Секция «Гидрометеорология»

MODELING THE TRAJECTORY AND FATE OF THE OIL SPILL IN THE STRAIT OF HORMUZ, ARABIAN SEA.

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Maritime transport, the primary method for global crude oil transportation, poses significant risks of oil spills [1], with tanker incidents spilling approximately 1,000 tons of oil in 2021[2]. To mitigate these risks, effective prevention and response strategies are essential, with oil spill modeling playing a critical role [3]. This study employs the GNOME and ADIOS2 models to predict oil spill behavior and assess response strategies [5, 6]. GNOME, a two-dimensional model, predicts oil slick movement using the Euler–Lagrange particle tracking method, while ADIOS2 simulates degradation processes like evaporation, dispersion, and emulsification. A hypothetical spill of 10,000 metric tons of Arabian Light crude oil was simulated in the Strait of Hormuz (SH) under summer (July 28–August 1, 2023) and autumn (November 25–30, 2023) hydrometeorological conditions, including wind, currents, and sea surface temperature (SST) [7, 8, 9].

In Scenario 1 (Summer) (Figure 1), strong NW winds and currents carried the oil toward the Iranian coast, affecting 120 km of coastline, with 58% of the oil remaining at sea, 30% evaporated, 6.4% dispersed, and 4% beached. In Scenario 2 (Autumn) (Figure 2), moderate winds and shifting currents [10] directed the oil toward the Omani coast, with 0.1% (15 metric tons) beaching and 60 metric tons settling on the seabed. Seasonal variations significantly influenced spill behavior, with evaporation and emulsification rates varying due to wind intensity and SST. Natural dispersion remained modest, highlighting the need for accurate modeling. The study underscores the importance of advanced oil spill modeling for improving response strategies, risk assessment, and environmental impact evaluations, enabling better preparedness and mitigation to protect marine ecosystems and coastal economies.

Источники и литература

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Иллюстрации

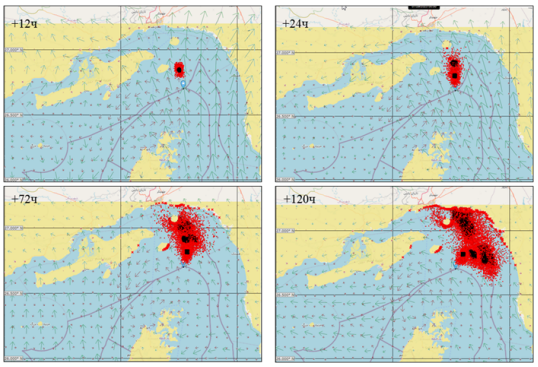

Рис. : Figure 1 Illustrates the position of oil particles in Scenario 1, which accounts for variable wind speed, direction, and sea currents. Black dots denote BGS, while red dots represent MRS. Wind direction is indicated by blue arrows, and currents are shown by brown arrows.

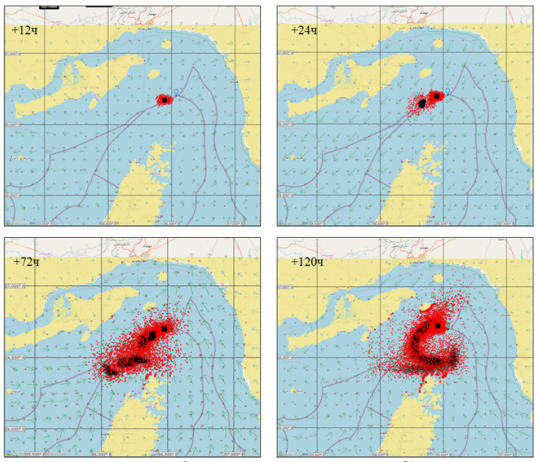

Рис. : Figure 2 Illustrates the position of the oil spill in Scenario 2 (Autumn) as simulated by the GNOME model. Black dots denote BGS, while red dots represent MRS. The spill source is marked by a large blue dot. Wind direction is indicated by green arrows, and currents are shown by blue arrows.