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DATA VISUALISATION WORKSHOP SERIES



PROGRAMME OF THE
EUROPEAN UNION

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Europe's eyes on Earth



IMPLEMENTED BY



Oceans and Sea Ice

Sentinel 1 data: a unique instrument for oil spill detection

Okeanos and Witoil: oil spill monitoring and forecasting system

Giovanni Coppini, Euro-Mediterranean
Centre on Climate Change (CMCC) Italy

Join activities by CMCC and OrbitalEOS

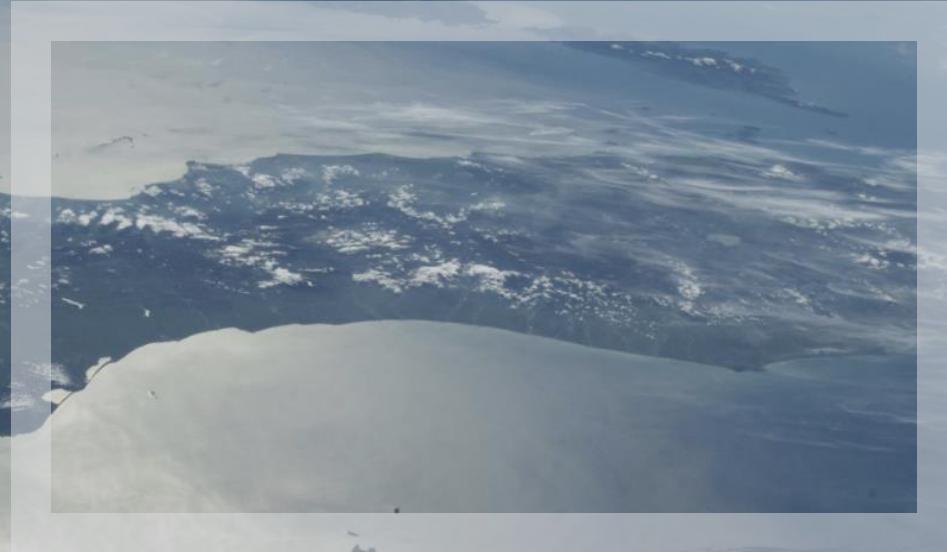


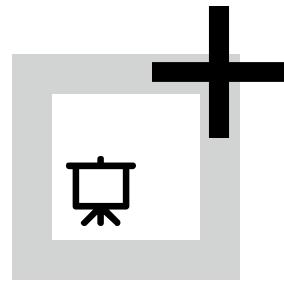
UNCERTAINTY IS THE
NEW NORMAL

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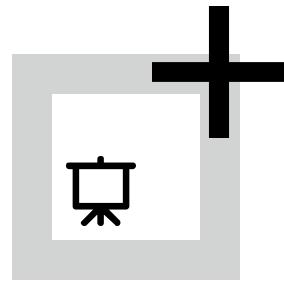
ENVIRONMENTAL CRISIS





THE FACTS

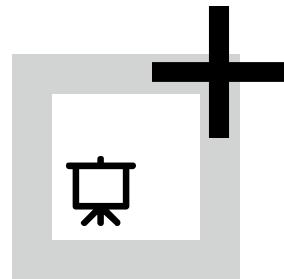




THE FACTS

1 Major oil leak

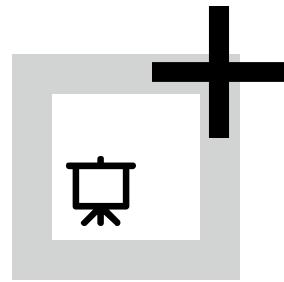




THE FACTS

- 1 Major oil leak
- 2 When will it be fixed?





THE FACTS

1 Major oil leak

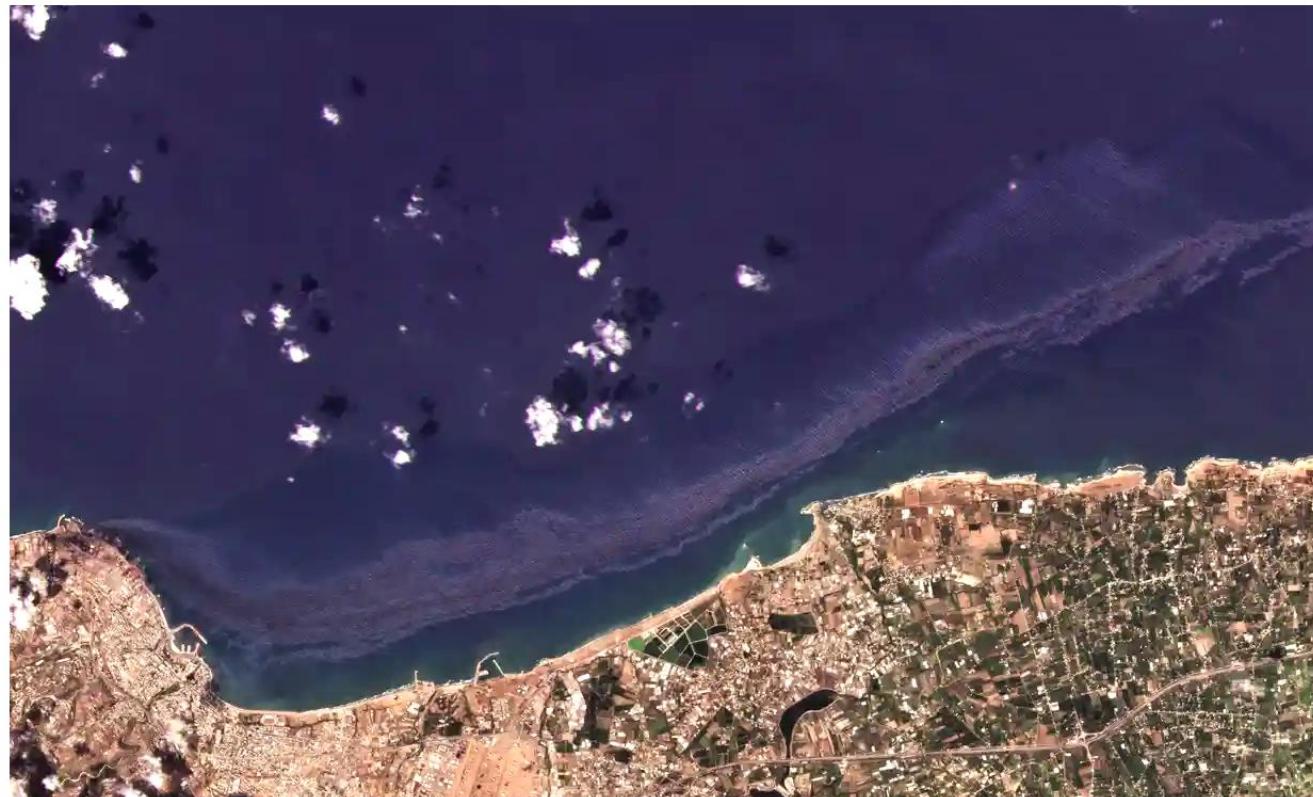
2 When will it be fixed?

3 Spill uncontrolled

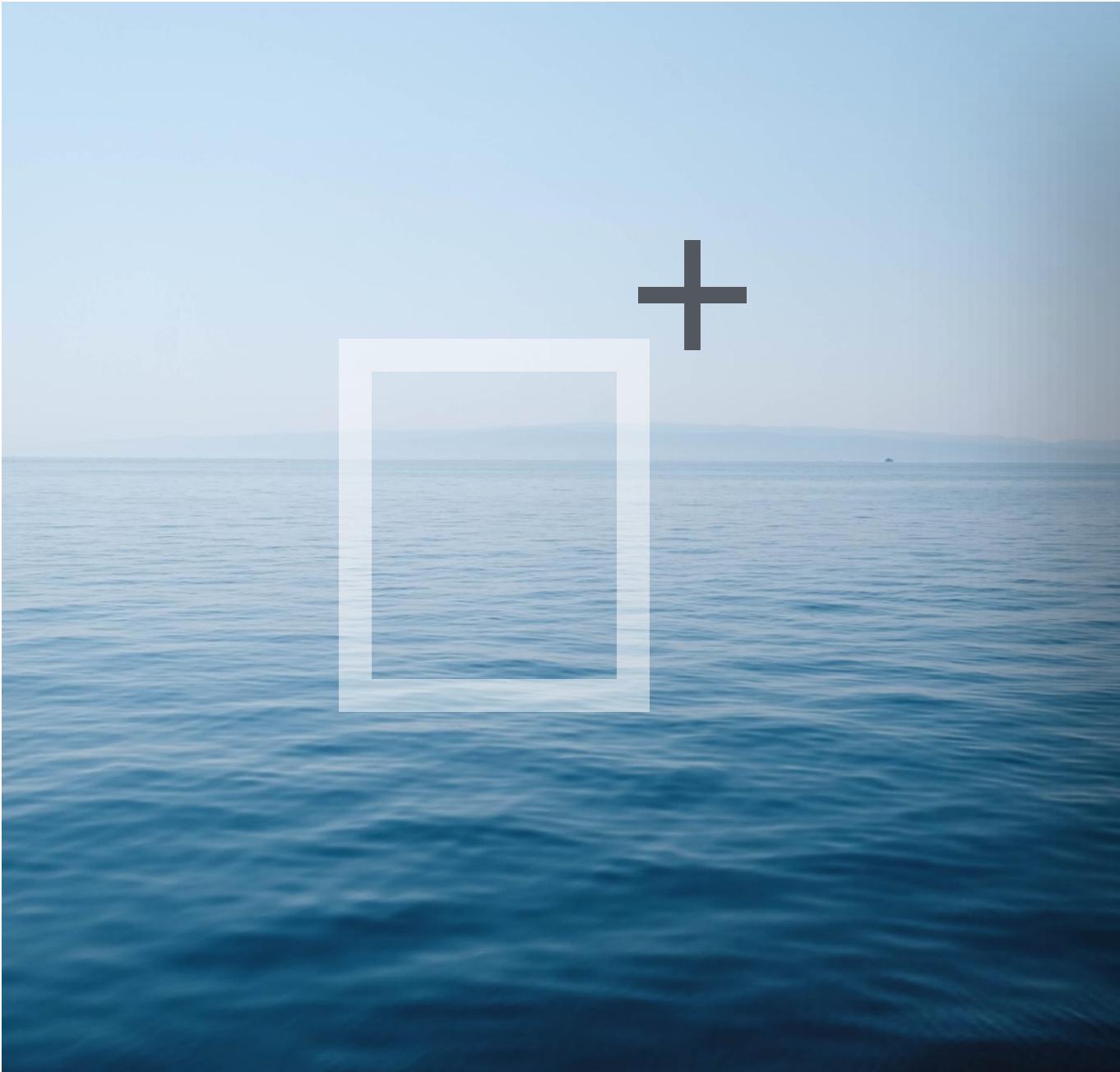


Cyprus prepares for Mediterranean oil spill from Syrian power plant

Officials in Turkish-occupied northern Cyprus say 20,000 tonnes of oil is approaching its coastline



▲ The oil spill off the coast of Baniyas, Syria on 24 August. Photograph: Planet Labs Inc./AP



THE CHALLENGE



Oil spills are large and dynamic



Where?



WhAT?



When?



Our solution :

OKEANOS

Digital platform designed
to be a **one-stop-shop** for
oil spill monitoring &
reporting.

**Exploiting Sentinel 1,
Sentinel 2, Landsat 8 and
9, Cosmo-Skymed, Iceye,
Saocom**



Our solution :

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Satellite-based detection



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Satellite-based detection



AI-based advanced analytics

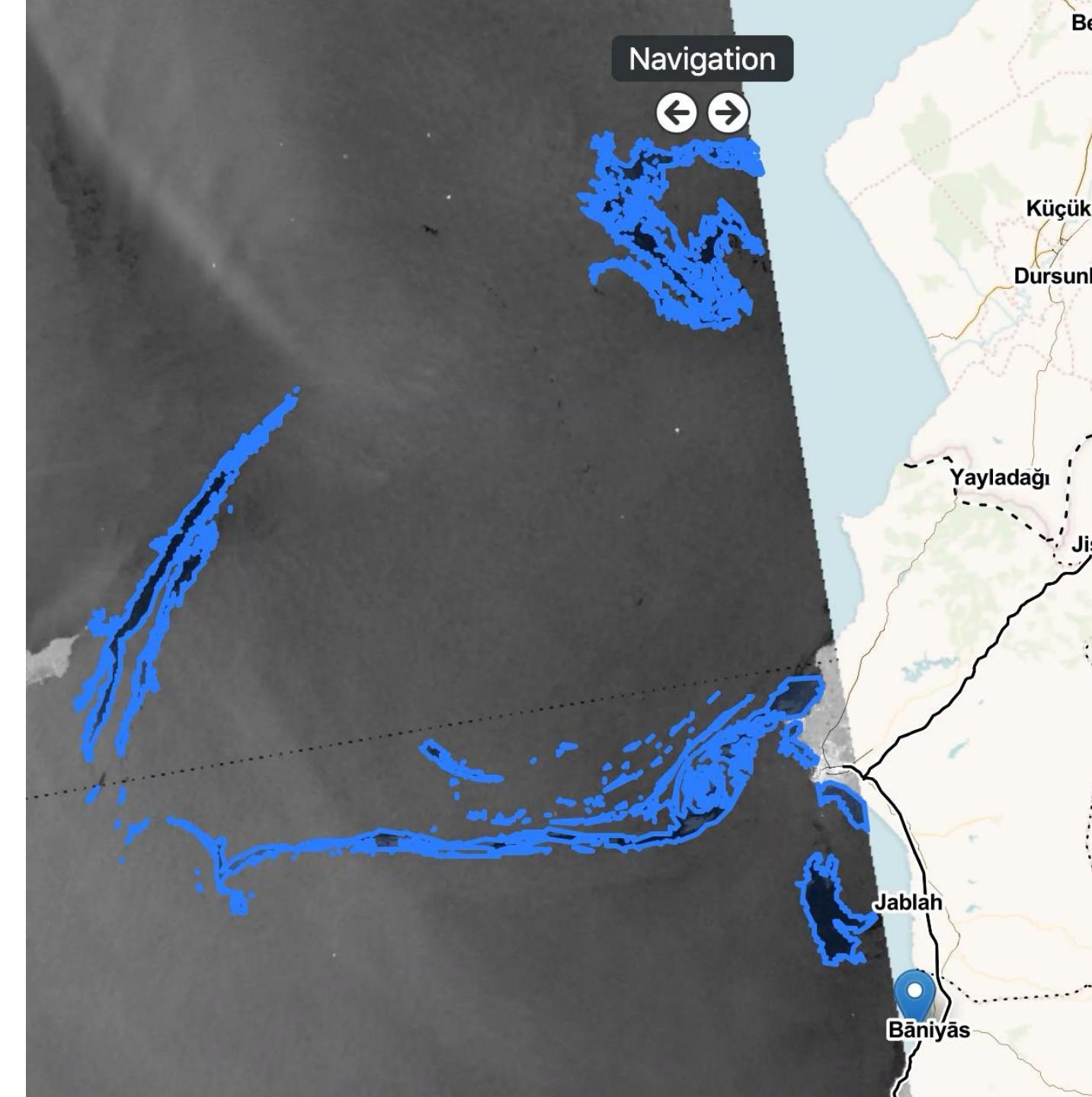


Our solution :

OKEANOS

Digital platform designed to be a **one-stop-shop** for **oil spill monitoring & reporting.**

- Satellite-based detection
- AI-based advanced analytics
- Identification of source (AIS)



Our solution :

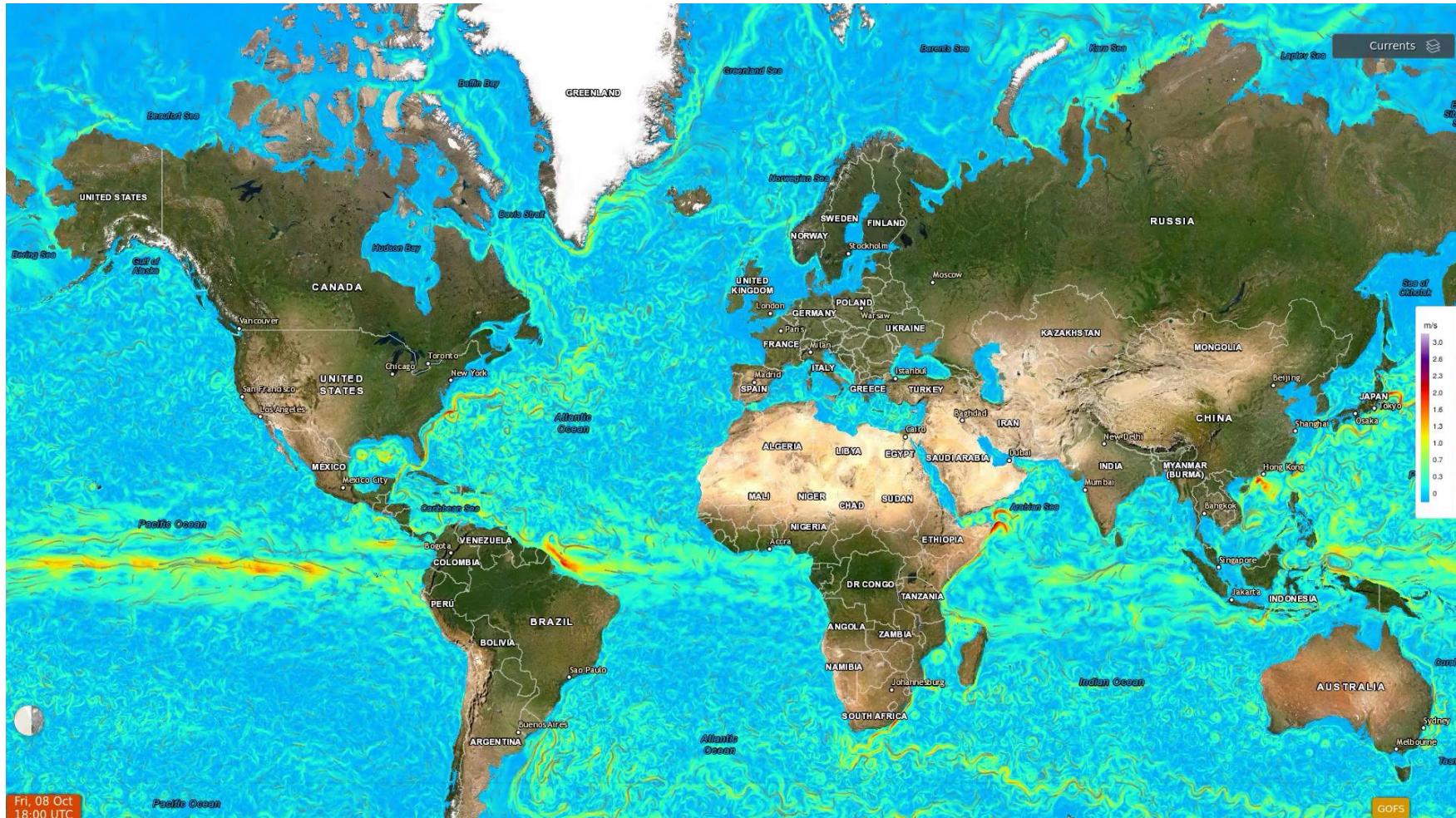
OKEANOS



Digital platform designed to be a **one-stop-shop** for **oil spill monitoring & reporting.**

-  Satellite-based detection
-  AI-based advanced analytics
-  Identification of source (AIS)
-  Spill forecasting

Marine forecasts: global scale



CMCC Global Ocean and Coastal forecast of Dubai

Multi model ocean forecasting systems approach:

- 2 Global models (Copernicus Marine Service and CMCC GOFS16)
- EU Seas Copernicus Marine Forecasting Systems
- CMCC coastal models

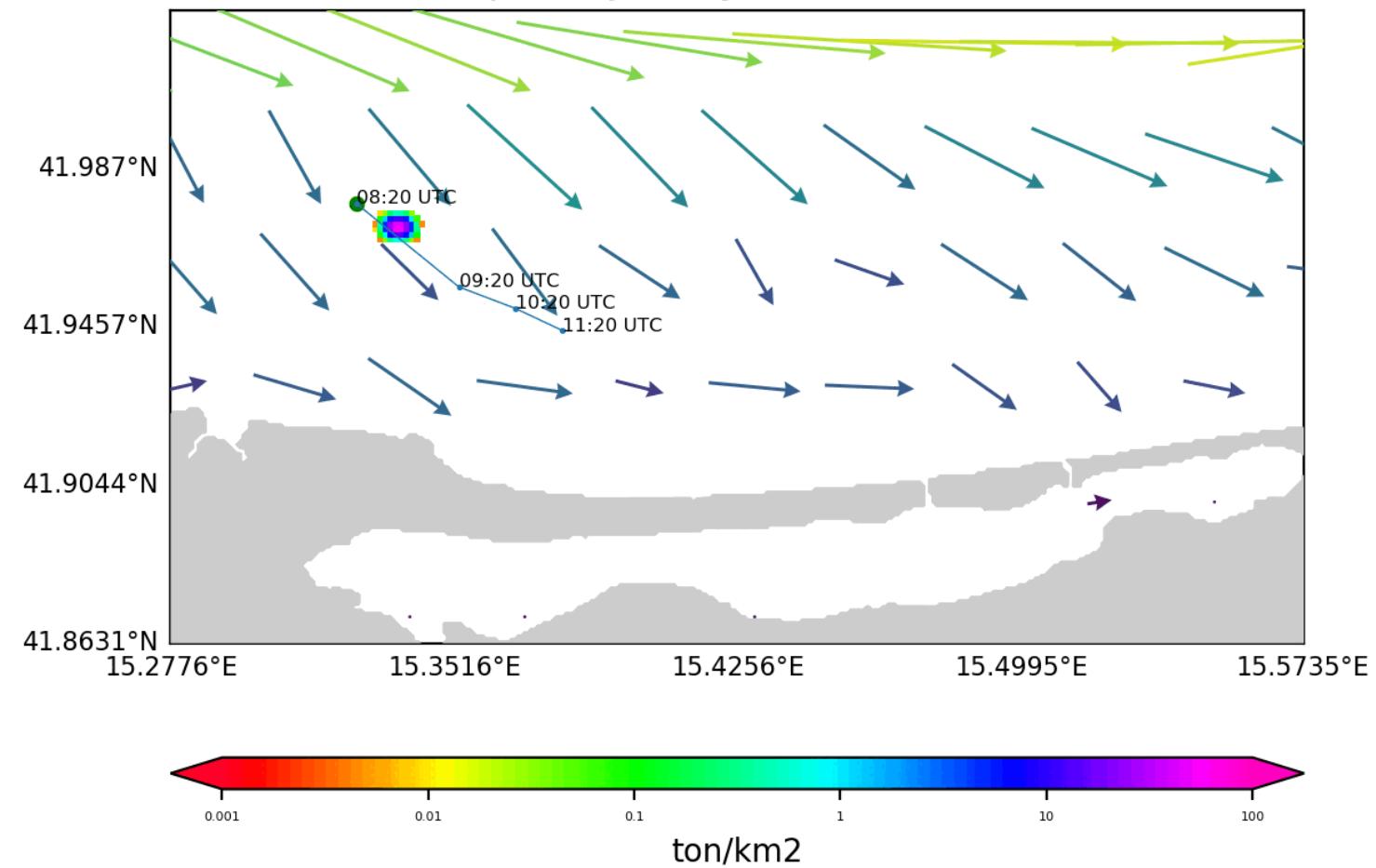
ECMWF wind forcings



Oil spill Emergency Real Field exercise with Apulia Civil Protection and Italian Coast Guard



Simulated spill trajectory - 05.05.2023 09:20 UTC



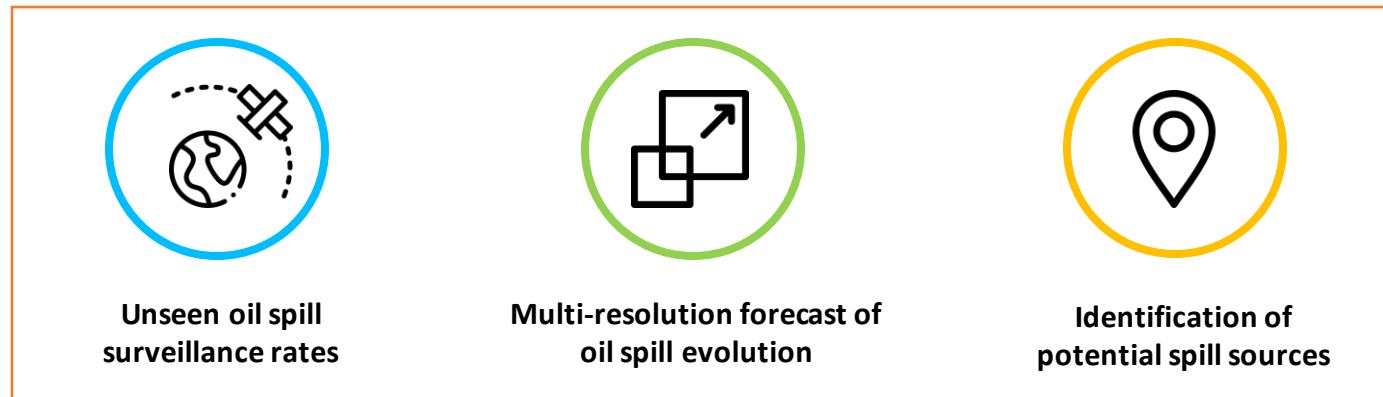
Okeanos Smart Pollution Control

Oil spill surveillance solutions are cheaper than traditional oil spill reduction measures

OKEANOS is an Integrated Solution

Monitor what happens at sea through a **user-friendly interface displaying real-time, intelligent and data supported insights.**

It's a **tailor-made solution** designed to satisfy present and future needs of our customers.



Results

Reduction in the volume of oil spilled within the area of interest by 30% after one year
Up to 69% reduction in five years



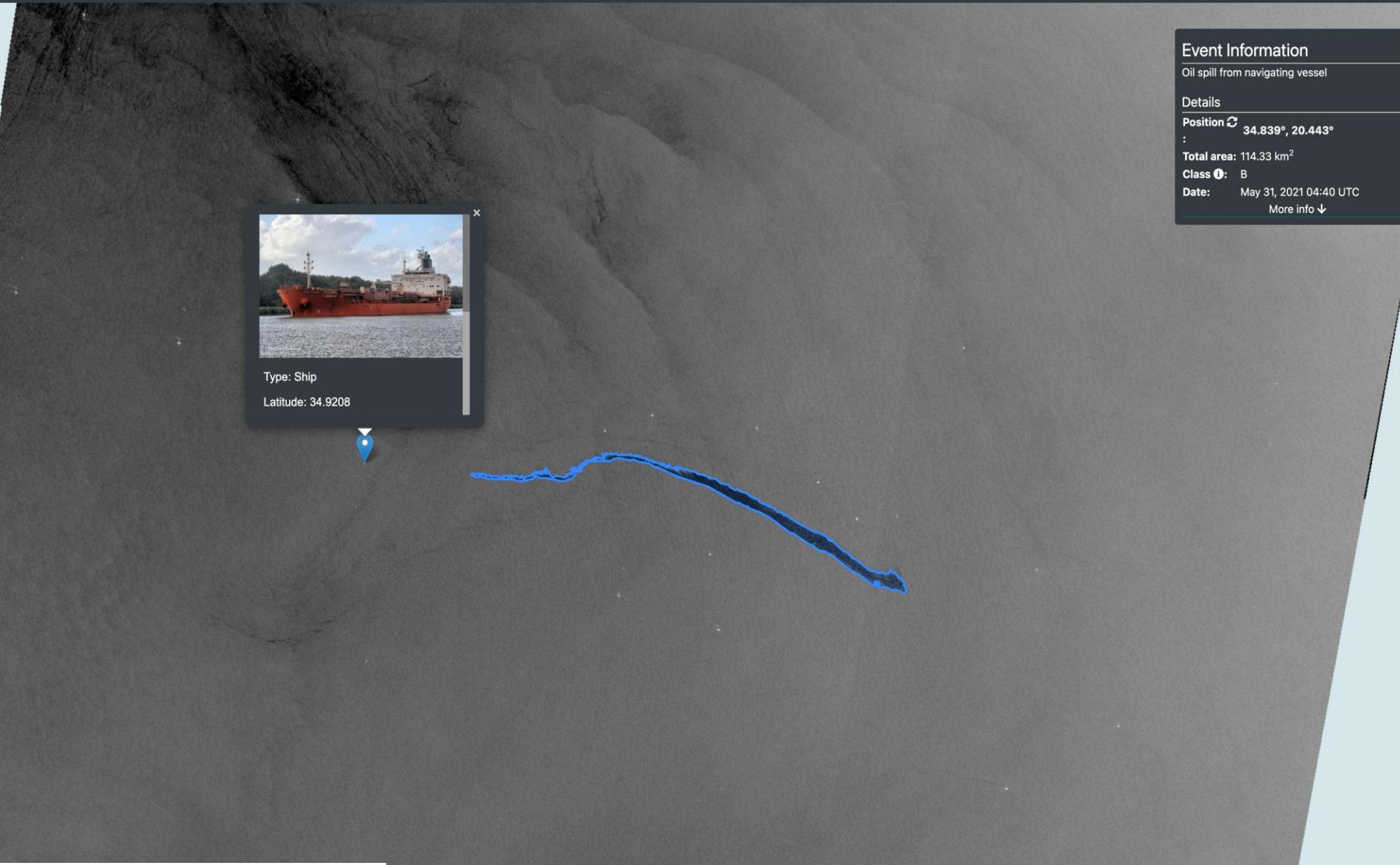
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C A S E S



Tools



DELIBERATE POLLUTION

Event Information

Oil spill from navigating vessel

Details

Position 34.839°, 20.443°

:

Total area: 114.33 km²

Class B

Date: May 31, 2021 04:40 UTC

[More info](#)



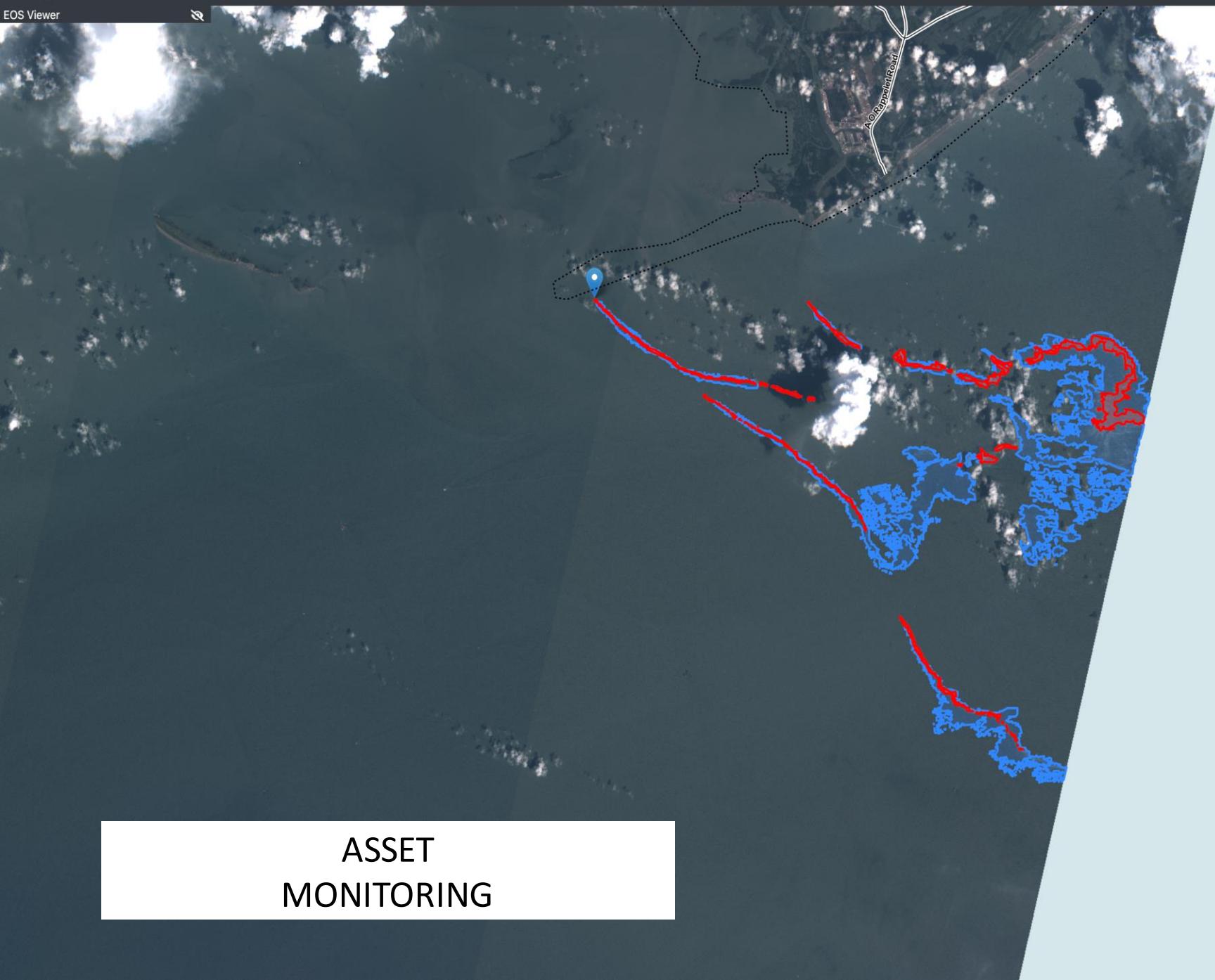
Relief



Vector

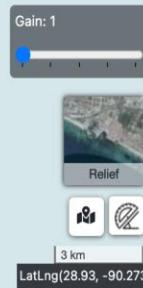
10 km

LatLng(34.616, 19.698)



ASSET MONITORING

Event Information	
Details	
Position :	28.988°, -90.132°
Total area:	56.43 km ²
Class :	A
Date:	Sep 02, 2021 16:55 UTC
More info	

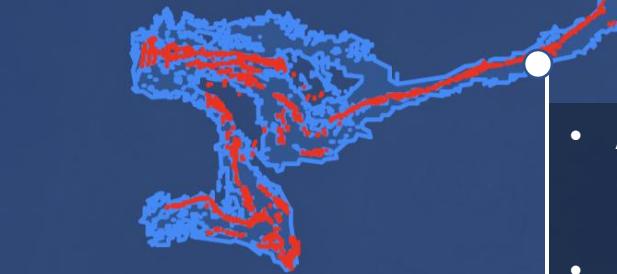


Use Case Support to REMPEC For emergency Support



Okeanos Smart Pollution Control

- Forecasted trajectory and fate of every detected spill
- Predictions in local, regional and global scale



- AI-supported oil spill detection and classification
- Multi-source optical and SAR imagery
- <24h average revisit time
- Low rate of false positives

- Detailed description of the spill

Event Information

Position  35.354°, 35.564°

:

Date: Aug 28, 2021 08:31 UTC

Area: 711.49 km²

Min. Volume: 219.1 m³

Max. Volume: 2123.72 m³

Class  A

Shore distance: 0 km

Satellite: Sentinel-2

 Thin oil  Thick oil  Very thick oil

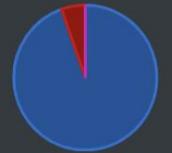
Area (km²)

 673.06

(94.6%)

 38.44 (5.4%)

 0 (0%)



Min. Volume (m³)

 26.92 (12.3%)

 192.18 (87.7%)

 0 (0%)



Max. Volume (m³)

 201.92 (9.5%)

 1921.8 (90.5%)

 0 (0%)



Thickness distribution ↑

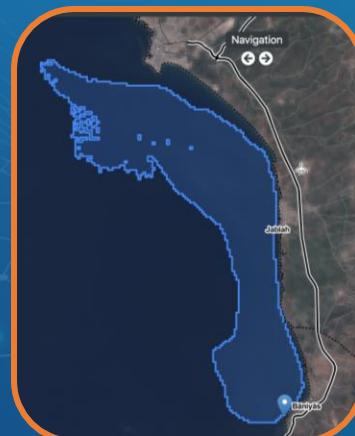


Use Case Support to REMPEC For emergency support



Okeanos Smart Pollution Control

CMCC supported the **Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea** (REMPEC) after the Baniyas Thermal Station spill in Syria.



Okeanos satellite observations of the Baniyas spill

15,000 tons of fuel oil discharged in the ocean and **followed for 30 days**.

One spill observation every 14h in average.

Cheap & accurate monitoring using optical and SAR imagery.

Up-to-date **forecasts of the spill impacts**, at all scales (regional to local).

Yu Feng - Mauritius (2022)

WITOIL simulation

December 19, 2022

EVENT: GROUNDING YU FENG (FISHING VESSEL)

DISCLAIMER

The information and views set out in this Bulletin are those of the authors CMCC Foundation and do not necessarily reflect the official opinion of the governments of the area. CMCC Foundation does not guarantee the accuracy of the data included in this study. Neither the CMCC Foundation nor any person acting on the author's behalf may be held responsible for the use which may be made of the information contained therein.

Contact point: Giovanni Coppini (giovanni.coppini@cmcc.it)

SUMMARY

The Taiwanese fishing vessel Yu Feng has run aground off *Île du Sud*, St Brandon. Weather conditions are expected to deteriorate in the following hours which may further damage the vessel potentially resulting in a diesel spill.

Trajectory and fate of the potential oil spill were computed using the MEDSLIK-II model. The model was forced by CMCC - GOFS16 ocean fields and ECMWF - High Resolution Weather Forecast and Analysis fields. The vessel is located close to the coral reef closing the eastern side of the island. Most likely, the oil will be transported by dominating E and E-SW winds of moderate intensity (about 10 m/s) rapidly reaching inner areas of the reef.

Computed average oil displacement: E

Expected first contact with the coastline: within one hour after the spill start.

Expected first contact location: The oil is expected to reach inner areas of the reef as indicated in the Figure below.



FIRST OIL IMPACT MARKED WITH GREY SQUARE.

December 19, 2022

MODEL & SCENARIO CONFIGURATION

The oil spill model MEDSLIK-II was used to forecast the following scenario:

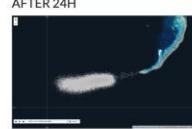
TABLE 1: SCENARIO SETUP

Scenario variable	Value
Start time	19/12/2022 09:50 UTC
Start location	16.83 S - 59.52 E
Oil type (API)	12 (Bunker oil)
Spilled volume	5.5 ton/hour spilled for 24h (78,000 liters)
Simulation length	48h
Ocean fields used	CMCC - Global Ocean Forecasting System 1/16 deg resolution
Wind fields used	ECMWF - High resolution analysis and Forecast 1/10 deg resolution
Wind drag coefficient	3% of instantaneous wind speed

SPILL EVOLUTION IN THE FOLLOWING 48H

(a) SURFACE OIL CONCENTRATION AFTER 24H 

(b) BEACHED OIL CONCENTRATION AFTER 24H 

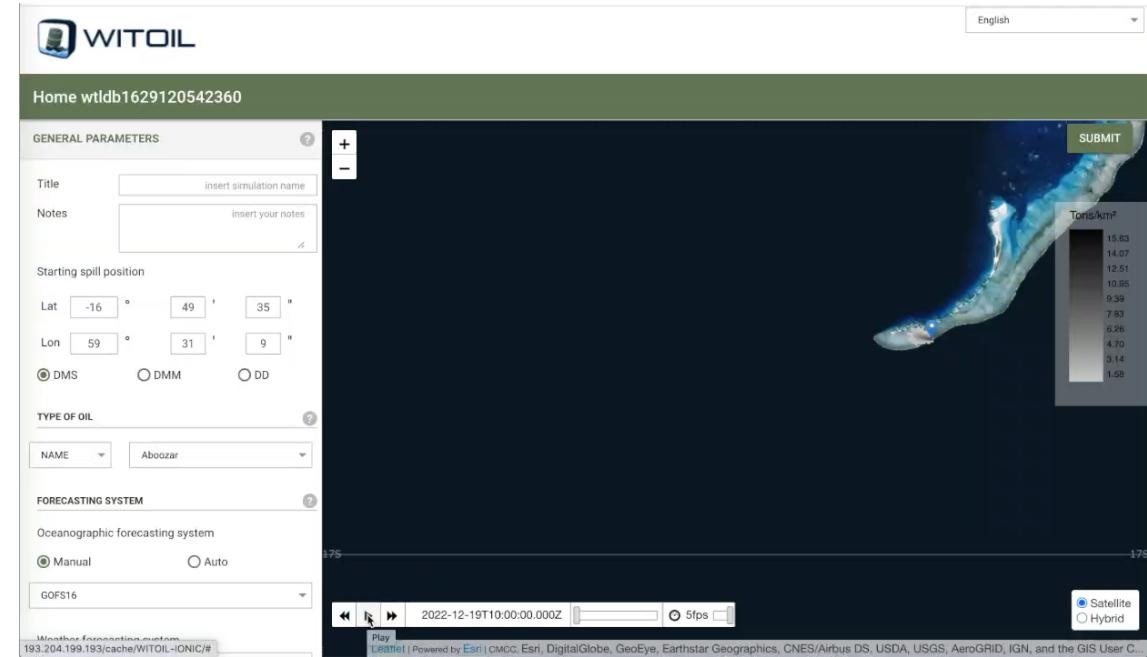
(c) SURFACE OIL CONCENTRATION AFTER 48H 

(d) BEACHED OIL CONCENTRATION AFTER 48H 

OKEANOS - OIL SPILL FORECAST REPORT 2

cmcc

OKEANOS - OIL SPILL FORECAST REPORT 3



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Oceans & Sea Ice

HOW ARE WE DIFFERENT?

The **most advanced system** for oil spill monitoring & reporting

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The **most advanced system** for oil spill monitoring & reporting

1

EXPERIENCE

25+ years of operational experience

HOW ARE WE DIFFERENT?

The **most advanced system** for oil spill monitoring & reporting

1

2

EXPERIENCE

25+ years of operational experience

SPEED

Fastest service in the market

HOW ARE WE DIFFERENT?

The **most advanced system** for oil spill monitoring & reporting

1

2

3

EXPERIENCE

25+ years of operational experience

SPEED

Fastest service in the market

CONVENIENCE

One-stop-shop digital solution

HOW ARE WE DIFFERENT?

The **most advanced system** for oil spill monitoring & reporting

1

2

3

4

EXPERIENCE

25+ years of operational experience

SPEED

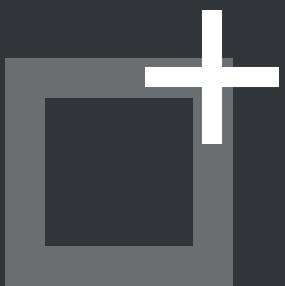
Fastest service in the market

CONVENIENCE

One-stop-shop digital solution

ACCURACY

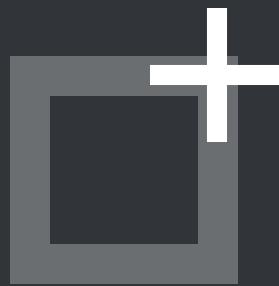
AI models trained by experts: 60% improved accuracy



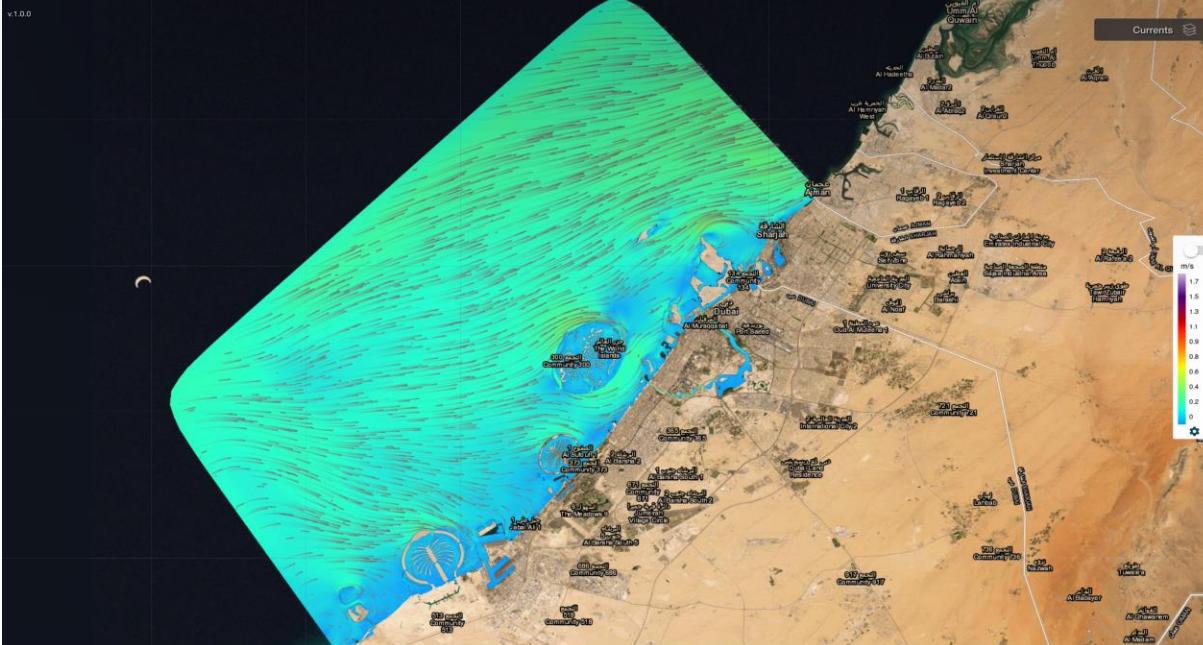
ORBITALEOS

Spin-off of the Spanish Coast Guard





CMCC
Euro-
Mediterranean
Climate Change
Foundation



Climate Change in the Future, Fast Changing World

The CMCC vision towards 2029

Strategic Plan 2019 - 2029





with The Global Ocean Observing System

Decade Action of the UN Ocean Decade Core project of CoastPredict Program

Integrated coastal ocean observing and predicting (PredictOnTime)

<https://PredictOnTime.org>

<https://coastPredict.org>

This programme is endorsed by the **UN Decade of Ocean Science**



2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development





Oil spill monitoring and
forecasting



+34619448352



info@orbitaleos.com



Pedralba, 19, Bétera,
Valencia,
Spain



+39 3923857919

service.oclab@cmcc.it
giovanni.coppini@cmcc.it

CMCC, Via Marco Biagi 5/6
/3100 Lecce
Italy