



Earth Observation for Water Management

International trends & developments

Earth observation applications

Business development

Capacity building



0. Introduction

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HCP international:
consulting, marketing of earth observation

Project director EOPOWER:
project for promotion & capacity building of
earth observation applications



Sequence:

- General assessment of the state-of-the-art of earth observation
- Major trends and developments in the application field
- Description of earth observation solutions
- Assessment of market potential for earth observation solutions and marketing instruments
- Capacity building for successful application of earth observation solutions



Earth Observation helps you:

save money

save lives

save the environment



Earth observation applications

- On the verge of reaching new user communities
- These new user communities need to be involved
- Weakest link / last mile aspects are important
- Marketing needed: promotion & capacity building



Life cycle of products & services

Initialization

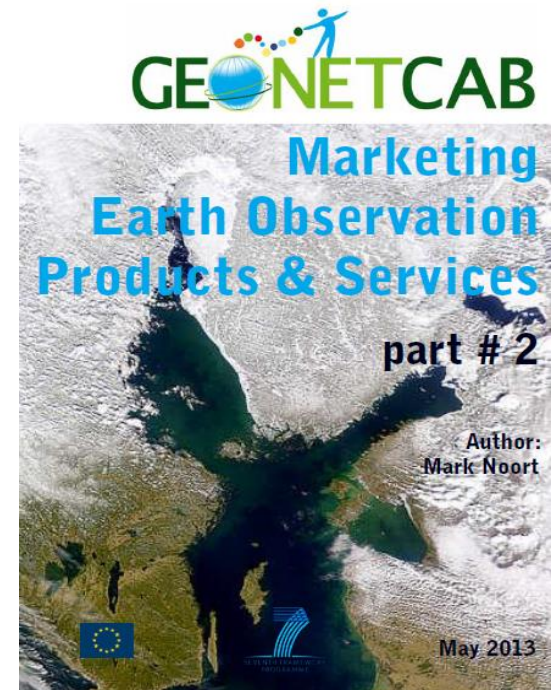
System analysis & design

Rapid prototyping

System development

Implementation

Post-implementation





Scope

The term “water resource” may be defined as:
the wider body of water upon which a water source depends

(This could be rainwater, surface water (e.g. rivers, streams, lakes) or groundwater within an aquifer.)

“Water resource management” is then:
the activity of planning, developing, distributing and managing the optimum use of water resources

Focus on **management of freshwater resources.**

(Flooding will be dealt with in the disaster management toolkit and rainfall in the weather toolkit.)



Assessment of business & funding opportunities

- Categories of water management products & services
- Life cycle phase of product or service
- Regional context, level of technological & economic development
- Optimum marketing mix



1. International trends & developments in water management



Issues & trends in water management

- Sustainable **water resources** management, including **water quality**, also with respect to climate change;
- **Water footprints** and **pricing**;
- **Risk management**;
- **Community empowerment**;
- **Water, energy, food nexus**



Drivers

- The increasing demand for water (agriculture, urban),
- Environmental factors (including climate change),
- The availability of water resources,
- Deterioration of water quality,
- Perceived low cost of water,
- Increased risks: floods, droughts, salinisation.



Sustainable water resources management

- Over the past 50 years global freshwater withdrawals have tripled
- A quarter of freshwater use exceeds accessible supplies
- By 2030 nearly 3.9 billion people will live under conditions of severe water stress (OECD)
- By 2030 global demand for water will be 40% higher than it is today
- Open data access and optimal data availability are of cardinal importance



Measuring Water use
in a Green Economy



Decision making

“We can only manage what we measure”

Need for “integrated and adaptive decision support systems able to explicitly account for system uncertainty”

Incorporate institutional, political, and economic considerations into translating physical science findings into relevant information for specific types of decisions within specific sectors

Communication should be perceived by the users as:

- Salient (answering the right questions)
- Credible (coming from a trusted source)
- Legitimate (accurate)



Different levels

“We can only manage what we measure”

- **User level:** price and technology play a key role (creating awareness, charging prices based on full marginal costs, stimulating water saving technology)
- **Catchment or river basin level:** choice on how to allocate the available water resources to the different sectors of the economy (depends on the value of water in its alternative uses)
- **International trade:** water as a global resource (overall efficiency)



Measuring Water use
in a Green Economy



More information:

The state of the world's land and water resources for food and agriculture (SOLAW) – managing systems at risk (FAO; 2011)

Measuring water use in a green economy (UNEP; 2012)

Food and water: analysis of potentially new themes in water management - future trends and research needs (FutureWater; 2010)



Water footprints and pricing

Calculating the monetary value of externalities and ecosystem resources and services that are currently underpriced or not priced at all

Decoupling concepts:

- **Resource decoupling:**
reducing resource use per unit of economic activity
- **Relative decoupling:**
resource use still increases but at a lower rate than economic growth
- **Impact decoupling:**
scale and character of resource use causes no negative environmental impact
- **Absolute decoupling:**
resource use declines irrespective of the growth rate of the economic driver



Measuring Water use
in a Green Economy



Water footprints and pricing

Water registers

(as key to fair distribution of access to water)

Water and ecosystem capital

(water as natural capital, linked to economy and well-being (UN SEEAW 2007, NAMEA))

Water scarcity and vulnerability indices

(per capita, renewal vs withdrawal, etc.)

Water footprint assessment

(amount of water consumed per unit of product)

Life cycle assessment

(benchmarking for industries)

Water stewardship

(quantify corporate water monitoring)



Measuring Water use
in a Green Economy



More information:

Measuring water use in a green economy (UNEP; 2012)

The water response mechanism – towards a practical approach to assess and reduce a water footprint (CREM; 2010)

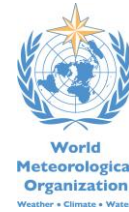
System for environmental-economic accounting for water (UNDESA; 2012)

Water footprint assessment manual – setting the global standard (Hoekstra et al.; 2011)



Risk management: drought

- Distinction between meteorological, agricultural, hydrological and socio-economic drought;
- Need for improved forecasting, early warning systems and general information provision on droughts;
- Need for improved resilience, also with respect to the possible effects of climate change;
- Sustainable management of natural resources;
- Insurance schemes for risk coverage.



More information:

Managing drought:

a roadmap for change in the United States (GSA; 2007)

Drought monitoring and early warning:

concepts, progress and future challenges (WMO; 2006)

Drought monitoring in France:

groundwater perspective (BRGM; 2011)



Empowering local communities

- Increase insight in and visibility of available resources
- Analysis of historical and future use for planning and decision making
- Mapping of informal settlements, infrastructure and resources
- Analysis for more efficient use of water resources
- Hydropower: assessment of resources, planning & monitoring
- instrument for community empowerment
- Using “human sensor webs” and/or “citizens observatories” for water point mapping and monitoring



More information:

Water security framework (WaterAid; 2012)

HSW final report - Empowering communities in East Africa in water service provision through information from human sensor webs (UN-HABITAT/University of Twente; 2010)



Water-energy-food nexus

- Demand for energy, water and food will grow, because of economic development;
- Access of poor people to energy, water and food needs to be improved;
- Increasing energy production means increasing demand on water resources (and vice versa);
- Alternative sources of energy (biofuel) also increase the demand for water;
- Increased production of biofuel could compete with food security;
- Finding acceptable trade-offs is important.



More information:

United Nations world water development report
volume 1: water and energy
volume 2: facing the challenges (UN WATER; 2014)

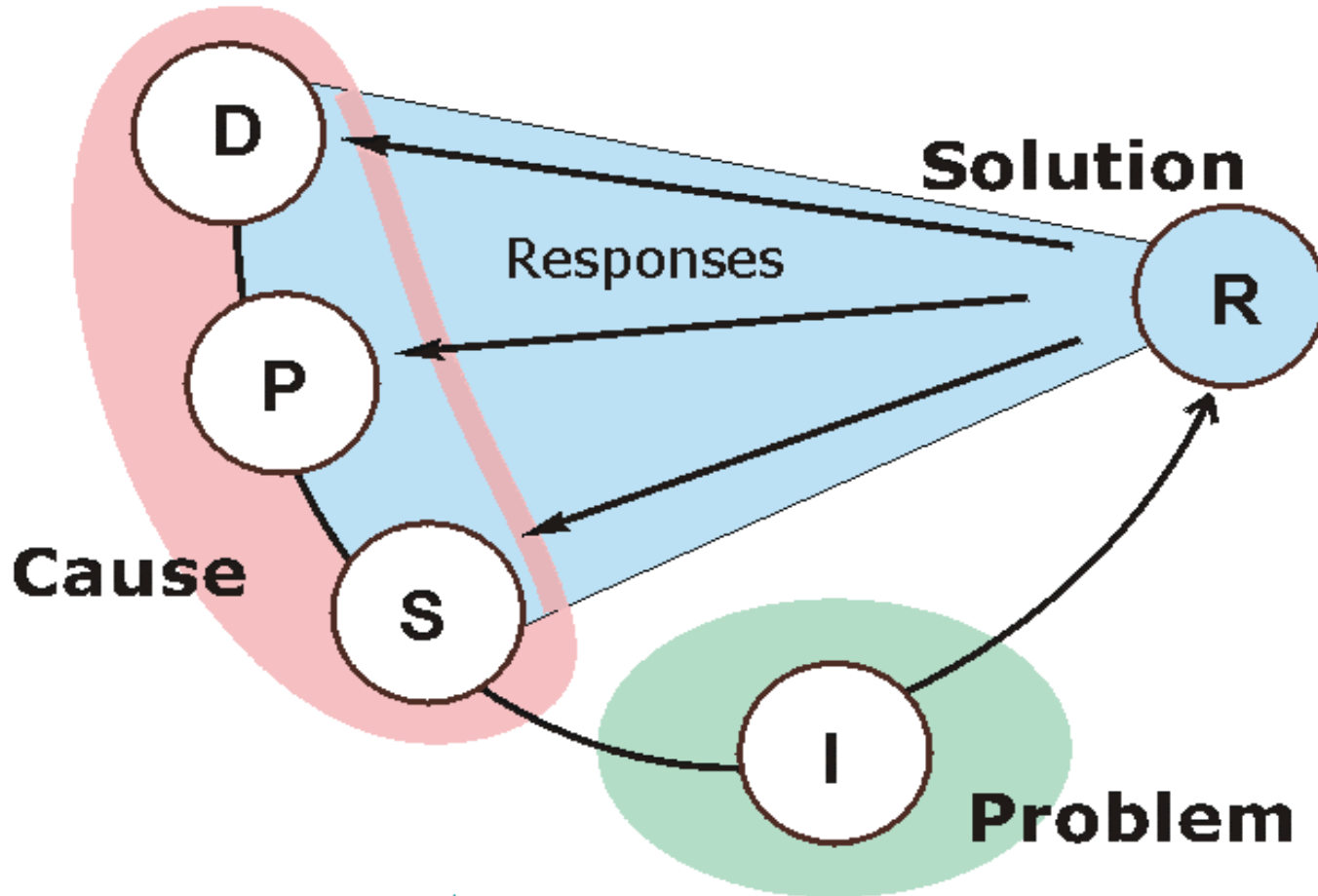
Water-Food-Energy Nexus:
towards a widening of the water agenda
(FutureWater; 2013)

Example Europe

Water resources across Europe - confronting water scarcity and drought

- DPSIR: framework used for water resources management
- Water exploitation index (ration of annual total water abstraction to available long-term freshwater resources)
- Action: water pricing, drought management plans, water efficiency and conservation, raising awareness, tackling illegal water use, alternative supplies, desalination
- Information requirements: river basin scale water balances based on the UN system of environmental economic accounting for water (SEEA, 2007) & WISE (water information system for Europe)

DPSIR framework: driving force, pressure, state, impact, response





Example Africa

Africa Water Atlas

Modelling of Africa's surface water systems (water balance data), identifying:

- **“hotspots”**: tenuous food security situation
- **“hopespots”**: potential for rainwater harvesting
- **“water towers”**: areas with upstream water surplus





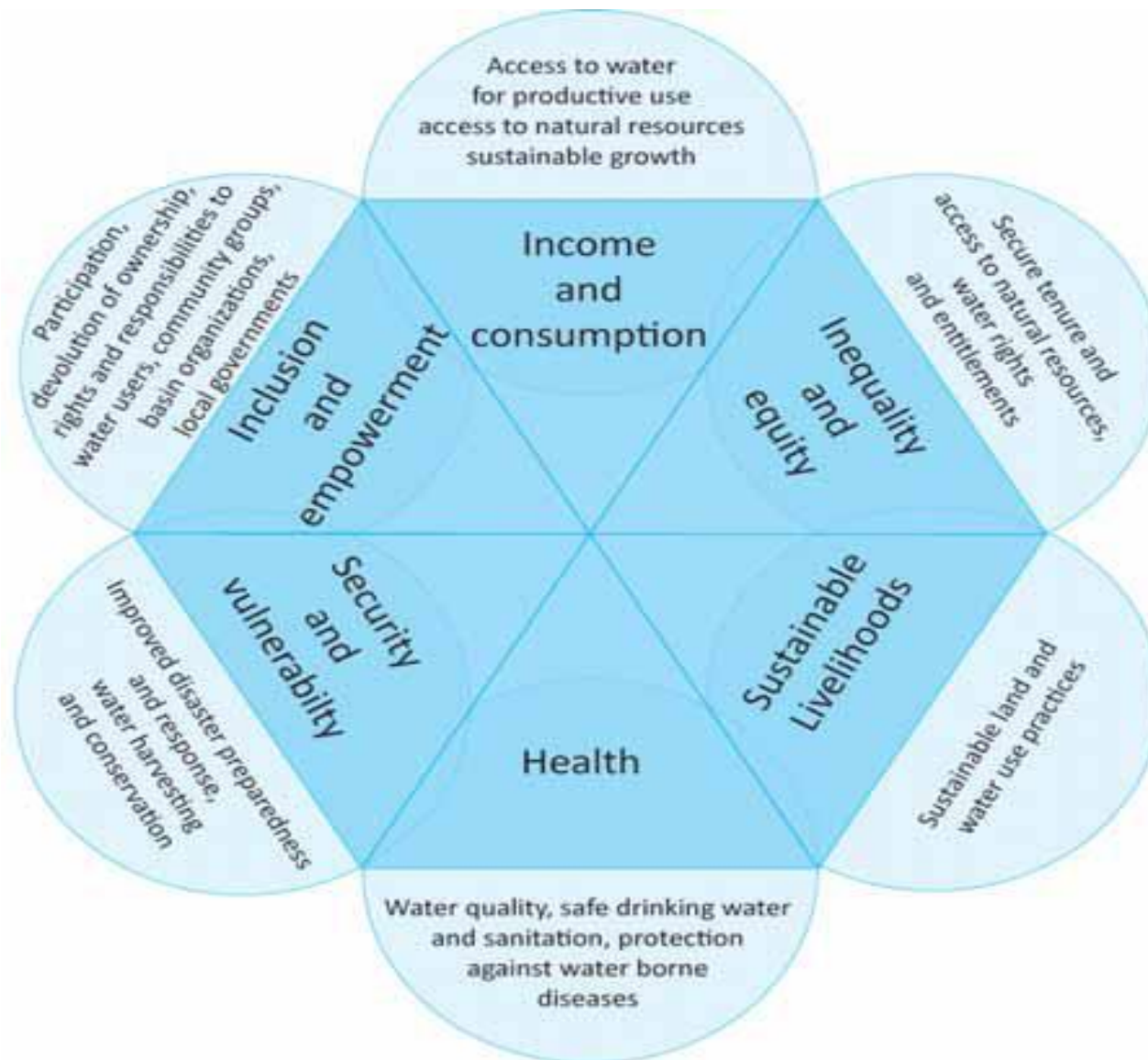
Africa Water Atlas

Key Facts

- Millions of people in Africa suffer water shortages throughout the year
- Water scarcity is not simply due to geography: population growth, poor planning and poverty are significant factors
- Most urban population growth has taken place in peri-urban slum neighbourhoods, overwhelming municipal water services
- 64% of people in Africa use improved drinking water sources (2010)
- Only 38% of Africa's population has access to improved sanitation facilities (2010)
- Increases in access to improved drinking water sources and sanitation facilities are not keeping pace with population growth

Africa Water Atlas

Linkages between poverty, water and the environment





Africa Water Atlas

Action

- Provide safe drinking water + ensure access to adequate sanitation
- Foster cooperation in transboundary water basins
- Provide water for food security
- Develop hydropower to enhance energy security
- Meet growing water demand
- Prevent land degradation and water pollution
- Manage water under global climate change
- Enhance capacity to address water challenges



European Environment Agency



More information:

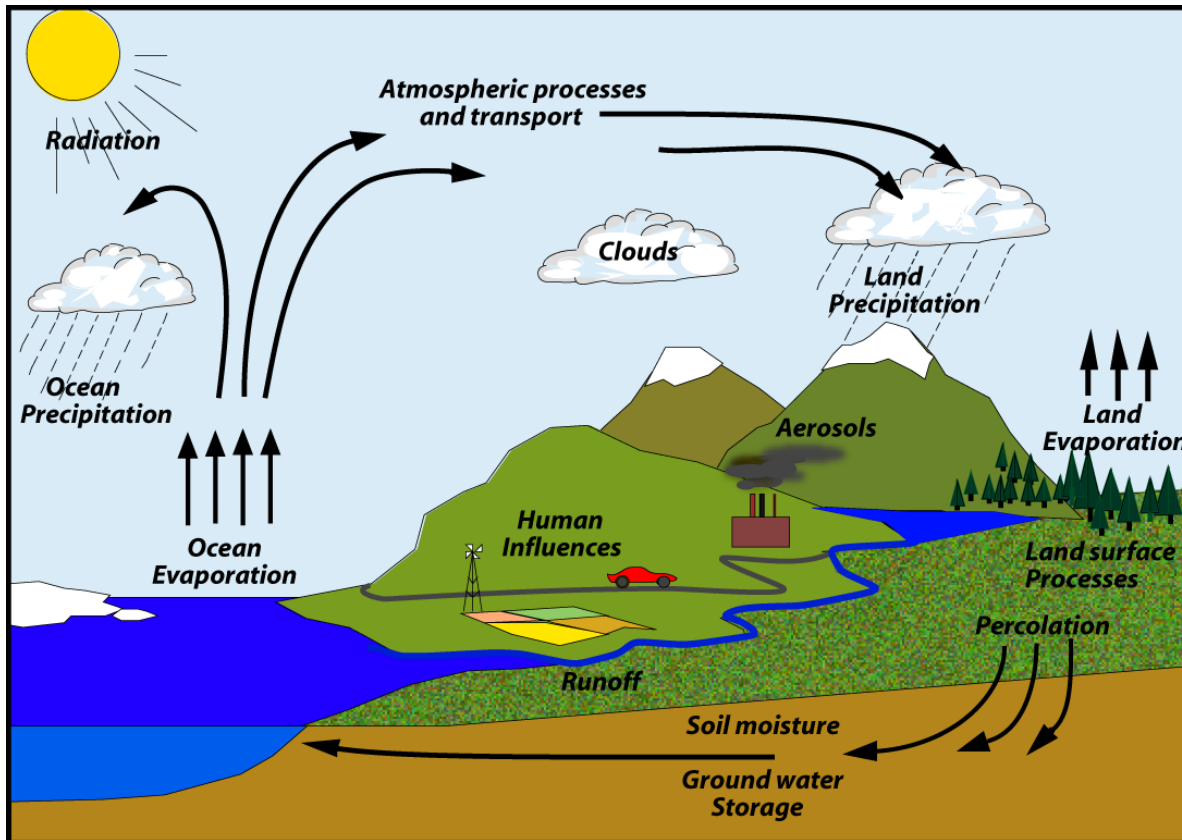
Water resources across Europe — confronting water scarcity and drought (EEA; 2014)

Africa water atlas (UNEP; 2010)



2. Earth observation applications

Earth observation for water management



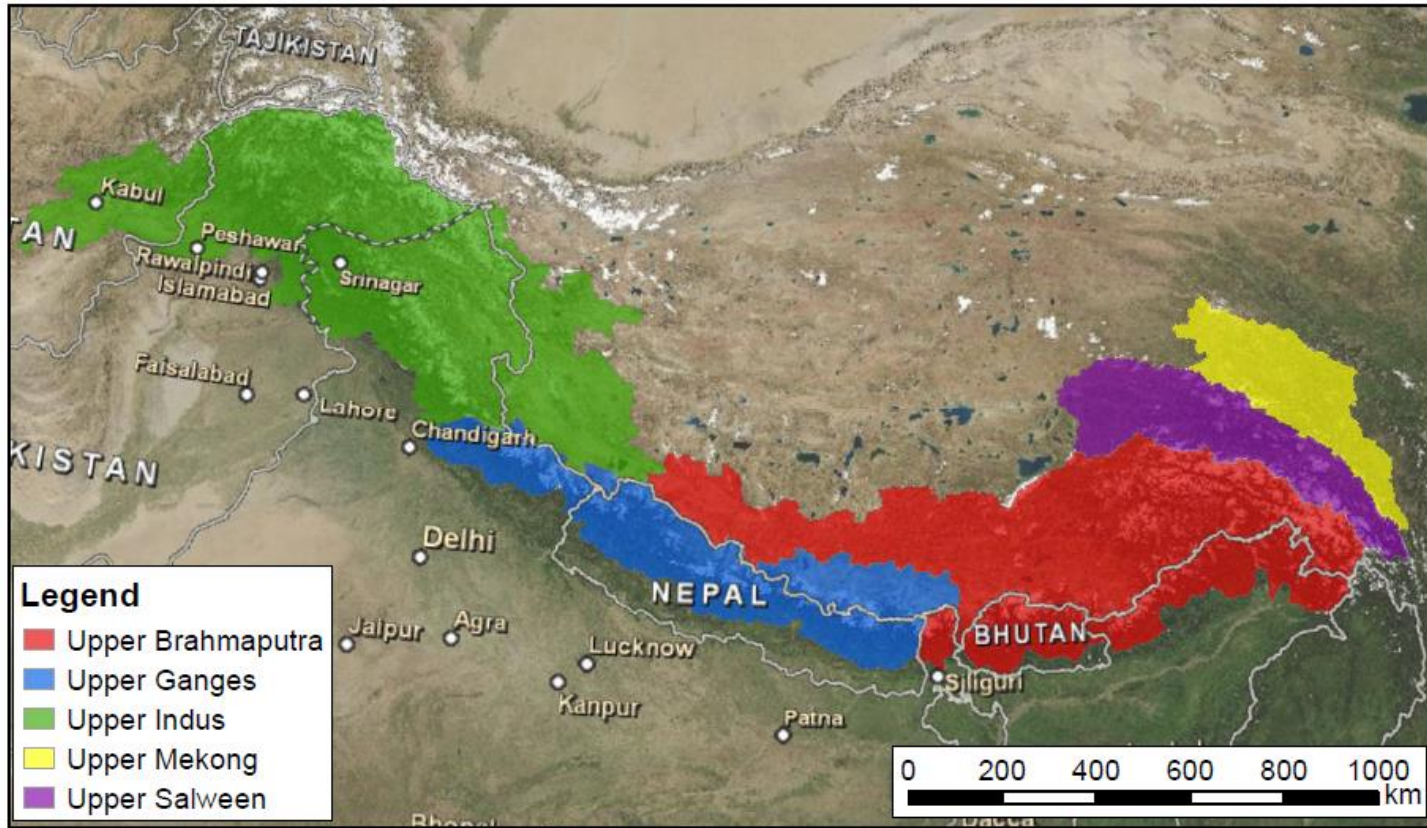
The water cycle (GEWEX)



Earth observation contribution

- **General water resources assessment**, for long-term planning and climate change scenarios
- **Hydrologic information systems**, for (detailed) run-off calculations & (irrigation) system management
- **Soil moisture modelling**,
- **Drought monitoring**,
- **Water quality monitoring**,
- **Snow cover monitoring**,
- **Water supply utilities**,
- **Others**: salinisation monitoring & mapping, sediment transport monitoring, erosion monitoring & mapping, reservoir monitoring, rainwater harvesting, etc.

Example water resources assessment



Overview upstream basin boundaries of the Indus, Ganges, Brahmaputra, Salween and Mekong river basins (FutureWater)



Water resources assessment

- Accurate and continuous observation of the long-term dynamics of the different key variables governing the energy and water cycle processes from global to local scale
- For decision making: global synoptic information on water resources availability and quality for water governance, management and planning (+ adaptation to climate change)
- Earth observation complemented with in-situ observations for validation, calibration and development of EO-derived products
- Cost estimate: service 100 - 200 k€ per river basin, data 1 - 10 k€ per scene, some data at no cost
- Main challenges: cost, capacity, reduce uncertainty



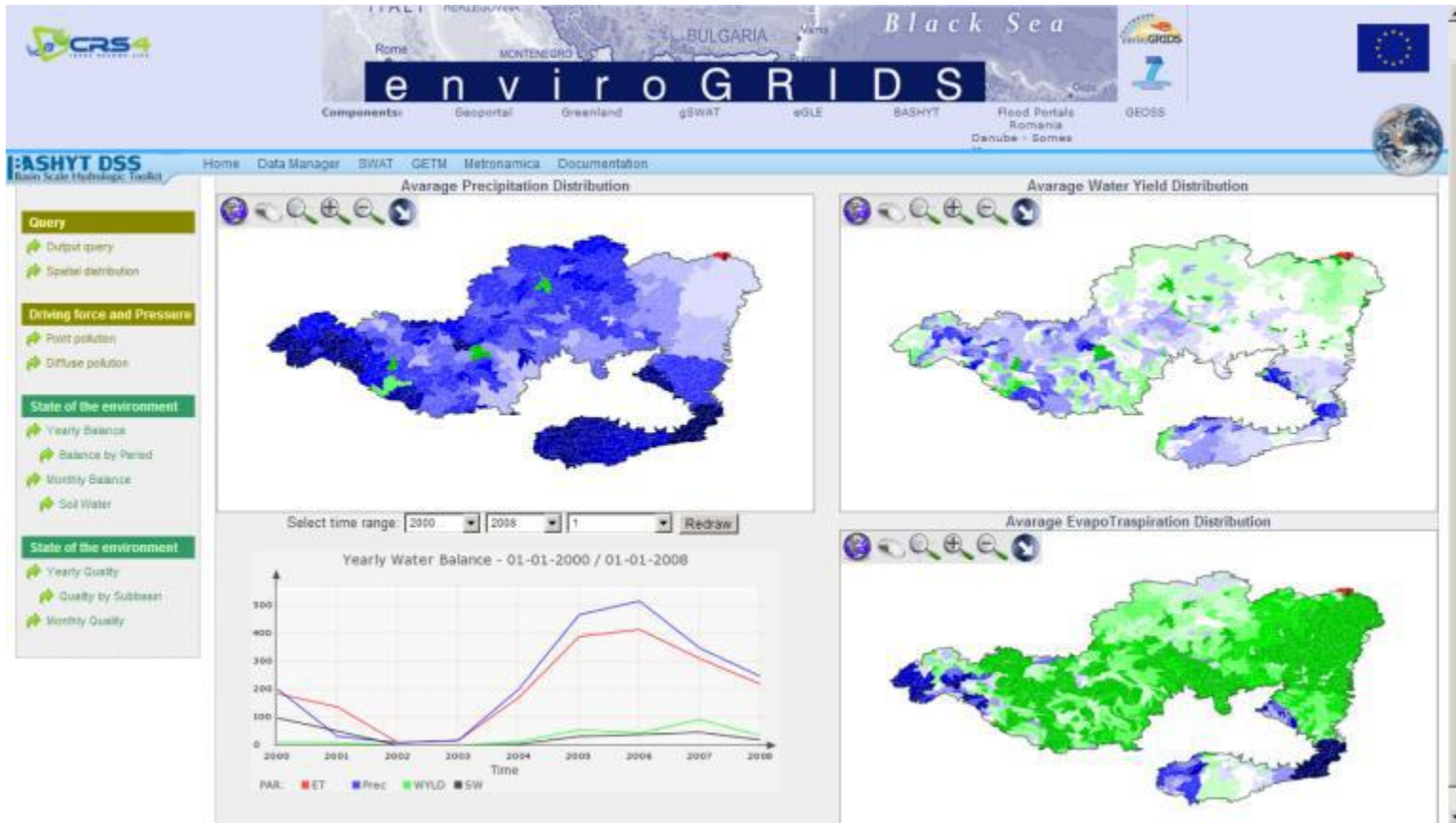
Examples:

Uses and limitations of observations, data, forecasts, and other projections in decision support for selected sectors and regions (NASA; 2008): *chapter 5 – decision support for water resources management*

Water availability analysis for the Upper Indus, Ganges, Brahmaputra, Salween and Mekong river basins (FutureWater; 2013)

GEWEX: *global and regional energy and water exchanges - research programme of the World Climate Research Programme intended to observe, comprehend and model the Earth's water cycle*

See also: Advances in Earth observation for water cycle science (Fernandez-Prieto, van Oevelen, Su, Wagner; 2012)



Water balance Danube basin mapped on a webGIS (source: enviroGRIDS, 2012)



Hydrologic information systems

- Land use and land cover mapping + change monitoring
- Water abstraction estimate with respect to crop water demand estimates for irrigated areas
- Refined land use / land cover mapping
- Surface water bodies or water pools (location, extent, dynamics)
- Digital elevation models and derived products
- Estimates of basin-wide evapotranspiration and precipitation
- Water and vegetation monitoring (entire aquifer)
- Ground subsidence monitoring and its correlation with groundwater abstraction
- Cost estimate: on case-by-case basis
- Main challenges: cost, capacity, data access



Examples:

TIGER (ESA)

application of satellite remote sensing to support water resources management in Africa: results from the TIGER initiative

GDRC

*Global Runoff Data Centre report series: hydrologic information – metadata
UML model of available catalogues*

enviroGRIDS

includes hydrological model for the Danube basin

HYPE: large-scale, high-resolution modelling of water quantity and quality

hydrological modelling for Europe

More examples:

Cost and benefits of satellite-based tools for irrigation management (Vuolo et al.; 2013) *overview and cost-benefit analysis of EO for irrigated agriculture in Austria*

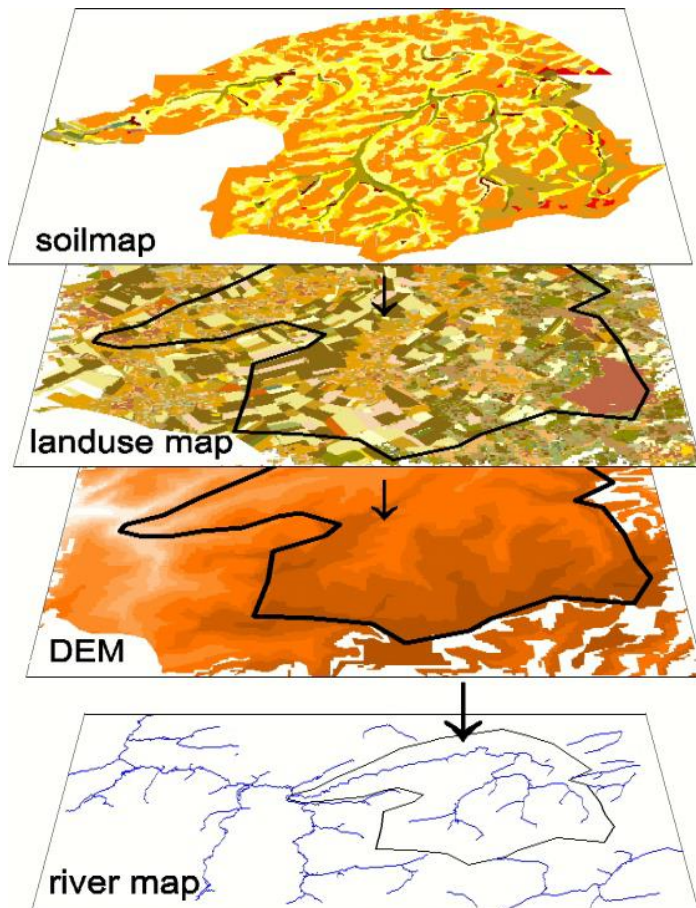
Landsat and water (USGS; 2014) *case studies of the uses and benefits of Landsat imagery in water resources*

Remote sensing for field scale monitoring of crop productivity and crop water consumption: Possibilities and limitations (UNESCO-IHE; 2015) *presentation on the SEBAL tool and FruitLook, including cost-benefit estimates*

Coupling VIS/NIR observations for crop characterisation and agro-hydrological model in irrigation management (IRRI-EYE; 2015) *presentation on practical application of EO for irrigation management*

Managing irrigation from space (TOPS; 2013) *presentation on mapping crop water requirements with satellite observations and CIMIS data in California*

Example *soil moisture modelling*



*enviroGRIDS
soil and water assessment tool (SWAT):
integration of different maps for soil
and hydrological modelling*



Soil moisture modelling

- Earth observation provides the base layers for soil moisture modelling: soil map, land use map, digital elevation model, river map
- Combination with rainfall data, temperature data and evapotranspiration data (derived from or supported with EO)
- Cost estimate: on case-by-case basis
- Main challenges: capacity, access to data



Examples:

enviroGRIDS:

soil and water assessment tool (SWAT) for soil and hydrological modelling

DRYMON (NEO):

detection of soil moisture with satellites: direct measurement of water in the soil, based on daily observations, works under all weather conditions

GEWEX

European Space Agency's Soil Moisture and Ocean Salinity (SMOS) satellite <http://smos.array.ca/web/smos>

Soil moisture data for global challenges (Copernicus; 2014)

brochure on the use of EO for regularly updated, global soil moisture maps

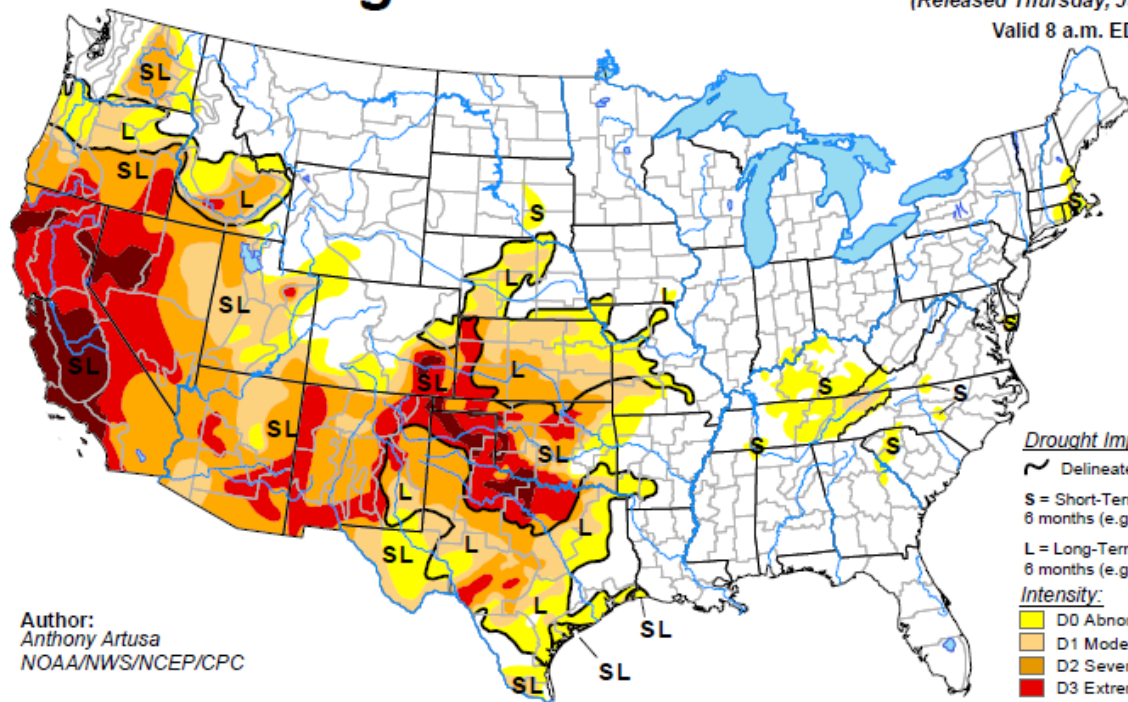
Example drought monitoring

U.S. Drought Monitor

July 1, 2014

(Released Thursday, Jul. 3, 2014)

Valid 8 a.m. EDT



US drought
monitor,
July 1, 2014
(Source: USDA)

Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC

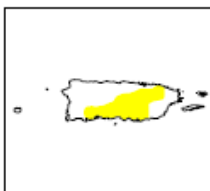
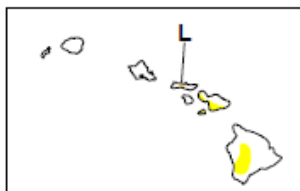
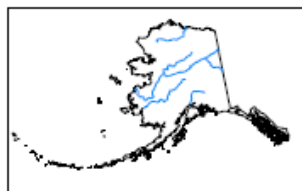
Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- Yellow: D0 Abnormally Dry
- Light Orange: D1 Moderate Drought
- Orange: D2 Severe Drought
- Red: D3 Extreme Drought
- Dark Red: D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

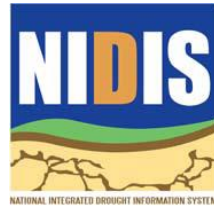


<http://droughtmonitor.unl.edu/>



Drought monitoring

- Remote sensing component (NDVI) + climate component (precipitation index, drought severity index) + biophysical component (land use/land cover type, soil characteristics, elevation, ecological setting).
- Currently mainly carried out by government agencies, but increasing involvement of private sector.
- **Cost estimate:** annual continental coverage with a suite of early warning indicators, at 10-day update frequency ranges between 200 and 300 k€.
- **Main challenges:** capacity, data access.



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

Examples:

**The national drought information system implementation plan:
a pathway for national resilience (NIDIS; 2007) www.drought.gov**

US drought monitor <http://droughtmonitor.unl.edu/>

**Agriculture and Agri-Food Canada's Drought Monitoring and
Information System (AAFC; 2010)**

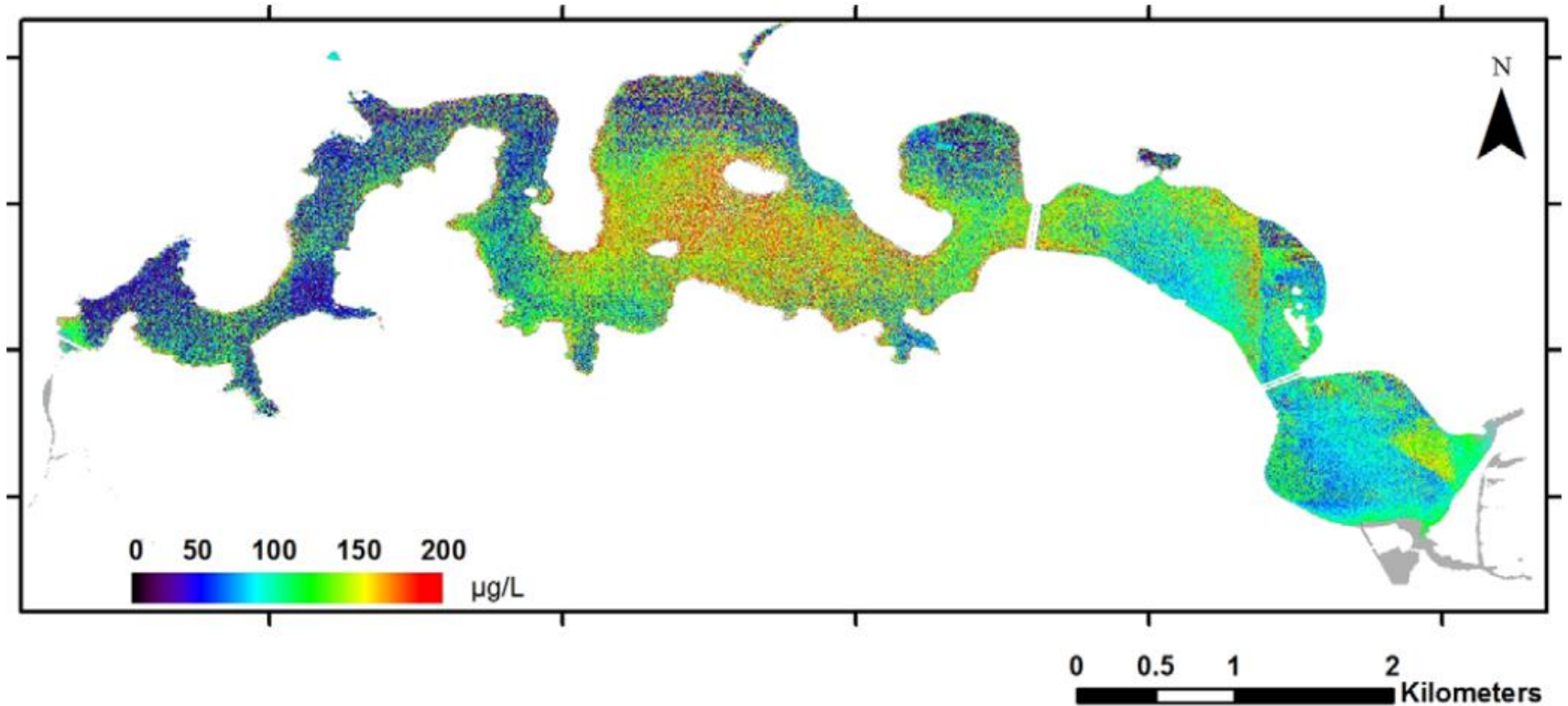
<http://www.agr.gc.ca/eng/?id=1326402878459>

Managing drought in the Southern Plains (Univ. of Nebraska; 2012)

Drought forecasting (ECMWF; 2012)

DROMAS drought monitor (GISAT; 2013)

Example water quality monitoring



*Chlorophyll concentration in Lake Burley Griffin from a Worldview-2 image 17 March 2010
(Source: Dekker, Hestir, 2012)*



Water quality monitoring

- **EO provides information** about chlorophyll content, indicators of harmful algal blooms, coloured dissolved organic matter, suspended matter, vertical light attenuation, turbidity and bathymetry.
- **Other indicators** are derived from analysis of habitats and time series of satellite images (emergent and submerged macrophytes, toxic chemicals, nitrate fertiliser run-off, etc.).
- **Cost estimate:** 50-100k€ per watershed, derived from land-use information (one time step, at 5-10 meter resolution).
- **Main challenges:** capacity, resolution, access to and availability of (in-situ) data, business model.



Examples:

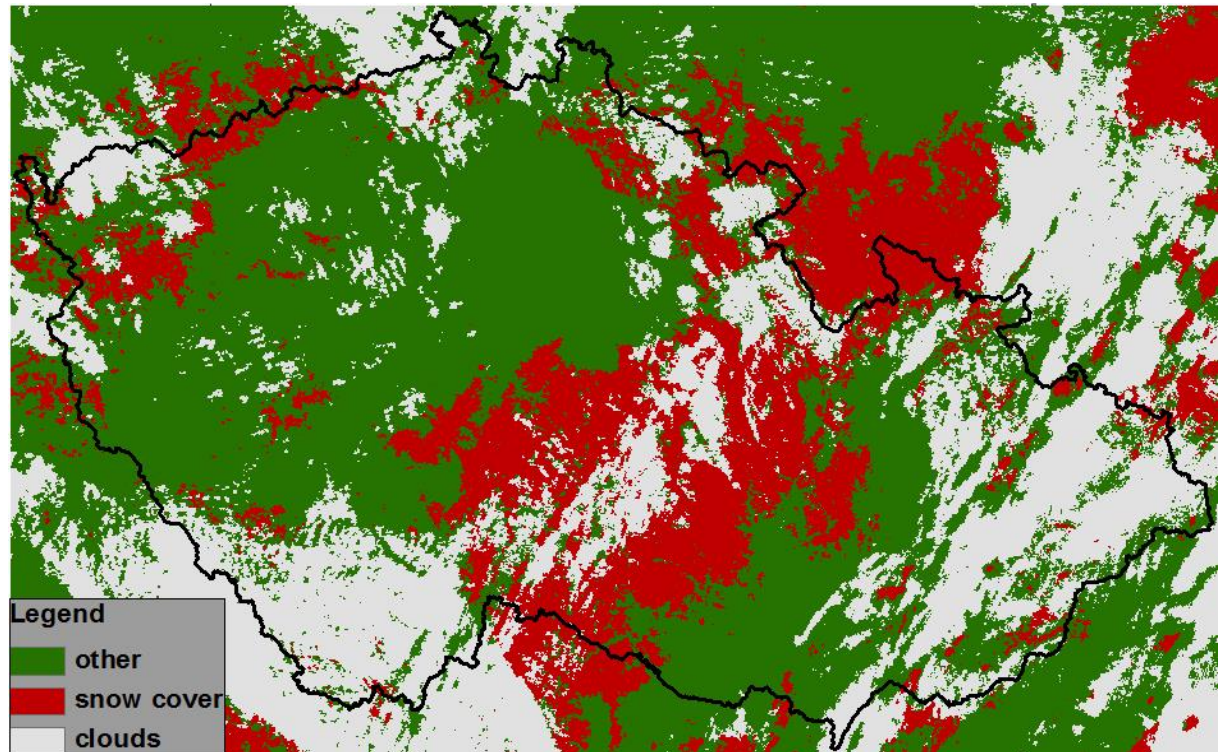
Evaluating the feasibility of systematic inland water quality monitoring with satellite remote sensing (CSIRO; 2012) *overview of EO options for water quality monitoring in Australia*

Real time monitoring of water quality parameters (BlueLeg monitor; 2012) *handheld remote sensing for water quality that can be used to refine and corroborate EO findings*

How clean is your favourite beach? (Copernicus; 2014) *brochure on EO applications for water quality and compliance with EU directives*

Example snow cover monitoring

*Snow cover
9th February 2009,
Czech Republic
(Source: Charles University)*





Snow cover monitoring

- Earth observation provides the input for mapping of snow-covered areas and baseline glacier outlines, changes to the surface area, velocities and mass balance;
- Application areas include hydropower, run-off estimates and information to the general public.
- Cost estimate: 100-200k€ for annual monitoring of a catchment, 20-50k€ for a glacier baseline product.
- Main challenges: capacity, data access, business model.



Examples:

Charles University / GISAT:

snow monitoring in the Czech Republic

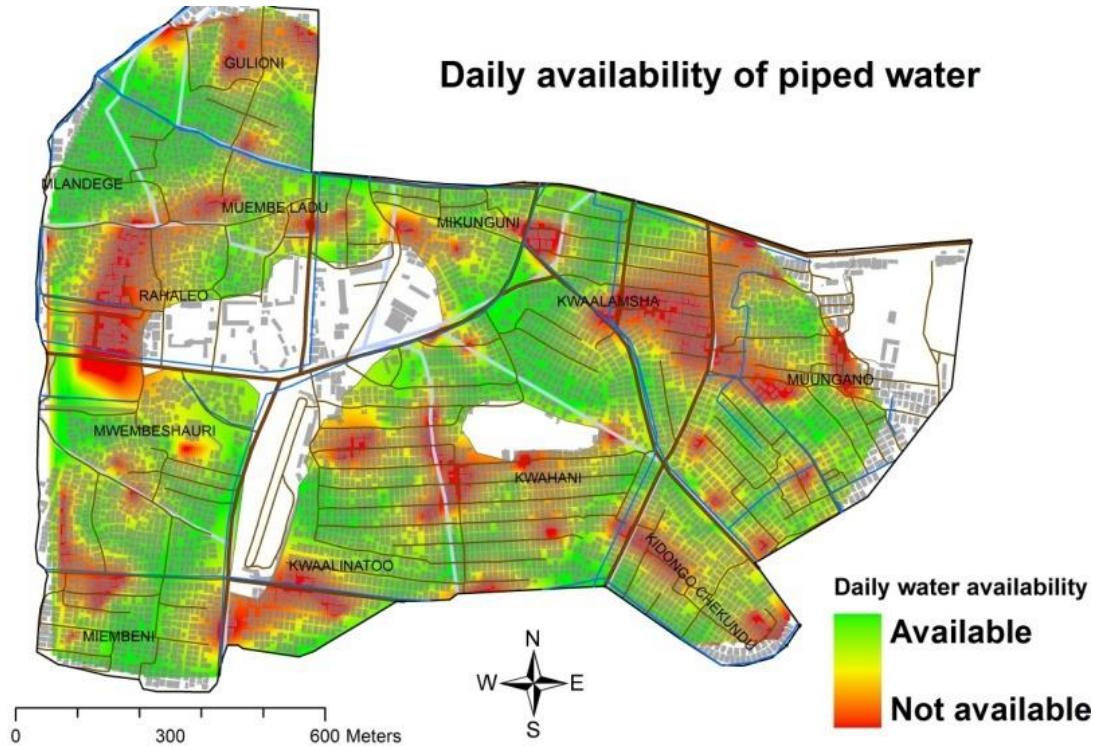
Space Research Centre (CBK PAN):

snow monitoring in Poland

Facing the renewable energy challenge (Copernicus; 2014)

brochure on use of EO for snow cover, snow water equivalent & run-off estimation for hydropower

Example water supply utilities



*Availability
of piped water in slums
Source: Mwehe, 2013*



Water supply utilities

- As in poor urban areas mostly no up-to-date and detailed maps are available, earth observation images serve as background and reference for mapping water supply utilities, analysis of utility performance, detection of unserved areas and damaged infrastructure, community participation, etc.
- **Cost estimate:** on case-by-case basis;
- **Main challenges:** capacity, cost, stakeholder buy-in.



Examples:

Tapping slum dwellers knowledge to improve water supply delivery in slums (Mwehe; 2013)

presentation on water supply problems in slum and how slum dwellers and service providers can be connected and local knowledge and spatial information can be used to improve the situation

WaterAid:

framework and practical tools (WaterPointMapper) to improve water supply and sanitation in poor areas

H2.0 inform and empower initiative:

initiative sponsored by google to improve water supply and sanitation in poor areas, making use of human sensor webs



Growth potential for earth observation

- **Long-term planning water resources planning, climate change scenarios and for (detailed) run-off calculations & (irrigation) system management.**

Main clients: government, water management agencies.

- **Drought monitoring.**

Main clients: government, water management agencies, farmers.

- **Water quality monitoring.**

Main clients: government, environmental agencies, NGOs.

- **Snow cover monitoring.**

Main clients: government, general public.



3. Business development



Why is marketing / promotion of earth observation needed?

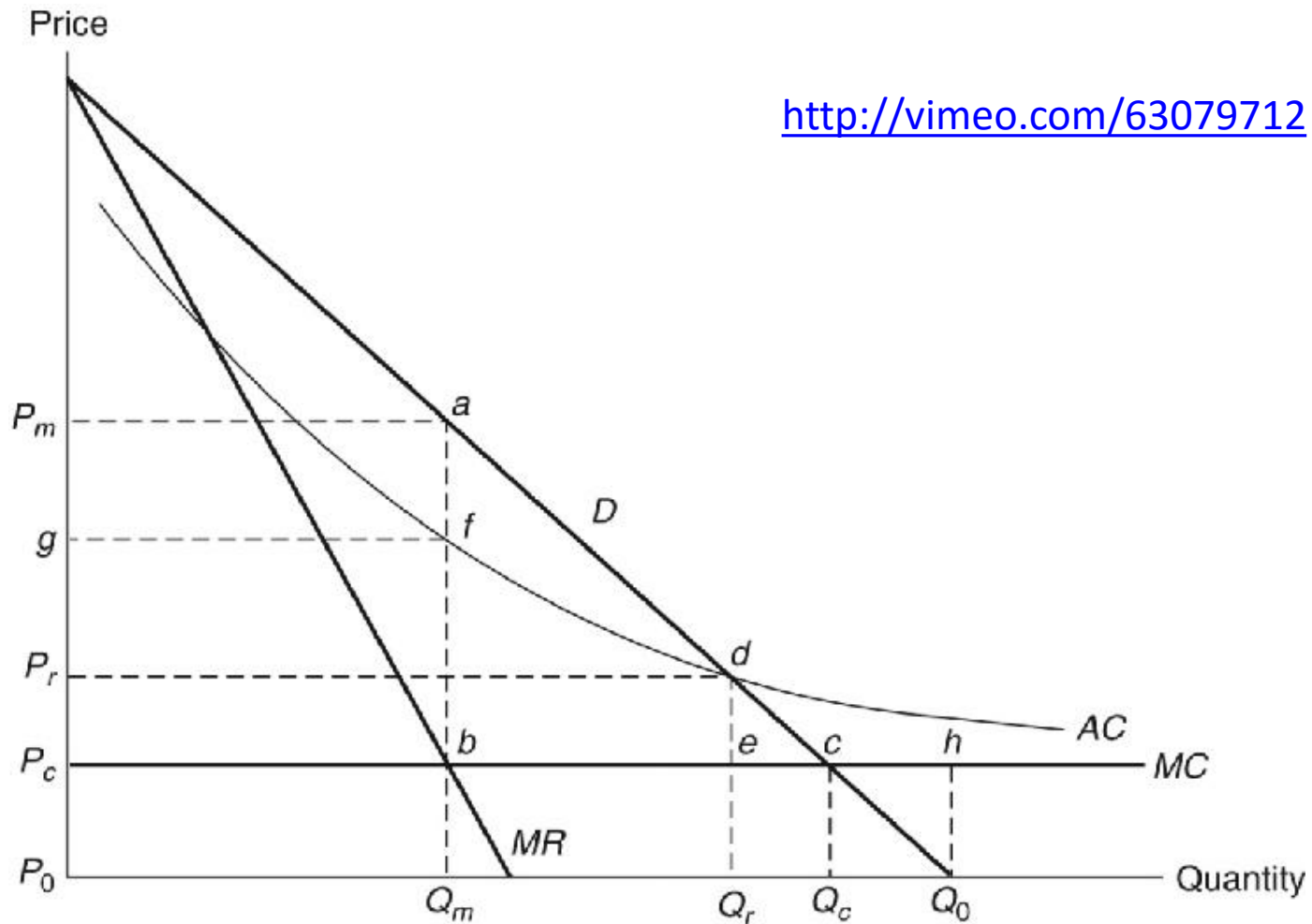
- Public sector information (PSI)
- Externalities (environmental accounting & payment for ecosystem services)
- Global datasets, open access, data sharing, compatibility (GEO)



If public sector information is made available free-of-charge, demand will increase and, in the end, government revenue also, as companies will derive income from value-added products and services, and consequently pay more taxes (see figures in following slides).

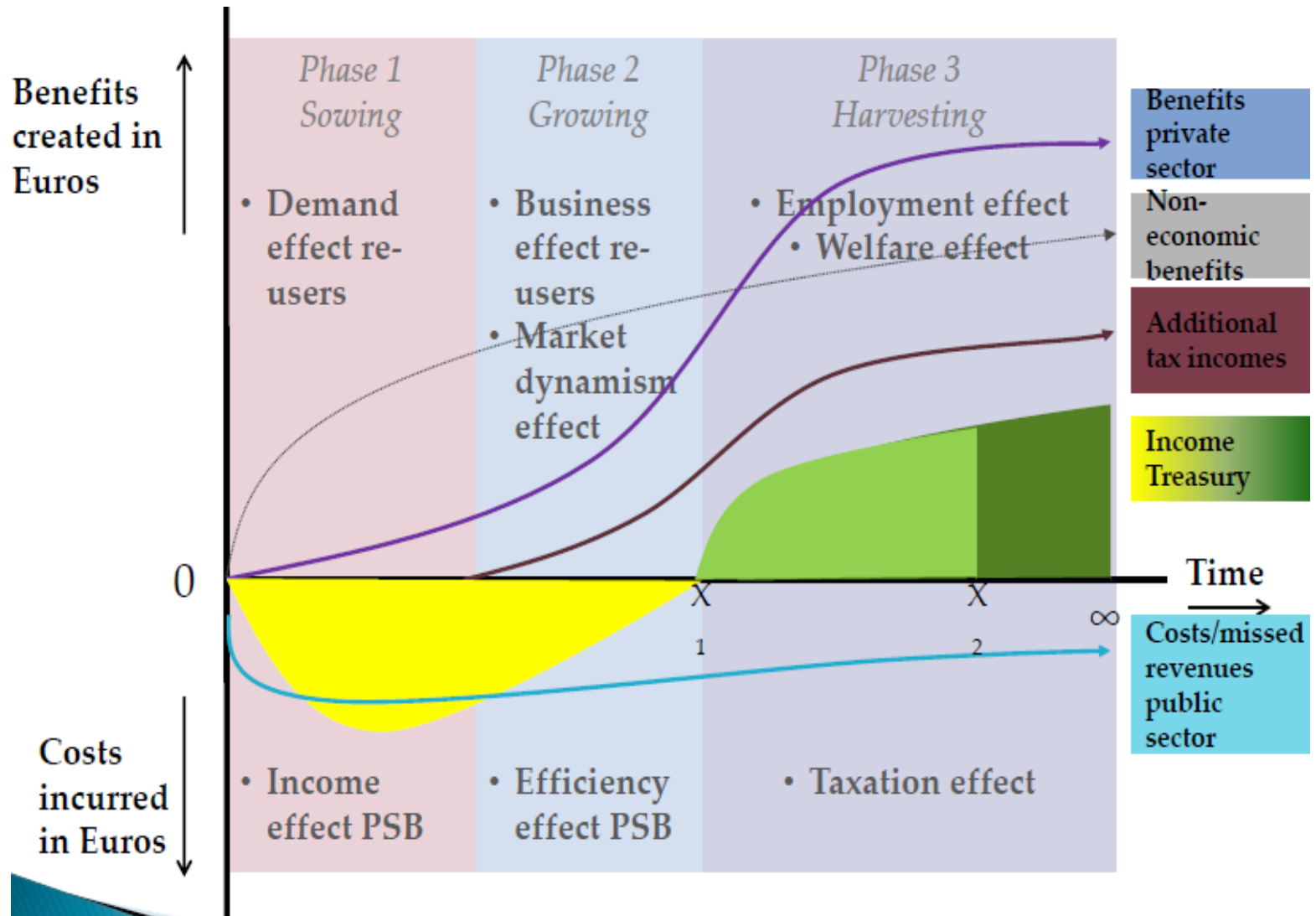
Supply & Demand Public Sector Information

<http://vimeo.com/63079712>



Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Cost-benefit Public Sector Information



Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Re-use of Public Sector Information



Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

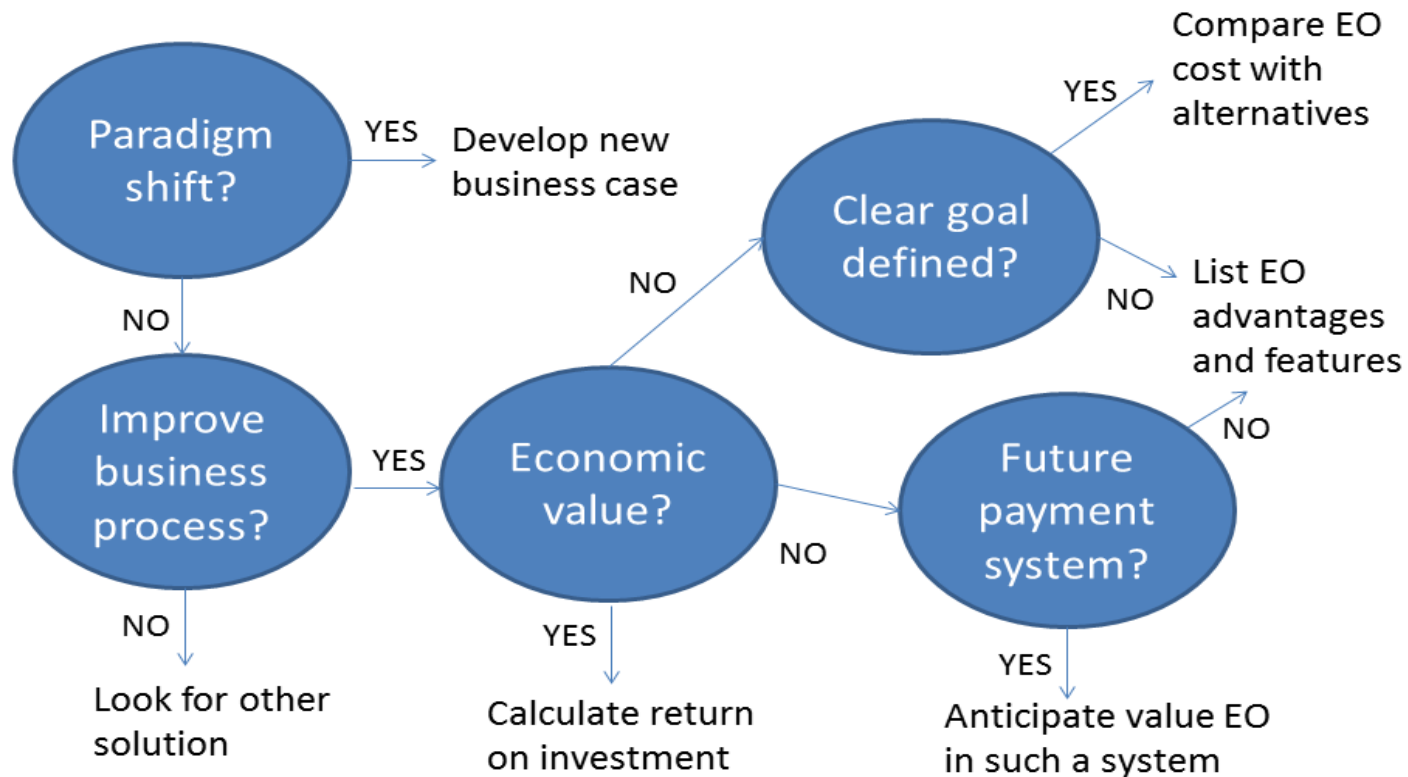


Most earth observation applications deal with so-called externalities, such as impact on the environment. It is difficult to capture these in terms of conventional cost-benefit models.

To tackle this, the following framework for analysis of earth observation applications is developed:

Framework for analysis

Step-by-step benefit EO



Step-by-step analysis of the benefits of earth observation (source: GEONetCab, 2013)



Key questions

- Does the new application cause a paradigm shift?
- Is the current business or organization process improved?
- Does the application provide economic value that can be quantified?
- Is a clear measurable goal defined to which the earth observation application contributes?
- Is a future payment scheme or other economic mechanism foreseen in which the earth observation application fits?



Assessment of geospatial solutions

Rating of **characteristics** of geospatial solutions:

- fit-for-purpose
- comparative advantage
- complexity to user / ease- of-use
- elegance
- cost-benefit,
- sustainability
- resilience
- reproduction capacity / flexibility
- acceptance
- level of knowledge transfer required
- ethics, transparency, public accountability, objectivity & impartiality

Rating of **business environment**:

- **Willingness to pay** (by clients)
- **Embedding** (in organizational processes)
- **Openness** (transparency and ease of doing business, access to markets)
- **Institutions** (is the institutional environment conducive to doing business, acceptance of new solutions?)



Fit-for-purpose

An important, but often forgotten requirement:
Does the product or service do what it is supposed to do to solve a certain problem?

In other words: is it really a solution or just an attempt towards a solution?

- **Quantitative:** not applicable
- **Qualitative (on scale of 1 to 5):** based on description of what the EO solution actually does



Comparative advantage

What it does significantly better than other solutions to the same problem.

For earth observation usually the comparative advantages of greater accuracy, better resolution in time and space, comprehensive overview of large areas and near real-time information provision are mentioned as comparative advantages.

- **Quantitative:** calculation of degree in which the EO solution is better than alternatives
- **Qualitative (on scale of 1 to 5):** based on listing of comparative advantages



Complexity (to user) / ease-of-use

At all levels in the value chain the users (professionals and end-users) are able to work with the product or service.

- Quantitative: not applicable
- Qualitative (on scale of 1 to 5): based on user testimonials and user surveys



Elegance

Once you get the idea behind this product or service, you want to be part of the community that uses it.

This sense of belonging facilitates the formation of user groups that provide valuable feedback.

- **Quantitative:** none, or it should be the size of the user community
- **Qualitative (on scale of 1 to 5):** based on user testimonials and user surveys



Cost-benefit

The cost-benefit of the product or service is quantified and sufficiently attractive, also in the long-term.

- Quantitative: cost-benefit calculation
- Qualitative (on scale of 1 to 5): based on quantitative assessment



Sustainability

The product or service can be delivered when it is needed.
There is a long-term perspective that guarantees delivery.

Sustainability concerns the following aspects:

- ✓ Long-term data availability
- ✓ Availability of finance/funds to provide the solution continuously for present and future use
- ✓ Long-term institutional / governmental interest and support
- ✓ Long-term user interest for a solution that addresses real needs
- **Quantitative:** not applicable
- **Qualitative (on scale of 1 to 5):** based on sensitivity analysis of the EO solution



Resilience

In case of extremes or breakdown in the value chain, the product or service can still be delivered at an acceptable level. Alternatives (plan B) are available (and developed).

- **Quantitative:** cost-benefit calculation of plan B
- **Qualitative (on scale of 1 to 5):** based on risk analysis of the EO solution



Reproduction capacity / flexibility

The product or service can be easily applied or adapted for use in another region or another situation, while still providing the solution without (too much) extra cost.

- **Quantitative:** calculation of reproduction costs for application in other regions or situations; measurement of spreading of actual use
- **Qualitative (on scale of 1 to 5):** based on quantitative assessment and description of EO solution



Acceptance

The users intuitively get what the product or service is about and are interested. They accept it as a solution to their problem.

- **Quantitative:** none, or survey results about acceptance. After introduction of the solution: number of clients and/or users
- **Qualitative (on scale of 1 to 5):** based on user testimonials and user surveys



Level of knowledge transfer required

The training requirements for professionals and other users along the value chain are clear and associated costs and efforts are acceptable.

- **Quantitative:** cost and time required to get the users at the desired knowledge and skill level
- **Qualitative (on scale of 1 to 5):** based on knowledge transfer plans and evaluation of training activities



Ethics, transparency, public accountability, objectivity & impartiality

Application of Earth observation increases the level of objectivity and impartiality in decision-making processes, including conflict resolution. The application improves transparency and public accountability. It raises no ethical issues or if it does, as in the case of privacy concerns, these are resolved in a satisfactory way for all parties concerned.

- **Quantitative:** not applicable
- **Qualitative (on scale of 1 to 5):** based on user testimonials and user surveys



Several attempts have been made to introduce environmental accounting and to enlarge the sphere of the conventional economy to include and quantify impact on ecosystems.

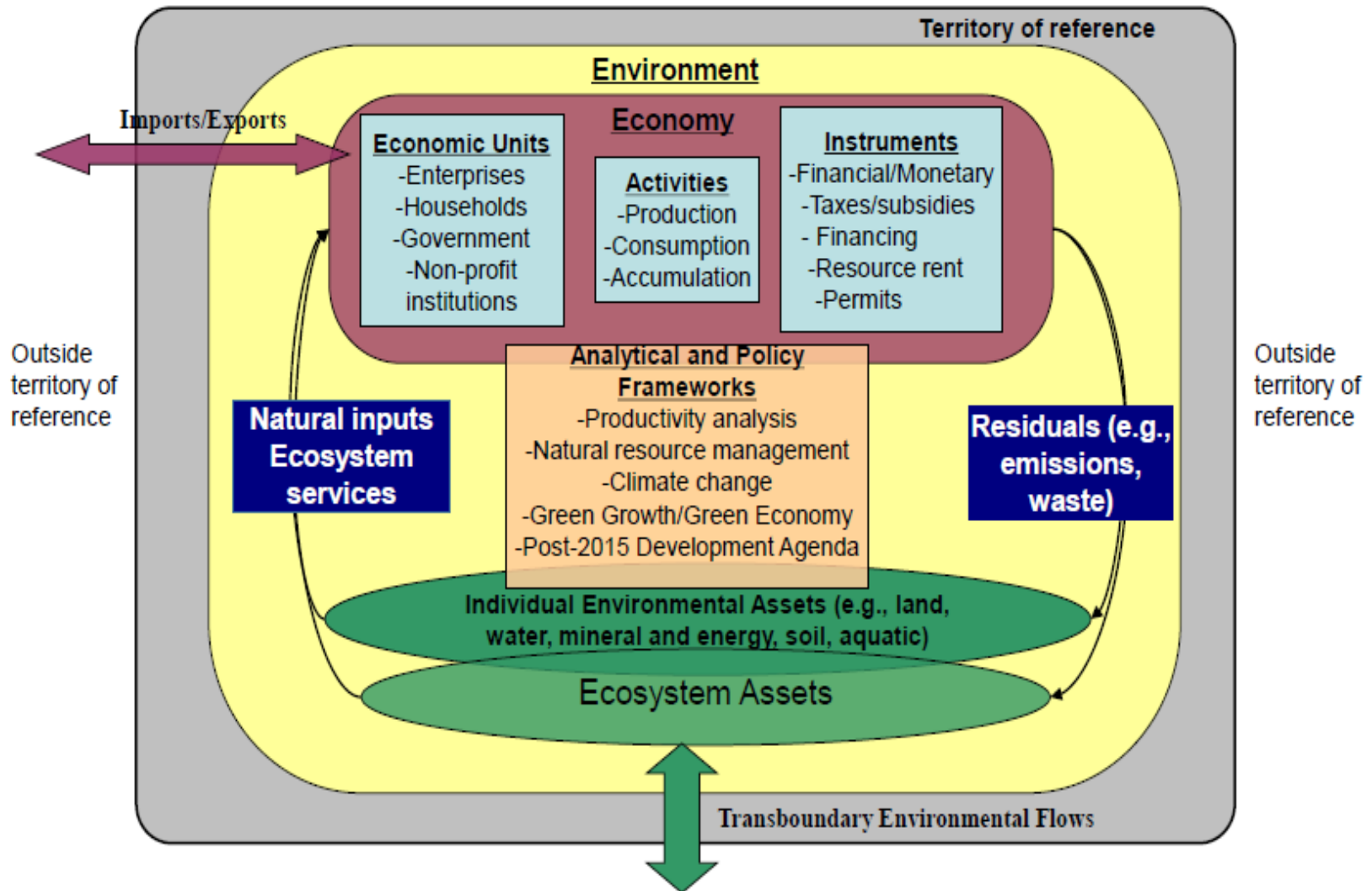
The following slides give some examples:



Environmental accounting & payment for ecosystem services

- **SEEA:**
System of Environmental-Economic Accounts
(EC, FAO, IMF, OECD, UN, WB)
- **WAVES:**
Wealth Accounting and the Valuation of Ecosystem
Services (global partnership, led by World Bank)
- **TEEB:**
The Economics of Ecosystems and Biodiversity
(group led by UNEP)

SEEA Conceptual Framework

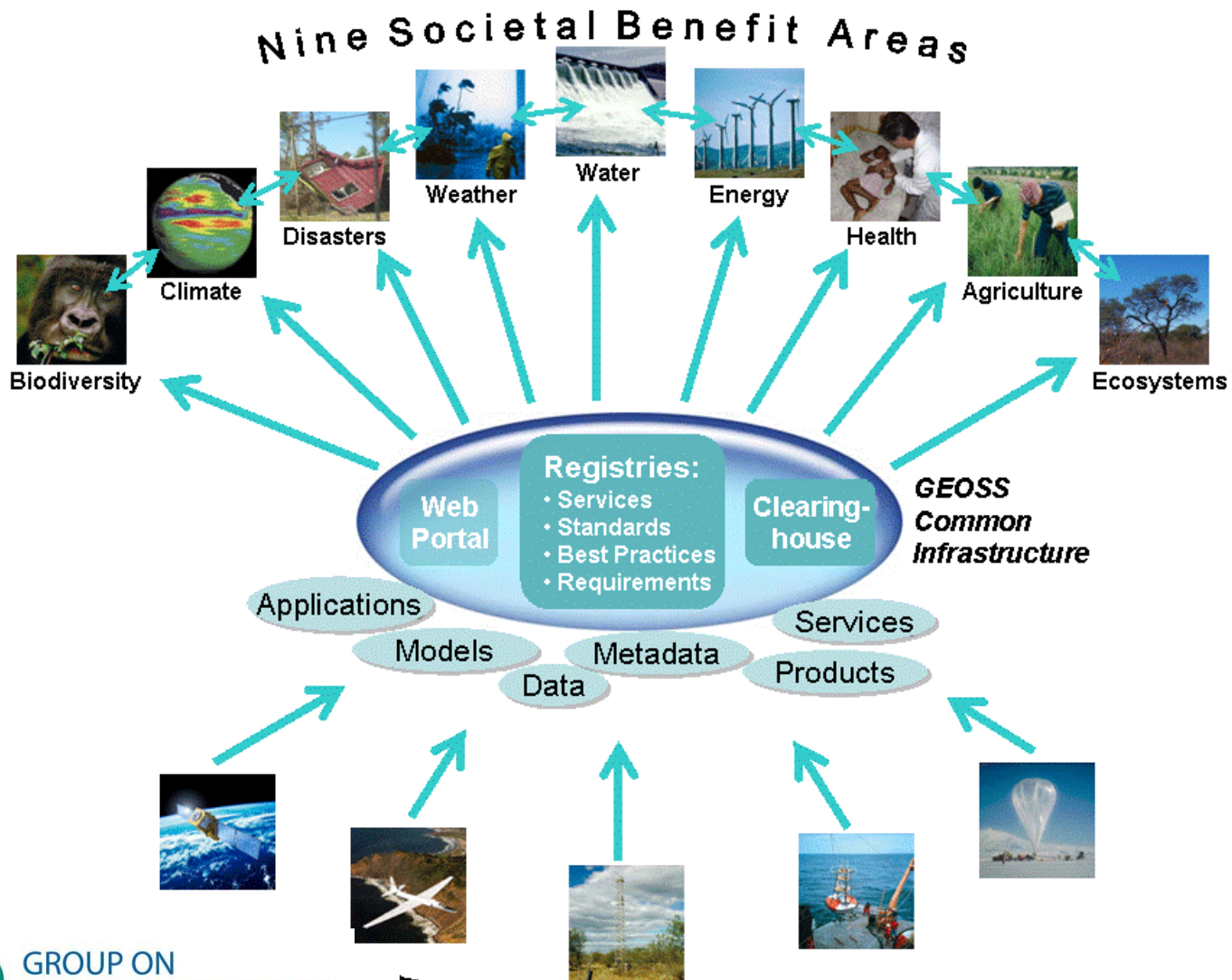


Source: SEEA conceptual framework report (EC, FAO, IMF, OECD, UN, WB 2012)



For earth observation the work of the Group on Earth Observations (GEO) is essential to achieve the goal of a Global Earth Observations System of Systems (GEOSS), resulting in the shared GEO common infrastructure (GCI):

Group on Earth Observations





Marketing elements

- Customer value propositions
- Crossing the technology chasm
- Creating shared value
- Promotion tools



Customer value propositions capture the unique value of a product or services as perceived and appreciated by the customer.

Interestingly, they can differ completely from the features that the provider considers most important:

Customer Value Propositions

VALUE PROPOSITION	ALL BENEFITS	FAVOURABLE POINTS OF DIFFERENCE	RESONATING FOCUS
Consists of:	All benefits customers receive from a market offering	All favourable points of difference a market offering has relative to the next best alternative	The one or two points of difference whose improvement will deliver the greatest value to the customer
Answers the customer question:	“Why should our firm purchase your offering?”	“Why should our firm purchase your offering instead of your competitor’s?”	“What is <i>most</i> worthwhile for our firm to keep in mind about your offering?”
Requires:	Knowledge of own market offering	Knowledge of own market offering and next best alternative	Knowledge of how own marketing offering delivers value to customers, compared with next best alternative
Has the potential pitfall:	Benefit assertion	Value presumption	Requires customer value research

Source: Customer value propositions in business markets (HBR 2006)

Buyer behaviour & motivation

Type	Buyer behaviour	Motivation
Transactional sales	Intrinsic value buyers: “keep it cheap and easy to do business”	Understands the product Perceives it as substitutable Cost focus Resents time ‘wasted’ with sales people
Consultative sales	Extrinsic value buyers: “I don’t know the answer: help me analyse and solve the issue	Focus on how the product is used Interested in solutions and applications Values advice and help Needs the sales person

Source: *Rethinking the sales force* (Rackham, de Vincentis 1999)

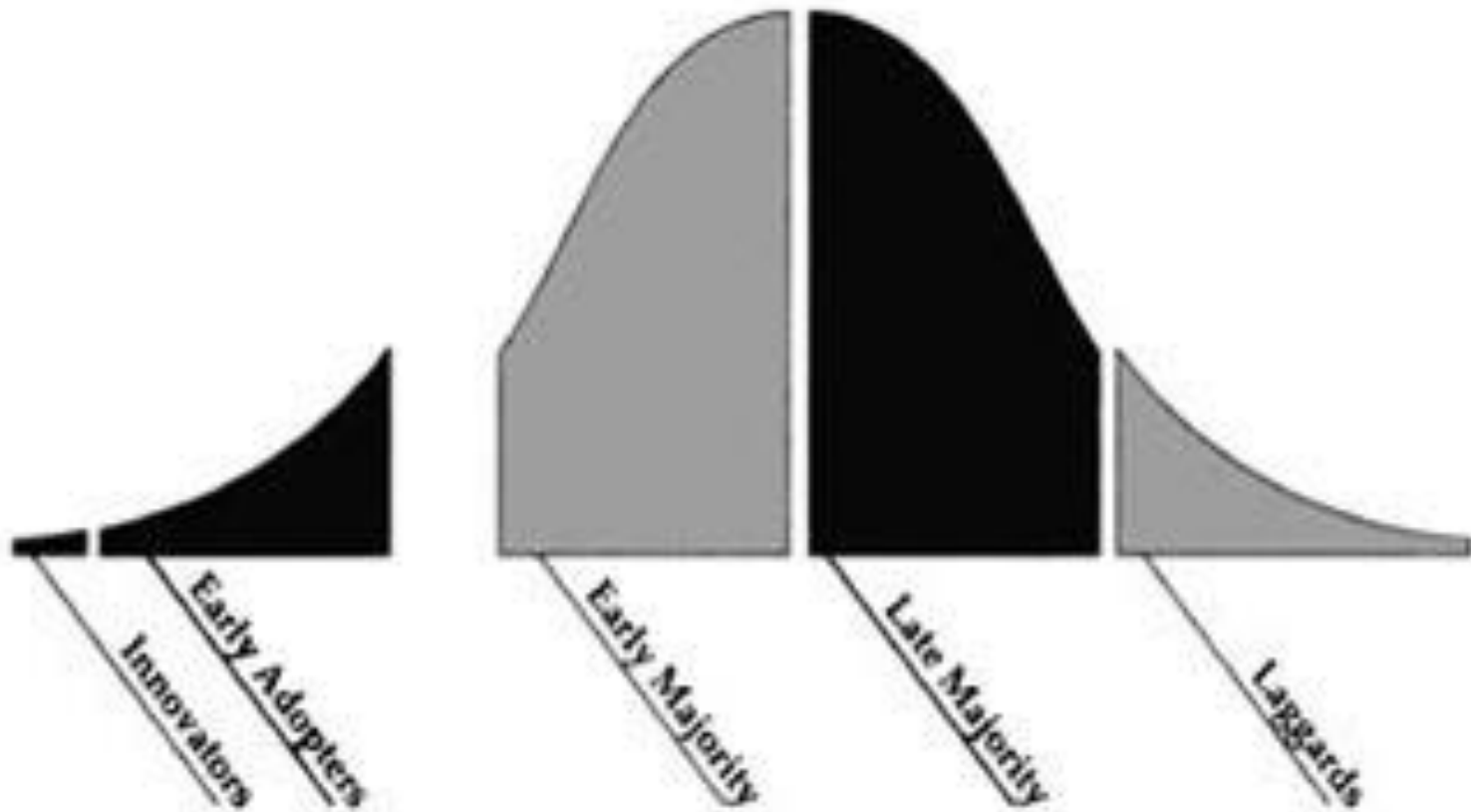


Even when customer value propositions are well captured and formulated, introduction of solutions that involve new technology will have to overcome some hurdles.

This is called “crossing the technology chasm”:

Crossing the technology chasm

The Revised Technology Adoption Life Cycle



Source: Crossing the chasm (Moore 1991)



Crossing the technology chasm

- Most clients of EO products and services belong to the early and late majority.
- They are pragmatists and are not prepared or willing to take substantial risk: the solution should work and be reliable.
- Once convinced, the pragmatists will be long-term clients.

Source: Crossing the chasm (Moore 1991)



More information:

Creating & delivering your value proposition

– managing customer experience for profit
(Barnes, Blake, Pinder; 2009)

Customer value propositions in business markets

(Anderson, Narus, van Rossum [Harvard Business Review]; 2006)

Rethinking the sales force:

refining selling to create and capture customer value
(Rackham, de Vicentis; 1999)

Crossing the chasm

– marketing and selling high-tech products to mainstream customers
(Moore; 1991)



Creating shared value is a key element of successful implementation of earth observation solutions.

To achieve this, in most cases earth observation applications have to be integrated into more general (business or organizational) processes:



Create shared value

Involves cooperation between:

- **Public sector**
- **Private sector**
- **Social sector**

Opportunity for earth observation (integrated) solutions:

- Integrate EO in general business / organizational process
- Integrate different EO (and GIS and navigation) functionalities



Based on all considerations dealt with in the previous slides, there are some practical approaches that can be applied in combination to promote earth observation applications:

Tools for earth observation marketing:

- Success stories (in non-technical language, feasible, replication capacity, sustainable)
- Marketing toolkits (international trends, earth observation examples, references)
- Pilot projects, innovation funds, quick-wins (demonstration that EO actually works)
- Promotion outside EO community (fairs, seminars, lunch-bag meetings, magazines)
- Resource facilities for reference and capacity building (distributed, but connected, in different languages)



Business elements

Business elements:

- **Proposal writing**
- **Business procedures**



Proposal writing is an art in itself.

During the GEONetCab and EOPOWER projects templates have been developed for writing successful proposals:



Proposal outline

1. Introduction / relevance
 2. Objective(s)
 3. Activities
 4. Output
 5. Management & evaluation
 6. Risk assessment
 7. Time schedule
 8. Budget
- Annexes

*(more detailed version in separate document,
see www.eopower.eu or www.hcpinternational.com)*



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Other guides that may be useful:

- Civicus: writing a funding proposal
- Michigan State University: guide for writing a funding proposal
- ESRI: writing a competitive GRANT application
- REC: project proposal writing



If you run a company, compete for assignments and manage projects, a structured approach towards responsibilities, tasks, implementation and documentation is needed.

The following business procedures may be helpful:



Business procedures

1. On acquisition
2. On offers
3. On negotiation
4. On contracts
5. On project management
6. On travel & deployment
7. On deficiencies & complaints
8. On internal organization
9. On finance

*(more detailed version in separate document,
see www.eopower.eu or www.hcpinternational.com)*



Again:

- **SHARED PROBLEM**
- **SHARED LANGUAGE**
- **SHARED SOLUTION**



4. Capacity Building



General

Marketing is promotion + capacity building.

Especially for the introduction of new technologies capacity building is important at all levels.

Capacity building is the instrument to increase self-sufficiency and make solutions work.



General references for capacity building, open data and success stories

GEO Portal: www.earthobservations.org

Capacity building resource facility www.geocab.org
compilation of tutorials, references, open-source software, etc.

Satellites going local: *share good practice* **(Eurisy handbooks)**
www.eurisy.org

Earth observation for green growth (ESA; 2013)



General references for capacity building, open data + call for proposals

Bringing GEOSS services into practice:

how to use data from the GEO portal and how to provide input

www.envirogrids.net

Science education through earth observation for high schools:

basic tutorials on all kind of subjects

www.seos-project.eu

Securing water for food: *call for proposals on innovative solutions*

securingwaterforfood.org

Copernicus briefs: *information on satellite applications for different topics*

<http://www.copernicus.eu/main/copernicus-briefs>

More references open data

Open data for sustainable development (World Bank; 2015)

description of the benefits of open data for a wide range of development goals, including the SDGs

<http://pubdocs.worldbank.org/pubdocs/publicdoc/2015/8/904051440717425994/Open-Data-for-Sustainable-development-Final-New.pdf>

Terms and conditions for the use and distribution of Sentinel data (European Parliament and European Commission; 2014)

standard stipulations related to free and open access to Sentinel data

http://www.demarine.de/lr/c/document_library/get_file?uuid=c5067655-b7ad-4d71-b07b-6111808f4abd&groupId=13521

Towards a thriving data-driven economy (European Commission; 2014) policy document on the use of (open) data for a knowledge economy and society

http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=6210



Capacity building resources for water management:

The TIGER initiative – looking for water in Africa (ESA; 2011)

Technical material for water resources assessment
(WMO; 2012)

Guide to hydrological practices: part 1 & part 2 (WMO; 2009)

Water point mapper: user guide & configuration guide (WaterAid)

Remote sensing applications

chapter 6: Water & chapter 8: Groundwater (NRSC, 2010)

MetEd: *tutorials and courses on meteorology and related subjects*

https://www.meted.ucar.edu/training_detail.php

Capacity building resources for water management (2):

From cloud top temperature to rainfall

Blending TRMM and MSG (ITC; 2015)

3-day EOPOWER (self-study) course for professionals

<http://menhir.itc.utwente.nl:5000/fbsharing/KGKOZXKU/>



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