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Morphogenesis and evolution of shelf mud depocenters controlled by natural and anthropogenic processes

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Shelf mud depocenters (MDCs) represent the proximal sink for continent-derived material during modern sea level conditions. They serve as habitat for benthic life and store large quantities of carbon nutrients, and contaminants. Most of them initiated to form during mid- to late Holocene. Despite of their important role in the global source-to-sink transport and ecosystem functioning, their growth dynamics and the particular natural as well as anthropogenic drivers that shape their morphology remain largely speculative. In this study we try to address the challenges for a comprehensive understanding of the development of MDCs along the NW Iberian continental margin based on the outcome of an interdisciplinary project GALIOMAR, which ultilizes dense-spaced subbottom seismic profiles, sediment cores, hydrographic monitoring in combination with 3D process-based numerical modeling.
The NW Iberian mud depocenter chain (Spain/Portugal) extends coast-parallel over 60 nm at 90-140 m water depth with an average thickness of 1 m (7 m in its core) holding 4,000 million tons of sediment. It started to form at 5.3 cal ka BP around remote accumulation nuclei rather than being attached to the main river suppliers. To link the long-term formation with the modern system, bottom sediment transport during a storm event as representative for winter hydrodynamic conditions was monitored and modelled. Storm-generated downwelling front and associated coastal jets are found to be the primary control for the morphogensis of the MDCs. Near-bottom concentrated suspensions initiated by the storm greatly shape the morphology of MDCs. Due to dam construction along the rivers and intense bottom trawling activities since the 20th century, a great portion of the surface layer of the MDCs has been eroded,endangering the development of the MDCs and their associated ecosystem that is worthy of greater concern.