ICG2022-254, updated on 28 May 2023
https://doi.org/10.5194/icg2022-254
10th International Conference on Geomorphology

Overwashing and rapid retreat of the gravel spit barrier assessment based on the Orford and Carter (1982) storm impact scale model

Serge Suanez[1], Pierre Stéphan[2], France Floch[3], and Julien Houron[4]
[1](serge.suanez@univ-brest.fr), Université de Bretagne Occidentale, LETG-Brest UMR 6554 CNRS, Institut Universitaire Européen de la Mer, rue Dumont d'Urville, 29280 Plouzané, France.
[2](pierre.stephan@univ-brest.fr), LETG-Brest UMR 6554 CNRS, Institut Universitaire Européen de la Mer, rue Dumont d'Urville, 29280 Plouzané, France.
[3](france.floch@univ-brest.fr), Université de Bretagne Occidentale, Laboratoire Géosciences Océan UMR 6538 CNRS, Institut Universitaire Européen de la Mer, rue Dumont d'Urville, 29280 Plouzané, France.
[4](maison-littoral-pleubian@orange.fr), Réserve naturelle régionale du Sillon de Talbert, 48 Rue du Sillon de Talbert, 22610 Pleubian, France.

The gravel barrier spit of the Sillon de Talbert (North Brittany, France) is a single-ridge swash-aligned barrier stretching over 3.5 km long and it is composed of a volume of sandy-gravel sediments of 1.23 10^6 m^3. Based on annual topomorphological surveys, the morphosedimentary evolution of the Sillon de Talbert was analyzed over the period 2002-2019. The results shown that the barrier spit is driven by both longshore and cross-shore dynamics. However, since cross-shore sediment transfers are dominant comparing to longshore sediment, respectively 430,000 m^3*vs* 52,000 m^3. For the last 80 years (1930-2010), the median section of this barrier spit has displayed an average landward migration rate up to −1.2 $m.yr^{-1}$. However, this barrier retreat rate has increased for the last fifteen years (2002-2017), reaching −2 $m.yr^{-1}$. This evolution of the Sillon de Talbert for the last decades led us to conduct a higher frequency (weekly to bi-weekly) morphological survey based on beach profile measurements along two radials. It was also based on tide and offshore and shallow wave records using modeling (WW3) and OSSI pressure sensor. By increasing the frequency of measurements, the objective was to record the impact of each storm on the morphological evolution of the barrier. It was also a question of better understanding the hydrodynamic functioning modalities involved in the measured morphological changes. Finally, the storm impact scale model of Orford and Carter (1982) was tested using these field measurements. The results show a barrier retreat of −23 to −30 m (*i.e.,* −3.3 to −4.3 $m.y^{-1}$) over the 7-year survey (Sep 2012-Dec 2019). This retreat is related to microscale (10^0 yr) morphogenic events combining storm wave and high spring tide. Over 87% to 90% of the barrier retreat is due to three significant events (February 1-2, 2014, February 9, 2016, and January 3, 2018). The storm impact scale model of Orford and Carter (1982) is tested using the flow depth ($O_{d,q}$) overtopping the crest of the barrier (B_h). Flow depth is thresholded by taking into account the morphological response of the barrier in order to define regimes corresponding to overtopping, discrete overwash, and sluicing overwash. While the Orford and Carter model is generally successful in reproducing the morphodynamic evolution of the Sillon de Talbert, this study shows that the wave energy flux (F) must be considered as an additional parameter in order to improve the fit of the model, so far as it contributes in some cases to change the morphodynamic regime. Thus, the wave energy flux constitutes a key component in the quantification of the water flow across the barrier ($O_{d,q}$)

corresponding to the hydrodynamic forcing of the model, which becomes ($O_{d,F}$).