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Spatiotemporal primary production and phytoplankton community behaviour in a highly dynamics and anthropized ecosystem: the seine estuary (france)

Leon Serre-Fredj, Pascal Claquin

Unicaen Borea, France

Abstract

Estuaries system are particular dynamics system where the phytoplankton primary production varies considerably along the environmental parameter. This variation induce a need of high frequency sampling of the phytoplankton production in order to improve carbon budget understanding in those areas. In the eutrophic and temperate estuary of Seine (France), management policy have succeed in reducing the N input with the instant consequence of lowering chl a concentration.

Over a period of two years crossing of a 100 km distance of the estuary has been performed in the estuary to carry out spatial high frequency sampling of environmental parameter (temperature, oxygen, salinity, turbidity) and phytoplankton primary production using a fast repetition rate fluorimeter (FRRF-ACT2 chelsea technology, UK). In addition, low frequency sampling for investigation phytoplankton biomass, composition and nutrient need with chl a, flow cytometry (CytoSense, Cytobuoy, Netherland), Alkaline phosphatase activity measurements and nutrient (N, P, Si) were analysed.

First, our results reveal very high phytoplankton biomass ($80 \mu\text{g chl a.L}^{-1}$) on a particular upstream point of the estuary similar to the concentration before the application of management policies. The phytoplankton composition varies along the crossing with pico-nano dominated population upstream followed by microphytoplankton-dominated population, and then picoplankton only dominated population. The high concentration is incidentally correlated with the high concentration of microphytoplankton in summer.

Overall, the maximum quantum yield of PSII (F_v/F_m) display stable value along the estuary, thus production is higher in the upstream part due to higher biomass. No N limitation are highlighted on the whole cross while P and Si concentration and their ratio partly influence estuarine phytoplankton dynamics and community structures. A proper evaluation of those drivers are required to help policy management targets.

Keywords

High frequency, primary production, phytoplankton , Flow cytometry