



Coastal Dynamics in the Pacific of Panama: An Analysis of Historical Records and Their Implications for Coastal Risk Management

In recent years, global-scale oceanic-atmospheric variations, influenced by climate change and exacerbated by phenomena such as the El Niño-Southern Oscillation (ENSO) and Southern Annular Mode (SAM), have contributed to an increase in the frequency and intensity of extreme events along the coasts of several countries in Latin America. Consequently, there has been a rapid loss of coastal areas, particularly evident in sandy shorelines of countries like Panama. Vulnerable coastal towns in Panama, lacking adequate coastal protection, have felt the impacts of these events, resulting in the destruction of houses and local businesses crucial to the economy and livelihoods of numerous families in the region. This issue extends beyond Panama, affecting other Central American countries, highlighting the urgent need to develop an analysis methodology applicable in the region. In response to this context, a methodological framework was proposed for analyzing historical records of variables associated with coastal marine dynamics, using the coasts of the Pacific of Panama as a pilot zone. To achieve this, the analysis of coastal climate data in Panama was conducted by adapting successfully implemented hybrid downscaling processes in beaches of Spain. Additionally, a comprehensive analysis of local institutions and authority accounts on social media was considered to identify trends in areas with frequent advisories regarding high waves and tides for beachgoers in the selected study areas. This analysis of advisories on Twitter was compared with data obtained from a hindcast for trend analysis, allowing for the validation of the accuracy of advisories published on social media platforms, evaluation of the sensitivity of the early warning system based on social media information, and identification of patterns and trends in the communication of coastal risks through digital platforms. Given studies indicating loss of beachfront exceeding 30 linear meters over the past few decades in various beaches of the Panamanian Pacific region, leading to the exposure and destruction of local residences and businesses such as restaurants by extreme events such as swells, storm surges, and high-intensity waves, this approach aims to establish how identified variations in coastal climate relate to advisories and news published in local Panamanian media. Furthermore, it seeks to determine how this data can contribute to providing a clearer insight for planning and decision-making in coastal risk management.

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