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Preliminary model results for subsurface oil and gas release

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Although most oil spill accidents occur at the sea surface, the growing offshore oil exploration activities increase the likelihood of subsurface releases. In this context, it is necessary to develop a subsurface oil spill model to forecast the oil transport in the water column and to prepare the response once the oil reaches the coasts and the surface. The novelty is to combine this buoyant plume model with realistic subsurface currents and ocean density fields and compare the results with idealized conditions. The model will be combined later with a community oil spill model Medslik-II (http://www.medslik-ii.org).

Following the literature (1,2), a 3D model of a buoyant jet/plume is developed, which simulates the key processes in the nearfield approximation. Turbulent entrainment of ambient water (both through forced and shear fluxes), dissolution and turbulent diffusion of oil droplets and gas bubbles are realistically represented. The used ambient oceanographic fields are provided by the Monitoring and Forecasting Centre (MED-MFC) of the Copernicus Marine Service. These fields, in particular water density and current velocity, directly control the evolution of the plume in time. In the model, there are options to simulate both oil and oil/gas mixture discharges. Additionally, it is possible to compute instantaneous and continuous subsurface releases.

The model is validated with a unique DeepSpill field experiment conducted in the North Sea with the release of oil and gas (3,4,5).

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