L'évolution du rivage et des petits-fonds en Baie de Wissant pendant le xx^{ème} siècle, Pas-de-Calais, France

Coastline and shoreface evolution in the Bay of Wissant, Pas-de-Calais, France

David Aernouts*[1] et Arnaud Héquette*[2]

Résumé

Le littoral de la Baie de Wissant consiste essentiellement en de larges estrans sableux bordés par des massifs dunaires dont la plupart sont fortement attaqués par la mer. L'analyse de l'évolution du trait de côte entre 1949 et 2000, à l'aide de photographies aériennes verticales, a montré qu'une grande partie de la côte de la Baie de Wissant a connu une forte érosion pendant la deuxième partie du XX^{ème} siècle, particulièrement dans sa partie centrale où les rythmes de recul ont été de l'ordre de 4 à 5 m/an. Nos résultats montrent également que l'érosion du littoral s'est presque entièrement généralisée à l'ensemble de la Baie de Wissant depuis le milieu des années 1970. La seule exception concerne le secteur oriental de la baie, à l'est du village de Wissant, où le rivage a au contraire progressé vers le large. La comparaison de levés bathymétriques datant de 1911, 1977 et 2002, a permis de montrer qu'il existe une nette correspondance entre les zones de forte érosion dans les petits fonds et les secteurs d'important recul de la côte, ce qui suggère que l'évolution de la ligne de rivage est fortement liée aux variations morphologiques de l'avant-côte. Dans l'ensemble le bilan sédimentaire de la baie est fortement négatif depuis le début du XX^{ème} siècle, les pertes de sédiments se chiffrant à plus de 100 000 m^3/an. Si l'aggravation de l'érosion littorale pendant le dernier quart de siècle peut en partie être expliquée par des phénomènes naturels comme des variations dans le régime des tempêtes, des facteurs anthropiques ont pu aussi accentuer le déficit sédimentaire de la baie.

Mots clés : dynamique du trait de côte, érosion littorale, avant-côte, Baie de Wissant, Pas-de-Calais

Abstract

The coast of the Bay of Wissant consists mainly of wide beaches and coastal dunes which have been severely eroded for a number of years. A study of shoreline evolution from 1949 to 2000, based on vertical aerial photographs, showed that a major part of the coast of the Bay of Wissant was affected by very severe coastal erosion during the second part of the 20th century, especially in the central part of the bay where coastal retreat rates have been on the order of 4 to 5 m/yr. Our results also indicate that coastal erosion became more extensive, affecting most of the shoreline of the Bay of Wissant since the middle of the 1970's. The only exception concerns the eastern part of the Bay, east of the hamlet of Wissant, where the shoreline conversely advanced seaward. The analysis of 1911, 1977 and 2002 bathymetry surveys shows that there is a strong correspondence between areas of significant nearshore erosion and sectors of coastline which experienced rapid retreat. The overall sediment budget in the Bay of Wissant is strongly negative since the early 20th century, the sediment deficit being in excess of 100 000 m^3/yr. Although the aggravation of coastal erosion during the last decades of the 20th century may be partly explained by natural phenomena such as variations in storm frequency and intensity, anthropogenic factors may have also increased the sediment deficit in the bay.

Key words : coastline evolution, coastal erosion, shoreface , Baie of Wissant, Northern France

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*Laboratoire de Géomorphologie Dynamique et Aménagement des Littoraux – EA 3599, université du Littoral Côte d'Opale 189A Boulevard Maurice Schumann, 59140 Dunkerque, France; [1]aernouts@univ-littoral.fr, [2]hequette@univ-littoral.fr.

Abridged English Version

The coast of the Bay of Wissant consists mainly of wide beaches and coastal dunes, which have been severely eroded for a number of years. A study of shoreline evolution from 1949 to 2000 was carried out using vertical aerial photographs. An analysis of bathymetry changes, down to approximately 20 m water depth, was also conducted, based on 1911, 1977, and 2002 bathymetry surveys in order to assess the morphological variations of the complete coastal profile including nearshore and shoreface environments.

The results of this work show that the central part of the bay was affected by very severe coastal erosion during the second part of the 20th century, with a shoreline retreat in excess of 200 m at several locations even reaching more than 250 m, representing mean annual retreat rates on the order of 4 to 5 m/yr (Fig. 6). In the western part of the Bay, the coastal dunes also underwent erosion, but the retreat rates were lower and more variable, mostly ranging from 0.9 to 3.0 m/yr. Our results also show that the retreat rates are variable through time. The period 1949 to 1977 was characterized by maximum retreat rates of more than 6 m/yr in the centre of the bay, while the coastline was relatively stable or slowly retreating in the western part of the bay during that period. The analysis of shoreline positions indicates that coastal erosion was more extensive between 1977 and 2000, affecting almost completely the Bay of Wissant. The only exception is the eastern part of the bay, east of the hamlet of Wissant, where the shoreline conversely advanced seaward during both periods.

The analysis of bathymetry changes suggests that coastline evolution is strongly related to nearshore morphological variations. There is a very strong correspondence between areas of significant nearshore erosion and sectors of coastline which experienced rapid retreat in the central and western parts of the Bay (Fig. 7). Conversely, east of the hamlet of Wissant, where the shoreline advanced seaward several tens of meters, the seabed in the nearshore zone was either stable or characterized by sediment accumulation. Computation of sediment volume change showed that the net sediment budget in the Bay of Wissant was strongly negative during the 20th century, the sediment deficit being in excess of 100 000 m^3/yr on average. Nearshore seabed erosion mostly occurred in a longshore trough located between the shore and an offshore sand bank (Banc à la Ligne), although this bank also experienced a significant decrease in sediment volume (Fig. 8 & Tabl.1). The decrease in the sediment volume of this bank, which represents a potential sediment source for the beach and coastal dune systems, may have contributed to a decrease in the littoral sand budget.

Bathymetry change analyses also indicate that nearshore erosion proceeded more rapidly during the 1977-2002 period compared to the preceding period, coastal erosion being also more widespread during the later period. Although the aggravation of coastal and shoreface erosion during the last decades of the 20th century may be partly explained by variations in storm frequency and intensity, anthropogenic factors should certainly be taken into account. Both the extraction of marine aggregates in the vicinity of the Banc à la Ligne and the extension in the early 1970's of an harbour jetty at Boulogne-sur-Mer, southwest of the Bay of Wissant, probably increased the sediment deficit in the bay.

This study shows that shoreline evolution in the Bay of Wissant strongly depends on erosion and sedimentation processes that affect the whole littoral profile from the coastal dunes down to the shoreface several meters below sea level. Seabed erosion in the nearshore zone caused a lowering of the level of the intertidal beach, which certainly favoured coastal retreat since lower beach levels result in higher frequencies of water levels that may reach and erode coastal dunes.