

Earth Observation Maritime Surveillance System

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German Aerospace Center (DLR)

German Remote Sensing Data Center (DFD)

National Ground Segment (NBS)

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Knowledge for Tomorrow



Presentation Outline

Background

- DLR Earth Observation Center
 - Maritime Security Lab Neustrelitz
 - Objectives and Applications
 - Sensors and modes

Earth Observation Maritime Surveillance System

- System overview
 - Image processing
 - Thematic processing
 - Product Dissemination
- Use case



Earth Observation Center – EOC



Bremen
Maritime Security Lab



Berlin



- **German Remote Sensing Data Center**
- **Remote Sensing Technology Institute**
- **Chairs at 2 university**
- **Appr. 350 employees at 4 sites**



Neustrelitz
National Ground Segment
Maritime Security Lab



Oberpfaffenhofen



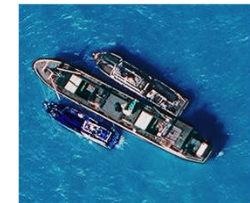
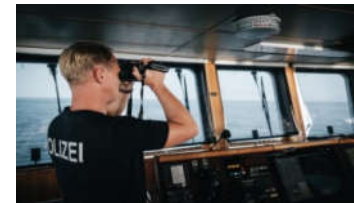
Objectives and Applications

- **Algorithm** development to derive value added information out of remote sensing data (SAR, Optic) for the **Maritime Domain**
 - in cooperation with Maritime Security Lab Bremen
- **Application** development to derive value added information products by using **different data sources**, mainly remote sensing and AIS to provide maritime information products for **Maritime Situational Awareness**

MARITIME SAFETY AND SECURITY



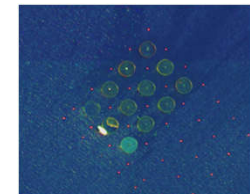
LAW ENFORCEMENT



MARINE ENVIRONMENT / POLLUTION MONITORING



FISHERIES CONTROL

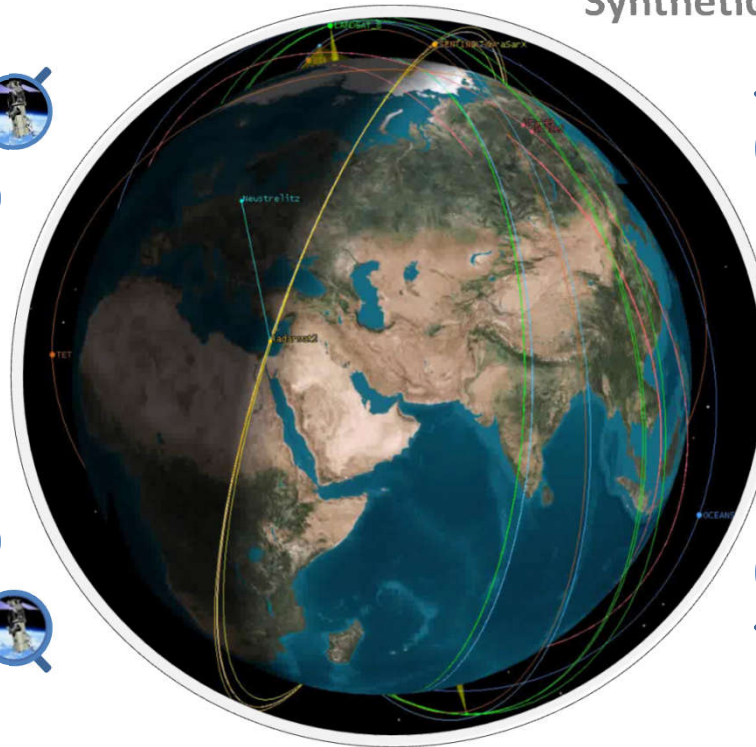
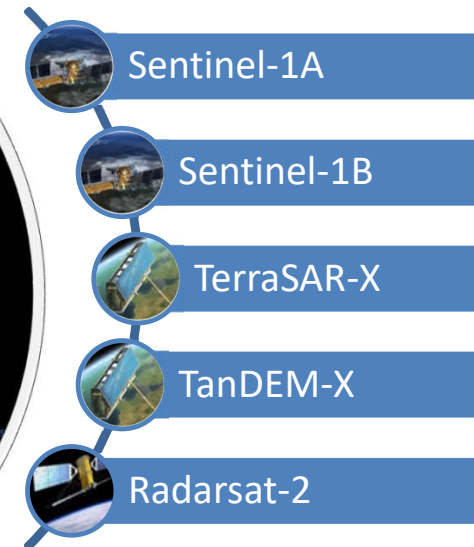


Sensors and Modes

Optical



Synthetic Aperture Radar (SAR)



Automatic Identification System

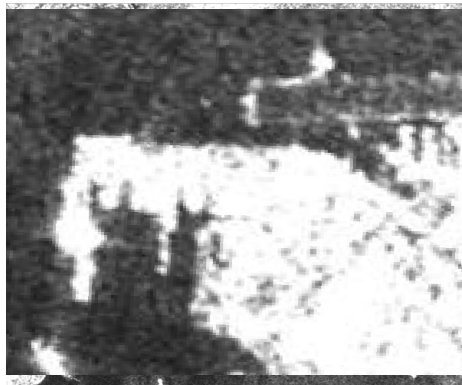
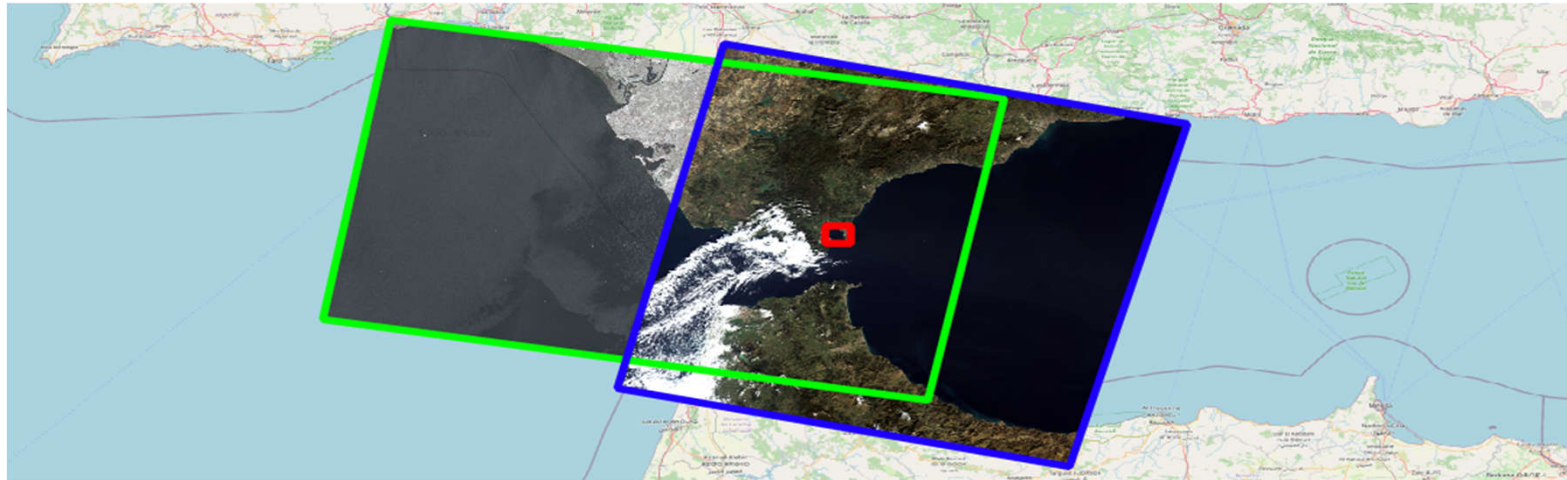
Terrestrial AIS



Satellite AIS



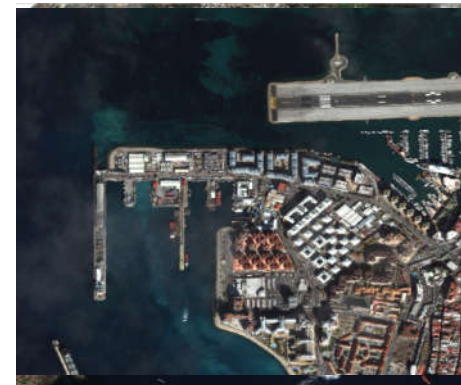
Sensors and Modes



□ SAR: Sentinel-1B



□ MR Optical: Landsat-8



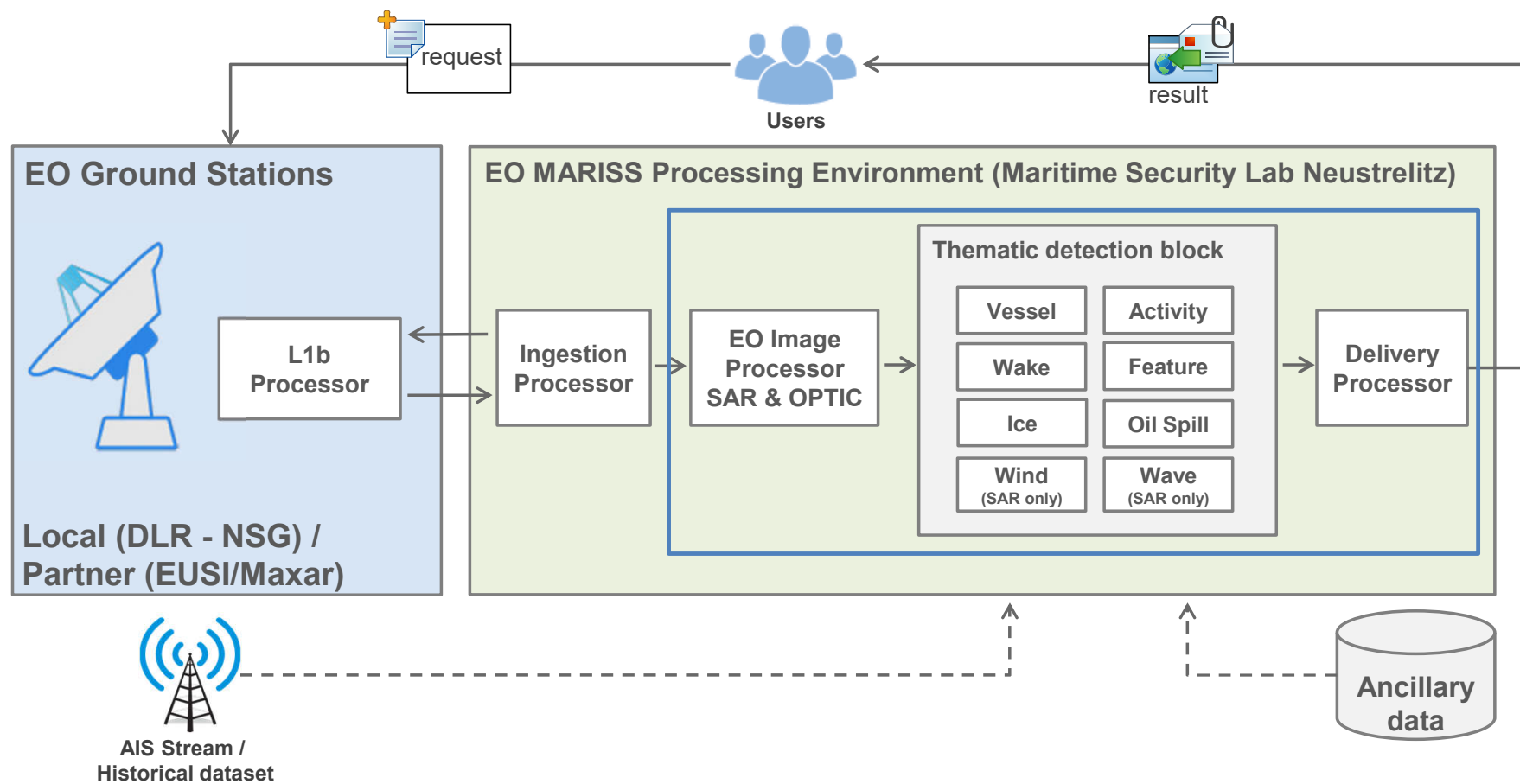
□ VHR Optical: Worldview-3



Earth Observation Maritime Surveillance System



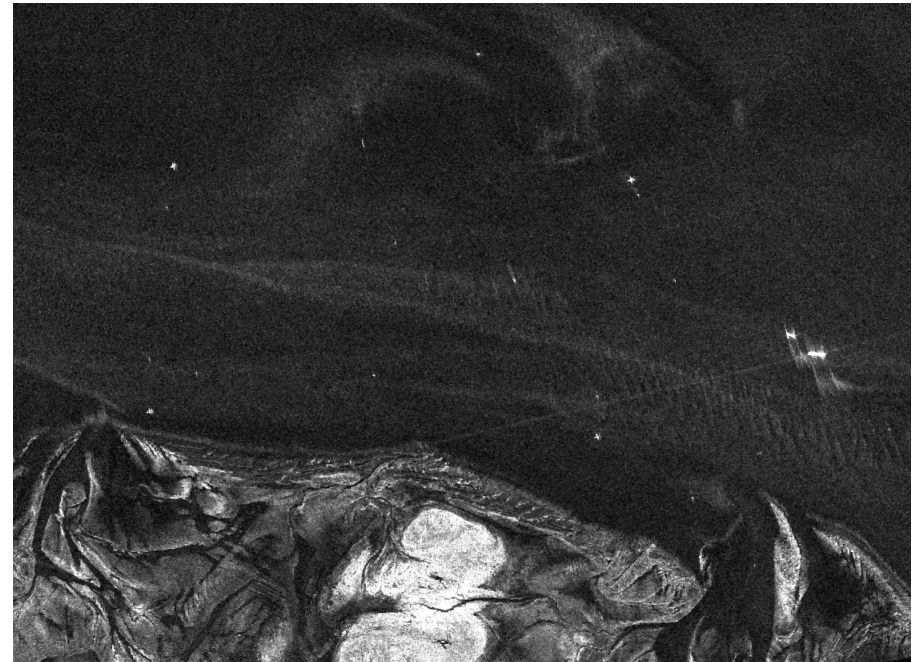
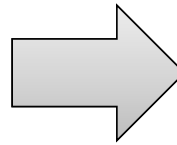
Earth Observation Maritime Surveillance System



EO Image Processor | SAR



No histogram stretch



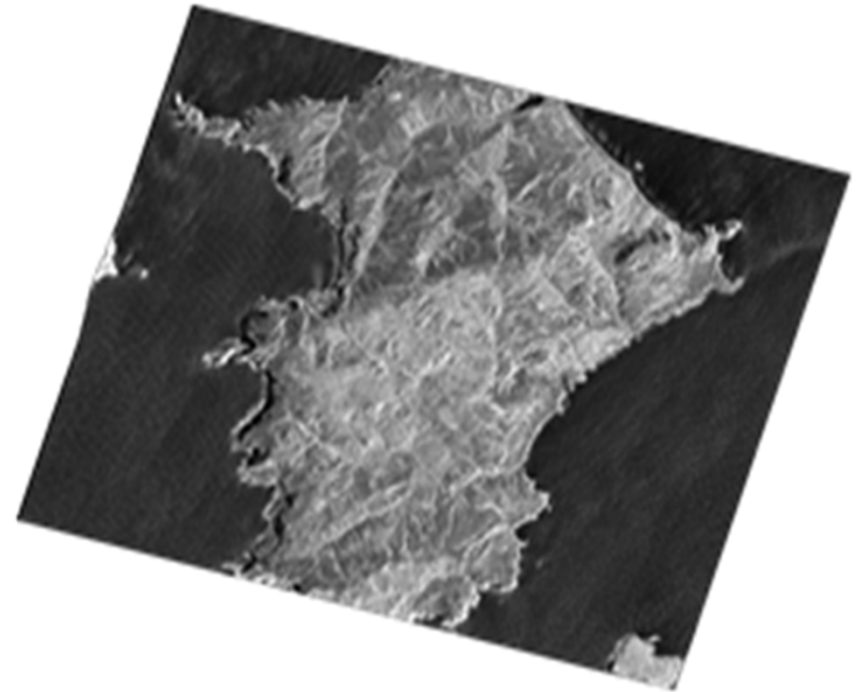
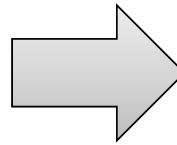
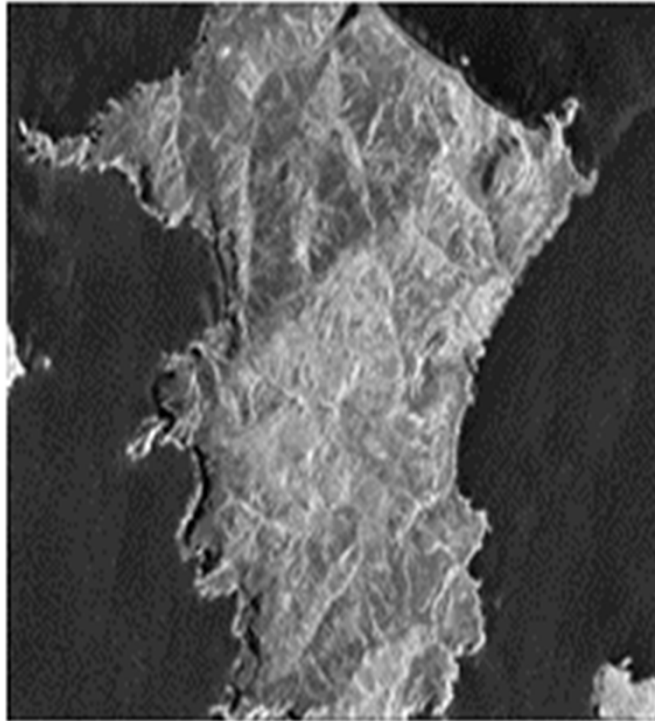
With histogram stretch

TerraSAR-X © 2020 DLR/Airbus DS

- Calculates surface reflectance (Optic)
- Pan-sharpening (Optic)
- Automatic histogram stretch
- Mosaiking
- Orthorectification with EU_DEM+TDM-90 DEM / SRTM-X DEM
- Fully automated



EO Image Processor | SAR

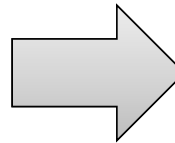


TerraSAR-X © 2020 DLR/Airbus DS

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EO Image Processor | OPTIC



No atmosphere correction

With atmosphere correction

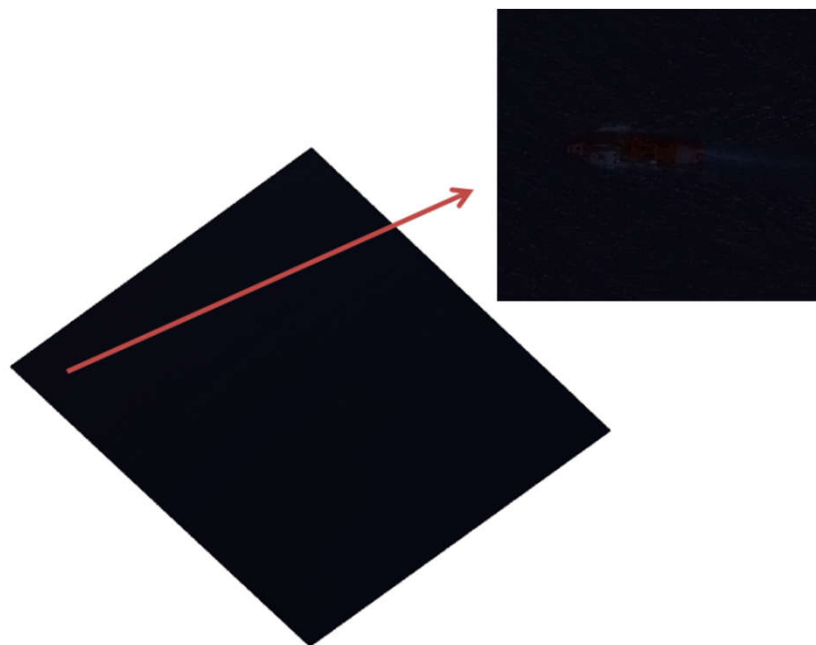
WorldView-3 © 2020 European Space Imaging

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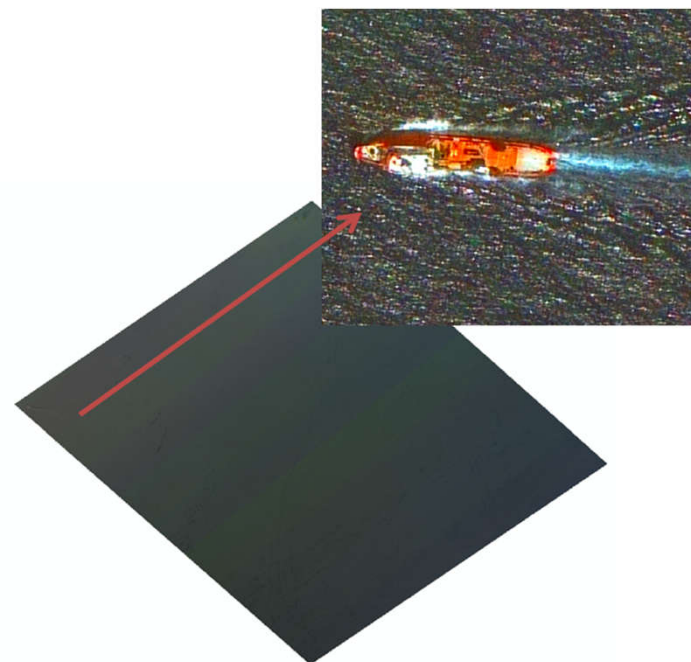
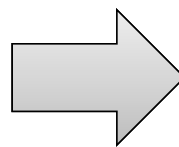
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EO Image Processor | OPTIC



No atmosphere correction



With atmosphere correction

WorldView-3 © 2020 European Space Imaging

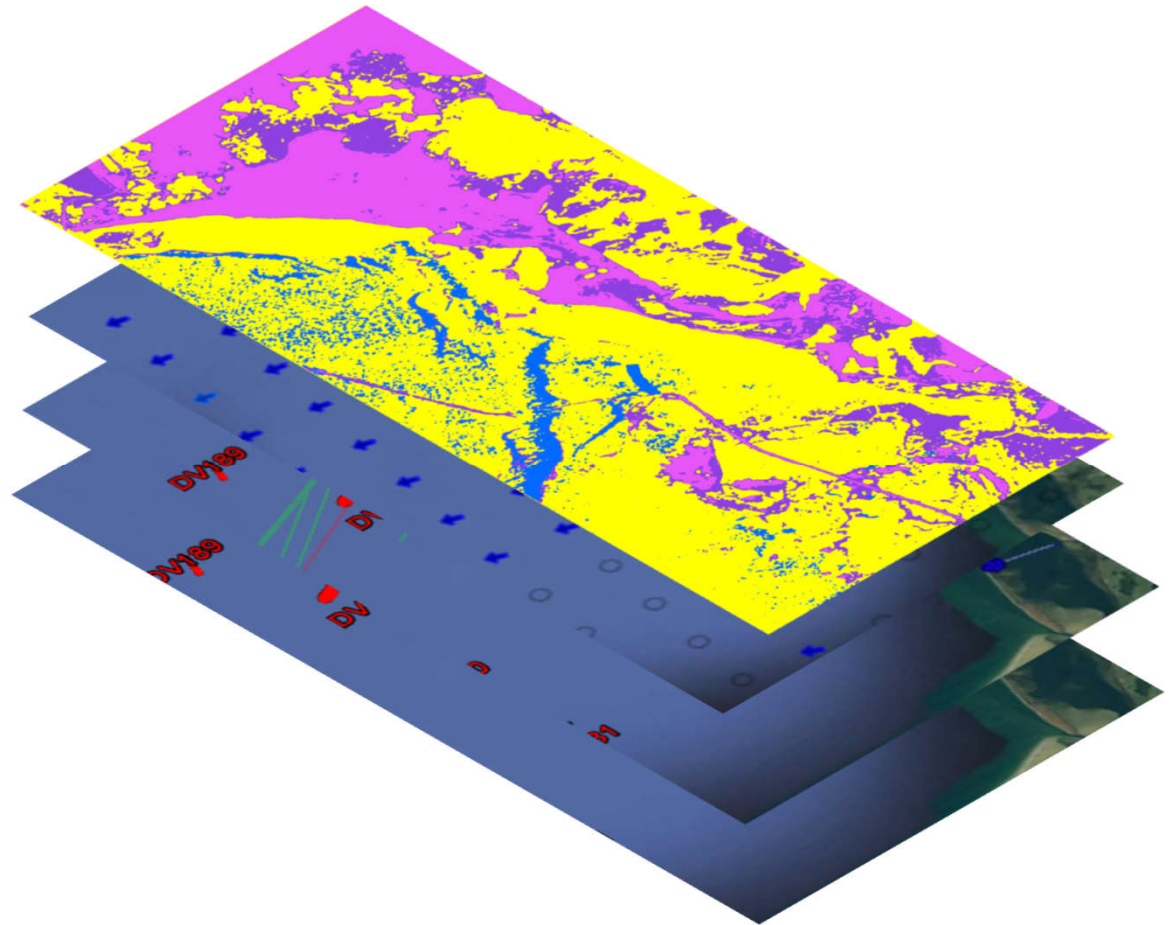
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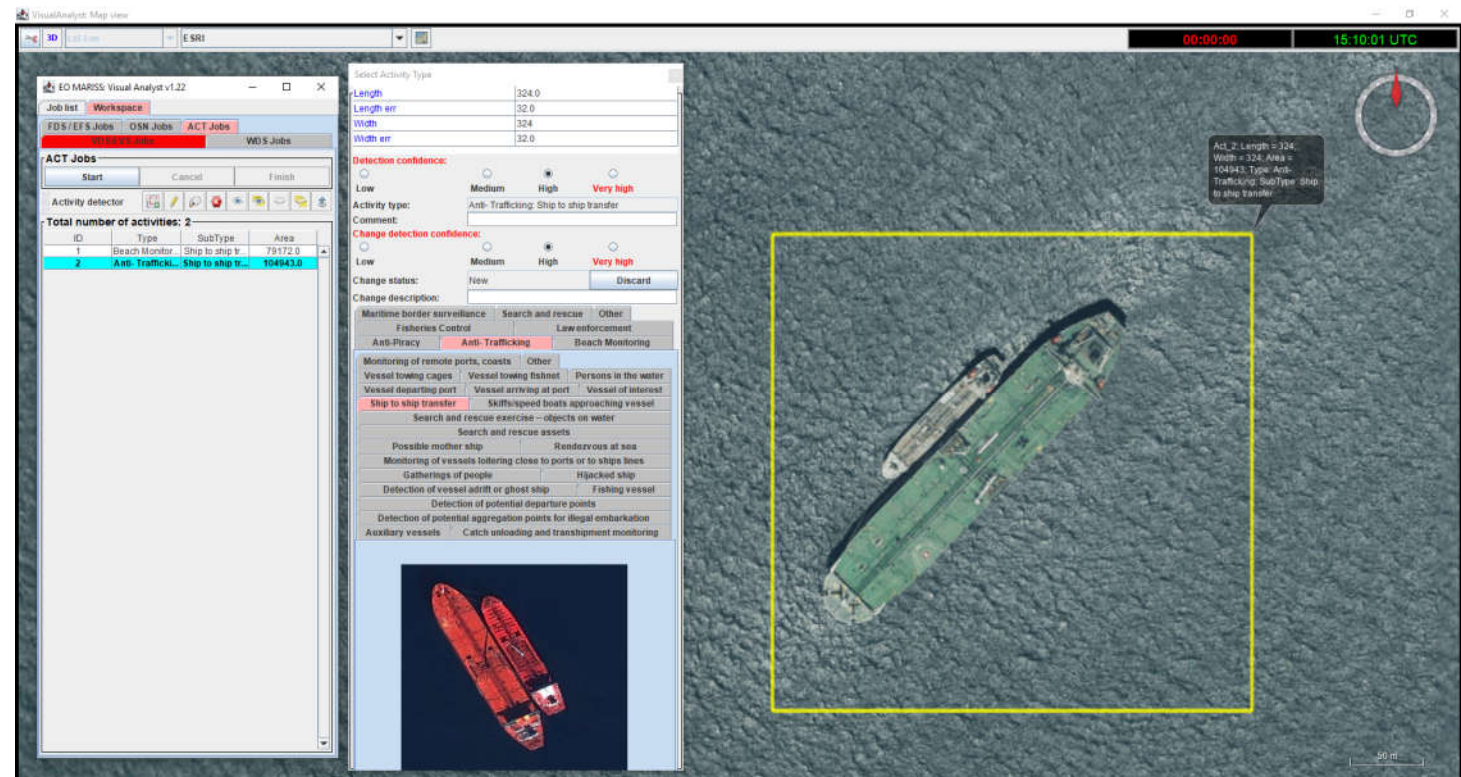
Thematic processing

- **Automated processing**
 - Target detection
 - Data fusion
 - Wind
 - Wave
- **Semi automated algorithms**
 - Target detection
 - Activity detection
 - Change detection
 - Data fusion
- **Operator Interface**
 - GUI with 3D viewer



Thematic processing

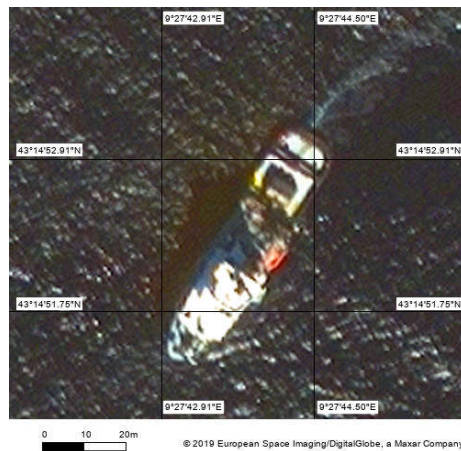
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EO MARISS Visual Analyst: interactive activity detection
WorldView-3 © 2020 European Space Imaging

Product Dissemination

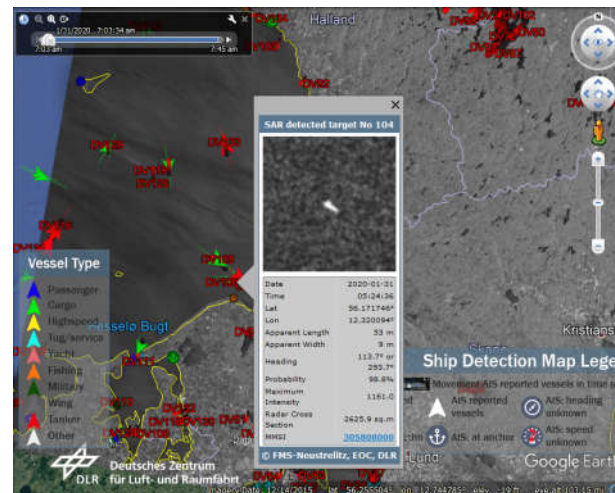
File delivery



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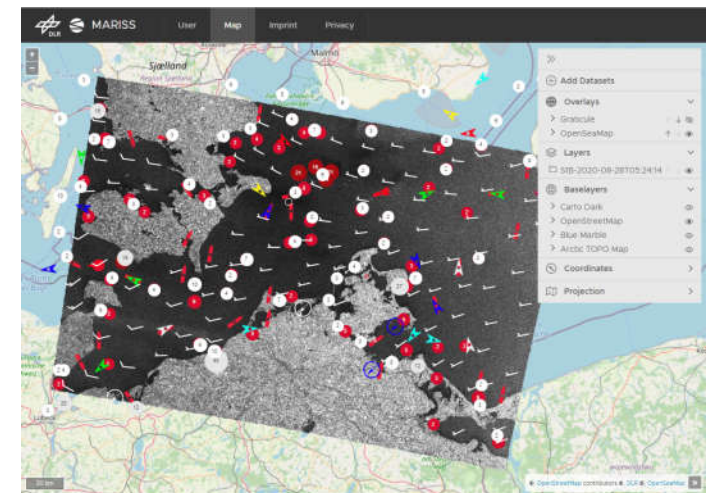
- OGC-standardized
- Custom formats

E-mail: kmz/kml



- Small file size
- Low image resolution

Web-based



- OGC-interfaces (WMS/WFS)
- Web-mapping client

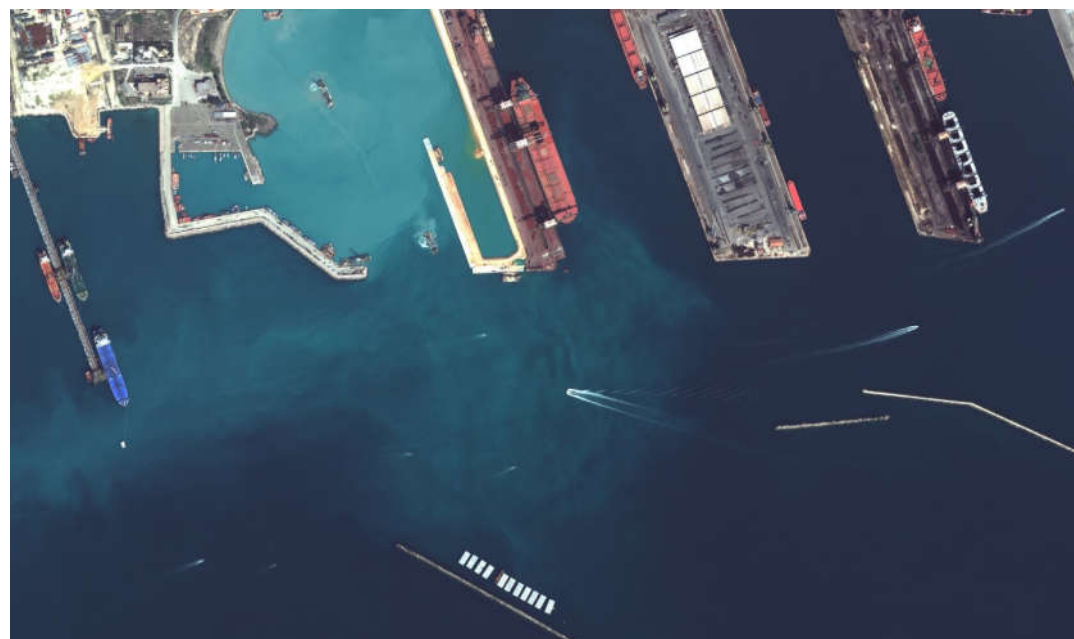


Operational Use Case

Optical Satellite Services for EMSA (OpSSERVE)

partner: EUSI (contractor) and DLR (subcontractor)

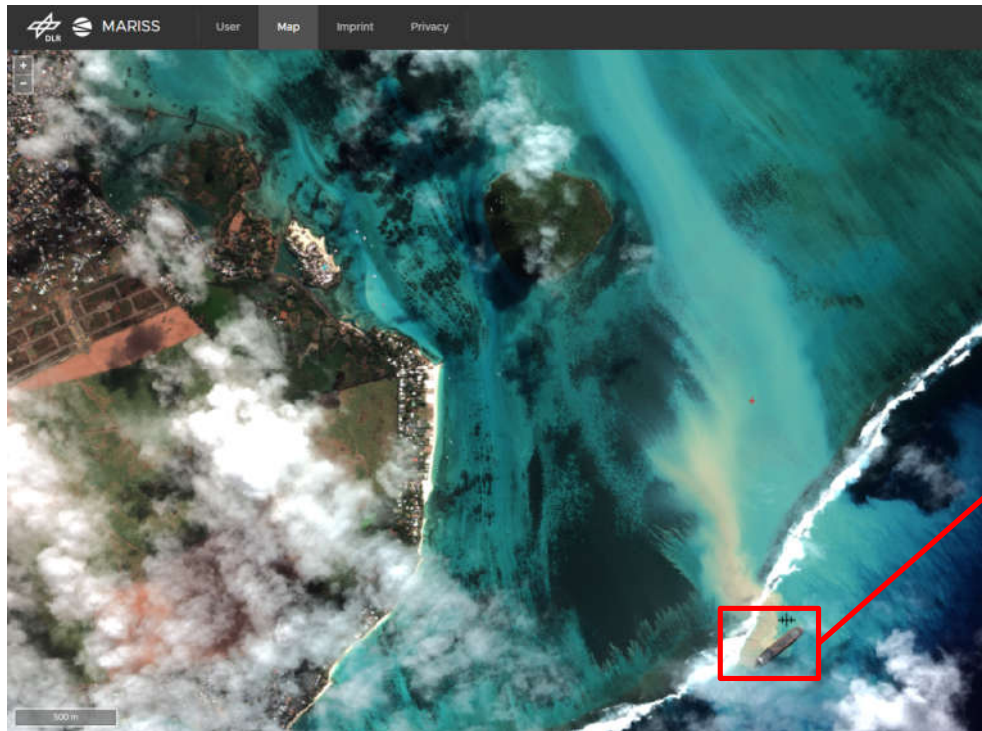
- Provision of **optical satellite imagery (< 1m)** and derived information at sea and coast :
 - **Vessels and wakes,**
 - **Oil Spills**
 - **Activities**
- Direct electronic delivery of information to EMSA Earth Observation Data Centre (EO-DC) in four temporal response categories:
 - **NRT 1** (< 1 hour)
 - **NRT 3** (< 3 hours)
 - **NRT 6** (< 6 hours)
 - **Non-NRT** (24 hours)
- Focus on European seas, as well as neighbouring and world wide waters



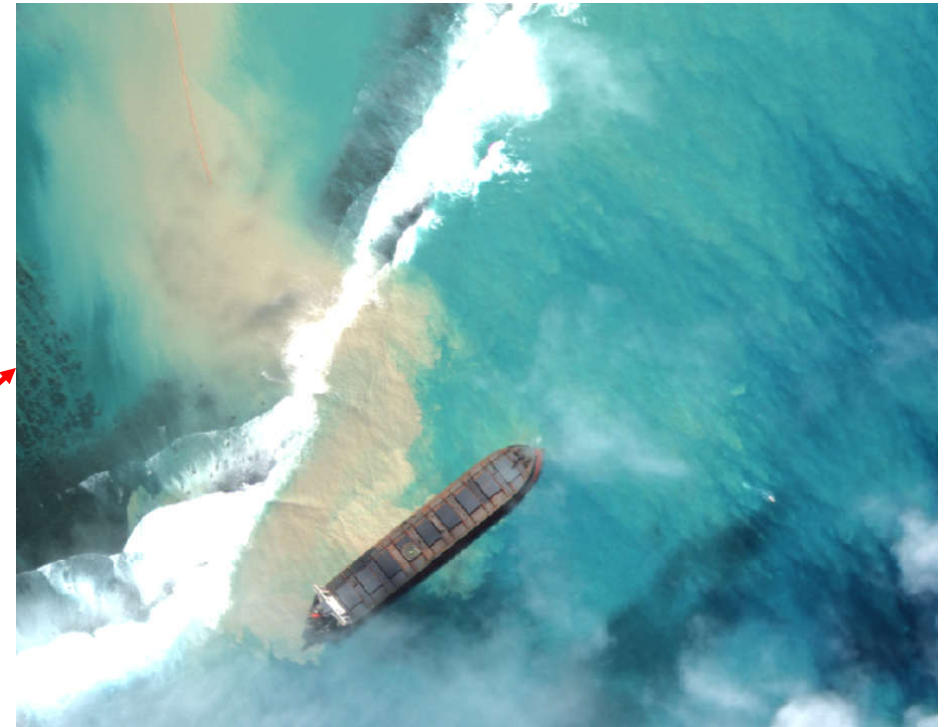
WorldView-3 © 2020 European Space Imaging



Case: Mauritius oil spill 07-09.2020



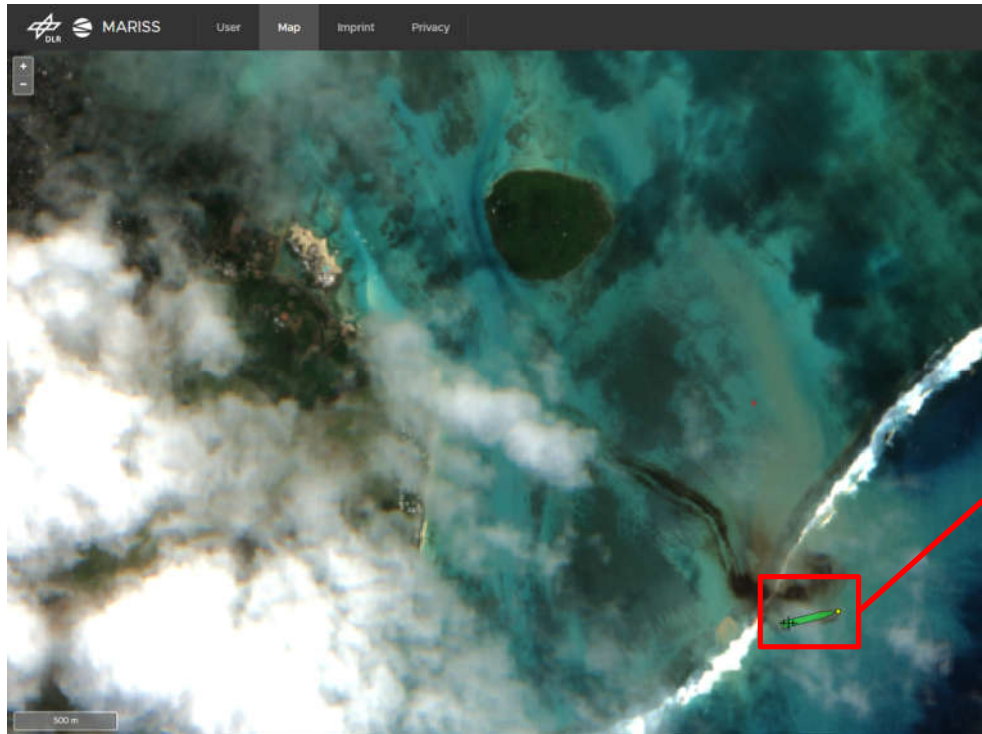
GeoEye-1 (01.08.2020) © 2020 European Space Imaging



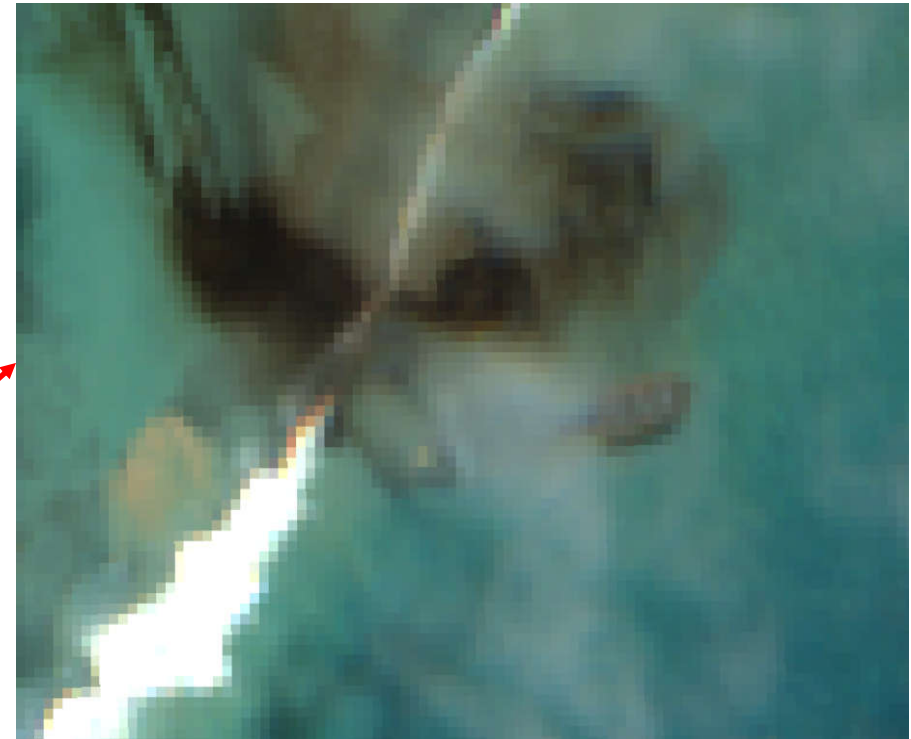
- On July, 25 the MV Wakashio ran aground on a coral reef
- It carried ~ 4,000 tones of fuel oil



Case: Mauritius oil spill 07-09.2020



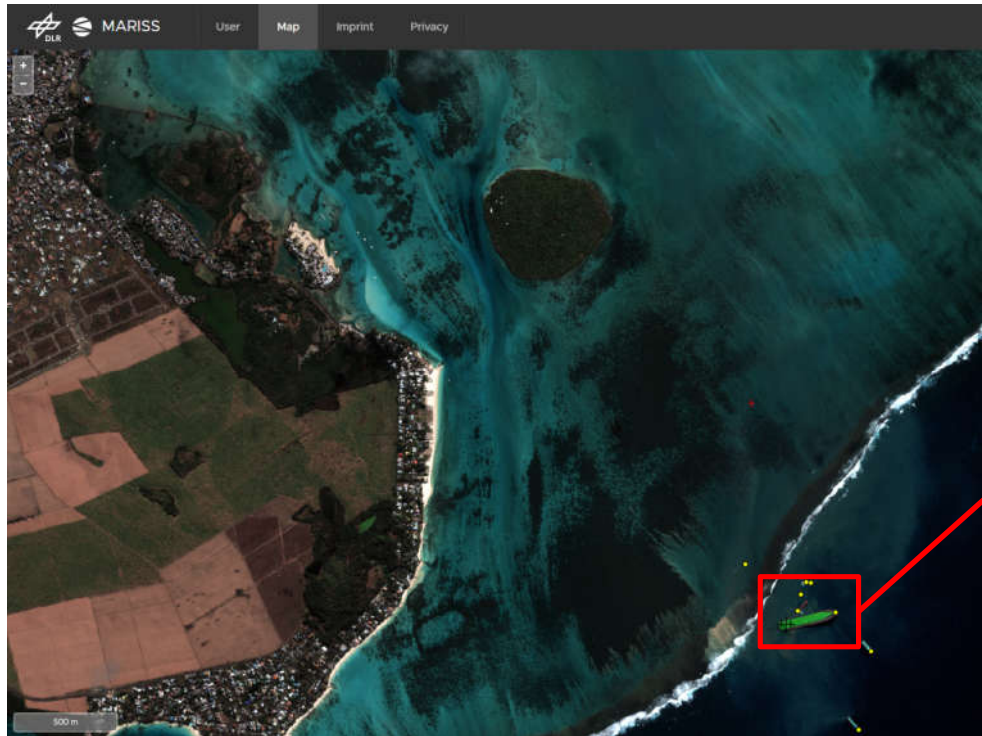
Sentinel-2B (06.08.2020) © 2020 ESA



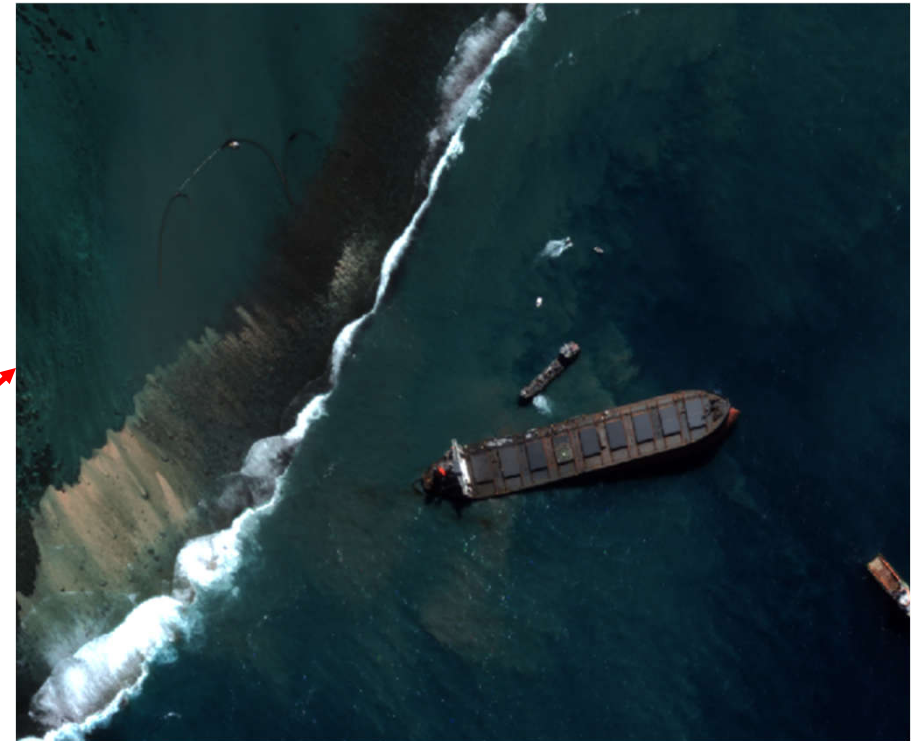
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Case: Mauritius oil spill 07-09.2020



GeoEye-1 (12.08.2020) © 2020 European Space Imaging



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Case: Mauritius oil spill 07-09.2020



Image Credit: <https://twitter.com/karmagawa>

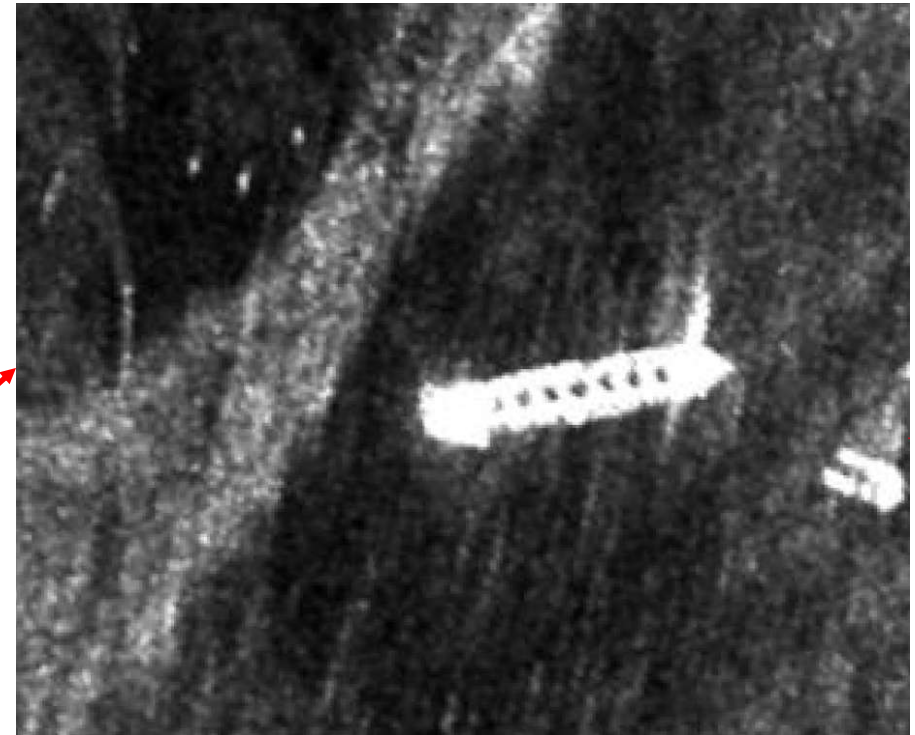
- On July 25 the MV Wakashio ran aground on a coral reef
- It carried ~ 4,000 tones of fuel oil
- On August 15 the vessel has broken into two sections



Case: Mauritius oil spill 07-09.2020



TSX-1 (15.08.2020) © 2020 DLR/Airbus DS



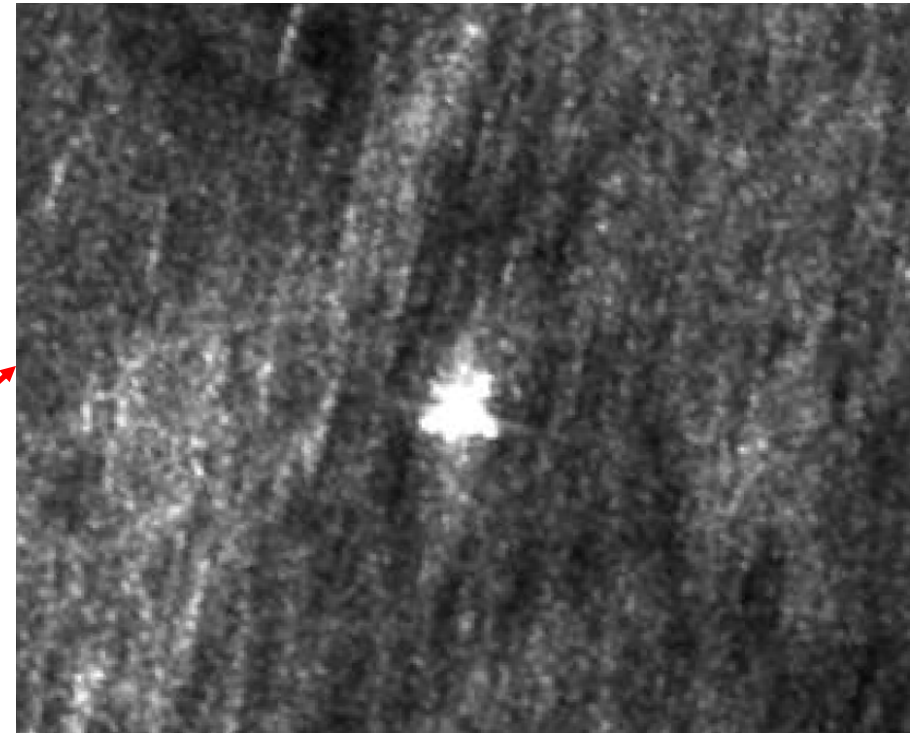
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Case: Mauritius oil spill 07-09.2020



TSX-1 (26.08.2020) © 2020 DLR/Airbus DS



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Summary

- **Remote sensing images are well-established in use to support maritime surveillance.**
 - Near real time capabilities are amongst others the main requirements for such services.
 - NRT requires automated fast processing of **large volumes of data** and **information** extraction within 20 to 55 minutes of image acquisition.
- Main tasks and capabilities of **EO MARISS**
 - Distributed processing to handle multiply request at the same time (P-Nodes based on CPU and GPU)
 - Advanced development of data mining techniques (deep learning)
 - High degree of automation and state of the art performance
 - Variety of data access options for the end-users



Our open-source project:



Frontend Libraries for DLR
UKIS (Map) Applications



<https://github.com/dlr-eoc/ukis-frontend-libraries>

Thank you very much for your attention!

Contact:

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Phone: +49 (0) 3981 480 231

German Aerospace Center, DLR

- **Germany's national research center for aeronautics, space, energy, transport & security.**
- **Space Agency**
- **Project Management Agency**
- ~ 9.000 Employees
- 47 Research Institutes and large test facilities at 26 Sites across Germany
- 3 Field stations in O'Higgins (AQ), Inuvik (CA) & Almería (ES)

