ADCP and CTD evaluations of the nepheloid-layer pathway for a *mathematical dredging* of relict sand for beach nourishment (Tuscany, Italy)

M. Capello[1,*], G. Budillon[1], L. Cutroneo[1], M. Castellano[1], M. Muzzi[1], N. Bigongiari[2], N. Ruggieri[1], R. Micheli[2], L.E. Cipriani[3], A. Ciappa[1], M.C. Focone[1], P. Povero[1], S. Tucci[1]

[1] CONISMA, Via Isonzo 32, 00198 Rome, Italy
[2] CIBM, Viale N. Sauro 4, 57128 Leghorn, Italy
[3] Tuscany Regional Authority, Via di Novoli 26, 50127 Florence, Italy.

Phone: +39-010-353.38143
* e-mail: capello@dipteris.unige.it

Introduction:
To study the evolution of the nepheloid layers during the dredging of relict sands on the Tuscan continental shelf, two oceanographic campaigns were carried out (April and August 2010) with the aim of collecting data on the dynamics and physicochemical characteristics of the water column.
The study areas are two relict sand deposits off Massa and Piombino (Tuscany, Italy); to better protect the environment of the area we also considered the possible routes to be traversed by the dredge when approaching the shore to dump its load.
All the data collected were used to construct a lagrangian model of the sediment diffusion [1], [2], [3].
As the dynamics of the study area are very variable, it is necessary to state that the results of this study furnish possible solutions on the basis of the different situations found during the two study periods.

Methods: The dynamics of the area were studied starting from the parameters considered essential for understanding the processes taking place there: the concentration of the suspended sediment (TSS), the physical characteristics of the water column, and the winds and currents determining the hydrodynamic characteristics of the area.
Simulations of the dispersion of the sediment released during the dredging operations were made in two exploitable sand deposits on the Tuscan continental shelf.
To do this we hypothesized using a Trailing Suction Hopper Dredger (TSHD) to highlight the importance of the overflow during the dredging and along the dredge route.

Results: The data obtained enabled us to characterize the study areas from a physical and dynamic point of view, supplying a good base for the lagrangian model. The results also showed that the sediment movement was “limited” in the area off Massa and that the sedimentation area was mainly inside the same dredging area.
In the case of Piombino, the two different hydrodynamic conditions noted in April and August 2010 highlighted a precise movement and a consequent deposition towards the NE (in April) and W (in August), with deposition areas far from the shore in both cases.

Discussion: The results demonstrate that the main areas of impact depend on the current field utilized in the simulations. This aspect highlights the critical role of the current regime in the study area, which involves sediment dispersion in restricted and identifiable areas (Fig. 1).

References:
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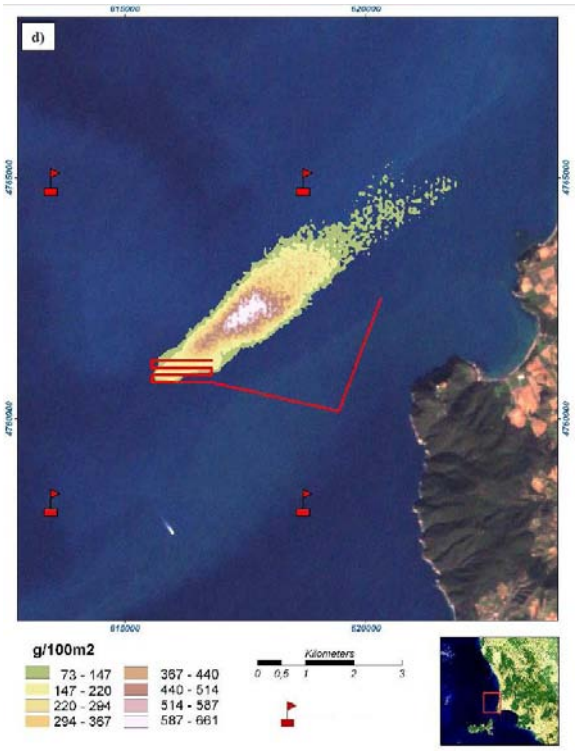

Fig. 1: Example of the simulation of the sediment diffusion (function of the dimensional characteristics).