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Relative role of climatic factors and anthropogenic actions in the water quality and ecological dynamics of the Aveiro lagoon (Portugal)

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The Aveiro lagoon harbours one of the largest saltmarshes in Europe, with a significant role of ecological services, supporting at the same time several economic activities that might impact its water and ecological quality. Besides the pressures associated with human activities, the impacts of climate change in estuarine ecosystems are also matter of concern worldwide. In this context, understanding the systems' natural variability, the impacts of climate change and the relative role of anthropogenic pressures is essential to ensure estuarine ecosystems' long-term management. Thus, this study evaluates the influence of climatic factors and anthropogenic pressures on the water quality and ecological dynamics of the Aveiro lagoon based on an integrated approach. This approach combines the analysis of long time series from the past 25 years and high-resolution numerical modelling of future scenarios of climate change (increase in air temperature, changes in the precipitation regimes and sea level rise) and anthropogenic interventions (dredging, a marina construction and emergency by-pass wastewater discharges) in the lagoon.

The analysis of the spatial and temporal patterns of variability of the water and ecological quality in the Aveiro lagoon at different scales, based on historical data from 1985 to 2010 complemented by the campaigns performed, suggested a combined influence of the climatic variability and anthropogenic interventions. Future scenarios of climate change and anthropogenic interventions simulated revealed a larger influence of climate change when compared with the analysed anthropogenic actions. The most important variations from the reference scenario are predicted for the sea level rise scenarios, followed by the changes in the hydrological regimes scenarios, putting in evidence the main role of circulation (tide and river flow) in establishing the water quality and ecological dynamics in the lagoon. A significant decrease of chlorophyll a and nutrients is predicted in the downstream and middle areas of the channel due to sea level rise, while a significant salinity increase is predicted upstream. These changes may promote modifications in the communities' distribution and composition, affecting the food web and promoting a progression further upstream of the marine species. Results also suggest that the identified effects may be more important in shallow estuaries.