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Simulation of a class of hazardous situations in the ICS «INM RAS – Baltic Sea»

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Development of Informational Computational Systems (ICS) for data assimilation procedures is one of multidisciplinary problems. To study and solve these problems one needs to apply modern results from different disciplines and recent developments in mathematical modeling, theory of adjoint equations and optimal control, inverse problems, numerical methods theory, numerical algebra, scientific computing and processing of satellite data.
In this work the results on the ICS development for PC-ICS "INM RAS – Baltic Sea" are presented. We discuss practical problems studied by ICS. The System includes numerical model of the Baltic Sea thermodynamics, the new oil spill model describing the propagation of a slick at the Sea surface (Agoshkov, Aseev et al., 2014) and the optimal ship route calculating block (Agoshkov, Zayachkovsky et al., 2014). The ICS is based on the INMOM numerical model of the Baltic Sea thermodynamics (Zalesny et al., 2013). It is possible to calculate main hydrodynamic parameters (temperature, salinity, velocities, sea level) using user-friendly interface of the ICS. The System includes data assimilation procedures (Agoshkov, 2003, Parmuzin, Agoshkov, 2012) and one can use the block of variational assimilation of the sea surface temperature in order to obtain main hydrodynamic parameters. Main possibilities of the ICS and several numerical experiments are presented in the work.
By the problem of risk control is meant a problem of determination of optimal resources quantity which are necessary for decreasing the risk to some acceptable value. Mass of oil slick is chosen as a function of control. For the realization of the random variable the quadratic "functional of cost" is introduced. It comprises cleaning costs and deviation of damage of oil pollution from its acceptable value. The problem of minimization of this functional is solved based on the methods of optimal control and the theory of adjoint equations. The solution of this problem is explicitly found.
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