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Operational simulations of a Mediterranean oil spill in February 2021

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In the framework of the Mediterranean Operational Network for the Global Ocean Observing System (MONGOOS), an oil spill modeling team supported the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) to simulate the transport of hydrocarbons at sea and to assess the potential impact to neighbouring countries during an oil pollution incident reported in the second half of February 2021. The oil pollution incident constituted a large amount of tar balls, which were landed on the beaches of Israel, Lebanon and Gaza Strip following an offshore oil spill.

Two oil spill models were simultaneously run: MEDSLIK and MEDSLIK-II (Zodiatis et al., 2021). MEDSLIK was forced by the 6-hour Cyprus Coastal Ocean Forecasting and Observing System (CYCOFOS) currents and sea surface temperature with a horizontal resolution of 2 km, the hourly SKIRON's winds and waves at a horizontal resolution of 5 km. MEDSLIK-II used the 6-hour wind datasets provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) at ~12.5 km horizontal resolution, and the oceanographic fields (currents and SST) produced by the Copernicus Marine Environment Monitoring Service (CMEMS) at a horizontal resolution of ~4 km. The Stokes drift was parameterized by JONSWAP.

Interestingly, the spill was not detected at early stages of its development. Therefore, the model results were compared with the coastline distribution of the accumulated oil represented by Israeli authority as a map of "Coastal Traffic Light". The map showed that the length of the affected coast was approximately 160 km with three distinct clusters located: (1) just south of Haifa; (2) near Nahariyya in the north of Israel; and (3) near Bat Yam in the south of Tel Aviv.

Preliminary MEDSLIK and MEDSLIK-II results showed reasonable level of consistency indicating the cluster between Haifa and Atlit. However, the other two clusters remained to be unpredicted by both models, despite the fact that the models predicted lower level of concentration on the coast of these two areas. Moreover, instead of the oil beaching onto the Lebanese coast, MEDSLIK-II predicted trapping the slick by the Shikmona gyre.

Although further usage of the updated satellite-derived polygons as the initial conditions allowed both models to improve their performances, the drift of tar balls in the coastal area and the map of "Coastal Traffic Light" could not to be represented with high precision.

Evidence from an investigation by the Israeli Environmental Protection Ministry has shown that the reason for observational and modeling problems could be related to the uncertainties in the early stage of the slick development. As the spilled oil aged, the formation of tar balls complicated both the satellite-derived detection and modeling the spill.

Reference

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