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ipsc
Institute for the Protection and Security of the Citizen



Monitoring sea-based oil pollution in the Black Sea: JRC activities

Guido Ferraro and MASURE team

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Content

- What is JRC?
- What do we do in MASURE?
- The use of satellite imagery to detect sea-based oil pollution
- Long term monitoring of oil spills in the Black Sea

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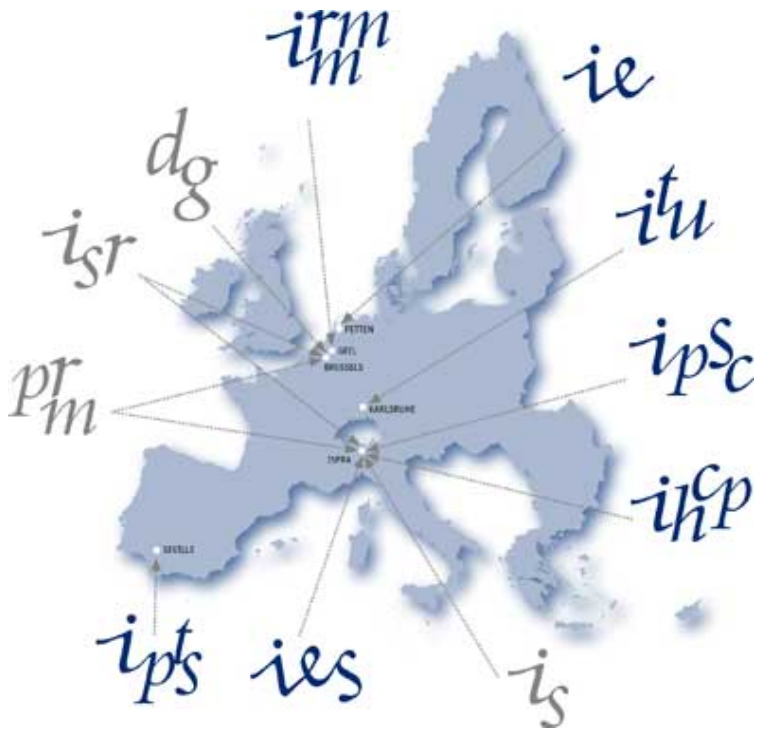
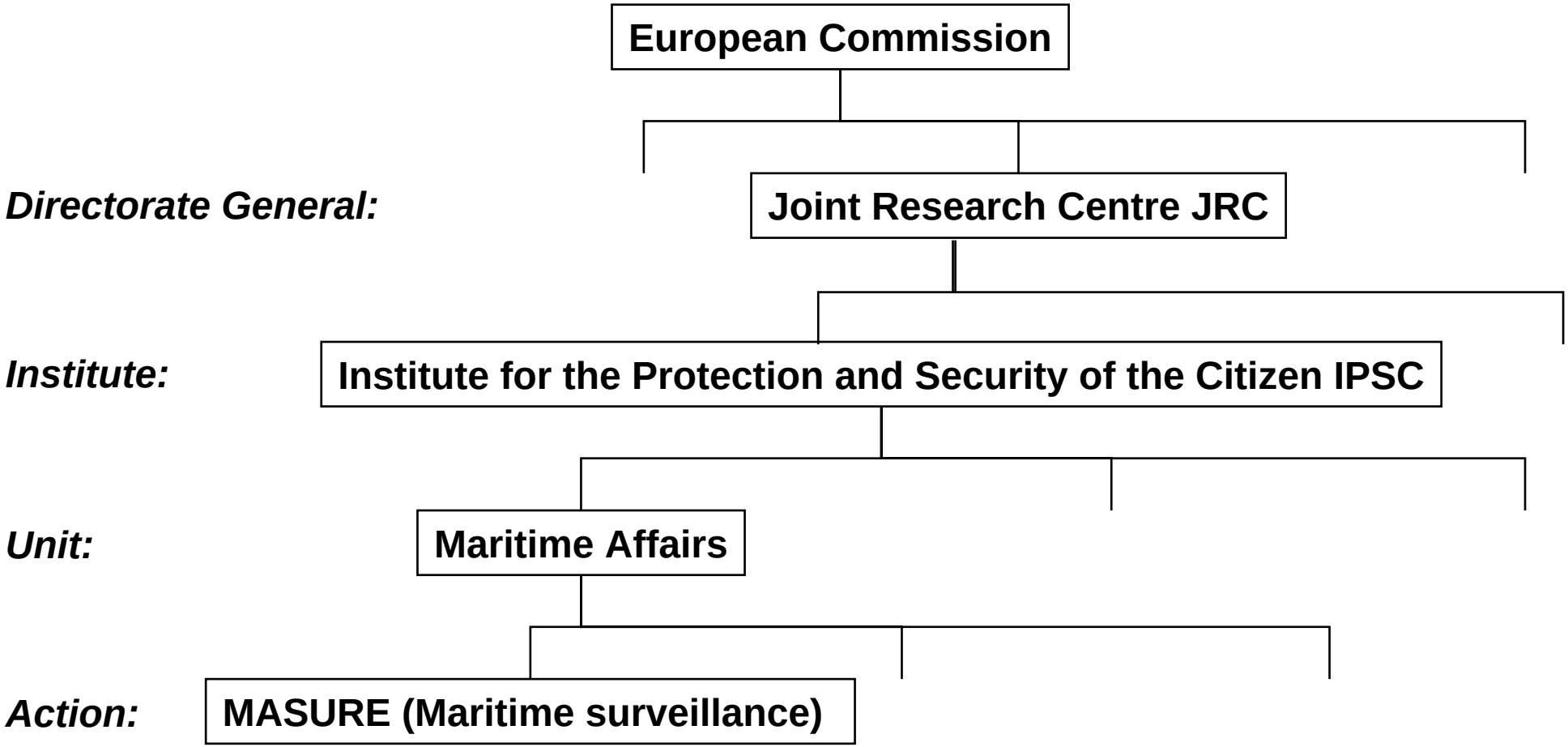
Joint Research Centre (JRC)

- JRC is a Directorate General of the European Commission
- Scientific and technical support for European Union policies (conception, development, implementation and monitoring)
- For European Commission, Agencies, Member States
- Reference centre of science and technology for the EU
- Serves the common interest of the Member States
- Independent of special interests (private or national)
- 7 Institutes, 5 sites




European Commission
Directorate General:
Joint Research Centre JRC
Institute:
Institute for the Protection and Security of the Citizen IPSC
Unit:
Maritime Affairs
Action:
MASURE (Maritime surveillance)

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MASURE:
The new JRC institutional Action on Maritime Surveillance:

- **Monitoring maritime traffic (including ship pollution);**

- **Monitoring container traffic;**

- **Support port security and underwater surveillance.**

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MASURE - Monitoring maritime traffic

- Vessel Detection System (VDS)

Detect ships in satellite images

- Maritime data fusion

Combine ship traffic data to form complete picture

- Support EU strategy on maritime policy

Requirements vs. technical feasibility

- Long-term topics

UAVs, new sensors, maritime GIS,

Projects:

LIMES Land/Sea Integrated Monitoring for European Security - FP6

TANGO Telecoms Advanced Networks for GMES Operations - FP6

WIMAS (Wide Maritime Area Surveillance) – FP7

OPERAMAR (An interOPERAble approach to European Union MARitime security management) – FP7

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MASURE - Monitoring ship pollution

- Long-term monitoring of oil pollution (suspended)
  (Mapping spills, identifying hotspots, trends)….

- Networking: European Group of Experts on satellite Monitoring of sea-based Pollution (EGEMP) meets jointly with EMSA CleanSeaNet User Group

- Project MONRUK (Monitoring the Marine Environment in Russia, Ukraine and Kazakhstan using satellite Synthetic Aperture Radar)

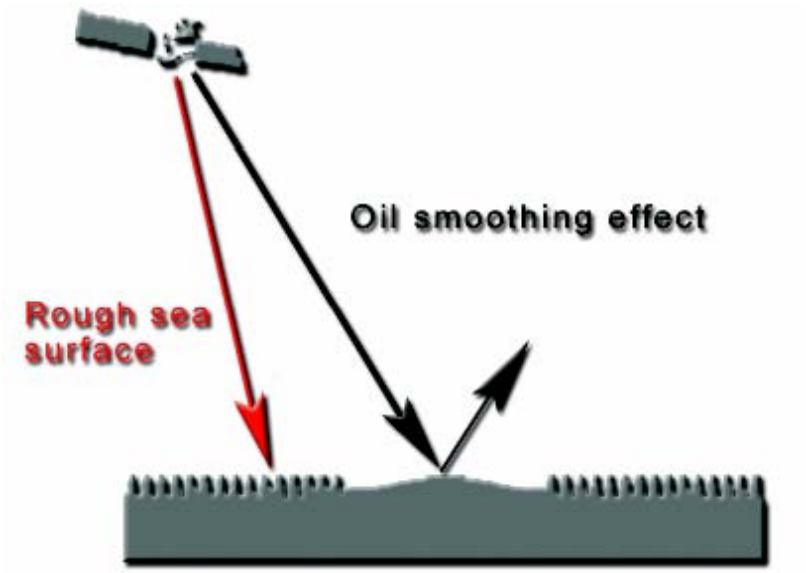
- R&D (in support of EMSA)
  - Automatic oil spill detection algorithm for satellite SAR
  - Feasibility of oil spill detection with MODIS
  - GIS layers for environmental and shipping data

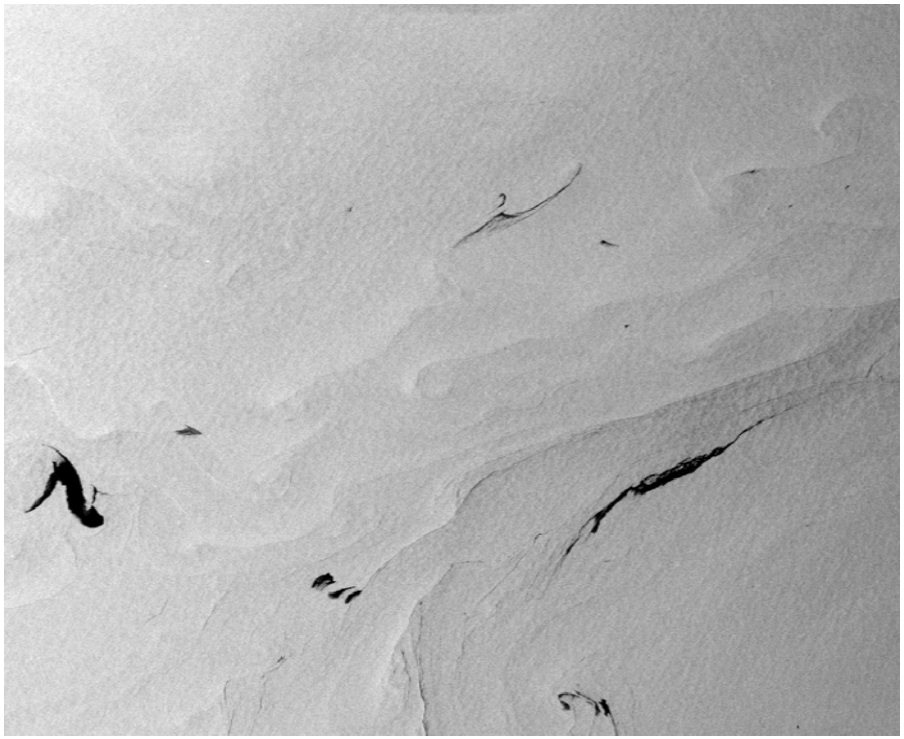
- Detection of oil pollution from ships (in the frame of environmental / transport issues)

(1) Support response operations in case of maritime accidents;
(2) Providing an early warning of possible threats to coastal areas in time to take counter-measures;
(3) Detecting and deterring illegal discharges from sea-based source;
(4) Measuring the state of European seas – means, variations, trends, to inform policymaking and assess the success or otherwise of action taken.

Available tools (I)

Radar sensors





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Available tools (II)

In optimal conditions oil spills appear dark in a SAR image

But

other phenomena can produce dark features in a radar image (look-alike features):

- **natural films;**
- **grease ice;**
- **areas of low wind speed;**
- **rain cells;**
- **current shear zones;**
- **…….**

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Potentials and limitations of the satellites

- Homogeneous and global coverage (including remote areas).
- Coverage precisely known.
- Large amount of data (including archive data from 1992).

- Reliability (false positive and false negative cases).
- Unable to identify the source of pollution.
- Low number of observations.

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Suitability of the satellite

1. Support response operations in case of maritime accidents; *Good for monitoring remote and large areas.*
2. Detecting and deterring illegal discharges from sea-based source; *Unable to perform all the required tasks but very good to complement aerial surveillance (early-warning role)*
3. Measuring the state of European seas – means, variations, trends, to inform policymaking and assess the success or otherwise of action taken. *Very good*

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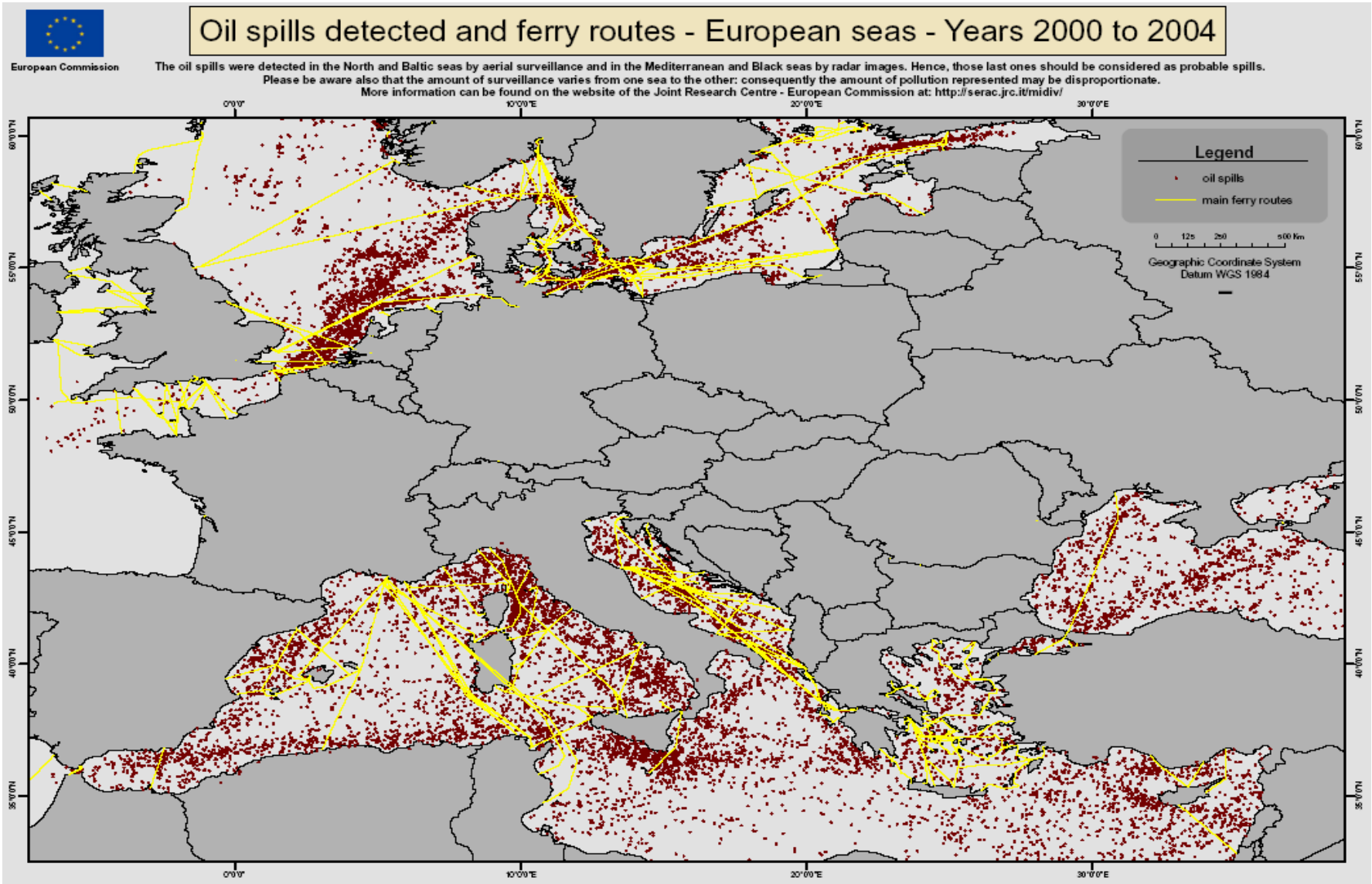

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Methodological approach

- Requirements for reliable and robust long term analysis:
  - Large amount of data/observations.
  - Knowledge of temporal and spatial sampling.
  - Procedure to transform oil slick dot maps in oil slick density maps.
  - Precise information on ‘special events’.
  - Appropriate tools for data management (database and GIS).

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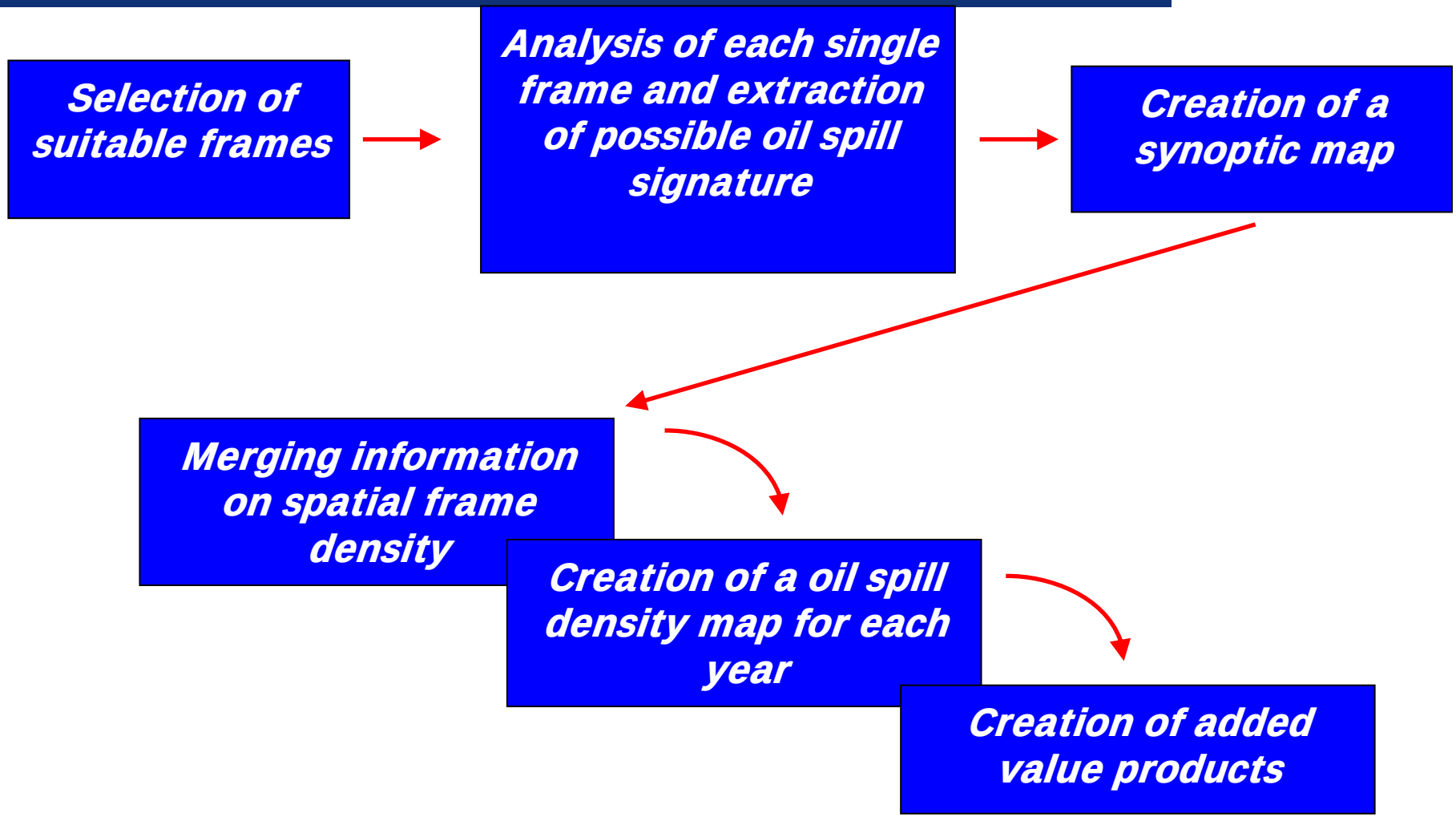
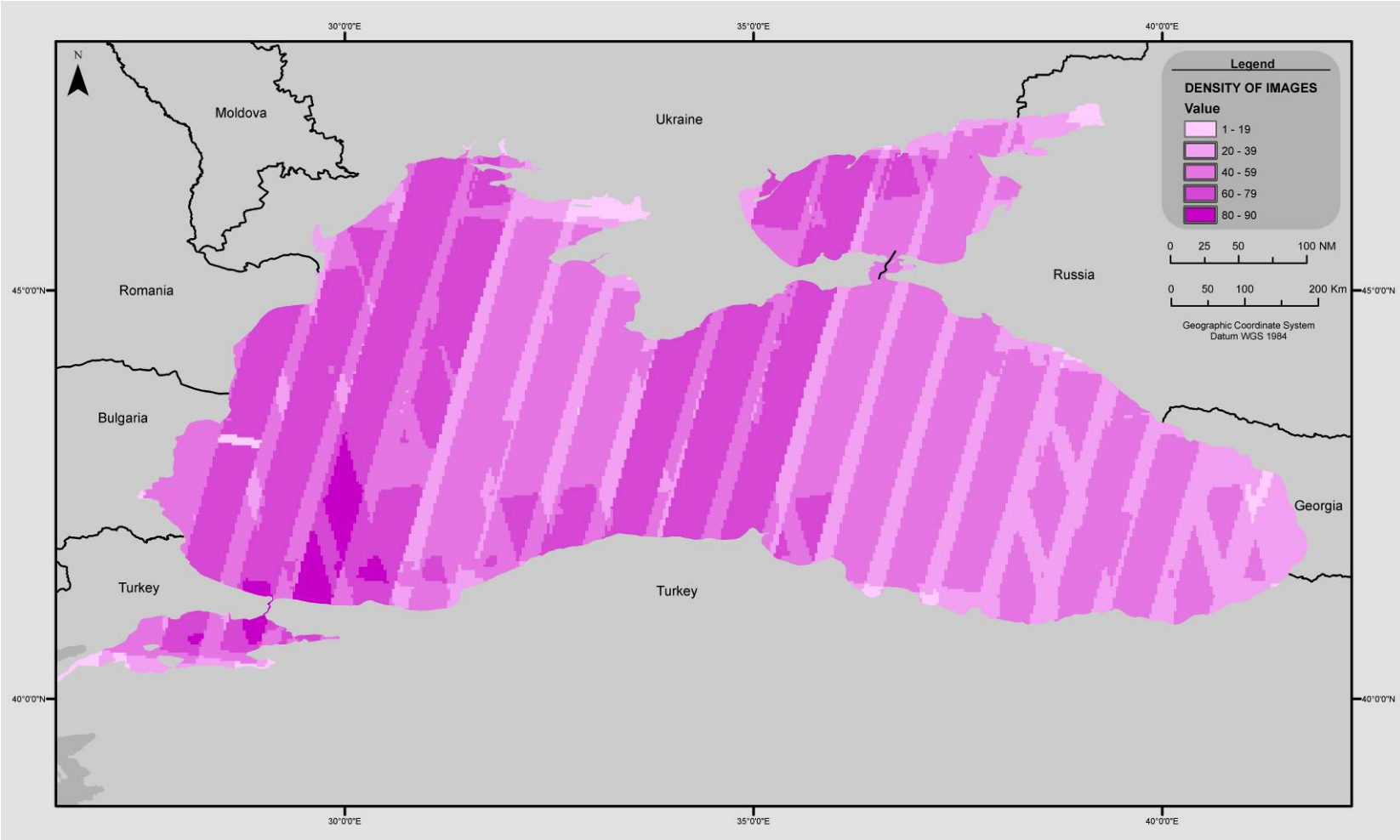
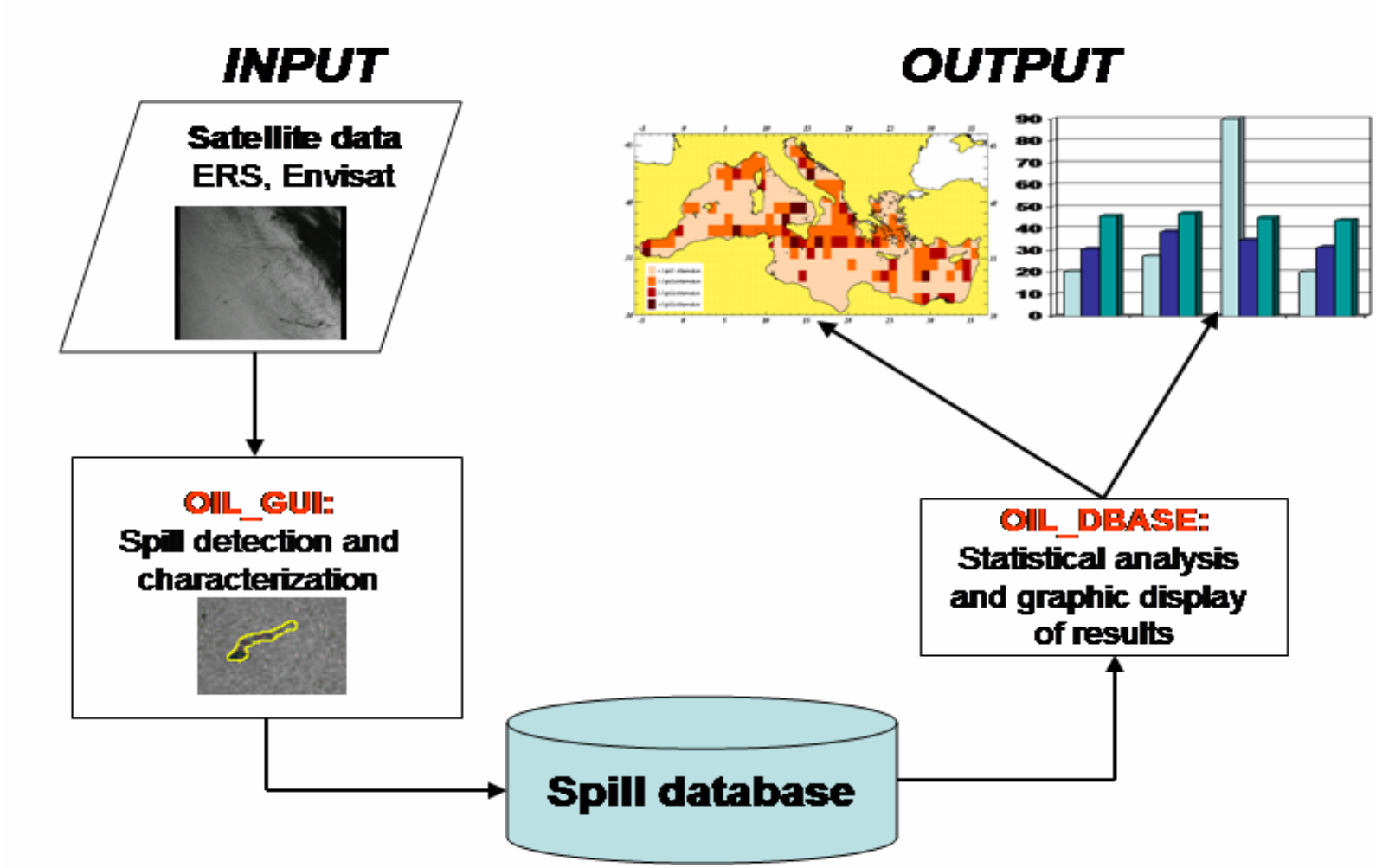
Processing procedure



Black Sea: Density of SAR images (2000, 2001, 2002, 2004)



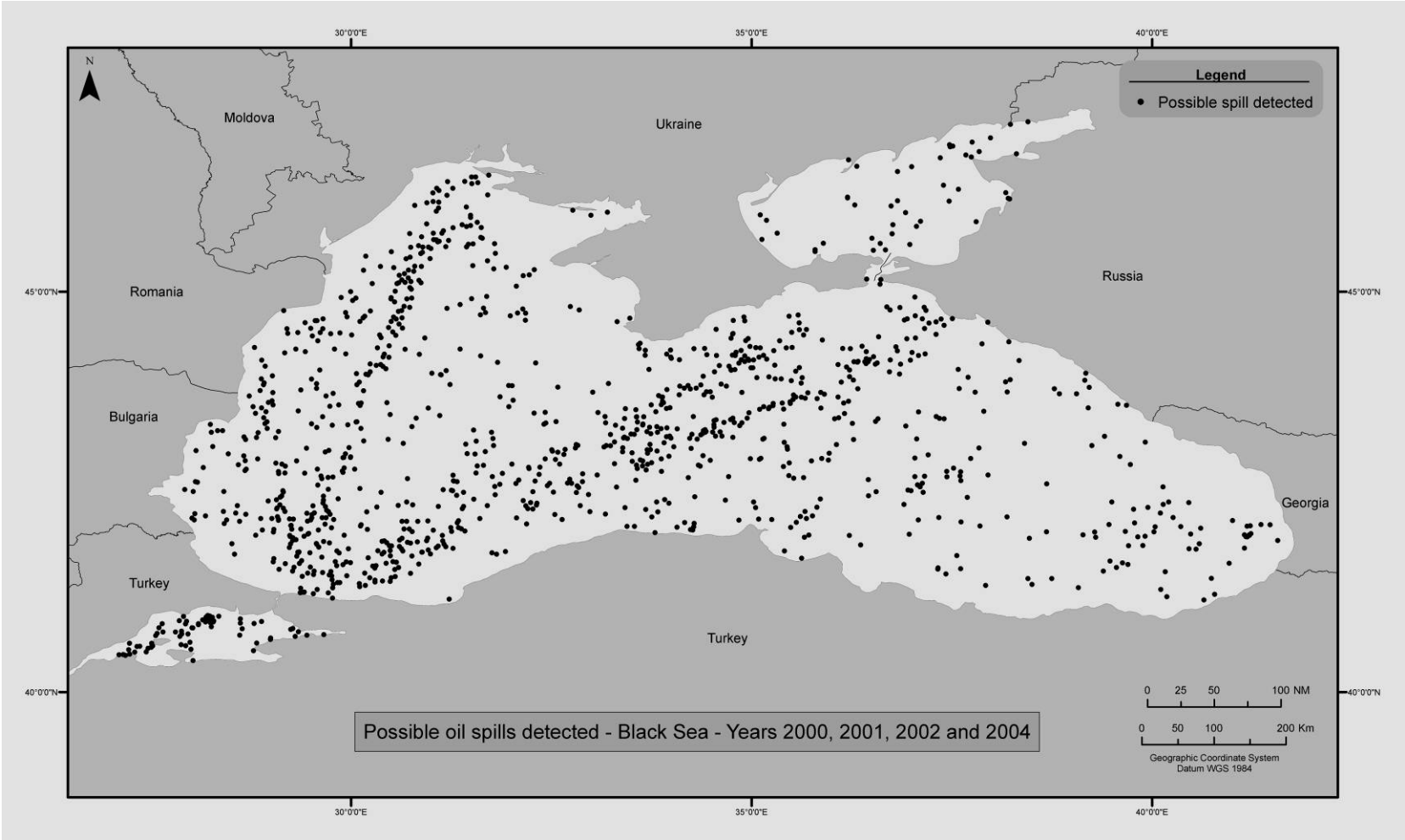
Implementation of an user friendly software package



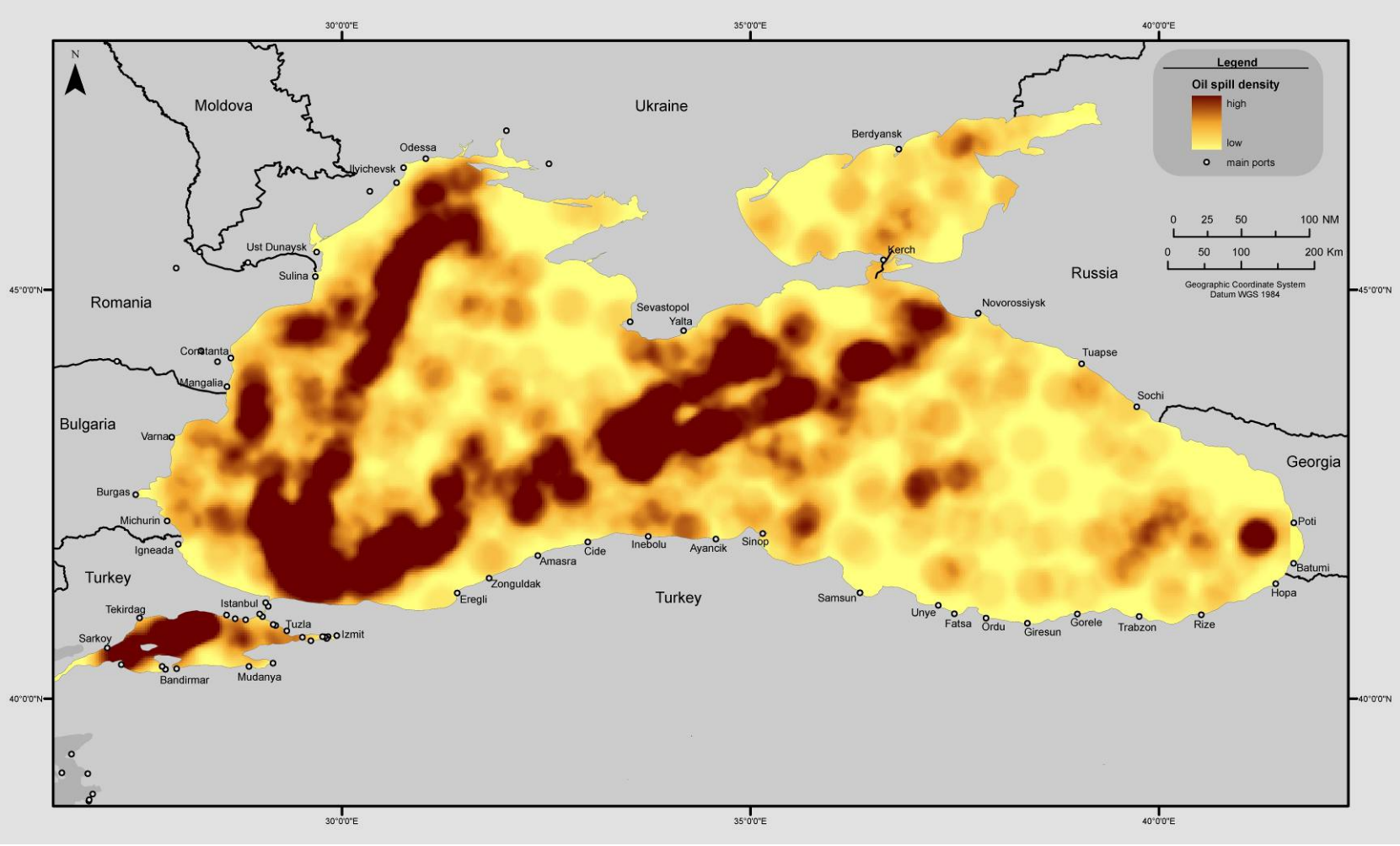
Long-term monitoring of oil pollution

Black Sea: Analysis of satellite images from archives (2000, 2001, 2002, 2004)

3125 SAR images analyzed – 1227 possible oil spills detected



Black Sea: Identification of hot spots



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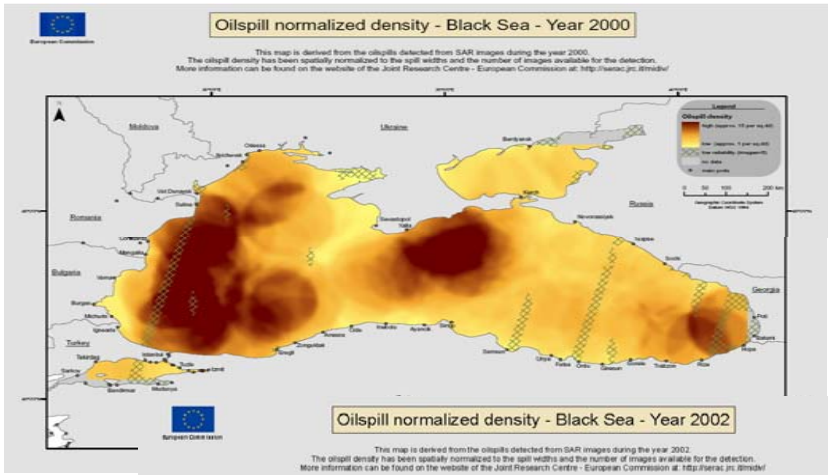
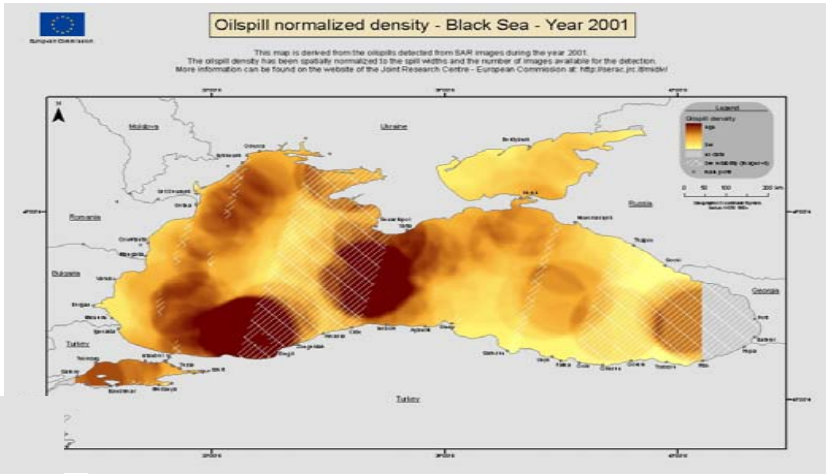
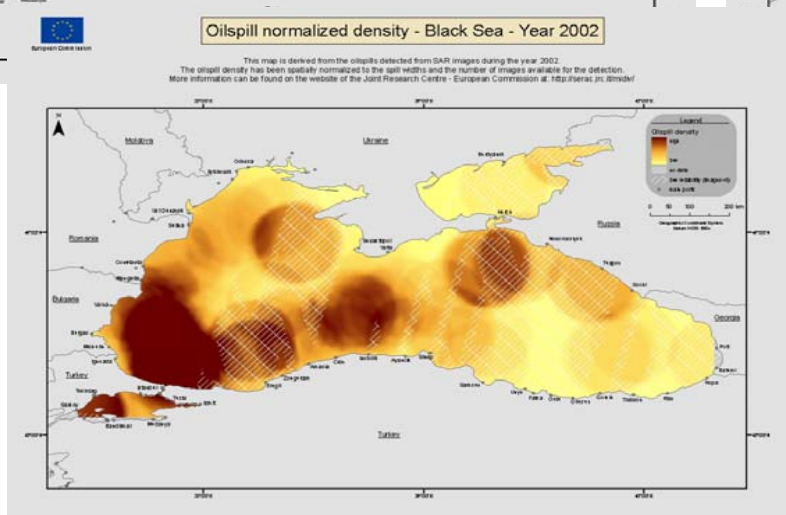
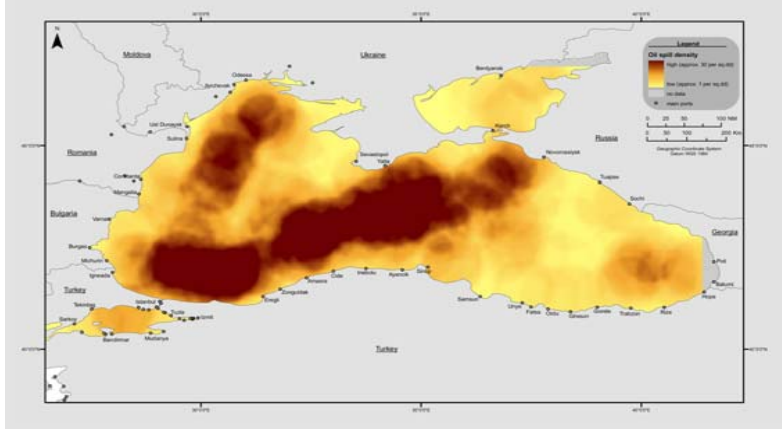
Trend Analysis

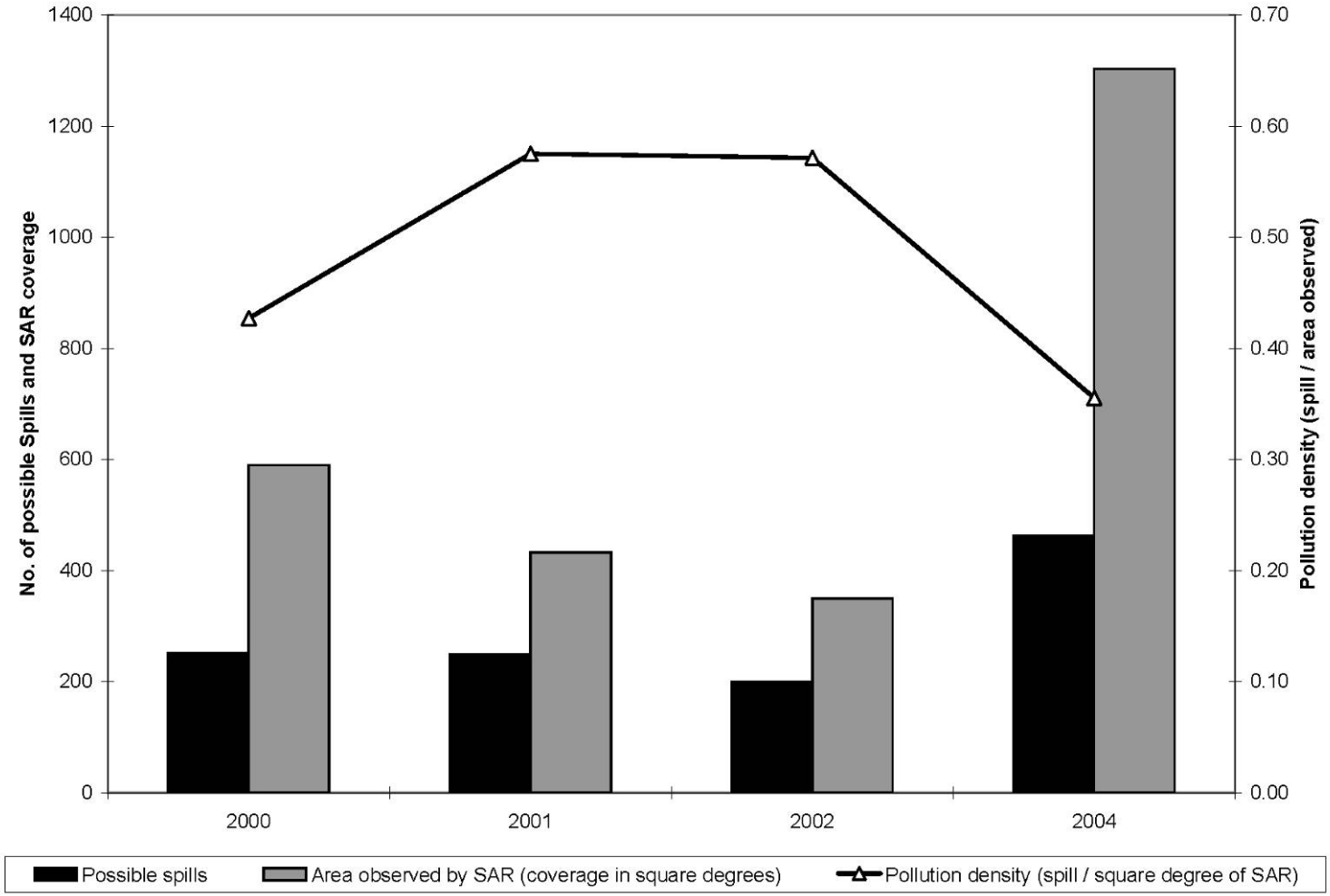








Black Sea: Trends of operational pollution



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Conclusions

- Space-borne SAR sensors has proven their ability to provide long-term monitoring.
- A specific methodology has been implemented and successfully applied.
- The application to the Black Sea basin allowed to identify hot spots.
- The multi-annual analysis reveals that the problem remains stable (or slightly decreasing?) at basin scale as well as in different sub-areas.
- The developed method for trend analysis is flexible and suitable for detailed analysis on specific areas.

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Thank-you for your attention

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