SYMPOSIUM OP'24 ADVANCING OCEAN PREDICTION SCIENCE FOR SOCIETAL BENEFITS

Harnessing Copernicus Marine Data for Effective Environmental Management

Abstract

• Nowadays, there exist an increasing volume of ocean data that can be utilized for the operational management of environmental accidents.

• Ocean data from the Copernicus Marine Environmental Monitoring Service (CMEMS) are used in the management of two maritime spill cases: the spill produced after the crash of the ferry Volcán de Tamasite at the dike Nelson Mandela in La Luz Port (Gran Canaria, Spain) (see [1]) and a large-scale oil spill incident involving the Mediterranean coast of several Middle Eastern countries at the beginning of 2021 (see [2]).

Volcán de Tamasite

• On Friday, April 21st, 2017, at 7:00 p.m., the passenger ferry "Volcán de Tamasite" crashed into the Mandela Pier at the Port of La Luz. Following the crash, an oil conduit pipe broke, resulting in oil spilling into the ocean. This incident posed a threat to several critical points, including a fish farm, a desalination plant, and Las Canteras beach.

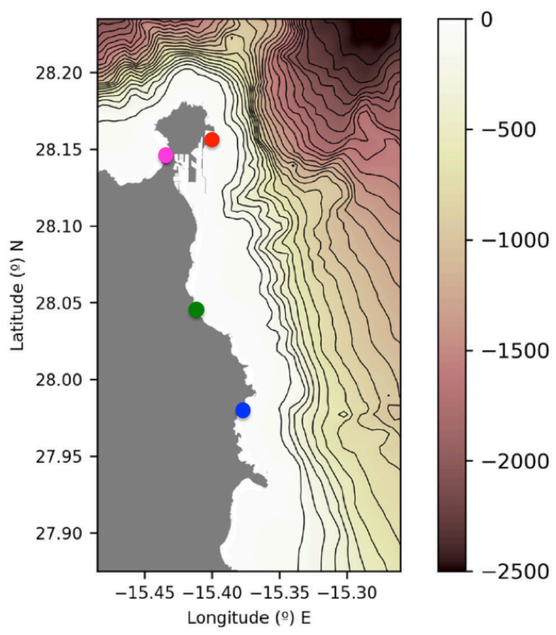

Figure 1: "Volcán de Tamasite" crash point is marked in red. Potentially affected areas: Las Canteras beach (magenta), fish farm (green), desalination plant (blue).

• On April 23rd at 7:00 a.m., satellite images detected oil to the south of the accident site.

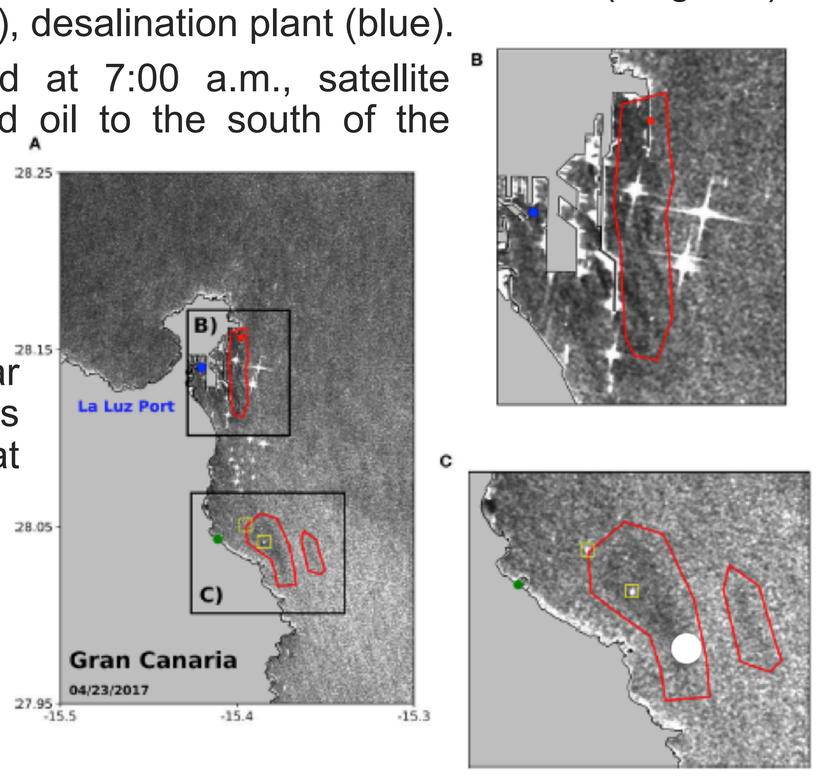

Figure 2: Radar satellite images on April 23rd at 7:00 a.m.

• Analyzing the event with Copernicus data offers insights into the oil's fate post-crash. Copernicus surface current data in the IBI domain is available at a 4 km resolution, while Spanish Puertos del Estado data offers resolutions up to 300 meters.

• Lagrangian Coherent Structures (LCS) help explain how the two ocean current sets spread the oil.

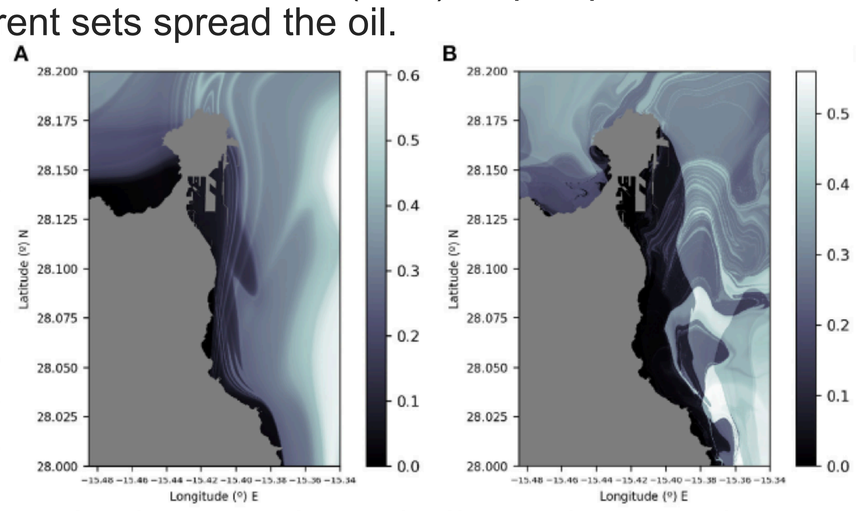

Figure 3: LCS on the accident day: A) IBI data; B) Puertos del Estado data. The delicate lines visible on the gray background show a hyperbolic trajectory in a detachment configuration, pushing the spilled fuel southward.

2021 Eastern Mediterranean Oil Spill

• In early 2021, oil from unknown sources affected the coastlines of multiple Middle Eastern countries in the Eastern Mediterranean. The spill reached Israel, Syria and Gaza.

• Satellite images in the Eastern Mediterranean showed spills on the sea surface before they reached the coast.

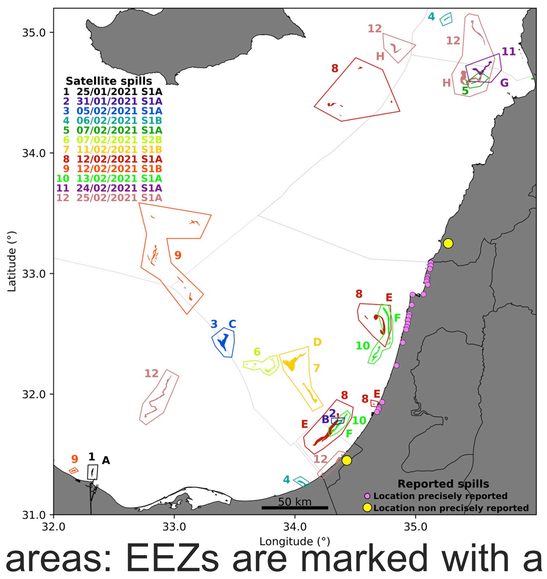

Figure 4: Scenario of affected areas: EEZs are marked with a dotted line. Pink and yellow dots indicate coastal areas with reported in situ oil or tar observations. Satellite detections are numbered and color-coded by the detection day.

• Satellite images identify the sources of the spill. Blobs are then simulated in the vicinity of these observations (bottom image below).

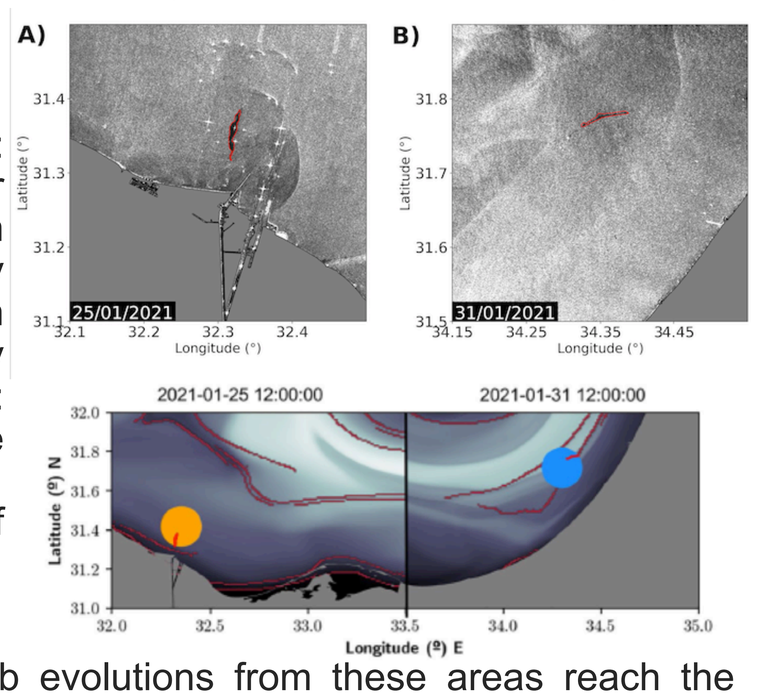

Figure 5: Top row: Sentinel 1A radar images. (left) on the 25th January 2021; (right) on the 31st January 2021. Bottom row: initialization of the simulations in the neighborhood of the observations.

• Notably, the blob evolutions from these areas reach the coast on the same dates and locations as in situ observations, marked in pink in the next figure.

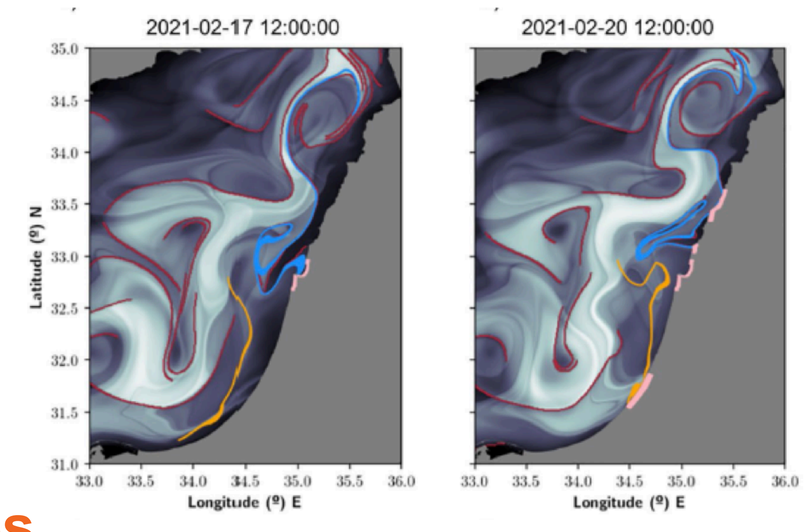

Figure 6: (Left) Simulated evolution on February 17th, 2021; (Right) Simulated evolution on February 25th, 2021.

References

[1] G. García-Sánchez, A. M. Mancho, A. G. Ramos, J. Coca, B. Pérez-Gómez, E. Álvarez-Fanjul, M. G. Sotillo, M. García-León, V. J. García-Garrido, and S. Wiggins. Very High Resolution Tools for the Monitoring and Assessment of Environmental Hazards in Coastal Areas. Frontiers in Marine Science, 7:1605804, 2021.

[2] G. García-Sánchez, A. M. Mancho, A. G. Ramos, J. Coca, and S. Wiggins. Structured pathways in the turbulence organizing recent oil spill events in the Eastern Mediterranean. Scientific Reports, 12:3662, 2022.

Acknowledgments & Contact

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