Record of ebb-channel shifting within an ebb-tidal delta, the Sado Estuary, Portugal

Brito, P.[1], Costas, S.[1], Rebêlo, L.[1] and FitzGerald, D.[2]
[1]Laboratório Nacional de Energia e Geologia, I.P.
[2]Boston University
e-mail: pedro.brito@lneg.pt; susana.costas@lneg.pt; luis.rebelo@lneg.pt; dunc@bu.edu

Backbarrier water bodies are highly valuable coastal environments due to the elevated biodiversity and productivity they maintain. Moreover, human occupation has traditionally chosen these environments for both recreation and harborages, leading often to the development of large port facilities and dredging of navigable waterways. Deepening and widening of channels commonly extends through the inlet into deepwater. Tidal inlets are highly dynamic systems, where the interplay of wave and tidal-driven currents leads to the formation of sandy shoals. Knowledge of shoal development and channel migrational patterns aid in the management of inlet and backbarrier systems, and provide data to maintain a healthy ecosystem. Here, we explore the migrational pattern of the main channel of the Sado estuary ebb-tidal delta by comparing six historical bathymetric maps (1929, 1954, 1961, 1979, 2002 and 2008) and interpreting single-channel high resolution seismic reflection lines, acquired along a 200-m spaced square grid using an IKB-Seistec profiler.

The Sado estuary, located 50 km south of Lisbon along the western Portuguese coast, is a mesotidal bar-built estuary with a 2-km wide inlet and a spring tidal prism of 400 million- m3. The estuary is fronted by an ebb-tidal delta that extends 6.5 km offshore and 12 km alongshore. The ebb-delta asymmetrically overlaps the southeast shoreline. Its main channel is bordered by two extensive sand banks and is regularly dredged to maintain a 300-m wide and 12-m deep navigation channel.

Historical maps (1929) document the rotation of outer segment of the main channel 900m to the south (updrift) from its present position. In addition, remnants of an older channel 1000 m downdrift of the present, suggest the rotation of the outer channel in the opposite direction.

Despite their gradual shoaling, bathymetric depressions still denote the presence of the former channel positions. These two former channels locate 2-km apart, were also identified in the seismic dataset as incisions filled with sediments prograding downdrift that can be followed landward for 1200 m. The presence of several erosional surfaces and nested channels indicates complex histories of channel infilling.

The shifting channel pattern identified in outer ebb delta region suggests a sediment bypassing mechanism capable of transferring large sand volumes to the downdrift northern bank. Here, we present evidence that sediment bypassing was an active process prior to the channel stabilization by periodic dredging.

Acknowledgements are due to the FCT funded project SCARPS (PTDC/CTE-GIX/101466/2008).