The inverse and variational data assimilation problem on finding the heat flux in the sea thermodynamics model

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Abstract

The methods of data assimilation have become an important tool for analysis of complex physical phenomena in various fields of science and technology. These methods allow us to combine mathematical models, data resulting from observations and a priori information. The problems of variational data assimilation can be formulated as optimal control to find unknown model parameters such as initial and/or boundary conditions, right-hand sides in the model equations (forcing terms), distributed coefficients, based on minimization of the cost function related to observations. A necessary optimality condition reduces an optimal control problem to an optimality system which involves the model equations, the adjoint problem, and input data functions

In this work the variational data assimilation problems in the Baltic Sea water area were formulated and studied [1, 3]. We assume, that the unique function which is obtained by observation data processing is the function of Sea Surface Temperature (SST) and we permit that the function is known only on a part of considering area (for example, on a part of the Baltic Sea). Numerical experiments on restoring the ocean heat flux and obtaining solution of the system (temperature, salinity, velocity, and sea surface level) of the Baltic Sea primitive equation hydrodynamics model [2] with assimilation procedure were carried out with the use of the data error covariance matrix. The spatial resolution of the model grid with respect to the horizontal variables is 0.0625*0.03125 degree. The results of the numerical experiments are presented.

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References

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