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Experimental simulation of nutrient enrichment and turbulence in coastal systems.

F. Peters, C. Marrasé, O. Guadayol, E. Berdalet and the NTAP Team
Institut de Ciències del Mar (CSIC), Barcelona, Spain (cesc@icm.csic.es)

Nutrient enrichment is an important driving force in the dynamics of coastal ecosystems. Small-scale turbulence also needs to be taken into account, beyond the hydrodynamic forcings of mixing that will bring nutrient rich water in contact with the illuminated upper mixed layer. In recent years, turbulence is being shown to affect several processes in the water column including the encounter of food particles with predators, the nutrient flux towards algal cells and the settling of particles.

We here report on an ensemble of experimental simulations with coastal water subjected to gradients of nutrient load (0 to 24 μM nitrate) and turbulence intensity ($2{\cdot}10^{-9}$ to 10^{-4} cm^2 s^{-3}). Experiments were done with coastal water from a Norwegian fjord and from the NW Mediterranean. Chlorophyll showed peaks within 2 to 5 days. These peaks clearly increased with nutrient load. In addition, increasing levels of turbulence directly affected chlorophyll. A synergistic effect of nutrient addition and turbulence was apparent with a larger response under both high nutrient additions and high turbulence levels. Settling of particulate material was apparent in the containers. The amount of settled material was estimated through budget calculations from the decrease of total phosphorus in the water column over time. A regression model showed that both nutrient load and turbulence affected the amount of settled material. The results show the importance to consider both nutrient load and turbulence in determining coastal ecosystem dynamics.