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Impact of dense shelf water and storm generated bottom currents on the seafloor of the Roses continental shelf, NW Mediterranean Sea, as evidenced by bedform analysis

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Recent studies have shown that strong bottom currents associated with short-lived (days to weeks) extreme events, such as large storms and dense shelf water flows, have the potential to transport large amounts of water and sediment over the shelf and off shelf, reshape submarine canyon floors and thus dramatically affect benthic and supra-benthic ecosystems. In this contribution we illustrate the seafloor morphology of the Roses continental shelf, in the NW Mediterranean Sea, between Cap de Creus and La Fonera submarine canyon heads, to improve the present understanding of the bottom current regime and its forcing mechanisms.

High-resolution bathymetry and very high-resolution seismic reflection data show a number of current-generated Holocene to modern bedforms and rocky outcrops on the Roses continental shelf. These bedforms include both erosional and depositional features, such as large-scale lineations, elongated and irregularly shaped overdeepenings, obstacle marks and sediment waves. Erosional bedforms cover most of the shelf in the vicinity of the Cap de Creus submarine canyon head, thus evidencing intense near-bottom sediment transport and shelf floor erosion. Depositional bedforms occur in the more sheltered middle shelf between Cap de Creus and La Fonera submarine canyon heads. The current regime interpreted from bedform analysis indicates a predominant flow towards the submarine canyons and the shelf edge, as well a depth contour parallel southwards flow along the Roses shelf. Seafloor features show a stronger impact by these bottom currents near the canyon heads, particularly near the Cap de Creus canyon head, where bedform estimated maximum bottom current velocity exceeds 60 cm s-1. The comparison between bedform-deduced information on bottom currents and present-day oceanographic conditions, including in situ measurements, and numerical models show that the bedforms identified on the Roses shelf are inactive during fair-weather conditions. However, when high-energy events such as large storms and dense water flows occur, this bedform association becomes active. The formation and evolution of the Roses shelf bedforms must be primarily driven by intermittent erosion occurring during such extreme episodic events, which are able of remobilising shelf sediments, leading to local erosion and off shelf export mainly along canyon heads and rims.