

Towards an operational sediment transport model for optimizing dredging works in the Belgian Coastal Zone

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The Belgian Coastal Zone (BCZ) is characterised by shallow waters, with an irregular bathymetry and a systems of sand banks. The bottom sediments generally consist of fine to medium sand. The waters are well mixed due to a high hydrodynamic energy. In the coastal zone, high concentrations of suspended particulate matter occur, where values of a few hundred mg/l are common. The sediments consist here of mud and muddy sands. The high turbidity area results in significant siltation of ports (Zeebrugge and Oostende) and of the navigation channels. Every year, about 10 million ton of dry material - mainly fine-grained sediments - is dredged and dumped back into sea on selected disposal sites. The dumped matter is quickly resuspended and transported away from the disposal sites. Depending on the location of the disposal sites, a significant quantity (up to about 10%) of the dumped matter recirculates back towards the dredging places, resulting thus in an increase of dredging quantities.

To study the recirculation of the disposed fine-grained material, numerical models have been used. In Fettweis and Van den Eynde (2003), a semi-Lagrangian two-dimensional sediment transport model was presented that was used to study the mud balance in the BCZ. The same model was used in Van den Eynde (2004) to simulate the dispersion of (radio-active) material and in Van den Eynde and Fettweis (2006) to investigate the influence of the disposal of dredged material on the sediment balance. The models results have been further validated with long term *in situ* measurements (Fettweis *et al.*, 2010).

The selection of an optimal disposal location, with a high disposal efficiency (low recirculation) is of high economic and environmental concern. It can be achieved by reducing recirculating of the dumped matter towards the dredging places, confining the physical, chemical and biological effects to local areas and keeping the distance between the dumping site and dredging places as short as possible. Different simulations were carried out to investigate how the location of the dumping sites and the meteorological conditions affect recirculation of the dumped material. An operational implementation of fine-grained sediment transport model was set up to predict the recirculation of the dumped material from different possible dumpings sites, taking into account the meteorological predictions for the following days. Using these results the most optimal disposal site can be assigned for the given situation.

References

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