



Beach dynamics in the Portuguese coast: the impact of atmospheric circulation on the two major driving factors (waves and precipitation)

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The beach setting is amongst the most dynamic systems on the face of the Earth. The frequency and magnitude of the beach profile modification depend on several forcing factors acting permanently over each system. The study of several small beach systems located on river mouth in the western coast of Portugal lead to the importance of atmospheric circulation types over the fetch and over Portugal. The morphological evolution of the beach is largely dependent on two major driving factors, namely; a) the wave climate patterns and b) the hydrological regime that is closely associated to the precipitation regime. In order to assess beach volume changes and sediment budget evolution, a morphological survey program was performed in Sta. Rita beach, in the Portuguese western coast, 33 km northwest from Lisbon. We have performed 60 beach profiles during 12 campaigns that took place between December 2005 and November 2006. Emerged beach profile changes were measured with dGPS and total station units, and volumes were calculated above chart datum and below the point of no relative hydrodynamic sand movement, applying the kriging interpolation method. During the field survey, 6 erosion episodes and 6 accretion episodes of different magnitudes were recorded. The maximum volume variability between campaigns was found higher by a factor of 2 than the minimum volume change. To explain beach sediment budget evolution, a previous classification scheme of atmospheric circulation affecting Portugal is used. This classification was initially proposed to explain the high inter-annual variability of the Portuguese precipitation regime. This approach

firstly proposed by Trigo and DaCamara (2000) is based on the corresponding objective classification defined for the British Isles. In this scheme, 26 types are assigned, which include 8 purely directional types dominated by strong straight flows (within 45° sectors), two other WTs dominated by the strength of vorticity (cyclonic and anticyclonic types) and then 8x2 hybrid types. In order to obtain a more practical analysis scheme, the WTs are re-grouped by including any of the hybrid types into the corresponding pure directional and cyclonic/anticyclonic types with a weight of 0.5. The WTs contributing to the highest fraction of the annual precipitation over Iberia are those considered as cyclonic (C) and those with a predominant directional flow from the Atlantic (W, SW or NW). The prominent role played by these weather types is particularly impressive during the “wet” half of the years (Oct-Mar) when roughly 80% of the annual precipitation is registered. Results show a good correlation between the temporal evolution of the erosion/accretion beach behavior and the weekly frequency of the four selected atmospheric circulation patterns (C, W, SW, NW). However, a better approach can be obtained using a classification of a weather type circulation over the fetch. Six major weather types are considered (Ramos-Pereira, 1992). Both classifications on weather circulation types are presented and discussed in order to obtain a better explanation of beach dynamics.

References:

Ramos-Pereira, A. (1992) - L'homme et l'érosion: l'exemple du littoral portugais. Finisterra, XXVI, 52-53, p. 205-225.

Trigo R.M., DaCamara C.C. (2000) – Circulation Weather Types and their impact on the precipitation regime in Portugal". International Journal of Climatology , 20, 1559-1581.