



## **3D LAGRANGIAN MODEL FOR OIL DISPERSION BY BREAKING WAVES AND CURRENTS**

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Oil spilled at sea often entrained by breaking waves in stormy conditions and forms clouds of oil droplets that are dispersed by subsurface turbulence and shear currents. We present 3D Lagrangian oil spill model that simulates oil transport and fate in five interacted phases: oil-on-surface, oil-in-water, oil-on-bottom, oil-on-suspended sediments, oil-at-shoreline. It is coupled with the 3D free-surface hydrodynamics and sediment transport model and with the third-generation wave model WAVEWATCH III. The two-equation turbulence model accounts injection of turbulence from the wave breaking. The new physically based numerical approach to compute the spreading of oil slick of arbitrary shape due to gravity and surface tension forces at early stage of spill is presented. The turbulent diffusion processes are simulated by use Lagrangian stochastic simulation technique based on the random walk method for Gaussian “spillets”. The surface oil entrainment by breaking waves is parameterized according Delvigne and Sweeney (1988) semi-empirical relation. The numerical results are compared with the self-similar solutions for oil slick spreading and turbulent diffusion. The model reproduces processes of surface slick entrainment by the breaking waves, generation of oil droplets, diffusion by subsurface turbulence and gradual resurfacing of droplets by buoyancy forces that contributes in the forming of frequently observed thin oil film tail (“sheen”) behind the thick slick area.