EXTREME WATER LEVEL PROJECTIONS AT THE COASTAL HERITAGE SITES OF TURKIYE

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INTRODUCTION

Climate change has led to changes in the severity and frequency of extreme weather events, storm surges, and sea level rise, increasing the future extreme water levels (EWL) in many places worldwide. In the scope of The Scientific and Technological Research Council of Turkiye (TUBITAK) funded project "Vulnerability of Coastal Cultural Heritage Areas to Sea Level Rise and Its Impacts," a preliminary statistical and spatial analysis has been carried out to investigate the projected EWLs at the coastal cultural heritage sites of Turkiye. The objective of this study is (i) to determine those cultural and natural heritage sites having higher EWLs, (ii) to discuss using rates of change of EWLs as a classification for flooding risks due to EWL, and (iii) to compare different EWL datasets in the literature under various RCP scenarios within the context of vulnerability of the coastal areas with heritage characteristics.

METHODOLOGY

The heritage sites at the coast of Turkiye are extracted as GIS (Geographic Information System) layers from the open-source ATLAS database (www.atlas.gov.tr) of Ministry of Environment, Urbanization, and Climate Change. The EWL projections obtained from the studies of Large Scale Integrated Sea-level and Coastal Assessment Tool (LISCOAST, Vousdoukas et al., 2018) and Kirezci et al. (2020) are assigned to the coastal heritage sites in the QGIS environment. These databases provide the probabilistic EWL projections for Representative Concentration Pathways (RCPs) 4.5 and 8.5. RCPs are emission rate scenarios described by the Intergovernmental Panel on Climate Change (IPCC), where RCP4.5 is a moderate pathway, and RCP 8.5 is considered the worst case. The projected EWL for 2100 and the changes during BL-2100, BL-2050, and 2050-2100 are investigated for every data point nearest to the heritage sites around Türkiye. Table 1 shows the range of the results for both datasets of EWLs.

Table 1. The ranges of the investigated parameters of EWL at the coastal heritage sites of Turkiye

Data Base	RCP Scenario	EWL for 2100 (m)	% change BL-2100	% difference BL-2050 and 2050-2100
LISCOAST	RCP4.5	1.12-1.65	34%-70%	-0.8%-+12.7%
	RCP8.5	1.44-1.94	57.3%-118%	+7.8%-+18.6%
Kirezci et al. (2020)	RCP4.5	0.65-1.4	46.6%-200%	-29%-+1%
	RCP8.5	0.85-1.6	68%-287%	-10%-+12.9%

RESULTS

The results based on the LISCOAST dataset show that most heritage sites are projected to have EWLs higher than 1.35m for the next century. Based on the RCP 4.5 scenario, 32 % of the archeological coastal cultural heritages and 26% of the natural heritage sites will have an EWL above 1.5 m. Under RCP 8.5, 56% (archeological) and 39% (natural) of the coastal heritage sites will have an extreme water level above 1.7 m. Kyzikos Ancient City in Balikesir is expected to have the maximum EWL reaching 2 m. For the moderate RCP scenario, 32% of the archeological heritage sites and 29% of the natural heritage sites will experience at least 50% of EWL increase in 100 years. Although there are some exceptions, there is a significant acceleration trend of EWLs between 2050 and 2100 for the shorelines with heritage characteristics (90% of the sites for RCP4.5 and 100% for RCP8.5). 9% of the archeological sites and 4% of the natural heritage sites are expected to have EWL doubled under RCP8.5.

While similar trends in EWLs are determined with Kirezci et al. (2020) dataset, there are some notable differences for the Turkish coast. One such difference is that the RCP8.5 projections of Kirezci et al. (2020) dataset is already within the projected values of LISCOAST dataset for RCP4.5 scenarios indicating a significant reduction of expected impact in terms of flooding for the same regions. In contrast, the rate of change is significantly higher, almost double LISCOAST values. Furthermore, some locations indicate a deceleration in the rate of sea level rise after 2050, which is another outcome. Still, the heritage sites expected to be threatened by flooding due to EWLs are 90% similar, indicating that these coastal areas should be considered for further assessments, which is the main objective of the TUBITAK-funded project. In addition to these initial results, the possible reasons for the differences between the two datasets and the consequences on the coastal heritage sites and their prioritization based on vulnerability and adaptation will be discussed.

REFERENCES

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