

# UNEP-DHI Water Quality Webinar Series

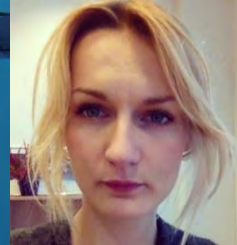
WQ Webinar #6

## Data and Knowledge Management for Water Quality

Facilitator: Gareth James Lloyd



Technical Support: Maija Bertule



UNEP-DHI PARTNERSHIP  
Centre on Water and Environment



[www.unepdhi.org](http://www.unepdhi.org)

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1. **Gorm Dige, European Environment Agency:** *European Water Quality – Experiences with pricing and cost recovery*
2. **Jesper Dannisøe, Water quality expert at DHI on WFD and EIA:** *Environmental Impact Assessments as a tool for WQ management*
3. **Lars Boye Hansen, Senior Project Manager at DHI GRAS:** *Opportunities and experiences in using Earth Observation data in support of global water quality*
4. **Additional questions from the audience**



# Assessment of cost recovery through water pricing

**Gorm Dige**

Territorial environment, policy and economic analysis

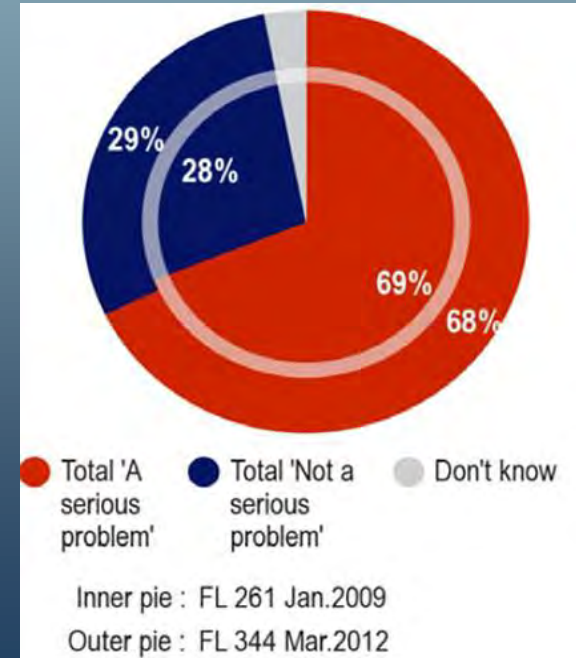
([gorm.dige@eea.europa.eu](mailto:gorm.dige@eea.europa.eu))

<http://www.eea.europa.eu/publications/assessment-of-full-cost-recovery>



# From the 2012 Water Eurobarometer (survey)

- 70% of Europeans realise the seriousness of **water-related problems** and support stronger EU action
- 84% of consumers **support charges** for the volume of water they use
- 12% **disagree** with pay-more-if-you-use-more-principle
- 57% **explicitly** call for a **fairer pricing** policy
- 47% want **stricter water regulation**



# Challenges in Europe

*Article 9 of Water Framework Directive (WFD) – cost recovery of water services taking into consideration environmental and resource costs (ERC)*

*Blueprint to safeguard Europe's water – enforce water pricing/cost recovery obligations under WFD including metering when relevant*



# Purpose of this study

- Water pricing
- Cost recovery including ERCs
- Incentives, affordability and social equity
- Selected countries: Croatia, England, France, Germany, the Netherlands, Serbia, Scotland, Slovenia, Spain and Wales
- Recommendations



# Water prices can be charged in many ways

Water service	Pricing mechanism	Cost types covered*
Water abstraction	Tax or charge	E&R
	Water trading	E&R
Water supply/consumption	Water price / tariff	C&I; O&M
	Tax on water use	E&R
Sewage	Sewage charge	C&I; O&M
Waste water treatment	Waste water charge	C&I; O&M
Water pollution	Water pollution charge/tax	E&R
Quantitative water management	Water system charge	C&I; O&M

\* C&I: Capital and Investment costs; O&M: Operational and Maintenance costs; E&R: Environmental and Resource costs.



# Pricing of water serve as policy instrument to achieve:

Cost recovery



Incentives





# Evidence of water pricing schemes providing incentives to reduce household water use

Czech Republic (1990-2004):

- Fees increased (0.8 to 48 CZK/m<sup>3</sup>) which led to a decrease in household consumption by 40%

Denmark (1993-2004):

- Real price of water (including environmental taxes) increased by 54 % which led to a decrease in urban water demand from 155 to 125 litres per person per day

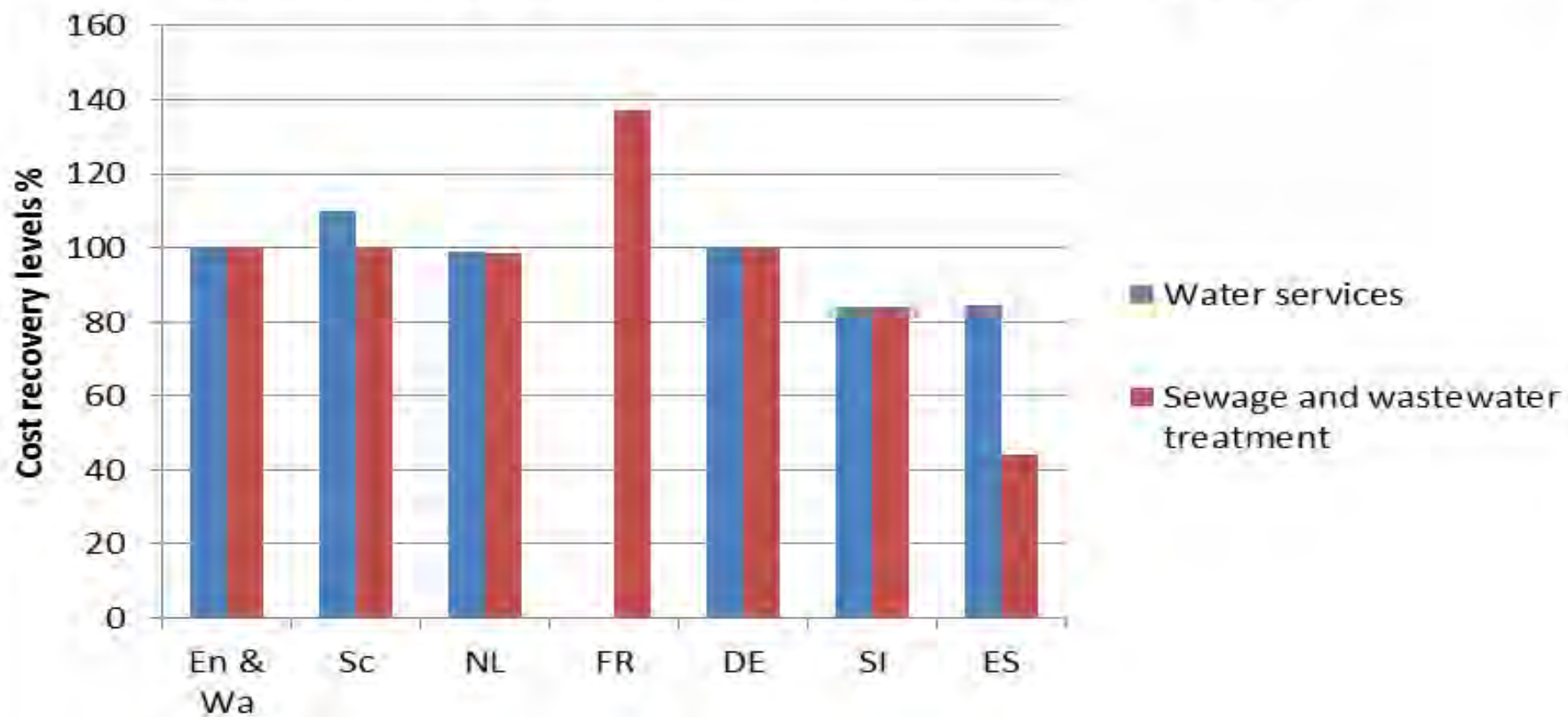


# Water pricing schemes to recover costs in water and wastewater services

Country	Water pricing structures		
	<i>Drinking Water</i>	<i>Sewage/Sanitation</i>	<i>Irrigation</i>
England and Wales	<p><i>Households: fixed + rateable value (if unmetered) OR fixed + volumetric</i></p> <p><i>Industry: fixed + volumetric</i></p>	<p><i>Households: fixed + rateable value (if unmetered) OR fixed + volumetric</i></p> <p><i>Industry: Small users pay volumetric; large users pay fixed + higher volumetric rate</i></p>	Abstraction charges (fixed + volumetric) apply
Scotland	<p><i>Households: fixed (based on tax bracket)</i></p> <p><i>Industry: fixed + volumetric (based on size of meter)</i></p>	<p><i>Households: fixed (based on tax bracket)</i></p> <p><i>Industry: fixed + volumetric (based on size of meter)</i></p>	Only abstraction charges apply
The Netherlands	<p><i>Households: fixed + volumetric</i></p> <p><i>Industry: fixed + volumetric</i></p>	<p><i>Households: fixed (based on size)</i></p> <p><i>Industry: variable (based on pollution units)</i></p>	Farmers using piped water are treated as business customers (industry); farmers using groundwater pay a groundwater charge; farmers using surface water pay nothing
Germany	<p><i>Households: fixed +volumetric</i></p> <p><i>Industry: fixed +volumetric</i></p>	<p><i>Households: fixed + volumetric + runoff charge based on land cover</i></p> <p><i>Industry: N/A</i></p>	N/A

# Financial cost recovery

## Cost recovery levels for water and sanitation tariffs



# Financial cost recovery (agriculture - where irrigation water tariffs are in place)

Country	Cost recovery levels	Year
Netherlands	99% (figure including all sectors, i.e., domestic and business users including farmers)	2010
France	O&M costs: 100% Investment costs: 15 – 95 % (Average: 55%)	Arcadis, 2012
Spain (Guadalquivir RBD)	49,78%	2005
Cyprus	51%	Arcadis, 2012
Greece	54%	Arcadis, 2012
Italy	20 – 30 % (South) 50 – 80 % (North) Average: 50%	Arcadis, 2012

# Any progress in internalising ERCs in water pricing schemes (selected examples)?

- New requirements in WFD Article 9 – not affect mechanisms put in place for recovering ERCs as indicated in total revenues
- Absence of drastic changes in revenues from env. taxes

(000s Euros)	2005	2006	2007	2008	2009	2010	2011	2012
Germany (all Länder)	339,480	289,140	269,330	254,040	-	-	-	-
France (all agencies)	1,789,300	1,665,800	1,730,400	1,876,200	1,838,700	1,959,600	2,044,700	2,084,000
Spain (ACA)	326,110	336,967	322,127	347,518	366,420	-	-	-
UK (EA)	119,400	114,300	184,500	188,900	200,000	200,600	194,300	196,700
Scotland (SEPA)	12,728	13,940	16,954	18,867	19,452	19,082	19,459	19,929

# Proposed options for reporting ERCs

- EU wide implementation of cost recovery principles - comparable systems for reporting of utility costs and revenues
- System needed that indicates what areas of ERCs are covered
- Benchmarking initiatives
- Reporting sheet for assessment of inclusion of ERCs in cost recovery (p. 103)



# Affordability levels for drinking water supply and sewage and wastewater treatment services

Country	Affordability for the household sector [% of disposable income]		
	Drinking Water Supply	Sewage and Wastewater	Year
England & Wales	1.09	1.21	2009/2010
Scotland	0.96		2010/2011
The Netherlands	0.6	1.00	2009;n.d.
France	0.42	0.38	2009/2010
Germany	0.55	0.68	2010
Slovenia	1.4	0.2	n.d.
Spain (Catalonia)	0.52		2010

# Do water pricing schemes account for social concerns?

- In examined MS affordability taken into account
- Some water authorities perform periodical pricing studies
- Some MS specify means to achieve affordability others leave this unaddressed
- Artificially low water prices not the best way to ensure affordability – risk of underfunded service providers....





# Example of means for achieving affordability

- Reductions in service charges
- Social welfare allowances
- Water charges pegged to the value of the house
- Sewage charge remission for households that cannot afford to pay
- A remission for the purification, pollution and water system charges
- Support through social welfare – includes an allowance for the cost for water service



# In conclusion - ways forward for pricing schemes

- Water bill is variable
- Volumetric or increasing block rates
- Rates or rules fixed in a transparent way
- Rates high enough for water suppliers to invest in improvements
- Affordability through social measures
- Regional variations reflected in water prices



**Please do not hesitate to ask us!**

**Contact the European Environment Agency for information**

<http://www.eea.europa.eu>



# Water quality: EIA as a tool

**Jesper Goodley Dannisøe, Senior  
Project Manager**

**Title: Senior Biologist**

**Bio: Large-scale infrastructure, water  
quality, EIA and monitoring**



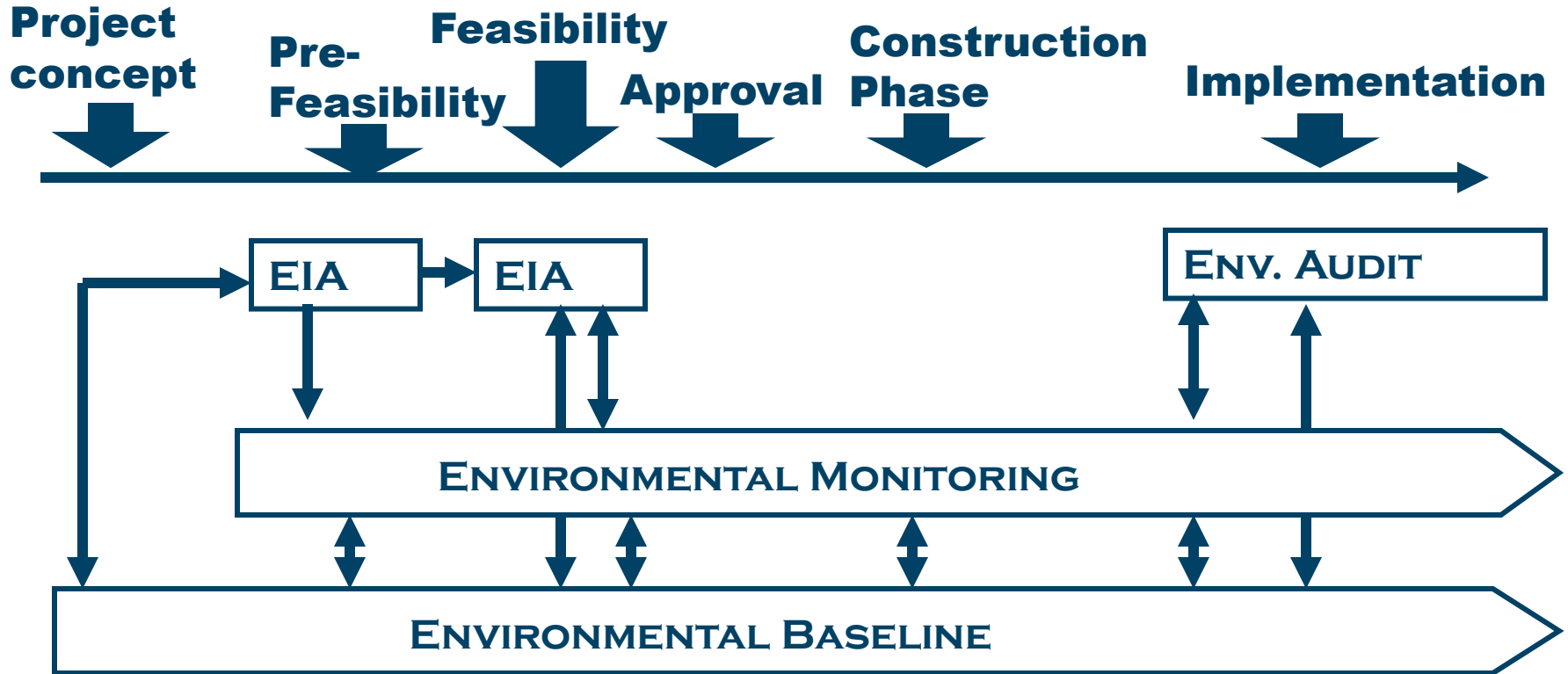
25 november

Environmental Impact Assessments as a tool –  
Why are Environmental Impact Assessments  
necessary and how to work with it?

## Legislation:

- Legislation very similar in most countries, often based on WB/ADB guidelines.
- List of operations requiring an EIA are country specific

# EIA in the Project Cycle



# OUTLINE OF THE EIA PROCESS

## Steps in the EIA

Screening



Bounding



Scoping



Data Collection



Analysis



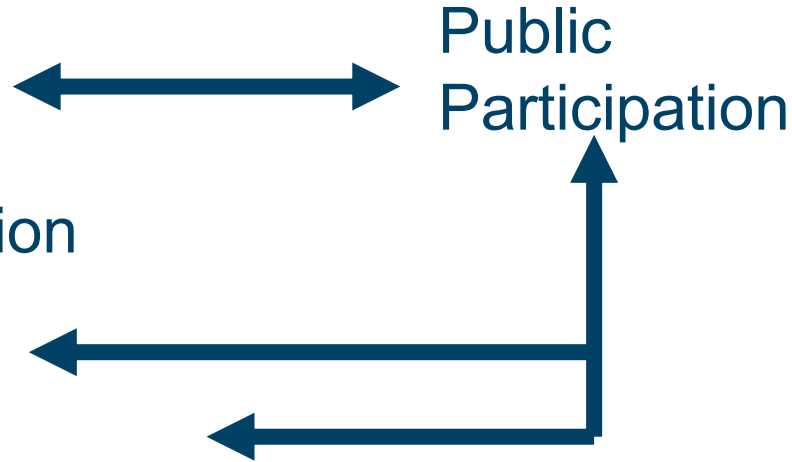
Mitigation



Quality Assurance



Report





# Screening

SCREENING. This is usually part of the regulatory requirements and set in conjunction with the planning authorities.

The project is screened according to legislative standards / demands:

Does the project require an EIA or not?

# Guidance on stages in screening

- Check mandatory project lists
- Check whether project is in a location where EIA is required
- Refer to guidance on projects which may require EIA
- Collect further information

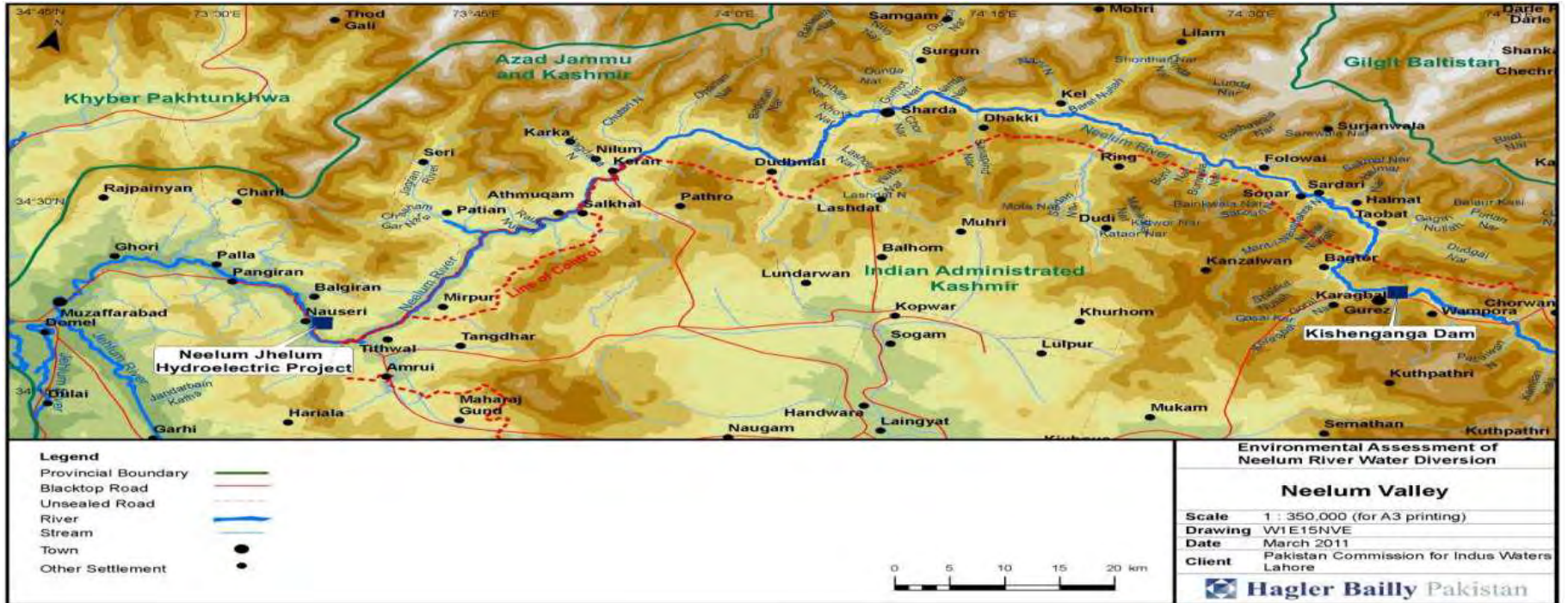
# Bounding

## Setting the spatial limits of the EIA

Bounding of the “project area” for an EIA may be confined to:

- A few hectares
- A few square kilometres or
- The globe!

# Project versus impact area



# Scoping

SCOPING. This is a crucial element in which the exact components to be studied by the EIA are carefully defined. These components in a holistic EIA will cover all relevant disciplines, and will relate to the areas of possible changes (positive & negative).

# Scoping

Defining the components to be assessed

**The scoping and definition of the components is the most critical part of the EIA!!**

# Use inventories in the scoping process

- Which type of equipment and chemicals
- Which processes and techniques
- The size of the water consumption
- Hazardous waste
- Transportation of the labour force
- Changes of the landscape
- Emissions ( Acid rain, waste water, chemical fall-out..)
- Social consequences
- Etc

# Public participation

## Purpose of the Public Participation:

- to inform the public about the proposal
- to improve the scoping of the EIA
- to identify local concerns/problems
- to allow a wider discussion of the environmental and social issues
- to improve the forms of mitigation
- to provide quality control to the EIA through acceptance by the public
- to protect and improve democratic governance



# Public participation

## Methods for Public Participation:

- Information displays
- Direct questioning of individuals
- Group meetings
- Opinion surveys
- Meetings with elected representatives
- Formal inquiries
- Any new information technology!

# Data Collection / Analysis

DATA COLLECTION. Once the components have been defined it is possible to define what data (both primary and secondary) are necessary for the assessment and to collect the data.

Collection of relevant data that will provide the necessary information for the EIA team to perform the assessments on a sound, up-to-date basis.

# Analysis

ANALYSIS. Here the components selected by Scoping are analysed for the nature and scale of change that each may cause or be affected by, positive or negative.

The intended data analysis of the collected data should be described prior to the analysis

...but the quality and quantity of the data may be very poor, allowing for alternative analytical methods, or for initiating new data collection.

Analysing the collected data for each component

# Mitigation

A good EIA is recognised through:

- GOOD scoping and
- GOOD descriptions of mitigating measures

that will diminish the impacts from the proposed project

# Mitigation measures

- New methodologies
- Cleaner technology
- Increased recycling and re-use
- Symbiotic relationships
- Changed location for the project
- Cultural and archaeological aspects
- etc

# Steps in the EIA

PUBLIC PARTICIPATION (Again!!). This element is reintroduced to ensure that suggested mitigation (and maximizing positives) actually meets the needs of affected communities.

# Conclusion

- An EIA is never better than each of the steps performed.
- Water quality impacts may or may not be a relevant issue (Case specific)
- The EIA should be followed by an Environmental Audit for compliance
- Environmental monitoring must be continued to ensure data

# Thank you

Jesper Goodley Dannisøe, [jda@dhigroup.com](mailto:jda@dhigroup.com)





# Earth Observation data for water quality monitoring



Name: Lars Boye Hansen

Title: Senior Project Manager, DHI GRAS

Bio: Remote Sensing, water quality, marine and coastal monitoring, environmental assessment

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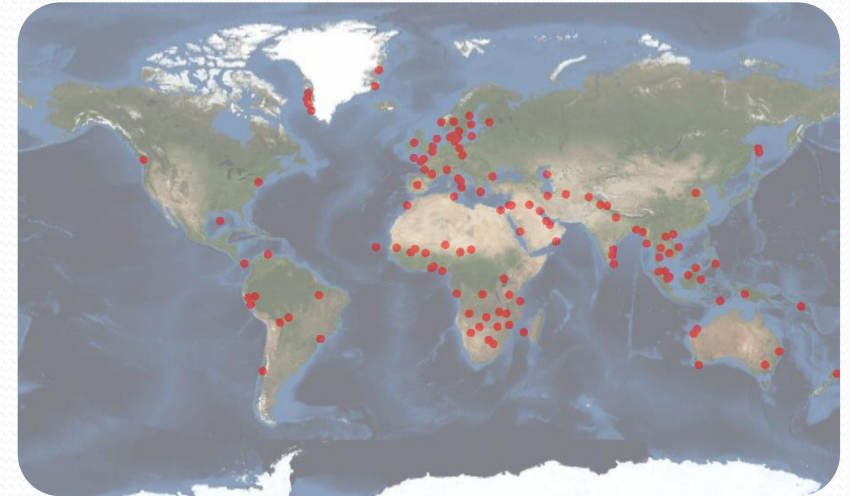


# Topics

- Brief about DHI GRAS
- Brief about how EO data can be used for WQ monitoring
- Global scale information
- Regional/local scale information - examples
- Focus on chlorophyll and sediment information
- perspectives

# DHI GRAS

- At **DHI GRAS** we use satellite images to assess environmental impacts, quantify natural resources and map human activities and land use.
- We can look **50 years back in time** and document changes in the environment
- We can also provide **daily information** to monitor the current situation for any location in the world.
- Global set of references from more than 60 countries

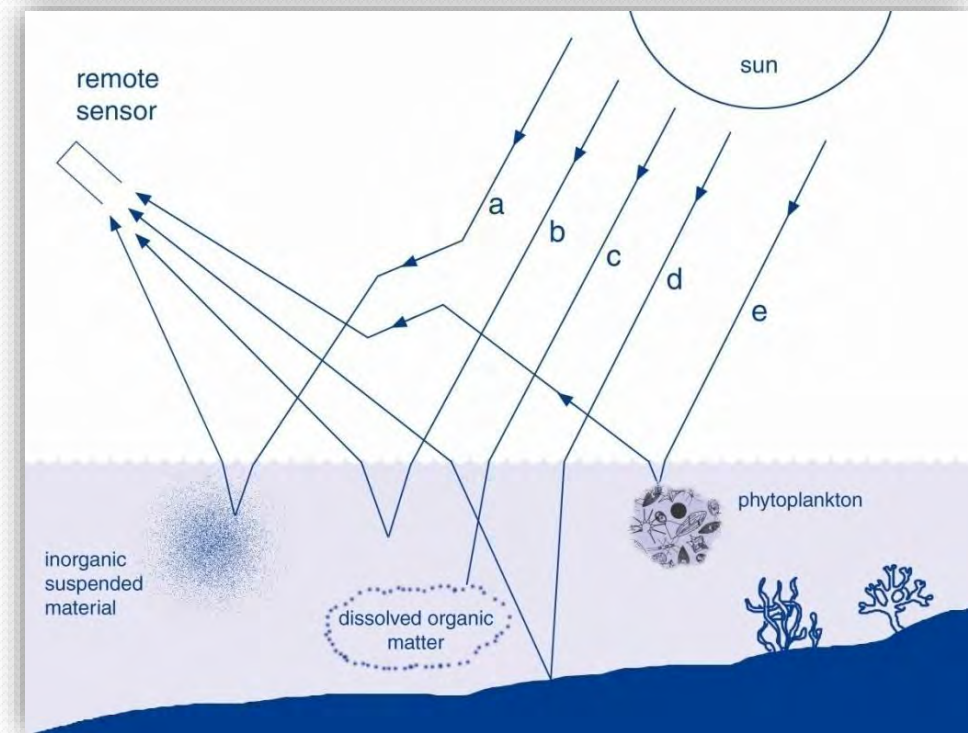
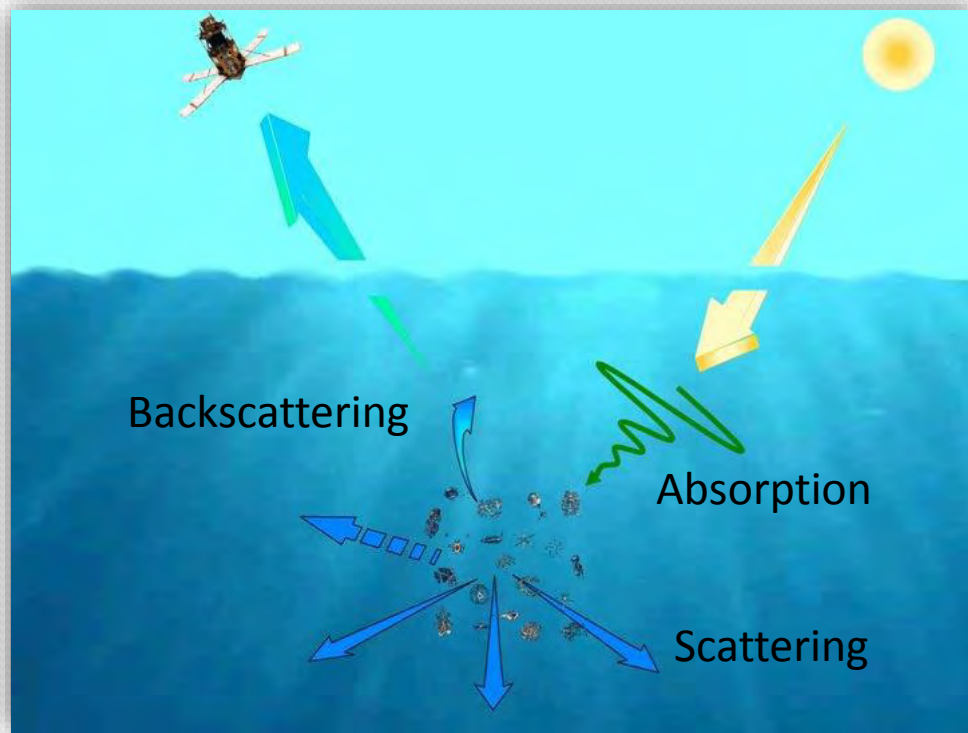


# Why use satellites for WQ monitoring?

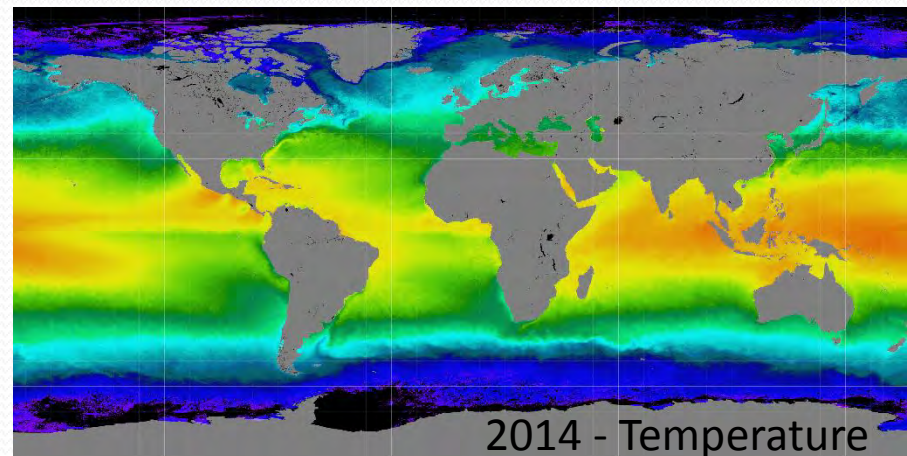
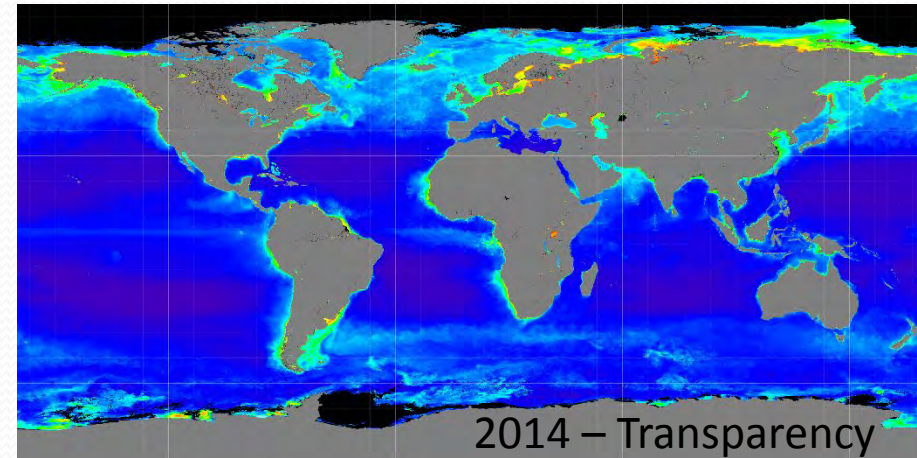
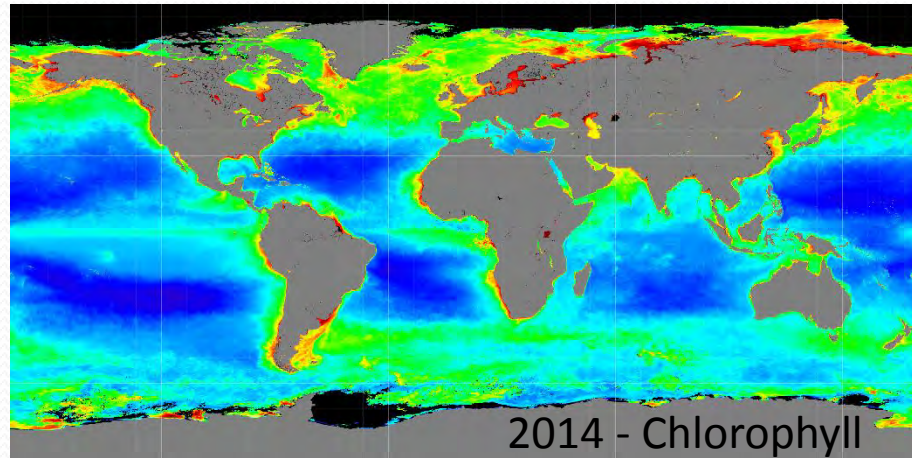
- Provide full spatial coverage of a region / country / globally
- Go back in time to assess changes and establish baselines
- Get up to date information for monitoring purposes
- (More) data = more information
- Covers remote and inaccessible areas
- No health and safety issues
- Cost efficient



# Water quality from Water Colour

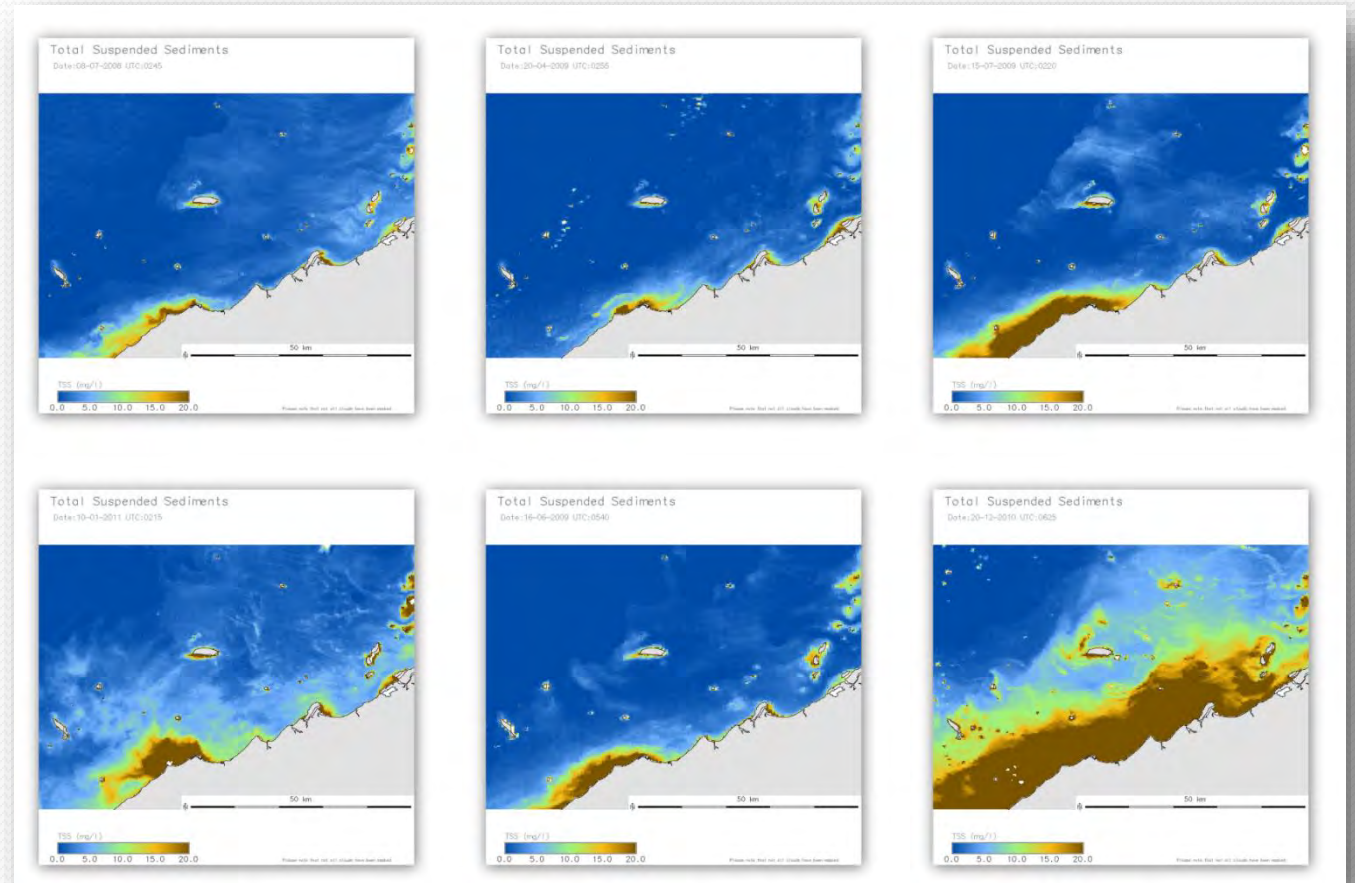


# Global coverage – global science



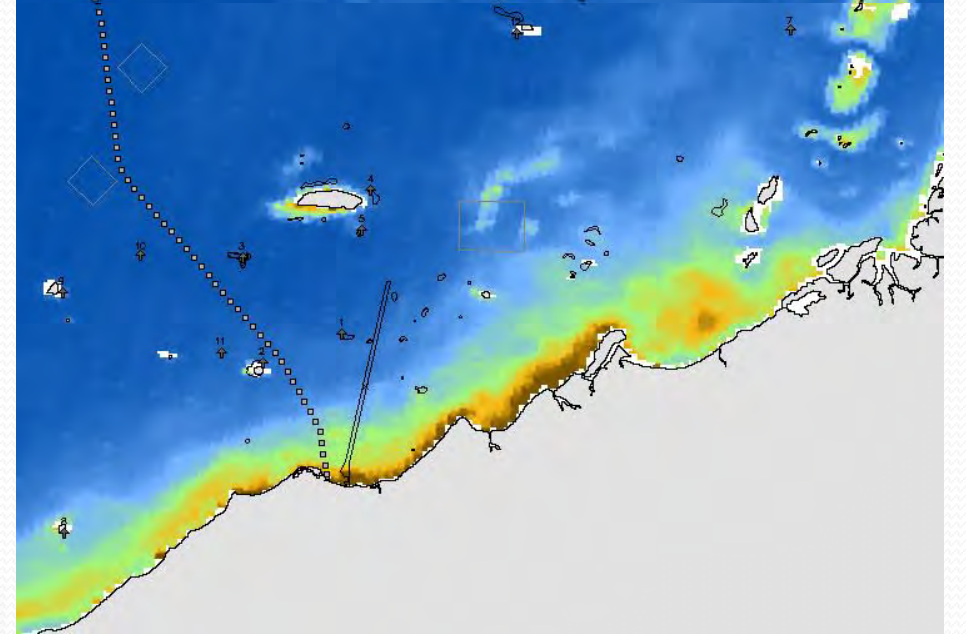
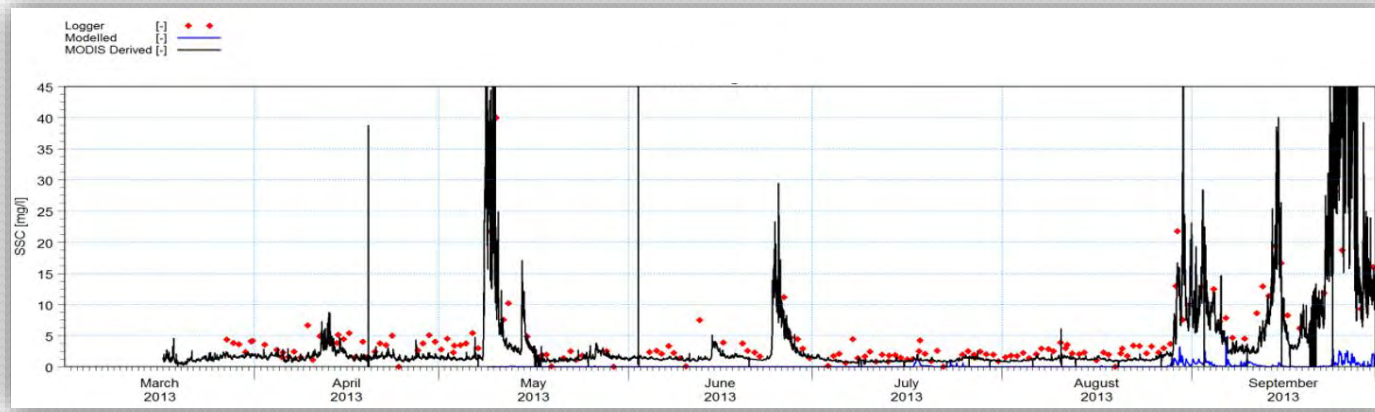
# Regional/local scale – suspended sediments

- Affects the water clarity
  - Coral reefs, seagrass etc.
- Temporal variations (comparison with baseline or season mean etc.)
- Spatial distribution (plume extent, area of values above  $X$  mg/L etc.)
- Extraction of site specific values



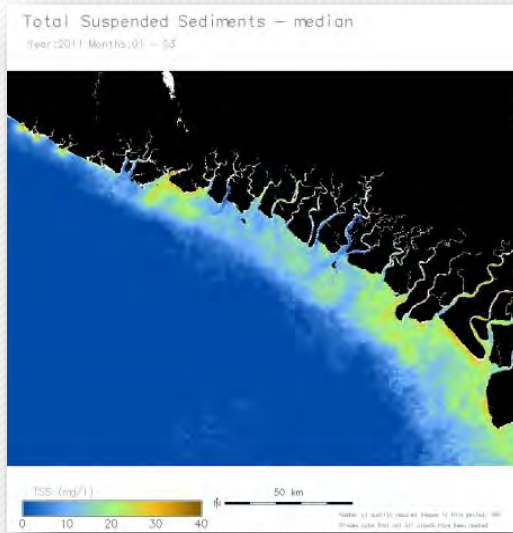
# Dredging operation

- Valuable tool for compliance monitoring
- Provides the spatial overview
- Production & environment benefit
- Clouds are a limitation

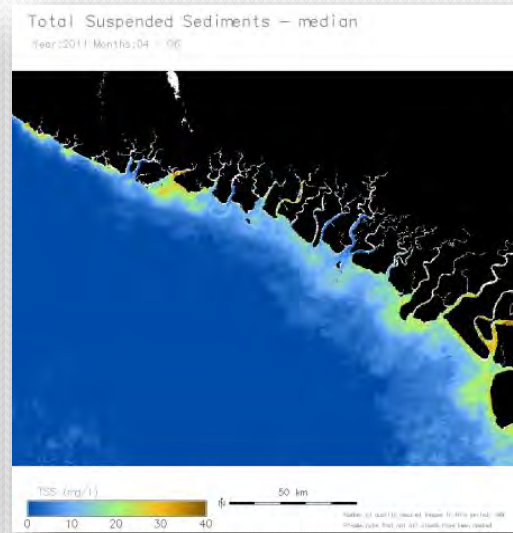




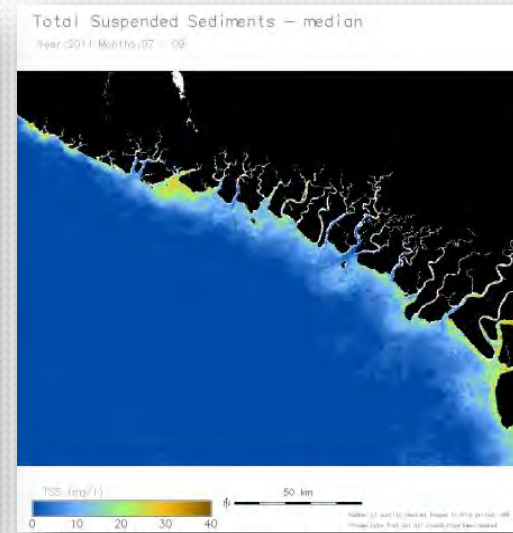
# Baseline generation – even in cloudy areas



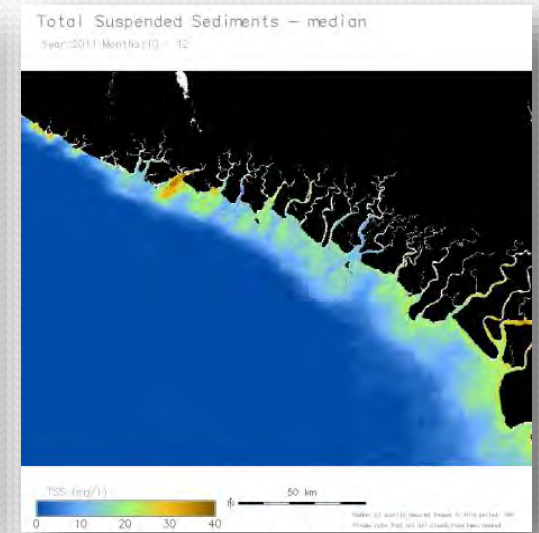
Jan - Mar



Apr - Jun

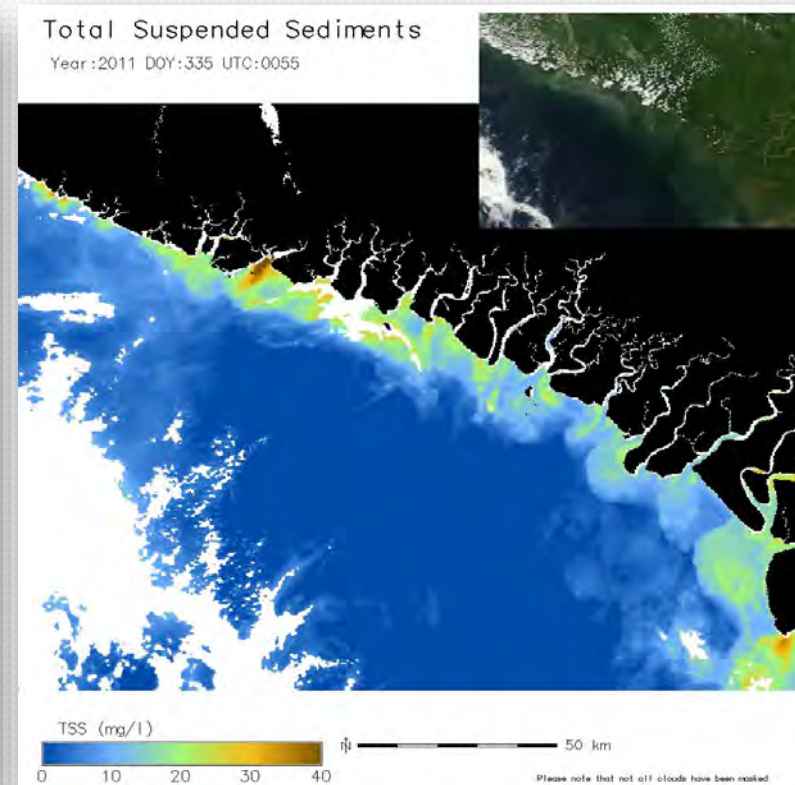
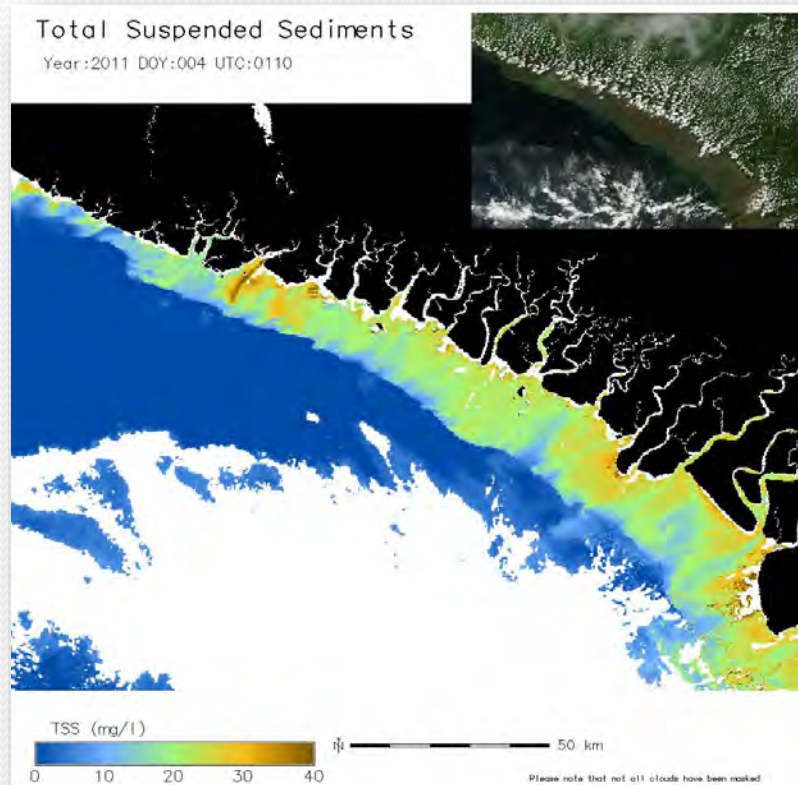


Jul - Sep

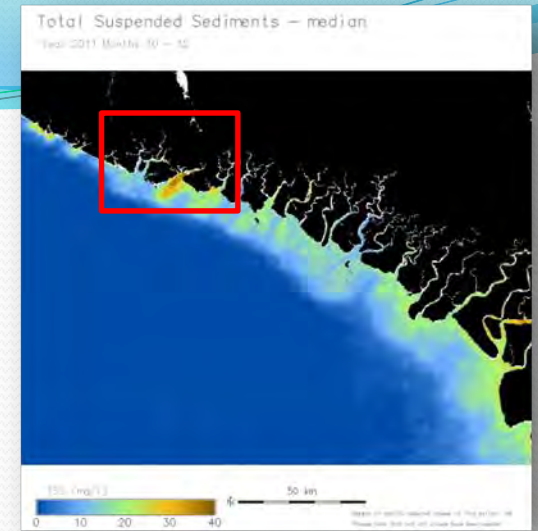
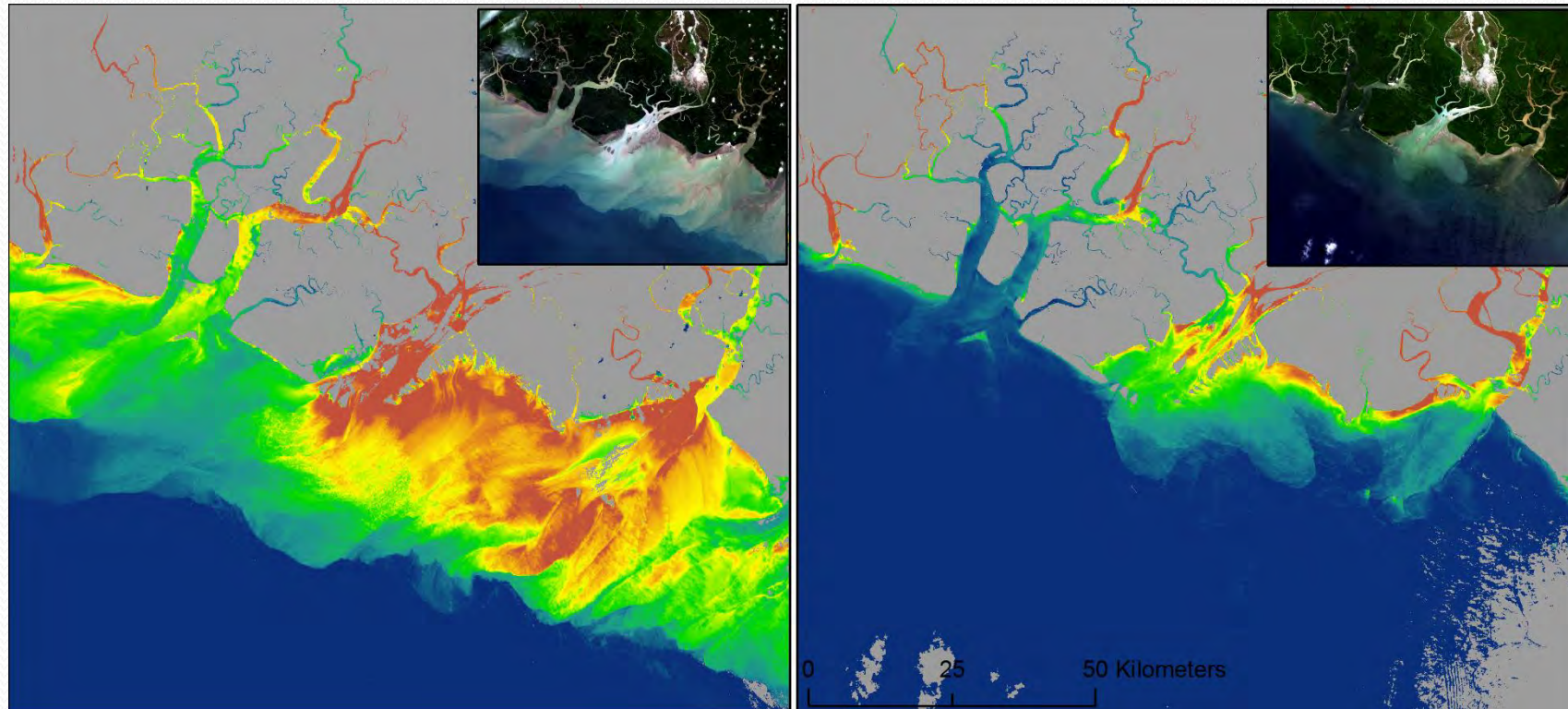


Oct - Dec

# Monitoring – even in cloudy areas

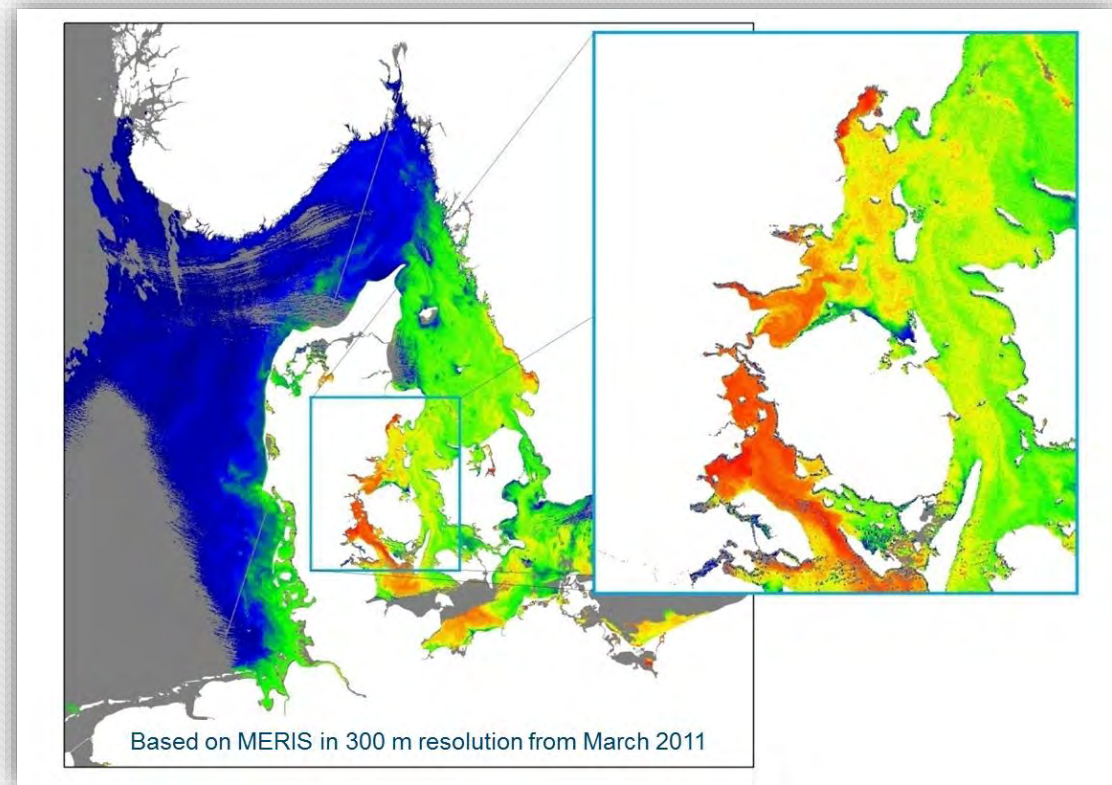


# High resolution for detail info



# Regional scale – chlorophyll

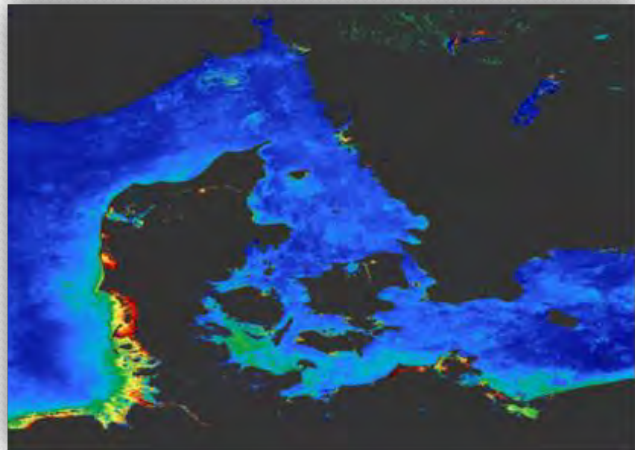
- Algae can be toxic to humans and animals
- Indicator of nutrient levels
- Indicator in water framework directive of the ecological status



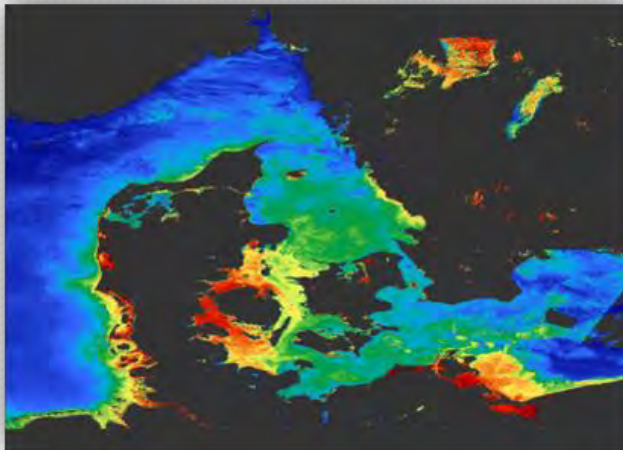
# Annual variation

- Monthly composite – phytoplankton pigment absorption

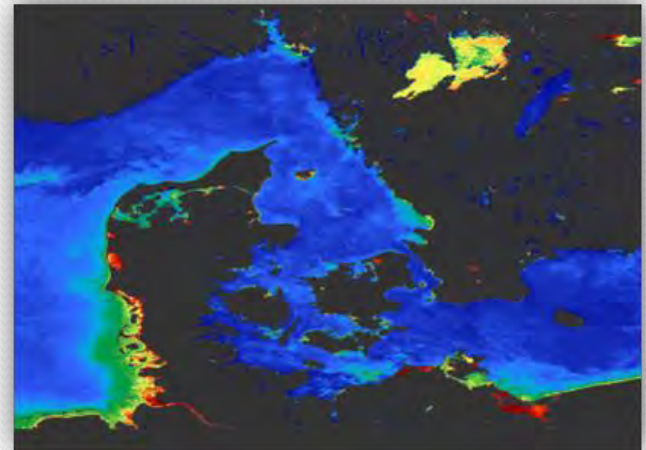
March, 2010



March, 2011



March, 2012

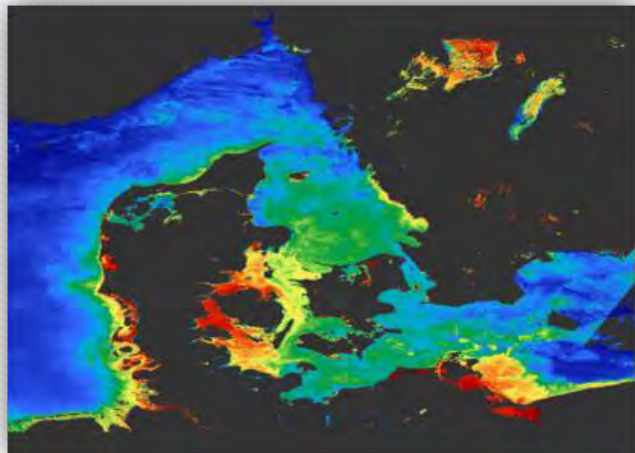


*Pseudochattonella* bloom!

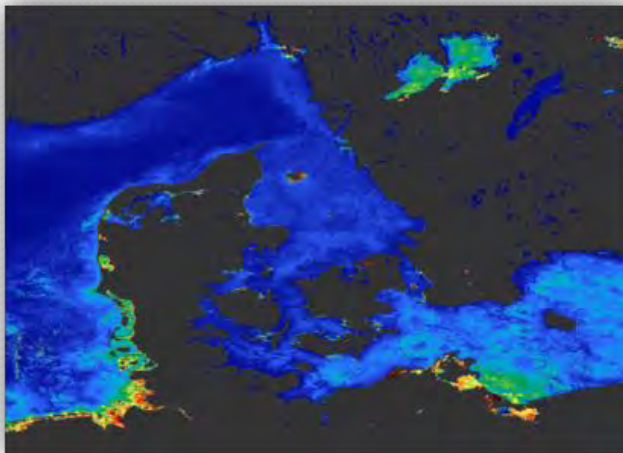
# Inter-annual variation

- Monthly composite – phytoplankton pigment absorption

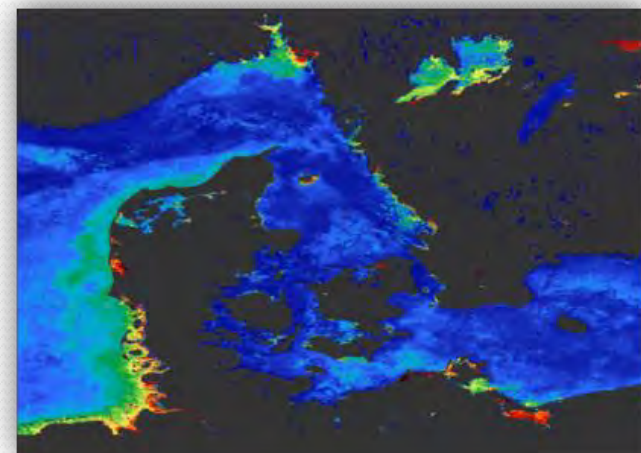
March, 2011



July, 2011

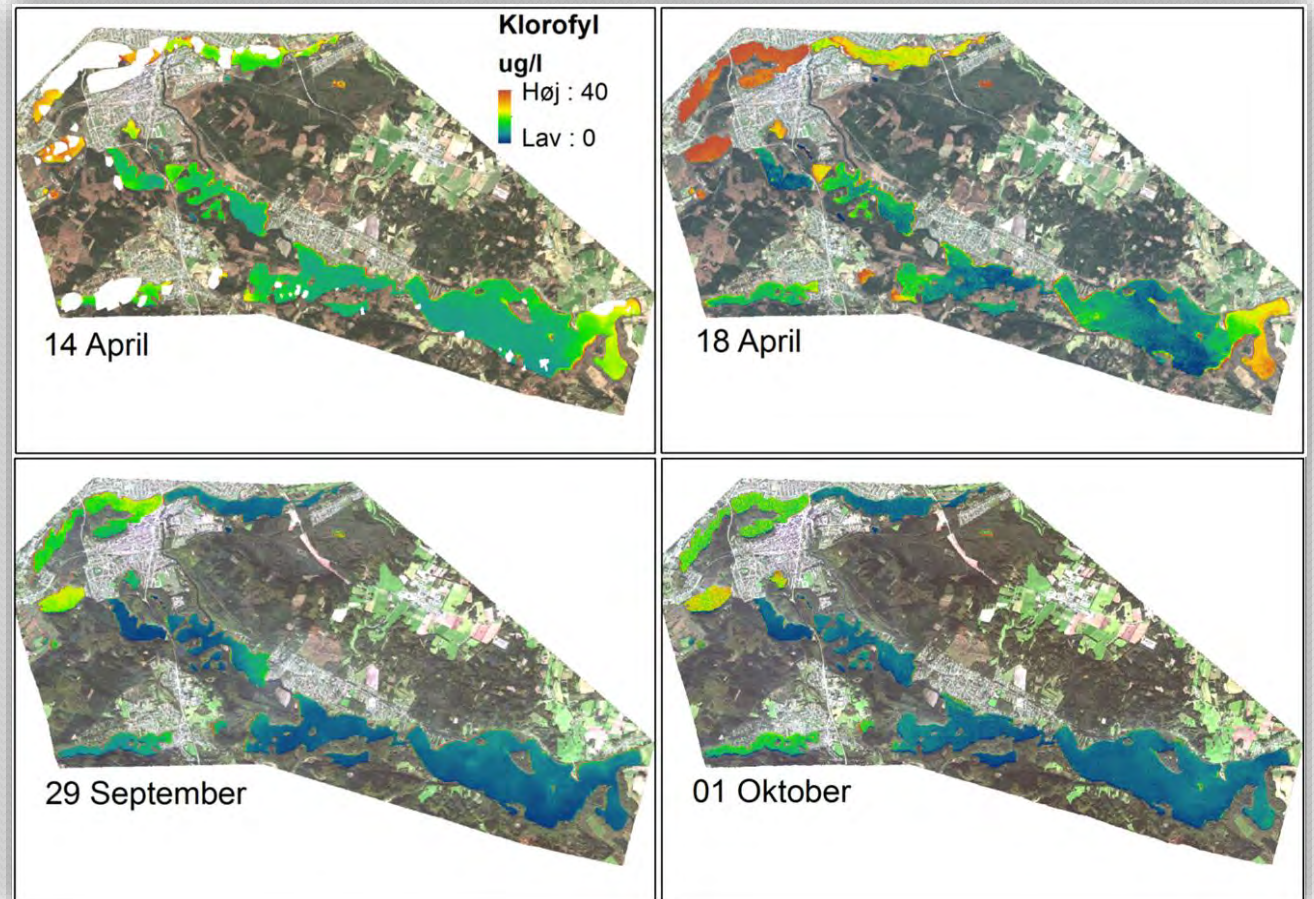


September, 2011

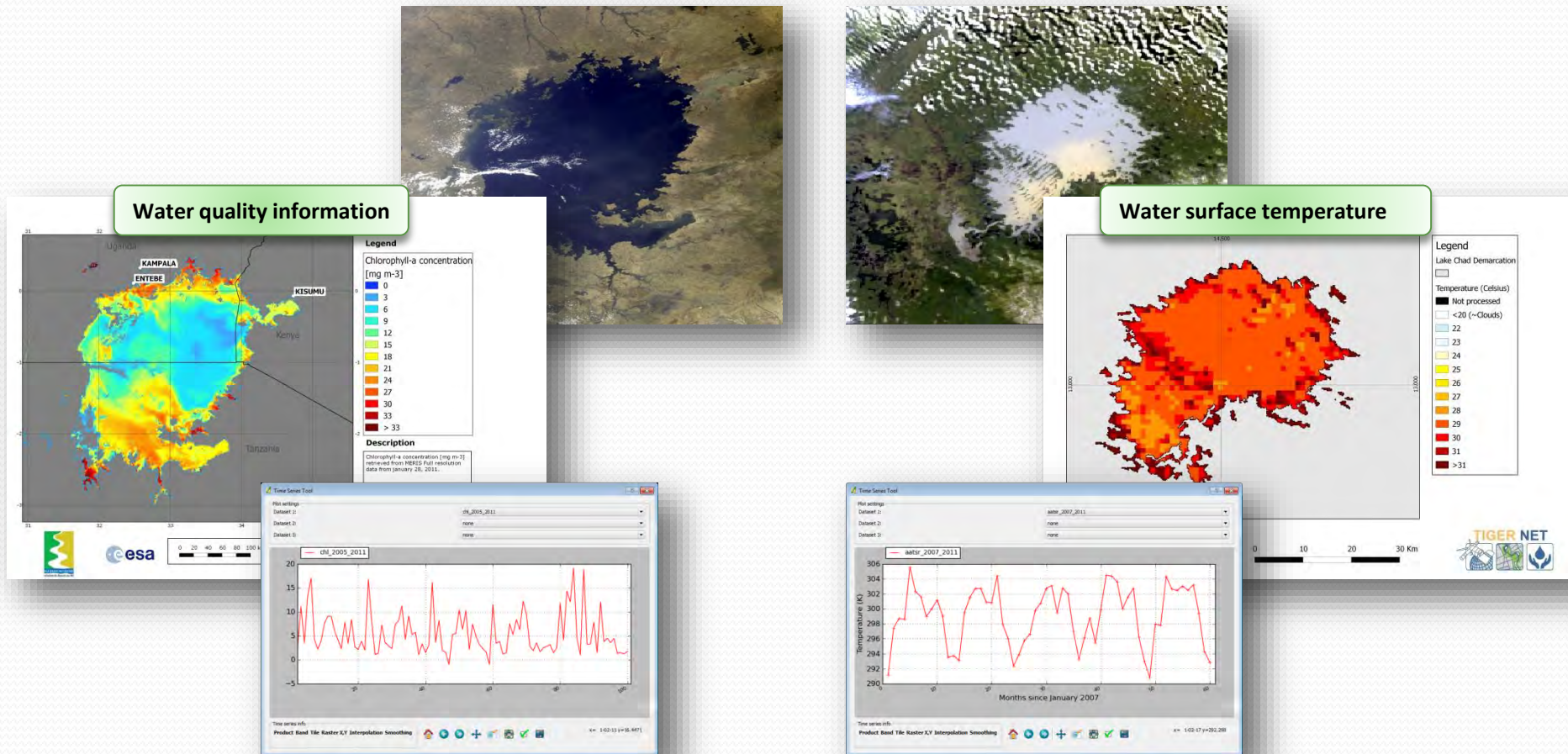


# Freshwater monitoring

- Rivers/lakes provide livelihood for a major part of the population on Earth
- Need to monitor the status
- Need to complement traditional monitoring activities
- Transboundary monitoring



# Water resource management - Africa





# EO monitoring of WQ - perspectives

- Data + methods are maturing -> higher precision and credibility
- High priority area
  - On the political agenda
  - Many international research activities
  - New satellites being launched
  - Cloud computing/big data
- EO data bridges a knowledge gap
- EO data essential – also for data poor areas
- huge archives are just waiting to be used



10-20 m. resolution  
Data every 5 days  
Data is free and open



300 m. resolution  
Data every day  
Data is free and open

*Thank you for listening*



*Lars Boye Hansen*  
*lbh@dhi-gras.com*

# Additional Questions

# Thank you for attending WQ Webinar #6

- Questions/comments to Maija Bertule [mabe@dhigroup.com](mailto:mabe@dhigroup.com)
- Webinar recording and slides on YouTube (UNEP-DHI) and <http://www.unepdhi.org/wq-webinars>
- Short feedback survey in follow-up email – please take 5 minutes to fill in – we value your opinion!

## Final webinar in the series

- Feedback and suggestions for future topics welcome