



## **GOLFEM a finite element model for the management of the Goro lagoon, Italy**

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The Goro lagoon, with an area of about 2,000 hectares, is part of the Emilia-Romagna territory of the Po Delta Park, enclosed between two branches of the wide delta of the river Po (Po of Goro and the Po of Volano). It is a transitional environment among inland fresh waters and external marine waters, in a continuous morphological evolution.

This lagoon is internationally known for the production of mollusks (in particular clams, that in these sandy bottoms, on average 60-70 cm, find their ideal habitat to grow and develop): the first production area of clams in Italy and Europe and the second one in the world. It is also a protected environment (with a wide variety of wildlife): RAMSAR area, SCI (Site of Community Importance) and SPA (Special Protection Area). Part of the barrier that separate the lagoon from the open sea is a National natural reserve as well. Finally, it is an important bathing attraction for the Emilia-Romagna region, with 15 bathing resorts and around 30,000 visitors/year, and an important port hub.

The natural evolution of the lagoon mouth, due to the progressive extension of the barrier that separate the lagoon from the open sea, causes a gradual reduction in the exchange between the internal and the external waters. This condition leads to a lower water turnover, to a lower tidal currents hydrodynamic circulation inside the lagoon and a consequent reduction of the water mixing capacity with a reduction of the transport capacity of good quality water compounds.

Hence, the Goro lagoon is an environment of high strategic, environmental and socio-economic value, in continuous evolution and that requires constant support from the Region and Institutions, and maintenance interventions in order to preserve its valuable habitat.

For these reasons we started to develop a high-resolution coastal numerical model, GOLFEM (Goro lagoon Finite Element Model), as a decision support tool for the planning of topo-bathymetric interventions and variations as well as of the management of water exchanges between the sea and the Po river. The numerical model is based on SHYFEM-3D, already developed and operationally tested on many lagoons, transition and coastal areas. The model uses an unstructured grid with variable resolution and a semi-implicit time integration scheme that allow the maximum versatility in the definition of horizontal resolution. The model is driven at the surface by the high resolution COSMO atmospheric fields and at the boundary by the operational oceanographic model AdriaROMS, both large scale models operational at the Hydro-Meteo-Climate service of Arpae (Arpae-SIMC). GOLFEM is set up to answer the following management questions: how large is the impact of channel dredging on the local hydrodynamics? How large is the impact of different freshwater inputs in the lagoon? The answer to these questions requires a specific consideration of uncertainties due to the space-time variability of the forcings and the hydrodynamics. The presentation will show that such a modeling approach is capable to be used as a management tool of the Goro lagoon and more generally of human impacted coastal areas.