

Interregional water way and water quality monitoring of Danube from the origin up to the Black Sea using GMES

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www.eomap.de

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Bavaria

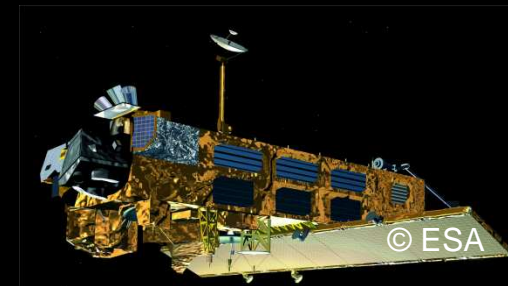


Photo NASA

EOMAP

Earth Observation & Mapping

- EO services for aquatic environments
- Need for interregional river monitoring
- Technical requirements for related EO based services
- Conceptual requirements for successful integration of EO services into applications for river monitoring

1. EO services for aquatic environments

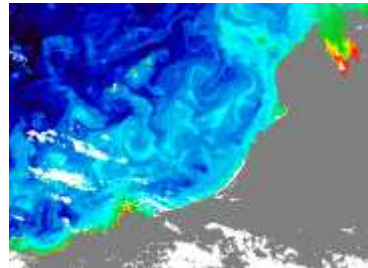


EO based service lines

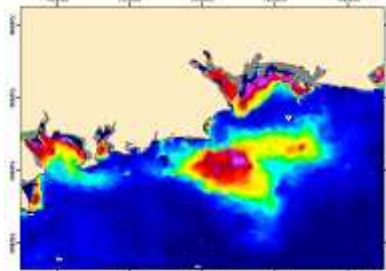
2011

Monitoring services

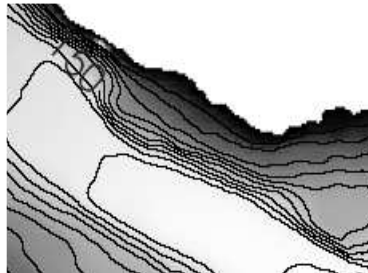
Water quality monitoring



Turbidity monitoring



Water depth mapping



Sea floor monitoring



River way and flooding mapping

Applications

Oil- and gas industry

Dredging

Offshore construction
impact monitoring

Water ways

Pipeline routing

Biodiversity baseline

1. EO services for aquatic environments

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- Industrial mapping contracts for coastal engineering and environmental monitoring

*Offshore and Oil & Gas companies..., environm. agencies
Monitoring in United Emirates, Australia, Mexico, ...*

- Operational satellite VA processors

e.g. ENMAP / DLR, Landgate/Australia,

- International project participation

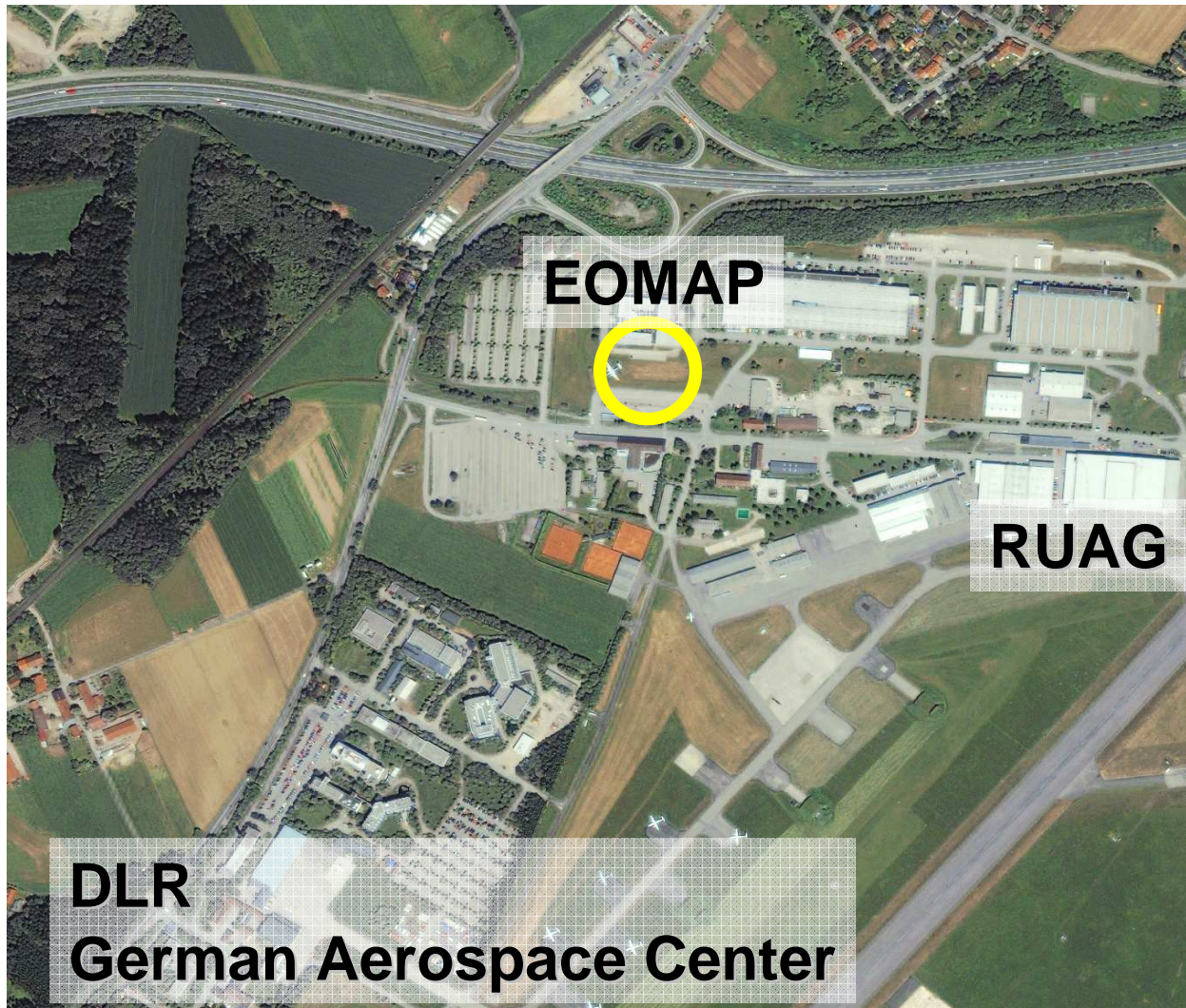
*Vietnam, Mexico, Australia, Armenia, Germany,
.. EU FP7 FRESMON Downstream Services*

Location



1. EO services for aquatic environments

2011



München

Sonderflughafen
Oberpfaffenhofen
82205 Gilching
Germany

Started as DLR spin-off in August 2006

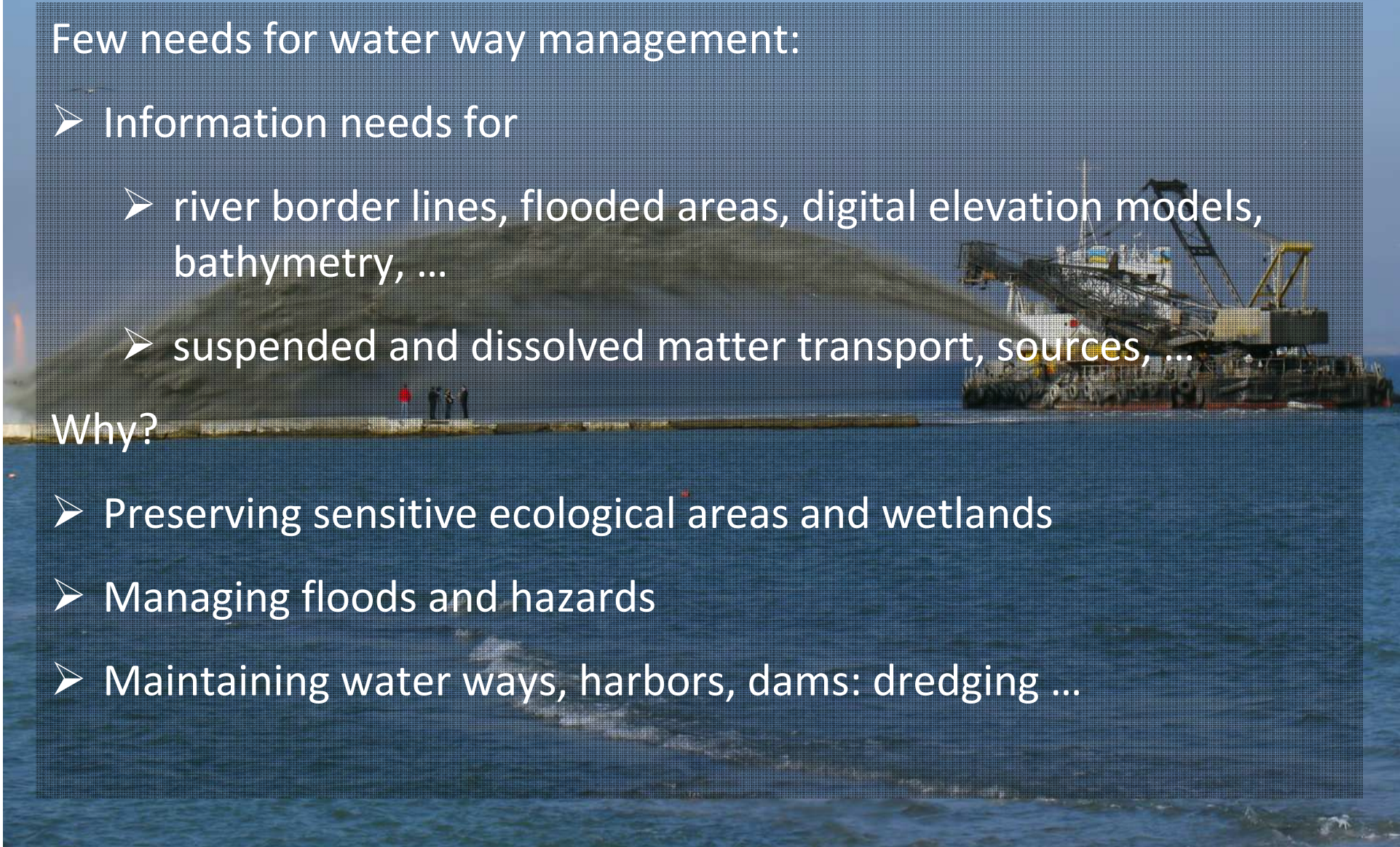
2. Need for interregional river monitoring

Few needs for water way management:

- Information needs for
 - river border lines, flooded areas, digital elevation models, bathymetry, ...
 - suspended and dissolved matter transport, sources, ...

Why?

- Preserving sensitive ecological areas and wetlands
- Managing floods and hazards
- Maintaining water ways, harbors, dams: dredging ...

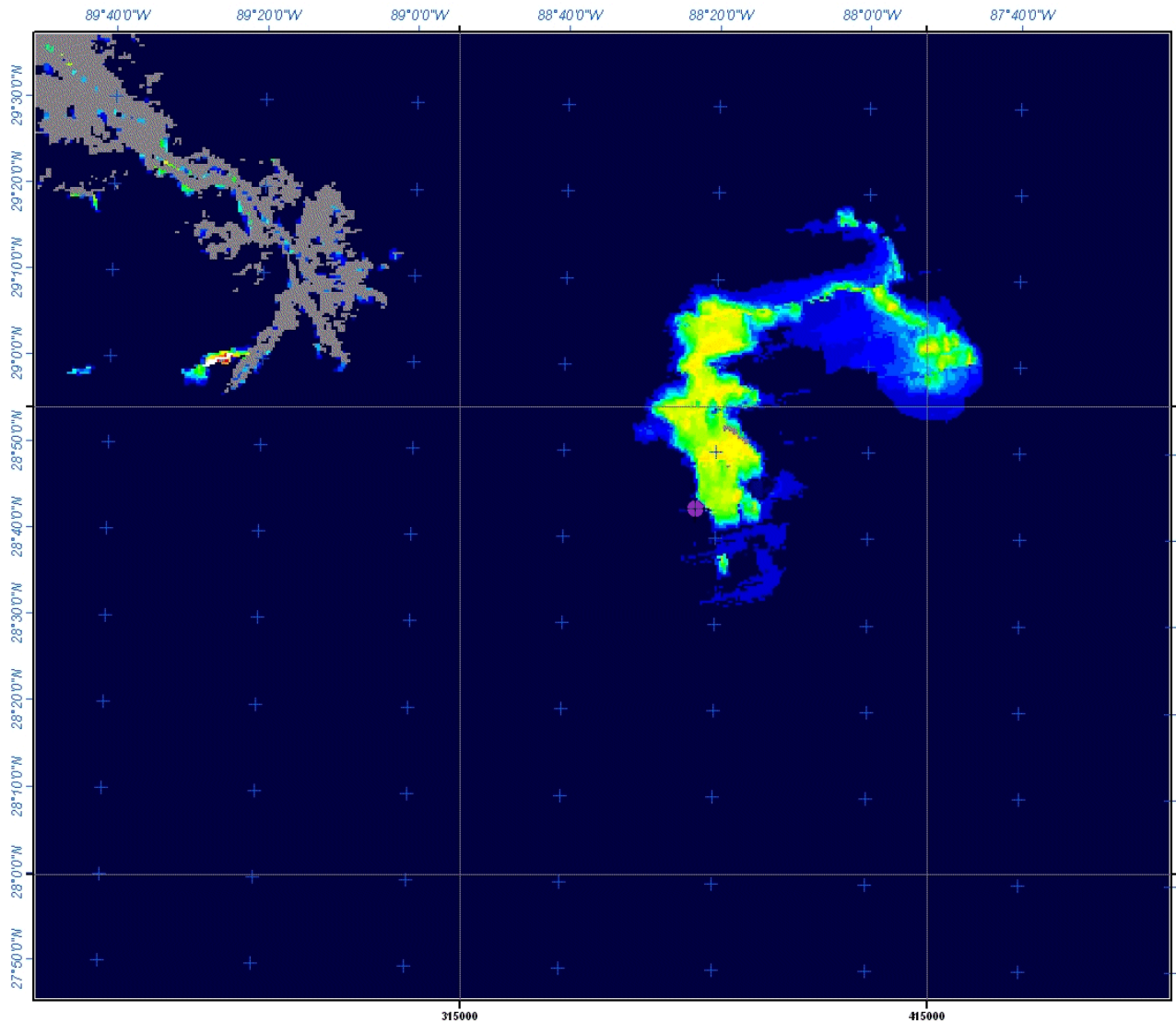


Why? Hazards - Oil spill detection



Louisiana Oil Spill Indication, Gulf of Mexico

2010-04-25



SCOPE

On April 21, 2010, an explosion destroyed the "Deepwater Horizon" oil platform operating in the Gulf of Mexico 80 kilometers offshore. The rig sank to the seafloor, about 1500m below the surface and most workers escaped the rig, but 11 are missing and presumed dead.

The map shows the extent and the Oil Spill Indication on April 25, derived by EOMAP multi-sensor oil indication technique. The Oil indication algorithm provides spatial information about oil film thickness.

DATA SOURCES

MODIS (or Moderate Resolution Imaging Spectroradiometer) is a key instrument aboard the Terra and Aqua satellites. Terra MODIS and Aqua MODIS are viewing the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths at 250m, 500m, and 1km spatial resolution.

PROCESSING / ANALYSIS

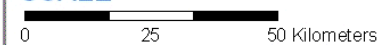
Data were processed with Modular Inversion System (MIP) by EOMAP. MIP is designed for the physically based assessment of hydro-biological parameters from multi- and hyperspectral remote sensing data. The conversion of radiances to detect oil spills is performed using a radiative transfer model. For the displayed emergency application MODIS data at 500m resolution were processed.



LEGEND

<ul style="list-style-type: none"> Former oil platform Lat.: 28°44'12" N Long.: 88°23'14" W Land Cloud 	<p>Oil indication</p> <p>low high</p>
--	--

SCALE



Scale: 1:850 000

Reference coordinate system

Projection:	UTM Zone 16 N	Geographic (DMS)
Spheroid:	WGS 84	WGS 84
Datum:	WGS 84	WGS 84

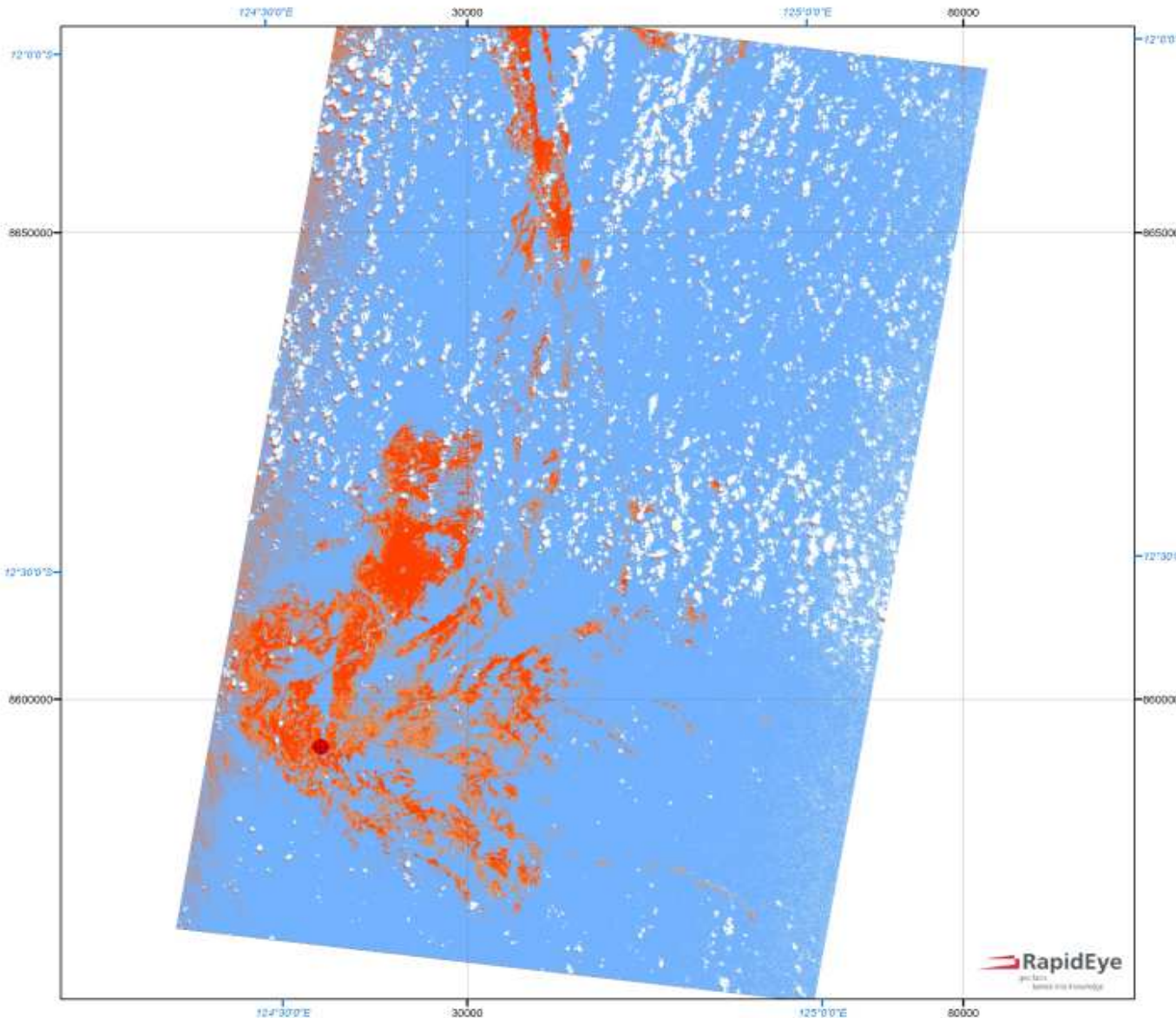


Why? Hazards - Oil spill detection



Oil spill emergency in Timor Sea

2009-09-06 1:400,000



Background

Oil and gas have been spilled from the West Atlas oil rig into the Timor Sea at the Montara development, about 250km off WA's Kimberley coast, starting on 2009-08-21 morning.

Data Sources

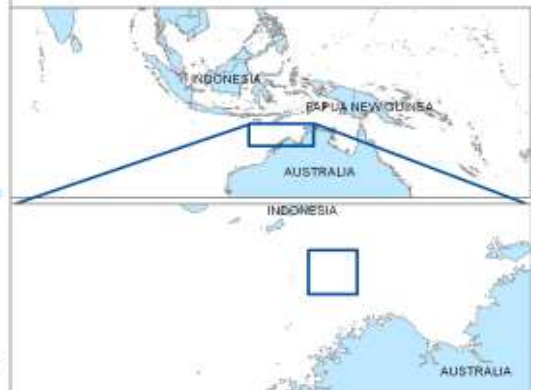
RapidEye's five satellites contain identical sensors, which are equally calibrated and travel on the same orbital plane. This constellation allows a large amount of imagery to be collected (4 million km² each day) and quick revisit times. The RapidEye satellite system is capable of imaging any point on Earth every day. (c) Data courtesy of RapidEye AG, Germany.

Sensor Specifications:

Blue 440-510nm Red Edge 690-730nm GSD 6.5 meters
Green 520-590nm Near IR 760-890nm Dynamic Range 12 Bit

Processing / Analysis

Data were processed the Modular and Inversion System (MIP) by EOMAP. For the displayed emergency application RapidEye data at 6.5m resolution were processed.



Legend

The extent of the oil spill is detected by processing optical RapidEye radiance satellite imagery.

- ☐ Clouds
- ☐ Ocean
- High oil concentration
- Low oil concentration
- Leaking oil platform

Scale

0 5 10 20 km



Scale: 1 : 400,000 (DIN A3 printing)

Reference coordinate system

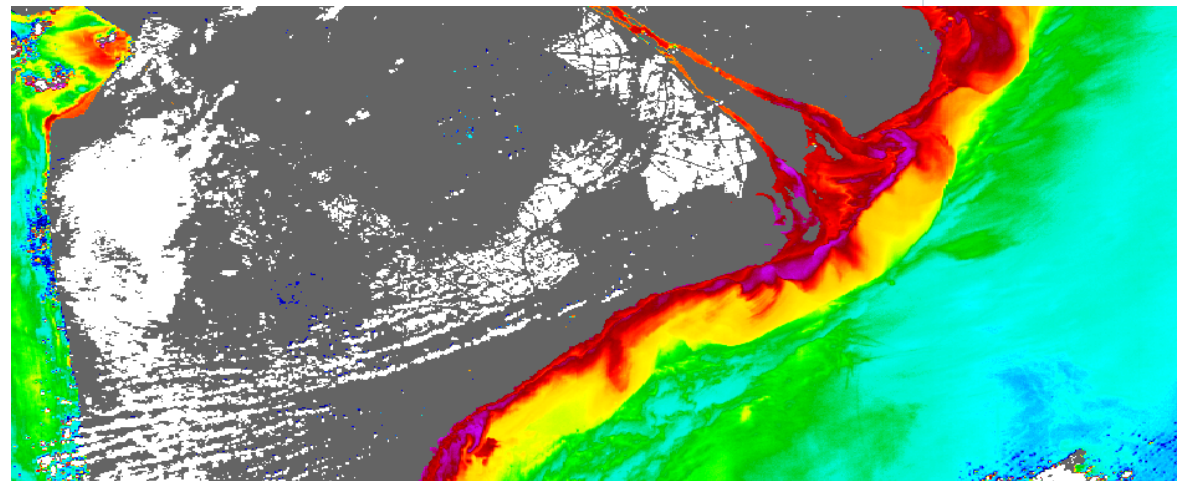
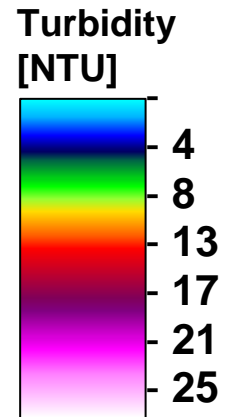
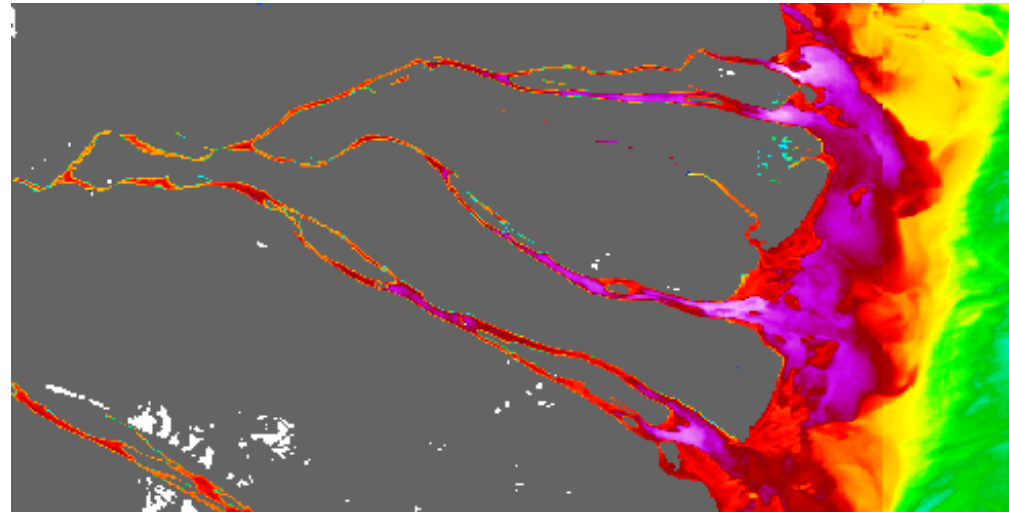
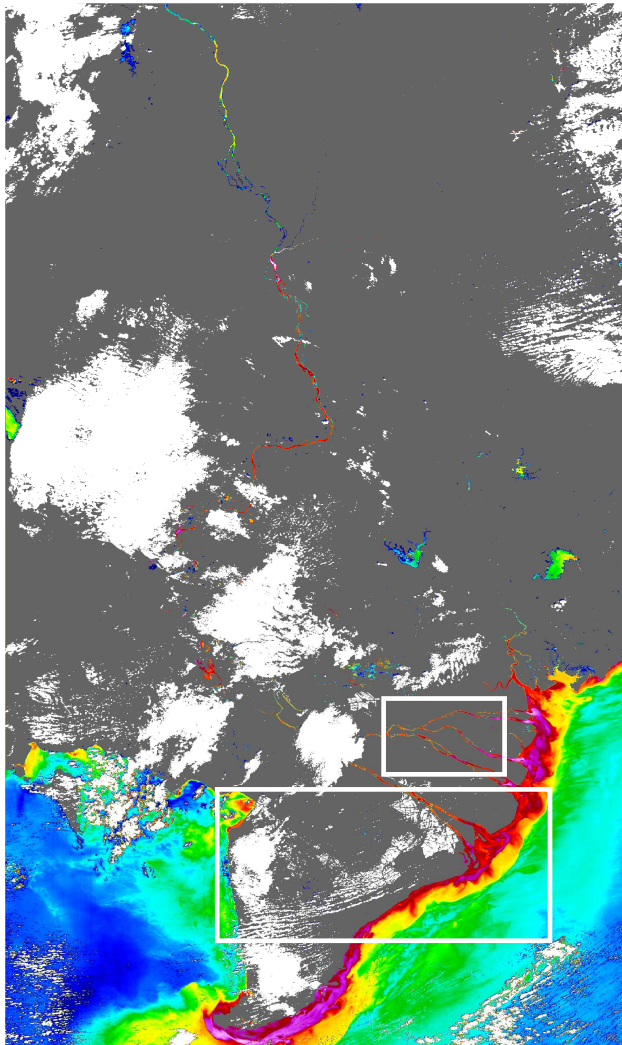
Projection: UTM Zone 52 S Geographic (DMS)
Spheroid: WGS 84 WGS 84
Datum: WGS 84 WGS 84

Why – interregional turbidity measurements, Mekong Delta (Vietnam)



MERIS 300m, 13 December 2009

2011

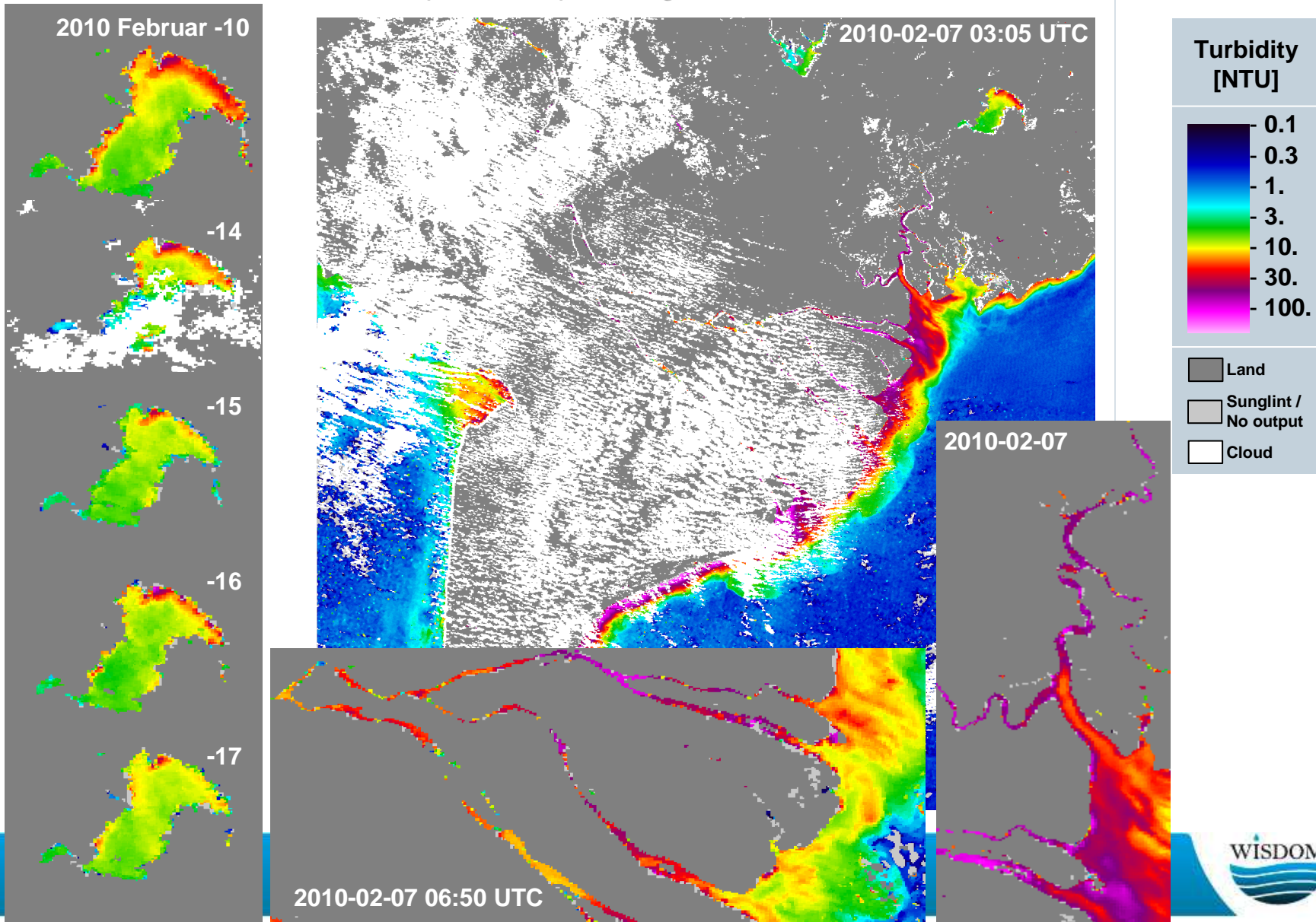


Why – hydropower damm management: TSM impact Mekong Delta (Vietnam)



MODIS 250m series: MIP-EWS Operational product generation

2011



Why? Understanding the sediment dynamics, reduction of dredging costs

River Elbe:

- Dredging costs for water way to Hamburg harbor: > 100 000 €/Y
- Intercalibrated suspended matter and turbidity measurements?



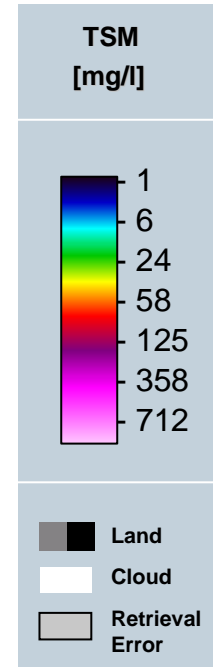
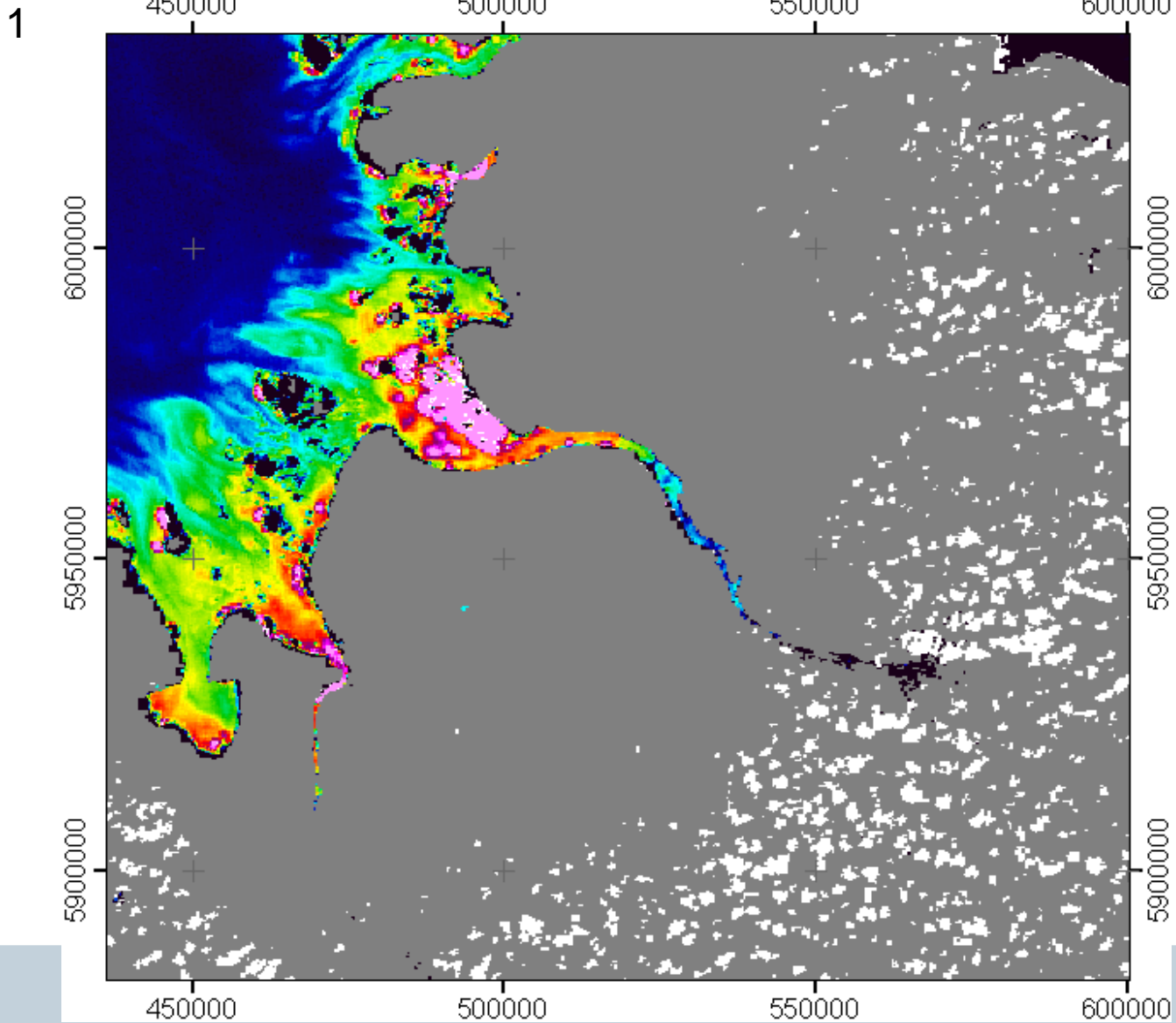
Multi-sensor water quality monitoring



27. Juni 2010, 09:55 UTC

MODIS Terra 250m. River Elbe, Germany

2011



BfG contract

Multi-sensor water quality monitoring

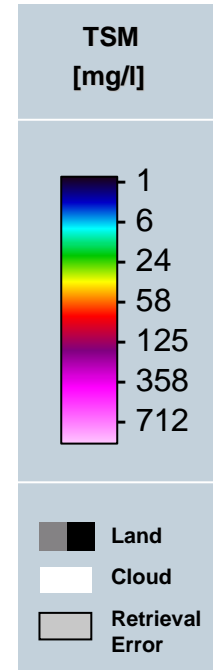
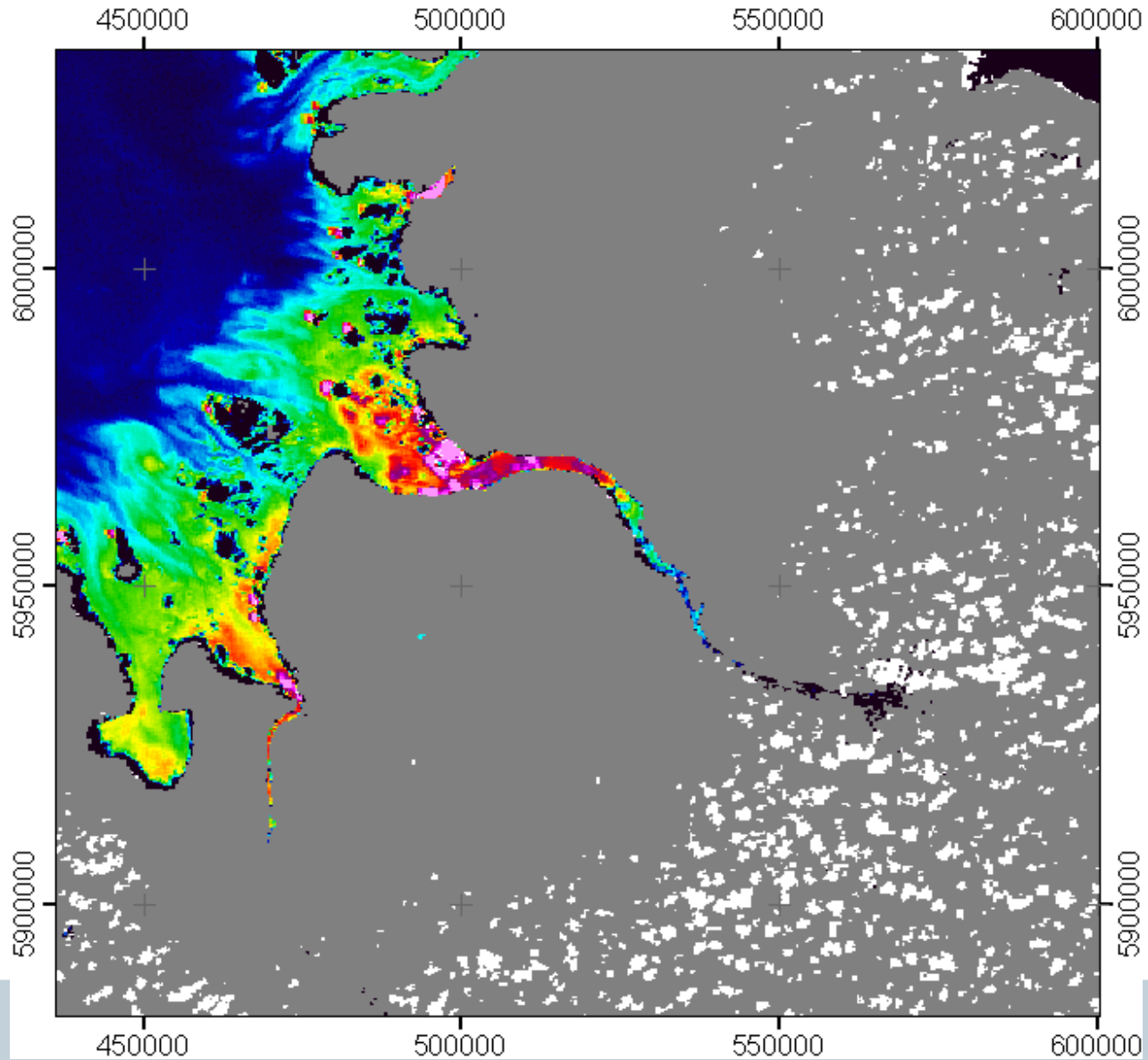


27. Juni 2010, 11:30 UTC

MODIS Terra 250m. River Elbe, Germany

2011

2



BfG contract

Multi-sensor water quality monitoring

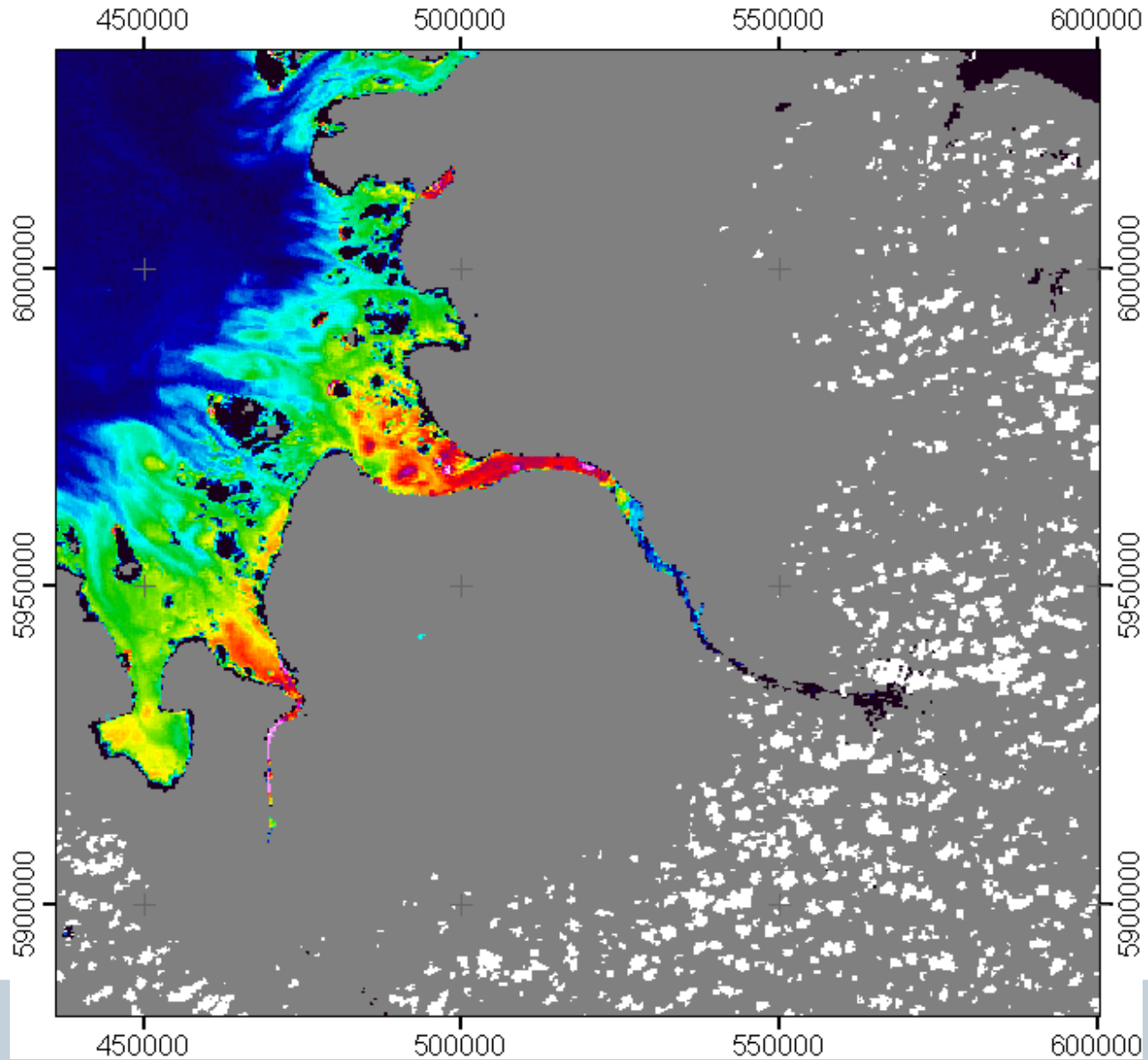


27. Juni 2010, 11:40 UTC

MODIS Aqua 250m. River Elbe, Germany

2011

3



BfG contract

Multi-sensor water quality monitoring

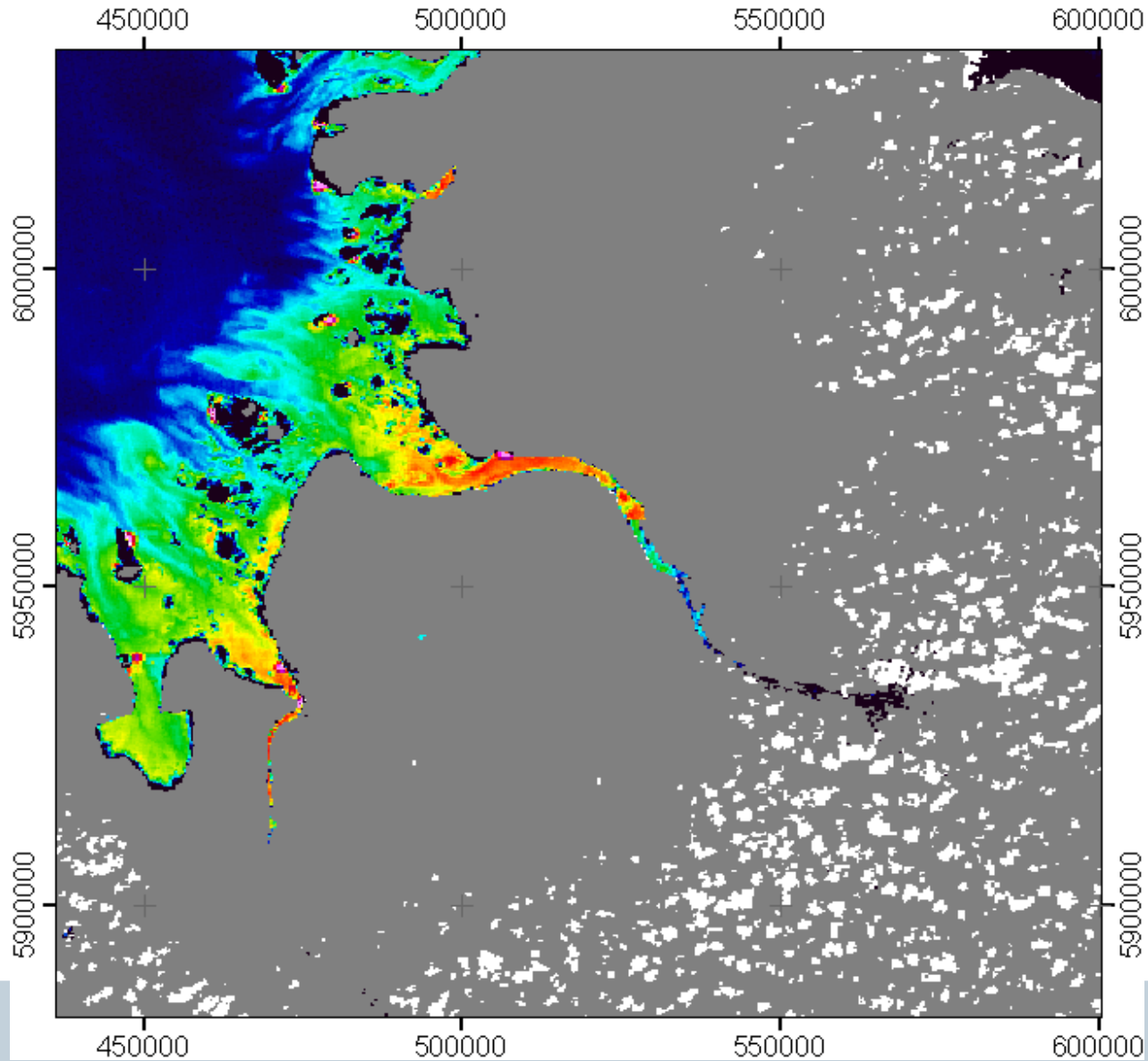


27. Juni 2010, 13:20 UTC

MODIS Aqua 250m. River Elbe, Germany

2011

4



BfG contract

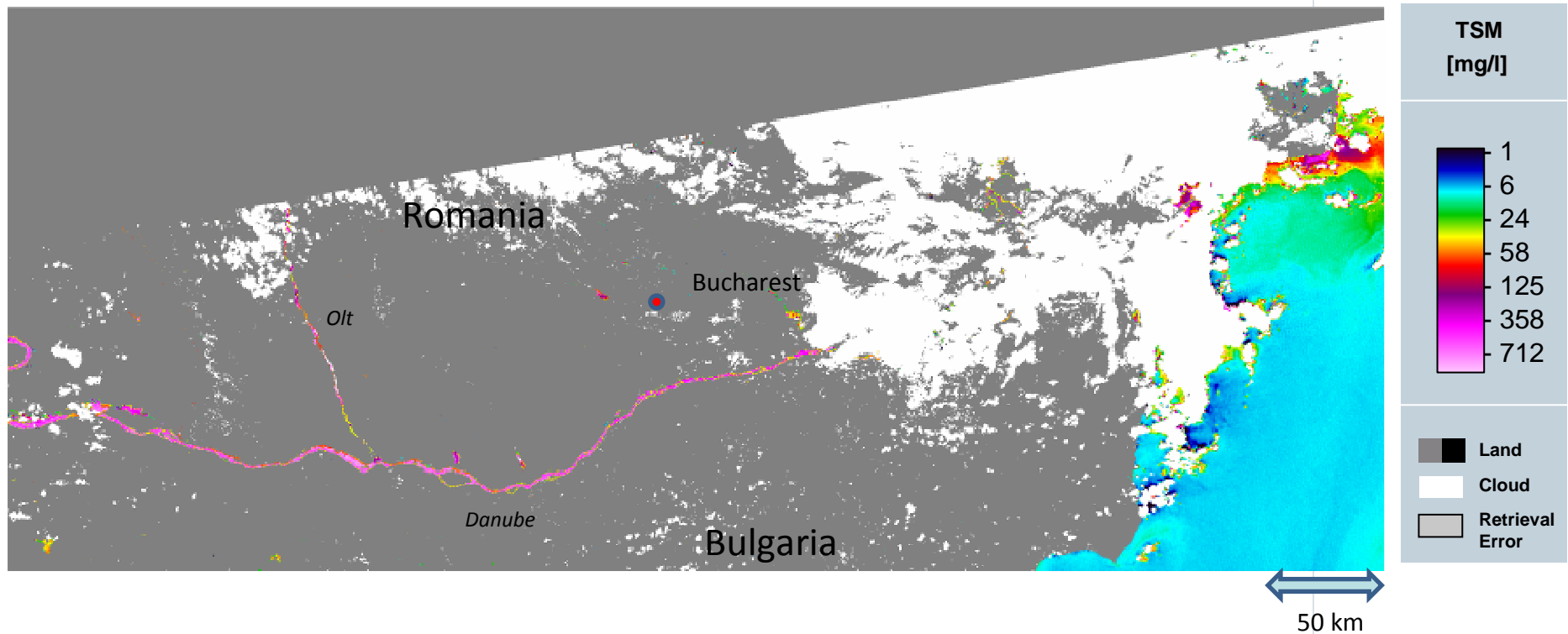
Suspended Matter concentration of Lower Danube (Romania, Bulgaria)



Source: MODIS Data (spatial resolution 250 m) acquisition date: 15.04.2006

2011

Danube flood, 15 April 2006



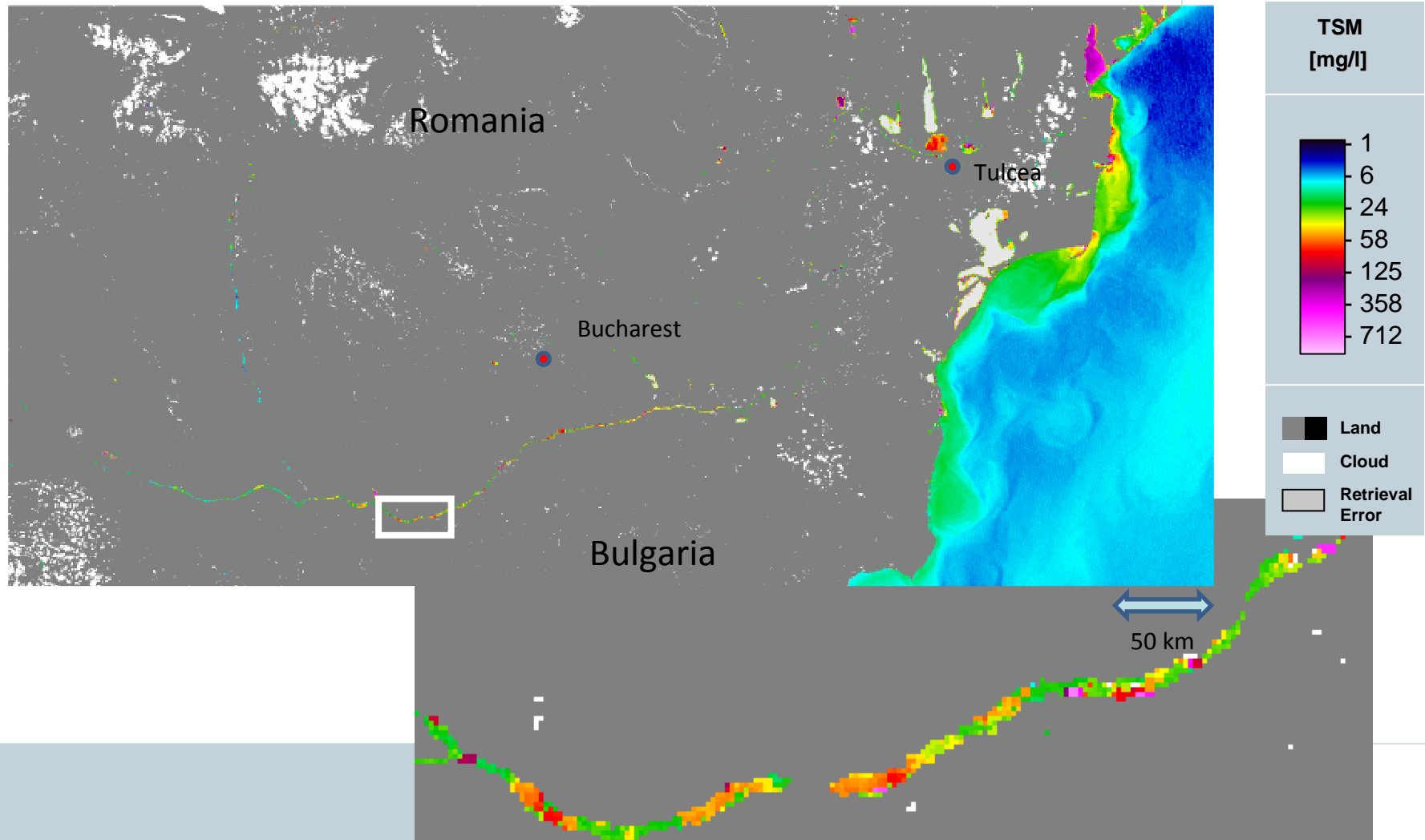
Suspended Matter concentration of Lower Danube (Romania, Bulgaria)



Source: MODIS Data (spatial resolution 250 m) acquisition date: 07.06.2011

2011

Normal conditions, 7 June 2011



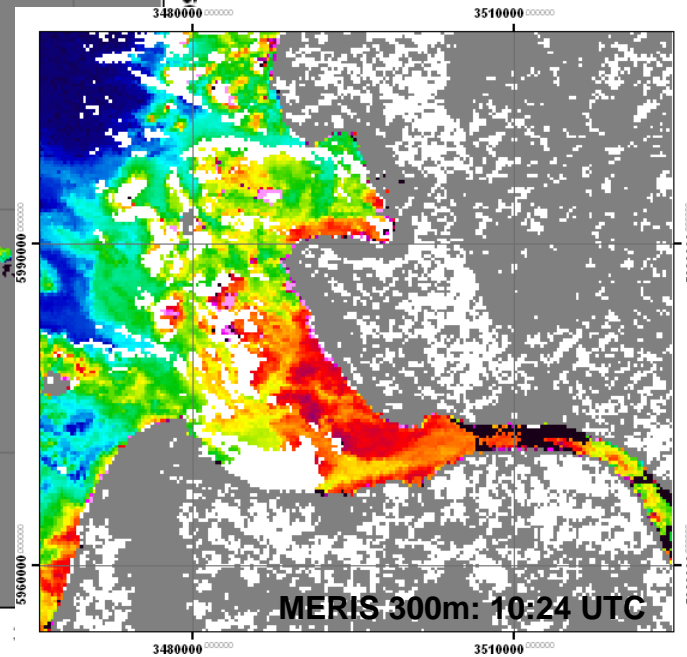
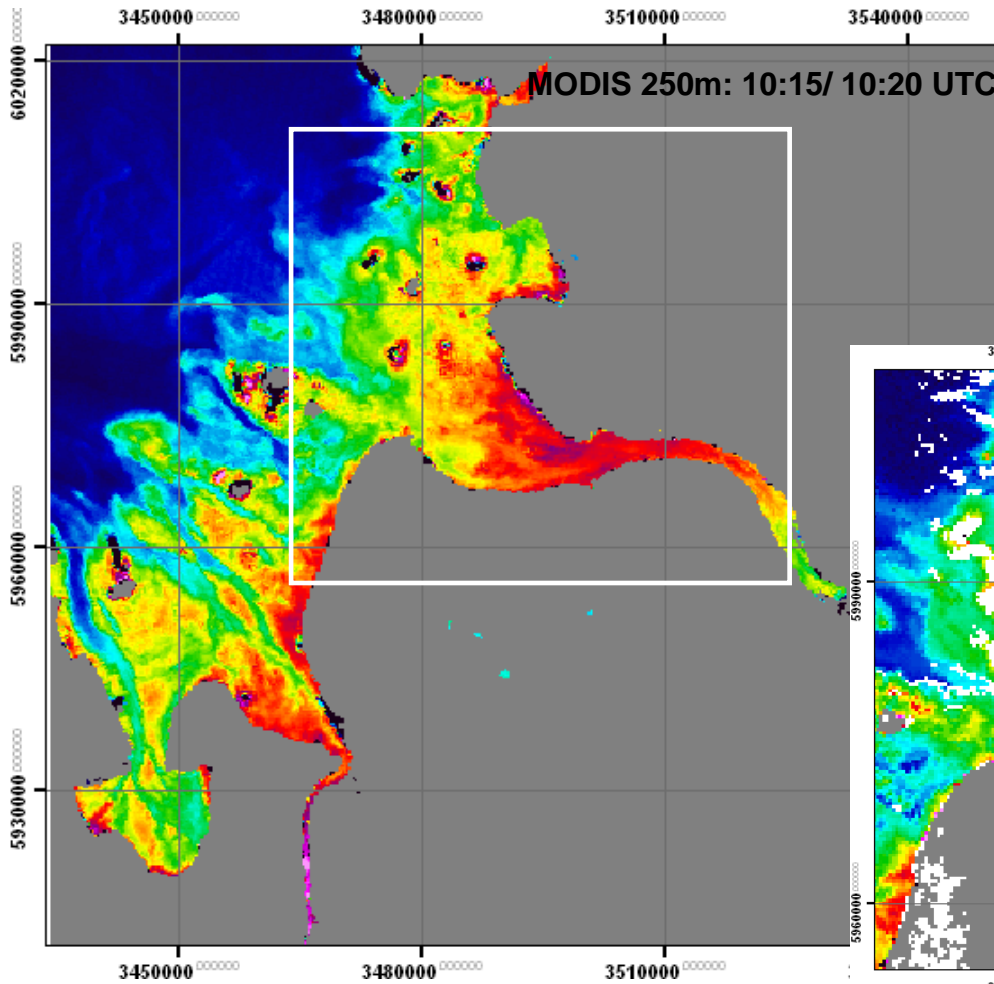
Multi-sensor water quality monitoring



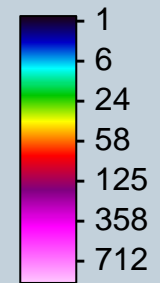
2011

Interpretation – Example BAW

River Elbe, Germany. MODIS 250m, MERIS 300m, 23. Juni 2010



TSM
[mg/l]



Land
Cloud

MODIS 250m:

- scene mosaiced
- no clouds pictured



Slide 18

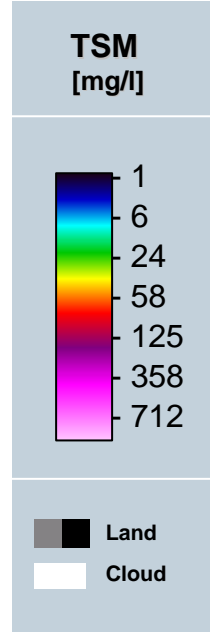
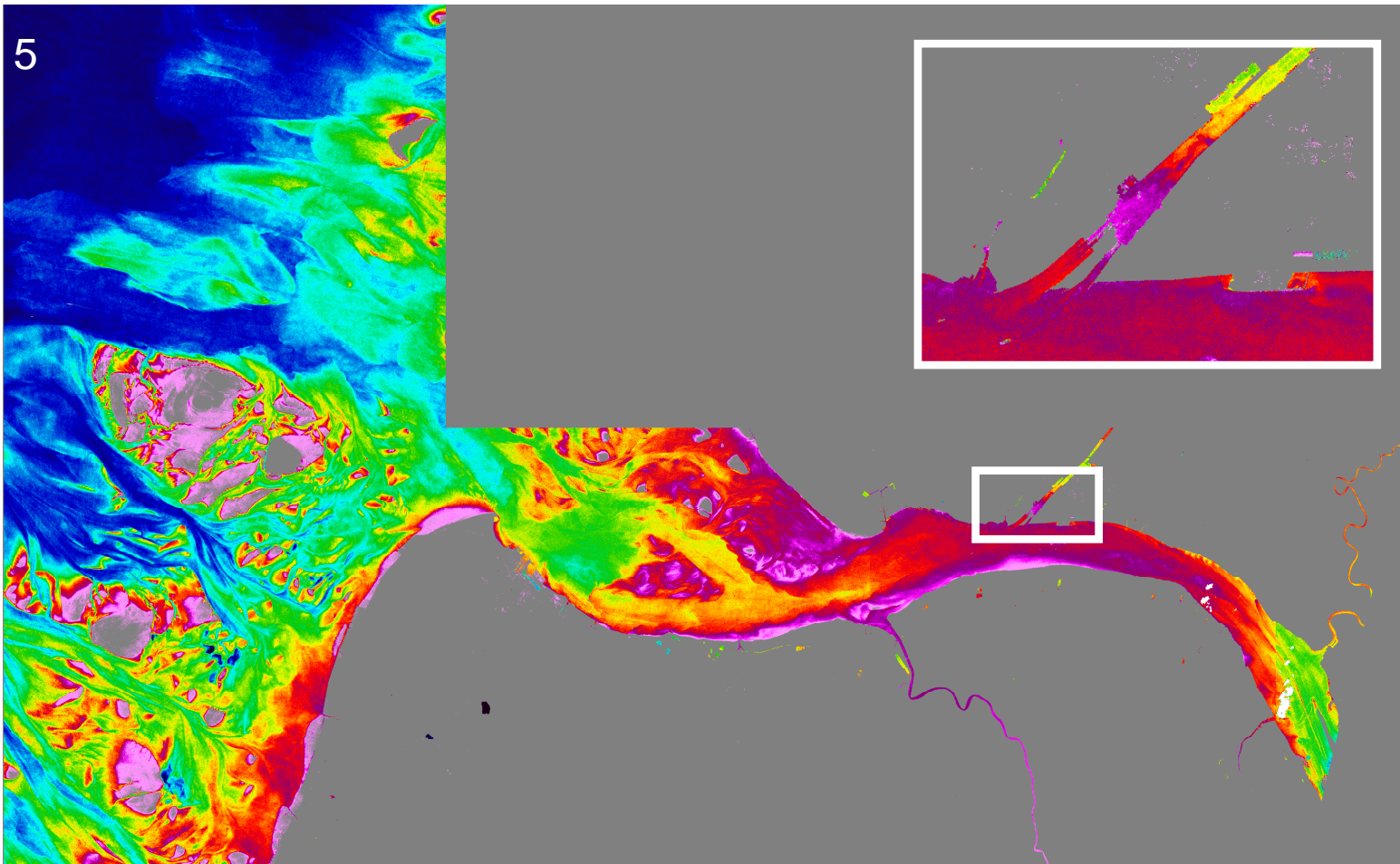
Multi-sensor water quality monitoring



2011

Interpretation – Example BAW

Rapideye 5/ 10m. River Elbe, Germany, 23. Juni 2010, 11:09 UTC



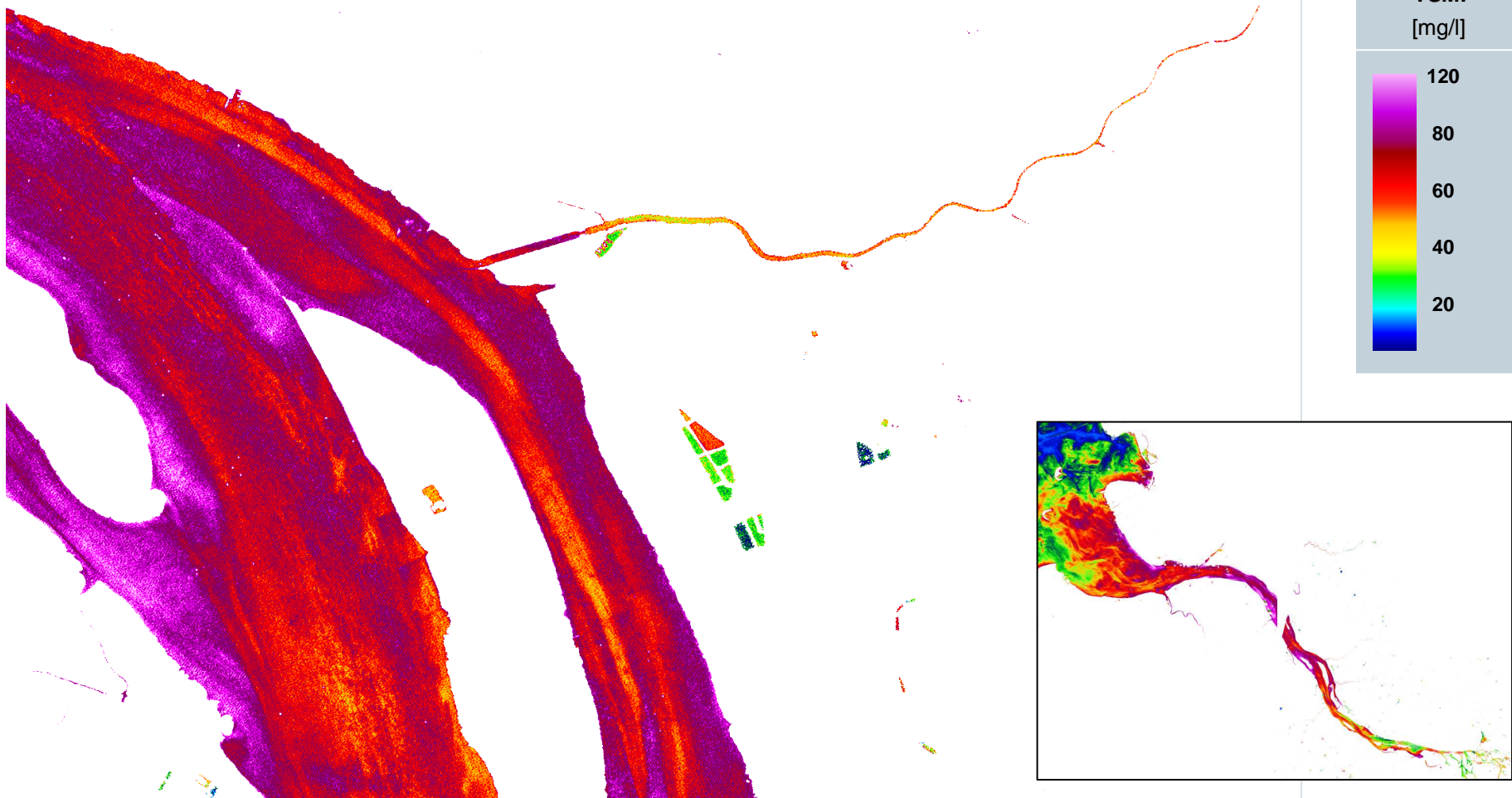
Slide 19

Suspended matter in river Elbe / Germany



RapidEye 6m resolution product

2011



> COMMENTS <

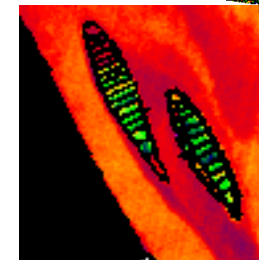
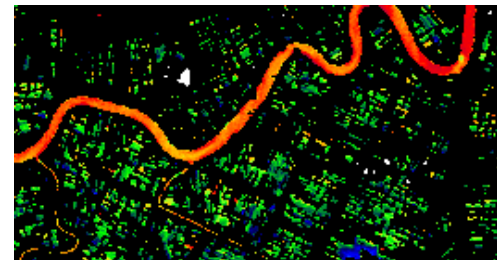
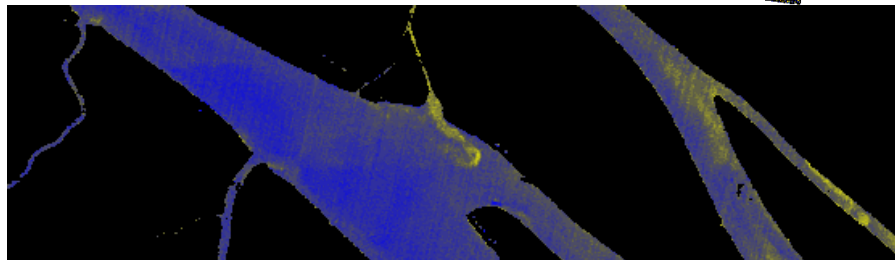
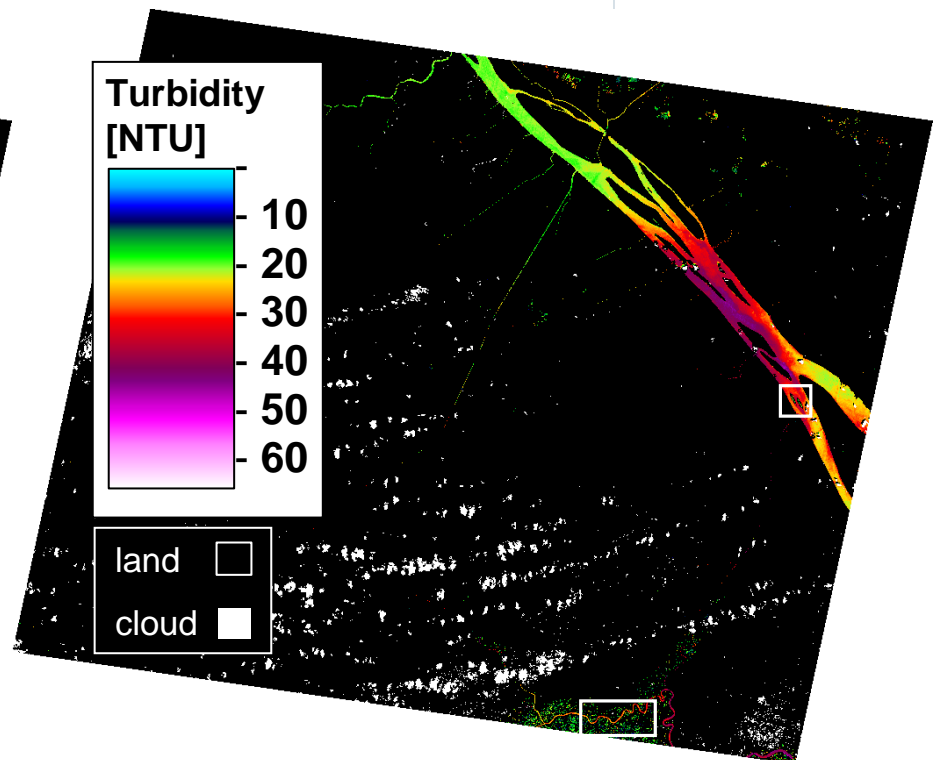
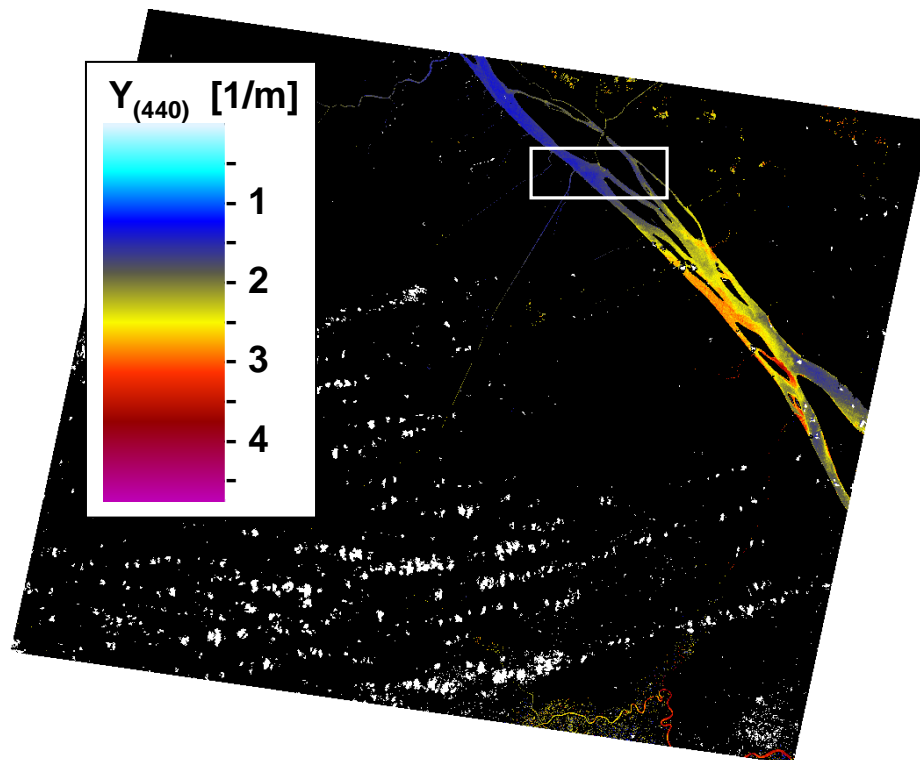
- **Sunglitter correction**
- **MIP standard processor**
- **Coupled retrieval AOD and WC**

Yellow substance and turbidity: MEKONG delta



SPOT 4, March 12, 2008

2011



Technical requirements: EO products for non-space markets



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Technical requirements:

- Fast, sustainable availability of standardized EO products
- Flexible and adequate resolution in space in time

Solutions:

- Multi sensor approaches
- Standardized, operational data processing, worldwide applicable

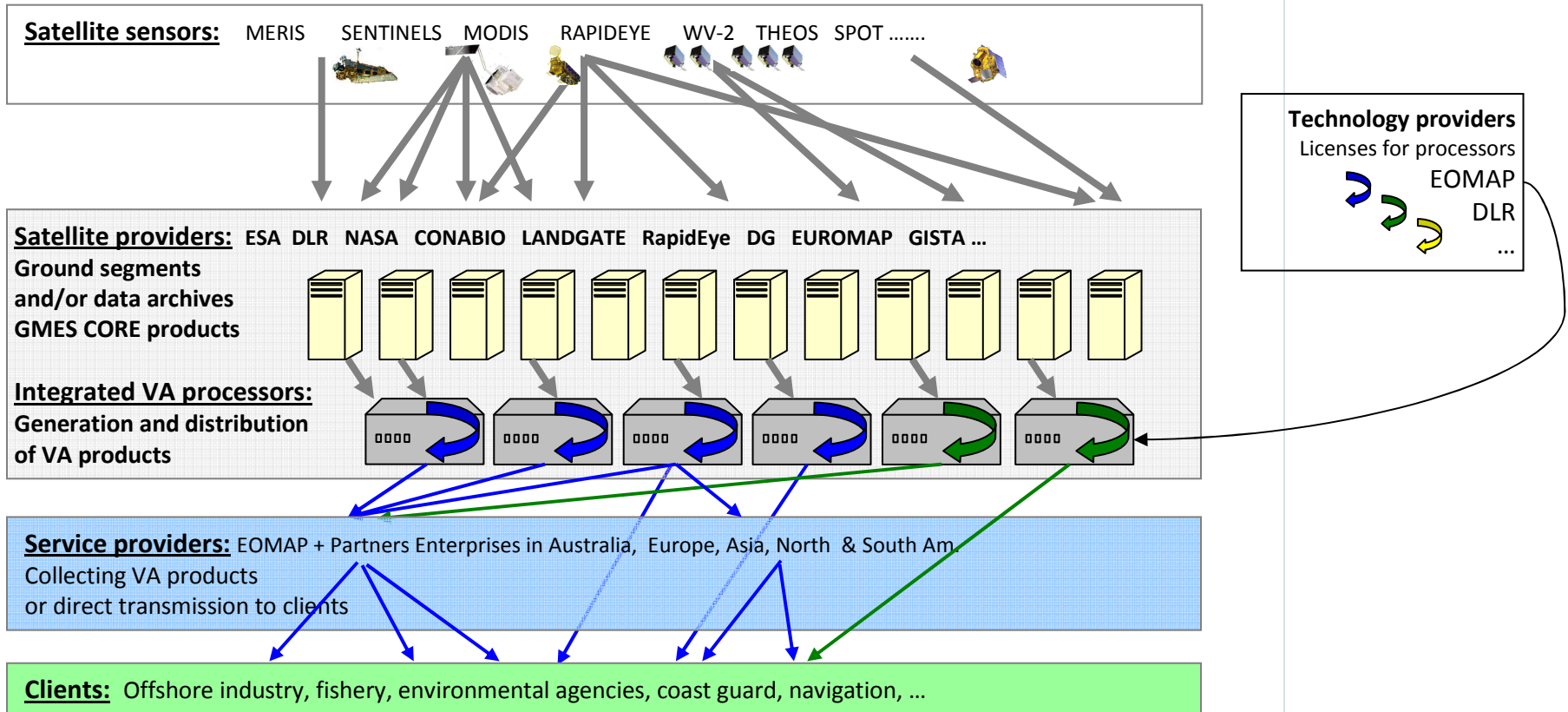
Solutions within and beyond GMES:

- Maximum use and synergy of GMES capabilities >> Access, costs, policies
- Integration with industrial EO services
 - >> Commercial investments into services can significantly push GMES
 - Base: More trust into free market and competition, less centralism
 - >> Reliable policies - for PPP models - clear separation to business cases

EO service infrastructure setup



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Conceptual requirements: Earth observation contribution to the Danube strategy



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Integration of the EO based Danube monitoring services ...

- with (hydrodynamic) river models, ...
- into **interregional** information platforms
 - integrating all aspects (e.g. socio-economic information)

Benefit: Sharing information, reducing costs, increasing synergy and interconnectivity of all river system related management tasks



Thank you for your attention