

Sustainability and security at sea in the context of the EU's Copernicus Earth observation program

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UN/UAE High Level Forum
Space as a Driver for
Socioeconomic Sustainable Development

The Joint Research Centre (JRC)

“As the science and knowledge service of the European Commission, the JRC’s mission is to support EU policies with independent evidence throughout the whole policy cycle”



Contents

- ➔ • Copernicus
- Recent results in maritime monitoring

Copernicus

– The EU's program for Earth observation

Space-based monitoring: Information valuable for

- Public authorities
- Companies, people – Private sector

Satellites provide data that is

- Regular, global, for common needs → EU role
- Only partial → Integration with non-satellite data

Use by public authorities

Keeping aware of state and changes of land, sea & air

- Need for new regulations?

Monitoring the implementation of regulations

- Agriculture, forestry, fisheries, environment, pollution, climate change, natural disasters risk & impacts, urban development, spatial planning, border security, ...
- Sustainability, safety, security

→ Better governance

Use by private sector

By end users

- Farmers, mariners, builders, miners, car drivers, ...

By service providers

- Intermediaries who make products for end users
- Value chain

→ Economic growth

Copernicus components

In space: Satellites

- “Sentinels”, EU-owned; 6 types (optical images, radar, ...)
- Data from 3rd party satellites

On ground

- Ground stations, etc.
- In-situ sensors (land, air, sea)
- Data access portals

Copernicus products

1. Data

- Basic products (e.g., satellite images) from the Sentinels
- Free & open

2. Services

- Higher level products made from satellite data + other data + models
- Mostly free & open

Copernicus Services



Hundreds of products, e.g.:

- Global forecast of sulphate aerosol
 - Arctic surface chlorophyll concentration
 - Global vegetation productivity index
 - Monthly surface air temperature
 - Hurricane Ophelia in Ireland
 - Vessel tracking

<http://copernicus.eu/>

Contents

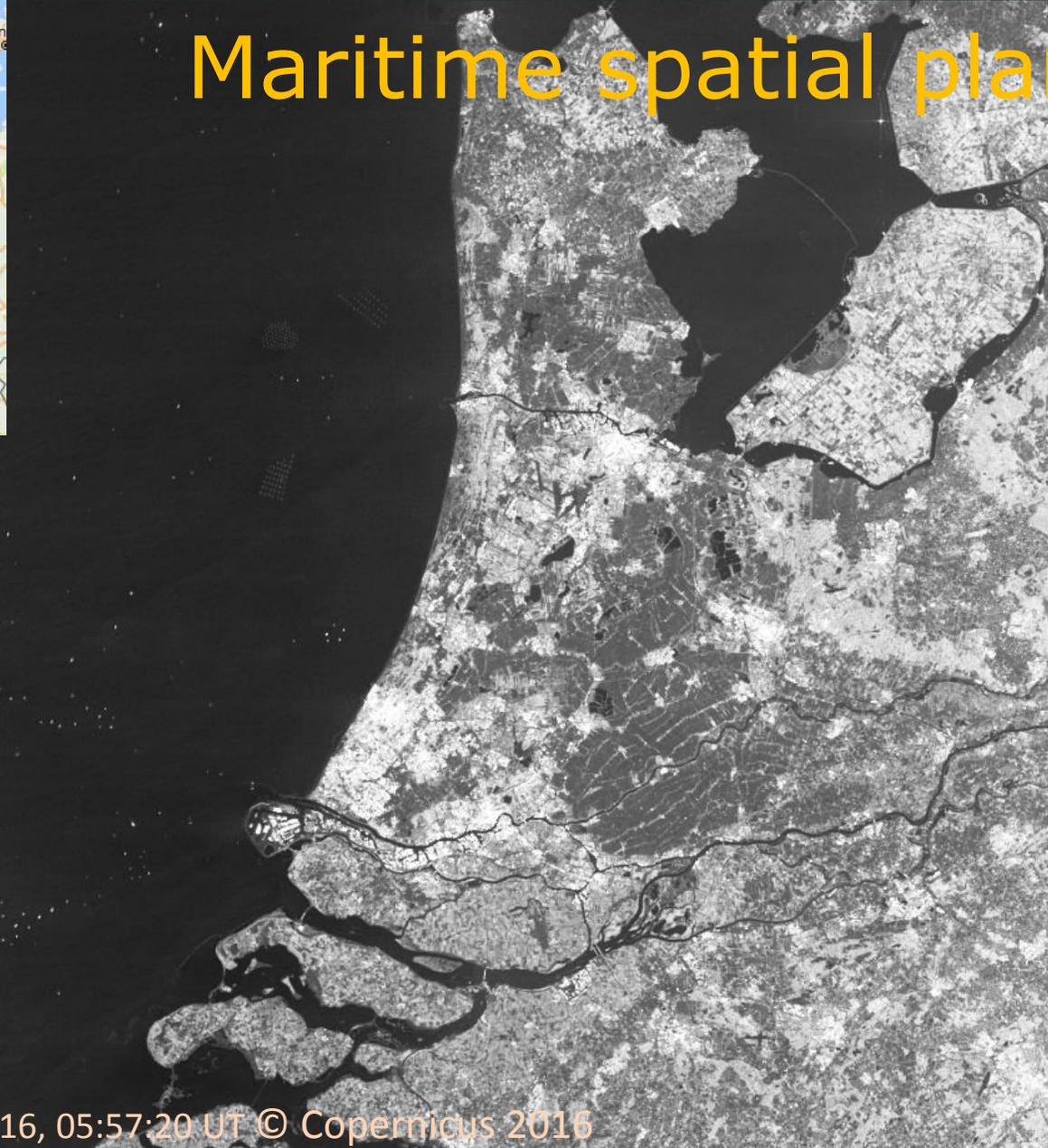
- Copernicus
- ➔ • Recent results in maritime monitoring

*While the Copernicus Security **Service** provides (among other outputs) Maritime Surveillance,*

- *operated by EMSA*
- *unlike the other 5 Services not publicly accessible,*

*Here we show some applications of the Copernicus **Data**, which are publicly available*

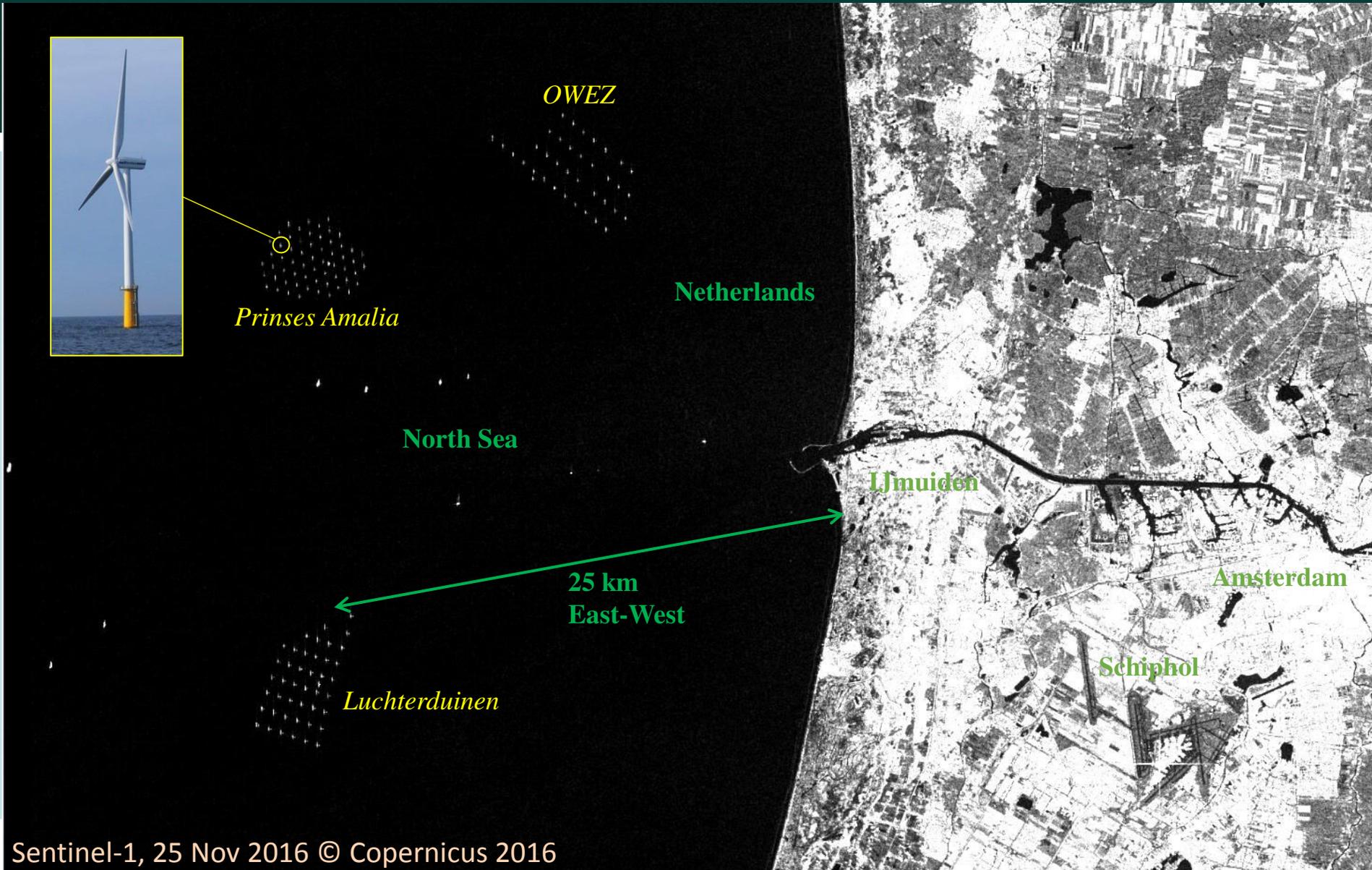
Maritime spatial planning



**Sentinel-1 image
(radar)**

**North Sea off
The Netherlands**

Sentinel-1 image, 250 km wide, 25 Nov 2016, 05:57:20 UT © Copernicus 2016

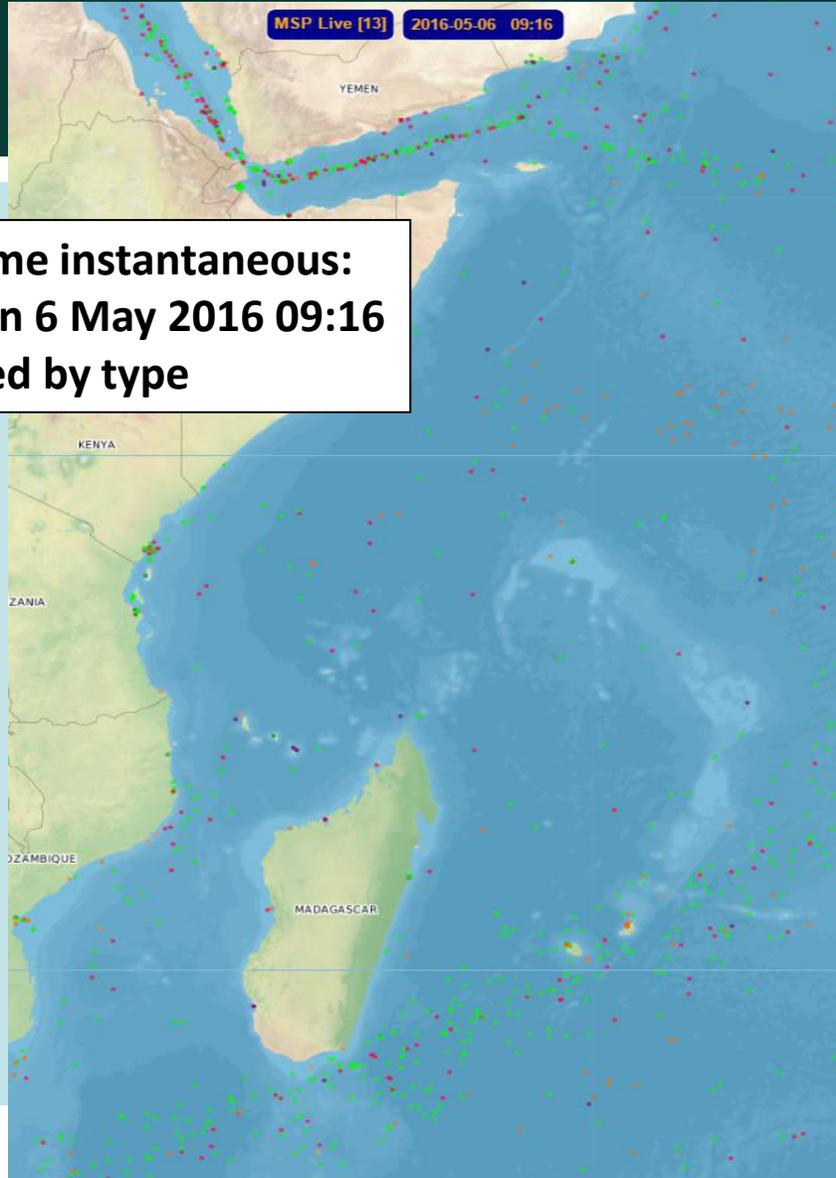


Offshore wind farms

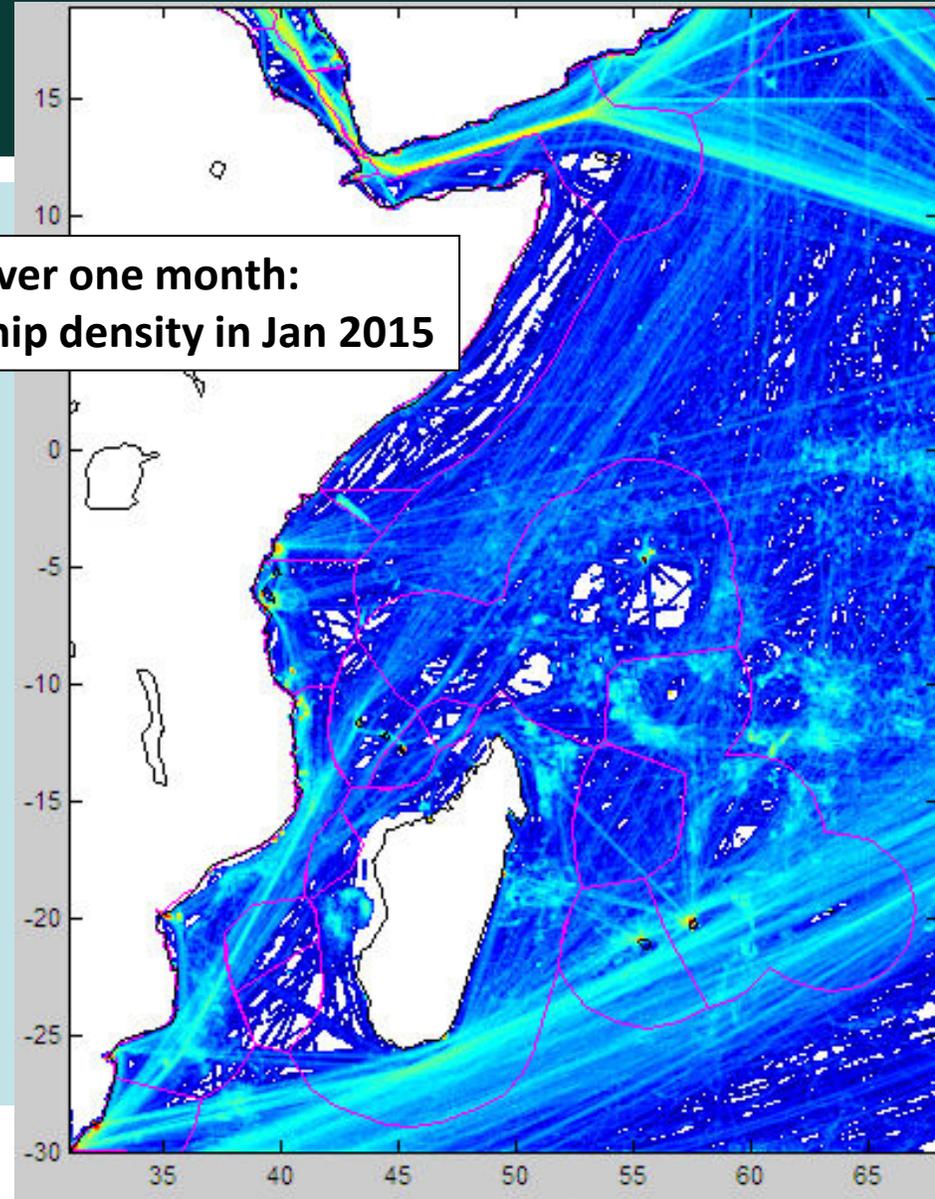
Maritime awareness around Africa

- Piracy, Maritime Awareness & Risks (PMAR) project
- Capacity building for maritime authorities in Africa
- Gulf of Guinea and Western Indian Ocean
 - Kenya Maritime Authority, Indian Ocean Commission
- Use of space & ICT technologies to become aware of what is happening at sea
 1. Automatic position reports from AIS (IMO-mandated);
Received by 17 satellites (*not Copernicus, not free*)
 2. Radar images by 5 Earth observation satellites

Information from AIS messages (cooperative)



**Real-time instantaneous:
Ships on 6 May 2016 09:16
coloured by type**



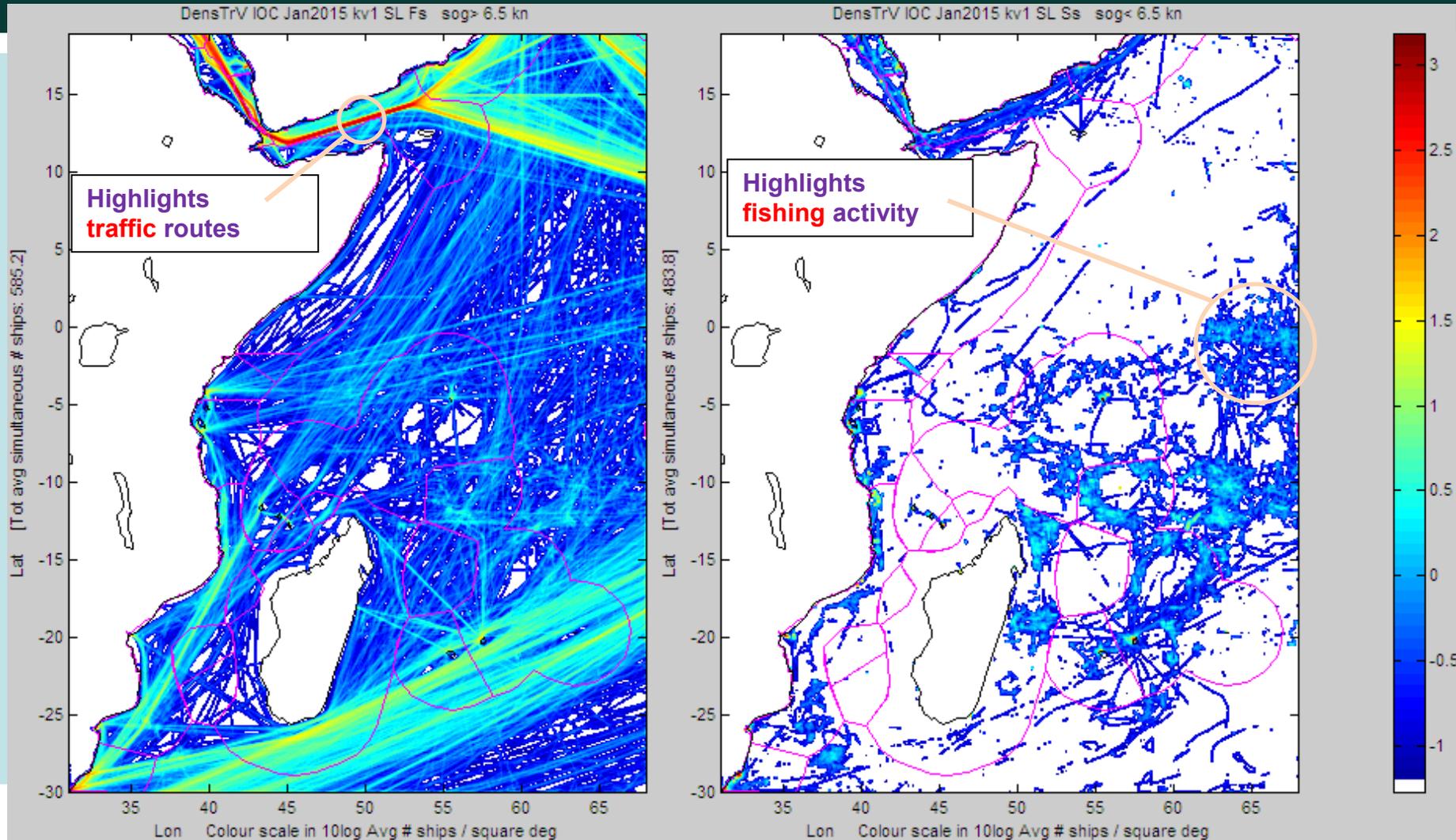
**Over one month:
Ship density in Jan 2015**

Information from AIS messages (cooperative)

Fast moving, > 6.5 kn

Slow moving, < 6.5 kn

Selection
on speed



Finding **non-reporting** ships

Sat/mode Resol- **Non-re-**
 ution **porting**

■ A-2 WBD	90m	13 %
■ RS2 DVWF	70m	33 %
■ RS2 SNB	50m	12 %
■ CSK WR	30m	15 %
■ S-1 IW	20m	68 %
■ TSX SC	20m	56 %
■ A-2 FBD	10m	31 %
■ RS2 F0W2	10m	0 %
■ A-2 HBQ	5m	14 %
Overall		29 %

★ Correlated SAR-AIS

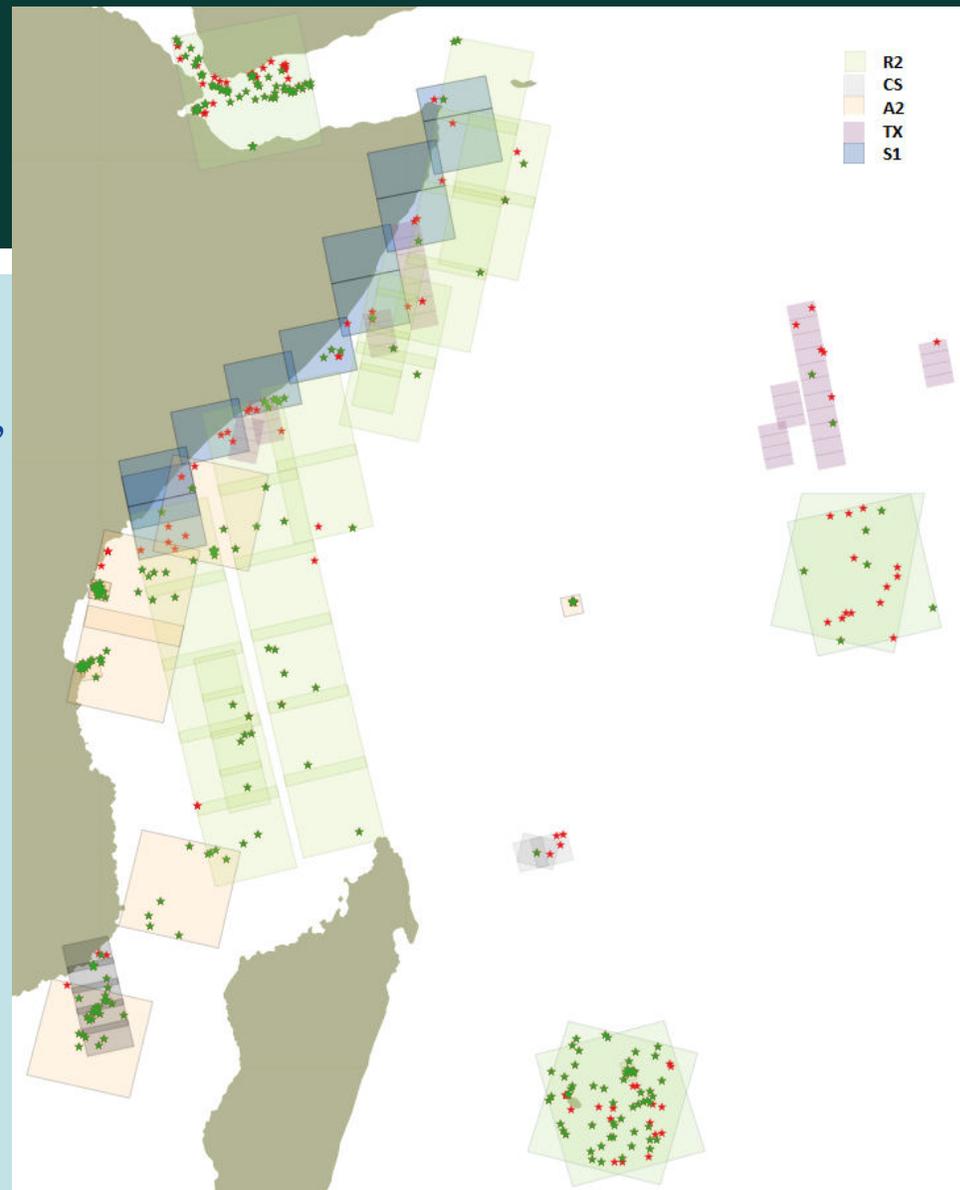
★ Uncorrelated SAR
 “= **Non-reporting ship**”

Satellites used:

Radarsat-2
 Cosmo-SkyMed
 Alos2-Palsar2
 TerraSAR-X
 Sentinel-1

Collaboration with:

DRDC - Defence R&D Canada

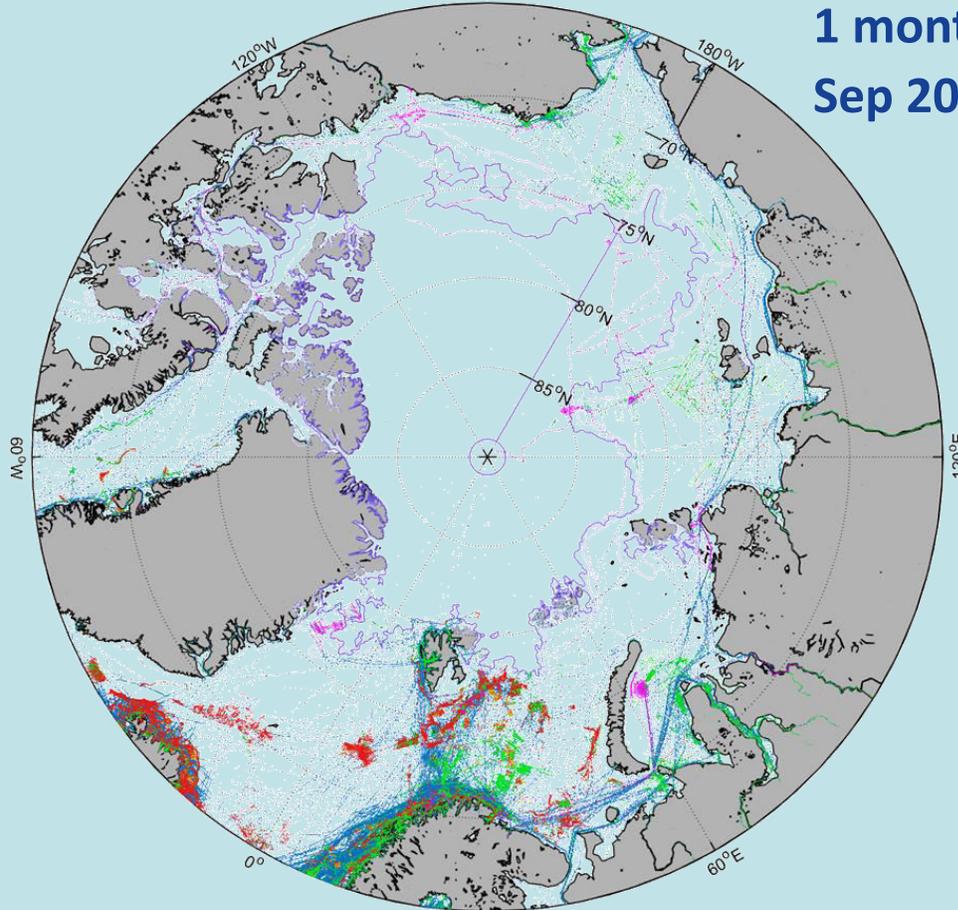


Ship traffic in the Arctic

Time period: from 2014-09-01 to 2014-09-30

1 month,
Sep 2014

Selection on
ship type
and speed



Fishing
Exploration
Shipping

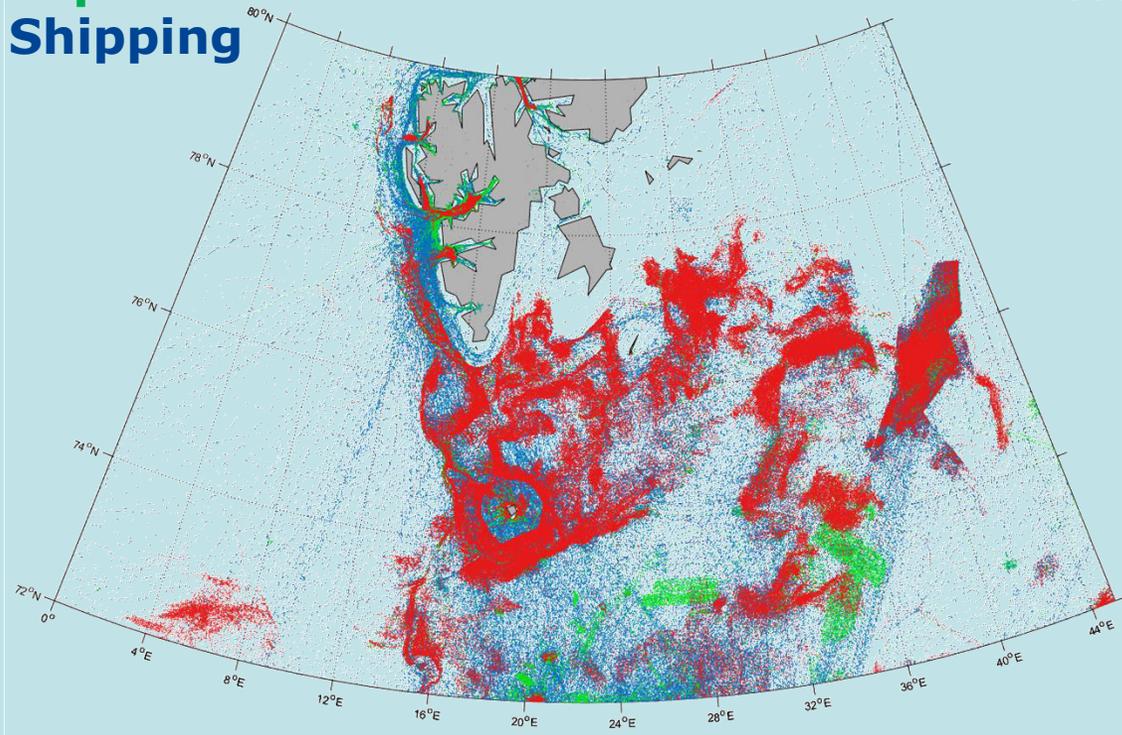
Data: Satellite AIS from Norwegian Coastal Administration / FFI

Non-reporting ship traffic in the Arctic

1 year, Nov 2014 – Oct 2015

Fishing
Exploration
Shipping

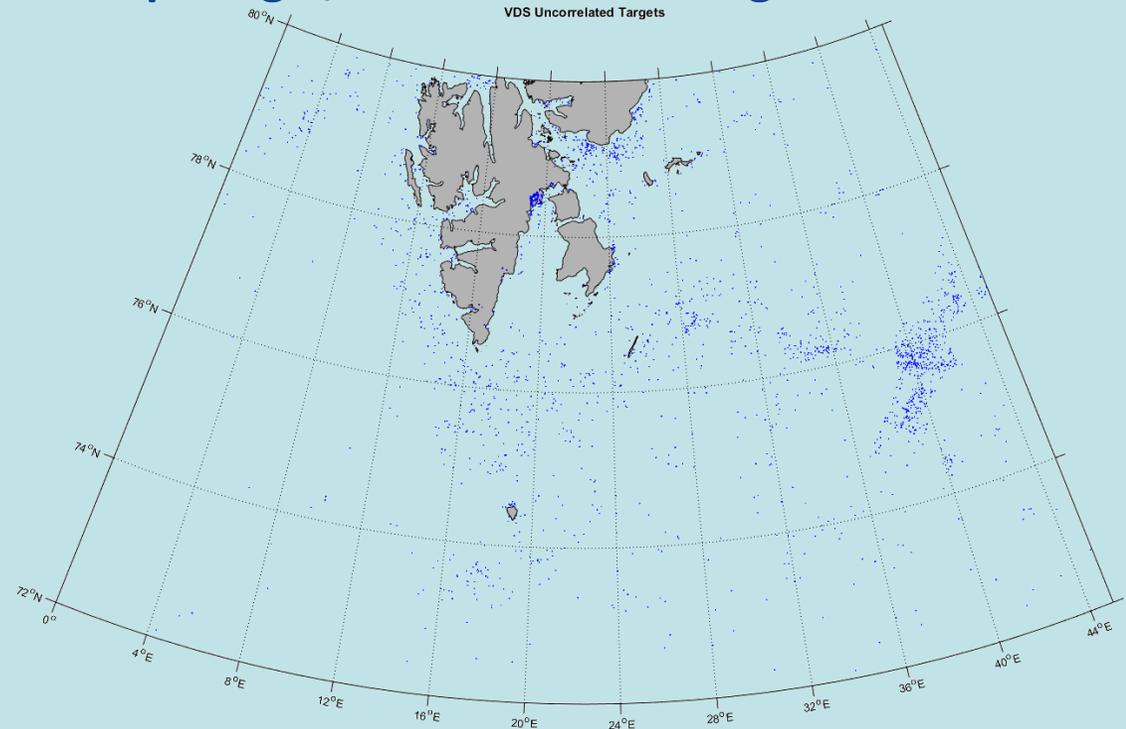
Reporting ships (AIS)



Data: Satellite AIS from Norwegian Coastal Administration / FFI

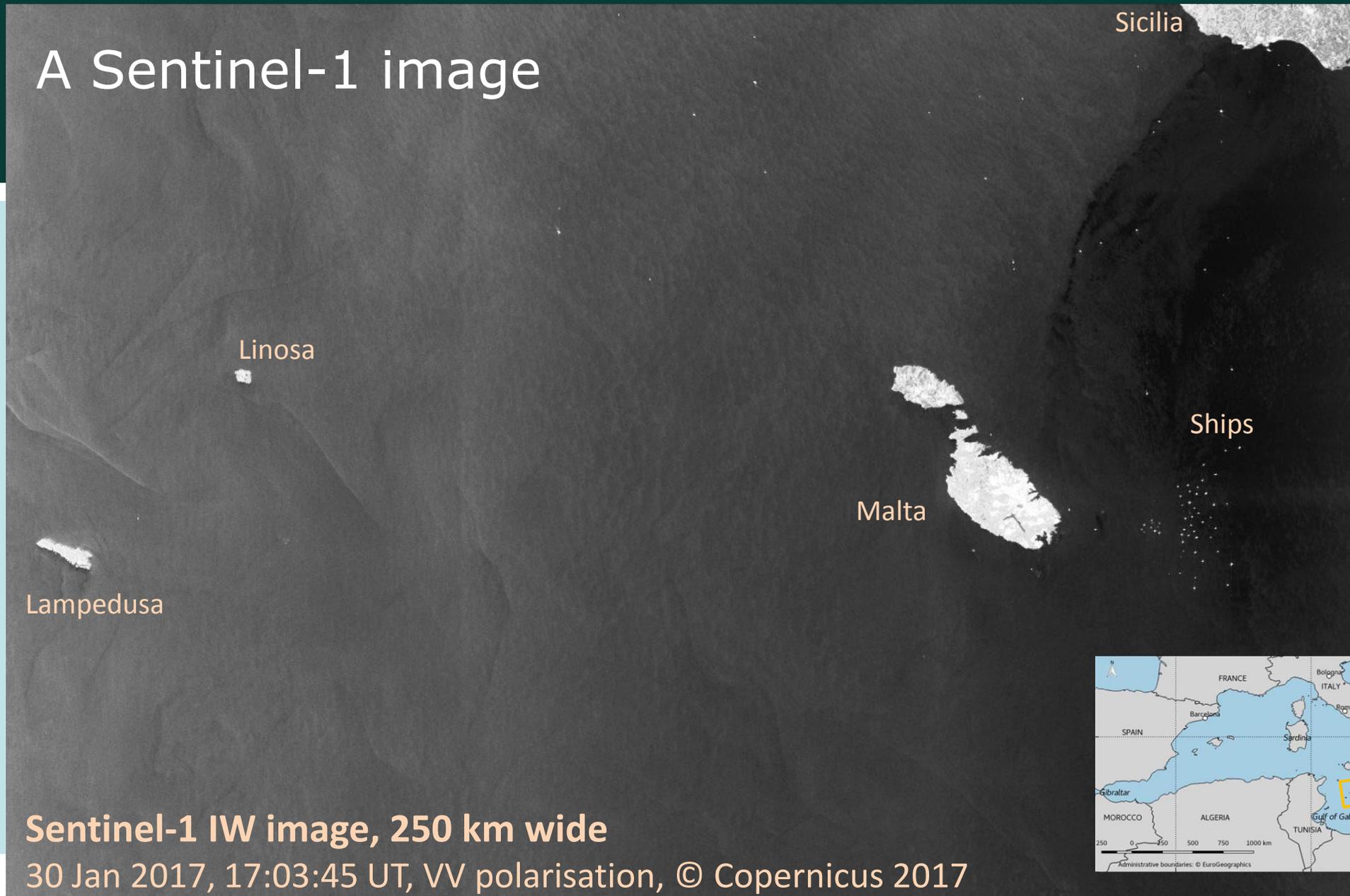
Non-reporting ships

From comparing 2,033 Sentinel-1 images with the AIS data



Uncorrelated Sentinel-1 targets (**16%** of the total).
Many of these are likely to be non-reporting ships

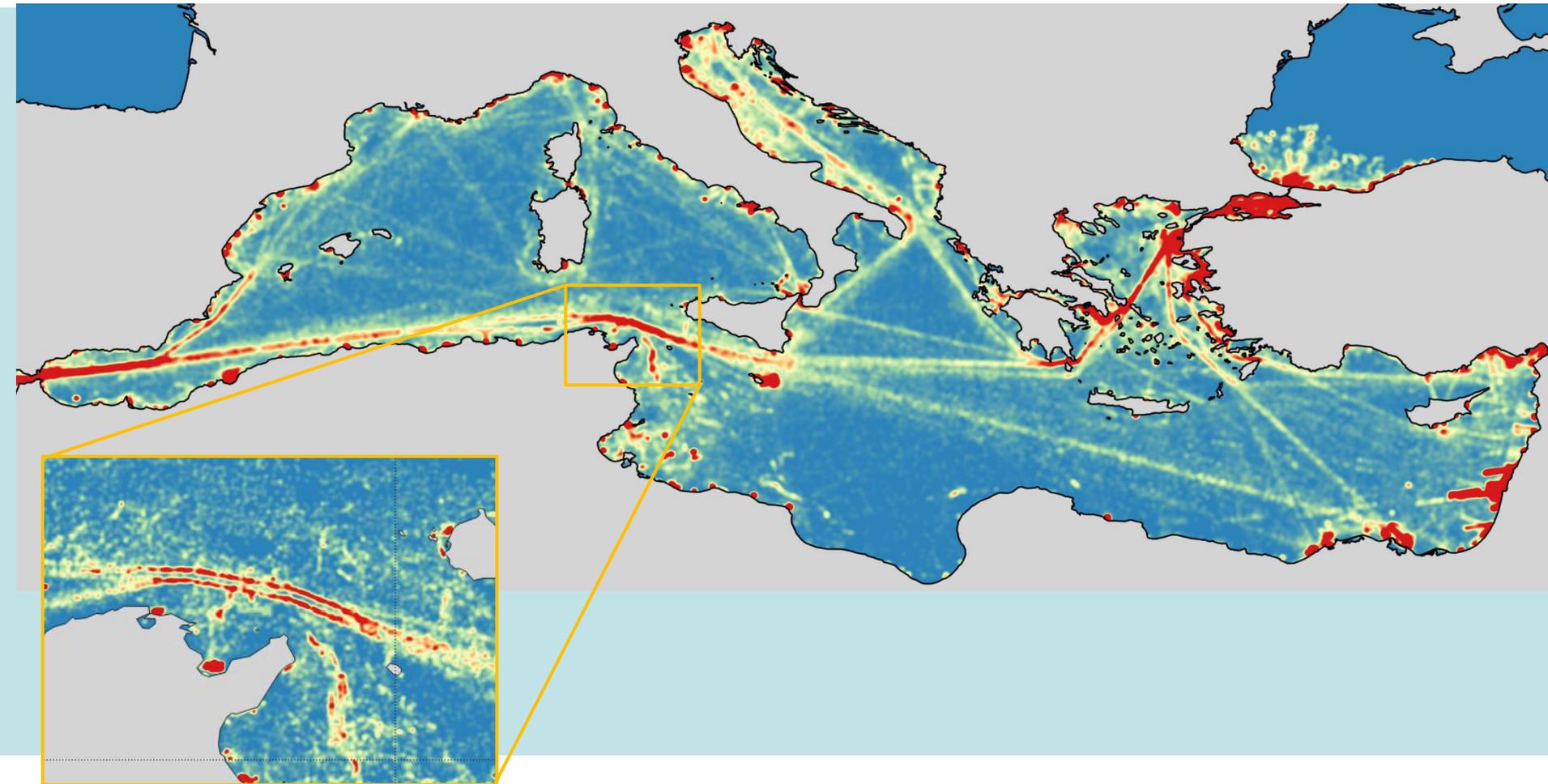
A Sentinel-1 image



Sentinel-1 IW image, 250 km wide

30 Jan 2017, 17:03:45 UT, VV polarisation, © Copernicus 2017

Ship density map Mediterranean Sea



- **2 years of Sentinel-1 data**
Oct 2014 – Sep 2016
- **11,500 satellite images**
- **485,000 ship detections**
- **Not depending on ship reporting**

Conclusion

- Satellite data provide unique information – not only on human activities at sea, but also on other observables
- Complementary to other data (such as reporting systems, in-situ measurements, ...)
- The EU's Copernicus program is now routinely collecting satellite data over land, sea and air, in vast amounts (Terabytes per day)
- The free availability of these data will stimulate better governance and economic growth



Thank you

Any questions?

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