Enhancing Hurricane Hazard Mapping Methods using a Geographic Information System

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Overview

Hurricanes have historically proven to be a threat to human life, property, and industry by causing devastating flooding and high winds that displace populations, cause billions of dollars in damage, and kill thousands of people. To protect those within a hurricane’s path, refined methods are needed to identify areas at risk of hurricane hazards for prioritization of disaster planning, aid, and evacuation measures. This work presents methods utilizing a geographic information system (GIS) to assess the risk a given area has of experiencing hurricane hazards. The Yucatán Region was selected for this study due to its active tropical climatology dating back thousands of years. High winds, storm surge flooding, non-storm surge related flooding, and rainfall triggered landslides were selected as primary hurricane hazards.

Data and Methods

• Data sets included: NOAA NCDC IBTrACS hurricane tracks, SRTM Digital Elevation Model, WorldClim monthly accumulated precipitation, USGS HydroSHEDS river locations, and Harmonized World Soil Database soil types
• ArcGIS Model Builder was used to assess wind risk by modeling each storm’s temporal wind profile and extent.
• Adopted wind model to identify the average storm motion and storm frequency over a given area.
• Model results were combined with physical and climatic data to identify areas at risk of hazards.

Key Findings

• This analysis found the eastern side of the peninsula, primarily coastal Belize and Mexico, at greatest risk of experiencing hurricane hazards.
• Risk of flooding is greatest along low-lying coastal areas
• Landslide risk is highest in the southeast due to increased terrain variability.

Impact

• Methods can help refine current hazard mapping techniques.
• Helps prioritize at risk areas for disaster planning and emergency response.
• Provides an approach for locations lacking detailed predictive atmospheric modeling capabilities.

Explanation

• This analysis applies satellite acquired datasets towards hazard identification and disaster mapping.
• Research developed a novel and detailed approach to utilizing GIS for hurricane hazard mapping.

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