Coastal flood risk analysis in Turkey's Black Sea Region

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1. Scientific context

A large proportion of the world's population lives in coastal areas and more people are expected to live in areas that are vulnerable to the effects of climate change [1-4].

As in many other parts of the world, floods are some of the most devastating extreme events in Turkey, often resulting in significant losses. In many cases floods have caused deaths, injuries and health deterioration [6].

Climate change is a major global problem with significant negative effects for coastal settlements. Risks include sea-level rise, increased frequency and intensity of storms [5].

The Geographic Information Systems (GIS) has had a significant role in flood hazard assessment and the identification of areas prone to floods and it is a crucial element for any mitigation strategy to the flood risk [7,8].

A vulnerability assessment of Turkey coastal areas regarding sea-level rise is needed both as part of coastal management policies for sustainable development and as a guideline for resource allocation for preparation of adaptation for the upcoming problems [9].

2. Study area

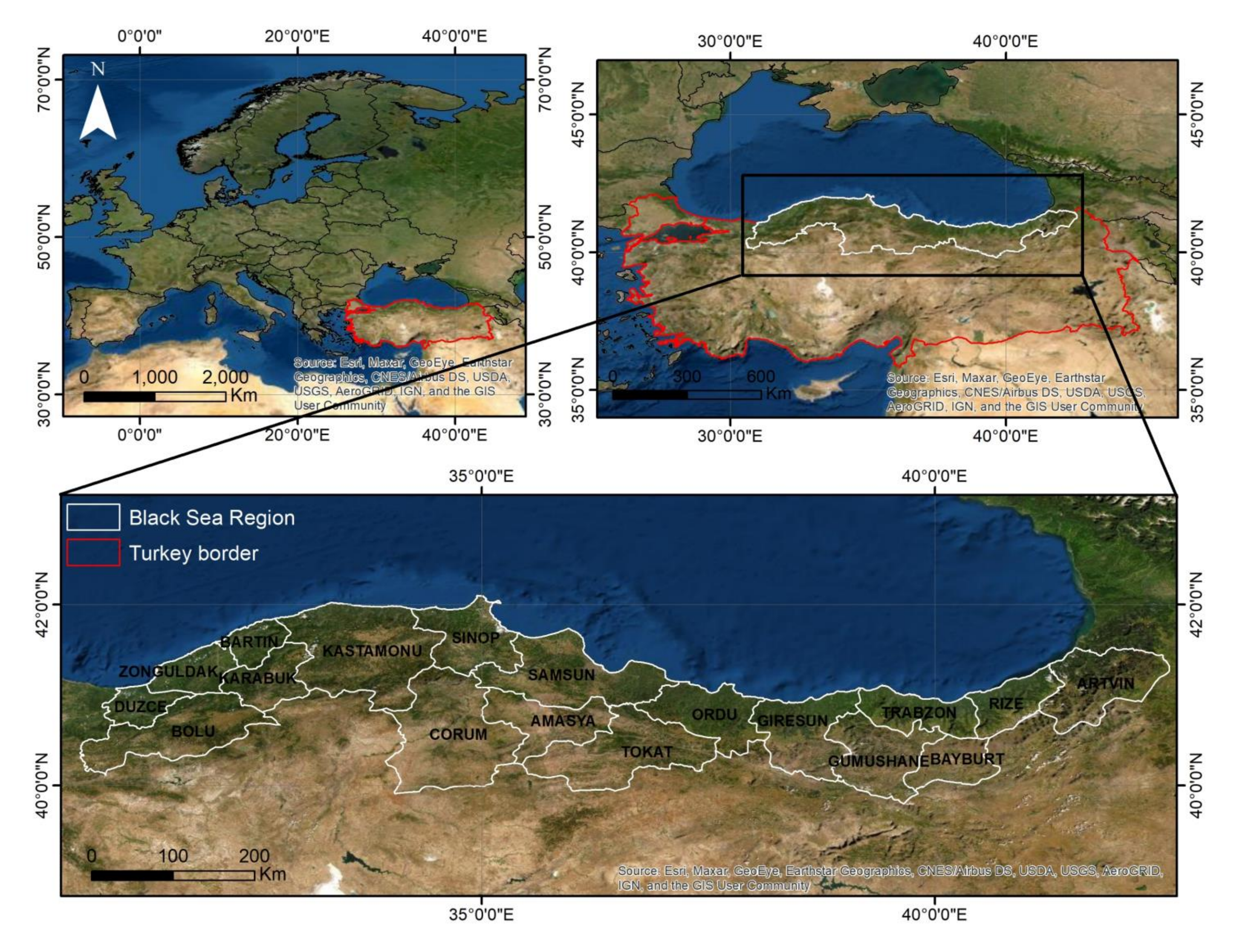


Figure 1. Study area

3. Methodology

Step 1
DEM processing

Step 2
Raster calculator and reclassification

Step 3
Raster to polygon and sea level rise scenarios

Step 4
Analysis the impact on the study area through spatial analysis

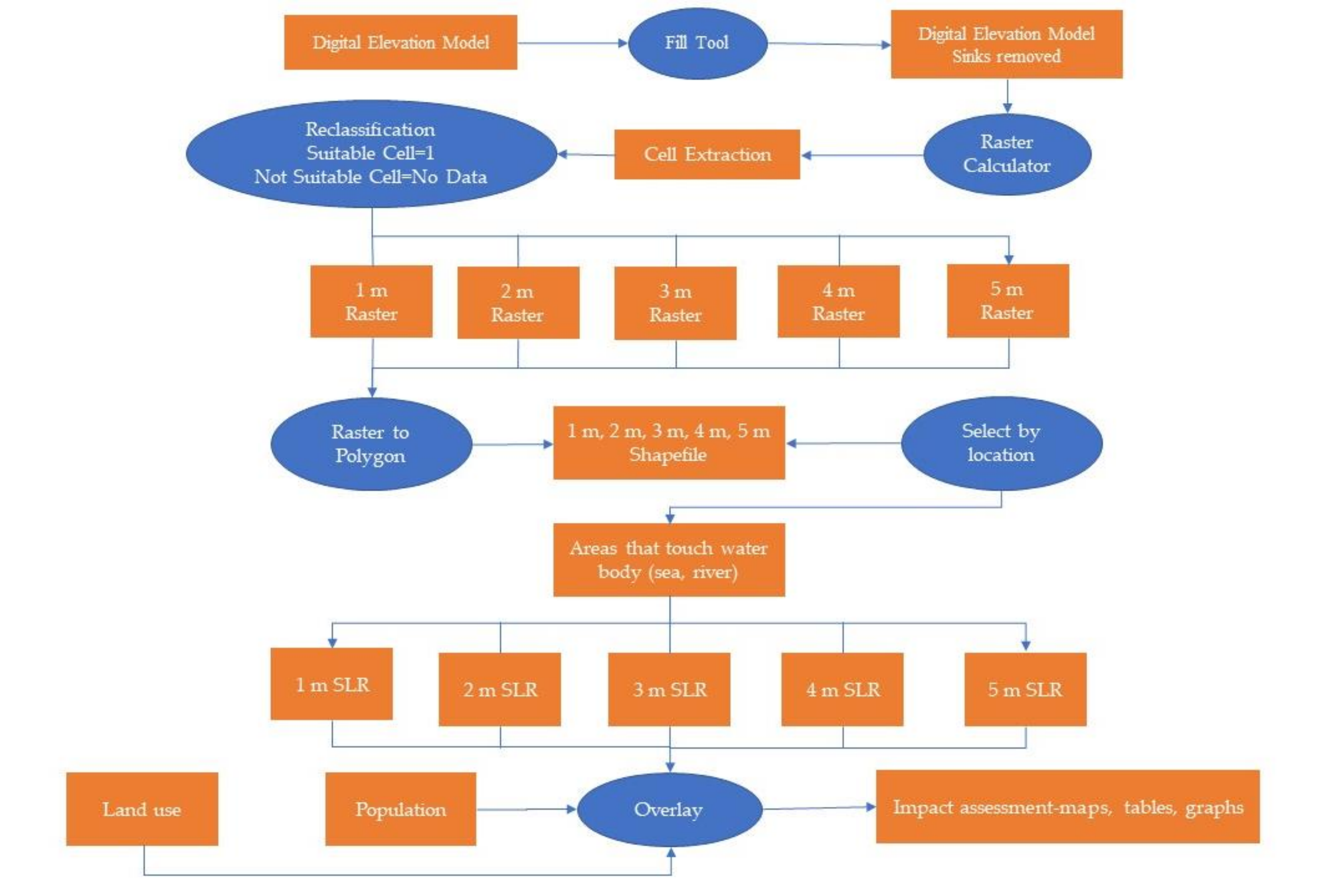


Figure 2. Methodology flowchart

4. Results

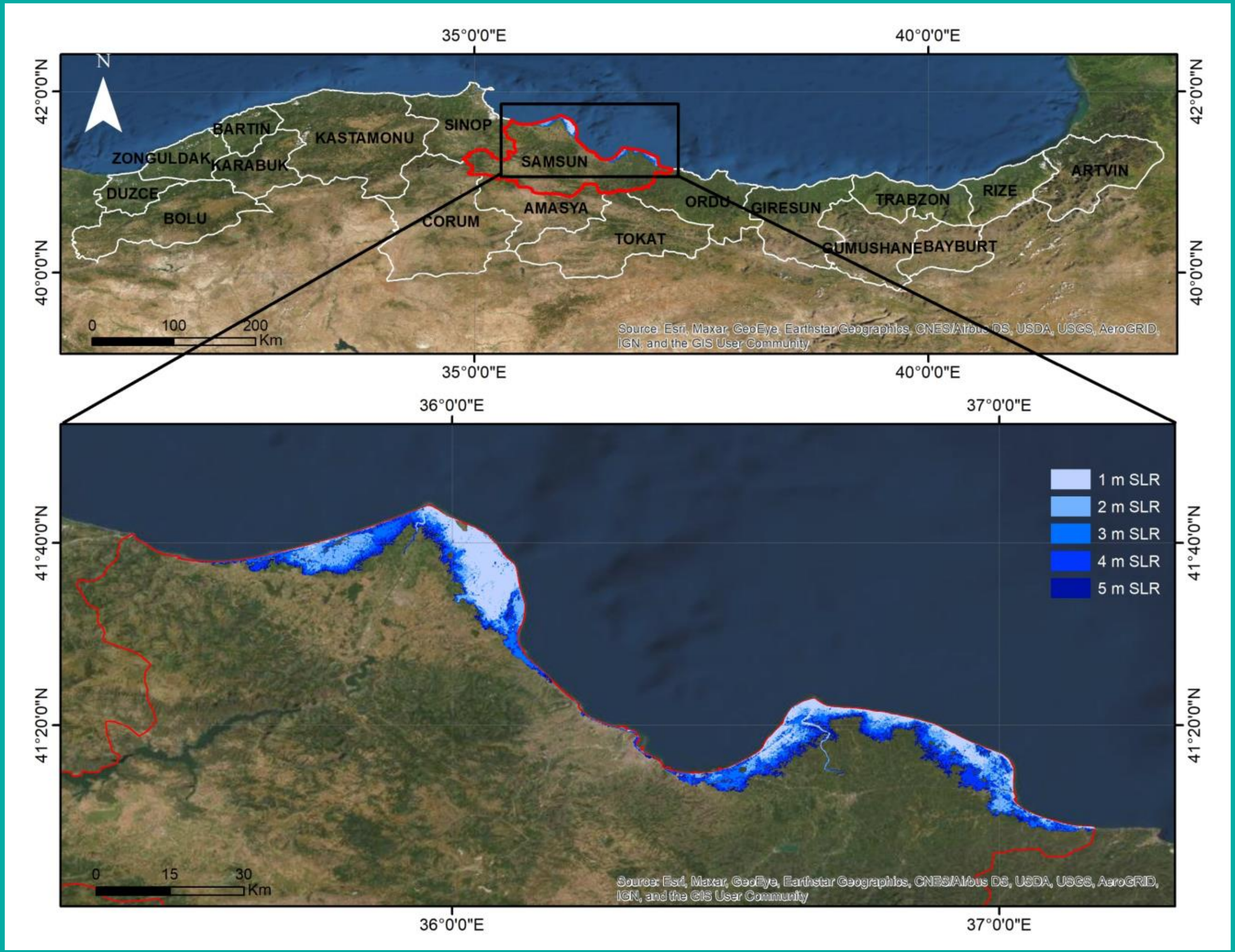


Figure 3. Modeling scenarios on the Samsun province coast

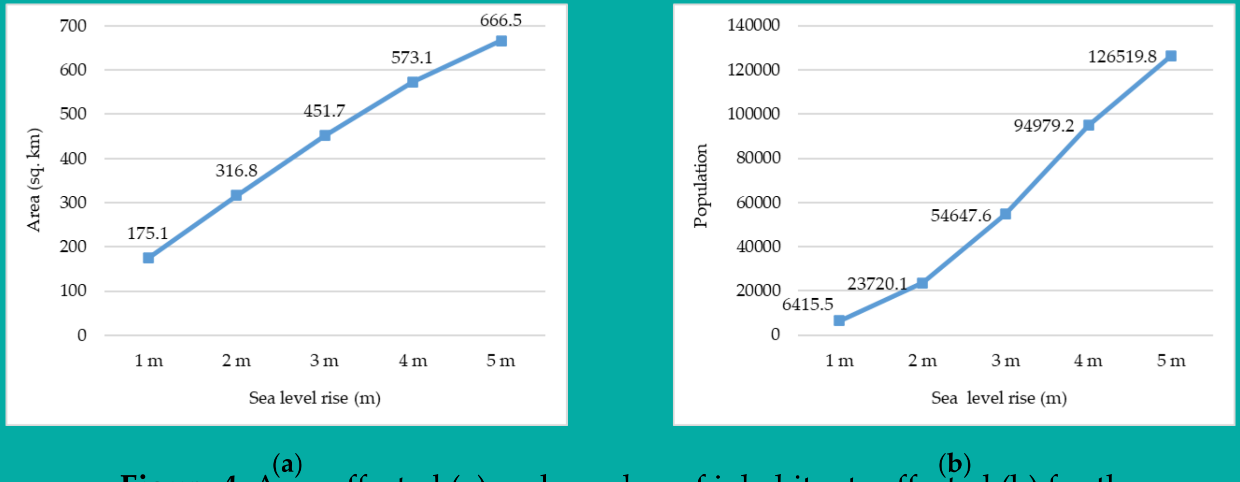


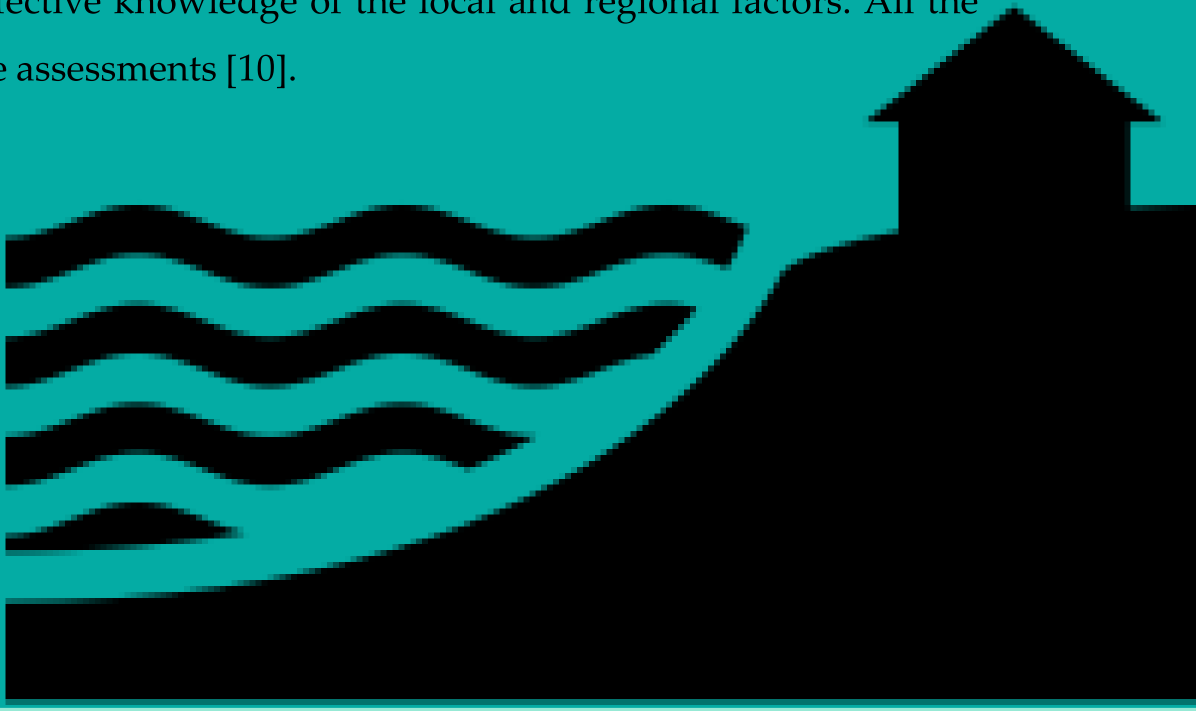
Figure 4. Area affected (a) and number of inhabitants affected (b) for the five scenarios of sea level rise

Table 1. Land use categories affected for the five scenarios of sea level rise

Land use	1m	2m	3m	4m	5m
Artificial surfaces	1.2 sq km	5.30 sq km	13.8 sq km	23.2 sq km	29.8 sq km
Agricultural areas	52.3 sq km	149.4 sq km	255.4 sq km	355.2 sq km	434.6 sq km
Forest and semi natural areas	17.8 sq km	32.9 sq km	48.2 sq km	57.9 sq km	63.8 sq km
Wetlands	66.4 sq km	89.1 sq km	93.1 sq km	94.4 sq km	94.9 sq km
Water bodies	37.4 sq km	40.1 sq km	41.2 sq km	42.4 sq km	43.4 sq km

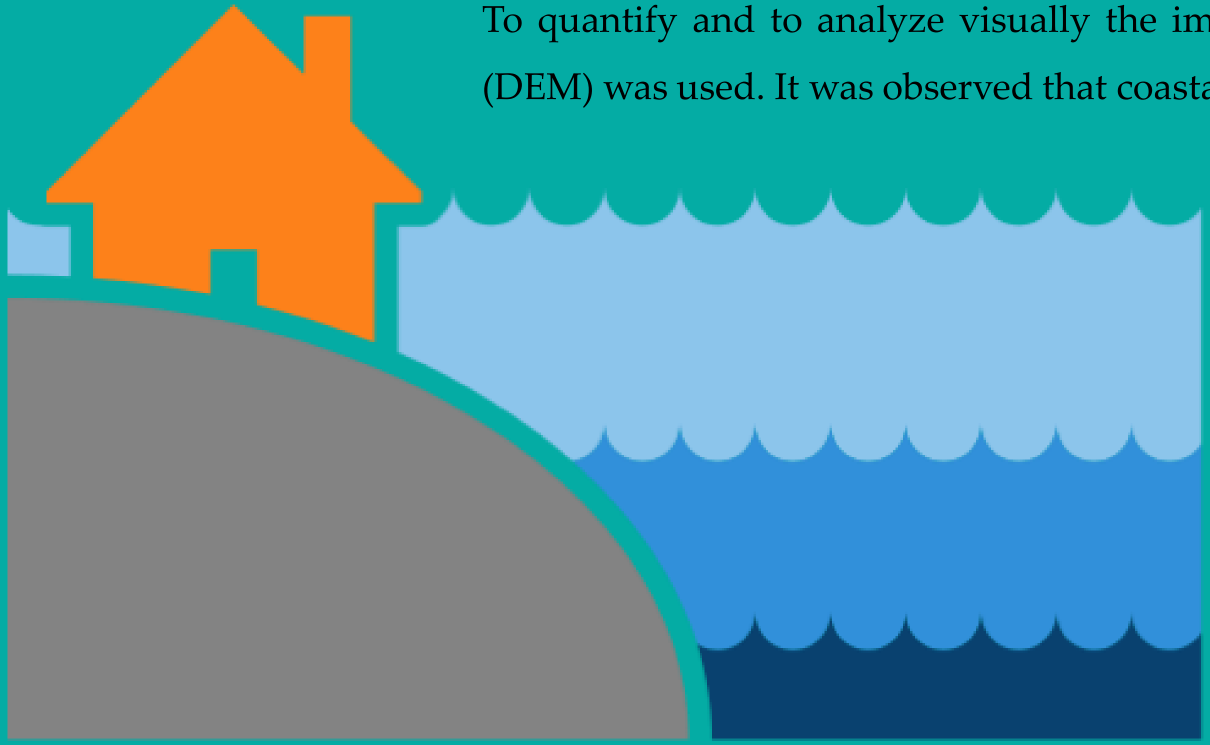
5. Discussions

- Sea level rise along the Turkish coast is not significant as in some other areas around the world but there will be local vulnerability. Coastal erosion and flooding along Turkish shorelines are problems of national significance. Generally there is a lack of regional, national and specific data.
- At this time, sea level rise scenarios are difficult to develop due to defective knowledge of the local and regional factors. All the uncertainties must be considered when explaining impact and response assessments [10].
- The modeling presented offers an alternative to identify critical areas, where rising sea levels can have negative effects. The databases used are accessible and can be replicated to other areas. The proposed methodological plus contributes to the completion of these approaches with the spatial design of the phenomenon that can lead to a better understanding of the determinants of a certain level of negative impact of human communities.



6. Conclusions

- The main objective of this research was to create potentially inundated coastal areas for Black Sea Region of Turkey. To quantify and to analyze visually the impact of sea level rise on Black Sea Region the Digital Elevation Model (DEM) was used. It was observed that coastal zone of Samsun province will be the most affected area.



- In order to analyze the sea level rise impact and assess the damage, a model of inundated areas was created. This model in the form of five different sea level rise scenarios was then overlaid on three GIS layers (total surface, population and land use) to assess the impact.
- This study presents a simulation of a different sea levels rise and can be considered by the authorities to implement measures to reduce negative effects.

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THANK YOU!