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Extreme Event impacts on Seafloor Ecosystems

Miquel Canals, Anna Sanchez-Vidal, Antoni Calafat, Rut Pedrosa-Pàmies, and Galderic Lastras
Universitat de Barcelona, GRC Geociències Marines, Estratigrafia, Paleontologia i Geociències Marines, Barcelona, Spain (anna.sanchez@ub.edu)

The Mediterranean region is among those presenting the highest concentration of cyclogenesis during the northern hemisphere winter, thus is frequently subjected to sudden events of extreme weather. The highest frequency of storm winds occur in its northwestern basin, and is associated to NE and NW storms. The occurrence of such extreme climatic events represents an opportunity of high scientific value to investigate how natural processes at their peaks of activity transfer matter and energy, as well as how impact ecosystems.
Due to the approximately NE-SW orientation of the western Mediterranean coast, windforced motion coming from eastern storms generate the most intense waves and with very long fetch in the continental shelf and the coast, causing beach erosion, overwash and inundation of low-lying areas, and damage to infrastructures and coastal resources. On December 26, 2008 a huge storm afforded us the opportunity to understand the effect of storms on the deep sea ecosystems, as impacted violently an area of the Catalan coast covered by a dense network of monitoring devices including sediment traps and currentmeters. The storm, with measured wind gusts of more than 70 km h-1 and associated storm surge reaching 8 m, lead to the remobilisation of a shallow water large reservoir of marine organic carbon associated to fine particles and to its redistribution across the deep basin, and also ignited the motion of large amounts of coarse shelf sediment resulting in the abrasion and burial of benthic communities.
In addition to eastern storms, increasing evidence has accumulated during the last few years showing the significance of Dense Shelf Water Cascading (DSWC), a type of marine current driven exclusively by seawater density contrast caused by strong and persistent NW winds, as a key driver of the deep Mediterranean Sea in many aspects. A network of mooring lines with sediment traps and currentmeters deployed in the Cap de Creus canyon in winter 2005-06 recorded a major DSWC event, the latest to date. Data show that DSWC modifies the properties of intermediate and deep waters, carries massive amounts of organic carbon to the basin thus fuelling the deep ecosystem, transports huge quantities of coarse and fine sedimentary particles that abrade canyon floors and rise the load of suspended particles, and also exports pollutants from the coastal area to deeper compartment.
Our findings demonstrate that both types of climate-driven extreme events (coastal storms and DSWC) are highly efficient in transporting organic carbon from shallow to deep, thus contributing to its sequestration, and have the potential to tremendously impact the deep-sea ecosystems.