

Flooding assessment under sea level rise scenarios: Ria de Aveiro case study

Lopes, CL., Azevedo, AR. and Dias, JM.
CESAM and Physics Department of University of Aveiro
e-mail: carinalopes@ua.pt; de.azevedo@ua.pt; joao.dias@ua.pt

Sea level rise is an important consequence of climate change with a significant impact on society and ecosystems. In general the physical impacts of sea level rise in coastal areas are inundation of low-lying coastal areas, landward intrusion of salt water in estuaries and aquifers, coastal erosion and ecosystems loss. However the response of each ecosystem depends on its physical features and on the rate of local sea level rise. Thus, it is a fundamental task to locally assess the effects of sea level rise on coastal ecosystems in order to improve the tools for vulnerability assessment.

The present work aims to determine the flooded areas around Ria de Aveiro (Portugal) in response to sea level rise, applying the hydrodynamic model ELCIRC, previously implemented for this coastal lagoon with success. However, as this study aims to assess the changes in the lagoon marginal flooding, the previous configuration was improved by including the intertidal areas and margins topography in the numerical grid. The present configuration was validated comparing model predictions with sea surface elevation data recorded at several stations distributed throughout the lagoon. The root mean square and the SKILL were computed in order to quantify the adjustment between predicted and observed sea surface elevation, and the results reveal that a good agreement was found. Once validated, the model was used to simulate the lagoon flooding under present mean sea level and under two local sea level rise scenarios. The sea level rise scenarios considered were 42 and 64 cm, which were established according to a previous study about the sea level change for the Portuguese coast. The lagoon flooded area, the tidal prism and the flood extent were evaluated for each model configuration.

Generally, the model results suggest that tidal prism raise in response to the sea level rise, leading to an increase in lagoon flooded area and in the salinity intrusion. The flood extent maps reveal that the margins of main channels head are the regions with a higher risk of inundation. Also, the lagoon flooded area further increases with the magnitude of sea level rise, evidencing the low height of the lagoon margins. These results indicate that some activities and infrastructures developed in the lagoon margins can be at risk, demonstrating that agricultural fields and residential areas will be more frequently inundated by saltwater if these sea level rise scenarios will be confirmed.