



## Visualization of the spatial extent of flooding expected in the coastal area of Algiers due to sea level rise. Horizon 2030/2100.

Rima Amoura<sup>\*</sup>, Krime Dahmani

University Bida, Laboratory of Environment and Technology for Architecture and Cultural Heritage (Lab ETAP), Institute of Architecture and Urban Planning (I.A.U.), BP 270, Bida, DZ080, Algeria

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### ABSTRACT

Sea level rise, one of the major consequences of global warming, is one of the most expected phenomena of the 21st century. Coastal areas, due to their geographical location, will be exposed to extreme weather events, such as flooding. This study evaluates the impact of sea level rise on the center of the capital of Algeria, with decennial and centennial occurrence. It is based on an empirical method to improve the assessment of extreme levels, taking into account several parameters (the astronomical tide, the surge of waves, the rise due to a decrease in atmospheric pressure, and scenario of sea level rise), calculated from the formula of Hootsmans, superimposed on a digital terrain model of 3 m resolution to delimit the potentially submersible areas, all integrated into a geographic information system (QGIS 3.10).

The calculation of the vulnerability of our case study was based on scenarios of 0.2 m in 2030 and 0.65 m in 2100. Our results allow us to map the land at risk of flooding and indicate that 26% and 36% of the study area will be submerged by a respective flood level of 5m to 8 m, in conjunction with extreme weather and sea events. The most severely affected sectors are expected to be the port of Algiers with its piers, the port terraces, the central urban area, the reserve corridor, the Hussein-Dey waterfront, the Sportsplex, and the Algiers Opera. The study stresses the importance of developing adaptation strategies to the risk of marine submergence in order to reduce damage such as raising the protective structures above the maximum level of flooding, taking into account the hazard by the regulations in force, planning the growth of issues, the development of prevention plans. This study allows us to analyze the future exposure of this territory to the different processes involved and highlights the vulnerability of the coastal areas studied. It provides valuable information for decision makers and coastal managers to guide and readjust future development in the most exposed areas, especially the port conversion of Algiers planned in 2030 by the master plan of development and urbanism.

### 1. Introduction

Middle East, belonging to the greater MENA (Middle East and North Africa) region, which had 60 million inhabitants in 2010, could be home to nearly 100 million people by 2030. Owing to their seaside location, they are really exposed to natural hazards due to the effects of climate change such as coastal erosion, flooding and marine submergence (Emmerson et al., 2016). Sea level rise is one of the consequences of global warming, caused by the phenomenon of thermal expansion of water masses and the melting of polar ice caps, it represents one of the most expected phenomena of the 21st century (El Hage et al., 2011). This phenomenon is topical, it extends globally, and affects the majority of coastal cities, as the case of the Maldives Islands threatened with

submergence, it represents an alarming sample that prefigures the risks and the future of coastal areas (Amoual, 2019). Among the coastal risks to which the coasts are exposed, the risk of marine submergence is a recurrent concern of the states, due to its serious impact on the natural environment and socio-economic sectors (Uwarakish et al., 2009; Garcia et al., 2012; Timmerman et al., 2021). According to the latest report (IPCC, 2021), the phenomenon of sea level rise is becoming a concern due to its acceleration worldwide, and it will continue to increase in the coming centuries, which will increase the frequency and severity of the phenomena on the coast. Based on the digital terrain model and geographic information system (GIS), it has been shown that visualization of land at risk of flooding due to accelerated sea level rise, is possible and crucial for coastal vulnerability assessment (Kulu et al.,

<sup>\*</sup> Corresponding author.

E-mail addresses: [rymasmoura@etu.univ-bida.dz](mailto:rymasmoura@etu.univ-bida.dz), [rymasmoura@yahoofr.fr](mailto:rymasmoura@yahoofr.fr) (R. Amoura), [dahmani.krime@univ-bida.dz](mailto:dahmani.krime@univ-bida.dz) (K. Dahmani).