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Summer nutrients structure and phytoplankton growth under the influence of freshwater-saline water mixing in the Changjiang River Estuary

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The spatial distribution of NO_3-, PO43-, $SiO_3$2- in summer were studied in the Changjiang (Yangtze River) Estuary and the adjacent East China Sea(ECS), the nutrients distribution was mainly controlled by the Changjiang dilution water and offshore seawater mixing. NO_3-, PO43-, $SiO_3$2- were high west and low east, presenting two tongues shape nearshore. Combined with the nutrient structure difference along the estuary gradient, the potential relative nutrient limitation of surface water at each station was distinguished. Coastal water was featured with excess nitrogen, in summer DIN/P ratio was up to 160 in the frequent algae blooms area, while Si/N reached as low as 0.5, which could be caused by luxury consumption of P and Si by diatom bloom. For better understanding the process of nutrients structure variation and influence on phytoplankton growth under the Changjiang dilution water and seawater mixing, we also conducted field incubation simulating different fresh-saline water mixing scale, by 100%, 75%, 50%, 25% and 0% for about 3 days. The results were as follows: (1) The lower the percentage of freshwater, the lower the growth rate and pH increase rate of phytoplankton during the exponential growth period; (2) Macronutrients were apparently consumed. PO43- in the 100%, 75% and 50% dilution treatments were depleted within 48 h, suggesting that PO43- limit phytoplankton growth below salinity of 26. (3) For the 100% treatment the DIN/P ratio doubled as PO43- was consumed rapidly, while DIN decreased slowly. The DIN/Si ratio decreased to about 0.7 times the original level during the first 48 h, reflecting the lower initial DIN/Si value compared to the diatom uptake ratio (dDIN/dSi) during the incubation period. The incubation presented the phytoplankton growth extent and rate difference during fresh-saline water mixing, which makes nutrients gradient, and this mixing process may cause local blooms to change the nutrient structure, then might result in phytoplankton regime shift.