



EUROPEAN MARITIME SAFETY AGENCY
QUALITY SHIPPING, SAFER SEAS, CLEANER OCEANS

CleanSeaNet – European Satellite Oil Spill Monitoring and Vessel Detection Service

Introduction to CSN

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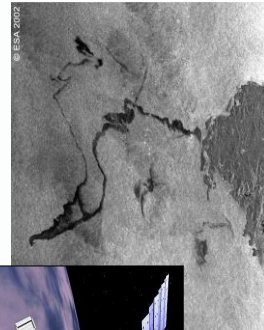
CleanSeaNet SAFEMED Info Day – Lisbon – November 2013



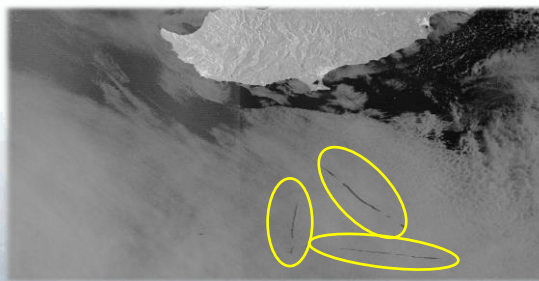
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Service Overview

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



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Service Overview

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

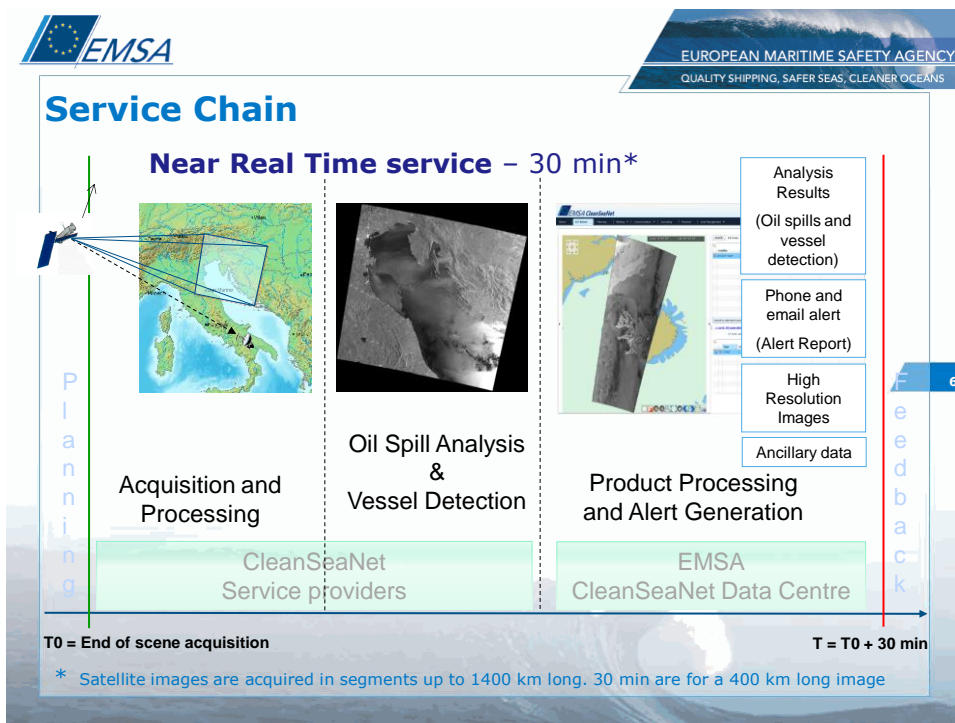




Service Overview

CleanSeaNet Fact Sheet

- Based on the analysis of Synthetic Aperture Radar (SAR) satellite images.
- Operational since April 2007
- 2.100 analysed satellite images per year
- 27 countries (23 EU coastal states, Iceland, Norway, Montenegro, and Turkey) - over 400 users
- Complete service chain from the collection of coverage requirements to the provision of operational results.
- 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, ...)

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



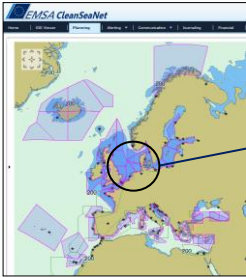


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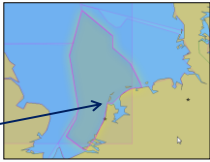
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Service Chain: planning




Planning the satellite scenes



Coverage requirements defined by Coastal States:

- Areas
- #scenes per month

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Service Chain: acquisition and processing

— Acquisition is normally done by direct real-time downlink when the satellite passes through the Ground Station Mask.

— raw radar data is processed into a usable image with adequate resolution, by applying heavy digital processing and a number of corrections;



Raw data

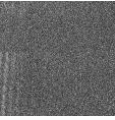


Image after range compression and range migration correction

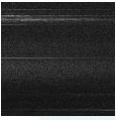
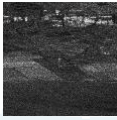



Image after azimuth compression

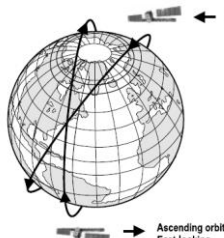




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SAR satellite and SAR products used in CSN



CONTRACTED SATELLITES (launch dates):

- ENVISAT (01/03/2002)
- RADARSAT 1 (04/11/1995*)
- RADARSAT 2 (14/12/2007*)
- COSMOSKYMED (05/11/2010* last satellite)

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	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
COSMOSKYMED	CSK-HR	ScanSAR Huge	100 x 100	50 x 50	200 x 200
COSMOSKYMED	CSK-WR	ScanSAR Wide	30 x 30	15 x 15	100 x 100

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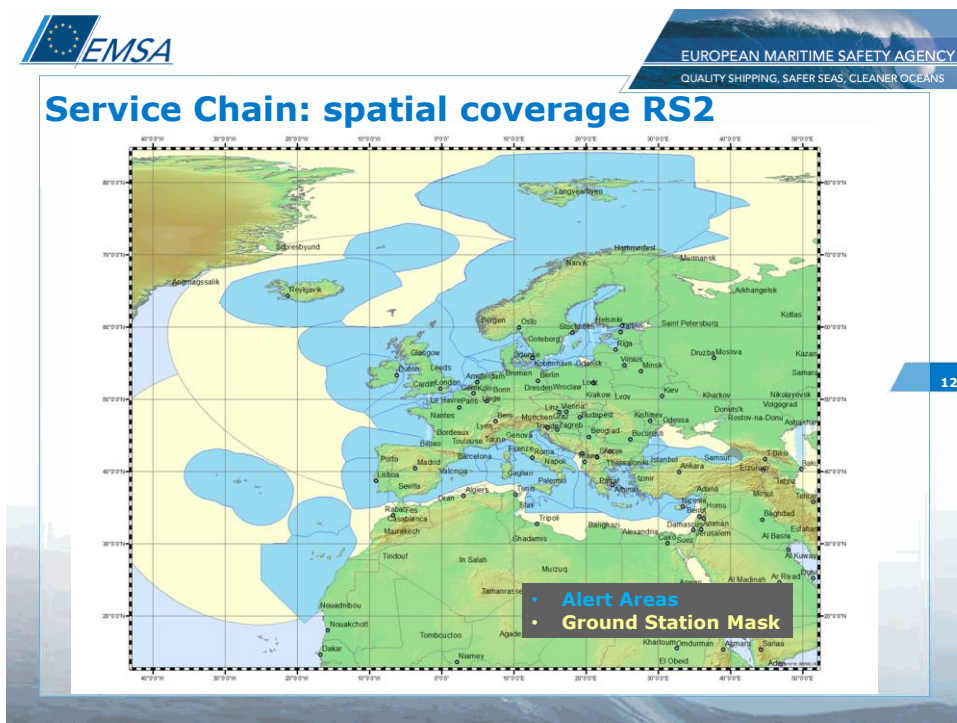
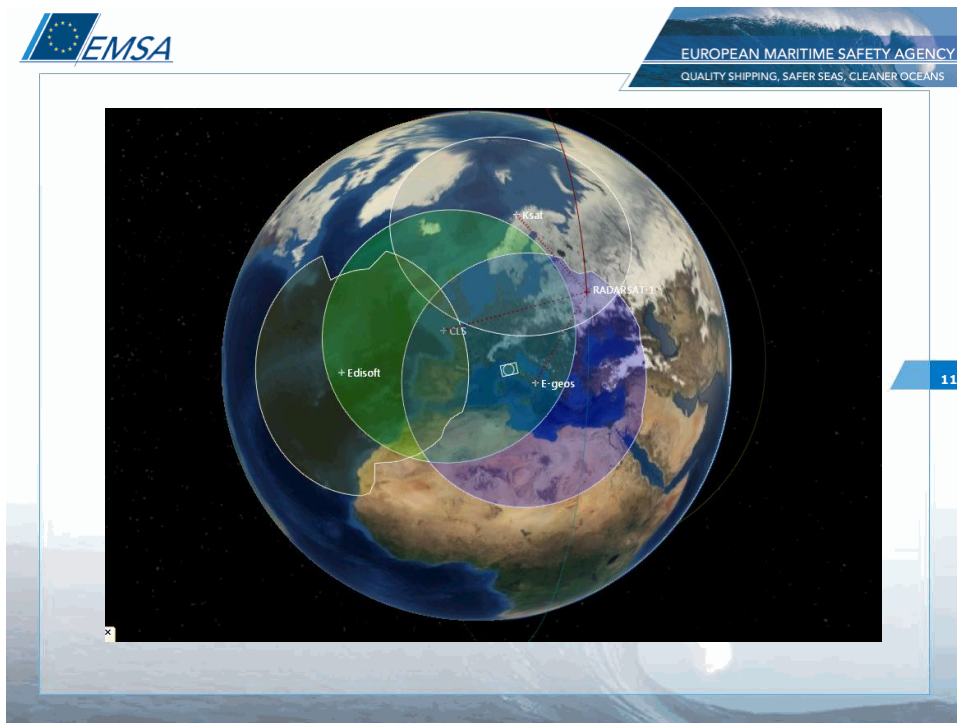
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Service Chain: network of ground stations RS2

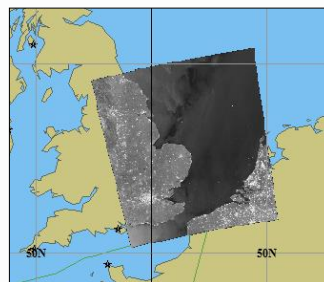
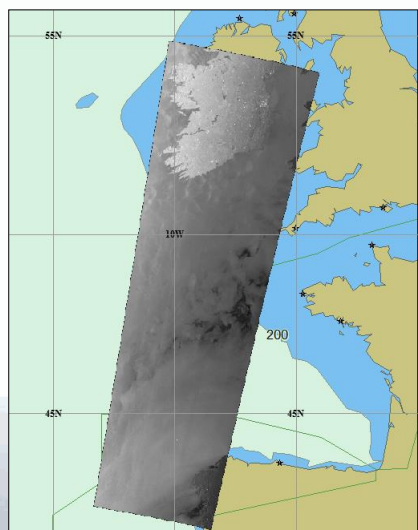


using the GEANT/NREN Network

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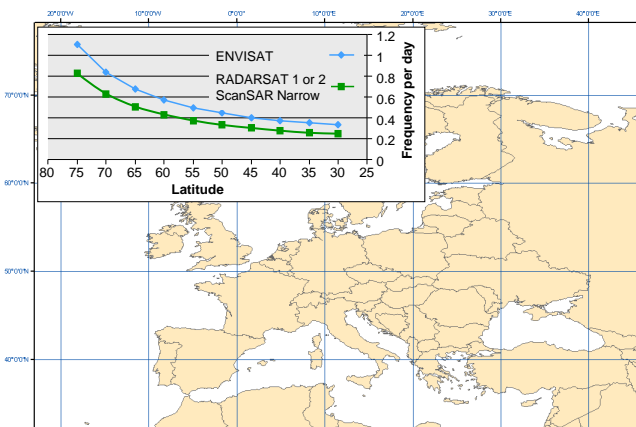
Service Chain: SAR satellite and products



The service allows the use of segments of variable length up to 1400 km long. Example RS2

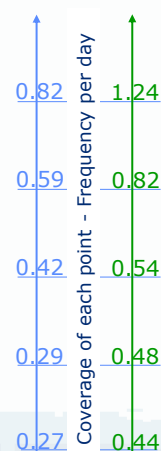
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Service Chain: SAR satellite and products




CleanSeaNet Temporal Coverage:

ENVISAT: From 2 images per week in the South to nearly 1 per day in the North
 RADARSAT 1 or RADARSAT 2: From 3 images per week in the South to more than 1 per day in the North;

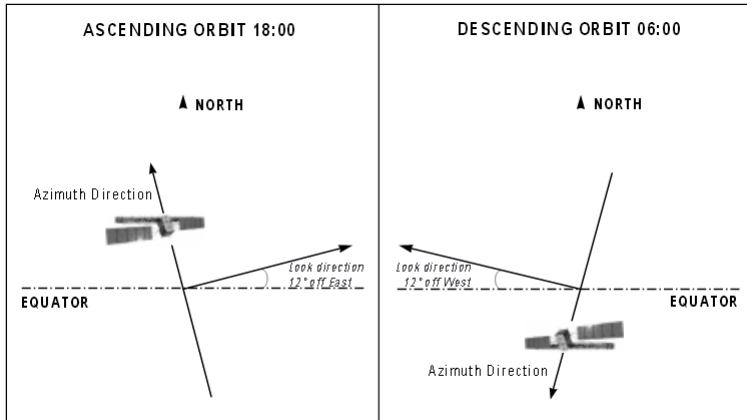

 ENVISAT
Wide
Swath

 RADARSAT 1 +
RADARSAT 2
ScanSAR
Narrow

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RADARSAT requires 24 days to return to its original orbit path. This means that for all geographic regions, it takes 24 days to obtain exactly the same image (i.e., same beam mode, same beam position, and same geographic coverage). However, by using RADARSAT's beam modes, images can be acquired on a more frequent basis.



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Service Chain: CSK Usage in CSN

- COSMO-SkyMed is a constellation of **4 satellites** funded by the Italian Ministry of Research and Ministry of Defense, and conducted by the Italian Space Agency (ASI), intended for both military and civilian use. Orbits of circa 100 minutes.



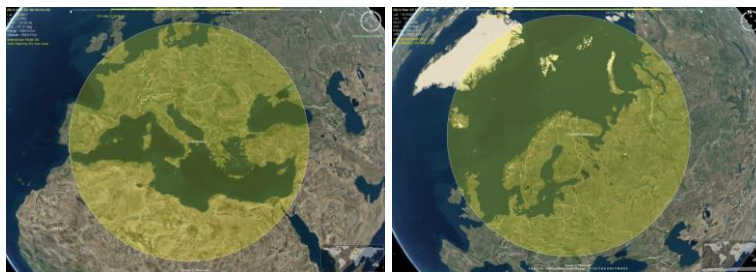
Service Chain: CSK Usage in CSN

- The satellites carry **X-band SAR sensors**, and provide incidence angles and image types which are adequate for oil spill monitoring and vessel detection;
- Timing of acquisitions are similar to Radarsat: around 6:00 AM Local Time for ascending passes and 6:00 PM Local Time for descending;
- With an orbit cycle of 16 days (4 acquisitions with same orbit direction, same look side, same incidence angle) and left and right look capability => **higher revisit capacity** than with Radarsat;
- Our Service Providers now operate 2 stations: in addition to Matera, now agreement with Sodankyla, operated by the Finnish Meteorological Service (FMI):
 - NRT acquisitions on a more vast area for both passes.

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Service Chain: CSK Usage in CSN

Available antennas

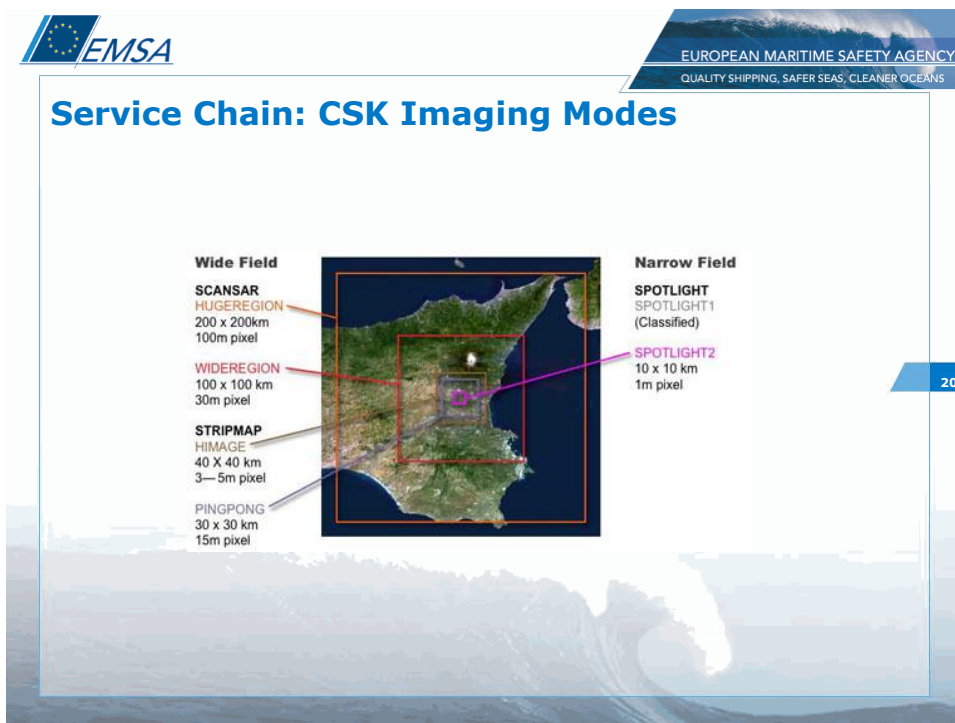
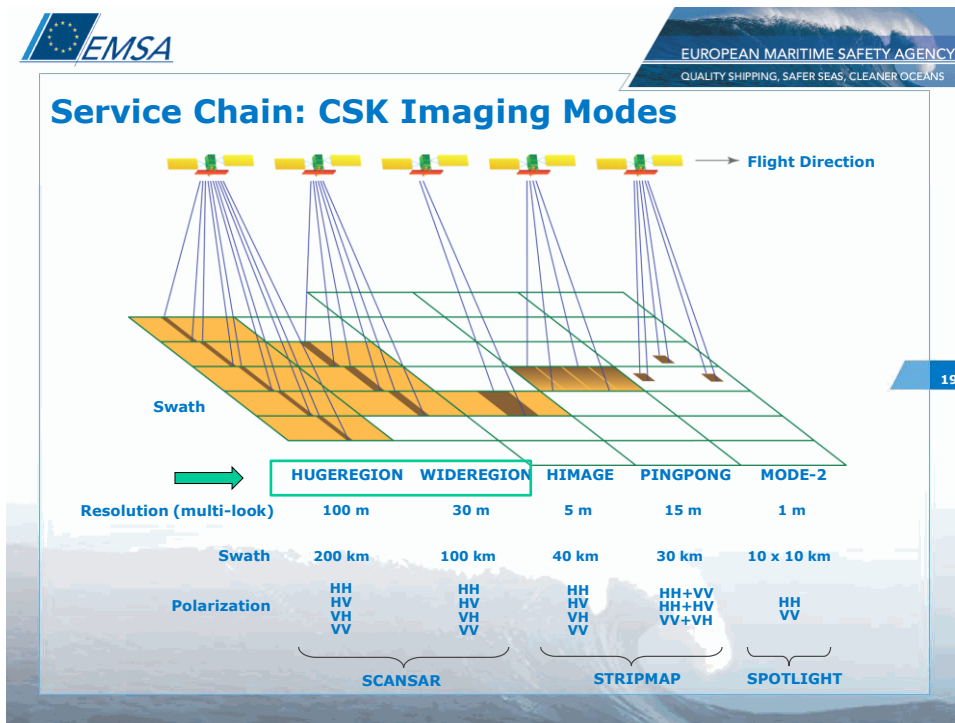


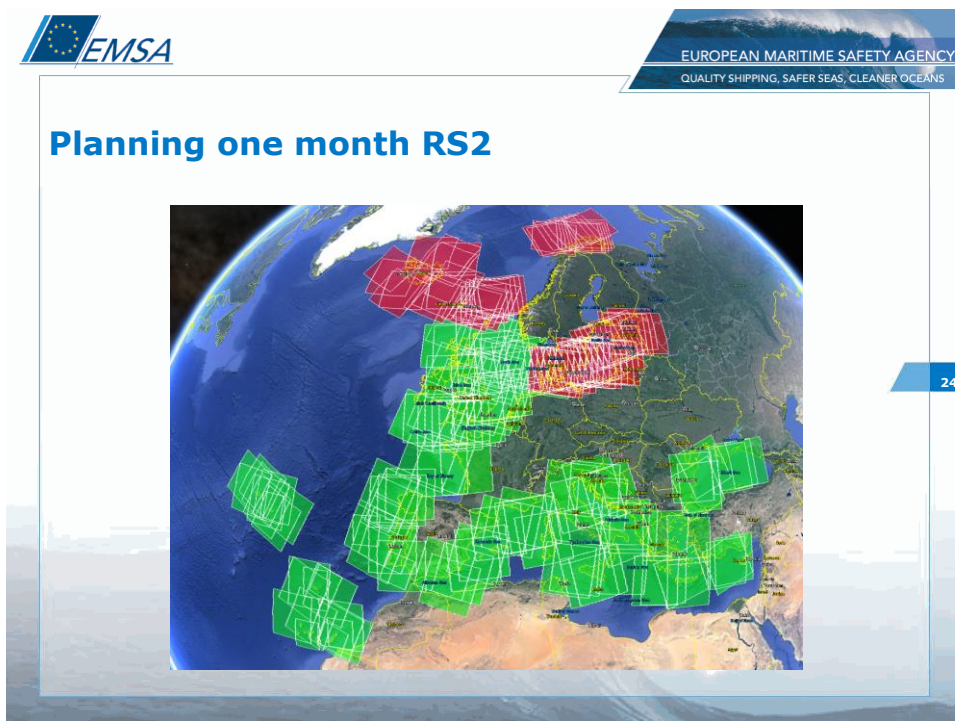
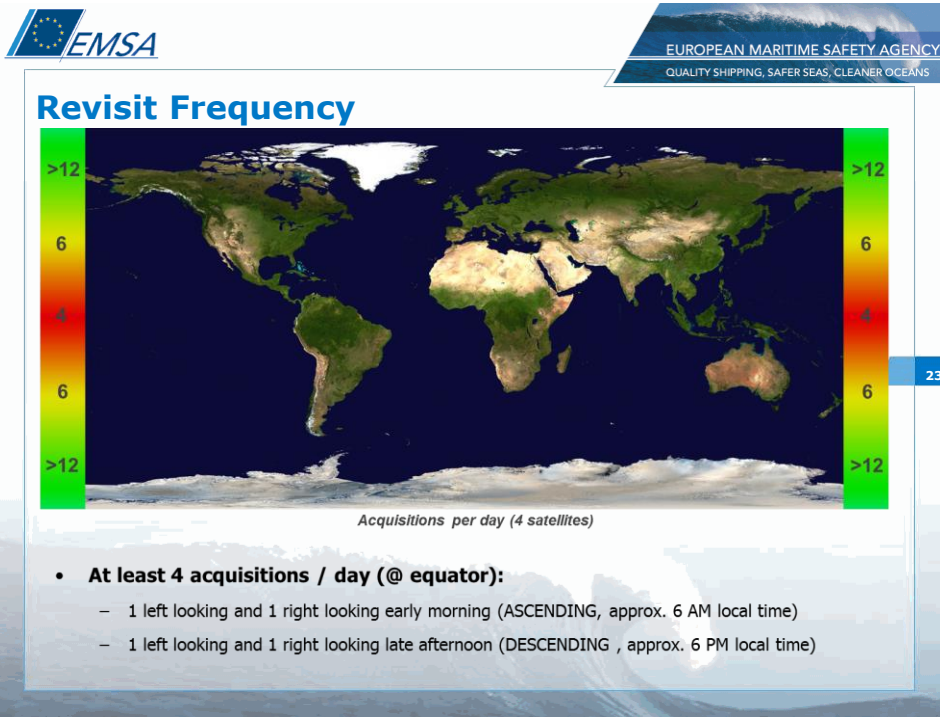
Footprint of the Matera station


Footprint of Sodankyla station

A small extra time (less than 2 minutes for ScanSAR Wide or Huge) for data transfer to Matera, for analysis, is the unique drawback.

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Optical Images

NDC Sibilla JSP CSNDC SIBILLA JSP



Search EO Scenes Oil Spills Data


EO Scenes Min Lat: Max Lat: Min Lon: Max Lon: Acquisition Time: From 02/11/2013 00:00:00

Search Stop Search Order

Enable External Catalogue ☐

EO Scene ID: Item Identifier: Satellite:
 Status:
 EROS_B
 GEOEYE-1
 IKONOS
 QUICKBIRD
 WORLDVIEW-1

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Optical Images

Topography Land Features

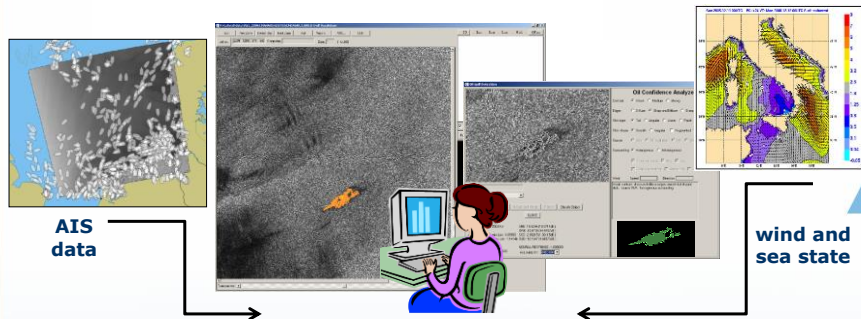


Item Identifier	Satellite - Sensor	Acquisition Time
9_IKON4BP_896169	Ikonos-Ikonos	2011-07-16 11:17:00



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Service Chain: oil spill analysis



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- Service Providers (SP) Operators, supported by SW tools, manually inspect the images in NRT
- Use AIS data, wind and sea state information and other ancillary information like bathymetry, platforms and wrecks layers, etc

Service Chain: oil spill analysis

1. Look for **ongoing discharges** and report them immediately for catching polluter "red-handed"
2. Proceed to **detailed analysis of the full image** and whenever an oil spill is detected:
 - Characterize the spill: position, shape (polygon), area, length
 - Set the confidence level of the detection: Class A (higher confidence) or Class B (lower confidence)
 - Identify possible polluters
 - Assess image quality
- Based on the Class (A or B) and on further rules configured by the Coastal States, considering the impact and the culprit of the spill, the spills are assigned an alert level: **red**, **yellow** or **green**.

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Service Chain: polluter identification

What additional information can we have about vessels?

- LRIT
- AIS /SAT-AIS
- VDS
- SAR detections

In CleanSeaNet, AIS from SafeSeaNet is used for polluter identification

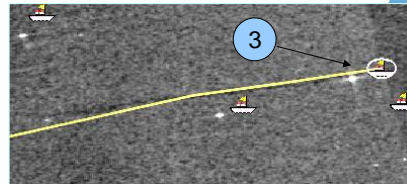
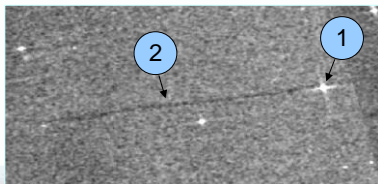
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AIS:

- Anti-collision system
- Mandatory for all passenger ships, ships over 500 gross tonnes, ships over 300 gross tonnes in international trips, fishing vessels over 15 metres (2014).
Based on GPS and VHF
Position is broadcasted
- Positions reported at least every 6 minutes

Service Chain: polluter identification

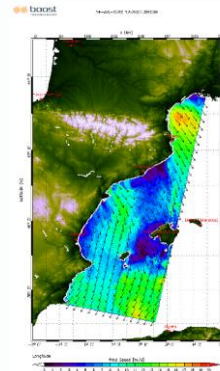
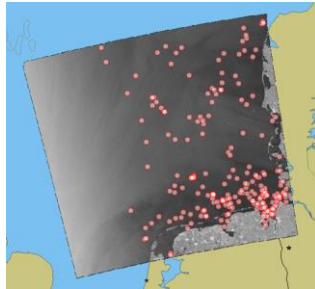
- Ship detected on SAR image (Bright Spot) ①
- Possible spill matches the track of the vessel ②
- Vessel identified using AIS information ③



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

Service Chain: Vessel Detection and SAR wind/sea state

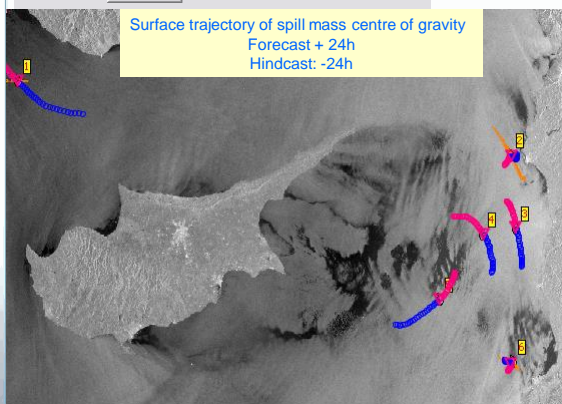


SP Operators also monitor the automatic generation of vessel detection and SAR extracted wind/sea state information

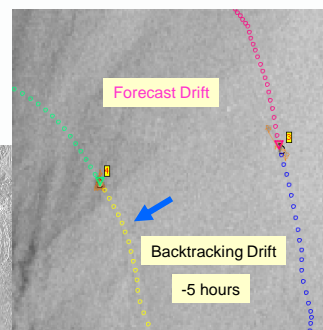
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Spill drift modelling

<input checked="" type="checkbox"/> Image	<input checked="" type="checkbox"/> Oil	<input type="checkbox"/> Wind sar	<input type="checkbox"/> Swell sar	<input type="checkbox"/> AIS
<input type="checkbox"/> Center	<input checked="" type="checkbox"/> Drift	<input type="checkbox"/> Wind met	<input type="checkbox"/> Wave ...	<input type="checkbox"/> all tracks
	<input checked="" type="checkbox"/> Oil ind.			



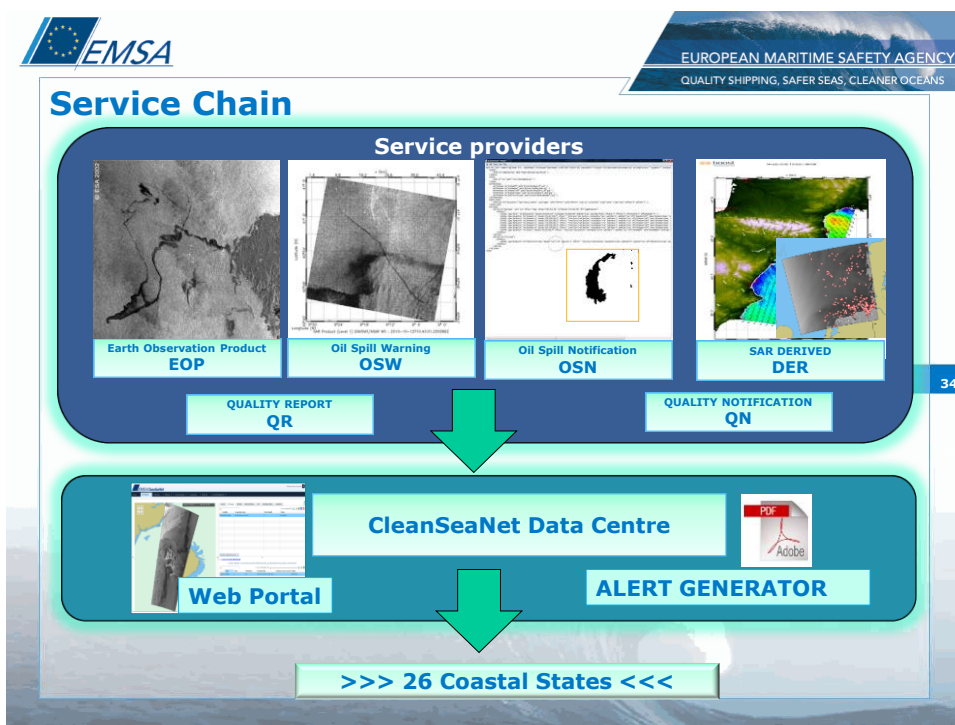
2010-03-12:
Eastern Levantine Basin (MEDSLIK: Cyprus Oceanography Centre)



Feature Info View
<http://www.oceanography.ucv.ac.cy>

Properties
 ItemProperties
 Time_offset: -5h
 Time: 2010-03-12 02:48
 Latitude: N 35° 7' 25.29"
 Longitude: E 35° 29' 40.08"
 ModelInfoLink: <http://www.oceanography.ucv.ac.cy>
 StartPos: Drift simulation
 OilSpillID: 4
 Time: 2010-03-12 07:48
 Latitude: N 35° 9' 36.94"
 Longitude: E 35° 28' 0.44"
 ModelInfoLink: <http://www.oceanography.ucv.ac.cy>

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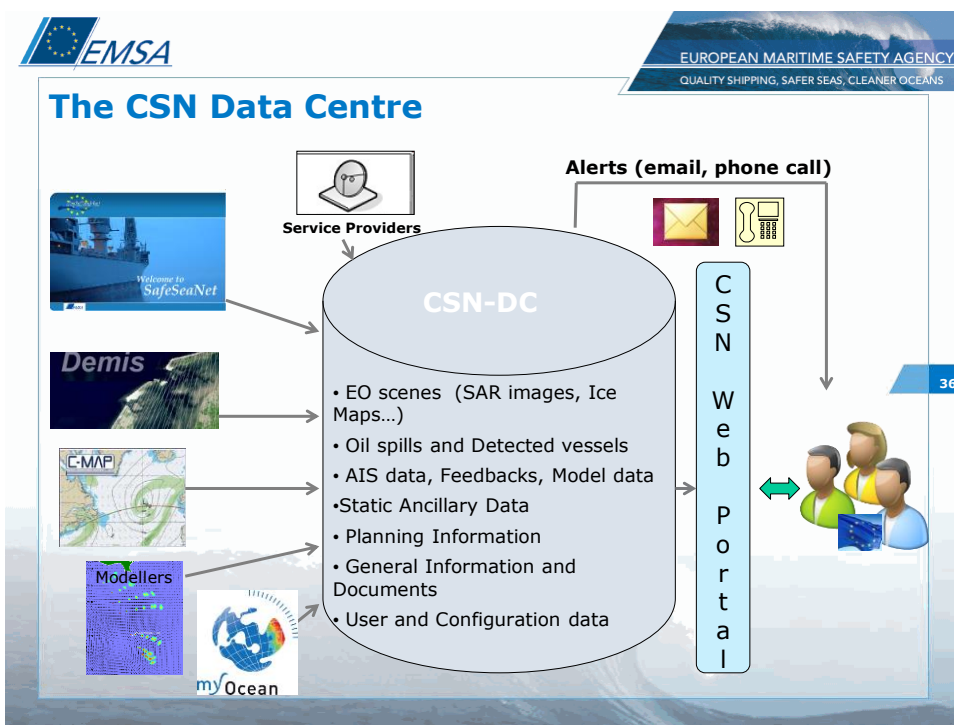
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The CSN Data Centre

- The **CSN Data Centre** (DC) is the core of the service and is hosted at EMSA premises
- Central element for data reception, management, storage, archiving, fusion and dissemination to the users
- Currently, we have CSN DC release version 1.4.5
- The service is provided to the end-user by means of:
 - The **CSN Web Portal** at:
<https://csndc.emsa.europa.eu/group/cleanseanet/homepage>
 - Alert phone calls** performed by EMSA 24/7 MSS Duty Officers (optional)
 - Alert emails** containing pdf documents, the alert reports

IMPORTANT: Portal and Alerting are independent mechanisms; it is possible for example to have the Portal unavailable and still receive the alert emails

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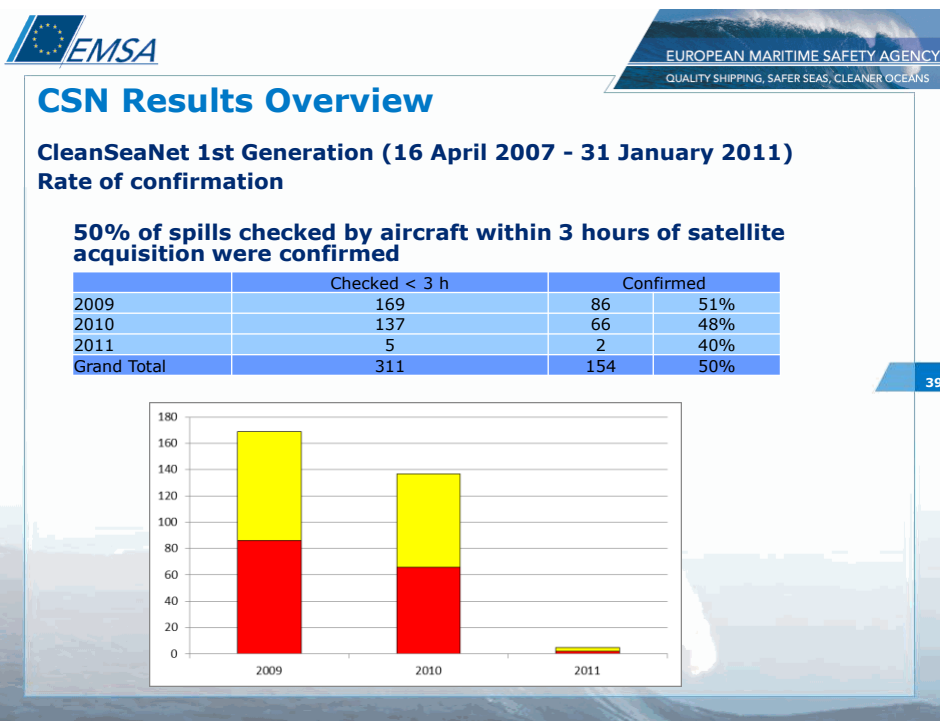
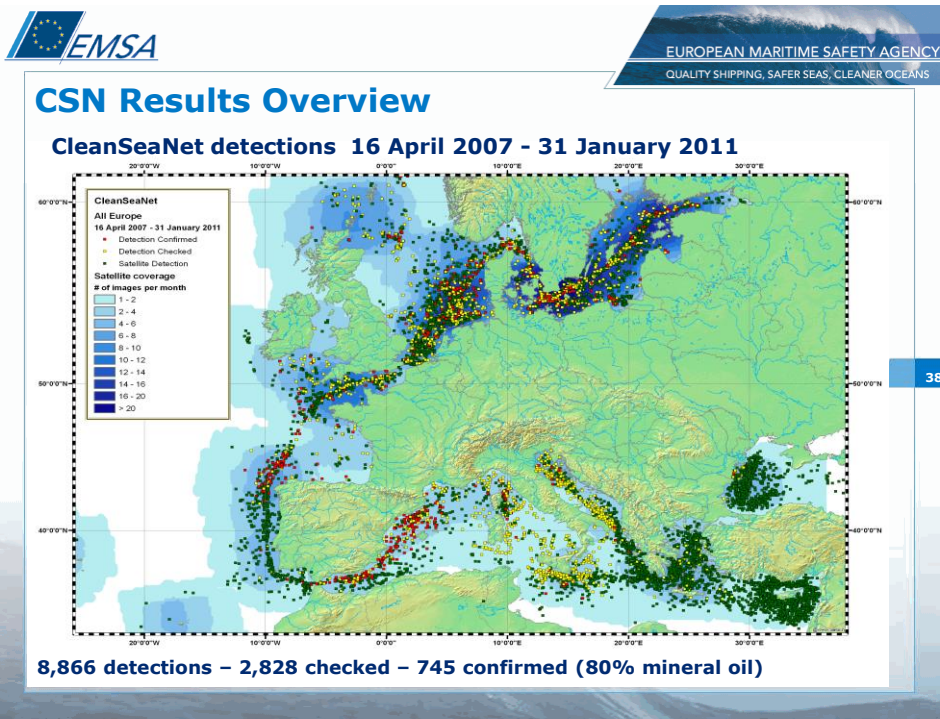


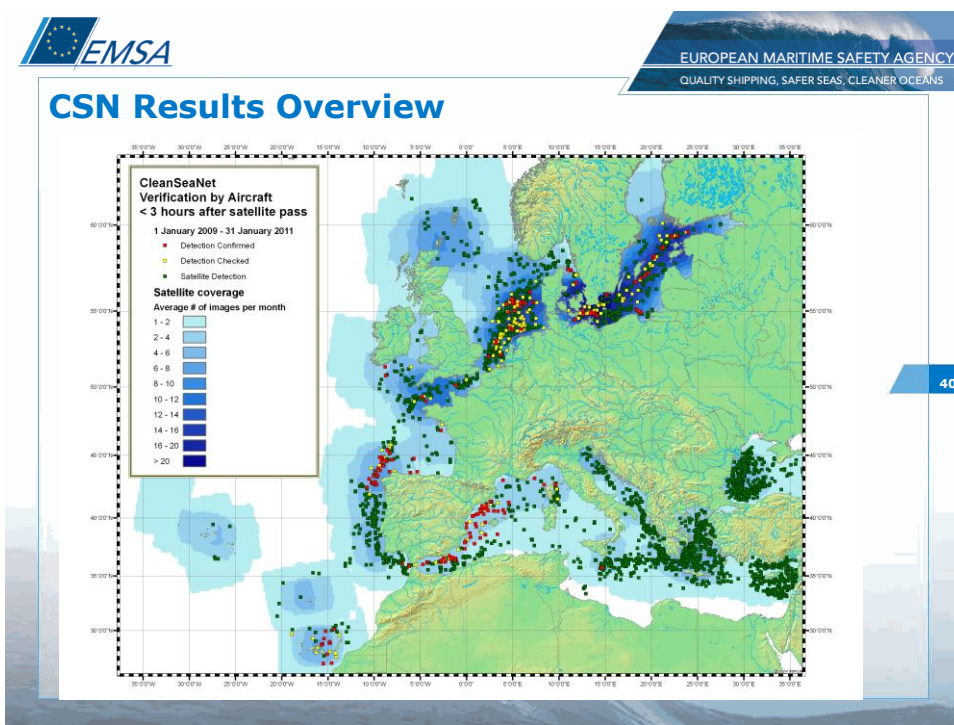
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The CSN Data Centre: the Portal

- The CSN Portal provides a single-point interface for:
 - User Management
 - Planning
 - Service Results Visualization
 - Feedback Provision
 - Alert Configuration
 - Communication platform among CSN community
- Each user requires a personal login account
- Users can belong to different user groups, what they “see” and can do depends on their role(s)

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CleanSeaNet Emergency Assistance

- EMSA provides support in the case of oil spill emergency upon request of:
 - National Maritime Administrations;
 - EC Monitoring and Information Centre of DG ECHO (MIC).
- Satellite images are provided via:
 - CleanSeaNet emergency ordering;
 - International Charter for Space and Major Disasters.

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Using CSN

CleanSeaNet Conditions of Use

Obligations regarding follow-up, verification and **feedback**:

4.7 The Participating State will ensure follow-up on CleanSeaNet detections and verify spills as extensively as possible. Therefore, the Participating State will take the coordinated satellite monitoring schedule into account for the planning of national or regional response, monitoring and surveillance resources (e.g. aircrafts, vessels).

4.8 As feedback is essential for monitoring quality and improving service reliability, the Participating State will provide information regarding verification of possible oil spills reported by CleanSeaNet.

4.9 The Participating State will provide information on observed spills that, although visible on the satellite image, were not reported by CleanSeaNet. In addition, the Participating State may provide information to the system on other spills detected by any surveillance means.

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Specific data access conditions

6.1 Some CleanSeaNet products available via the CleanSeaNet User Portal are subject to special "End User Licence" conditions and/or restricted "Access Rights" which have to be followed by the Participating State.

6.2 Special end users licence conditions and access rights policy for CleanSeaNet products currently available in CleanSeaNet are published on the CleanSeaNet User Portal.

Using CSN

Entry point at EMSA:

for problems with a specific service, during operational activities, please contact EMSA 24/7 MSS Duty Officers by email or phone:

MaritimeSupportServices@emsa.europa.eu

+351 21 1209 415

For general support, quality issues, information, issue reporting or features request:

Satellite.Coordinators@emsa.europa.eu

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