EGU24-8508, updated on 19 Apr 2025
https://doi.org/10.5194/egusphere-egu24-8508
EGU General Assembly 2024

A new fully erosive end-member to the strait depositional model: the importance of strong internal tides and shallow water settings, case of the Rion-Antirion Strait (Greece)

Basile Caterina[1], Romain Rubi[1], Elias Fakiris[2], Dimitris Christodolou[2], Xenophon Dimas[2], Maria Geraga[2], George Papatheodorou[2], and Aurélia Ferrari[1]

[1]Dept. of Physical Geography and Quaternary, University of Liège, Liège, Belgium (basile.caterina@uliege.be)
[2]Laboratory of Marine Geology and Physical Oceanography, Geology Department, University of Patras, Greece

Straits are crucial in terms of oceanic circulation between basins. Many modern straits are dominated by tidal currents that flow differently than in the connected basins. These tidal currents are shaping the seafloor into complex geometries, alongside sediment sources, tectonic activities and inherited lowstand features. The proposed common tidal strait depositional model comprises a strait centre zone in erosion bounded on both sides by depositional areas with 2D and 3D tidal dunes (known as dune-bedded strait zones). This model does not consider another type of hydrodynamic forcing that can be generated in strait, internal tidal waves. The aim of this study is to evidence the combined effect of tidal currents and internal tides on the morphosedimentary features of the strait seafloor.

We focused here on the Rion-Antirion strait in Greece, connecting the Corinth Gulf with the Ionian Sea. Despite its location in the microtidal Mediterranean context, this 2 km wide and 70 m deep strait is strongly experiencing strong tidal currents. We utilized high-resolution multibeam bathymetry (MBES) covering a 21 km² area to reveal seafloor morphological structures. Swath bathymetric profiles were coupled with chirp sub-bottom and sparker reflection profiles imaging the internal sedimentary structures and with currents data from two ADCP campaigns. To comprehensively assess all the oceanographic parameters, we also incorporated satellite data and ROMS modelling. Consequently, we establish connections between oceanographic circulation, sea bottom dynamics within the strait and Gulf, and the observed sedimentary features.

Typically, in tidal settings, sand deposition occurs when the tidal current velocity drops, usually before the currents change direction, and the existing strait tidal model shows sand dunes. The complex bathymetry features observed in the Rion tidal strait lack dunes but features erosional characteristics such as deep pools and crest morphology, with limited depositional features. In our settings, the numerical model demonstrates that the strait experience strong tidal currents alongside currents associated with the internal tide, which are predominantly out of phase, generating significant turbulences. As a result, there are no periods during which sand can settle. These factors underline the absence of deposition in this case and the need to revise the strait depositional model to incorporate this new end-member.