

**17^{ème} journée d'information du Cedre:
La Détection des Pollutions accidentelles et des
Rejets Illicites**

Paris, 20 Mars 2012

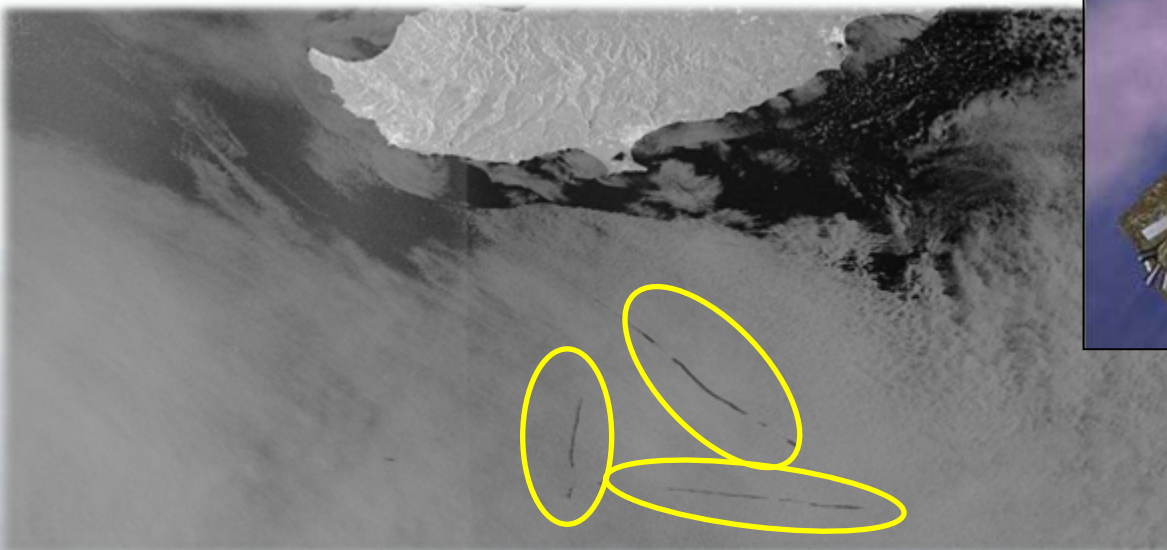
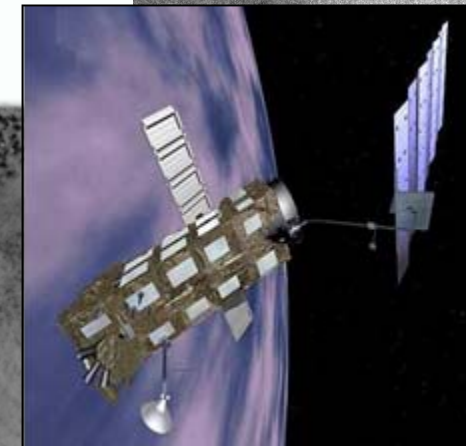
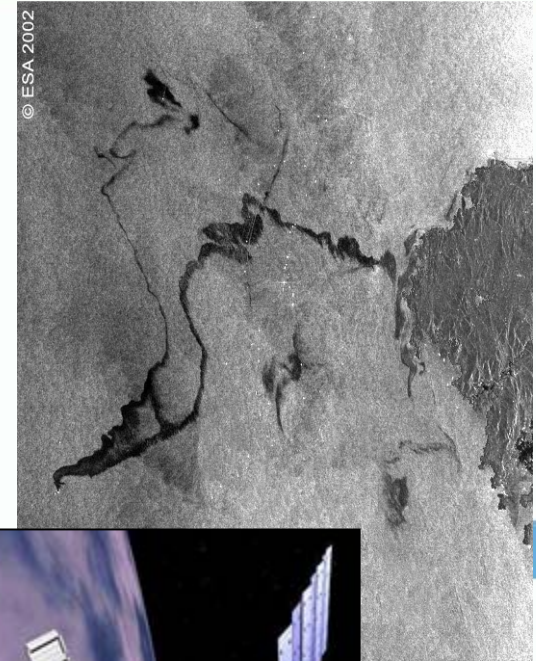
CleanSeaNet

Marc Journal

**Unit C3
Satellite Based Monitoring Services**

CleanSeaNet

- The European satellite oil pollution and vessel detection and monitoring system
- Linked into national/regional response chain strengthening operational pollution surveillance and response for deliberate and accidental spills.



Legal basis

- **Directive 2005/35/EC*** of 7 September 2005 on ship-source pollution and on the introduction of penalties, including criminal penalties, for pollution offences

Article 10

Accompanying measures

2. In accordance with its tasks as defined in Regulation (EC) No 1406/2002, the European Maritime Safety Agency shall:
 - (a) work with the Member States in developing technical solutions and providing technical assistance in relation to the implementation of this Directive, in actions such as tracing discharges by satellite monitoring and surveillance;
 - (b) assist the Commission in the implementation of this Directive, including, if appropriate, by means of visits to the Member States, in accordance with Article 3 of Regulation (EC) No 1406/2002.

* as amended by Directive 2009/123/EC of 21 October 2009

Operational use of CleanSeaNet

Routine monitoring of all European waters looking for illegal discharges :

- Detection of possible spills
- Detection of vessels
- Identification of polluters by combining CleanSeaNet and Vessel traffic information available through SafeSeaNet

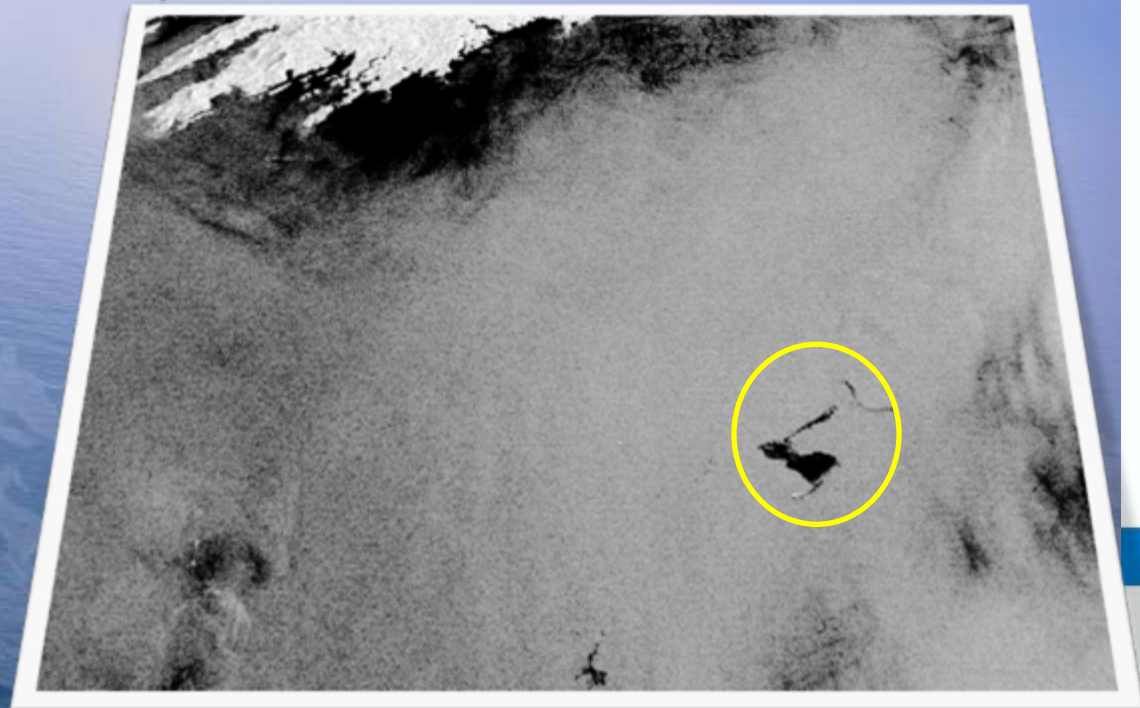
Supporting enforcement actions by the Coastal States

- On site verification and follow-up
- Inspection of suspected vessels in the next port of call

Supporting response operations to accidental pollution



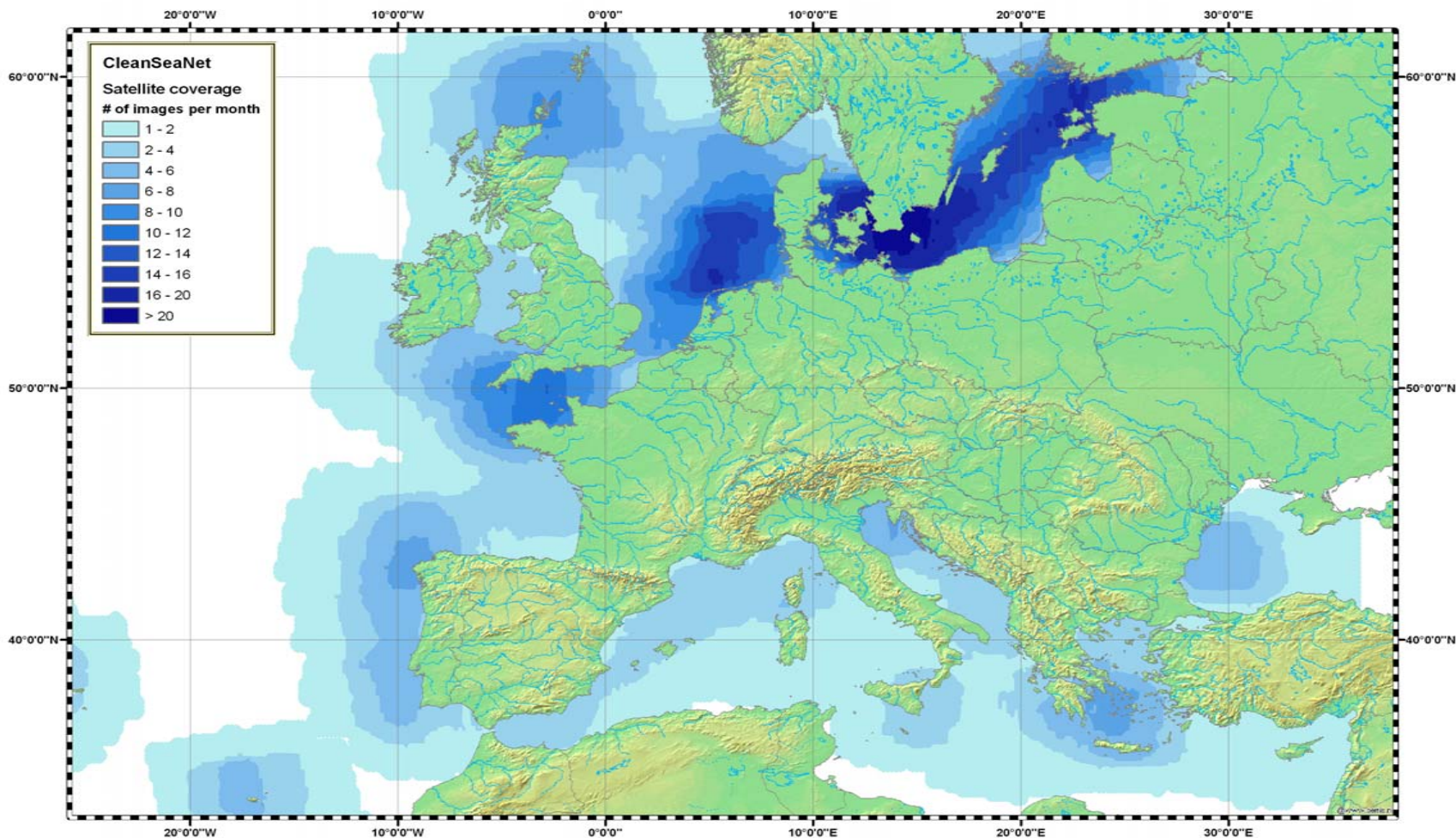
Admiral Kuznetsov
off the Southern Irish coast
17/02/2009



CleanSeaNet Fact Sheet

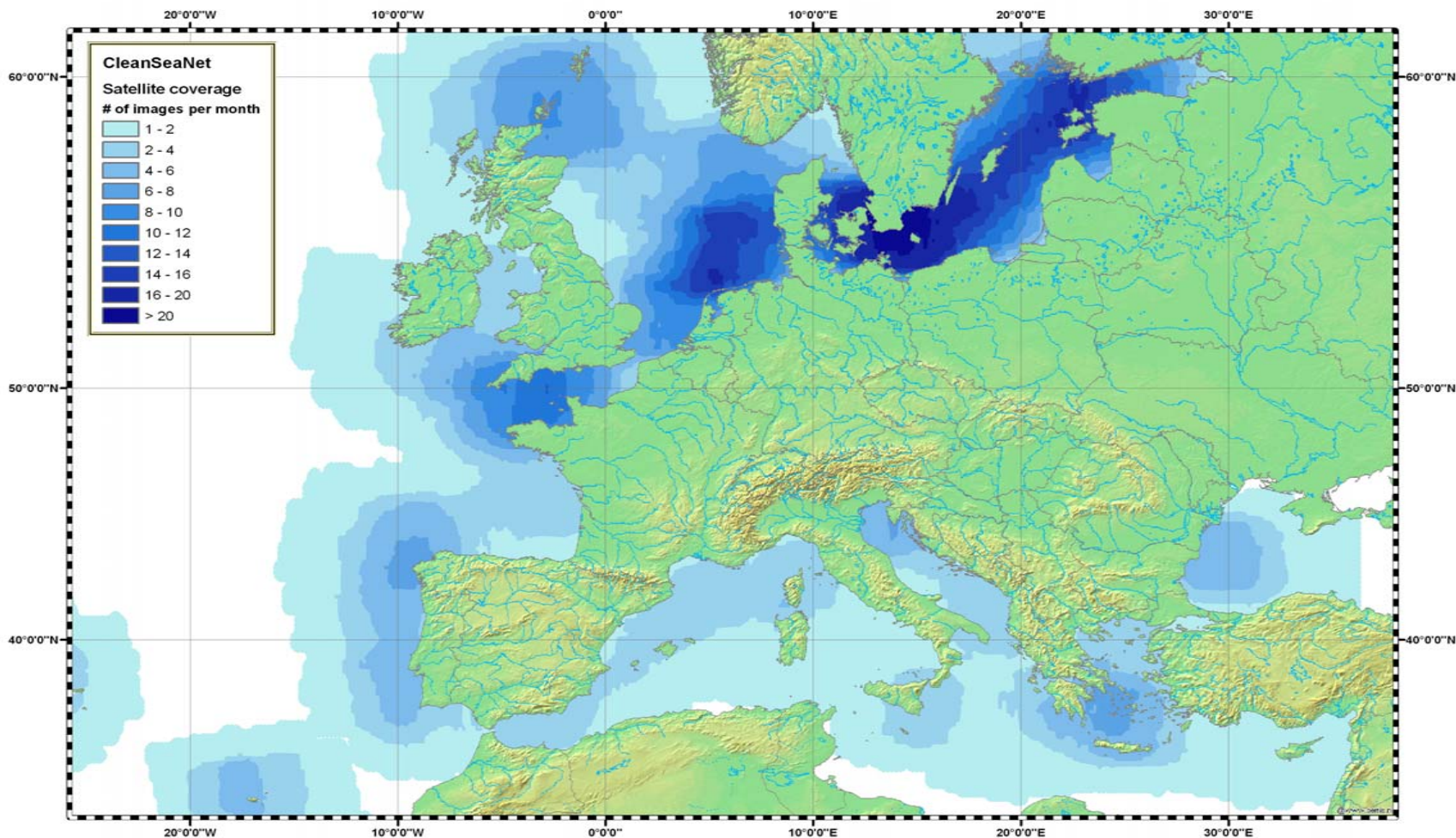
- CSN V1 operational since April 2007
- CSN V2 started operations in December 2010 – Full operations 1 February 2011
- 2.100 analysed satellite images per year
- 26 countries (22 EU coastal states, Iceland, Norway, Croatia, and Turkey)
- Distributed Service-Network approach via regional service providers (acquiring and processing satellite data)
- NRT: 30 minutes end product delivery
- Alert passed to response authorities (Coast Guard, Customs, Navy, ...)
- Emergency portfolio under the GMES/Data Access Grant providing access to third party mission data

CleanSeaNet Coverage Density



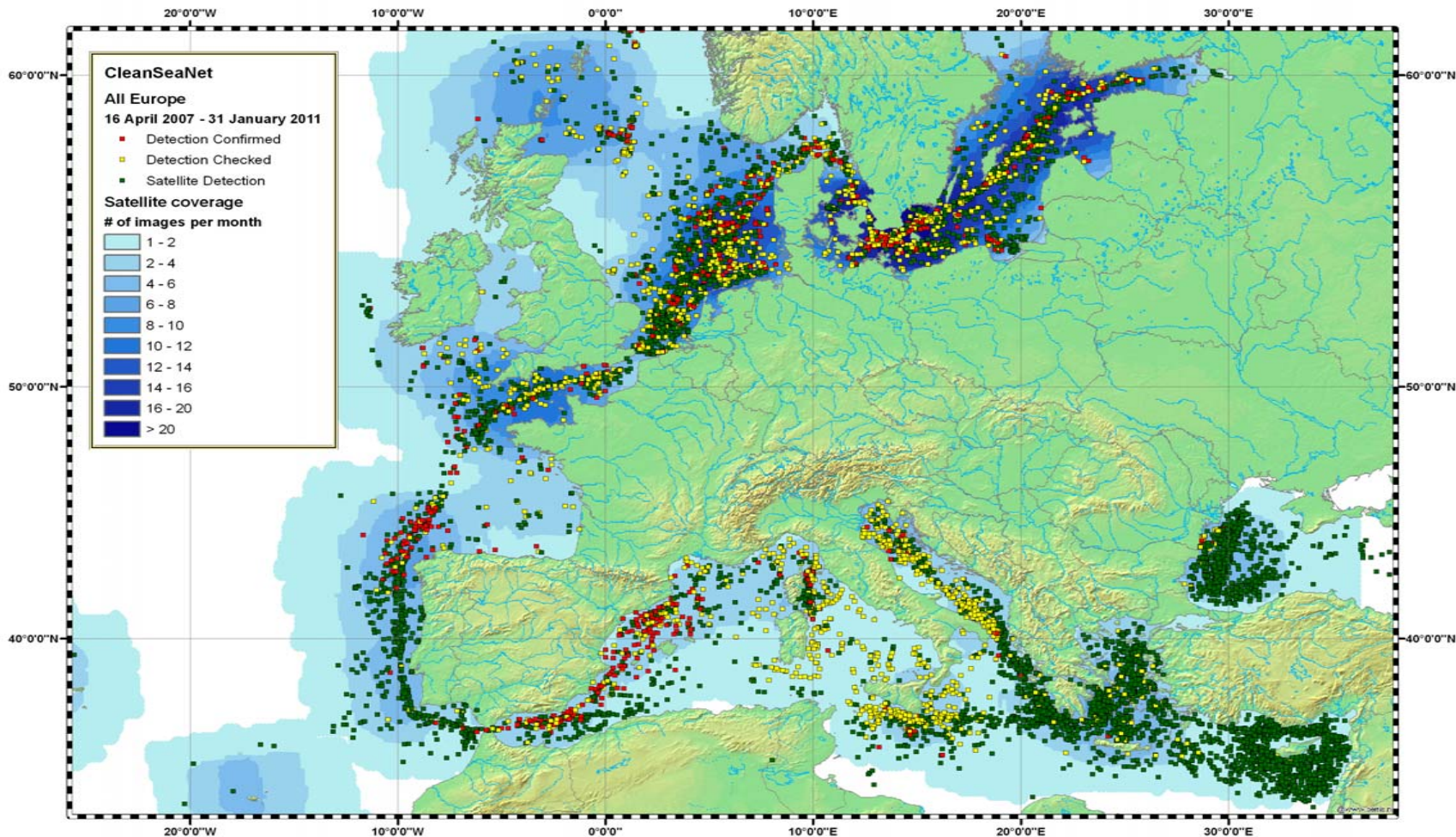
Coverage density from 1-2 images to more than 20 images per month

CleanSeaNet – Area Monitored



Over 1,000 million km² monitored ≈ 50,000 flight hours

CleanSeaNet detections 16 April 2007 - 31 January 2011



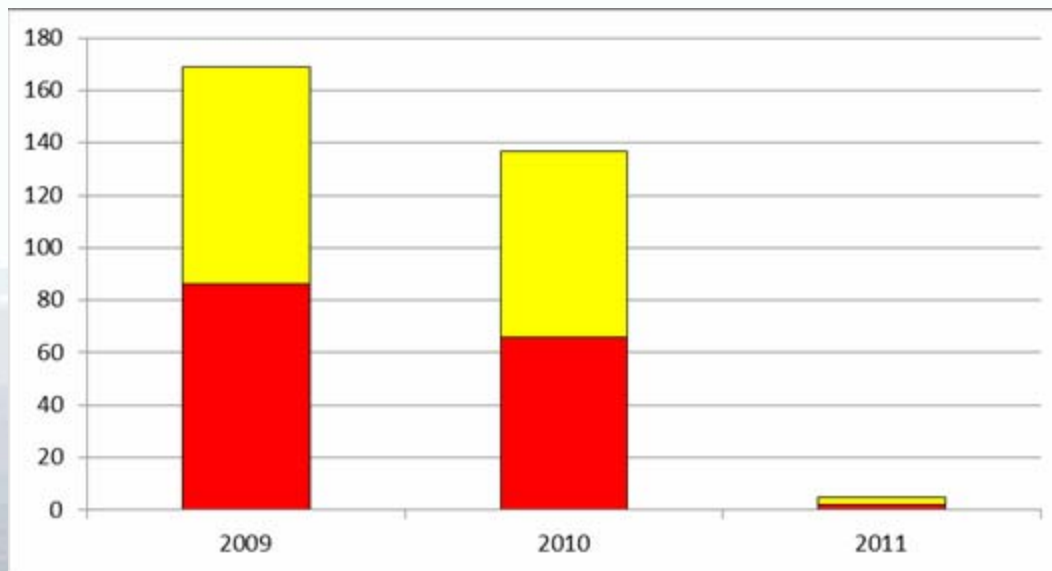
8,866 detections – 2,828 checked – 745 confirmed (80% mineral oil)

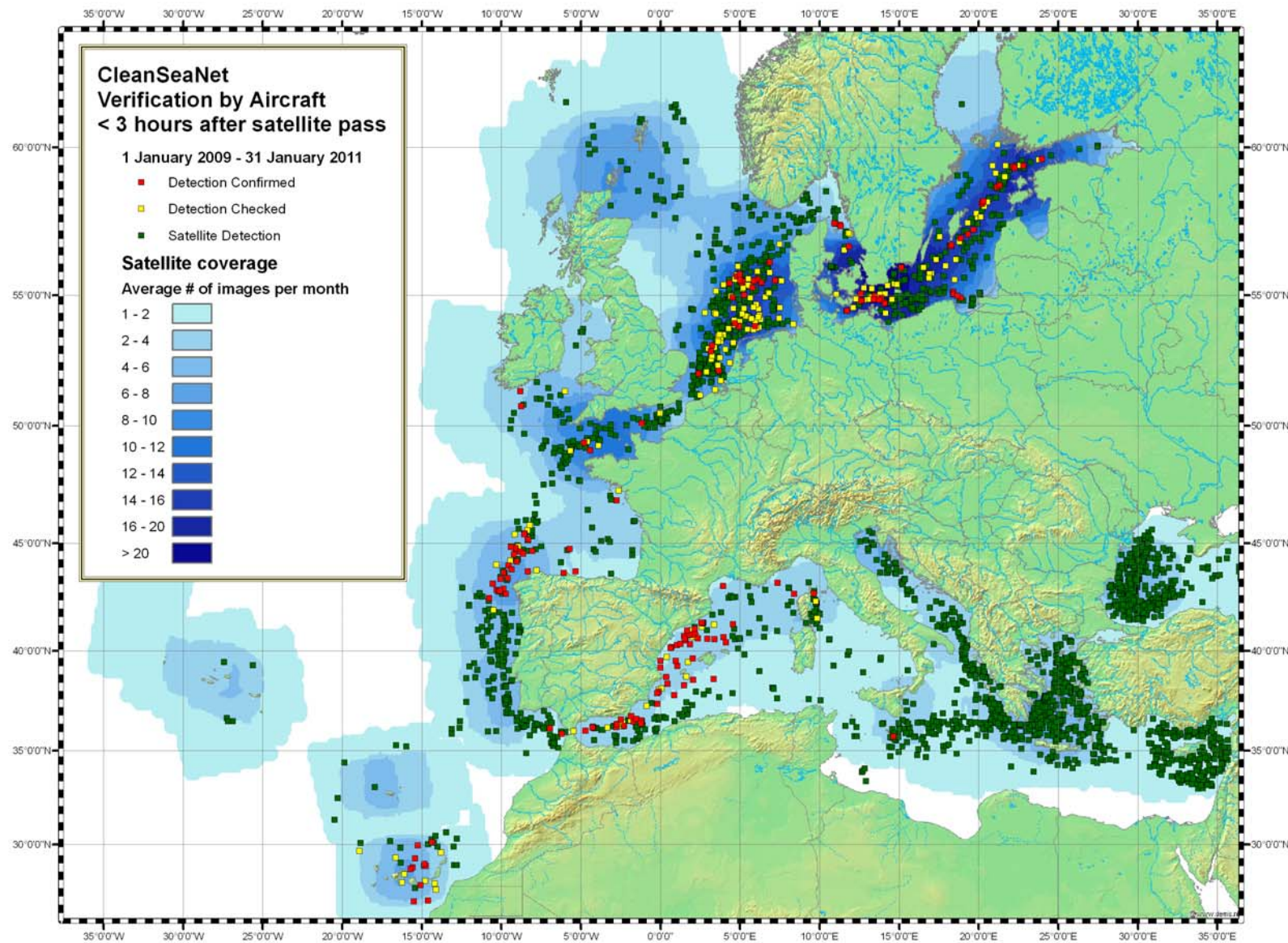
CleanSeaNet 1st Generation (16 April 2007 - 31 January 2011)

Rate of confirmation

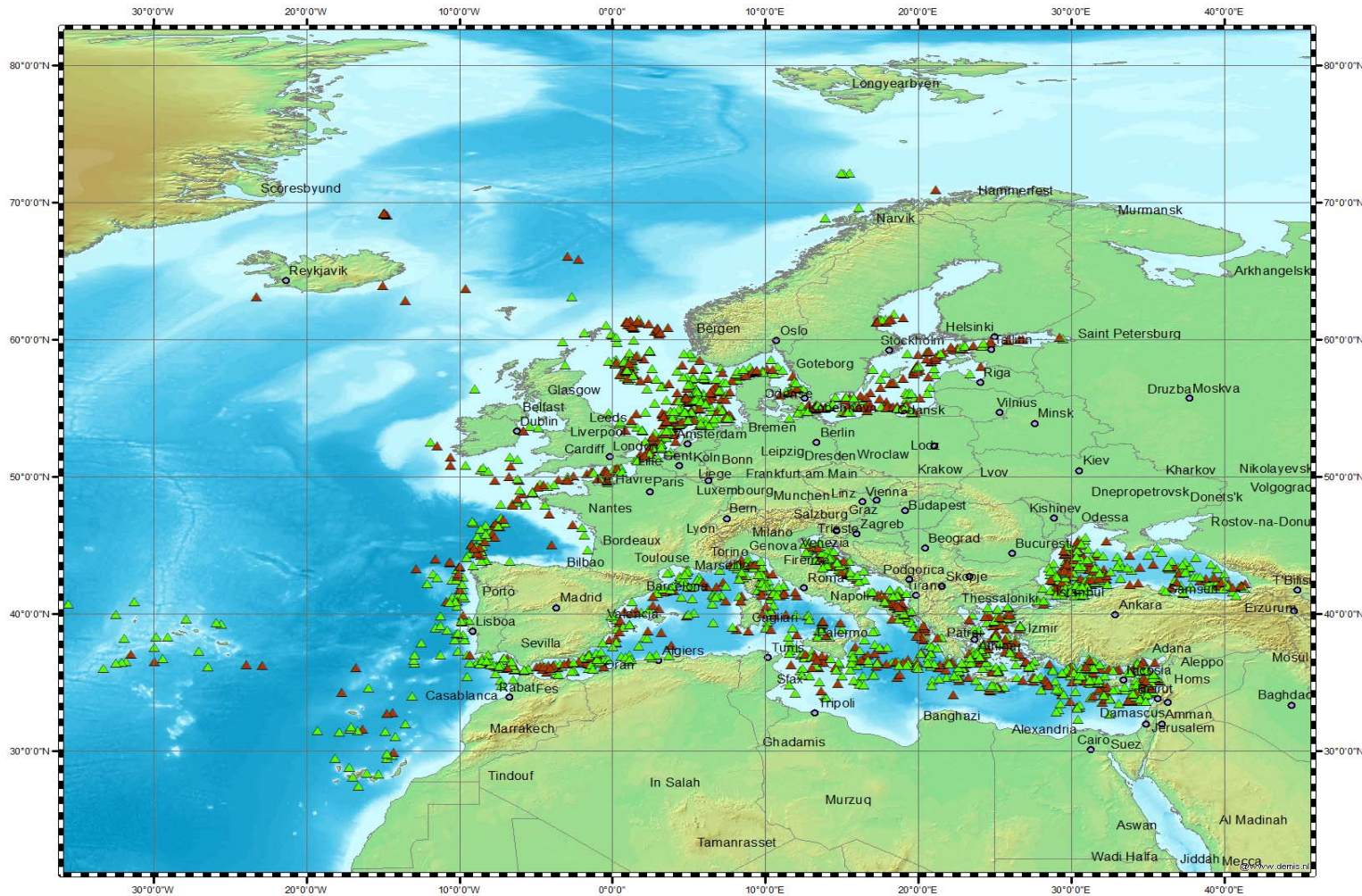
50% of spills checked by aircraft within 3 hours of satellite acquisition were confirmed

| | Checked < 3 h | Confirmed | |
|--------------------|---------------|------------|------------|
| 2009 | 169 | 86 | 51% |
| 2010 | 137 | 66 | 48% |
| 2011 | 5 | 2 | 40% |
| Grand Total | 311 | 154 | 50% |





CleanSeaNet detections 1 February 2011 - 31 December 2011



- 2129 Satellite image based services have been delivered
- 2,048 detections - 749 Class A spills - 1,299 Class B spills

CleanSeaNet Detection trends

Trend: global reduction in the number of possible spills per image

| | 2007 | 2008 | 2009 | 2010 | 2011 | Total |
|--|------|-------|------|------|------|-------|
| Number of detections | 1590 | 3311 | 2106 | 1766 | 2141 | 10914 |
| Average per image | 1.22 | 1.38 | 1.00 | 0.75 | N/A | |
| Average per 1,000 Km x 1,000 Km square | N/A | 10.77 | 7.61 | 5.68 | 5.08 | |

Average number of detections per image indicator substituted by number of detections per million Km²

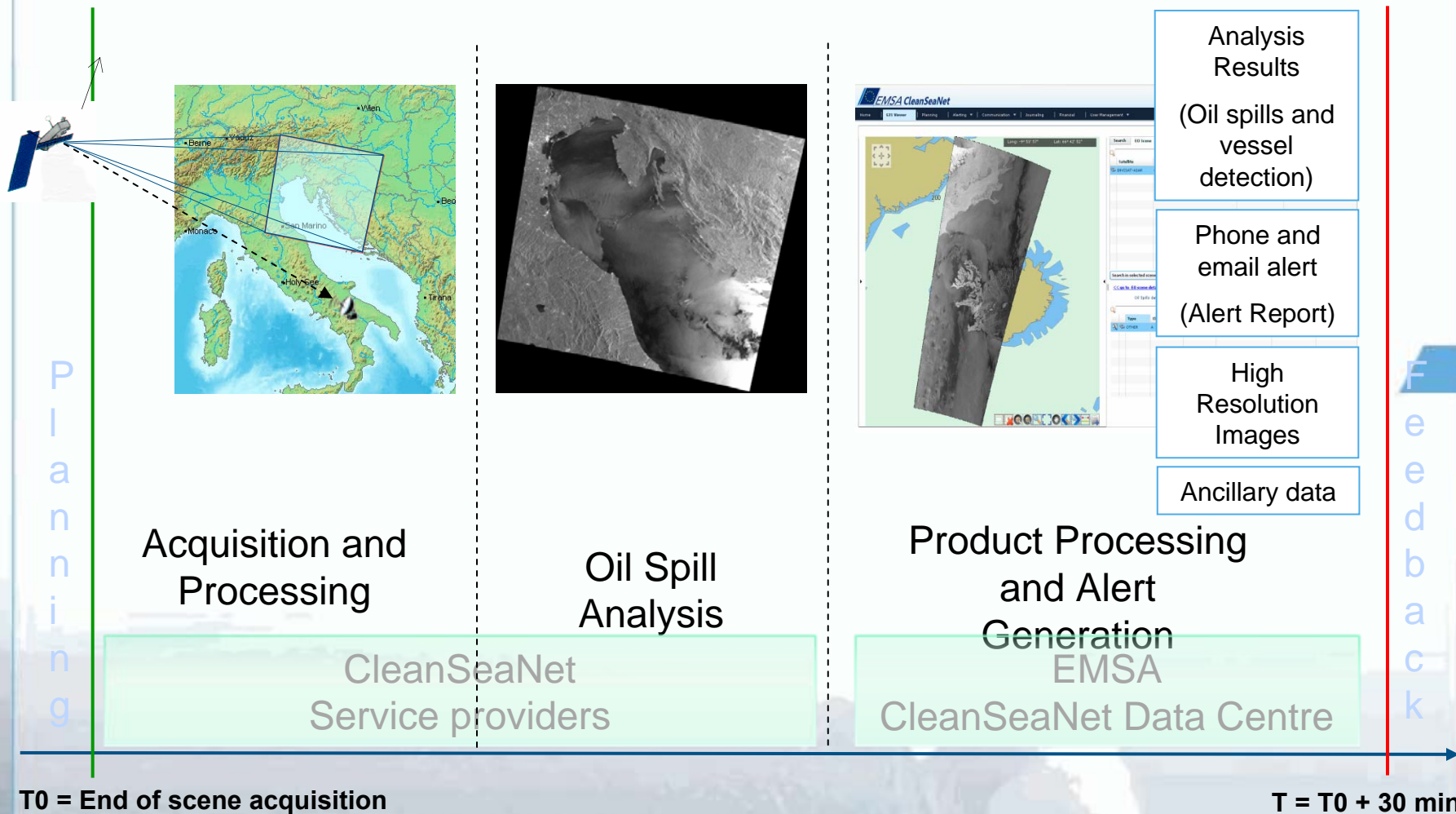
Indicator not anymore dependent of image size

CleanSeaNet Results Analysis

- SAR satellites efficient for Oil Spill and Vessel Detection
 - **Oil spills are likely* to be detected**
- Spills weather out rapidly => **TIME IS CRITICAL**
 - **CleanSeaNet is a Near Real Time Service**
- Timely **Use of Aerial Surveillance essential** for
 - Catching polluters in the act
 - Collecting on-site actionable evidence
- Feedback provided limited to results of verification activities

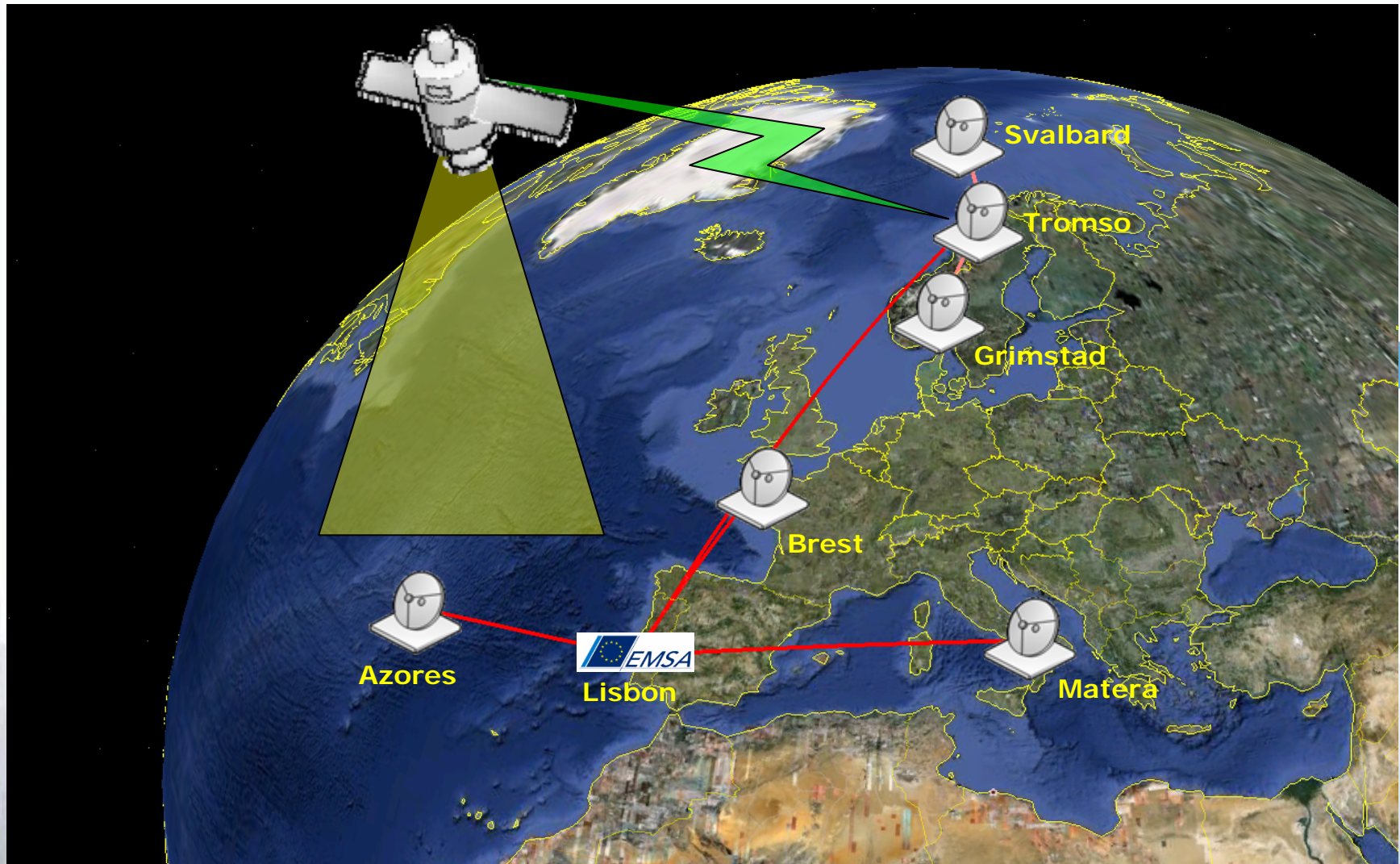
* in suitable wind conditions

CleanSeaNet : Near Real Time service – 30 min*

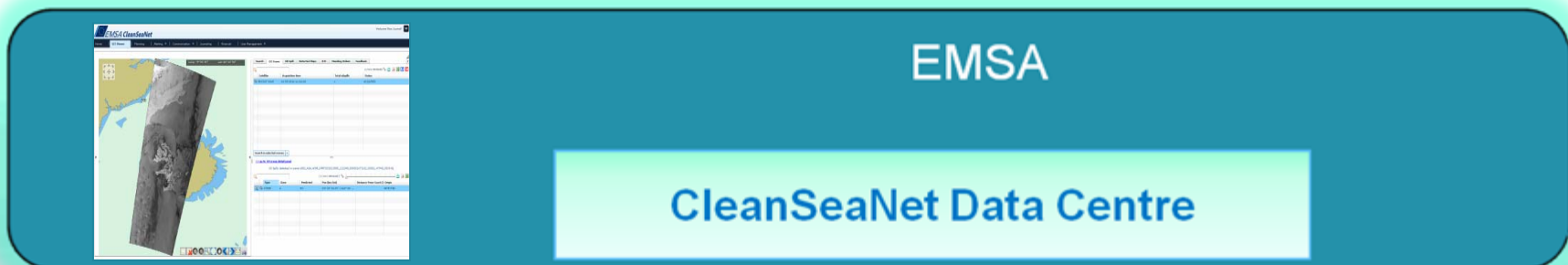
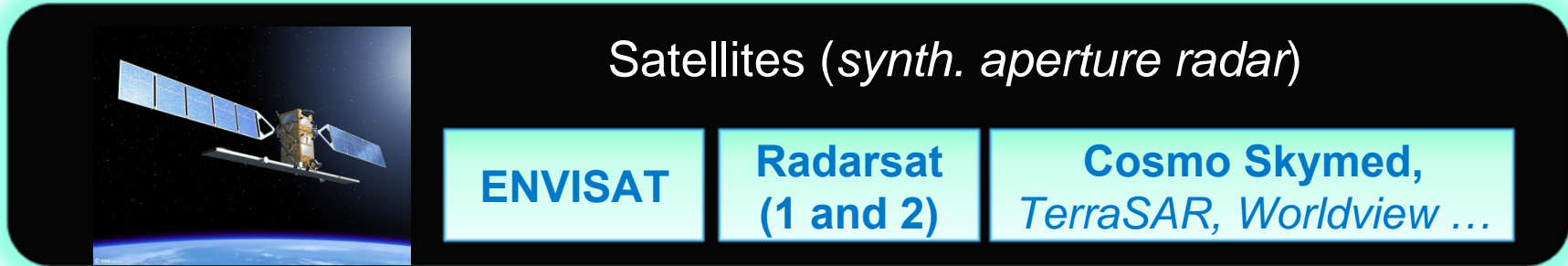


* Satellite images are acquired in segments up to 1400 km long. 30 min are for a 400 km long image

CleanSeaNet : Near Real Time service – 30 min.



CleanSeaNet service architecture



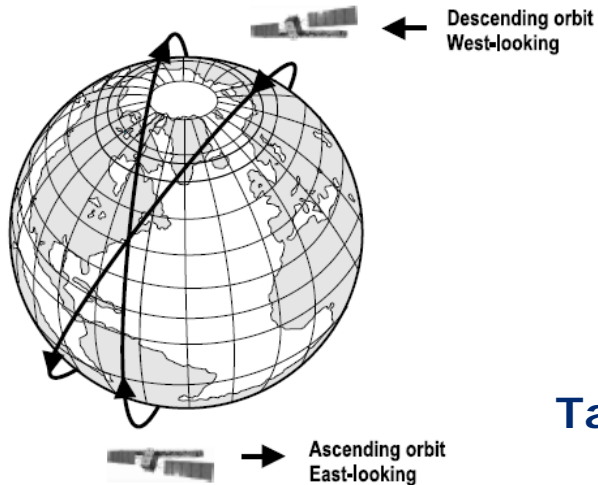
>>> 26 Coastal States <<<

>>> EU / EC <<<

CleanSeaNet Spatial Coverage



SAR satellite and SAR products used in CSN



CONTRACTED SATELLITES:

- ENVISAT (01/03/2002*)
- RADARSAT 1 (04/11/1995*)
- RADARSAT 2 (14/12/2007*)

Table of main products used in CSN:

| SATELLITE | PRODUCT IDENTIFICATION | Description | Resolution (Range x Azimuth, meters) | Spacing (Pixel x Line, meters) | Area Coverage (Range x Azimuth, Km) |
|------------|------------------------|--|--------------------------------------|--------------------------------|-------------------------------------|
| ENVISAT | ASA_WSM_1P | Wide Swath Mode medium-resolution (VV) | 150 x 150 | 75 x 75 | 405 x 405 |
| RADARSAT-1 | RS1_SNA | ScanSAR Narrow A | 50 x 50 | 25 x 25 | 300 x 300 |
| RADARSAT-2 | RS2_SNA | ScanSAR Narrow | 50 x 50 | 25 x 25 | 300 x 300 |
| RADARSAT-2 | RS2_SCW | ScanSAR Wide | 100 x 100 | 50 x 50 | 500 x 500 |

Occasionally, other sensors/modes can be used. (Cosmoskymed, TerraSAR-X...)

* Launch dates

Products delivered by CleanSeaNet

- Satellite images in **Full resolution**
- **Oil spill detection and alerts**
- **Vessel detection information**
- **Possible polluter Identification**
 - AIS information via EMSA SafeSeaNet service
 - Backward modeling (link a spill and a vessel)
- Electronic Nautical Charts
- Ancillary data:
 - meteorological wind and
 - meteorological wave data,
 - SAR derived wind and
 - SAR derived swell data

CleanSeaNet Alert Report



CleanSeaNet Alert Report

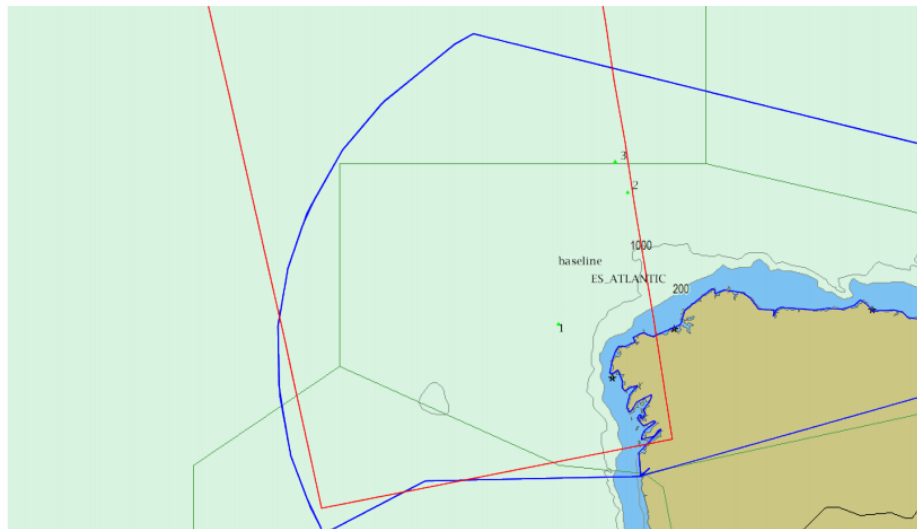
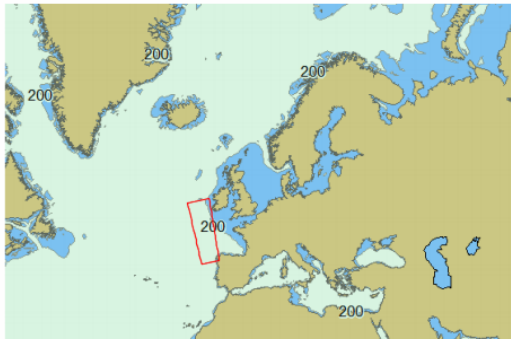
SPAIN

Acquisition:

2011-10-05 22:38:46 UTC

Scene ID: 13977

ENVISAT - ASAR/WS


[GIS Viewer](#)


Comments

List of possible spills

| Spill # on map | Spill Identifier | Centre Position | | Area (nm ²) | Length (nm) | Width (nm) | Alert | Oil Spill Warning Issued | Possible Source | |
|-------------------|------------------|-----------------|-----------|----------------------------|----------------|---------------|-------|--------------------------------|-----------------|------------|
| | | Latitude | Longitude | | | | | | Detected | Identified |
| 1 | OS_13977_1 | 43.43787 | -9.99482 | 1.30 | 9.996851 | 0.396560 | Green | N/A | Yes | No |
| 2 | OS_13977_2 | 44.72608 | -9.04886 | 0.93 | 1.766042 | 0.747524 | Green | N/A | Yes | No |
| 3 | OS_13977_3 | 45.02441 | -9.21735 | 0.66 | 3.002023 | 0.493583 | Green | N/A | Yes | No |

Note: Possible spills outside alert area are presented on map as

 - Additional spills may also have been reported outside the map - Please consult GIS Viewer

CleanSeaNet Alert Report



CleanSeaNet Alert Report

SPAIN

Acquisition: 2011-10-05 22:38:46 UTC

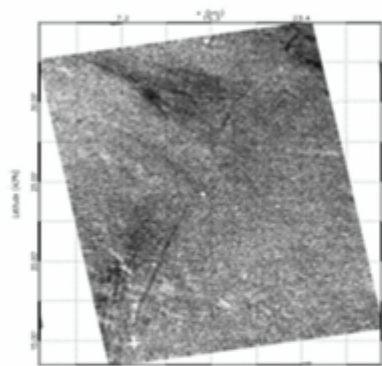
Scene ID: 13977

ENVISAT - ASAR/WS

[List of Spills](#)
[GIS Viewer](#)

Details of possible Spill n°1 - OS_13977_1

| Centre Position | | SAR Wind at Center | | Area (nm ²) | Length (nm) | Width (nm) | Class (A/B) | Alert Level | Number of slicks | Oilspill Warning Issued |
|-----------------|-----------|--------------------|-------------|----------------------------|----------------|---------------|----------------|----------------|---------------------|-------------------------------|
| Latitude | Longitude | Direction (From) | Speed (m/s) | | | | | | | |
| 43.43787 | -9.99482 | 0 | 0 | 1.30 | 9.996851 | 0.396560 | A | Green | 3 | Unkown |



| Meteorological and Ocean Data | | | |
|-------------------------------|------------------|-------------|-----|
| Sea State | N/A | Wave Height | 0 |
| Met.Wind | Direction (from) | | 0 |
| | Speed (m/s) | | 0 |
| Current | Direction (from) | | N/A |
| | Speed (m/s) | | N/A |

Note: Grey fields are parameters set as "invisible" in the Print Parameters matrix or not available

Comments from Service Provider

Possible source information

| N. | Detected | Dist.(Km) | Identified | Type | IMO | Name | MMSI | C/S | Latitude | Longitude | Time (UTC) | Track |
|----|----------|-----------|------------|------|-----|------|------|-----|----------|-----------|------------|-------|
| | | | | | | | | | | | | |

CleanSeaNet Alert Report



CleanSeaNet Alert Report

SPAIN

Acquisition: 2011-10-05 22:38:46 UTC

Scene ID: 13977

ENVISAT - ASAR/WS

[List of Spills](#)
[GIS Viewer](#)

Additional Information

| Distance (null) to | | | | | Traffic Density |
|--------------------|-----------|--------------------|---------------|--------------|-----------------|
| Sensitive Areas | Shoreline | TSS/Shipping Lanes | Rigs/Offshore | Known Wrecks | |
| N/A | N/A | 0 | N/A | N/A | N/A |

Note: Grey fields are parameters set as "invisible" in the Print Parameters matrix

Alert rules parameters

| | |
|----------------|---|
| Classification | A |
|----------------|---|

Note: Classification level is set by the operator analysing the satellite image
 Impact and Culprit values ("High", "Medium" or "Low") are the result of alert level rules defined by the Coastal State.
 Grey fields are parameters selected as "invisible" in the Print Parameters matrix or parameters for which the alert rules

List of slicks composing the spill

| Slick ref. on Map | Centre position | | Area (nm ²) | Length (nm) | Width (nm) |
|-------------------|-----------------|-----------|-------------------------|-------------|------------|
| | Latitude | Longitude | | | |
| A | 43.30190 | -10.06871 | 0.9625310452 | 7.6435500 | 0.3965608 |
| B | 43.48050 | -9.98330 | 0.1979454721 | 1.1568202 | 0.2468185 |
| C | 43.56197 | -9.90990 | 0.1439302114 | 1.1964816 | 0.1627469 |

List of affected areas

| Country | Zone | Impact | Culprit |
|---------|-------------|--------|---------|
| Spain | ES_ATLANTIC | Low | Low |
| Spain | baseline | Low | Low |

CleanSeaNet Alert Report



CleanSeaNet Notification

FRANCE

Acquisition: 2011-10-05 22:38:46 UTC

Scene ID: 13977

ENVISAT - ASAR/WS

[GIS Viewer](#)




Comments

Empty comment box.

Clean sea

No possible spills have been detected in the alert area

Note: Possible spills outside alert area are presented on map as  - Additional spills may also have been reported outside the map - Please consult GIS Viewer

CleanSeaNet Alert Level

CleanSeaNet Alert Report **ITALY** Acquisition: 2011-12-02 09:18:21 UTC
Scene ID: 16203 ENVISAT - ASAR/WS [GIS Viewer](#)



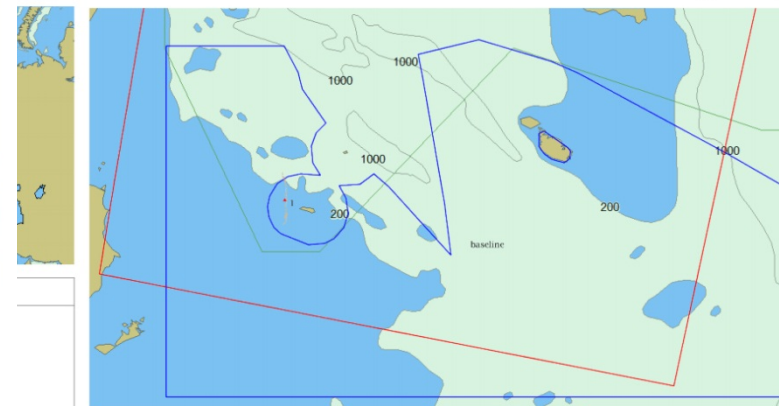
Comments

List of possible spills

| Spill # on map | Spill Identifier | Centre Position | | Area (km ²) | Length (km) | Width (km) | Alert | Oil Spill Warning Issued | Possible Source | |
|----------------|------------------|-----------------|----------------|-------------------------|-------------|------------|-------|--------------------------|-----------------|------------|
| | | Latitude | Longitude | | | | | | Detected | Identified |
| 1 | OS_16203_1 | 39° 33' 56" N | 012° 54' 22" E | 12.81 | 8.718729 | 1.469035 | Green | N/A | Yes | No |
| 2 | OS_16203_2 | 35° 31' 11" N | 012° 24' 39" E | 29.30 | 37.16071 | 0.788332 | Green | N/A | Yes | No |

Note: Possible spills outside alert area are presented on map as - Additional spills may also have been reported outside the map - Please consult GIS Viewer

Net Alert Report **MALTA** Acquisition: 2011-12-02 09:18:21 UTC
Scene ID: 16203 ENVISAT - ASAR/WS [GIS Viewer](#)



List of possible spills

| Spill # on map | Spill Identifier | Centre Position | | Area (km ²) | Length (km) | Width (km) | Alert | Oil Spill Warning Issued | Possible Source | |
|----------------|------------------|-----------------|----------------|-------------------------|-------------|------------|-------|--------------------------|-----------------|------------|
| | | Latitude | Longitude | | | | | | Detected | Identified |
| 1 | OS_16203_2 | 35° 31' 11" N | 012° 24' 39" E | 29.30 | 37.16071 | 0.788332 | Red | N/A | Yes | No |

Note: Possible spills outside alert area are presented on map as - Additional spills may also have been reported outside the map - Please consult GIS Viewer

Alert Level defined per Coastal State

Same possible spill: Red alert for Malta – Green for Italy

CleanSeaNet Alert Level configuration

North Sea Impact High

3 nm zone even outside EEZ

North Sea Impact Medium

Spill < 33 nm from coast within EEZ

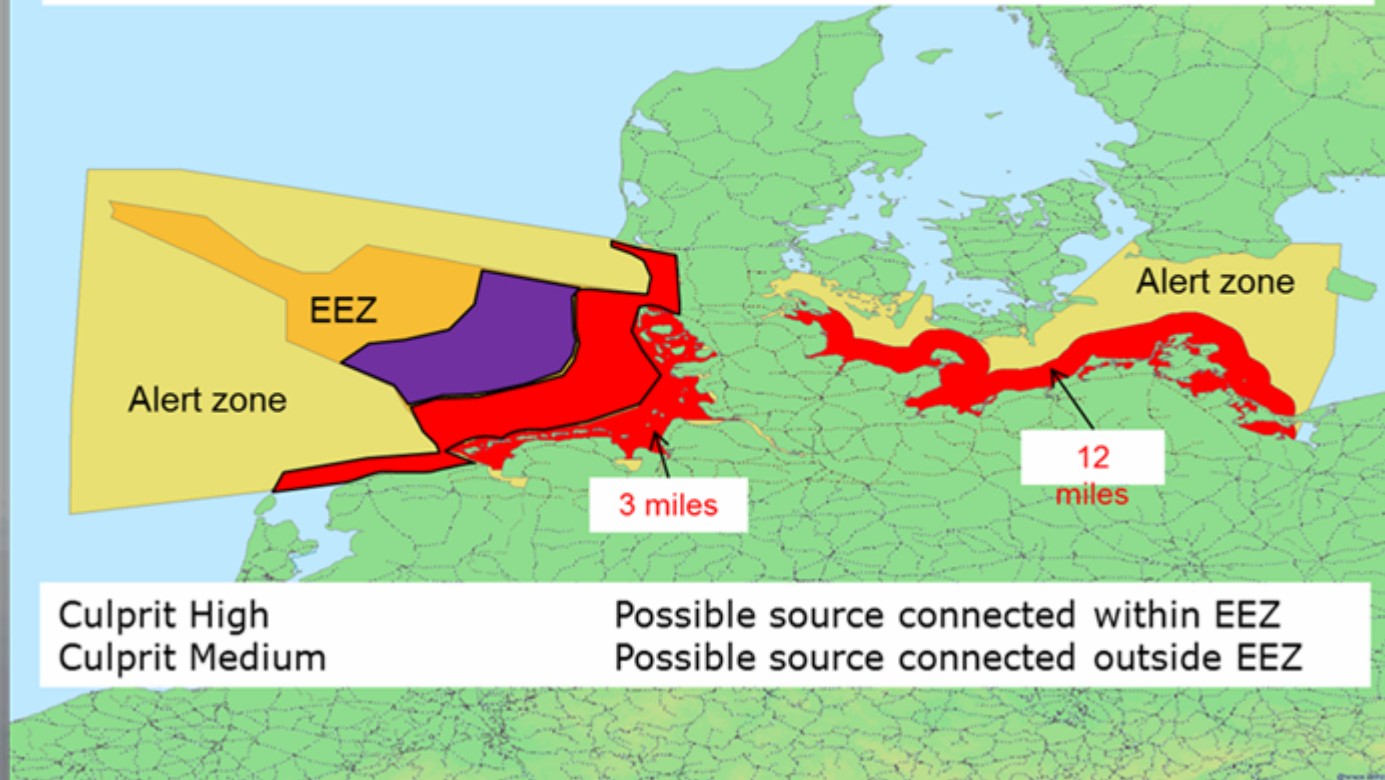
Baltic Sea Impact High

33 nm < spill < 63 nm within EEZ

Impact low

12 nm zone even outside EEZ

All other situations



Culprit High

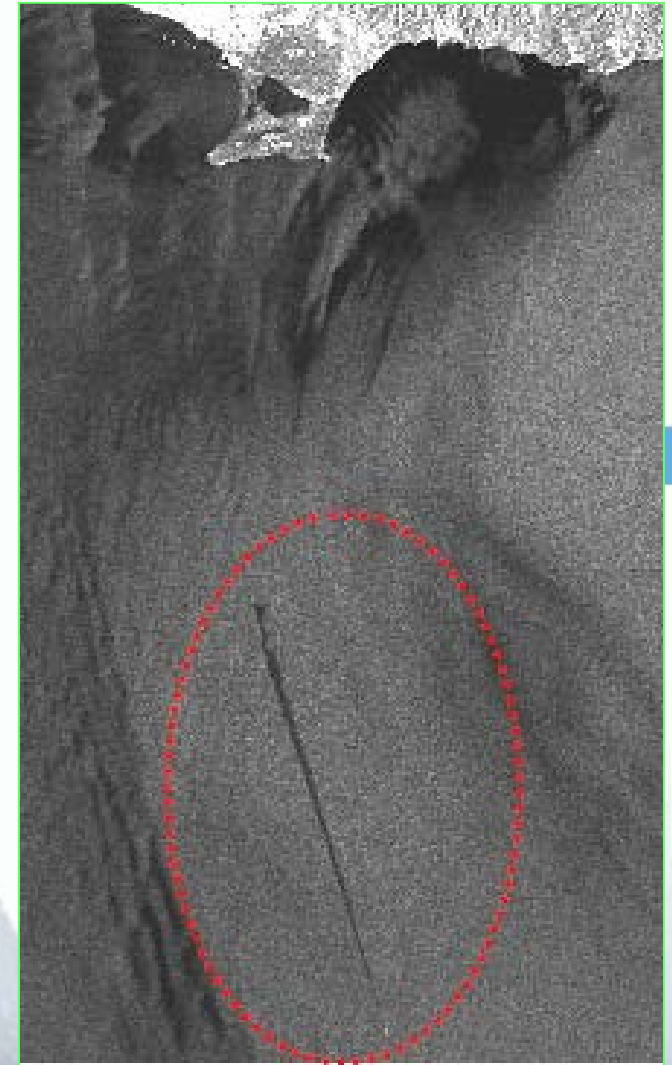
Possible source connected within EEZ

Culprit Medium

Possible source connected outside EEZ

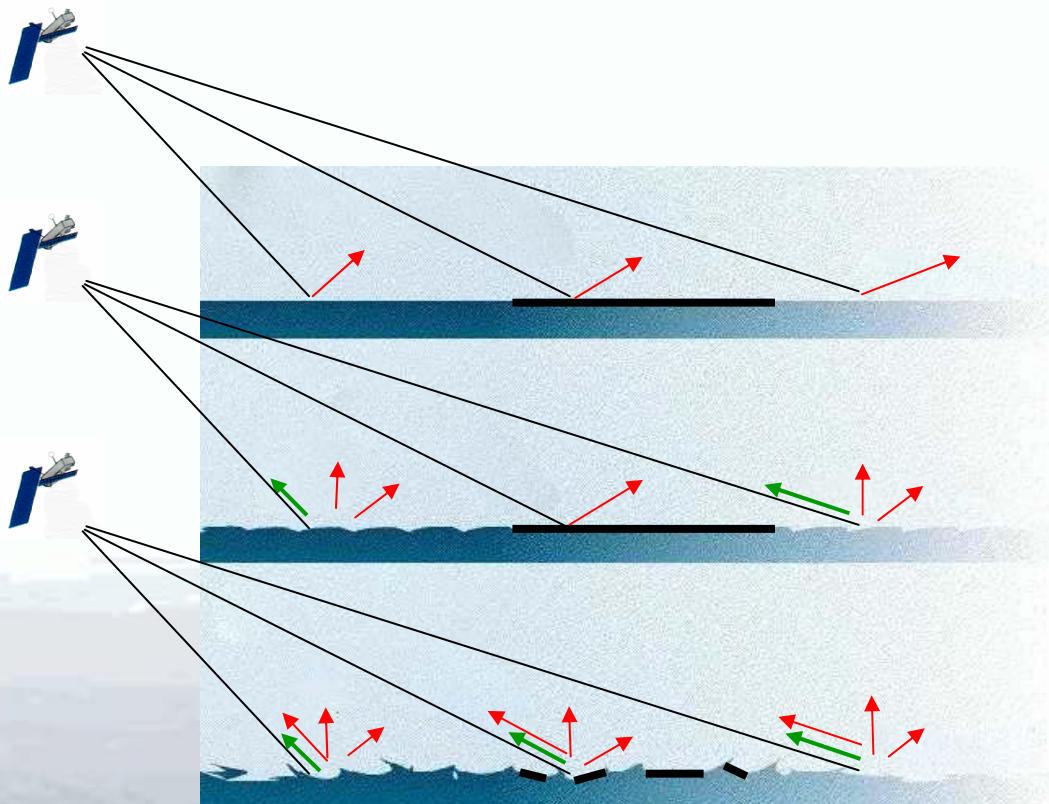
Oil Slick Detection in SAR images

- Synthetic Aperture Radar (SAR) emits electromagnetic pulses
- Radar signal bounced back by sea ripples created by the wind
- SAR sensor measures the level of the backscattered signal i.e. Ocean's roughness
- **Oily films**
 - smooth the sea surface
 - reduce the backscattered signal
 - **appear as darker areas**



Oil Slick Detection in SAR images

Moderate winds favourable for oil slick detection



Low wind: Weak backscattered signal - Low contrast between oil slick and surrounding waters

Moderate winds: strong contrast between oil slick and surrounding waters

High winds: Useful signal lost in the ambient noise - Oil slicks often broken and dispersed into the water column

Oil Slick Detection in SAR images – Look-alikes

- SAR sensors detect all films that, like oil, smooth the sea surface

CleanSeaNet detects:

NOT “OIL SPILLS” BUT “POSSIBLE OIL SPILLS”

- Look-alikes: Other man-made substances: fish or vegetable oil, chemical, sewage, other...
- Natural phenomena: low wind area, algae, current front, upwelling area...



Current fronts



Low wind, rain cells and oil seepage



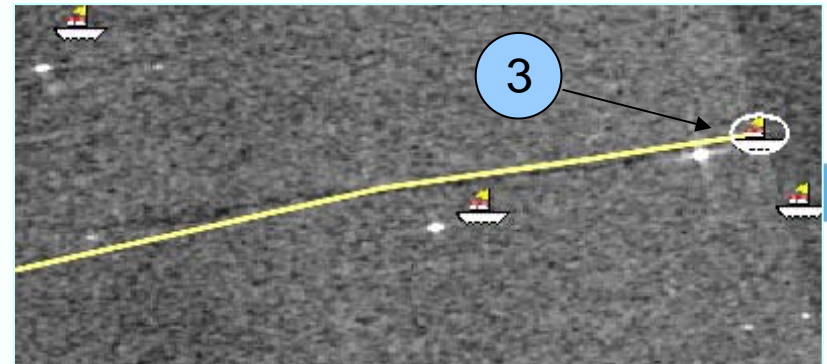
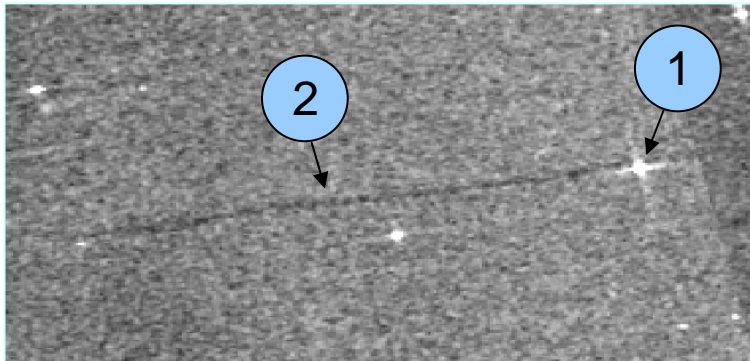
Algae



Land breeze

Detection of Discharging Vessels

- Ship detected on SAR image (Bright Spot) ①
- Long and linear possible spill trailing in the wake ②
- Vessel identified ③



CleanSeaNet is able to:

DETECT AND IDENTIFY DISCHARGING VESSELS

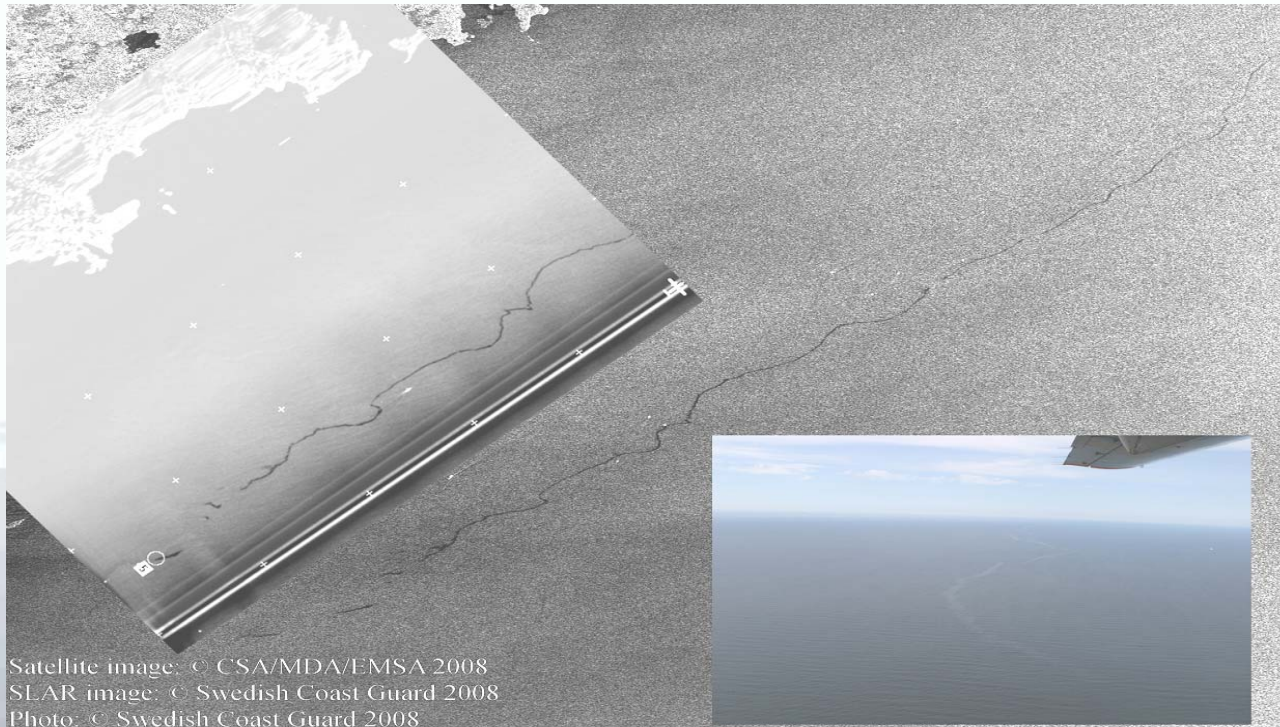
Remark: Similar vessels in vicinity at similar course and speed => not a wake

Catching Polluters

- In case of a discharge detected by CleanSeaNet

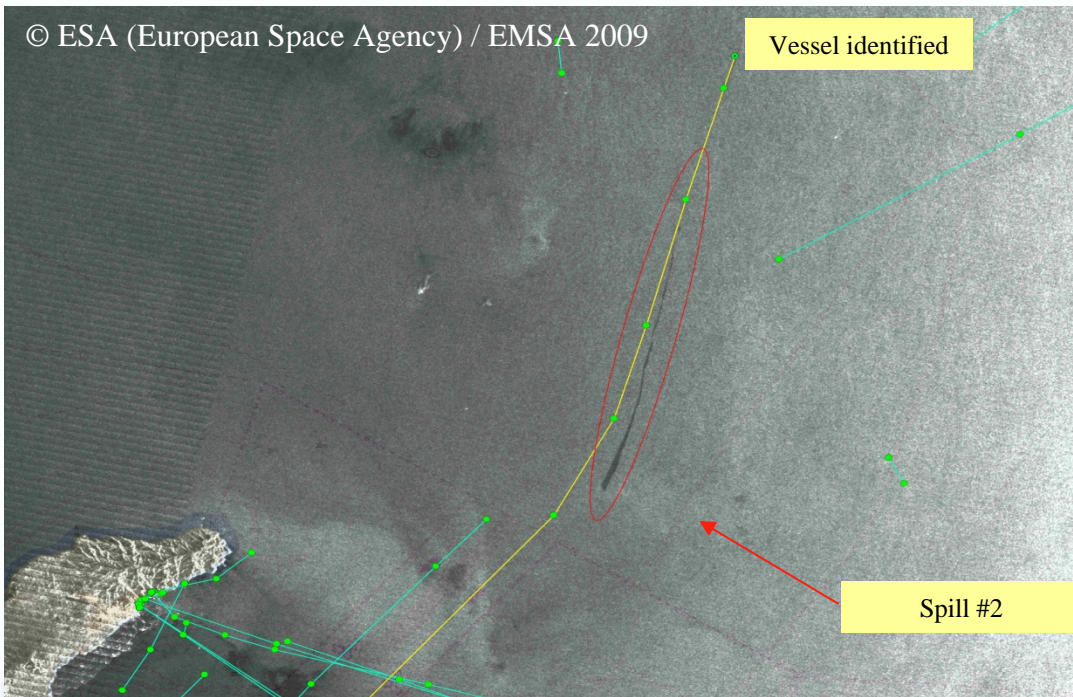
PROVING A MARPOL VIOLATION REQUIRES COMPLEMENTARY EVIDENCE

- Evidence can be collected **ON SITE AND/OR IN PORT**



Catching Polluters – On Site Follow-up

- CleanSeaNet detection initiates the action



3 oil spills confirmed by aircraft:

1. 154 km long
2. 42 km long
3. 14 km long

2 polluters identified using AIS information

One polluter caught in the act (154 km long spill)

- On Site follow-up brings actionable evidence
- Satellite brings corroborating evidence

Full extent of the spill – Link between spill and polluter

Article 6 of Directive 2005/35/EC and CleanSeaNet

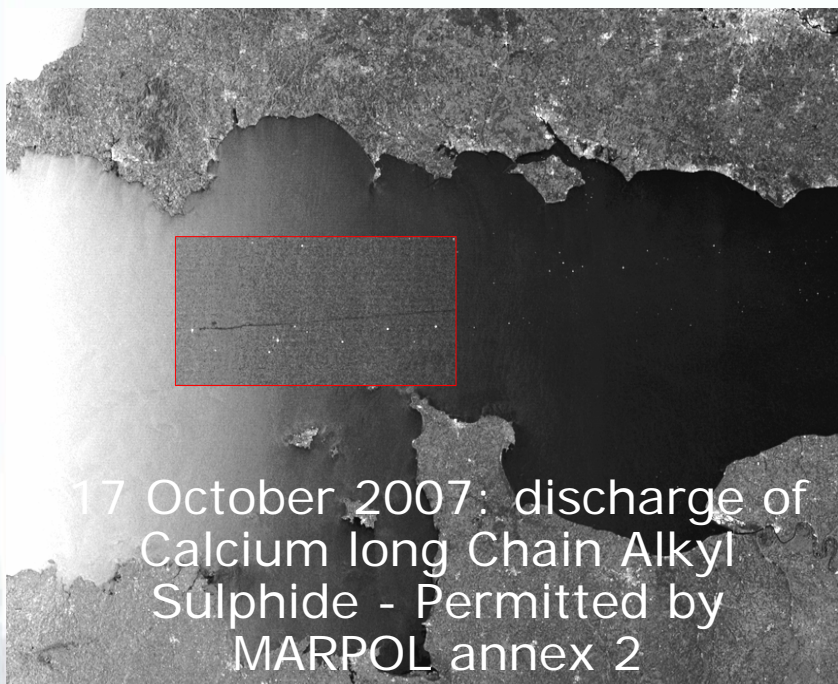
Enforcement measures with respect to ships within a port of a Member State

1. If irregularities or information give rise to a **suspicion** that a ship which is voluntarily within a port or at an off-shore terminal of a Member State has been engaged in or is engaging in a **discharge of polluting substances** into any of the areas referred to in Article 3(1), that Member State shall ensure that an appropriate inspection, taking into account the relevant guidelines adopted by the International Maritime Organisation (IMO), is undertaken in accordance with its national law.

2. In so far as the **inspection** referred to in paragraph 1 reveals facts that **could indicate an infringement** within the meaning of Article 4, the competent authorities of that Member State and of the flag State shall be informed.

Article 6 of Directive 2005/35/EC and CleanSeaNet

- **SUSPICION OF A DISCHARGE of polluting substances? YES**
- **MARPOL VIOLATION? POSSIBLE (discharge might be legal)**



17 October 2007: discharge of Calcium long Chain Alkyl Sulphide - Permitted by MARPOL annex 2

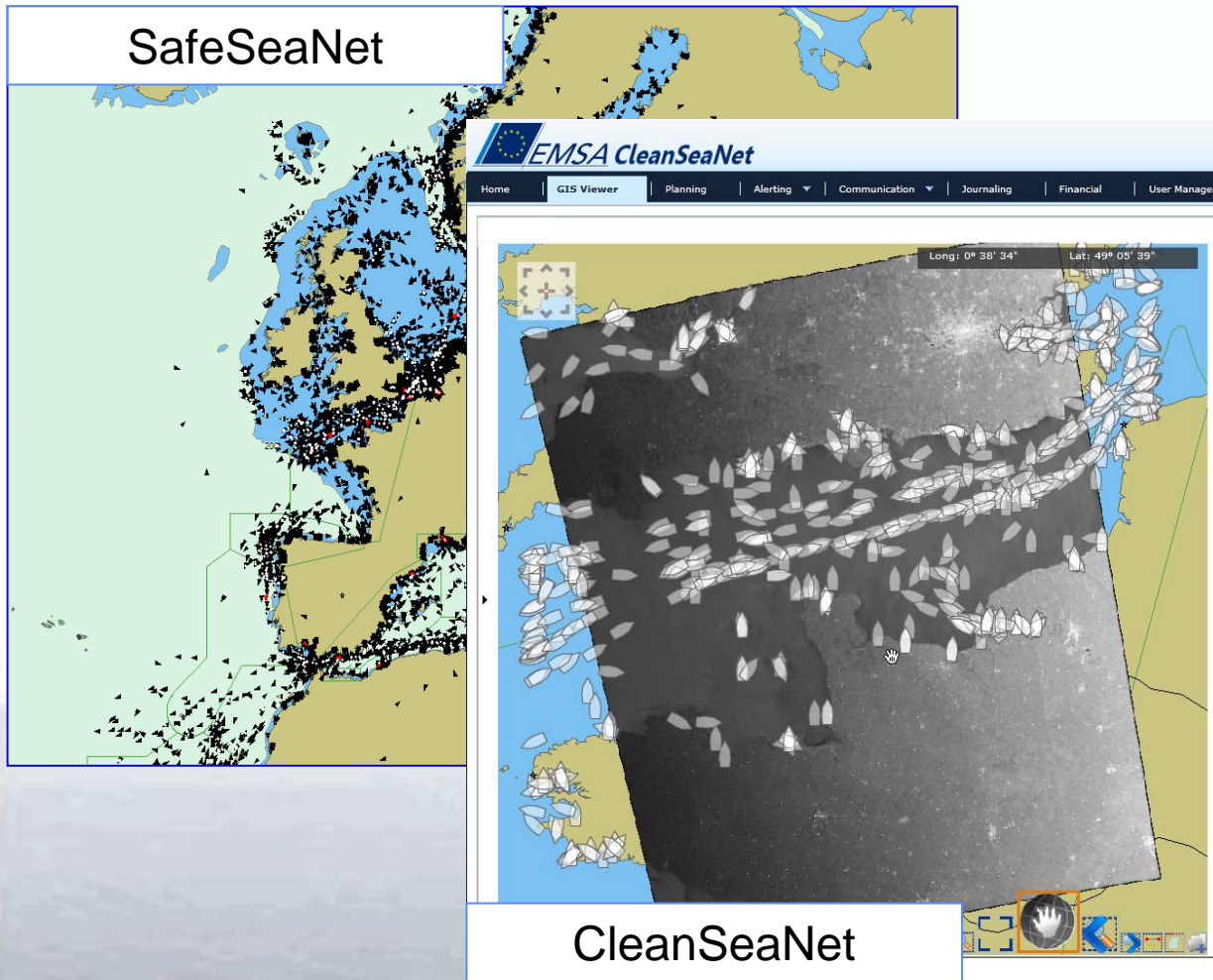


•CleanSeaNet USED TO TRIGGER INSPECTIONS IN PORT

A number of vessels detained and/or fined based on the evidence collected in port

Identification of Discharging Vessels

AIS information from SafeSeaNet overlaid on SAR images



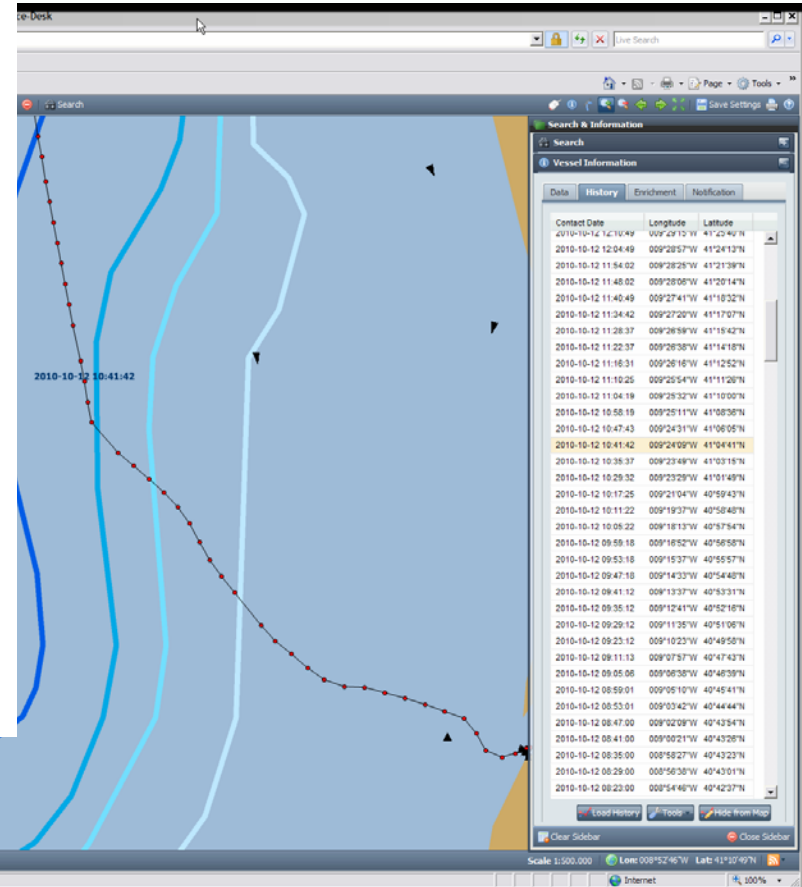
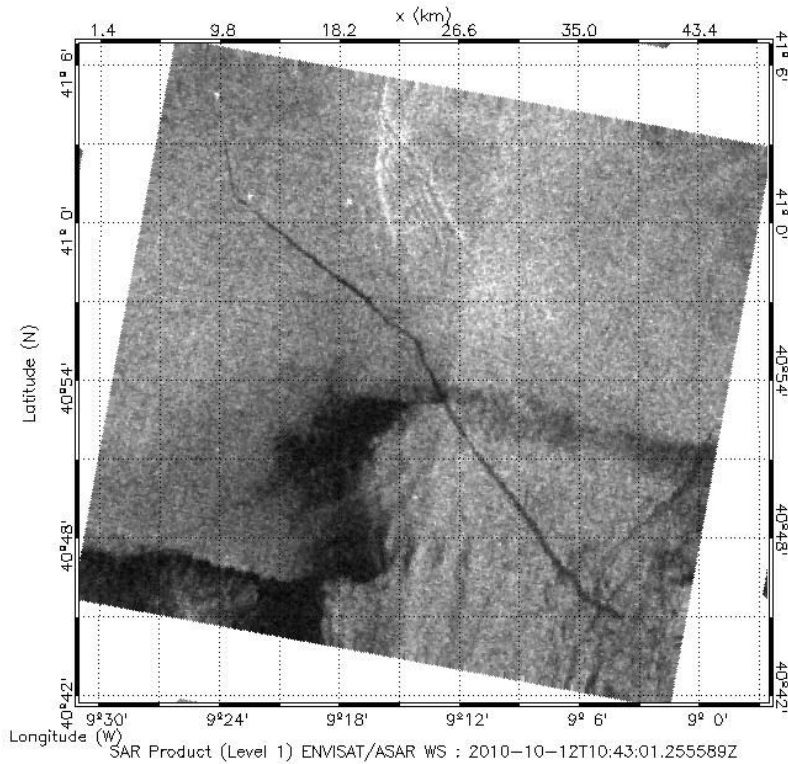
SafeSeaNet Figures

727 AIS coastal stations

2.326 data providers and 556 authorized users in 22 EU coastal states, Norway and Iceland

20.000 ships tracked in European waters:
average of over 100.000.000 AIS positions per month

Identification of Discharging Vessels



Workshop “Enhancing the effectiveness of the law enforcement chain in combating illegal discharge”

EMSA, 15-16 February 2011

Objectives

Stimulate discussion and exchange of ideas between

1. operational actors responsible for spill detection and response including CleanSeaNet users
2. authorities responsible for vessel inspections in port, and
3. administrative and judicial enforcement authorities

With a view to take actions in order to

1. improve the overall efficiency of the illegal discharge response chain
2. to set-up a feedback mechanism on follow-up actions

Workshop “Enhancing the effectiveness of the law enforcement chain in combating illegal discharge”

EMSA, 15-16 February 2011

Key conclusions

- Variety of legal systems
- Efficient detection techniques including CleanSeaNet
- Limited enforcement results
- Lack of feedback on enforcement procedures
- In some areas lack of resources
- Cooperation with non EU neighbouring countries
- Important role of Regional Agreement
- Analysis of all data available (PRF, ship voyage, cargo information...)

Workshop “Enhancing the effectiveness of the law enforcement chain in combating illegal discharge”

EMSA, 15-16 February 2011

Main possible actions identified

EMSA and the Member States could work together to support the enhancement of the illegal discharge response chain:

- Guidelines and Procedures – Establishment of an informal working group
- Training – Near future: CTG Surveillance training
- Regular meetings
- Feedback mechanism on enforcement actions

All workshop presentations and documents on the Agency's website at <http://cleanseanet.emsa.europa.eu/docs/public/ws201101.html>

Working Group for drafting European Guidelines for Combatting Illegal Discharges in the Marine Environment

Objective

EU Guidelines should complement those established at regional and national level:

- To support the harmonised enforcement of anti-pollution regulations
- To provide non legally binding guidelines mainly for inspectors and investigators
- To provide useful information for effective prosecution of offenders
- To promote the use of existing information systems

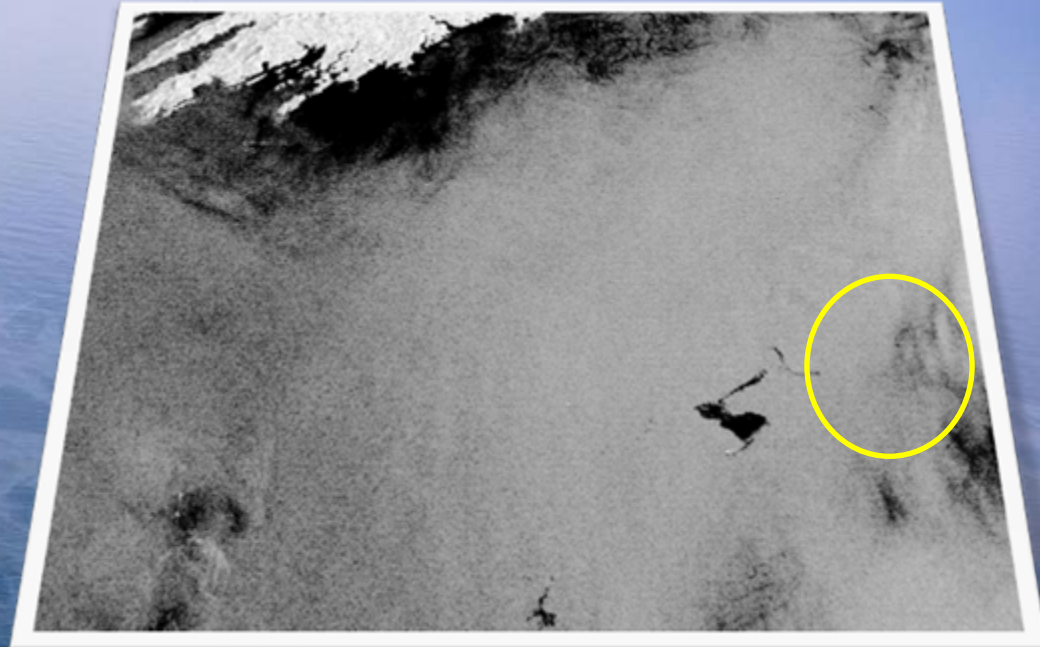
Participants

Members from Regional Agreements, from existing networks of investigators and prosecutors, Interpol, and interested countries

CleanSeaNet Emergency Assistance



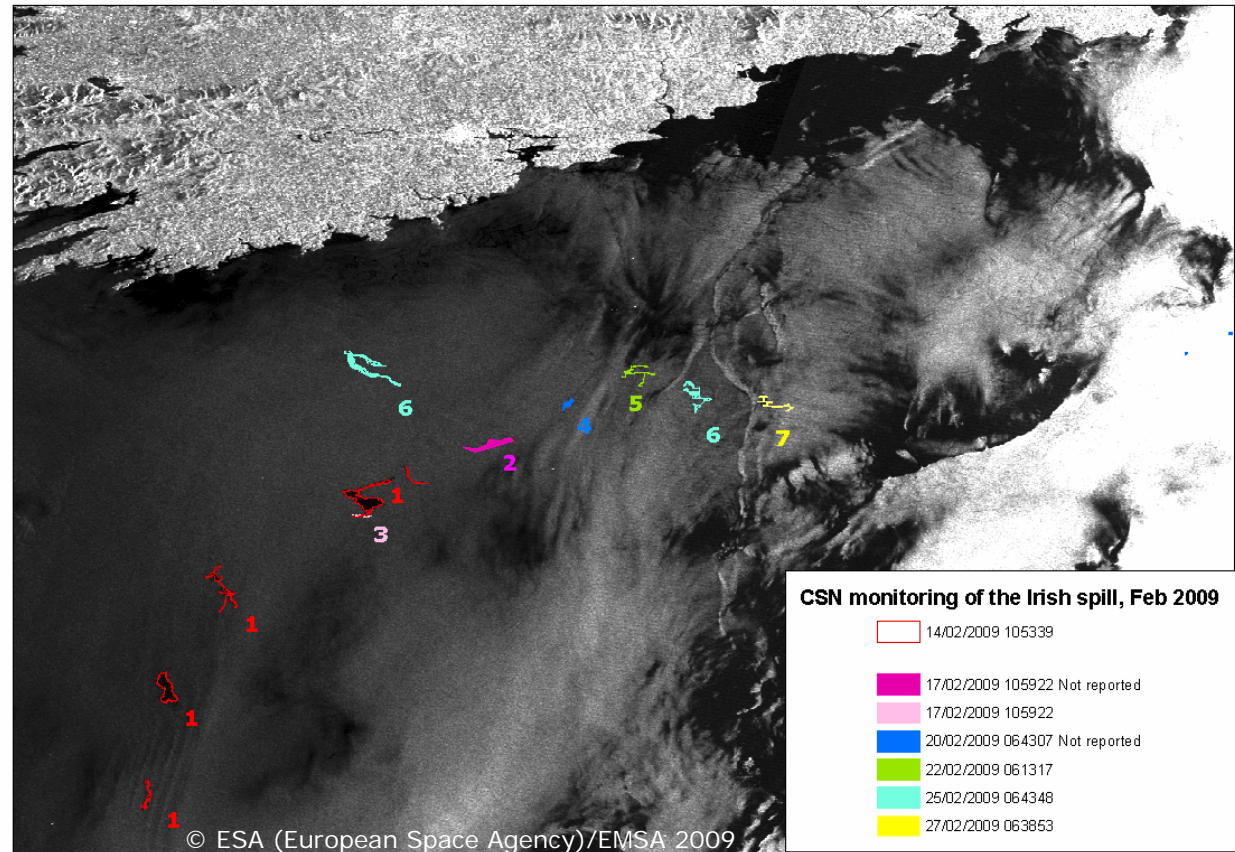
Admiral Kuznetsov
off the Southern Irish coast
17/02/2009



Monitoring accidental spills extent and movement

Example: spill in Irish waters in February 2009

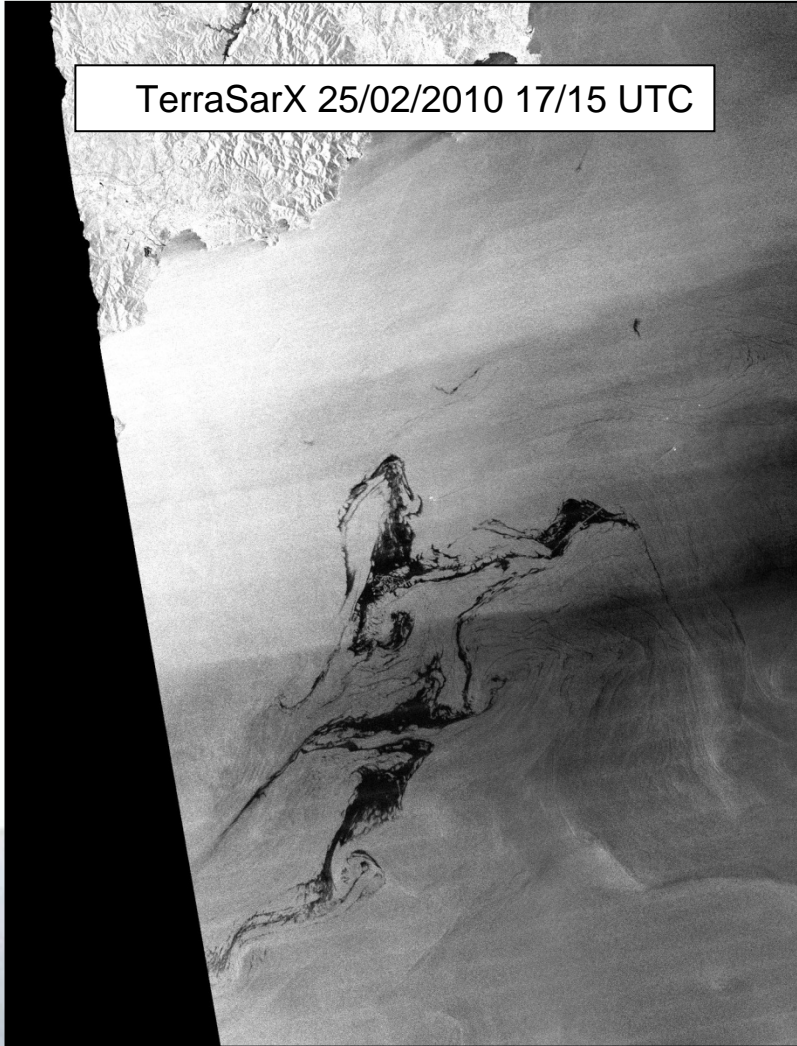
- CSN alert on four possible oil slicks was sent to Irish Coast Guard and to MCA in UK on 14/02/2009
- Aerial surveillance confirmed the mineral oil spill that was at least 300m³
- The heavy fuel oil spill was due to failure in bunkering operation
- CSN monitored the area and oil was still detected on 27/02/2009



Access to other sensors via GMES for emergency support

- **CosmoSkyMed**
- **TerraSarX**
- **Medium and High resolution Imagery**

Example: support to French authorities in February 2010:

A grayscale satellite image from TerraSarX showing a coastal area. The image is oriented vertically, with the coastline on the left. The land is dark, and the sea is light. There are some dark, irregular shapes in the water, possibly indicating a spill or other maritime activity. A white box with black text is overlaid on the top right of the image.

TerraSarX 25/02/2010 17/15 UTC