METHODOLOGIE OF SEASONAL MORPHOLOGICAL MODELISATION FOR NOURISHMENT STRATEGIES ON A MEDITERRANEAN BEACHE

Philippe Larroudé[1], Jean-Paul Barusseau[2] and Raphaël Certain[2]

[1] LEGI BP 53 38041 Grenoble, France, larroude@hmg.inpg.fr
[2] Université de Perpignan, Laboratoire d'Etude des Géo-Environnements Marins,
52 av P. Alduy, 66 860 Perpignan, France, brs@univ-perp.fr, certain@univ-perp.fr

Introduction and Objectives

Examples of nourishment tests carried out on the nearshore zone are few and far between in the relevant literature, compared to the many ones undertaken directly on the beach. SAFE, latest European project within the MAST programme, acknowledges the absence of reference documents on this question, although such a technique could presumably constitute a less costly alternative (Hamm *et al.*, 2002).

The use of offshore bars to fight beach erosion, dating back to the 90th, was based on the fact that they represented a substantial reservoir of sediments. That theory turned out to be irrelevant, as beach nourishment requires coarser grain sizes. However, the essential role these bars can play in wave mitigation was evidenced by recent studies. Hence, working on reinforcing existing bars or even adding extra bars is a convincing approach, for they constitute a line of defence with no visual impact and are therefore environment-friendly. The method offers the added benefit of tapping abundant fine sands, easily available offshore, to build up the bars.

In addition, adequate depths in the inner shelf area would facilitate dredging and discharge operations and, the material reclaimed being usually clean, it can therefore be used directly without any processing. The core of the additional bar too could be made from marine muds, also easily available. All these assumptions should, of course, be systematically checked, the purpose of the exercise being to assess, through mid-term bathymetric evolution simulation, the consequences of the implementation of offshore bar nourishment and define the best location.

Procedure and Selected Results

Certain & Barusseau (2006) show that morphodynamic evolution of offshore bars in a microtidal environment and bimodal moderate wave regime follows two different conceptual models, the main one being a seasonal pattern in line with the observed cycle of hydrodynamic conditions.

The morphological evolution in the nearshore region, including its large-scale features, was first investigated using a combination of a commercial 2DH model and a Multi1DH model (Camenen and Larroudé, 2003, 2003b). Simulation of the wave-driven currents was carried out with TELEMAC, a finite-volume elements model, and the SISYPHE sand transport module served to compute sediment transport rates and bed evolution. Since the sediment transport in the surf zone is mainly controlled by undertow, an undertow model (based on Svendsen, 1984) was added to account for that process.

These models were used in the framework of a simulated meteorological cycle describing the seasonal evolution of hydrodynamic factors. Results from monthly 2DH evolution simulations show a perfect fit with field data obtained on the "plage de la Corniche" in Sète (Certain, 2002). Morpho-hydrodynamic feedback of a bar having undergone reinforcing is also examined (see Figure 1).

Acknowledgement

This paper is largely based on research work carried out in the task group Coastal Morphology of the LITEAU programme supported by the French Government and the HUMOR programme supported by the European Community.

References

Camenen B. and Larroudé Ph. (2003), *Comparison of sediment transport formulae for a coastal environment*, Journal of Coastal Engineering, 48, pp. 111-132, 2003.

Camenen B. and Larroudé Ph.,(2003b) Un modèle morphologique côtier pour la création de barres rythmiques*, Revue française de génie civil*, Génie côtier, vol. 7, pp. 1099-1116, 2003.

Certain, R. 2002 Morphodynamique d'une côte sableuse microtidale à barres : le golfe du Lion (Languedoc-Roussillon). PhD Thesis, University of Perpignan, 199 pp.

Certain, R. and Barusseau J.P., 2006 Conceptual modelling of straight sand bars morphodynamics for a microtidal beach (Gulf of Lions, France), submited at ICCE 2006, San Diego.

Hamm, L., Capobianco, M., Dette, H.H., Lechuga, A., Spanhoff, R., Stive, M.J.F, 2002. A summary of European experience with shore nourishment, Coastal Engineering, 47, 237-264.

Svendsen I.A. (1984), Mass flux and undertow in the surf zone, *Coastal . Eng. ,*8, 347-365.

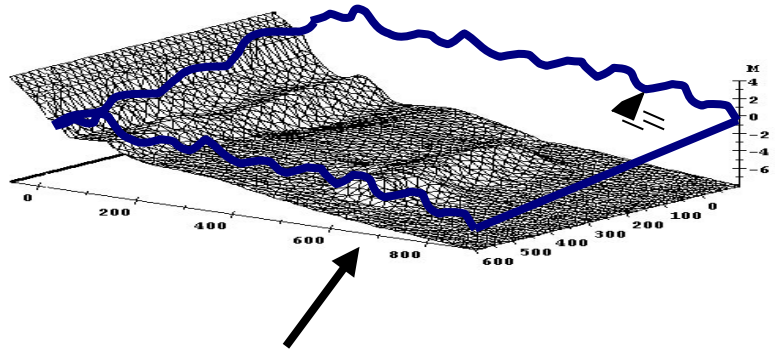

Figure 1: Initial bathymetry used for simulation, based on the data collated on the "plage de la Corniche" in Sète, and the creation of an artificial offshore bar (thick arrow).