

A FIVE-YEAR BUDGET OF FINE SEDIMENT IN THE GULF OF LIONS: IMPORTANCE OF INTENSE EVENTS (FLOODS, STORMS AND DENSE WATER CASCADING)

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Abstract

A sediment transport model has been applied to the Gulf of Lions to estimate the budget of fine particles over the period running from December 2003 to December 2008. The consequences of the succession of intense events are examined in terms of sedimentation and resuspension on the different parts of the shelf, and export toward the slope and the deep basin.

Keywords: Coastal Models, Continental Shelf, Sediment Transport, Western Mediterranean

A modelling approach [1] was used to study during a 6-month period in 2003-2004 the effect of marine storms and high rivers discharge on the fate of fine sediment in the Gulf of Lions. This study was extended to a period of 5 years including a variety of hydrologic and hydrodynamic conditions characteristic of the region including an exceptional flood of the different rivers of the Gulf, two severe winters and a few storms associated to moderate to high waves. Thanks to the monitoring of currents, temperature and turbidity performed on the Gulf of Lions slope during several crucial periods [2, 3], the model was first calibrated and validated. The main transport events are satisfactorily simulated. As both velocity and suspended matter concentration are well represented at the moorings localized in the canyon known as the main conduit from the shelf to the slope, the export given by the model is considered as robust. The duration of the simulation (5 yrs) allows to better understand the different mechanisms affecting the fate of fine particles. First the role of the Rhone prodelta on the storage of the river-borne particles, the effect of storms to transport sediment from east to west and the dense water cascading flushing the matter in the canyons of the western part of the Gulf. The role of bioturbation to renew the stock of fine particles in the surface sediment after a storm is also shown. The model is used to integrate the effect of these different mechanisms and to estimate the time constants associated to the transport along the river mouth, shelf, slope and deep sea continuum. A sediment budget of the different parts of the shelf and slope is shown on Figure 1.

has been estimated to lie between 20 and 30 Millions of tons in 5 years. The region of the Cap de Creus is the main pathway for this export. The role of the Cap de Creus canyon is particularly important as it is able to stock after a storm large amounts of matter which can be later flushed by dense water cascading. The affinity of heavy metals with fine particles allows us to give a first estimation of the remobilization of these contaminants by intense events.

References

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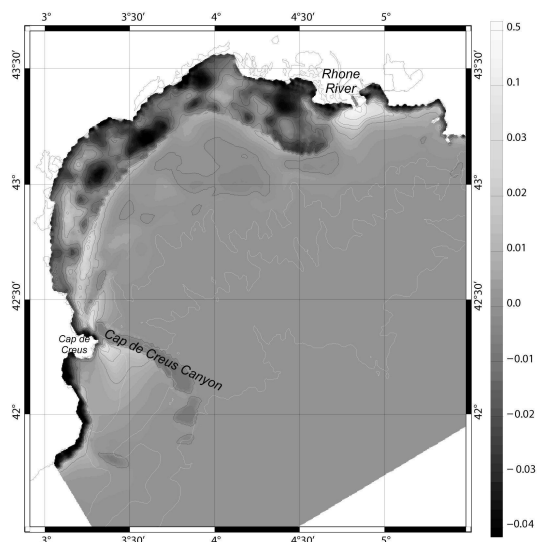


Fig. 1. Sediment budget of the December 2003-December 2008 period in meter. Positive value correspond to deposition, negative values to erosion. White isocontours indicate the 200, 1000 and 2000m isobaths.

Dark colors indicate mean erosion, light colors indicate accumulation. The Rhône prodelta accumulates a large part of the continental particulate input to the Gulf of Lion. Erosion is mainly confined on the inner shelf but the Cap de Creus canyon was also eroded due to the strong currents associated to the dense water cascading of winters 2005 and 2006. The exportation off the Gulf of Lion shelf