



Geo-hazards in the North Arabian Sea with special emphasis on Makran Subduction Zone

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ABSTRACT

The intricate convergence of tectonic plates and the interplay between landmasses and oceans in subduction zones give rise to marine geo-hazards, encompassing catastrophic events in marine environments, posing significant risks to ecosystems, coastal communities and infrastructure. The Makran Subduction Zone (MSZ), with its remarkable history of devastating earthquakes and tsunamis, is a subject of significant attention from both academic and industrial sectors in recent decades. In this comprehensive review, we investigated various marine geo-hazards in the north Arabian Sea (NAS), particularly those associated with the MSZ, providing valuable insights for risk mitigation in the coastal regions with a population of over 45 million. The review employed bibliometric methods to comprehensively analyze relevant publications from databases such as Web of Science, Scopus, and China National Knowledge Infrastructure. By conducting a systematic review of 133 publications, this study deepens our understanding associated with MSZ, uncovering 07 distinct categories of geo-hazards. The earthquakes and tsunamis hazards have received extensive attention, with a tentative recurrence interval of around 500 years, while the remaining categories, including seabed fluid flows, mud-volcanism, sub-marine mass movements, subsidence, and erosion, were similarly explored in their respective order. The eastern side of the MSZ demonstrated greater instability compared to the western side, attributed to the ongoing subduction process. The 'Gang of Four', consisting of faults, has been identified as a primary causative factor for seismic activity in the NAS, largely influenced by transpressional tectonics. The identified geo-hazards exhibit complex interdependencies, where the initiation of one hazard can amplify the severity of another. An integrated approach is essential for assessment of the complex and interrelated risks and hazards. The research emphasizes the significance of long-term seafloor observatories in the MSZ for real-time monitoring, enabling proactive management and mitigation strategies to address these geo-hazards effectively.

1. Introduction

Marine geo-hazards (Fig. 1), which involve catastrophic incidents in marine environments, pose significant risks to human lives, infrastructure, and valuable assets in both shallow and deep-sea regions (Ercilla et al., 2021). These hazards include earthquakes, volcanic eruptions,

mass wasting, the occurrence of high-pressure gas in shallow layers, liquefaction, and tsunamis (Camargo et al., 2019). A variety of natural geological processes and sometimes anthropogenic interventions, resulting in severe incidents that transpire in terrestrial and marine environments (Jia et al., 2016; Liu et al., 2023; Wu et al., 2018). These are predominantly observed in active tectonic regions, including

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