



Sediment distribution and hydrodynamic patterns in the Cabras Lagoon, Italy

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Hydrological parameters such as water currents, surface elevation and transport time scales have been assessed by many authors to be fundamental parameters for the understanding of the ecological processes that interest lagoon environment.

In many works, the variability of the water circulation and water transport time scale within the basin, has been used to describe the variability of important environmental features such as the dissolved nutrient concentrations, the mineralization rate of organic matter in the bottom sediment and in the water column, the primary production, the dissolved organic carbon concentration and the distribution of phanerogames in the bottom.

Therefore, the comprehension of these hydrodynamic processes is of major interest in the environmental management of lagoons and coastal basins. Nevertheless also sediment dynamics in lagoon environments are mainly dependent on the water circulation induced by the meteo-marine forcings.

In this work the water circulation of a micro tidal lagoon located along the Sardinian West coast (Italy), the Cabras Lagoon, have been investigated by means of a 2D hydrodynamic model. The main lagoon hydrodynamic features such as the root mean square current velocity (RMSV), which gives a good estimate of the hydrodynamic activity, and the water residence times (WRTS), which gives informations about the flushing features of the basin and which is mainly influenced by the tidal action, have been computed when the basin is forced by the tide and the main wind regimes.

The obtained results have been compared with the lagoon bottom sediment distribution in order to detect the main factors influencing the sediment transport processes in the

basin.

Factor analysis has been carried out between hydrodynamic variables, RMSV and WRTS, and the main sedimentological variables characterizing the sediment distribution of the basin such as the grain size parameters, the ratio between the sortable and non-sortable sediment fraction (SO) and the ratio between the silt and clay sediment fraction (SC).

The results indicate a strong correlation between the distribution of the water circulation intensity (RMSV) and the distribution of the fine sediment fractions. In particular, as the RMSV values increase, the amount of sortable and silt fraction increase with respect to the non-sortable and clay fraction respectively over the basin.

Furthermore no correlation between WRTS and any of the considered sedimentological variables have been found. This can be explained being the tidal forcing very weak and therefore the tidal induced water circulation not influencing the basin sediment distribution.

Being RMSV the only hydrodynamic variable explaining most of the sedimentological dataset variance, it can be considered as a good estimator of the influence of hydrodynamics on the sediment spatial variability and, therefore, as the main factor influencing the sediment transport process in the basin.

In order to confirm this hypothesis, a grain size trends analysis, based on the vectors transport, have been applied over the whole sedimentological dataset to determine the residual sediment transport pattern in the Cabras lagoon and the results compared with the RMSV distribution.

The results reveal that the sediment transport in the basin is directed from areas characterized by high RMSV values toward areas with low RMSV values. Furthermore, over the most part of the lagoon, the transport direction is accordance with the RMSV gradient direction and not with the water current direction.

Therefore, in the Cabras lagoon, sediment transport processes are governed mainly by diffusion processes which tend to transport fine suspended sediment particles from highly diffusive areas along the lagoon borders, which are characterized by high RMSV values, to low diffusive areas in the lagoon centre, characterized by low RMSV values.

From a sedimentological standpoint the Cabras lagoon, is much more similar to an enclosed basin such as a lake, in which coarse sediment are generally found along the borders and fine sediments are found in the centre of the basin, than to a semi-enclosed basin such as a lagoon in which the sediment grain size distribution is influenced by

the tidal action and is generally characterized by a sea-lagoon positive gradient.