

# Assessment of Marine Geohazards Activity in the Farasan Islands Using Acoustic, GIS, and Remote Sensing Techniques

Ghazi Alqahtani (Saudi Arabia)

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## SUMMARY

This study focuses on investigating the tectonic activity of the Farasan Islands, located in the southern Red Sea, using advanced methods in Geographic Information Systems (GIS) and remote sensing, combined with the analysis of morphotectonic indices. The primary objective of the research was to assess neotectonic activity in the region by analyzing geomorphic features and evaluating their relationship with tectonic processes. The study utilizes Digital Elevation Models (DEMs) and bathymetric data to derive key geomorphic indices, such as the stream length-gradient index and the basin asymmetry index, which serve as indicators of tectonic deformation. By integrating these indices with remote sensing data and GIS techniques, the study provides a detailed spatial assessment of the tectonic features of the Farasan Islands.

Field observations and previous geological reports were incorporated to ensure the accuracy of the analysis and provide ground-truthing for the remote sensing data. A multi-criteria decision analysis (MCDA) approach was used to assess the spatial distribution of neotectonic activity by combining different geospatial layers, such as lineament data and lithological information. The results show a clear spatial variation in tectonic activity across the region, with the central and eastern parts of the islands exhibiting signs of high tectonic activity, particularly linked to fault systems, while the northern and western regions display lower levels of tectonic deformation. This study highlights the importance of using integrated GIS and remote sensing techniques, particularly when combined with morphotectonic indices, to generate accurate tectonic hazard maps.

The findings of this research have significant implications for understanding the tectonic processes that shape island and coastal regions, with potential applications in disaster risk management, land-use planning, and environmental protection. The use of bathymetric data, alongside traditional land-based methods, further enhances the precision of tectonic assessments, offering a more holistic

view of the interconnectedness between terrestrial and marine tectonic features. This study serves as a valuable contribution to the growing body of knowledge on tectonic hazards in the Red Sea region and provides a framework for similar geomorphic and tectonic studies in other coastal and Island areas globally.

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