# THE USE OF ONE-LINE MODEL AND LITTORAL DRIFT ROSE CONCEPT IN PREDICTING LONG TERM EVOLUTION OF THE MOLISE COAST

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Analysis and prediction of long-term evolution of shorelines are challenges engineers and scientists have recurrently to face, especially when structural protection measures exist or are to be planned. This kind of problems are usually addresses via the so called *one contour line* numerical models (*OCL*, e.g. Hanson and Kraus 1989), which assume the submerged beach to follow rigidly the shoreline movements, and account in a simplified manner the main wave-structure interaction processes, including wave diffraction (Goda et al., 1978), wave transmission (Van der Meer et al., 2005, Buccino et al., 2014) and, more rarely, wave reflection (Buccino et al., 2018). Wave climate is indeed a leading input to *OCL*; however, it is often reduced to a single sea-state, which is somehow supposed to rule the entire shoreline evolution. In fact, engineers have long been looking for a wave statistics being simple and, at the same time, capable of explaining the main features of the observed shoreline trends. In this view, the Littoral Drift Rose (LDR) concept (Walton and Dean, 2010) seems to provide a quick and easy engineering way for representing the wave climate over a large area. It is worth highlighting that this *equivalent wave approach* (EWA) is widely employed in the engineering practice, although some literature studies (e.g. Silvester, 1984) seem to indicate it may be not completely appropriate.
Therefore, two issues deserve to be investigated; one is the most convenient way to select the climate-equivalent sea state, given the lack of widely accepted procedures. The other is assessing at which extent EWA could explain the long term evolution of shorelines, when used to force a one contour line model.
To have a deeper insight on the issues above stated, a medium-term (2004-2016) shoreline change study of Molise coast (southern Italy) has been presented, and attention has been drawn to a 5 Km long reach (Trigno river mouth) located in the northern part of the region. The coast is exposed to the Adriatic Sea climate, which is inherently bimodal. The equivalent wave climate, obtained from the LDR concept, has been used as a deep water forcing to run the GENESIS one-line model. The analysis has been conducted using the Linear Regression Rate (LRR) as indicator of the coastline evolution.
The location and characteristics of the main erosion/accretion areas indicate a dominant NW to SE longshore sediment transport, and the most intense erosion has been occurring at the mouth of the main rivers Trigno and Biferno. Numerical simulations conducted with GENESIS have shown that the use of the "Equivalent Wave" as stationary forcing, may lead to a reasonable prediction of shoreline response behind several structure systems over the whole Molise coast. Moreover, focusing the simulations on Trigno river mouth, it is seen that with the setting of only two parameters (based on simple physical considerations) reasonable agreement is achieved with a $R^2$ statistics of about 60% between measured and predicted erosion/accretion rates. Further analyses have revealed that a proper use of parameters, such as transport coefficient K and structure permeability P, can rise the determination index up to 90%, which is rather surprising given the simplified assumptions adopted (Figure 1.).
On the whole, this study suggests that the use of a monodirectional equivalent wave climate may be totally appropriate to engineering scopes, even for sites characterised by a large directional variability. When validated by new case studies, which allow defining robust confidence bands, such a simple approach may aid either the plan of new defence systems (structural and non-structural) or the ex post evaluation of old measures.

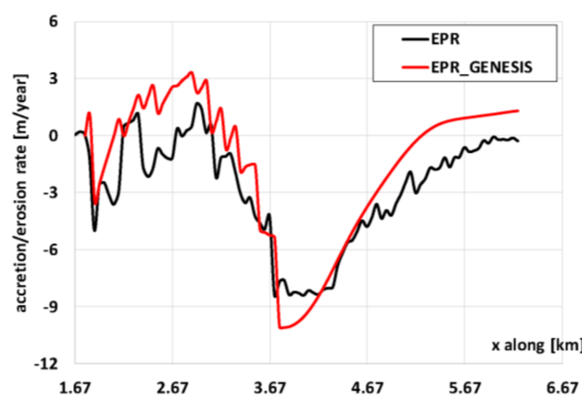


Figure 1. Comparison between measured and predicted EPR for the groins permeability P=0.2 and for the K=0.2.

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