SnT 2025 8 SEPTEMBER 9 TO 12 SEPTEMBER
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Vulnerability and Earthquake Risk Assessment for Buildings in Kuwait Governorates, Kuwait

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INTRODUCTION AND MAIN RESULTS

This presentation provides insights related to seismic risk analysis which was computed to evaluate the economic and human loss in Kuwait governorates to help emergency planners to design plans to control or mitigate future risks. This study required incorporating the seismic hazards to Kuwait from seismic sources, the exposure risks, and vulnerability, including the properties of buildings and infrastructure in each governorate. The economic loss for each exposure element was calculated using probabilistic metrics. These metrics are the Loss Exceedance Curve (LEC), the predicted Average Annual Loss (AAL) and the Probable Maximum Loss (PML.

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Introduction

Kuwait is a small oil-producing country situated in the northeastern Arabian Peninsula. Seismologically, Kuwait is classified as a region with low to moderate seismic activity However, its geographical location places it regionally close to the Zagros seismic belt, and there are also local seismic sources within Kuwait itself.

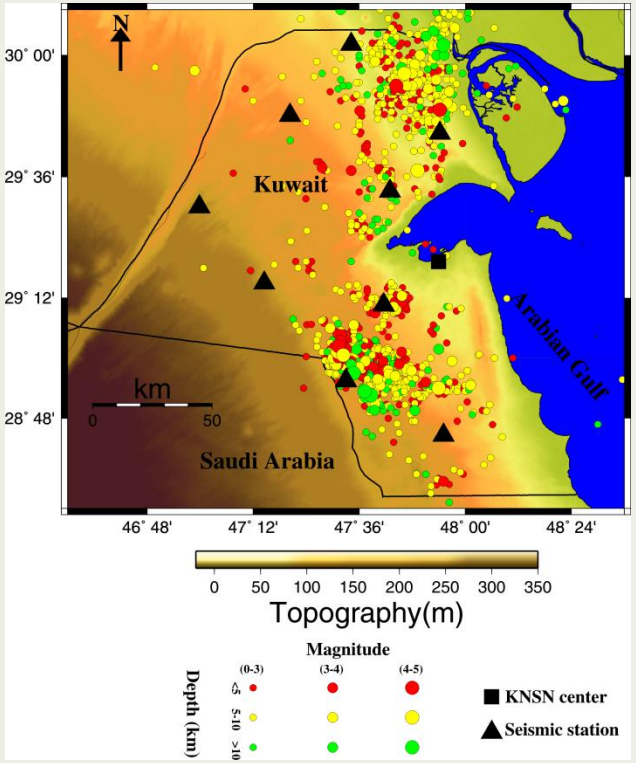

Figure 1. Seismicity map of Kuwait

Methods/Data

The Risk Model

Three modules (hazard, exposure and vulnerability) are designed and calculated to build the risk model.

1- Hazard Model

The probabilistic seismic hazard assessment (PSHA) is used to define the magnitude and frequency of seismic hazards at Kuwait. All local and regional historical and recent earthquakes have been collected to create a model that describes the earthquake process.

2- Exposure Model

A huge database of the exposure elements for 177451 buildings was gathered to assess the seismic risk in Kuwait. For each exposure element, economic, social, and engineering information (human and economic exposures) was collected from the Kuwait public authority for civil information.

3- Vulnerability Model

The Vulnerability model is essential in seismic risk because it calculates the loss (L) in means of damage to man-made structures, social weakness and service interruption. It provides all the information needed to calculate the probability of reaching or exceeding loss values, called seismic demand (S). This model determines the statistical moment variation of losses for different values of seismic demand.

Data Inputs

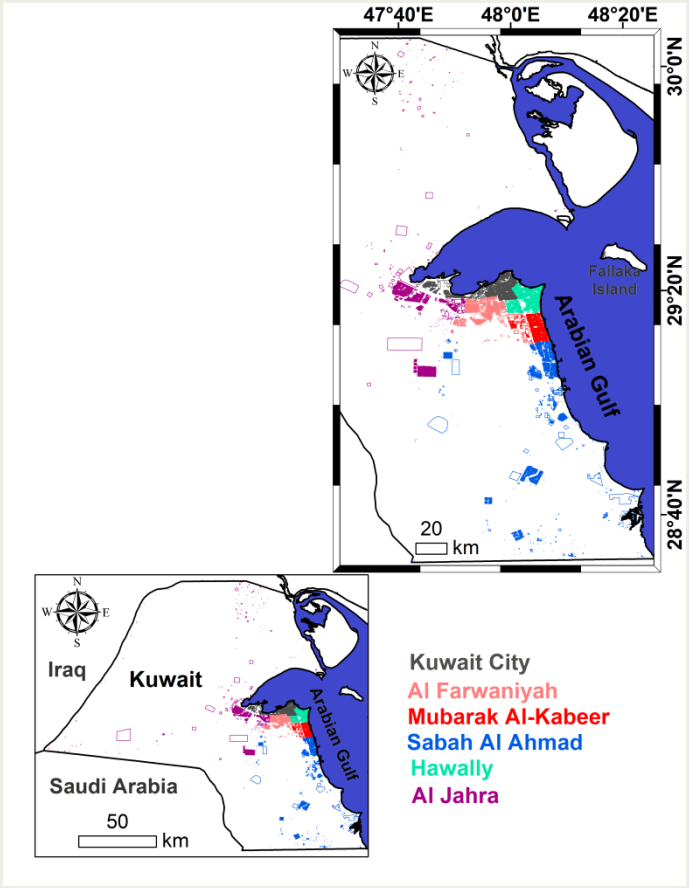

Figure (2): Location map of the Kuwait's governorates and the exposure elements for which the seismic risk were estimated.

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Seismotectonic model

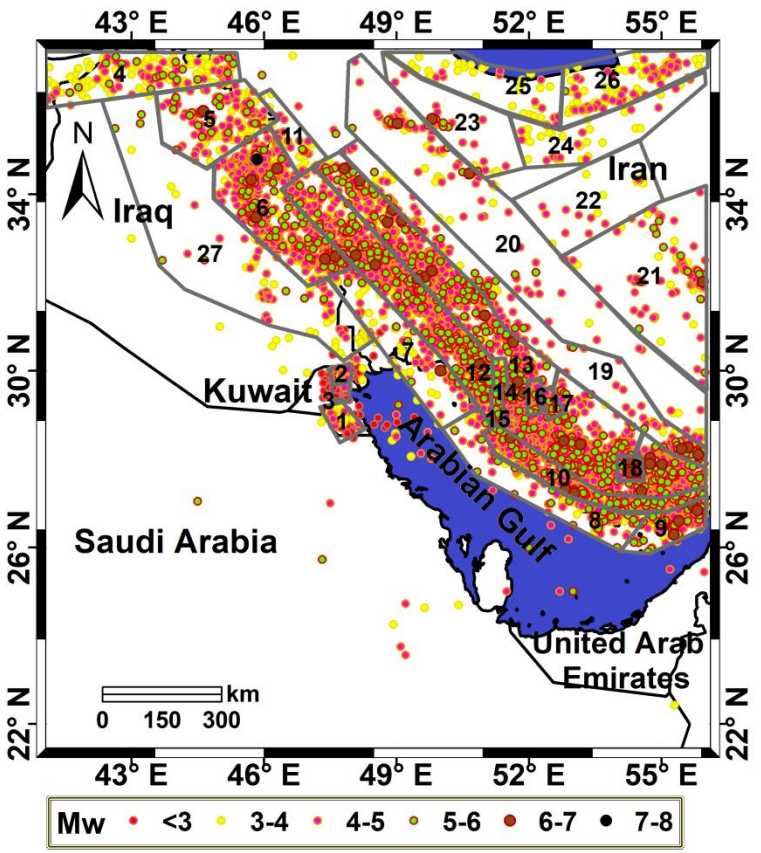

Figure 3. Sesimotectonic source model of Kuwait and its surroundings.

Results

Future losses from upcoming earthquakes including economic and human losses were estimated in the governorates of Kuwait City, Al Farwaniyah, Mubarak Al-Kabeer, Sabah Al Ahmad, Hawally, and Al Jahra. In each governorate, the seismic hazard, exposure, and vulnerability were estimated to calculate the seismic loss.

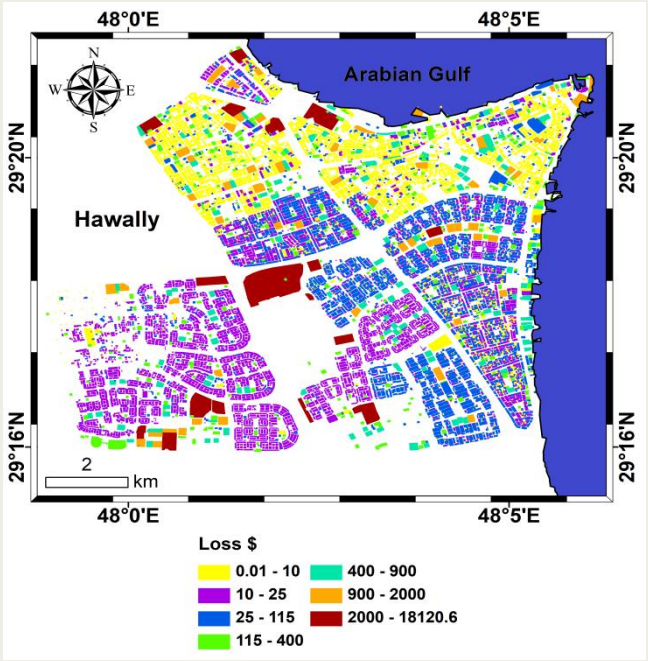

Figure 4. The predictable absolute monetary loss for each building for Hawally governorate

Conclusions

Kuwait City has small to medium seismic activity. It is affected by local seismicity from near sources and also by regional earthquakes. The probabilistic seismic risk was computed to evaluate the economic and human loss in the governorates of Kuwait City, Al Farwaniyah, Mubarak Al-Kabeer, Sabah Al Ahmad, Hawally, and Al Jahra.

the predicted absolute monetary loss for each exposed element in each governorate was estimated.

Moreover, the lose exceedance curve (LEC) was estimated to predict the financial cost of the properties in the Kuwait's governorates

Acknowledgment

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Data for buildings in Kuwait City were obtained from the Kuwaiti Public Authority for Civil Information.

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