

## Application of the State of the Art of Hydraulic Models to Manage Coastal Problems, Case Study: The Egyptian Mediterranean Coast Model

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**Abstract :** Coastal problems are stressing the coastal environment due to its complexity. The dynamic interaction between the sea and the land results in serious problems that threaten coastal areas worldwide, in addition to human interventions and activities. This makes the coastal environment highly vulnerable to natural processes like flooding, erosion, and the impact of human activities as pollution. Protecting and preserving this vulnerable coastal zone with its valuable ecosystems calls for addressing the coastal problems. This, in the end, will support the sustainability of the coastal communities and maintain the current and future generations. Consequently applying suitable management strategies and sustainable development that consider the unique characteristics of the coastal system is a must. The coastal management philosophy aims to solve the conflicts of interest between human development activities and this dynamic nature. Modeling emerges as a successful tool that provides support to decision-makers, engineers, and researchers for better management practices. Modeling tools proved that they are accurate and reliable in prediction. With its capability to integrate data from various sources such as bathymetric surveys, satellite images, and meteorological data, it offers the possibility for engineers and scientists to understand this complex dynamic system and get in-depth into the interaction between both the natural and human-induced factors. Enabling decision makers to make informed choices and develop effective strategies for sustainable development and risk mitigation. The application of modeling tools supports the evaluation of various scenarios by affording the possibility to simulate and forecast different coastal processes from the hydrodynamic and wave actions and the resulting flooding and erosion. The state-of-the-art application of modeling tools in coastal management allows for better understanding and predicting coastal processes, optimizing infrastructure planning and design, supporting ecosystem-based approaches, assessing climate change impacts, managing hazards, and finally facilitating stakeholder engagement. This paper emphasizes the role of hydraulic models in enhancing the management of coastal problems by discussing the diverse applications of modeling in coastal management. It highlights the modelling role in understanding complex coastal processes, and predicting outcomes. The importance of informing decision-makers with modeling results which gives technical and scientific support to achieve sustainable coastal development and protection.

**Keywords :** coastal problems, coastal management, hydraulic model, numerical model, physical model

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