitoring near active faults to evaluate radon’s role as a seismic precursor.





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