Dissertations

Mathematical modelling of the chlorophyll *a* distribution function in a stratified sea

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The thesis discusses the assumptions underlying a two-dimensional mathematical model describing the distribution function of the concentrations of chlorophyll *a* and nutrients in a stratified sea and presents a numerical algorithm for solving it. The model takes account of the most important physical, chemical and biological processes selected from the subject literature that exert a deciding influence on the shape and value of these functions. These factors include:

- the irradiance entering the sea,
- the initial concentration of nutrients,
- the occurrence of short-lived, fine-scale interlayering,
- the Kelvin-Helmholtz hydrodynamic instability,
- the consumption of phytoplankton by zooplankton,
- the natural mortality of phytoplankton.

This two-dimensional model was applied to simulate the effect of the above-named factors on the temporal and spatial variability of the chlorophyll *a* and nutrient concentration fields.

Numerical studies of the effect of solar energy entering the sea basin in question, and of dynamic processes and phytoplankton consumption on the shape and absolute value of the chlorophyll *a* distribution function in the sea show that these processes are responsible to the same degree for the observed *in situ* shape and value of the vertical phytoplankton fluorescence profiles. It is, however, hard to state which of these processes is the dominant one and to what extent it limits the shape of the distribution function.

A fully stable solution to the model using the super-relaxation method is discussed, and a boundary transition from a two-dimensional model to a one-dimensional one is presented.

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