Hydroclimatic modulation of diatom/Phaeocystis blooms in nutrient-enriched Belgian coastal waters (North Sea)

Breton, Elsa, Véronique Rousseau, Jean-Yves Parent, José Ozer, Christiane Lancelot

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ABSTRACT: Statistical analysis of 14 yr (1988-2001) of intensive phytoplankton monitoring at Station 330 in the central Belgian Coastal Zone (BCZ, Southern Bight of the North Sea) indicates that the long-term diatom biomass trend and the spring dominance of *Phaeocystis* colonies over diatoms are determined by the combined effect of the North Atlantic Oscillation (NAO) and freshwater and continental nitrate carried by the Scheldt. The strong correlation between diatoms and the NAO index is largely explained by the modulating effect of the latter on the water budget at the monitoring station. The relationship between *Phaeocystis* spring blooms and winter NAO (NAO_w) is indirect, better expressed by springtime *Phaeocystis* dominance over diatoms because of the higher response of the latter to the NAO. The spring *Phaeocystis* : diatom bloom ratio is negatively (or positively) linked to positive (or negative) NAO_w values. A complex cascade of events links large-scale NAO index variations with those local meteorological conditions (wind strength and direction, rainfall) that drive the hydrography and water budget of the BCZ. Local meteorological conditions in turn modulate the geographical spread of Scheldt nutrient loads in the coastal zone and ultimately regulate the magnitude of *Phaeocystis* spring blooms by determining winter nitrate enrichment. Hence, the absence of a linear relationship between *Phaeocystis* spring blooms and NAO_w is explained by the nonlinear response of river-based nitrate pulses to NAO due to local wind-driven hydrodynamical forcing.