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A simple model for phytoplankton growth in turbid estuaries

H.E. de Swart (1), H.M. Schuttelaars (2), S.A. Talke (1)

(1) Institute for Marine and Atmospheric Research, Utrecht University, The Netherlands [h.e.deswart@phys.uu.nl], (2) Delft Institute of Applied Mathematics, Delft University of Technology, Mekelweg 4, 2600 GA, Delft, The Netherlands

An idealized model is presented and analysed to gain more fundamental understanding about the dynamics of phytoplankton blooms in partially mixed estuaries. The model describes the behaviour of subtidal currents, suspended sediments, nutrients and phytoplankton in a channel geometry. The initial growth of phytoplankton is calculated by solving an eigenvalue problem. These growth rates depend on the position in the estuary due to along-estuary variations in nutrient concentration and suspended sediment concentration. Results show how the onset of blooms in the model depends on physical and biological processes (turbulent mixing, fresh water discharge, light attenuation, imposed nutrient concentrations at the river and sea side). In particular, the model suggests that the joint action of spatial variations in turbidity and in nutrients causes the maximum phytoplankton concentrations to occur seaward of the estuarine turbidity maximum.