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Evaluation of sediment transport at a fetch-limited beach from spring to neap tide

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Sediment transport studies are useful tools for the determination of sediment budgets, important in the definition of management policies, in particular in environments not fully understood like fetch-limited beaches. Only a few studies have been made with respect to these beaches, and research efforts need to be continued to correctly quantify the main factors governing morphological changes.

The present study provides new insights on sediment transport at a fetch-limited backbarrier beach located at the Peninsula do Ancão (Ria Formosa, South of Portugal). The field site extends over ∼150 m and includes a sandy beach with a low and narrow reflective morphology, and an external sand bank at the seaward edge of the sub-aerial beach profile. Fluorescent tracers were used to measure the short-term sediment transport (rates and directions) from spring to neap tides, for fair-weather conditions. The experiment was set at two beach morphologies: beach face and sand bank. Tracer was released on 20th March 2008 at both sites, and sampling was conducted at low tide, each 24h, during 7 days. In situ fluorescent tracer detection was performed with UV light. Currents were obtained with a portable single-axis electromagnetic current meter located at the beach face, and an Aquadopp Profiler located at the sand bank. Local waves were obtained by numerical modelling for the study area, based on prevailing winds (measured by a nearby meteorological station), and using available bathymetric surveys.

Tracer trends, tidal currents, wind conditions and waves were integrative in order to determine to which forcing mechanism the beach morphology was more responsive. Daily wind intensities were, in average, close to 5 m/s, and maximum estimated significant wave height (Hs) did not exceed 0.045 m. Daily mean wave period ranged from 0.5 s to 0.7 s. The maximum tidal range was 2.8 m. Currents were of higher magnitude at the sand bank than at the beach face, with the maximum during ebb tide (0.50 m/s). At the beach face, maximum velocities are very similar for both ebb and flood tide, with a maximum of 0.26 m/s.

Tracer displacement was greater at the beach face, indicating that this is the most active part of the profile during the experiment. At the sand bank, tracer dispersion was greater, but tracer advection was shorter. Tracer isopachs illustrate a relatively independency of both analysed morphologies, without significant exchange across the profile. At both morphologies, the residual transport is dominated by the longshore component, and mostly directed towards the ebb. Ebb directed transport agrees with ebb dominance on tidal currents at this location. Results suggest a tidal and current dominance. Tidal range assumes particular importance at beach face.