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Different responses of natural coastal sediments to fluid-induced resuspension in mesocosms

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In the context of the BioFlow EU-Network, a joint experiment was performed in the new mesocosm facility set up at the CNR-IAMC Messina (Italy).

Sandy sediment was sampled at 1-m depth in the coastal lake of Faro, which is located 15km north of Messina. The sediment was placed in two twin 1.5x1.5 m^2 pools to form an 8-cm thick layer on the pool bed and covered with 50 cm of natural seawater. One of the pools has been equipped with a lighting system (1x400W solar spectrum, 2260 μE m^{-2} s^{-1}; 12:12 day-night cycle). After one month in the mesocosm, resuspension experiments with a benthic annular flume (MiniFlume) were carried out to study the different responses of the sediment/water interfaces developed in the two situations (illuminated and darkness).

Several parameters were measured on water samples taken during the step-wise erosion experiment with increasing fluid-induced stress: organic matter, nutrient fluxes, primary production, and bacterial respiration.

The thresholds of bedload motion (1.2 Pa) and suspended transport were similar in both experiments. That indicates an absence of bioconsolidation by light-dependent organisms.

Phytoplankton biomass, expressed as chlorophyll a concentration, showed a gradual increase in both experiments? following the sediment resuspension and reached the maximum value of 49.9 mg-Chl$a$ m^{-3} at the maximum MiniFlume speed (12000 rpm).

The dynamic of phytoplankton primary production followed the similar trend of the biomass distribution, and the increase of carbon assimilation (about 150 mgC m^{-3} h^{-1}) was measured at very high MiniFlume speed (10000 rpm): when the biomass reaching an high concentration ($>$ 10 mg-Chl$a$ m^{-3}) and well can photosynthesize. In fact the next increase of biomass not modify the rate of carbon assimilation.