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Propagation of uncertainties through the oil spill model MEDSLIK-II: operational application to the Black Sea

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In operational oil spill modeling, MEDSLIK-II (De Dominicis et al., 2013) focuses on the reliability of the oil drift and fate predictions routinely fed by operational oceanographic and atmospheric forecasting chain.

Uncertainty calculations enhance oil spill forecast efficiency, supplying probability maps to quantify the propagation of various uncertainties. Recently, we have developed the methodology that allows users to evaluate the variability of oil drift forecast caused by uncertain data on the initial oil spill conditions (Liubartseva et al., 2016). One of the key methodological aspects is a reasonable choice of a way of parameter perturbation. In case of starting oil spill location and time, these scalars might be treated as independent random parameters. If we want to perturb the underlying ocean currents and wind, we have to deal with deterministic vector parameters. To a first approximation, we suggest rolling forecasts as a set of perturbed ocean currents and wind. This approach does not need any extra hydrodynamic calculations, and it is quick enough to be performed in web-based applications.

The capabilities of the proposed methodology are explored using the Black Sea Forecasting System (BSFS) recently implemented by Ciliberti et al. (2016) for the Copernicus Marine Environment Monitoring Service (http://marine.copernicus.eu/services-portfolio/access-to-products). BSFS horizontal resolution is 1/36° in zonal and 1/27° in meridional direction (ca. 3 km). Vertical domain discretization is represented by 31 unevenly spaced vertical levels. Atmospheric wind data are provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) forecasts, at 1/8° (ca. 12.5 km) horizontal and 6-hour temporal resolution.

A great variety of probability patterns controlled by different underlying flows is represented including the cyclonic Rim Current, flow bifurcations in anticyclonic eddies (e.g., Sevastopol and Batumi), northwestern shelf circulation, etc. Uncertainty imprints in the oil mass balance components are also analyzed.

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