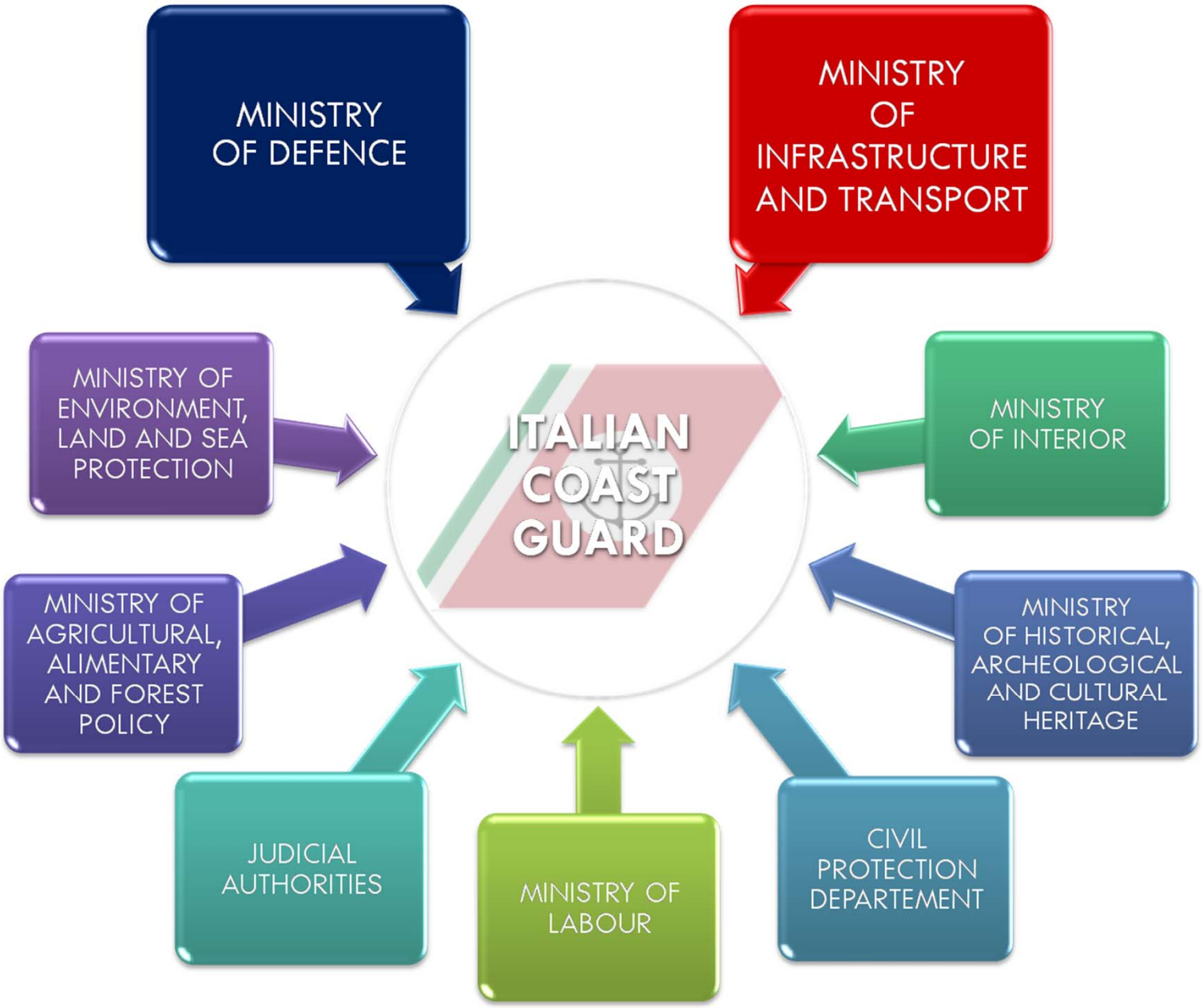
ITALIAN COAST GUARD HEADQUARTERS

satellite based maritime awareness and surveillance

LT. J.G. LUIGIA CAIAZZO AND DINO QUATTROCIOCCHI (E-GEOS)

SeaSar Symposium, 20 June 2012, Tromsø (Norway)

THE ITCG'S ACTIVITIES ARE PERFORMED FOR:



BY LAW ITALIAN COAST GUARD IS RESPONSIBLE FOR:

- ***PERFORMING AND COORDINATING MARITIME SEARCH AND RESCUE OPERATIONS*** *(PROTECTION OF THE HUMAN LIFE AT SEA)*, **safety and security of navigation (included ports and harbour);**
- **Maritime traffic monitoring (ARES, VTS, AIS,VMS, LRIT);**
- ***Maritime environment protection*** *(Surveillance and police inside special protected maritime areas, Pollution prevention and response, Environmental police for illegal garbage disposal and maritime/coastal pollution);*
- ***Fishing activities control*** *and National Centre for Fishing Control by European Community Rules as the Italian depute, on behalf of the Ministry of Agriculture, food and forestry policy;*
- **Cooperation in international operations on request by the Member States at European Agency "FRONTEX"** *GMES projects participation (MARNISS and MARCOAST, LIMES, MARISS, Mariss scaling up, G-Mosaic, SeaU, DOLPHIN, NEREIDS, FISHSAT);*
- *Involvement in* ***CleanSeaNet, SafeSeaNet*** *and* ***AIS*** *and participation in the recent "SSN/VMS Synergies" Pilot Project with* ***EMSA;***
- ***Involvement in VDS blue fin tuna campaign with EFCA ;***

EXAMPLES OF USING SAR IMAGES IN SUPPORT OF OPERATIONAL ACTIVITIES

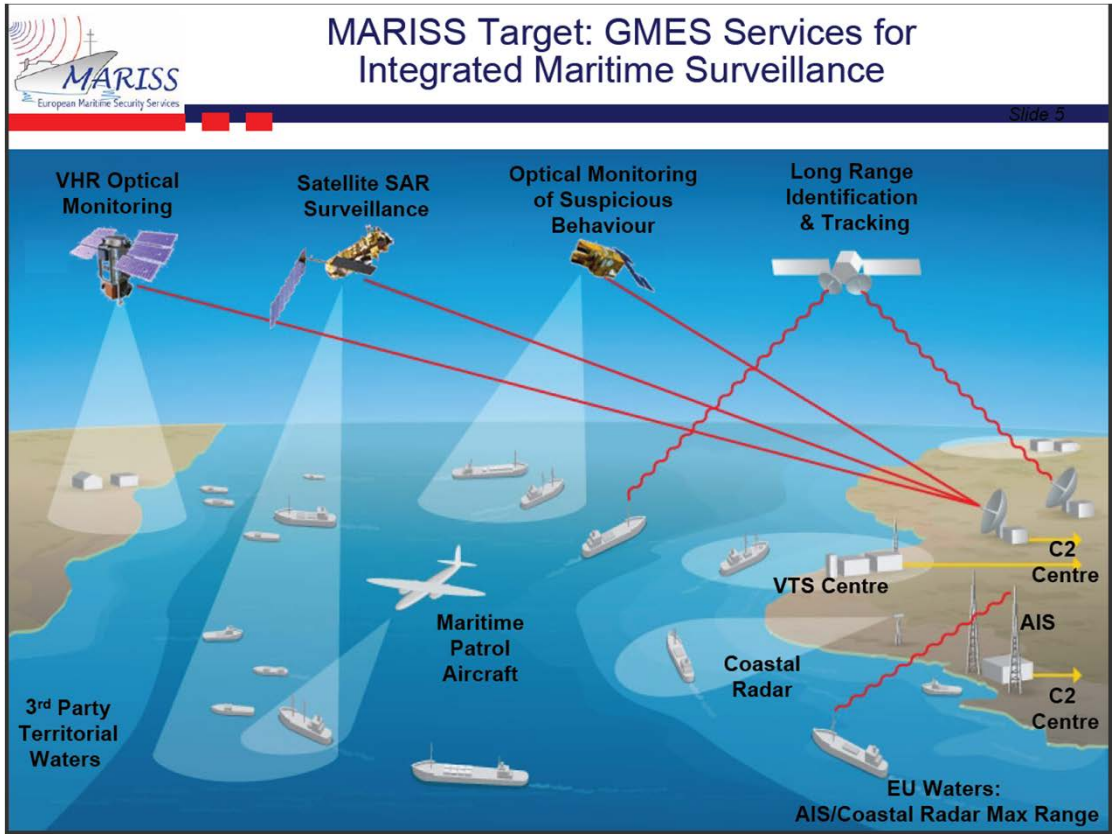
- **Ship detection**: from the migration flows from Tunisia and Libya coasts to the piracy attack to Italian merchant vessels;

- **Oil spill** prevention and response: Porto Torres event and Costa Concordia monitoring;

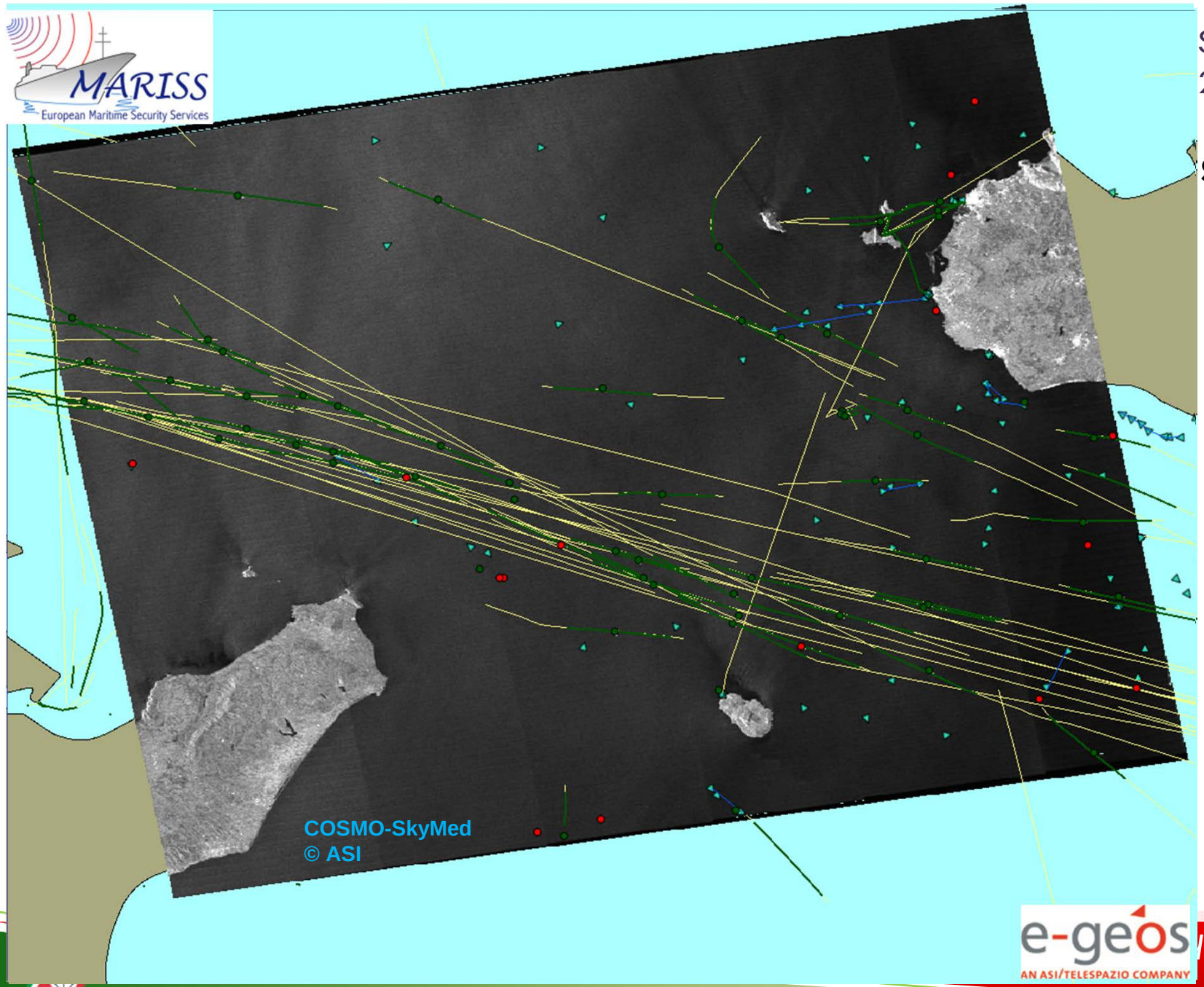
- **Illegal fishing fighting**: VDS blue fin tuna campaign with EFCA;

MARISS and MARISS SCALING-UP

- ✓ AIS data available
- ✓ VMS data available
- ✓ LRIT data available
- ✓ Cross – checks with ships detected by SAR images



EO SAR - Satellite AIS –terrestrial AIS and VMS integration COSMO SkyMed



SAR Image L1B
2009-07-15 05:16:14

Ship Detection Report

Terrestrial AIS

Satellite AIS

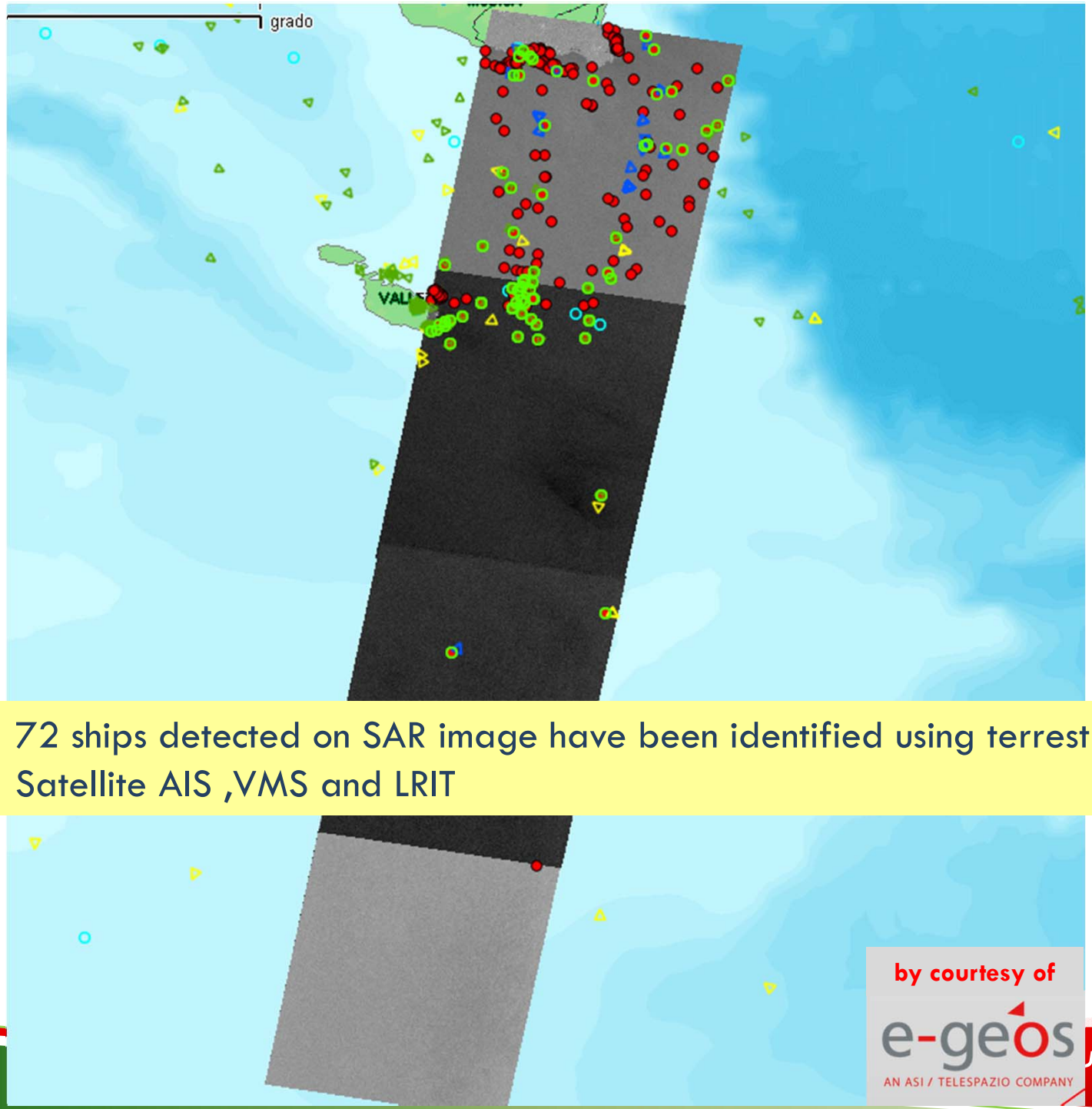
VMS

Not Correlated Ships

e-geos
AN ASI/TELESPAZIO COMPANY

Headquarters

MARISS : ENVISAT ASAR 21:12:2010



Ship Detection Report

LRIT

Satellite AIS

VMS

AIS

Correlated Ship

72 ships detected on SAR image have been identified using terrestrial AIS, Satellite AIS ,VMS and LRIT

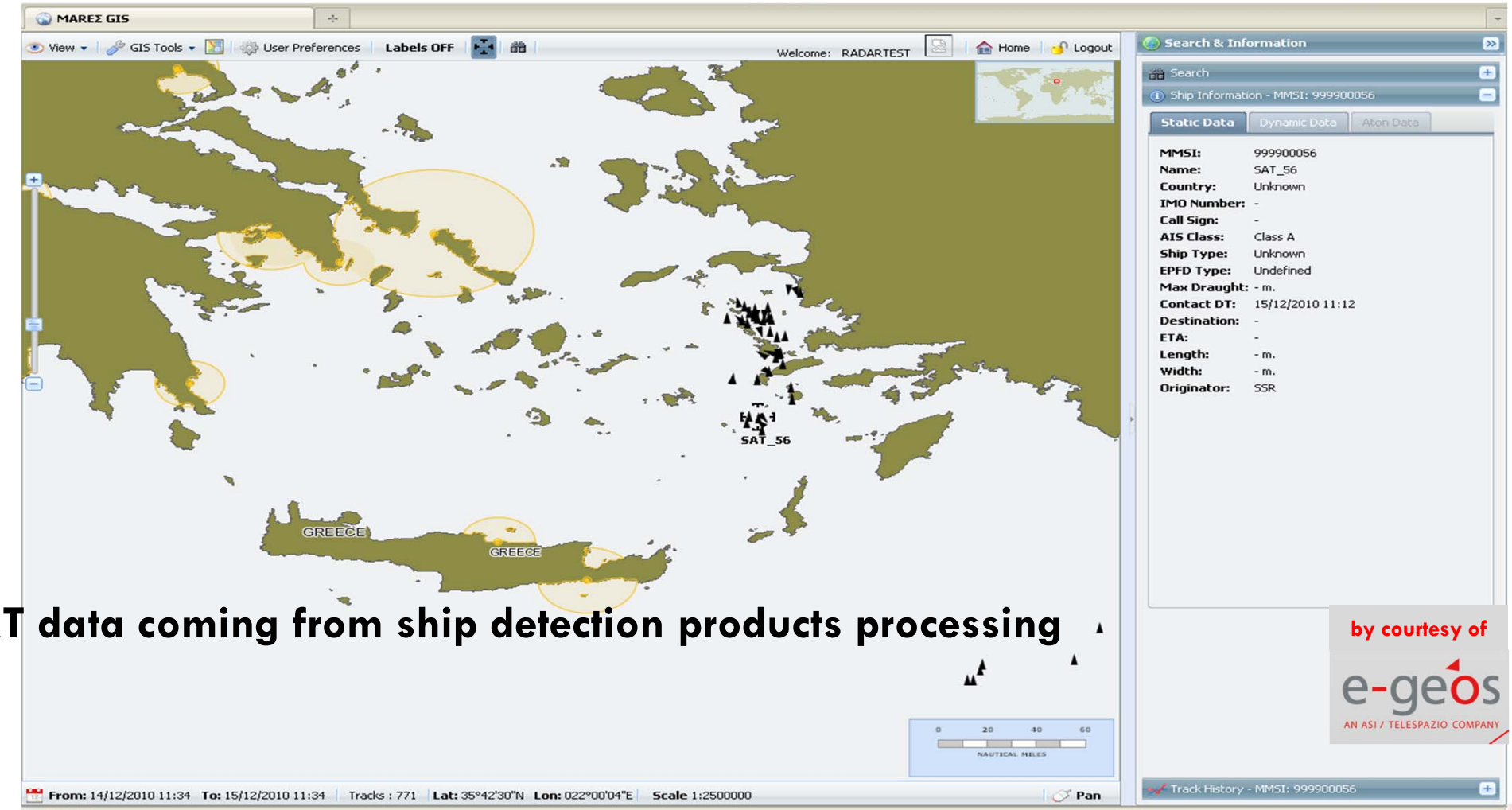
by courtesy of

e-geos

AN ASI / TELESPAZIO COMPANY

Ship Detection Report in AIS Format

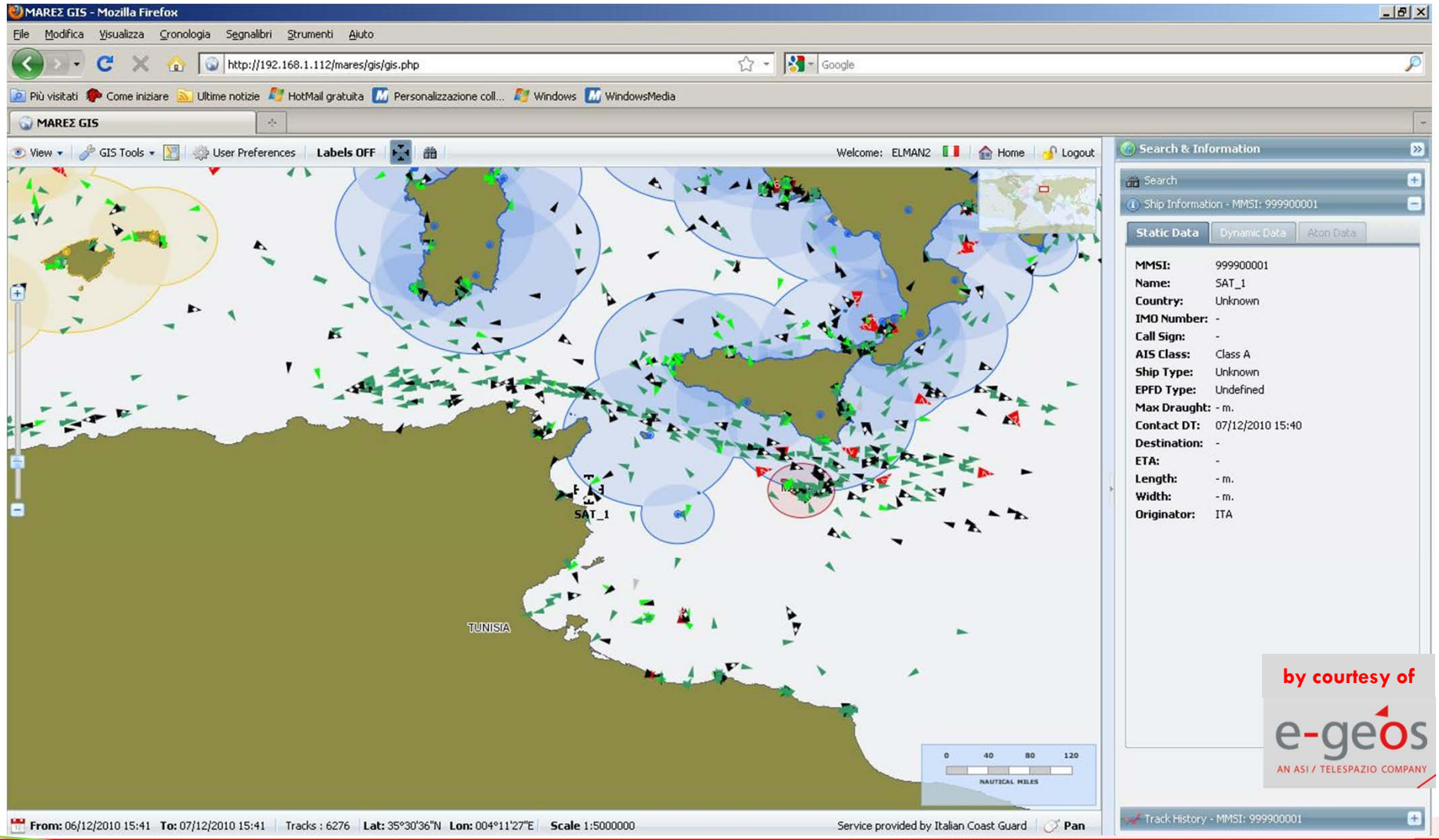
Ship detection products coming from the **NRT processing** chain make available non-correlated data. Custom applications collect information (position, speed, dimension) about suspected vessels and **integrate** them **into an AIS platform**



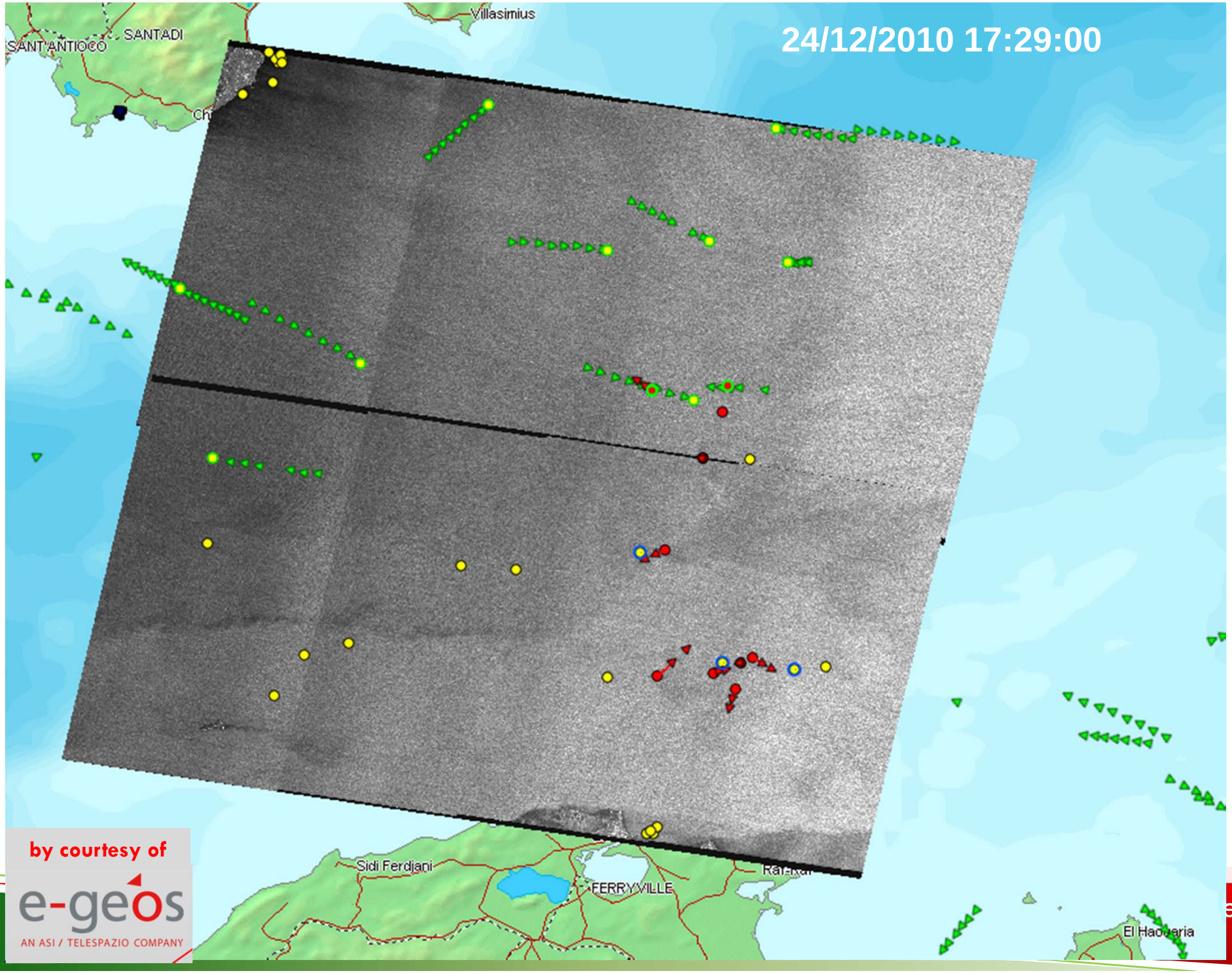
NRT data coming from ship detection products processing

Ship Detection Report in AIS Format

This provides added-value to the end-user (ITCG) who will be able to see, on the **same monitoring** platform both **RT data,** and **NRT data** coming from ship detection activity

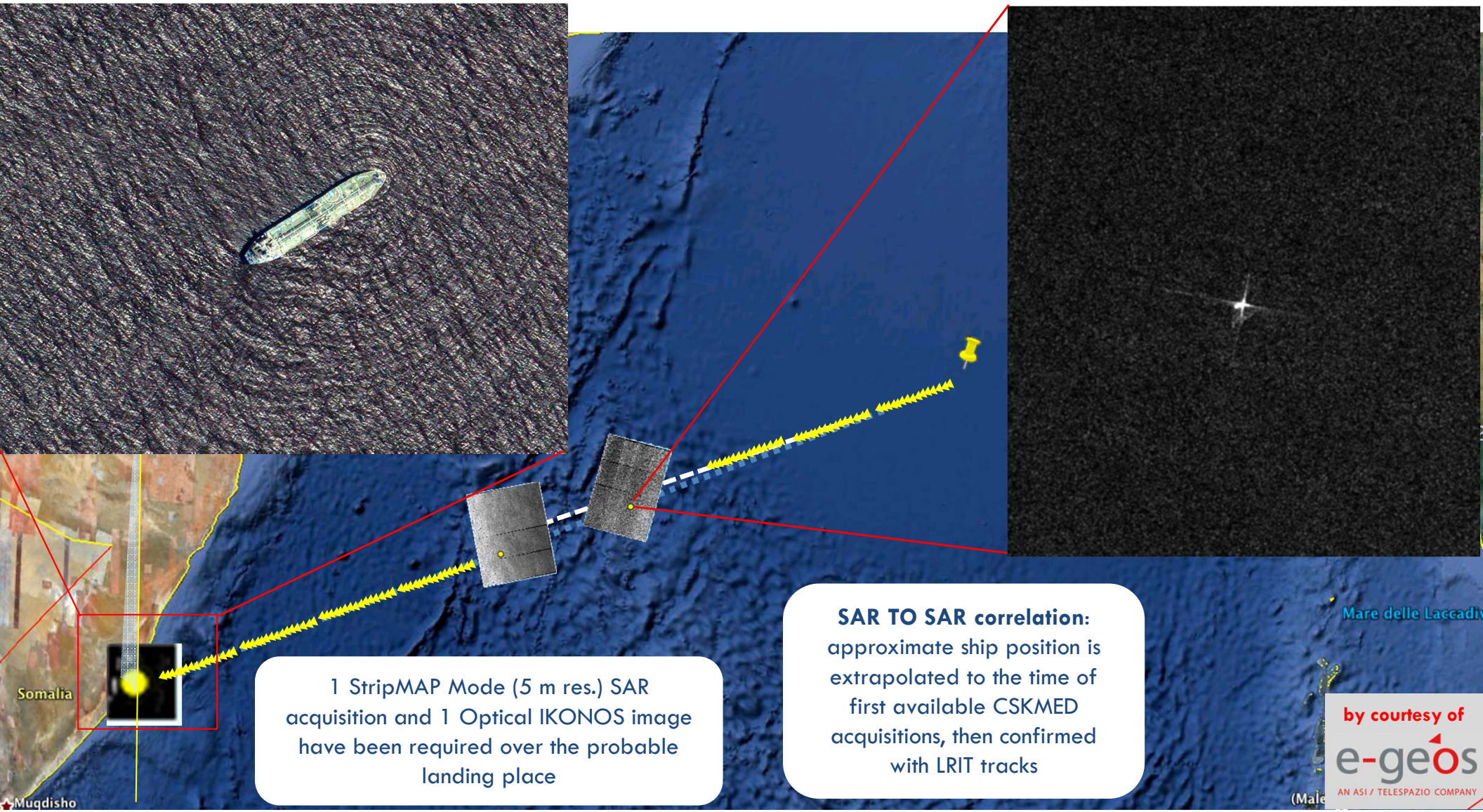


MARISS: SAR TO SAR CORRELATION



MARISS ScUp during Libyan crisis: service in support of monitoring of the migration flows from Tunisia and Libya coasts

SAVINA TANKER MONITORED WITH COSMO SKYMED AND LRIT TECHNOLOGIES

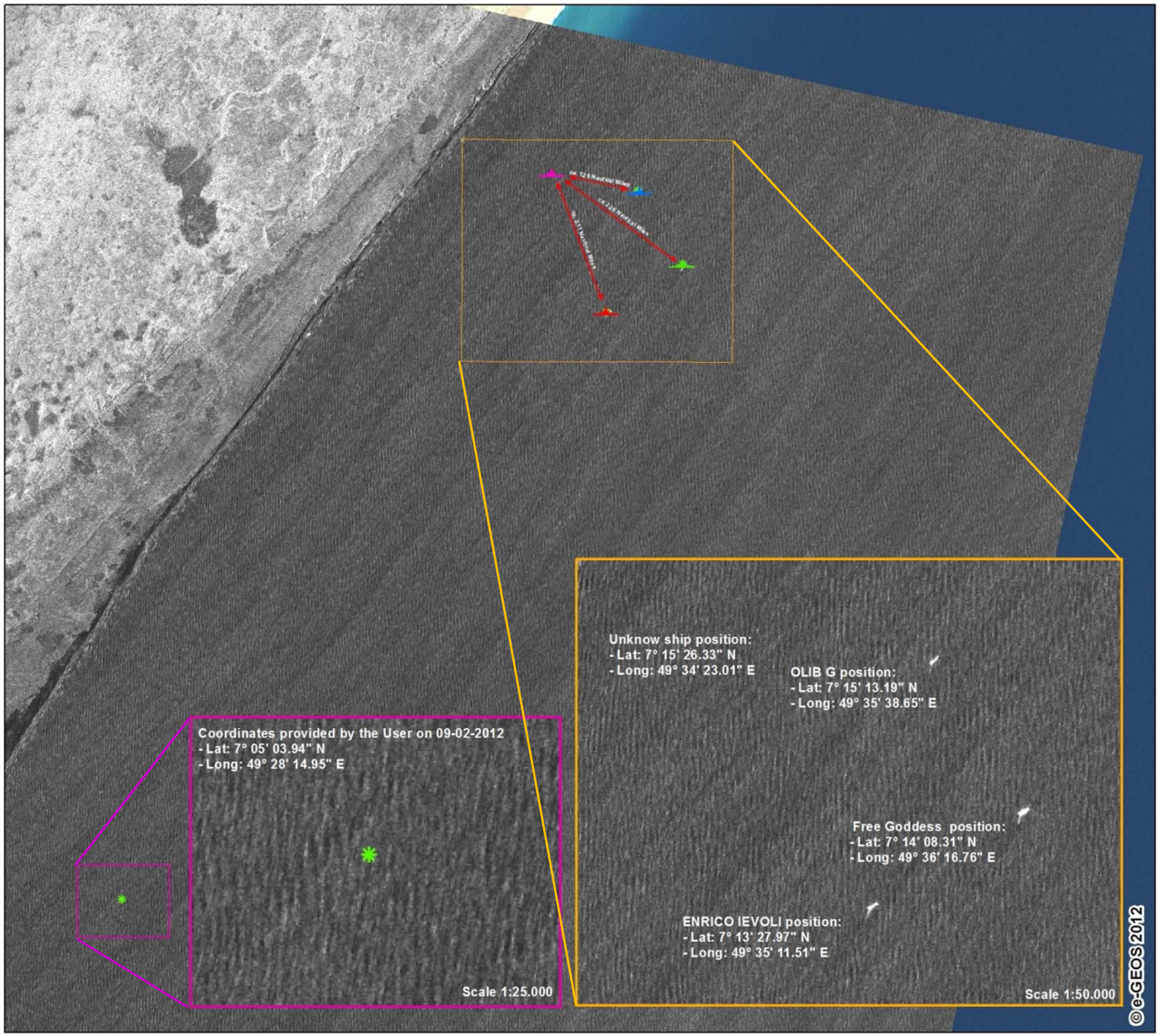


1 StripMAP Mode (5 m res.) SAR acquisition and 1 Optical IKONOS image have been required over the probable landing place

SAR TO SAR correlation: approximate ship position is extrapolated to the time of first available CSKMED acquisitions, then confirmed with LRIT tracks

by courtesy of e-geos AN ASI / TELESPAZIO COMPANY

ITALIAN TANKER ENRICO IEVOLI

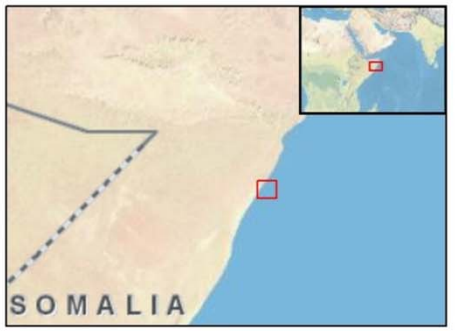


EG-SOM-OVR-04 20/02/2012

Enrico Ievoli Pirates seizure

Somalia

Location



Local projection: UTM Zone 39N , Datum: WGS 84

Scale: 1:100.000for A3 prints

N

Legend

- Enrico Ievoli ship, hijacked on 27 December 2011
- OLIB G ship, hijacked on 8 September 2010
- Free Goddess ship, hijacked on 7 February 2012
- Unknown ship detected
- Relative distances among the unknown ship and the other ships already detected
- Coordinates provided on 9 February 2012

Data sources

Satellite data
Satellite: COSMO-SkyMed
Date: 15-02-2012
Copyright: © ASI (2012)
Provided by e-GEOS S.p.A.
Resolution: 1 m

Background satellite data
Satellite: Landsat ETM
Date: 27-01-2010
Copyright: © USGS (2012)
Resolution: 30 m

Other data
Vector Data - © e-GEOS

Description

On December 27th, Somalian pirates hijacked the Italian tanker Enrico Ievoli off the coast of Oman in an area notorious for attacks by Somali pirates. The Enrico Ievoli, with18 crew on board, was carrying a cargo of caustic soda from the United Arab Emirates to the Mediterranean.
The map shows an overview of the area around the Italian vessel.
With respect to the previous image acquired on 14th of February, the three ships already detected (Enrico Ievoli ship, OLIB G ship and Free Goddness ship) kept the same position, but another unknown ship, with a lenght< 50 m was detected, with a distance of about 2.11 nautical miles far from the Enrico Ievoli in North direction.

Disclaimer

This map has been generated in a very short timeframe at the best effort by optimizing the material available.
Boundary or naming information implies no endorsement from the producer.
Geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials.
The producer accepts no legal responsibility or liability whatsoever with regard to the use of this product.

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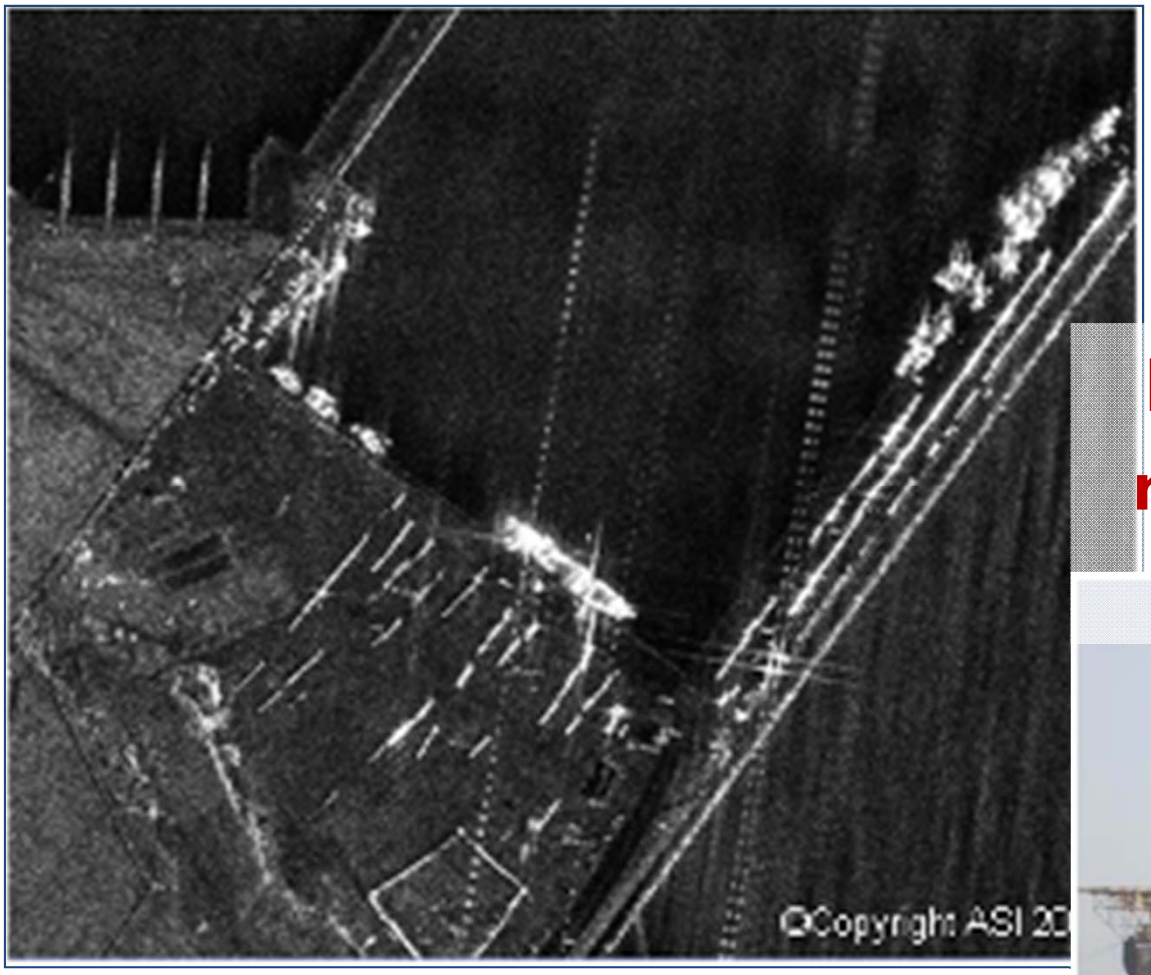
COSMO SkyMed for Maritime surveillance

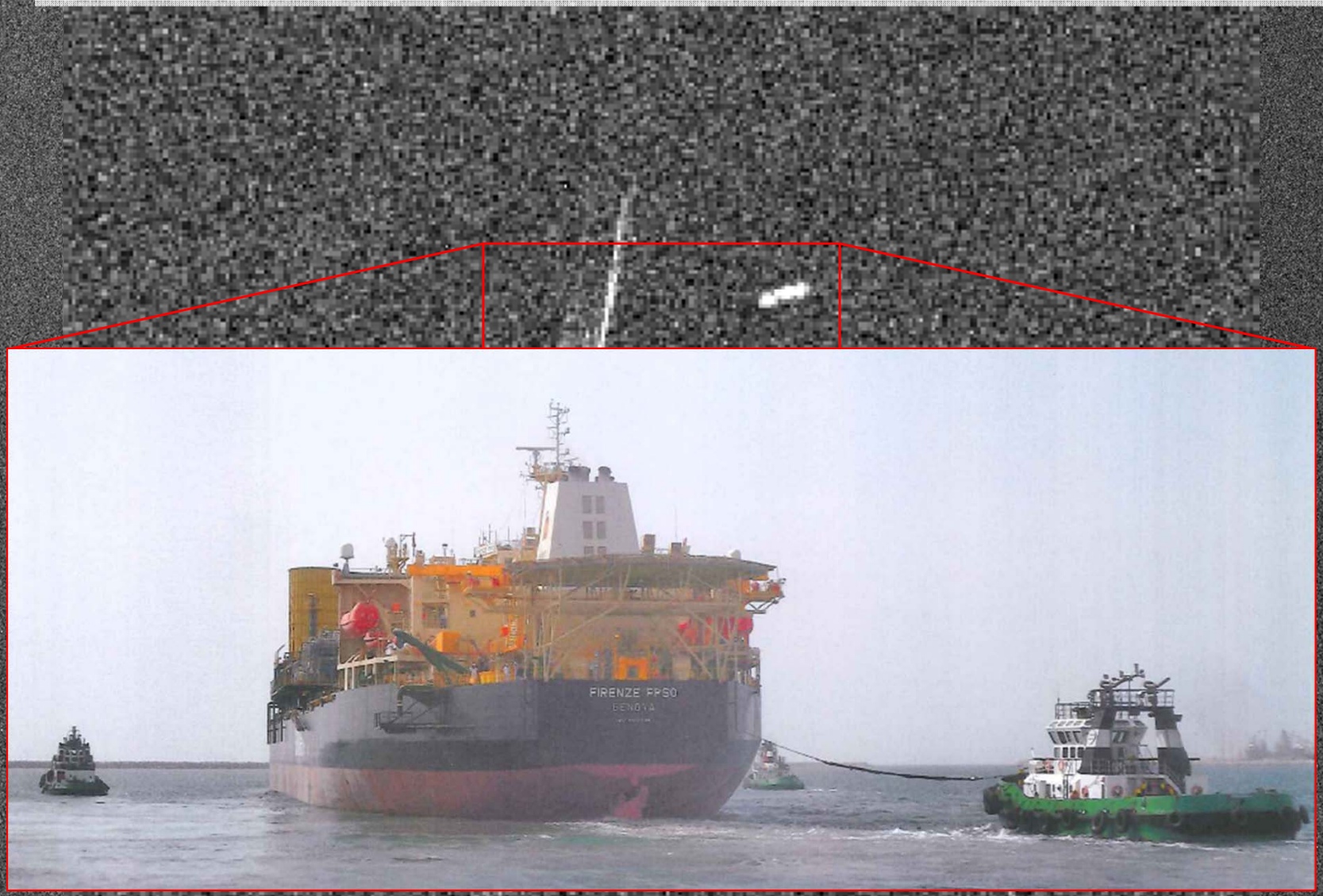


FPSO VESSEL "FIRENZE" monitoring from Dubai to Red Sea

by courtesy of

e-geos
AN ASI / TELESPAZIO COMPANY

Ship and tug monitoring through CSK and LRIT from 10-08-2011 to 29-08-2011



by courtesy of e-geos

Case 1: M/N REINA 1 maltese flag OIL SPILL RESPONSE: CLEANSEANET System

Satellite oil spill detection

~~Satellite slip detection~~

DETAINED !

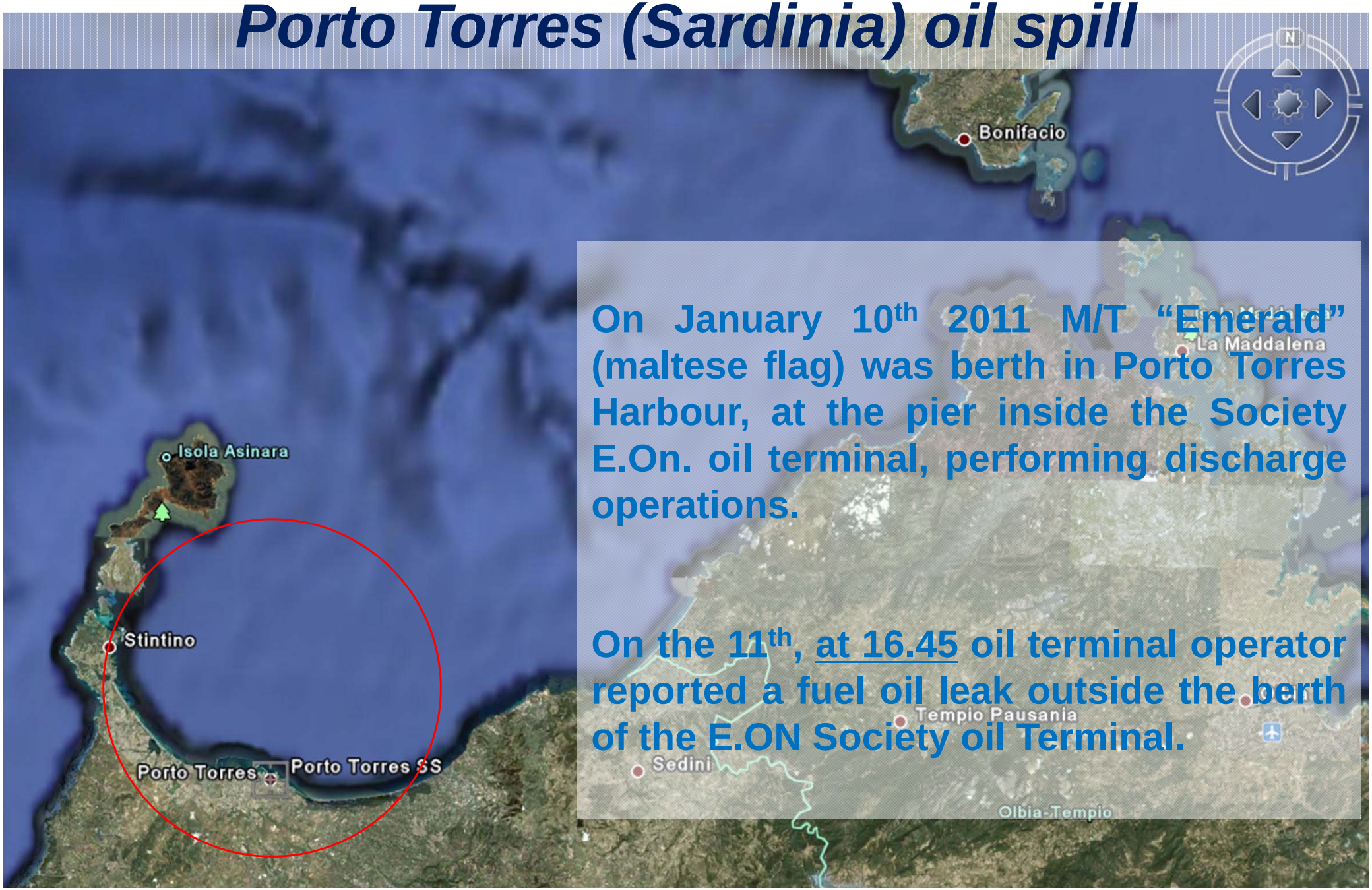
2011: 6 oil spills detected through satellite image (SAR)

Unable to detect possible polluter through AIS information in MARE∑

PSC More detailed and MARPOL inspection carried out by Slovenian Authority (Ljubljana PSC Authority) on 11/05/2011: inoperative oil filtering equipment, an hold bilge pump/seawater line ball valve installed (used for possible illegal discharge), class investigation required.

© 2010 European Maritime Safety Agency | CleanSeaNet DataCentre

Porto Torres (Sardinia) oil spill



On January 10th 2011 M/T "Emerald" (maltese flag) was berth in Porto Torres Harbour, at the pier inside the Society E.On. oil terminal, performing discharge operations.

On the 11th, at 16.45 oil terminal operator reported a fuel oil leak outside the berth of the E.ON Society oil Terminal.

...Going on with the operations

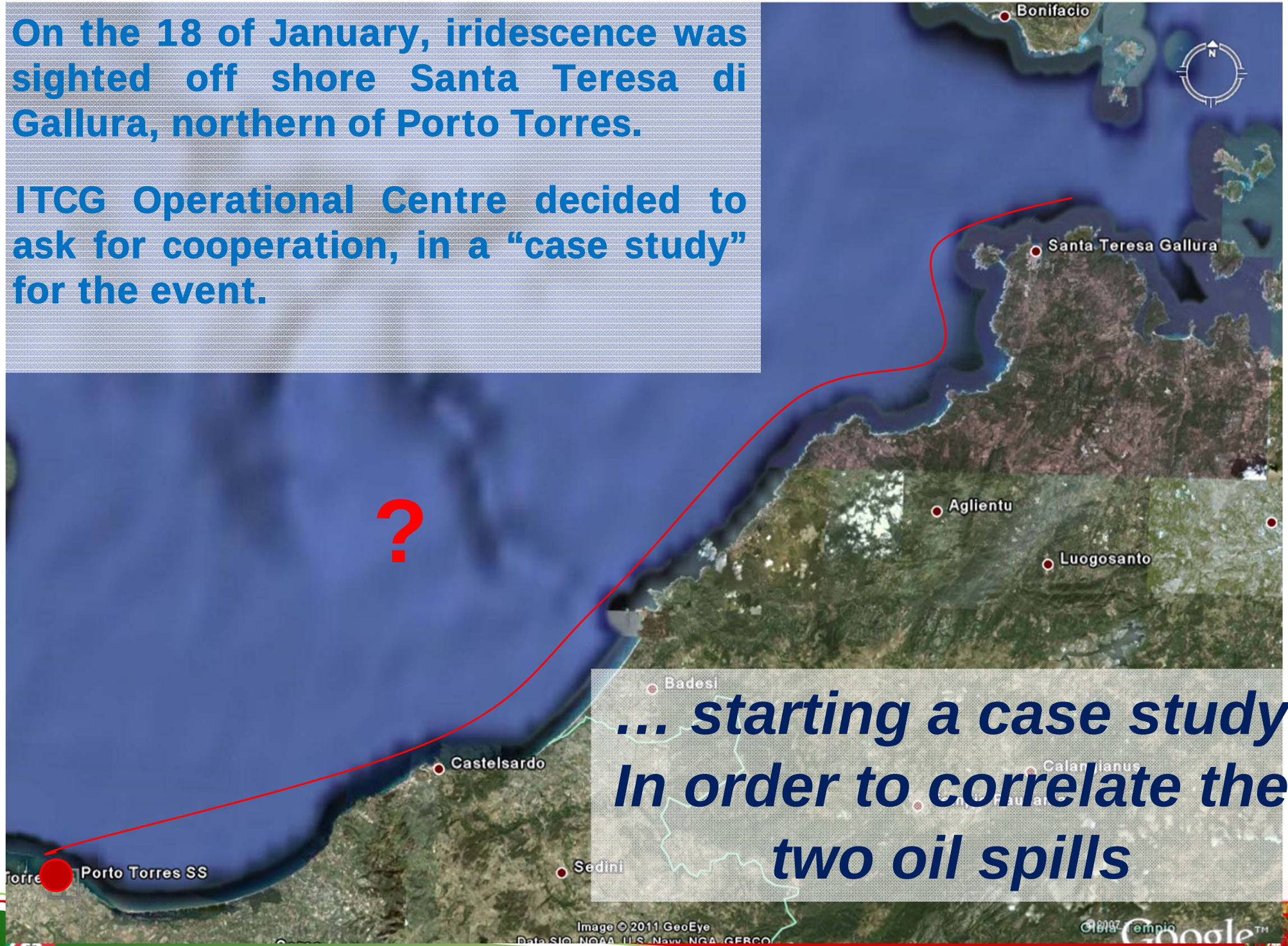
In the following days, from 12 to 16 of January, ITCG local offices performed all the oil response activities, patrolling the long shore area.

Oil was found on land in the area from Porto Torres to Castelsardo.

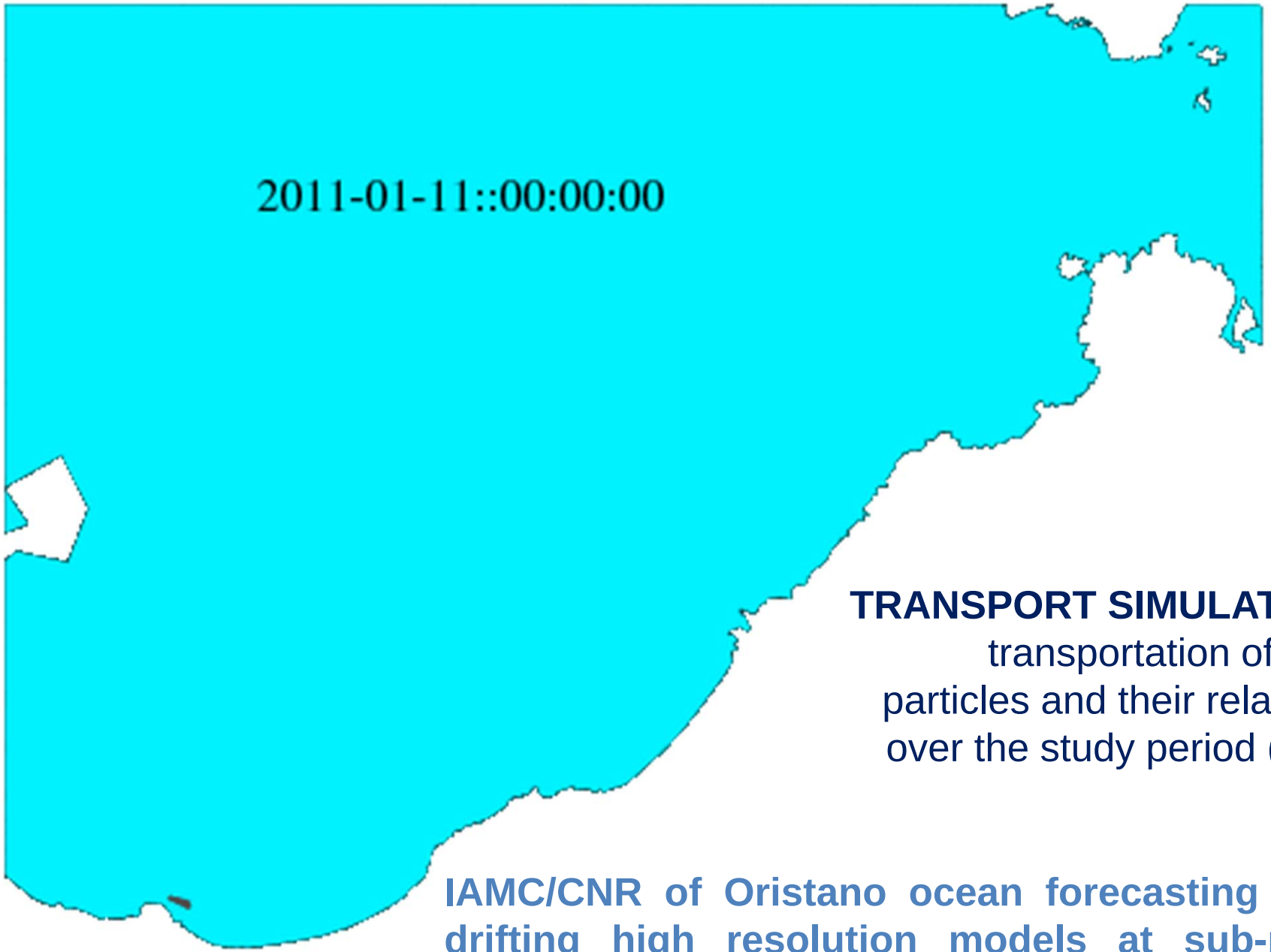
Class 300S

On the 18 of January, iridescence was sighted off shore Santa Teresa di Gallura, northern of Porto Torres.

ITCG Operational Centre decided to ask for cooperation, in a "case study" for the event.



… starting a case study In order to correlate the two oil spills



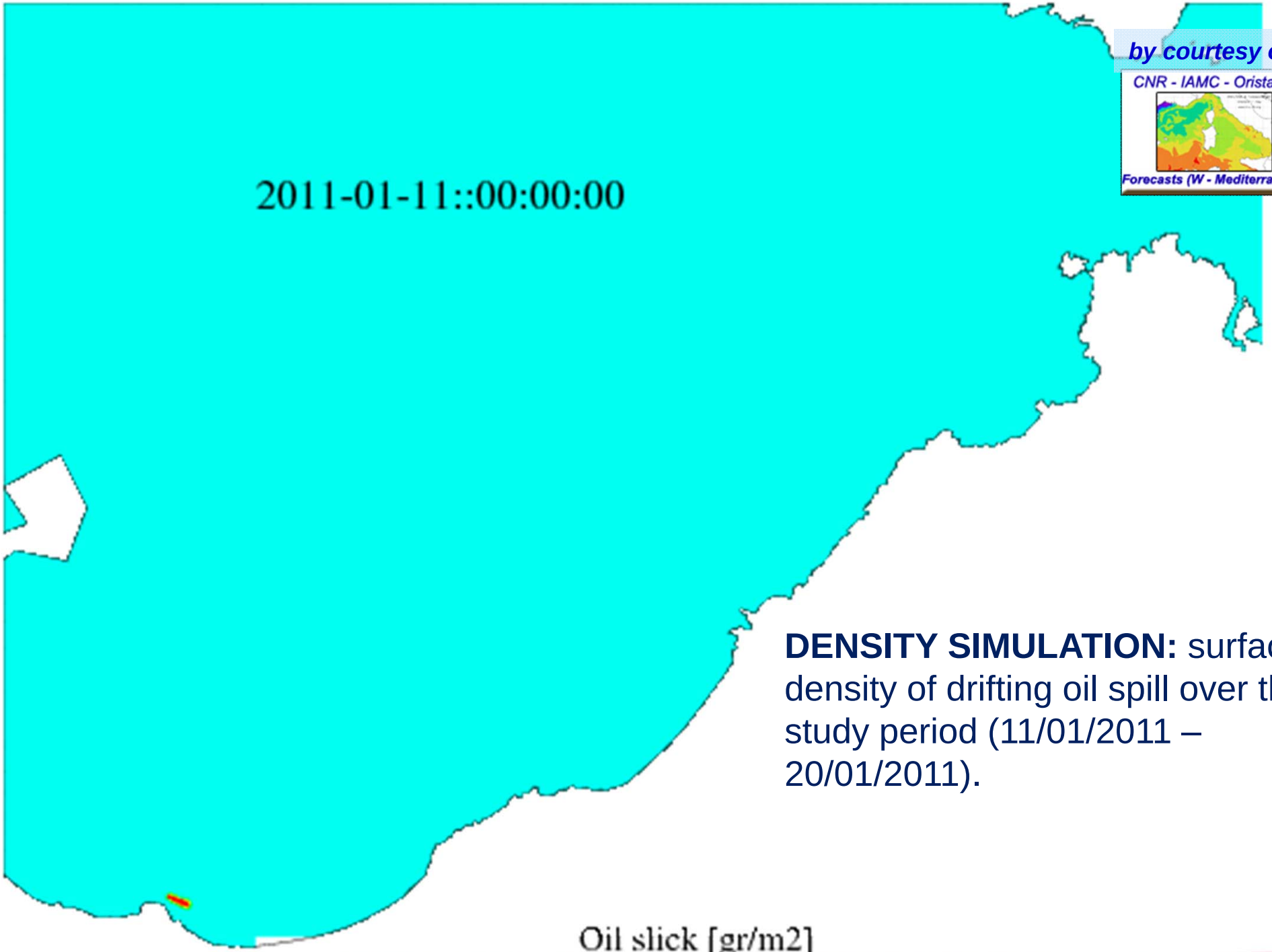
by courtesy of

CNR - IAMC - Oristano

Forecasts (W - Mediterranean)

TRANSPORT SIMULATION: surface transportation of hydrocarbon particles and their relative beaching over the study period (11/01/2011 – 20/01/2011).

IAMC/CNR of Oristano ocean forecasting and Oil-Spill drifting high resolution models at sub-regional and coastal scale, in order to demonstrate the oil drifting from Porto Torres to Santa Teresa di Gallura



DENSITY SIMULATION: surface density of drifting oil spill over the study period (11/01/2011 – 20/01/2011).

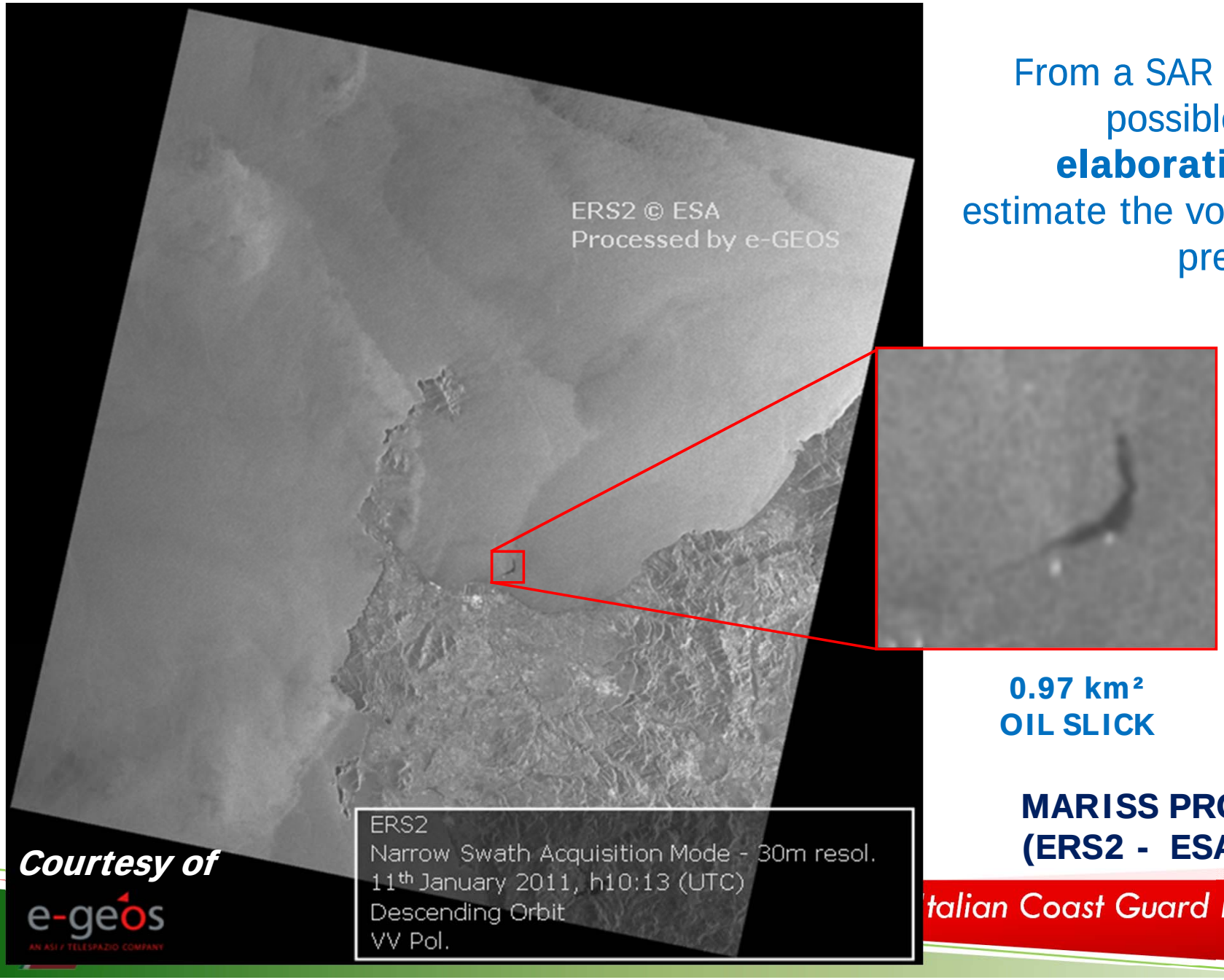
ITCG TECHNICAL GROUP FOR OPERATIONAL OCEANOGRAPHY

CASE STUDY: to understand the correlation between Porto Torres oil spill (on the 11 on Jan.) and oil spill reached the beach from Capo Testa to Santa Teresa di Gallura (about 6 tons).

The terminal operator estimated between 17 and 45 tons of product leaked into the sea.

The results of the model developed by CNR showed that the oil spill position near Capo Testa was compatible with the paths followed by the oily particles leaked from P. Torres oil terminal. Even in the absence of chemical compatibility analysis of the samples, we could already assumed the correlation between the events.

e-GEOS satellite service provider (COSMO-SkyMed, RADARSAT, ENVISAT ed ERS2)



From a SAR image has been possible, **through the elaboration of e-GEOS**, estimate the volume of product present in the sea.

0.97 km²
OIL SLICK

MARISS PROJECT
(ERS2 - ESA Archive)

Courtesy of

e-geos
AN ASI / TELESPAZIO COMPANY

Italian Coast Guard Headquarters

- Physical and chemical characteristics of the hydrocarbon, identified as HFO (Heavy Fuel Oil), based on the of classification reported in the literature;

- The area of the oil spill from the first data available on the area (ERS2) was **$A = 0,97 - km^2 = 9,7 * 10^5\ m^2$**;

- Estimated volume: since the ERS2 data was acquired on the 11/01, that is the same day in which the spill occurred, as reported on BAOAC* , thickness of reference was considered to be **$S = 0,05\ mm = 5 * 10^{-5}\ m$**.

Estimated volume= 48,5 m^3

(compatible with the quantity of oil leaked declared by the oil terminal operator)

(*)**Bonn Agreement Oil Appearance Code (BAOAC)**

ITALIAN COAST GUARD HEADQUARTERS

COSTA CONCORDIA EMERGENCY:

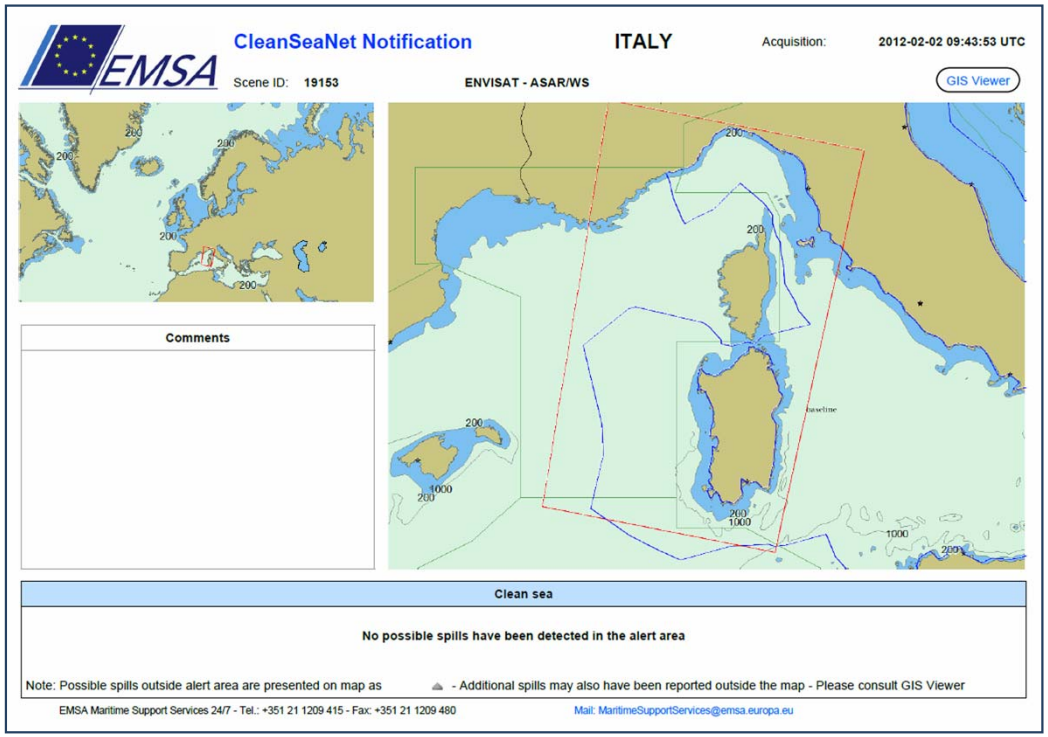
SATELLITE IMAGES AND OPERATIONAL OCEANOGRAPHY IN SUPPORT OF ITALIAN COAST GUARD ANTI-POLLUTION AND OPERATIONAL ACTIVITIES

CleanSeaNet Service

An average of 1 image every two days is acquired. The planning is focused over the first three weeks of February (until 17th) and uses three satellites to satisfy the monitoring needs

An additional request has been made on the 15th of March 2012

CleanSeaNet additional planning

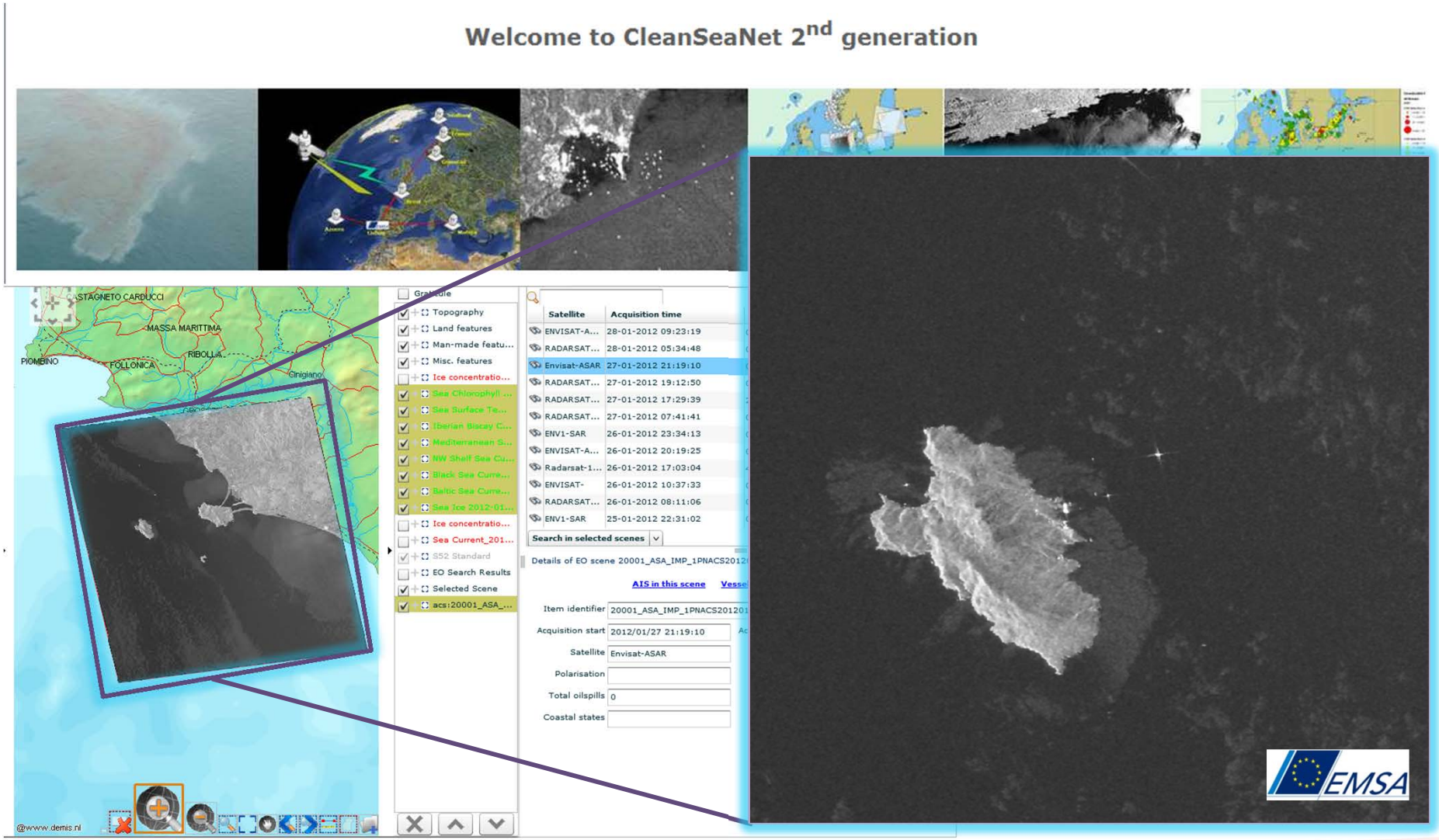


Satellite	Acquisition date and time
Satellite	Acquisition date and time
Radarsat-1	02/02/2012 at 05:25 UTC
Envisat	05/02/2012 at 09:37 UTC
Radarsat-1	06/02/2012 at 17:09 UTC
Envisat	07/02/2012 at 09:24 UTC
Radarsat-2	08/02/2012 at 21:05 UTC
Envisat	10/02/2012 21:05 UTC
Envisat	13/02/2012 09:40 UTC
Radarsat-2	14/02/2012 17:00 UTC
Envisat	16/02/2012 09:31 UTC
Radarsat-2	17/02/2012 17:13 UTC
Envisat	21/02/2012 21:02 UTC
Satellite	Acquisition date and time
Radarsat-1	23-02-2012 at 05:29 UTC
Envisat	26/02/2012 21:19 UTC
Envisat	27/02/2012 09:27 UTC
Radarsat-2	28-02-2012 at 05:33 UTC
Envisat	29/02/2012 21:09 UTC

As EMSA is concerned the only (and official) point of contact regardin t Guard. From the CleanSeaNet perspective the Italian Coast Guard is th (emergencies and otherwise).

CleanSeaNet Service

ITCG is NCA Operational in the framework of CSN service



Oil Spill Drifting Forecast

FORECAST OF THE POSSIBLE OIL POLLUTION SCENARIO IN CASE OF OIL SPILL FROM THE SHIP

ITALIAN COAST GUARD HEADQUARTERS

Comando Generale del Corpo delle Capitanerie di Porto

In collaboration with Italian National Group of Operational Oceanography
Istituto Nazionale di Geofisica e Vulcanologia (INGV) – MyOcean Med MFC

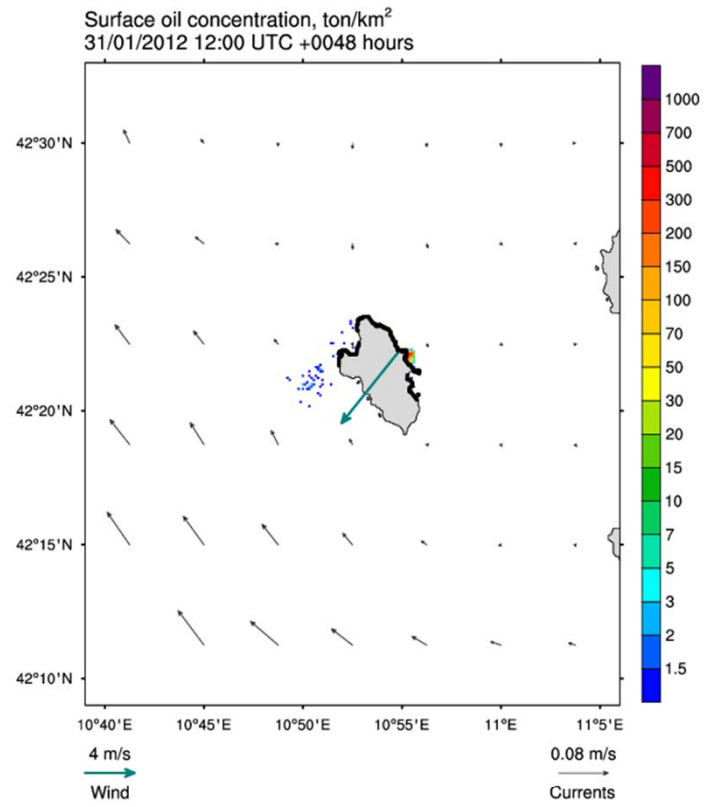
Costa Concordia accident: forecast of the possible oil pollution scenario in case of oil spill from the ship.

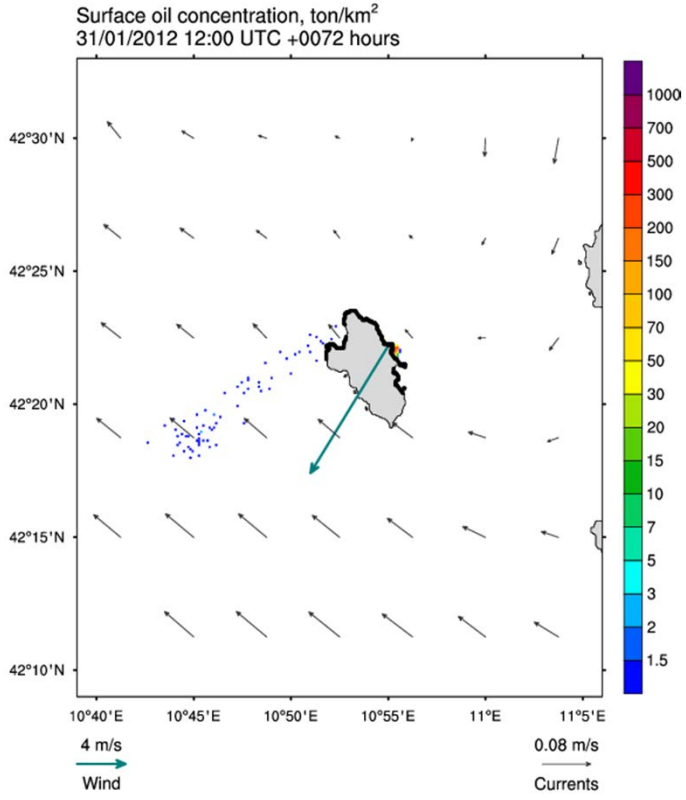
Analysis and forecasting system used by the Italian Coast Guard Operational Centre - I.M.R.C.C. Rome.

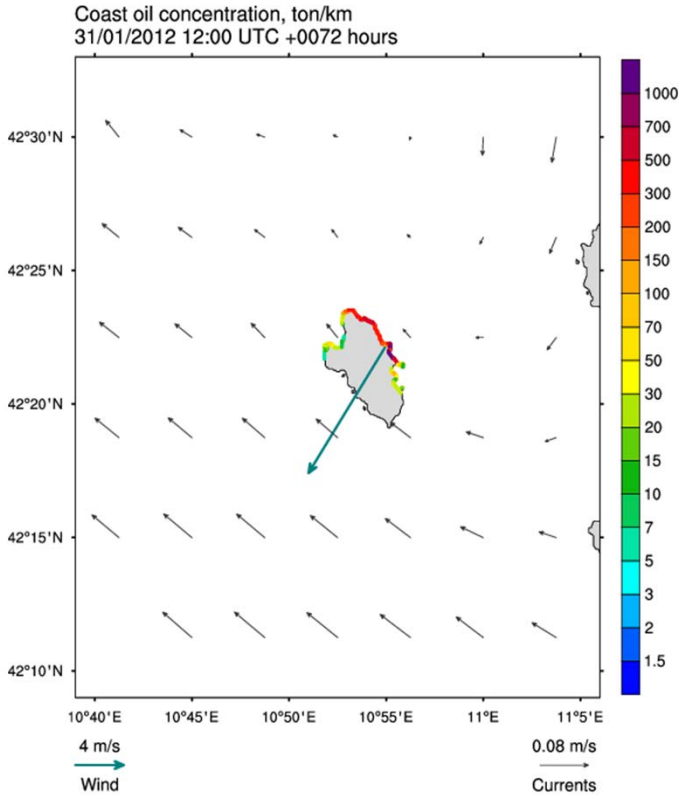
Wind Currents Wind Currents

Sended to: CPD Civil Protection Department – Technical Committee , Peripheral Offices (ITCG Livorno, ITCG Porto S.Stefano, ITCG Giglio Island), REMPEC and other Authorities involved

Oil Spill Drifting Forecast







48 and 72 hours after the possible start of the oil spill

oil concentration on the coast is visualized with colours from blue to purple in Ton/km. Currents (black arrows) and wind forecasts (green arrow) are shown in the background

WP7 – Satellite Data Access

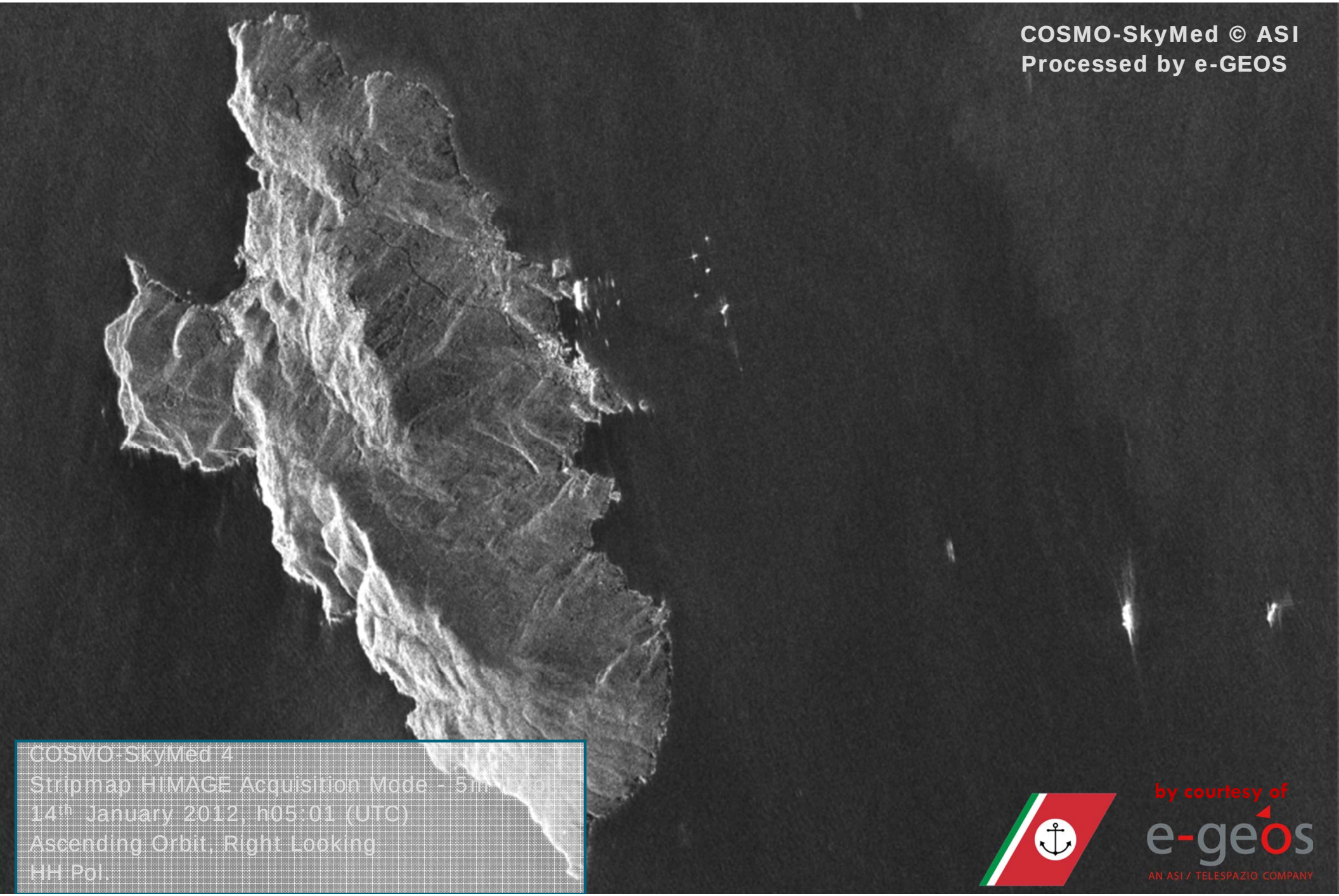
SeaU supported the Italian Coast Guard in the Giglio island oil pollution risk monitoring (Costa Concordia, January 2012):

WorldView-2

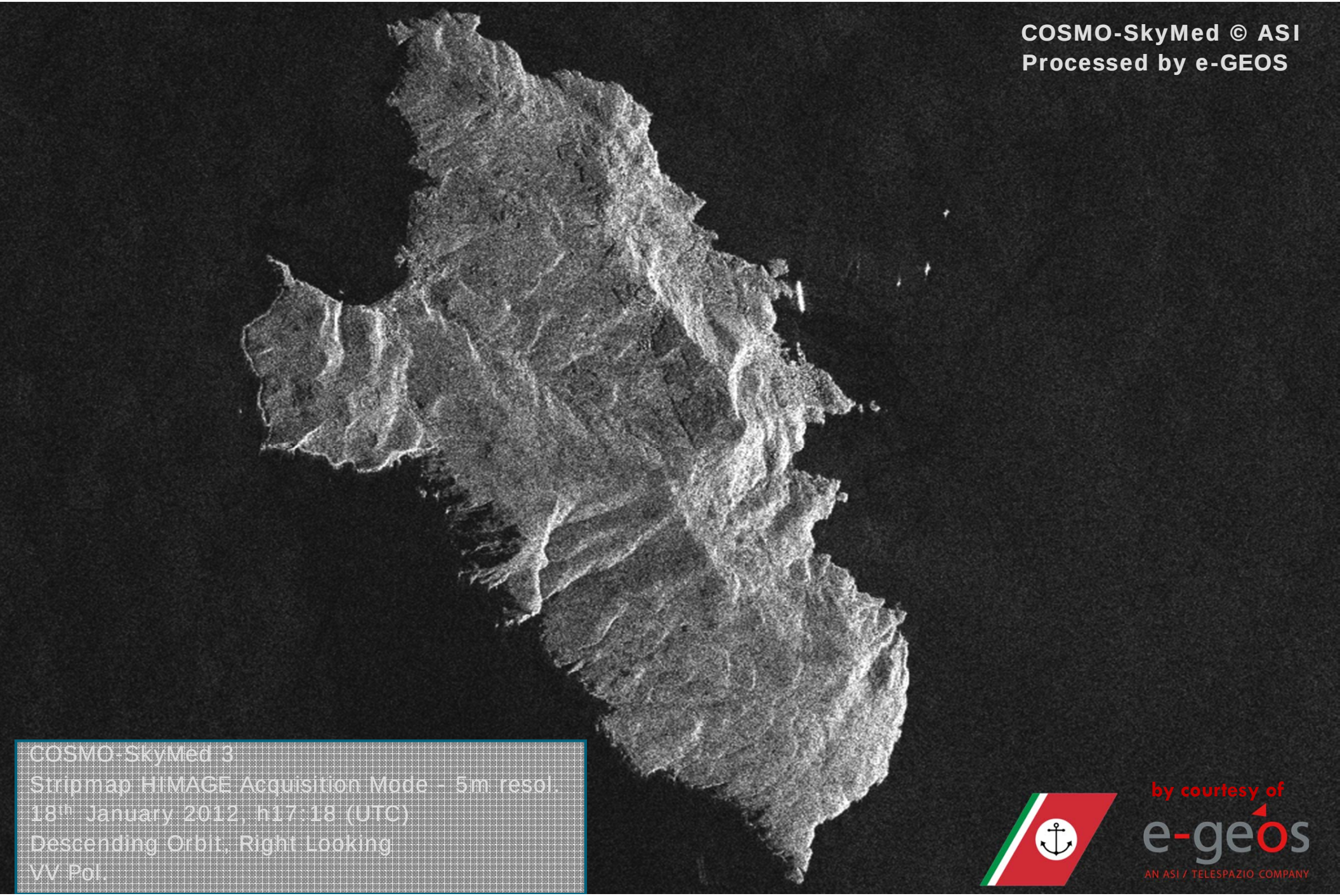
19th January 2012

by courtesy of e-geos
AN ASI / TELESPAZIO COMPANY

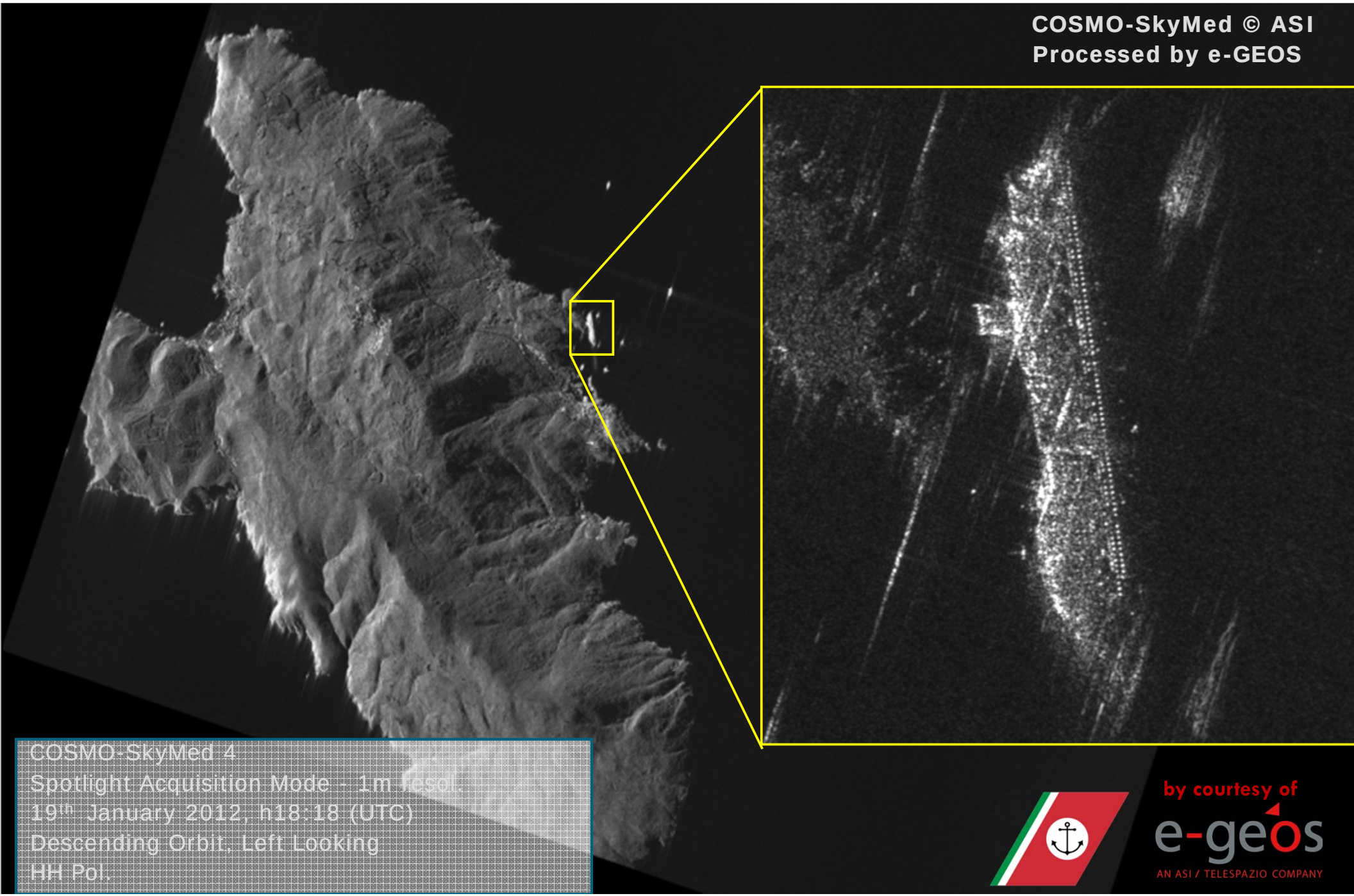
WP7 – Satellite Data Access



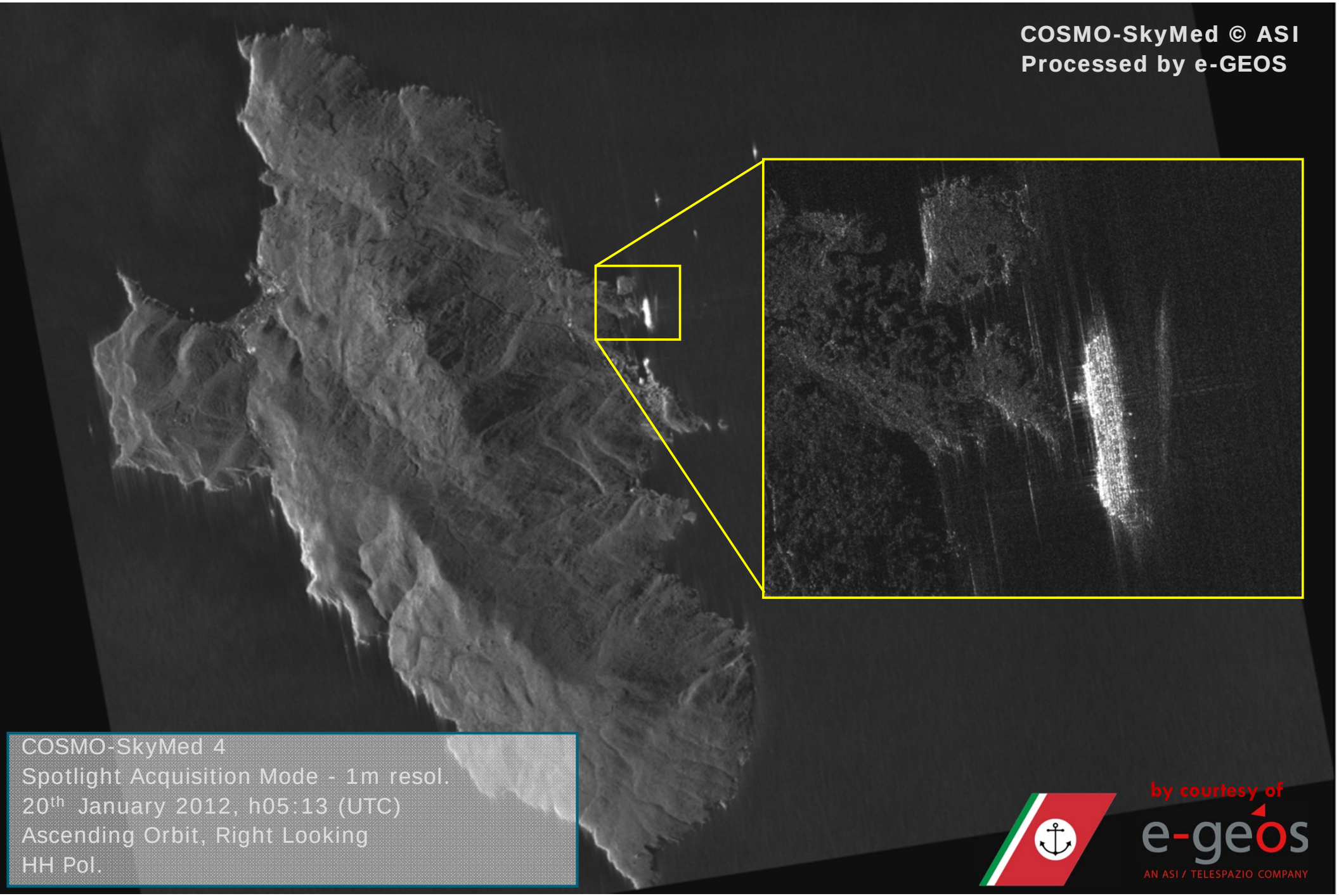
WP7 – Satellite Data Access



WP7 – Satellite Data Access



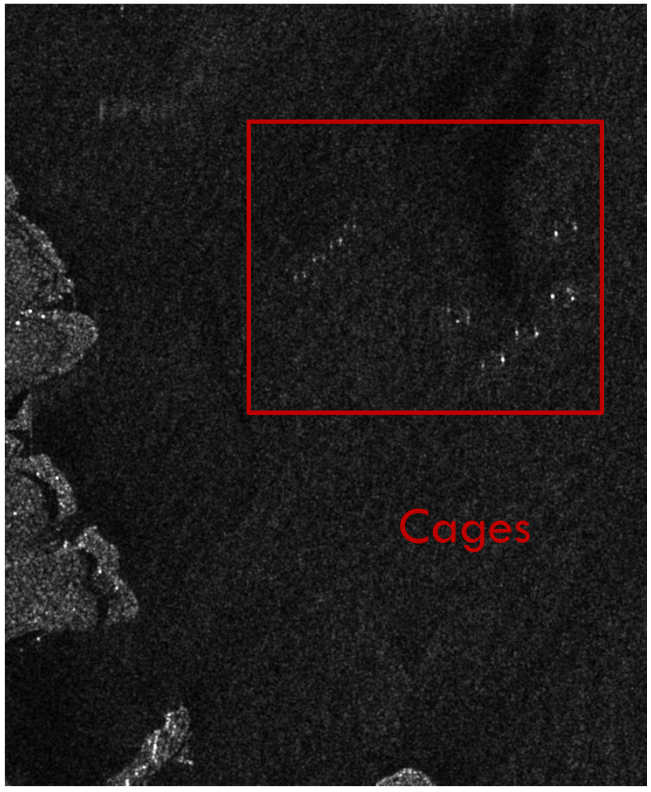
WP7 – Satellite Data Access



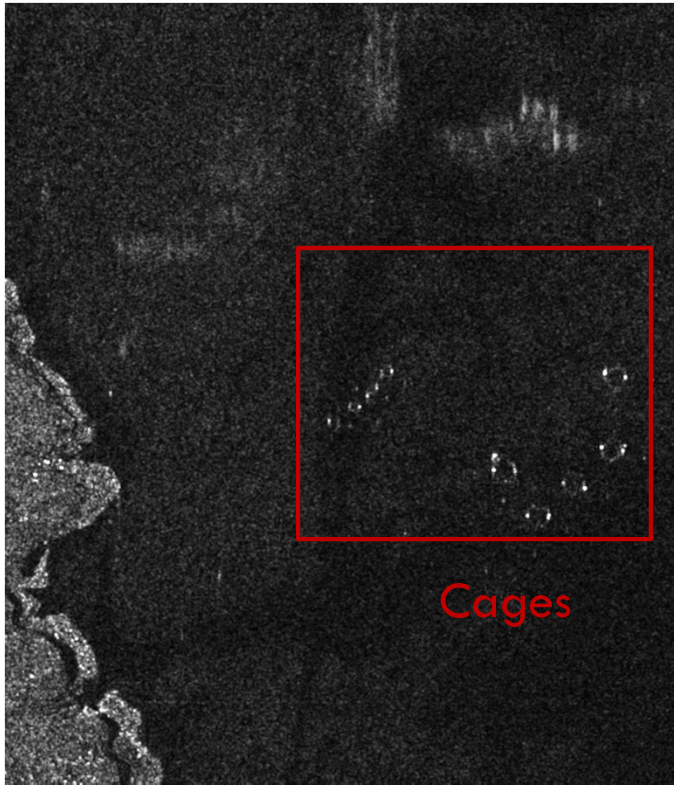
Cooperation with European Fisheries Control Agency (EFCA)
Blue Fin Tuna campaign 2012

Blue Fin Tuna campaign 2012

CSK2 StripMap 2010-06-10 04:50



CSK4 StripMap 2010-06-14 04:49

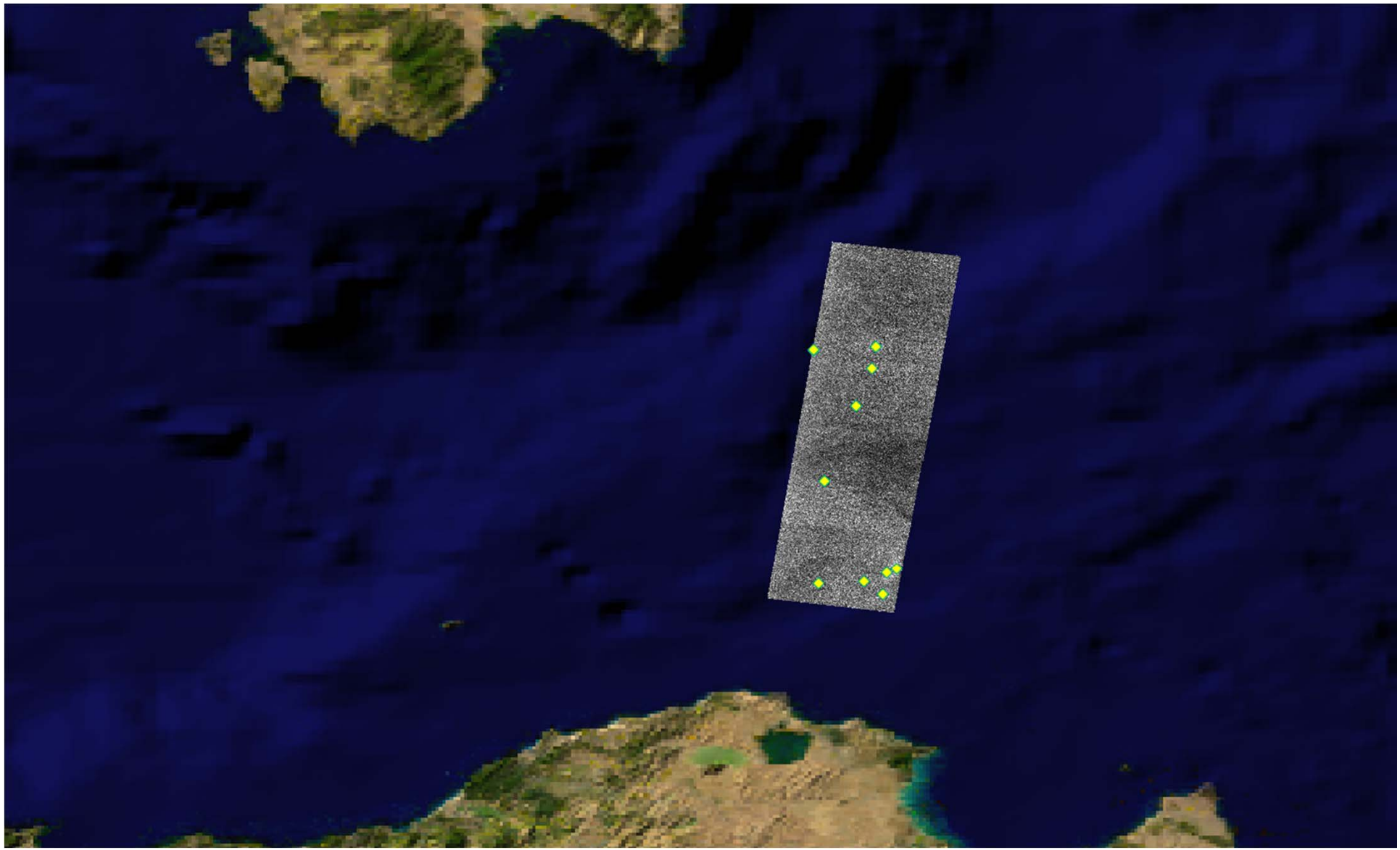


CSK2 StripMap 2010-06-26 04:50

by courtesy of e-geos AN ASI / TELESPAZIO COMPANY

© ASI

SAR used as standalone system



by courtesy of

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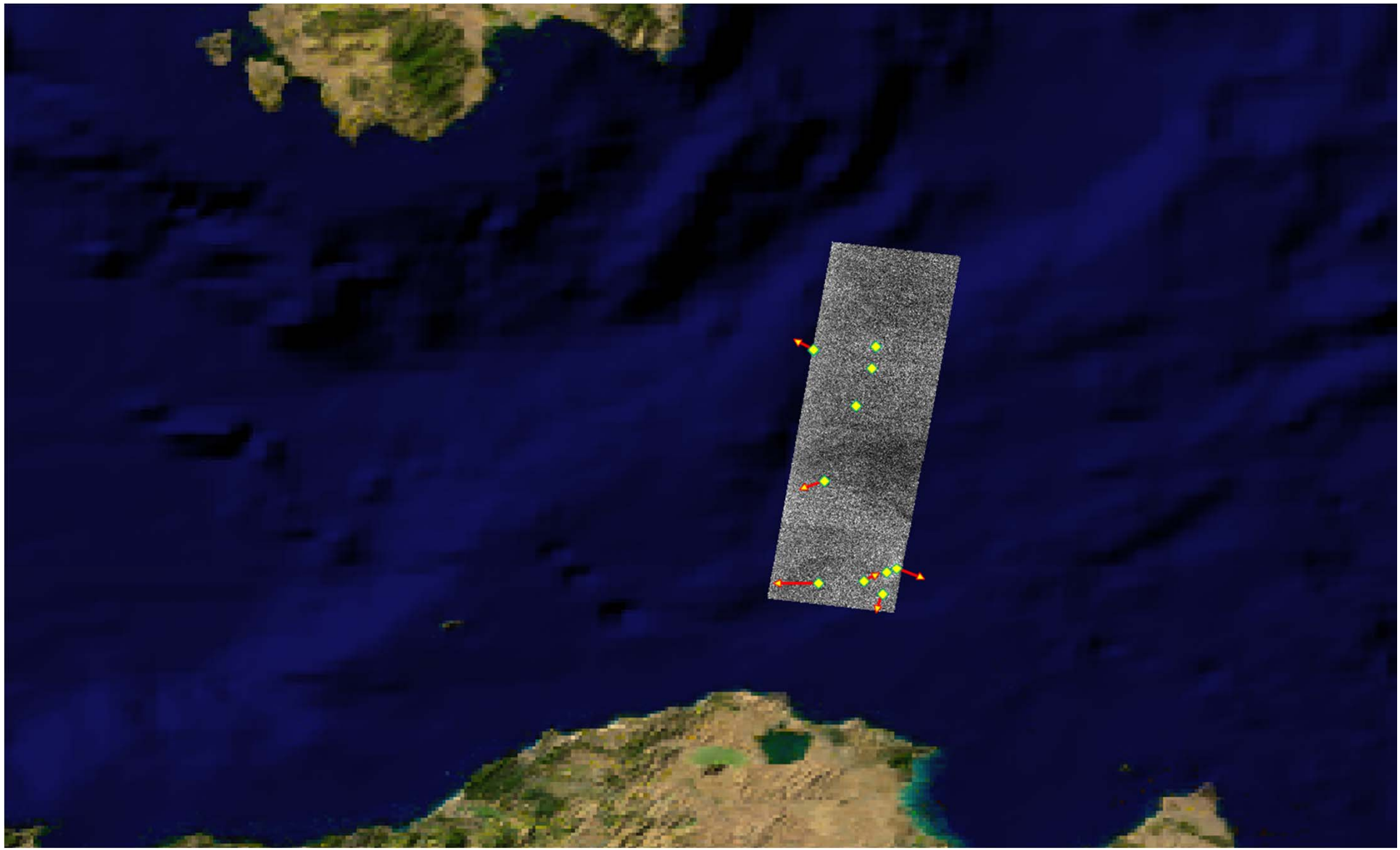
SAR used as standalone system



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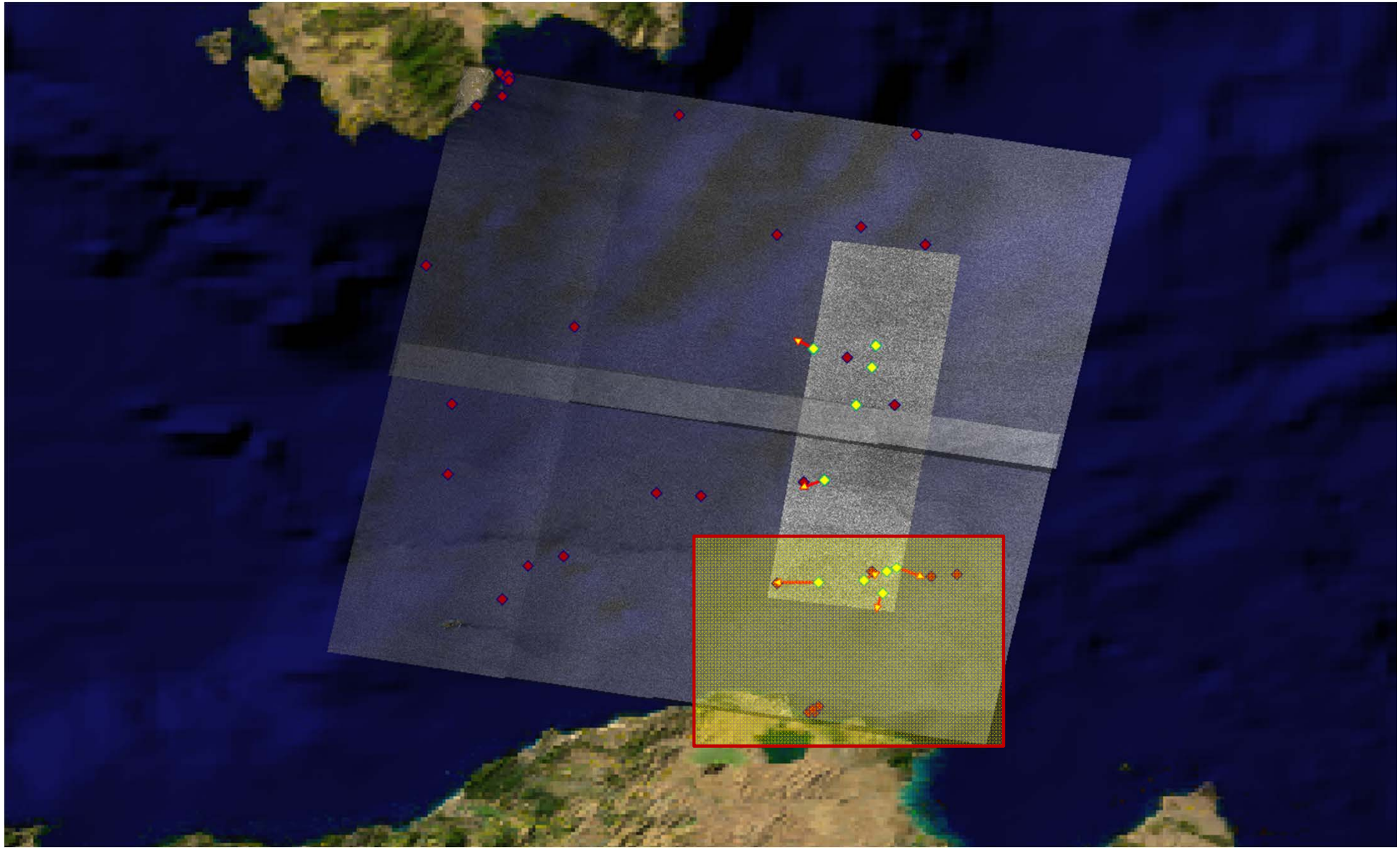
SAR used as standalone system



by courtesy of

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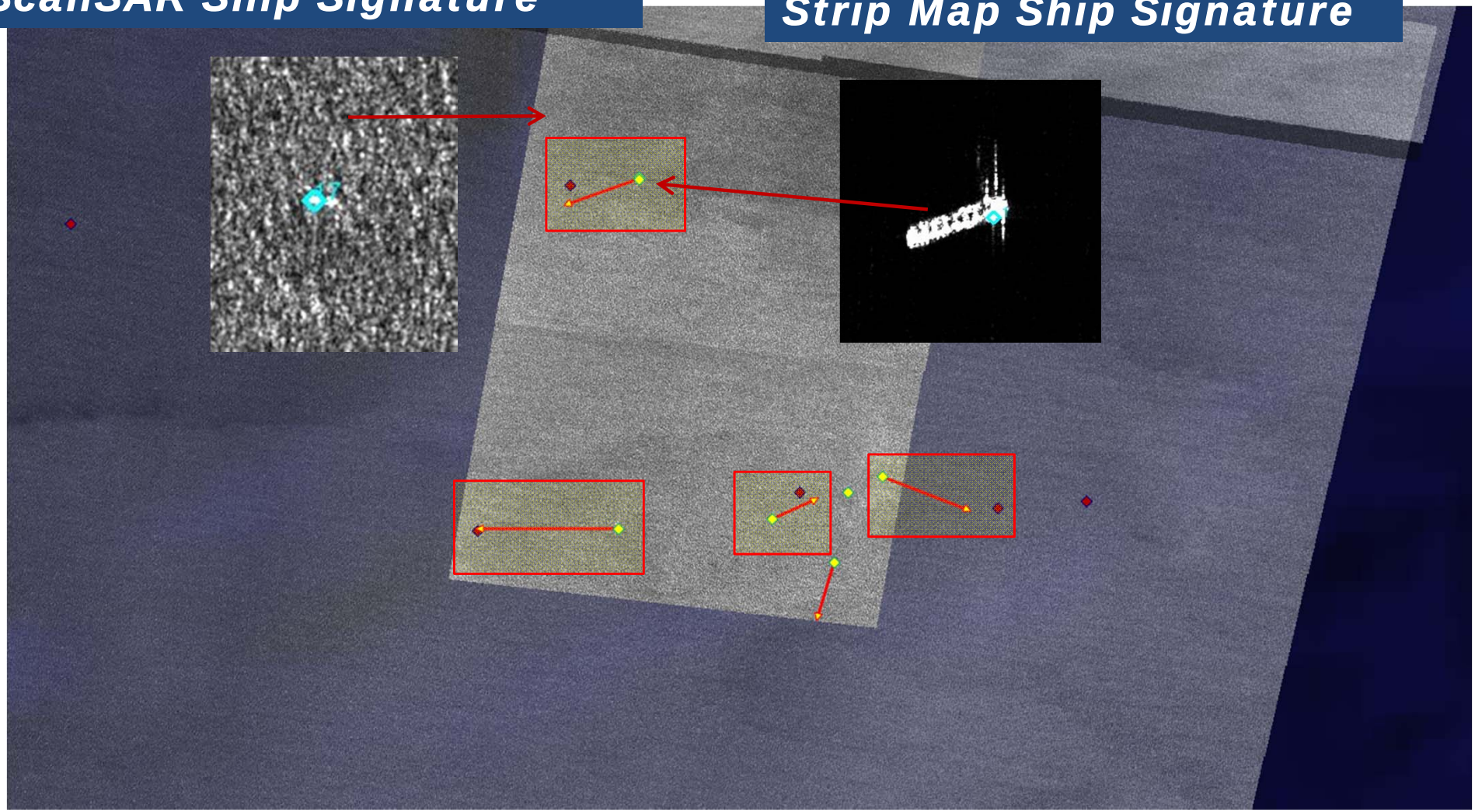
SAR used as standalone system



by courtesy of e-geos AN ASI / TELESPAZIO COMPANY

The two CSK images have been acquired in a timeframe of about 18 minutes. In this way it is possible to track no cooperative ships.

SAR used as standalone system

SAR SENSORS, USED AS STAND-ALONE SYSTEMS, ALLOW TO

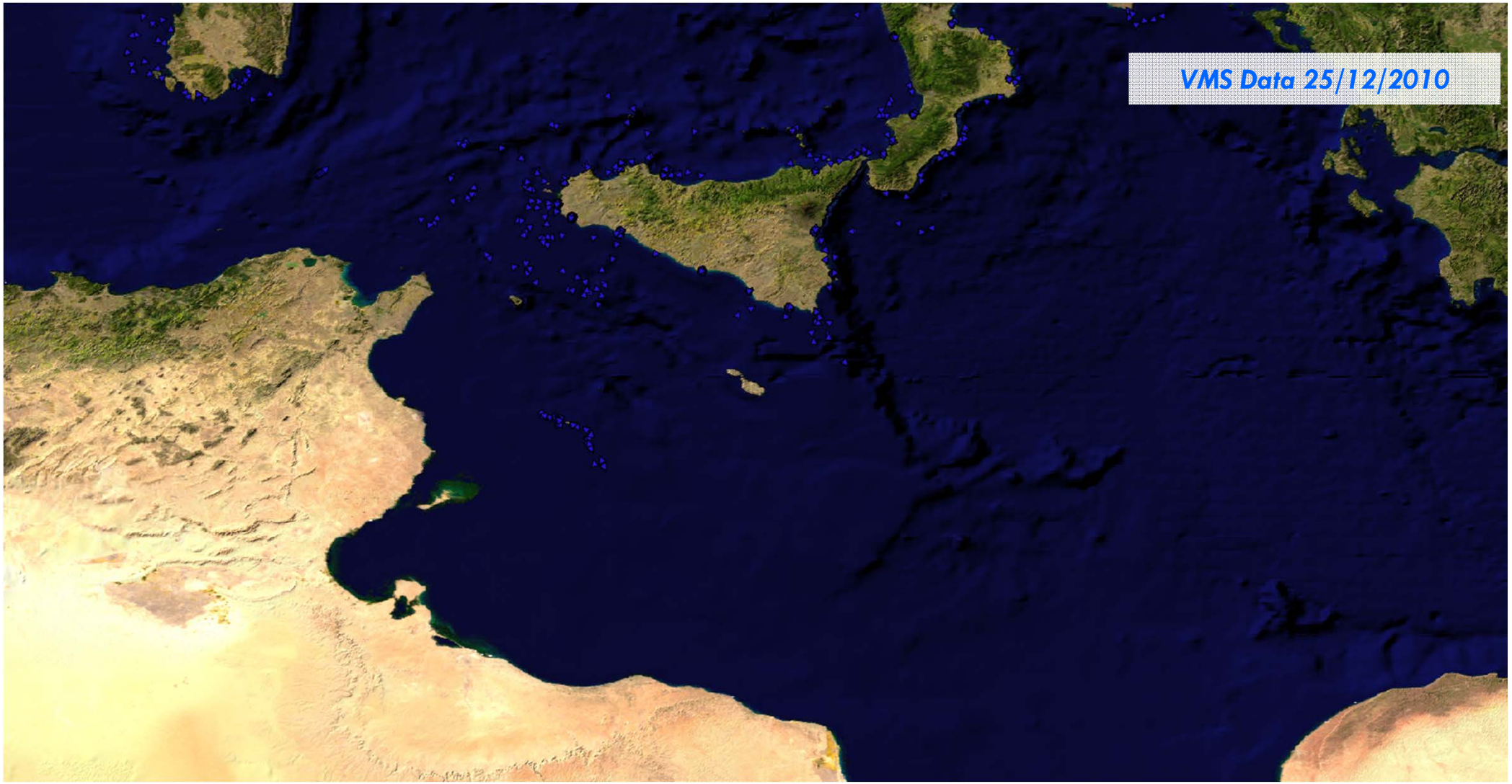
- Detect ships (cooperative or not) sailing the observed AOI (the probability to detect the ships depends on the ship's dimension with respect to the satellite data ground resolution). This probability is very high (>90%) if the ships' dimension is about half the image ground resolution
- Localize detected ships (Geographical Coordinates)
- Classify detected ships (dimension classes)
- Determine ships' velocity and course direction
- Track ships (very useful for ships which are not transmitting their position)
- Detect and classify objects other than ships, such as fishing cages

On the other hand, SAR sensors do not provide information on ship's identity (name, IMO number, etc…)

Legacy Ship Reporting Systems

by courtesy of
e-geos
AN ASI / TELESPAZIO COMPANY

Legacy Ship Reporting Systems



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Legacy Ship Reporting Systems

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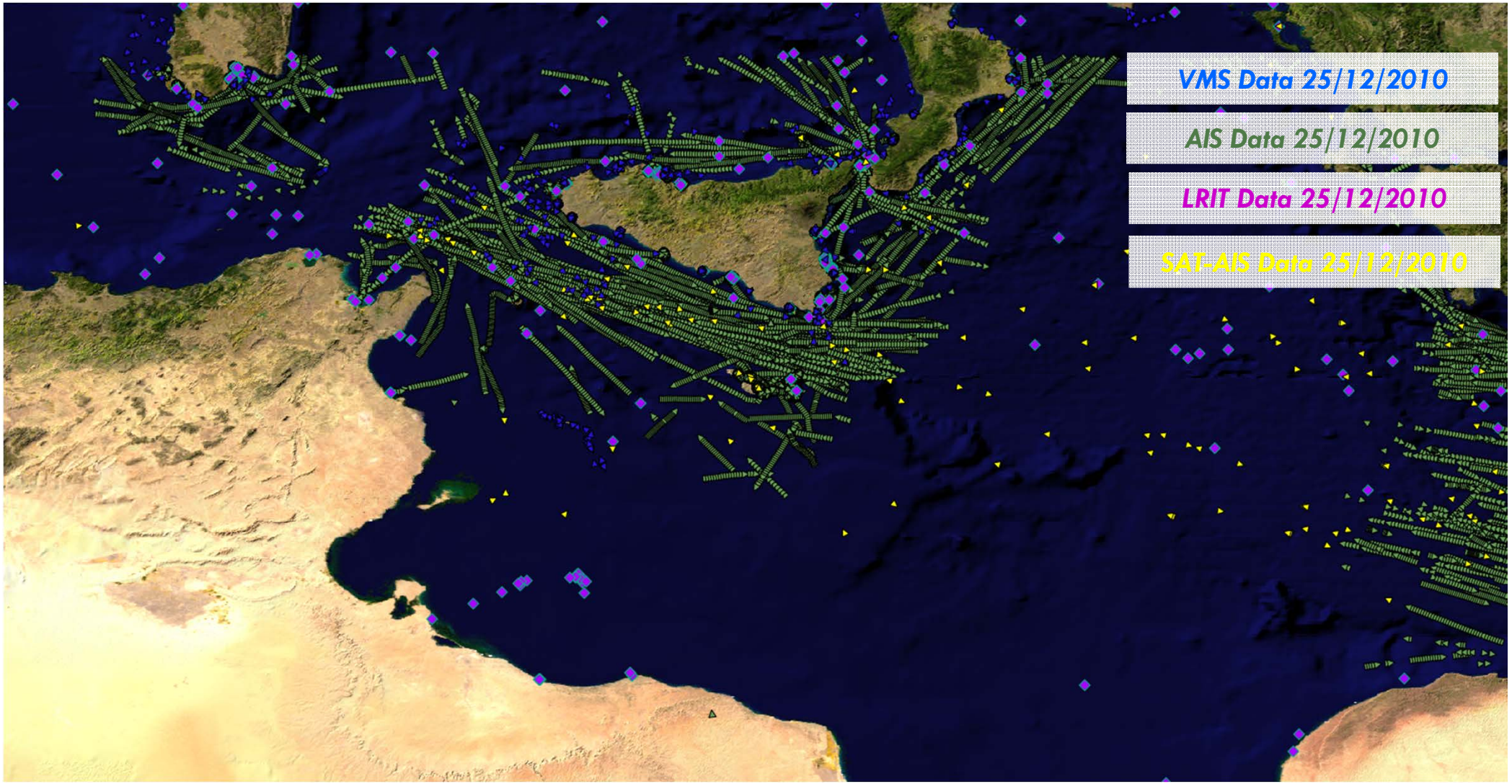
Legacy Ship Reporting Systems



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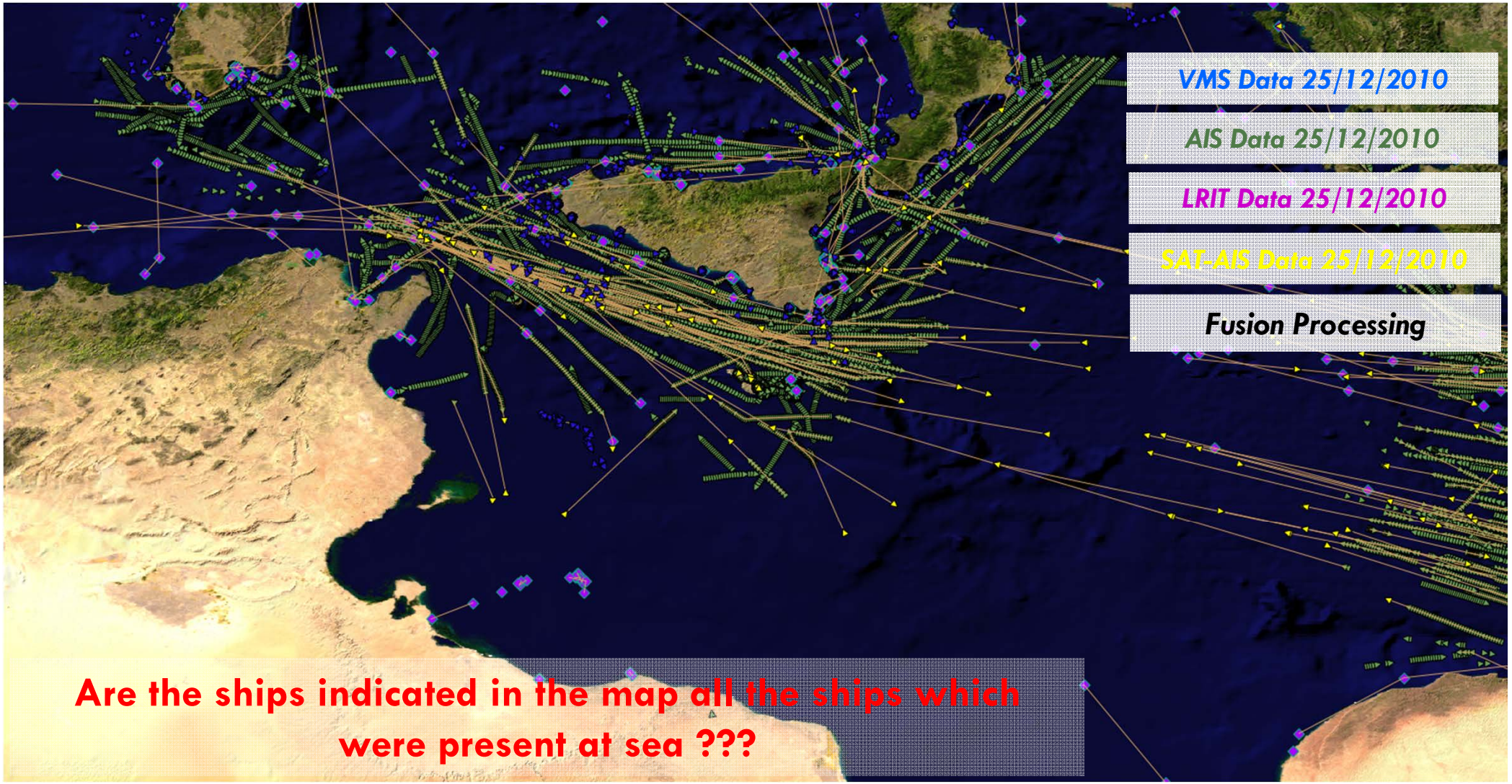
Legacy Ship Reporting Systems



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Legacy Systems

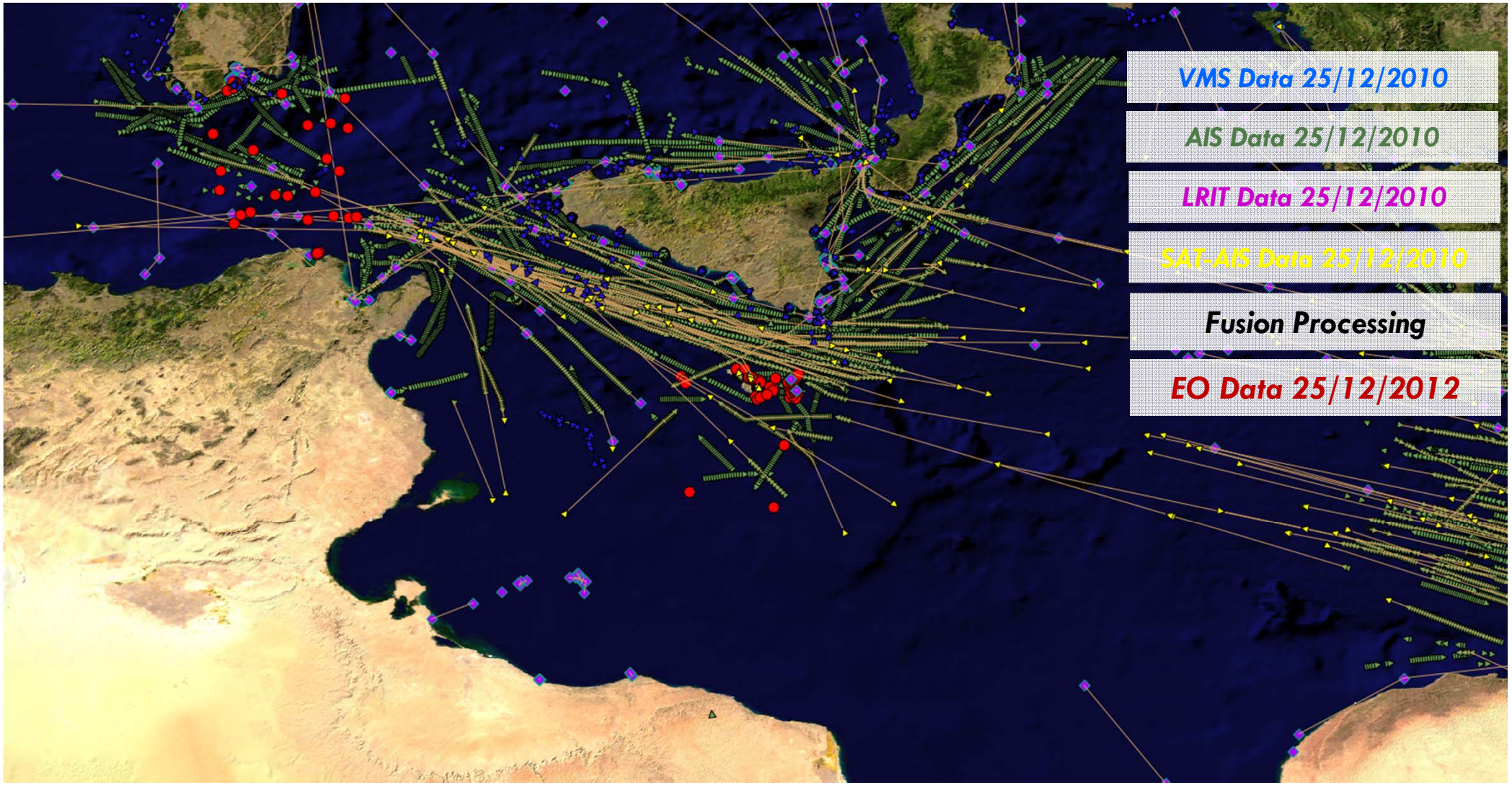
LEGACY SYSTEMS (AIS,LRIT,VMS,…) ALLOW TO

- Localize cooperative ships
- Identify cooperative ships
- Give access to information relevant to the ship voyage

An integrated approach is the key point for success.

In particular , the integration of satellite sensors with existing surveillance systems will improve monitoring capability and efficiency, while reducing overall costs.

Conventional Ship Reporting Systems



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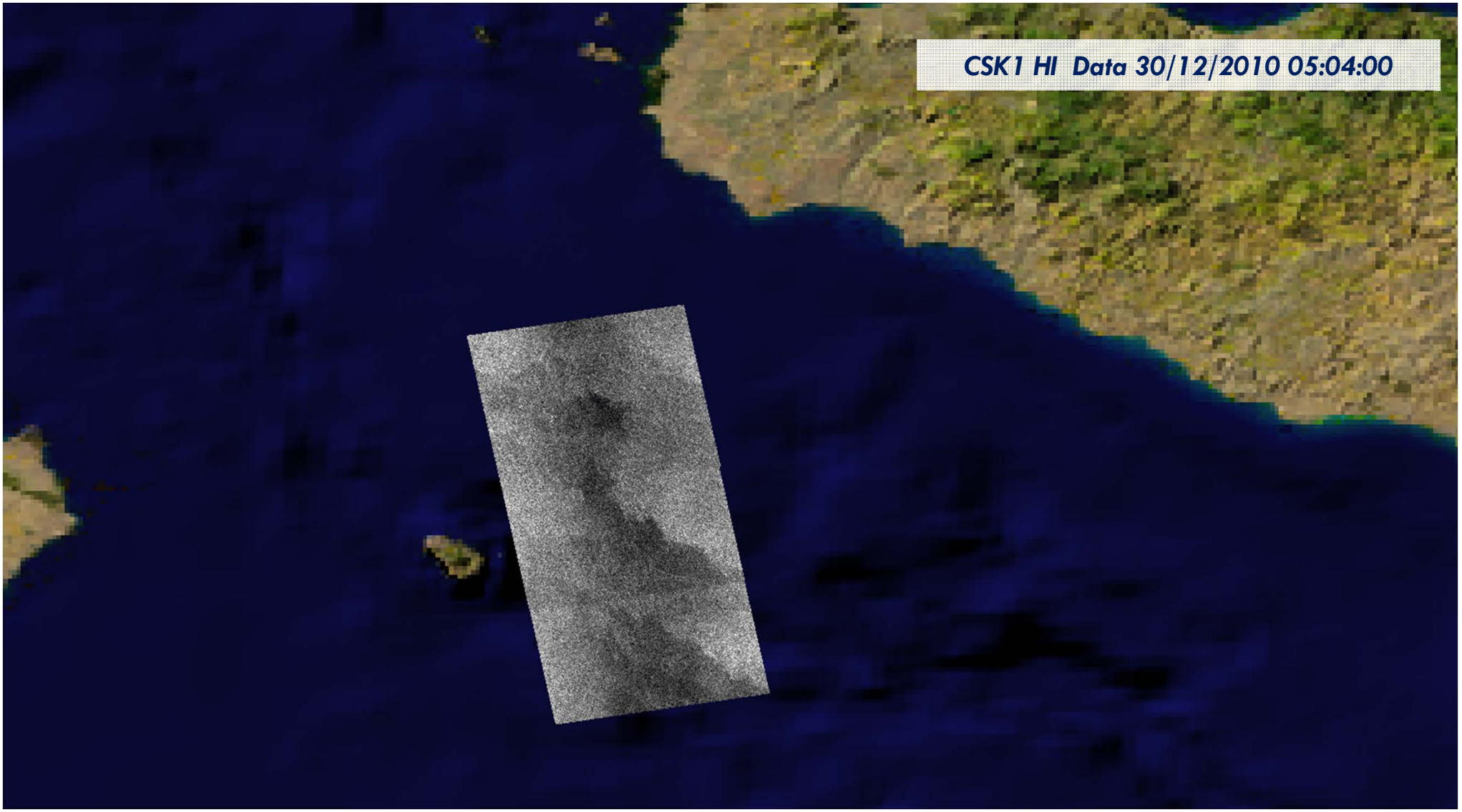
Example of Integrated Product



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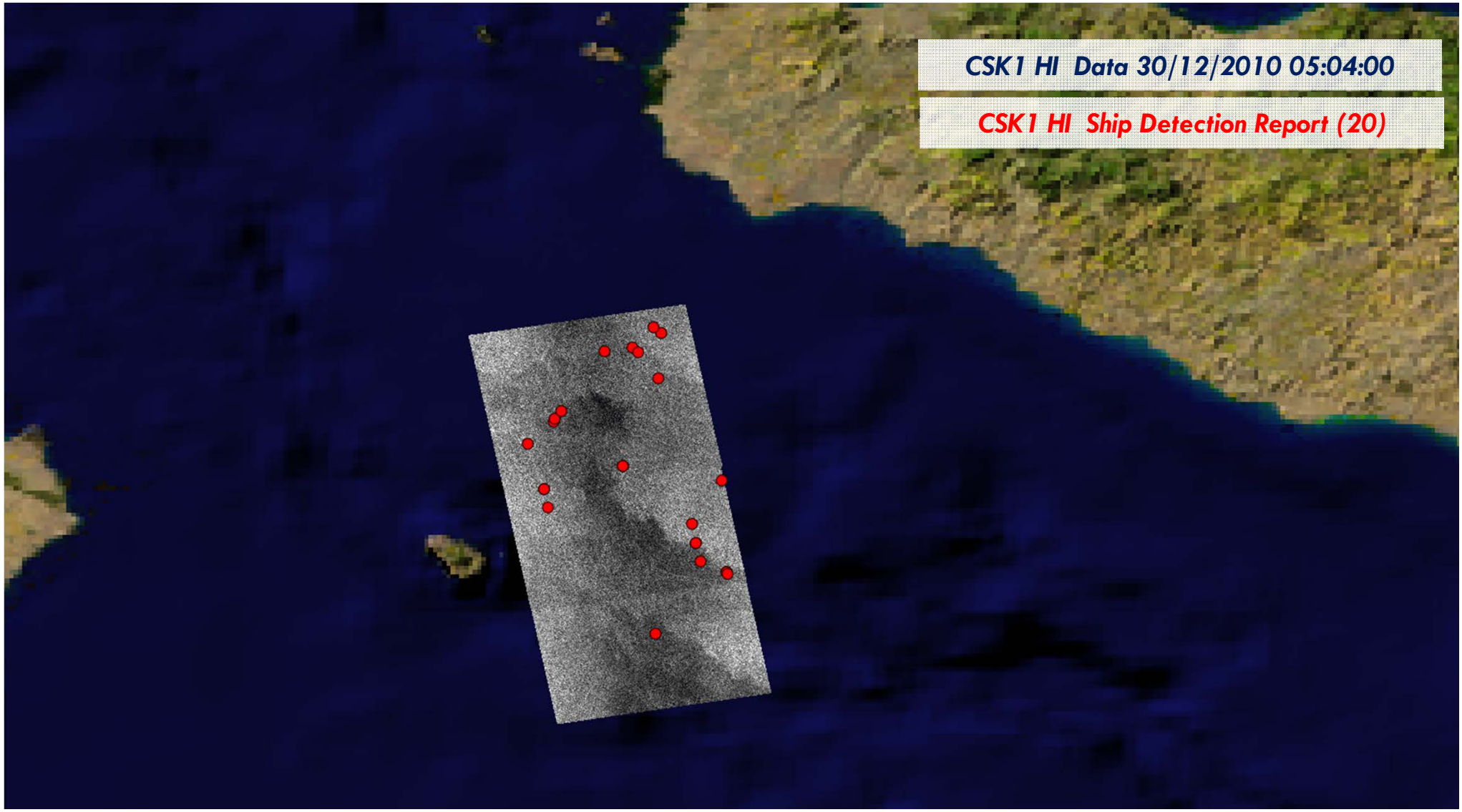
Example of Integrated Product



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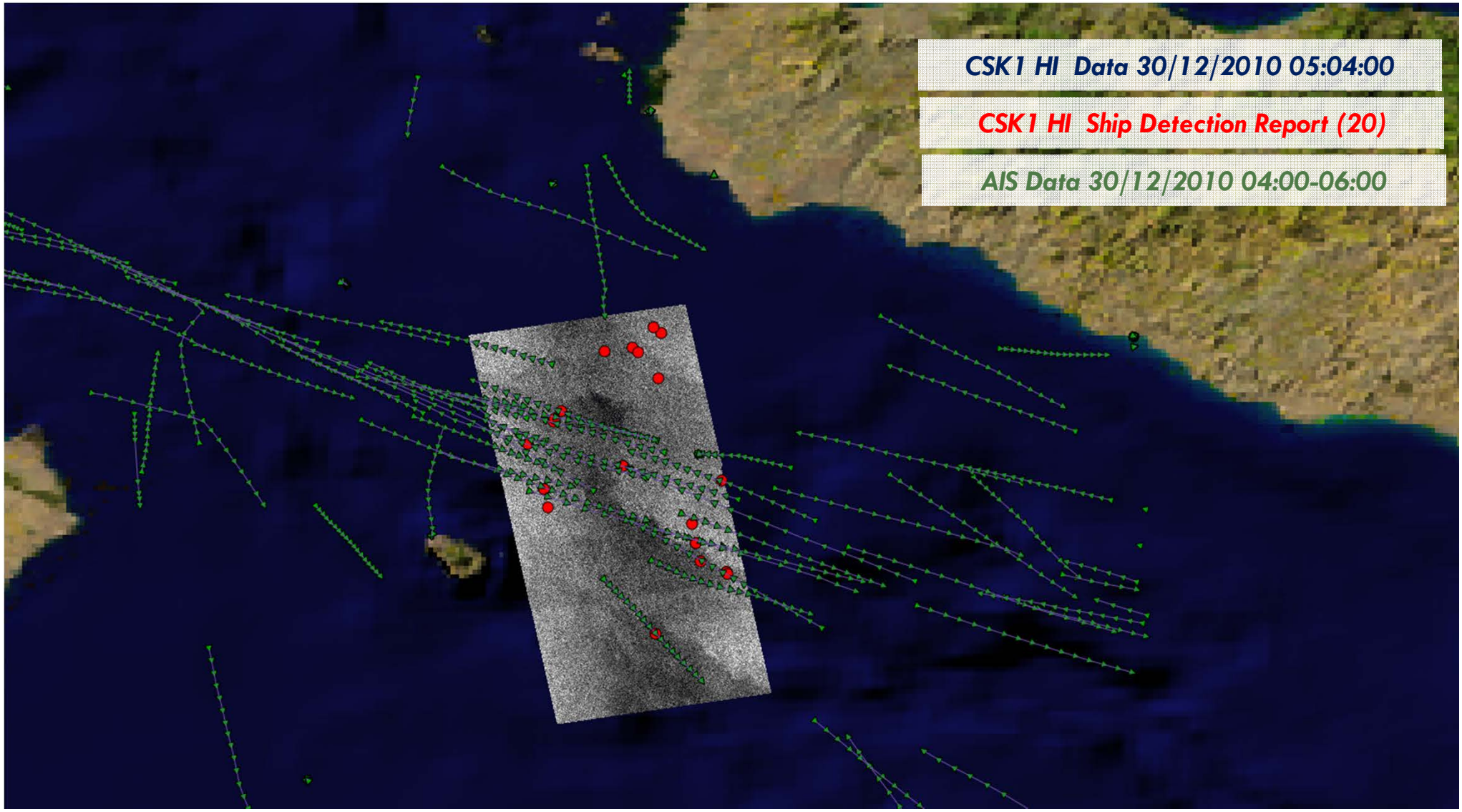
Example of Integrated Product



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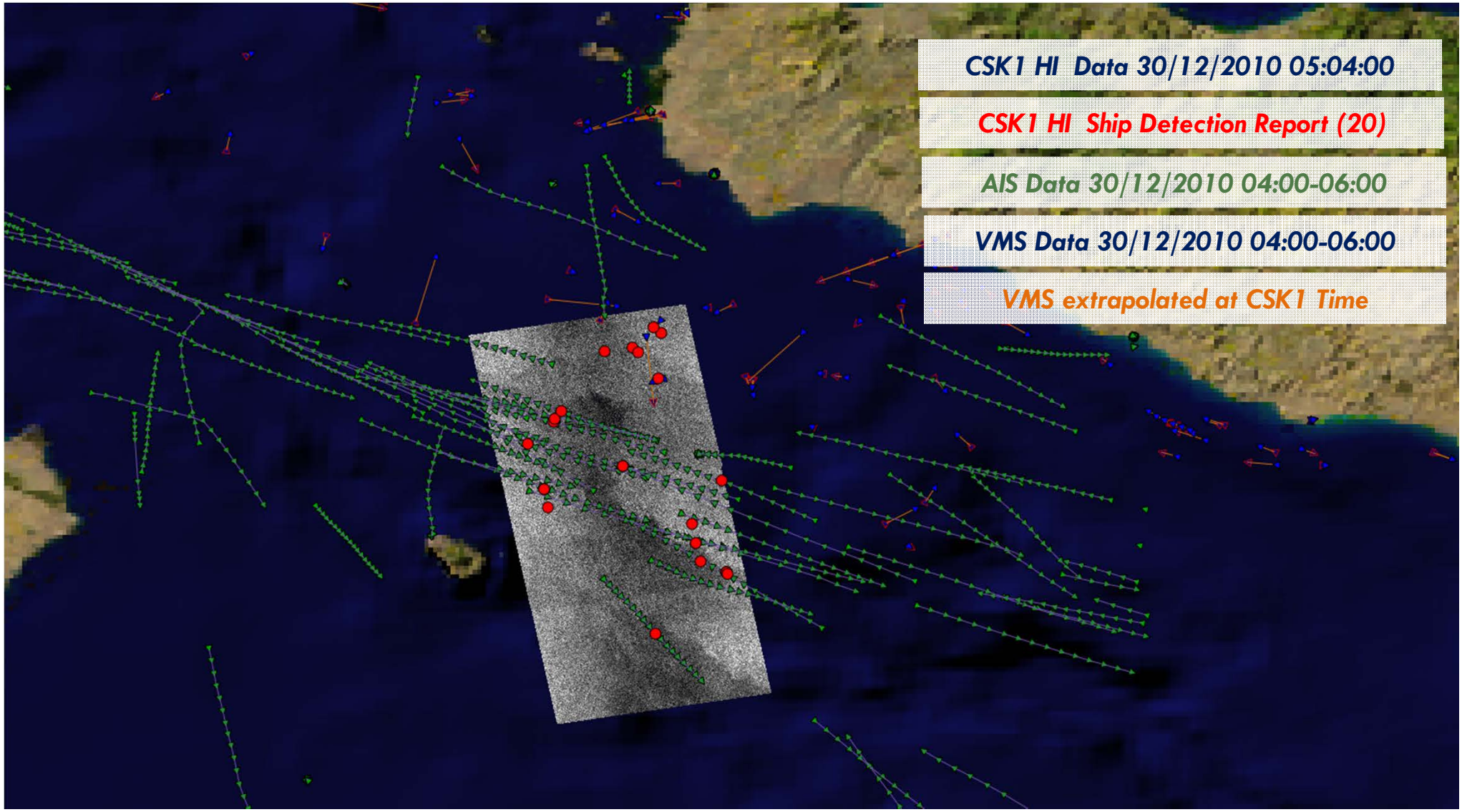
Example of Integrated Product



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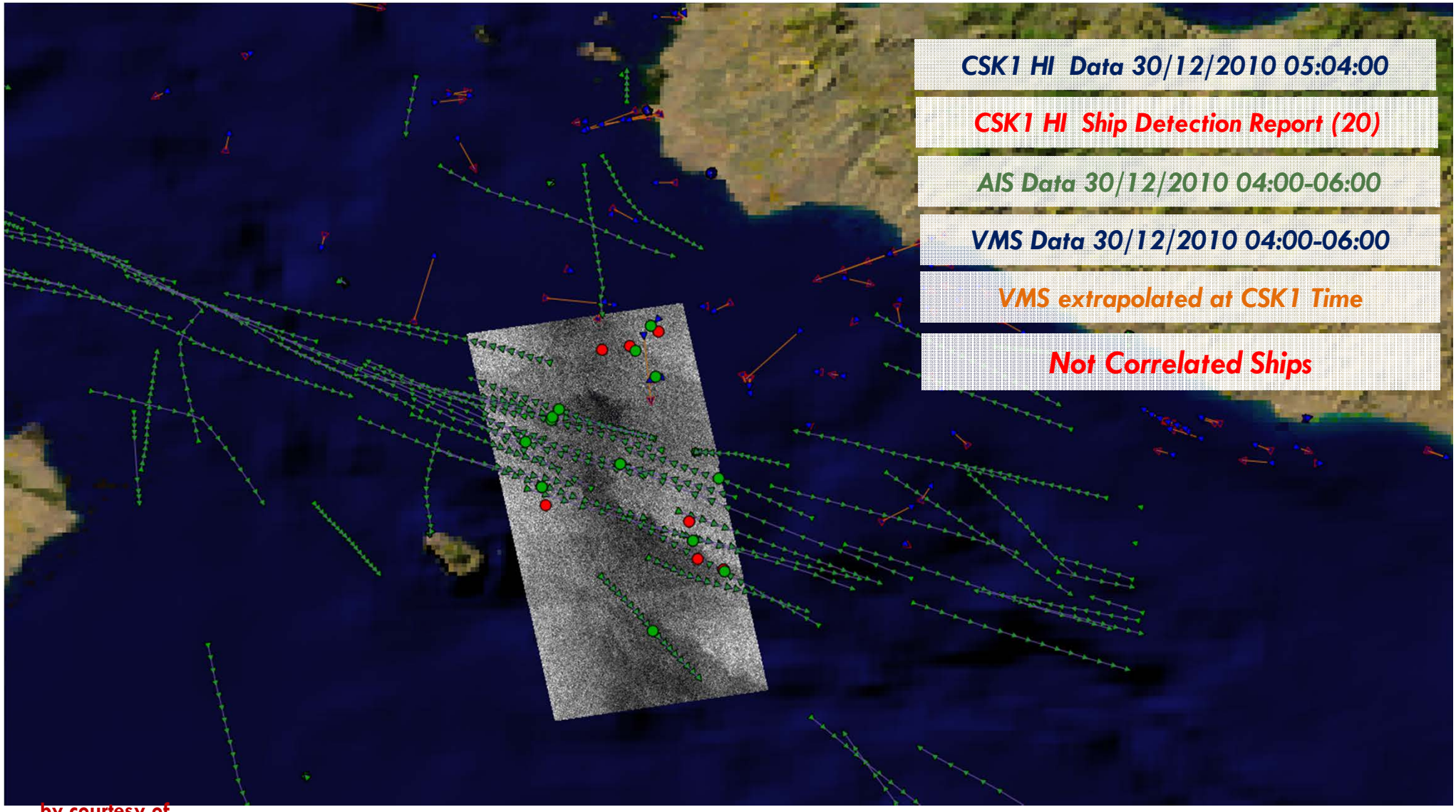
Example of Integrated Product



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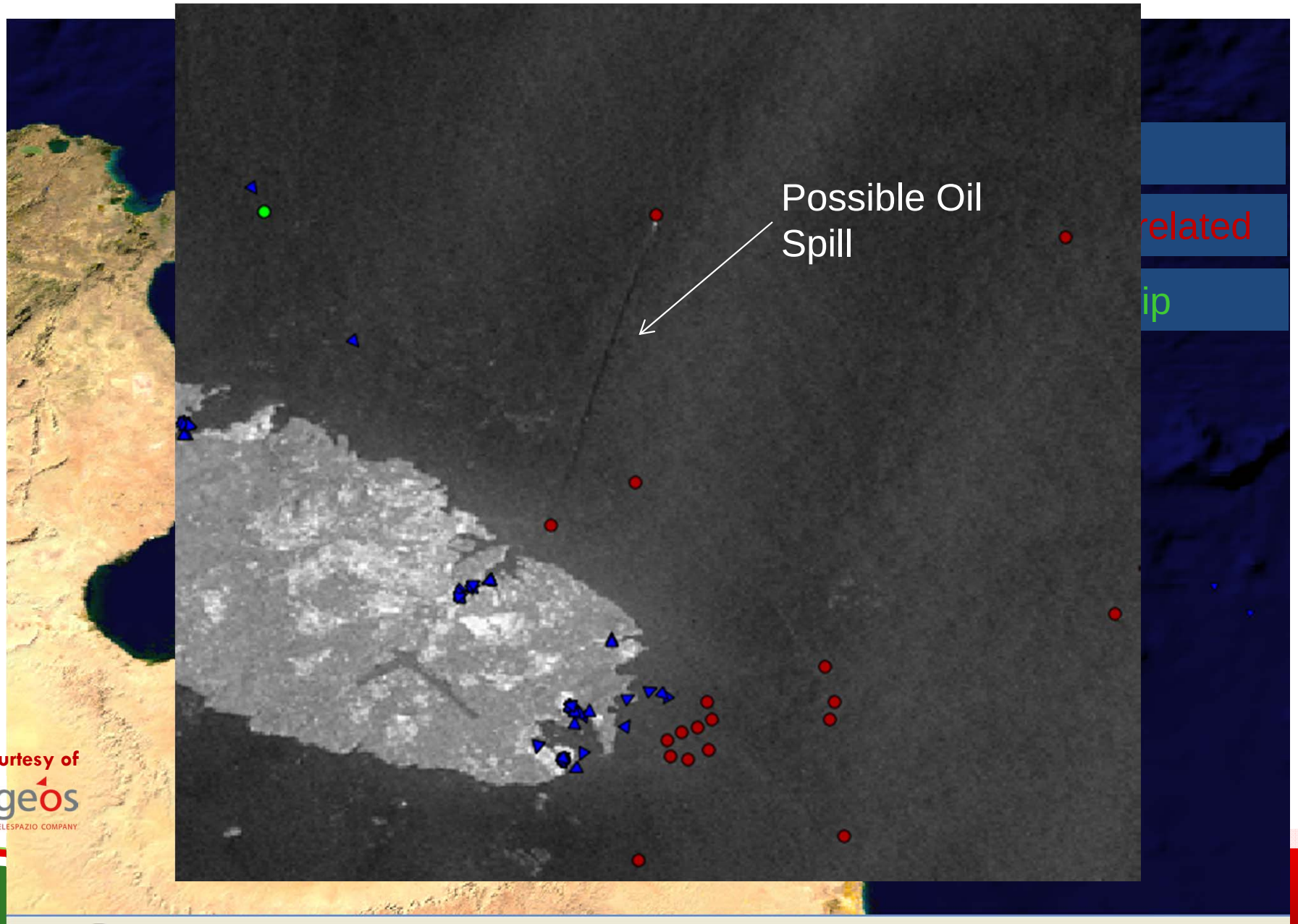
Example of SAR and VMS Correlation-18-05-2012



Thank you for your kind attention!

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