

Sediment dynamics in artificial nourishments

Carlos Coelho¹, Margarida Ferreira¹, André Guimarães¹, Paulo A. Silva²

Serious erosion problems related to significant negative sediment budgets in the coastal systems have been identified worldwide. Artificial nourishments are a coastal erosion mitigation strategy that compensates the negative sediment budgets by adding sediments to the coastal system. The coastal processes' complexity, the sediment transport dynamics and the morphological impact of artificial nourishments are difficult to assess. Cross-shore and longshore sediment transport distribution, shoreline evolution impacts after nourishments, longevity of the nourishment, and its interaction with other coastal interventions are some of the topics under research and discussion, supported by physical and numerical modelling.

Hydrodynamic, sediment transport, and morphological variations due to the presence of a nearshore nourishment were monitored in a reduced scale 3D movable bed physical experiment (Figure 1). The nourishment enlarged the emerged beach width, inducing an increase in the flow velocities range and suspended sediments concentration, which led to an overall increase of the total sediment transport. Looking at the morphological and volume variation over time (Figure 2), the authors

were able to assess the lifespan of the nourishment in the reduced scale model, as well as its impact on the sediment transport rates.

The artificial nourishment effects on the longshore sediment transport and shoreline evolution were simulated with the LTC numerical model to assess the sediment's permanence at the deposition site and the re-nourishment frequency. The results also show an increase of the overall beach width, with the greatest nourished volume scenarios presenting the highest area gains. However, by distancing even further the beach from its dynamic equilibrium, the sediment transport rates are superior for the greater volumes' scenarios. These sediment transport rates decrease overtime, as the beach returns to its original dynamic state.

1 – Department of Civil Engineering & RISCO, University of Aveiro
2 – Department of Physics & CESAM, University of Aveiro

FIGURE 1
View of the laboratory experiments in a wave tank.

FIGURE 2
Bathymetric and topographic digital model terrain of the beach, along time.

