



Controls of physical forcings on pelagic primary production dynamics in the Scheldt river and estuary: Coupling hydrodynamics, sediment transport and biogeochemistry

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A two-dimensional nested grid model of the macrotidal Scheldt estuary (B/NL) and its network of tributaries has been developed to identify the driving forces controlling the temporal and spatial dynamics of pelagic primary production during a summer diatom bloom. The model explicitly accounts for hydrodynamics, solute and sediment transport. It includes a description of light-dependent diatom growth forced by suspended particulate matter (SPM) dynamics, respiration and mortality. The model domain extends from the estuarine mouth up to the limit of tidal propagation in the riverine part. The transient simulations are in good agreement with field data collected during the June-September 2003 period and indicate that the spatial variations in diatom concentrations are mainly determined by turbidity and water depth. Concentrations reach a maximum of 50-300 μM Chl a in the area of minimum turbidity located in the vicinity of the balance point where the total energy flux is the lowest. They decrease downstream with increasing turbidity and unfavorable euphotic to mixing depth ratios. Temporal diatom dynamics mainly mirror the temporal evolution of river discharge. High river discharges lead to lower diatom concentrations, which result from the higher turbidities and the lower residence times in the area where primary production is most favorable. During periods of low river discharge, silica becomes a limiting factor for diatom production and maximum production is shifted further upstream in a zone where dissolved silica is constantly supplied by the river.