Small estuary, big insights: Mapping water level and temperature variability in the Alvor estuary under climate change scenarios

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Accurate prediction of water temperature is crucial for informed decision-making in aquaculture, influencing factors such as fish growth, feeding rates, and disease occurrence. Coastal numerical models are employed for this purpose, but predictions are susceptible to uncertainties in input data. Additionally, water level prediction is vital for optimizing pumping operations in aquaculture systems, where tank water renewal is accelerated through pumping [1].

This work highlights a study conducted in the Alvor estuary, in the Portugal's southern region, focusing on improving the quality of water level and temperature predictions by analyzing physical forces, particularly meteorological and oceanographic factors, influencing residual tides. The research also evaluates the impact of rising sea levels and air temperatures on water levels and temperatures in the context of global climate change.

The study's two primary objectives are: analyzing different datasets for various variables, validating them, and comparing model errors under different meteorological and oceanographic conditions; and utilizing the hydrodynamic model MOHID to create realistic climate change scenarios for the Alvor estuary. These scenarios include increases in mean sea level, air temperature, and river flow.

Data from January 2019 to April 2021, obtained from monitoring stations and the MOHID model [2] via the AquaSafe platform, were analyzed [3, 4]. The model underwent validation and sensitivity analysis, revealing minimum RMSE values of 0.11 m for water level and 0.74 °C for temperature.

The study revealed that sea level rise significantly influences water level increase in the Ria de Alvor, and the response of water temperature is directly influenced by the rise in air temperature. These findings not only enhance comprehension of estuarine hydrodynamics in the region but also enable an assessment of the potential impacts of climate change on water temperature, water level, and velocity.

The study provides valuable insights into the hydrodynamic behavior and tide propagation within the Alvor estuary, addressing a significant knowledge gap in the region where literature is scarce. The climate change scenarios developed using MOHID contribute to an improved understanding of potential future impacts on water temperature, water level, and velocity in the estuarine system.

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Keywords
Numerical Modelling; MOHID; Alvor Estuary; Hydrodynamics; Climate Change Scenarios; Harmonic Analysis