



The solution of the problem of oil spill risk control in the Baltic Sea taking into account the processes of oil propagation and degradation

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The report is devoted to the one approach to the problem of oil spill risk control of protected areas in the Baltic Sea (Aseev et al., 2014). 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. It is supposed that only moment of accident is a random variable. 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 (Agoshkov, 2003, Agoshkov et al., 2012). The solution of this problem is explicitly found.

In order to solve the realistic problem of oil spill risk control in the Baltic Sea the 2d model of oil spill propagation on the sea surface based on the Seatrack Web model (Liungman, Mattson, 2011) is developed. The model takes into account such processes as oil transportation by sea currents and wind, turbulent diffusion, spreading, evaporation from sea surface, dispersion and formation of emulsion “water-in-oil”. The model allows to calculate basic oil slick parameters: localization, mass, volume, thickness, density of oil, water content and viscosity of emulsion. The results of several numerical experiments in the Baltic Sea using the model and the methodology of oil spill risk control are presented.

Along with moment of accident other parameters of oil spill and environment could be chosen as a random variables. The methodology of solution of oil spill risk control problem will remain the same but the computational complexity will increase. Conversion of the function of control to quantity of resources with a glance to methods of pollution removal should be processed. As a result, the developed 2d model of oil spill propagation combined with the methodology of solution of oil spill risk control problem could provide the basis for oil spill simulation systems, systems of evaluation and control of oil spill risk and damage in seas or decision support systems.

References

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