Geophysical Research Abstracts
Vol. 19, EGU2017-10233, 2017
EGU General Assembly 2017

Phytoplankton bloom dynamics in temperate, turbid, stressed estuaries: a model study

Huib E. de Swart (1), Bo Liu (1), and Victor de Jonge (2)

(1) Institute of Marine and Atmospheric Research, Utrecht University, Utrecht, Netherlands , (2) Institute of Estuarine and Coastal Studies, University of Hull, United Kingdom

To gain insight into mechanisms underlying phytoplankton bloom dynamics in temperature, turbid estuaries, experiments were conducted with an idealised model that couples physical and biological processes. Results show that the model is capable of producing the main features of the observed blooms in the Ems estuary (Northwest Germany), viz. in the lower reach a spring bloom occur, which is followed by a secondary bloom in autumn.

The along-estuary distribution of suspended sediment concentration (SSC) and the along-estuary distance between the nutrient source and the seaward bound of the turbidity zone control both the along-estuary locations and intensities of the blooms. Results of further sensitivity studies reveal that in a shallow, well-mixed estuary, under temporally-constant suspended sediment conditions, the seasonally-varying water temperature has larger impact on the timing of spring blooms than the seasonally-varying incident light intensity. The occurrence of the secondary bloom is caused by the fact that the growth rate of phytoplankton attains a maximum at an optimum water temperature.

Bloom intensities are also modulated by the advective processes related to subtidal current because the latter regulates the seaward transport of nutrient from riverine source. Large-scale deepening of navigation channels leads to later spring blooms due to increased mixing depth. Finally, phytoplankton blooms are unlikely to occur in the upper reach due to the elevated SSC and the landward expansion of turbidity zone related to large-scale deepening.