Earth Observation for Water Management

International trends & developments

Earth observation applications

Business development

Capacity building

0. Introduction

Mark Noort, consultant, project manager

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

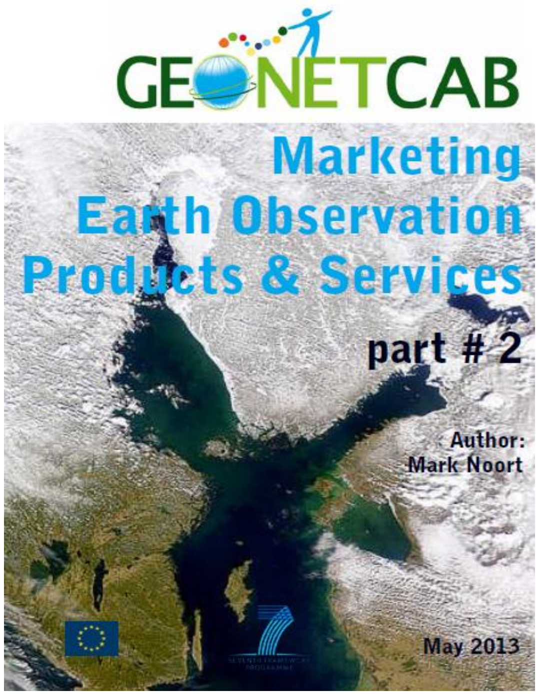
System analysis & design

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 environmental 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

UNEP

International Resource Panel

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 of 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

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)

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)

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)

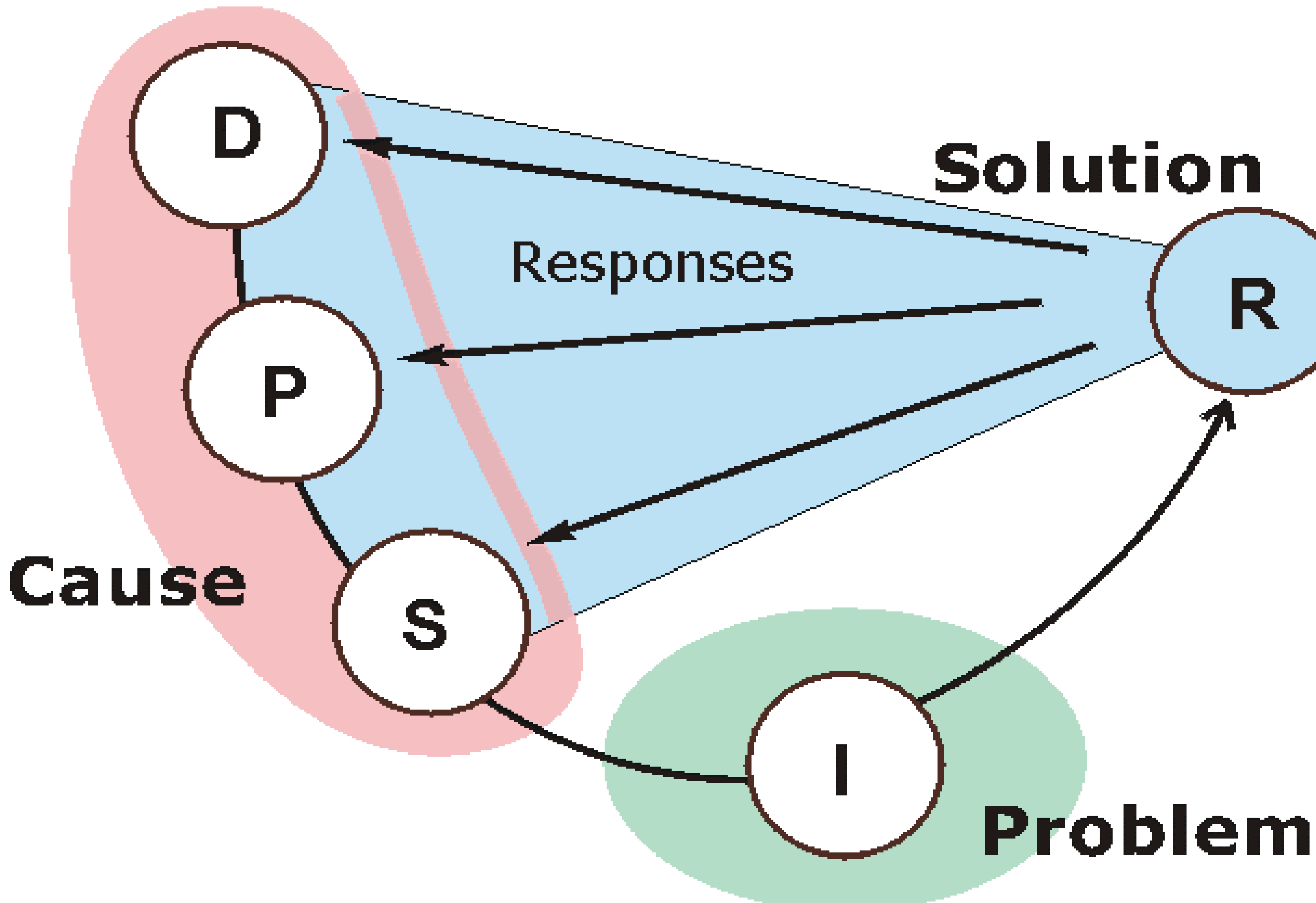
European Environment Agency

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 (SEEAW, 2007) & WISE (water information system for Europe)

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



European Environment Agency

Example Africa

Africa Water Atlas

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

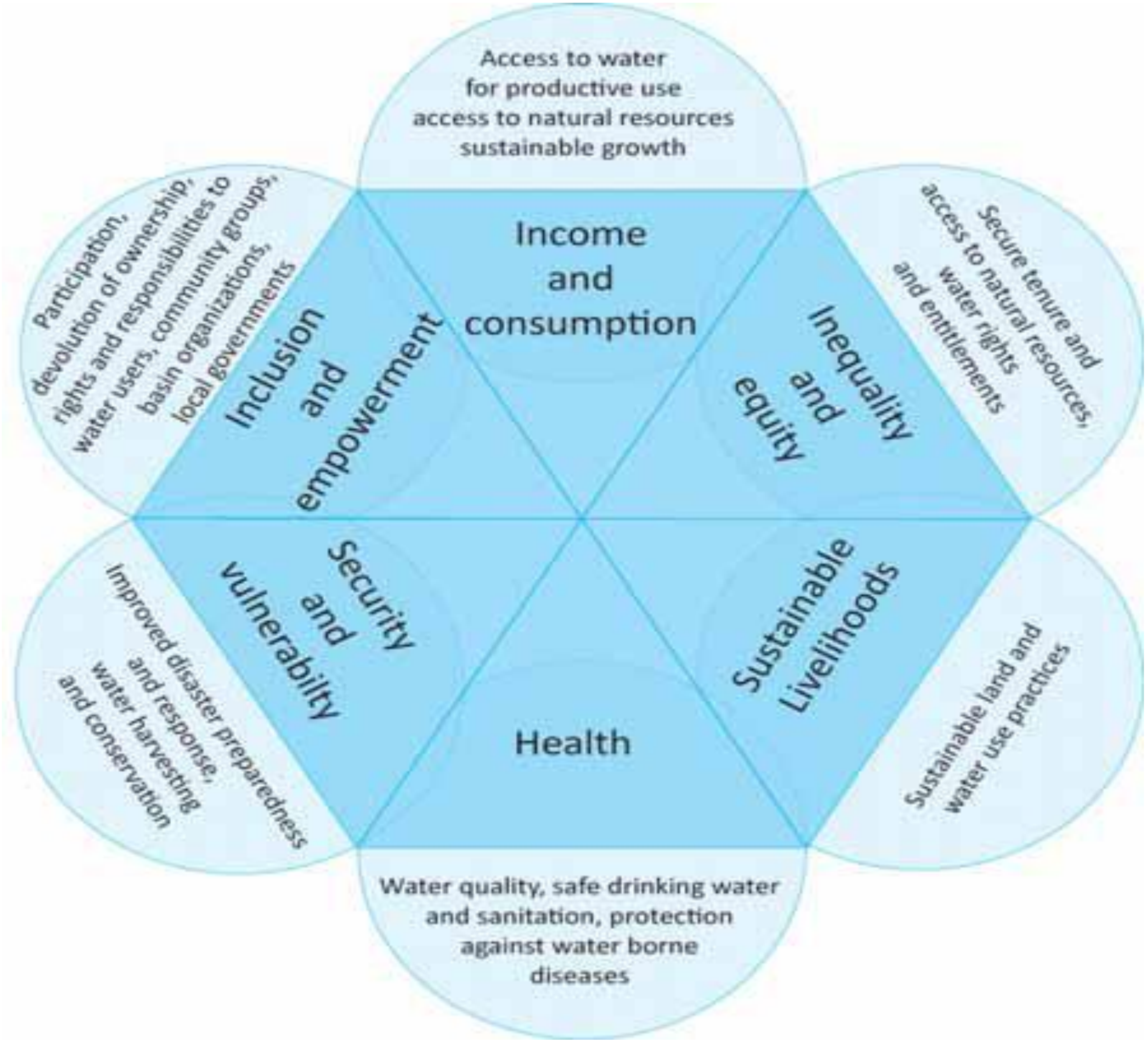
- **"hotspots":** tenuous food security situation
- **"hopespots":** potential for rainwater harvesting
- **"water towers":** areas with upstream water surplus

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

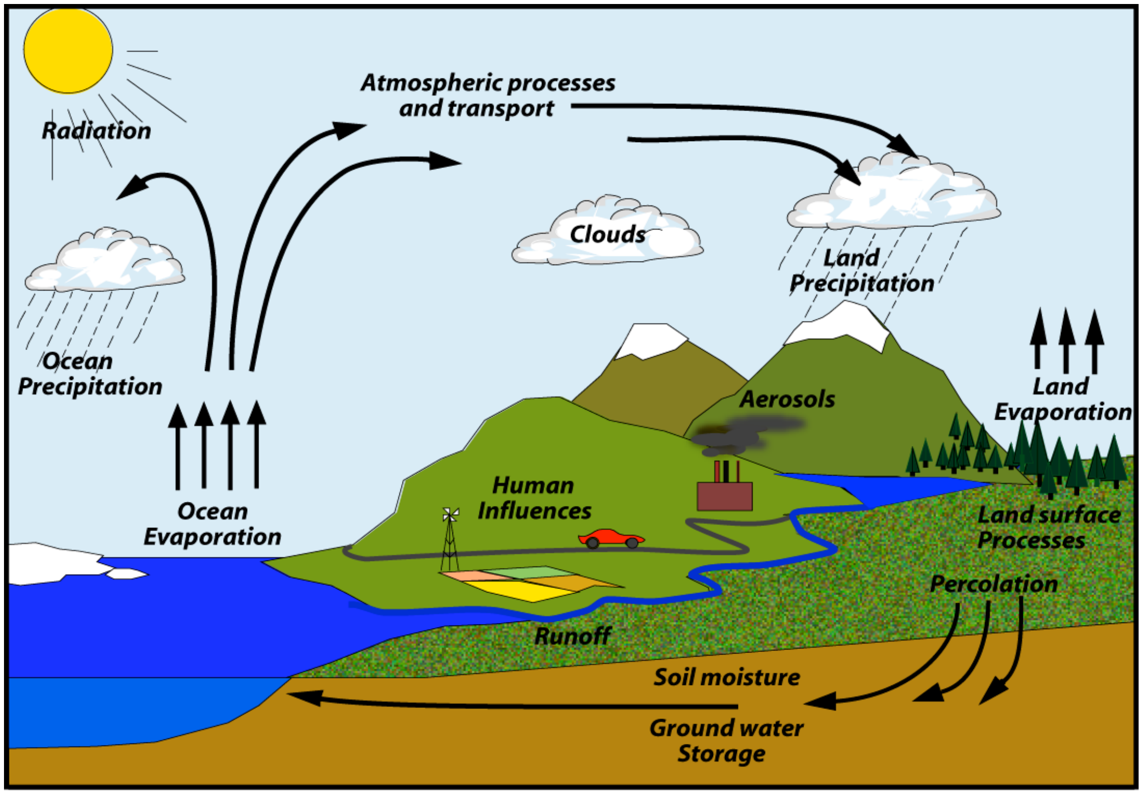
More information:

Water resources across Europe — confronting water scarcity and drought, EEA Report No 2/2009 **(EEA; 2014)**

Africa water atlas (UNEP; 2010)

2. Earth observation applications

Earth observation for water management

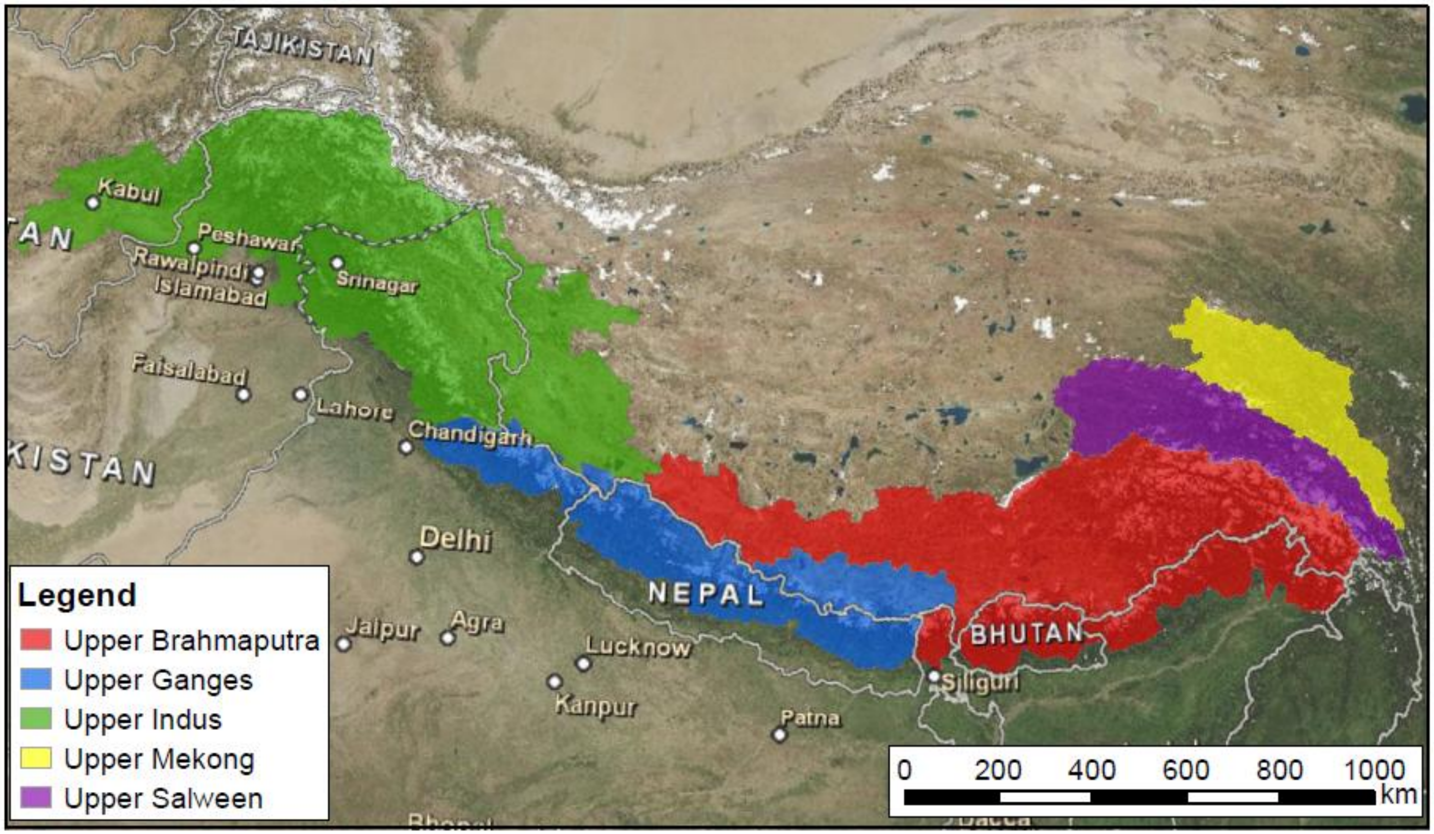


The water cycle (GEWEX)

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:

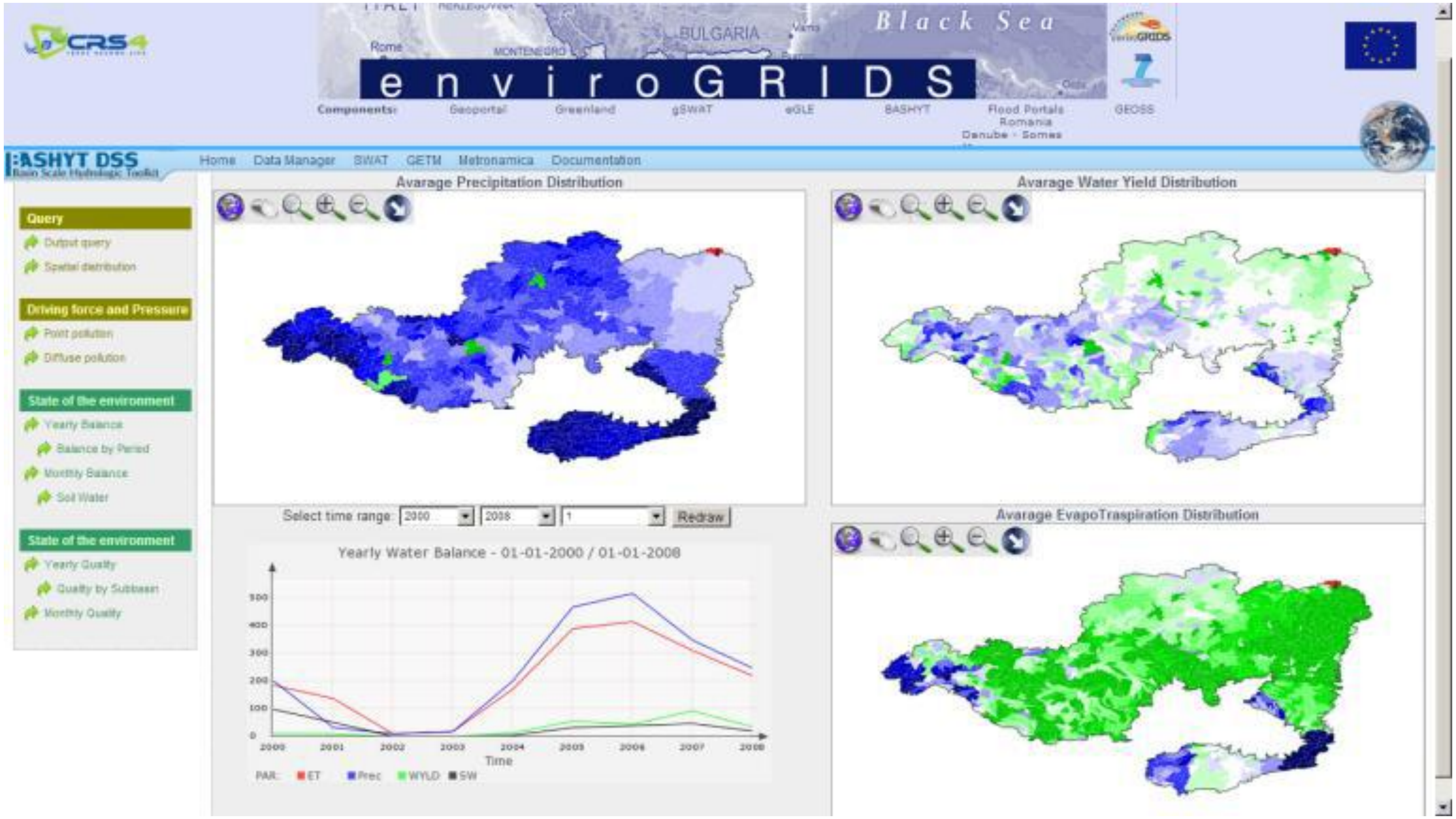
Uses and limitations of observations, data, forecasts, and other projections in decision support for selected sectors and regions (NASA; 2008): *chapter 5 – decision support for water resources management*

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)

Example hydrologic information systems



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 in respect of 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:

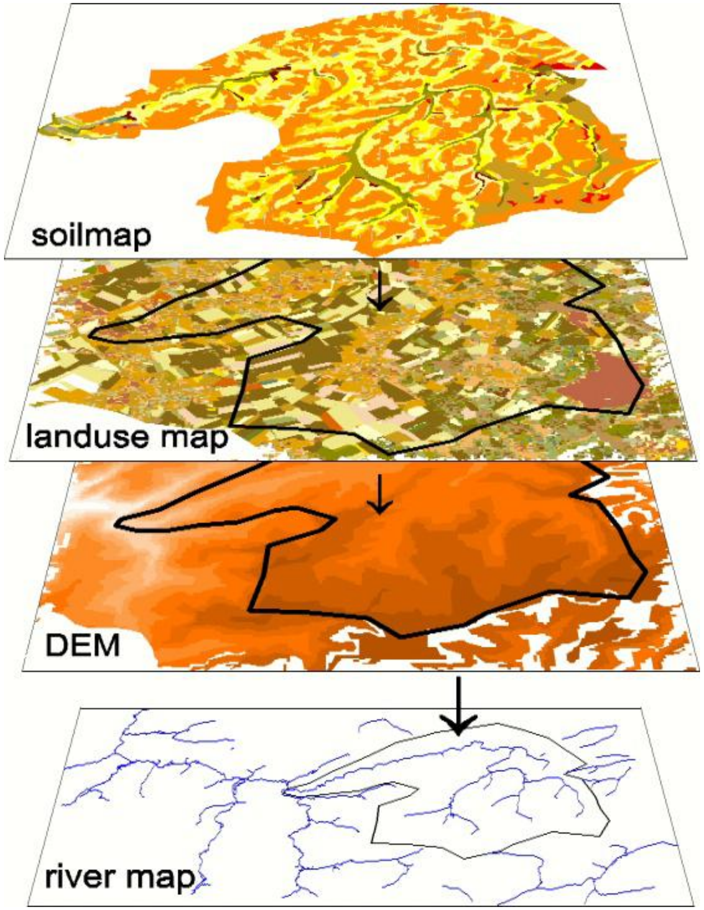
TIGER (ESA)
Application of satellite remote sensing to support water resources management in Africa: results from the TIGER initiative

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

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):

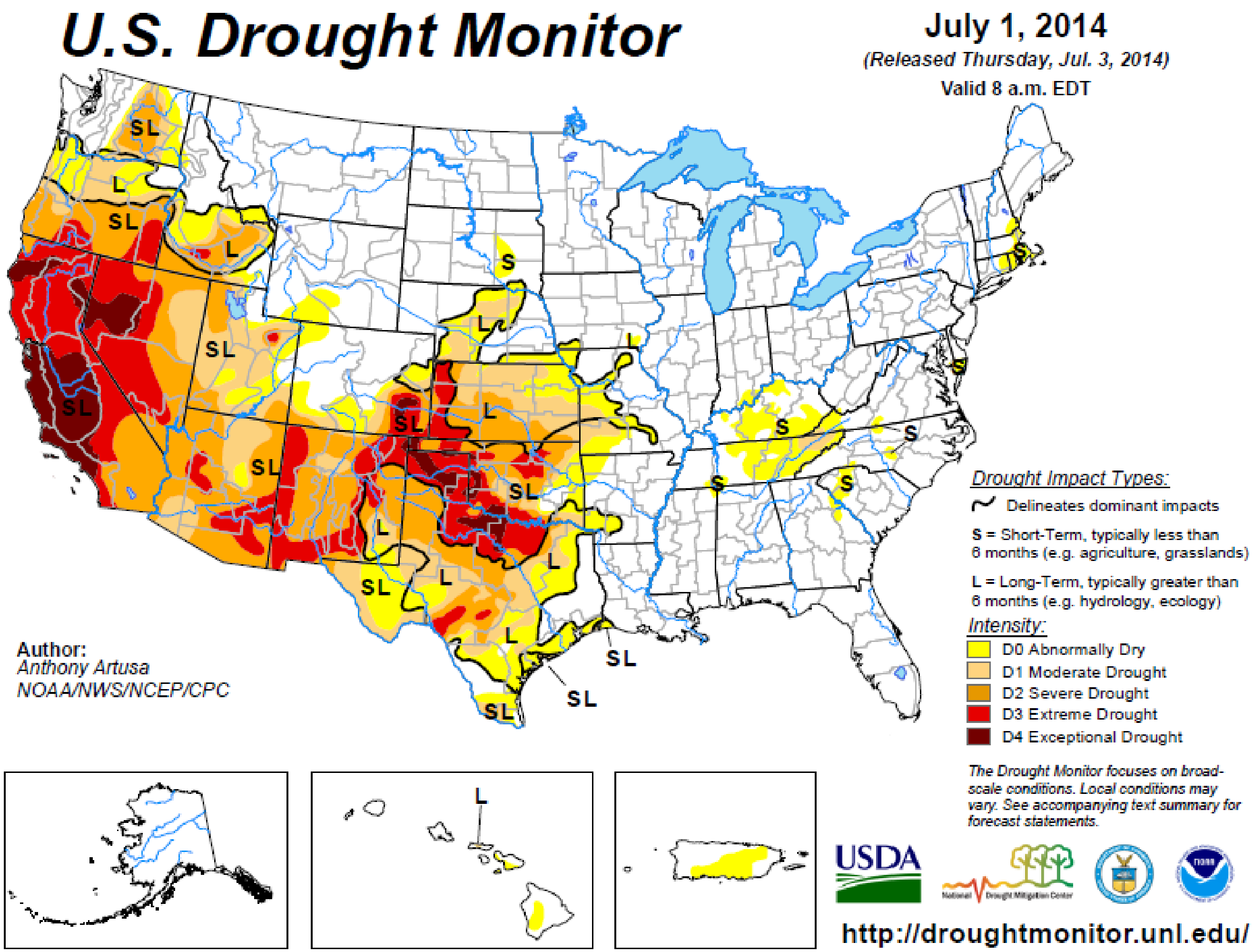
Detection of soil moisture with satellites: direct measurement of water in the soil, based on daily observations, works under all weather conditions

GEWEX

European Space Agency's Soil Moisture and Ocean Salinity (SMOS) satellite

http://smos.array.ca/web/smos

Example drought monitoring



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

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/

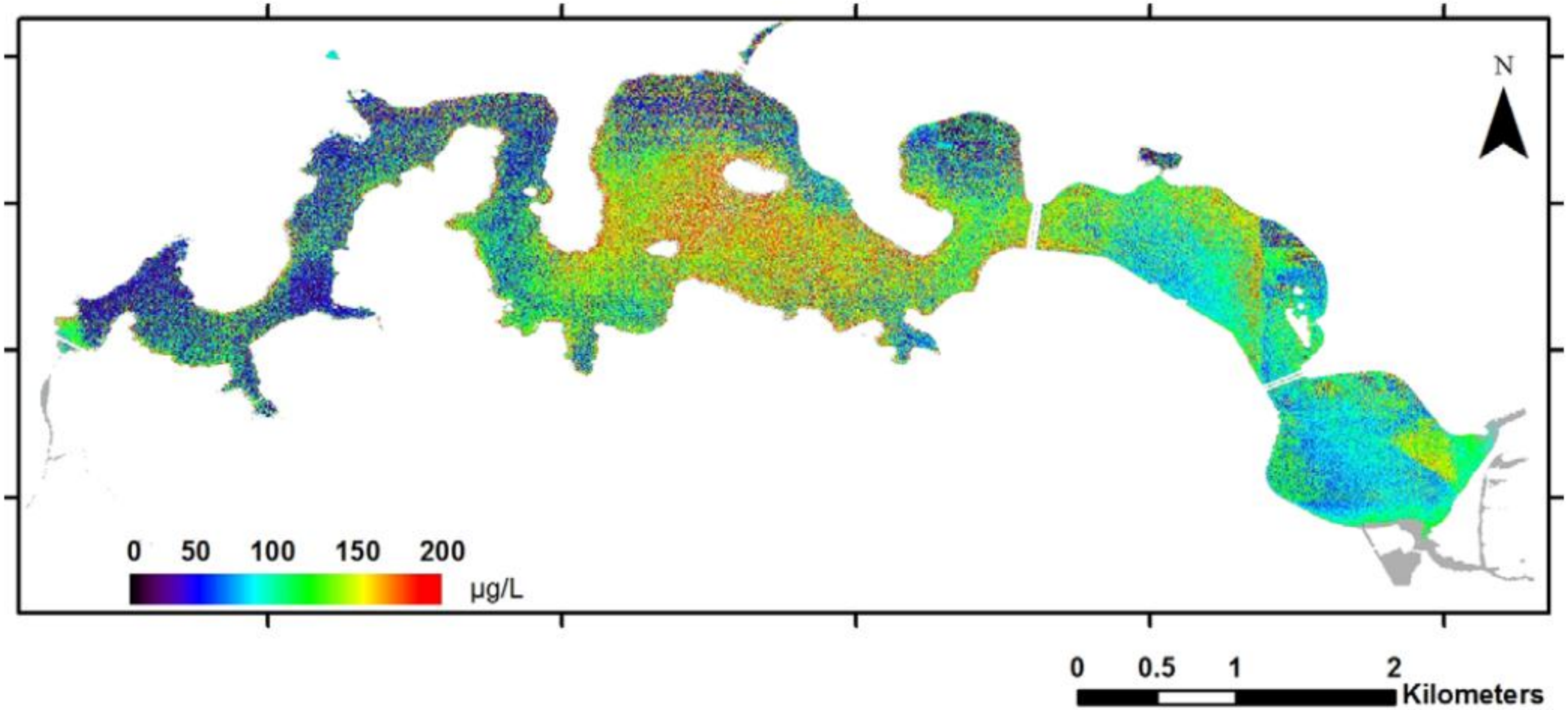
Agriculture and Agri-Food Canada's Drought Monitoring and Information System (AAFC; 2010)
http://www.agr.gc.ca/eng/?id=1326402878459

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.

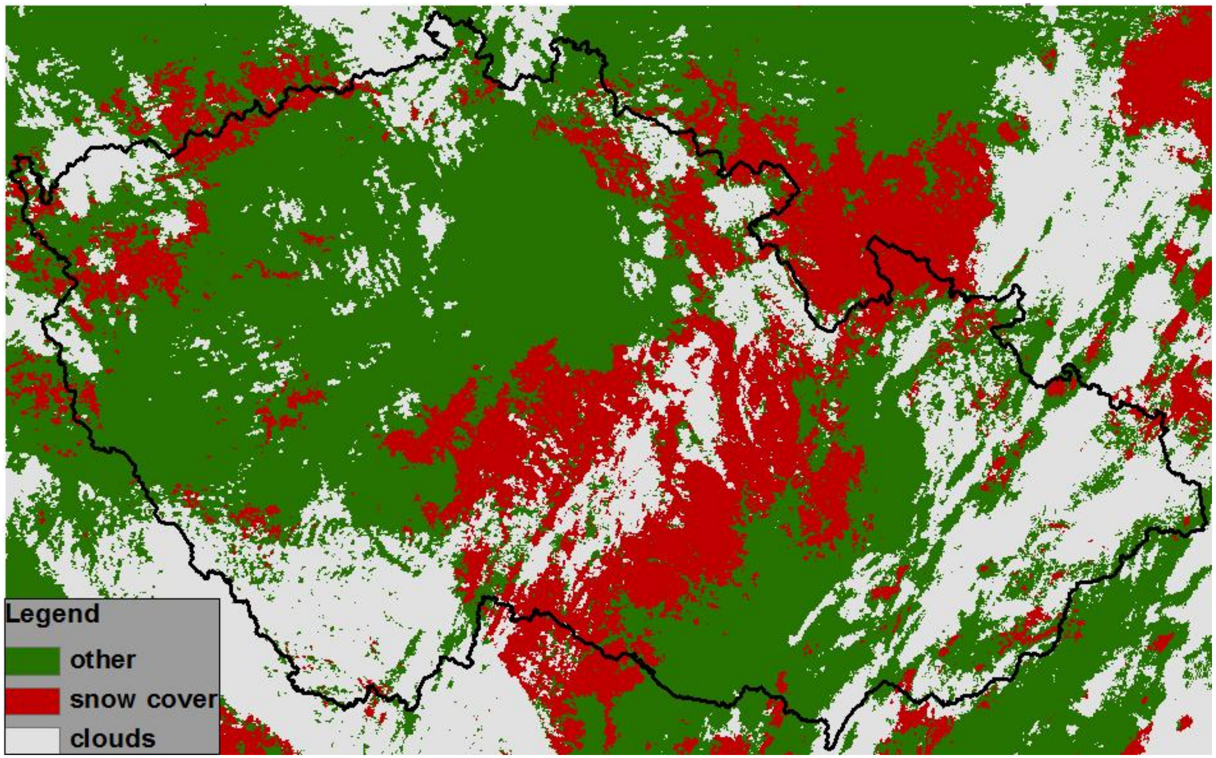
Examples:

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

Example snow cover monitoring

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



Snow cover monitoring

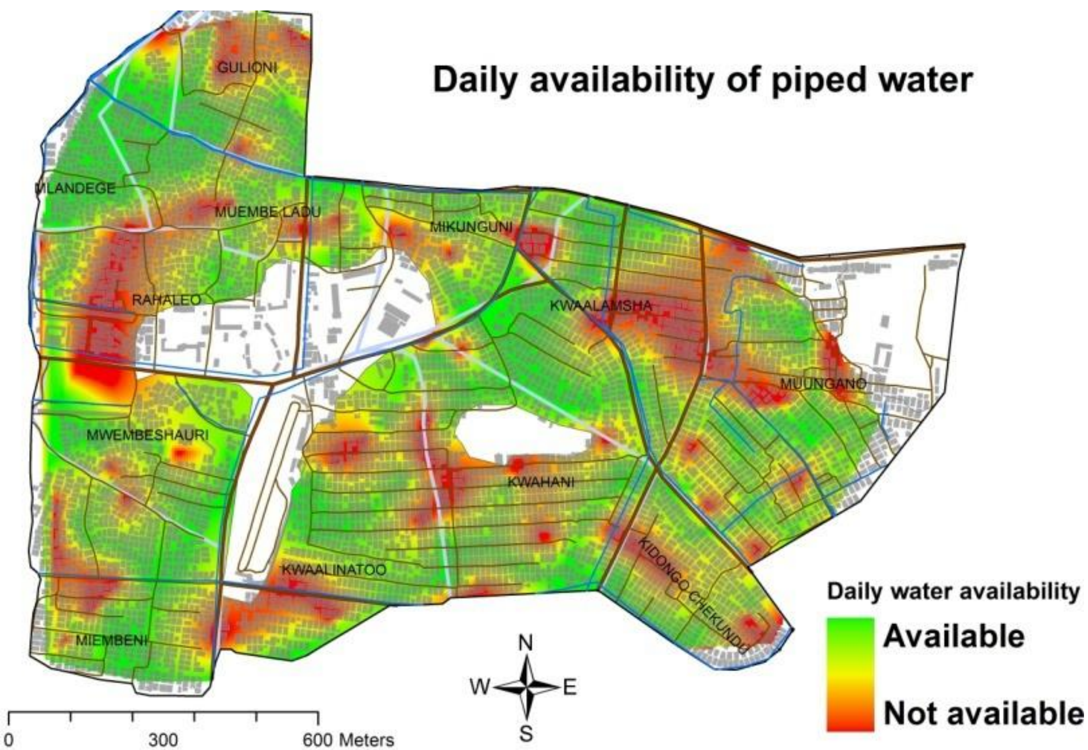
- Earth observation provides the input for mapping of snow-covered areas and baseline glacier outlines, changes to the surface area, velocities and mass balance;
- Application areas include hydropower, run-off estimates and information to the general public.
- Cost estimate: 100-200k€ for annual monitoring 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 WAW):
Snow monitoring in Poland.

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.

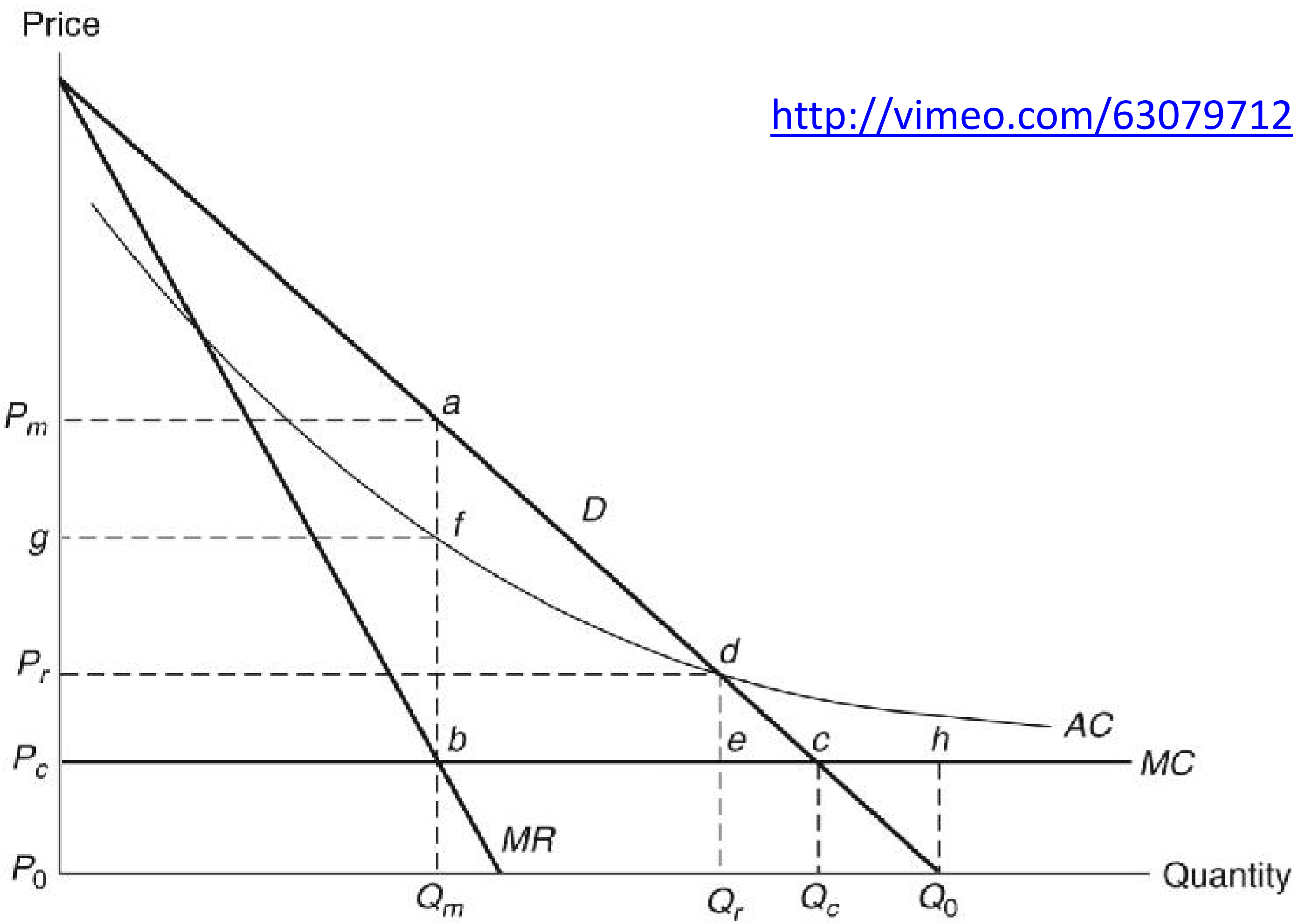
3. Business development

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).

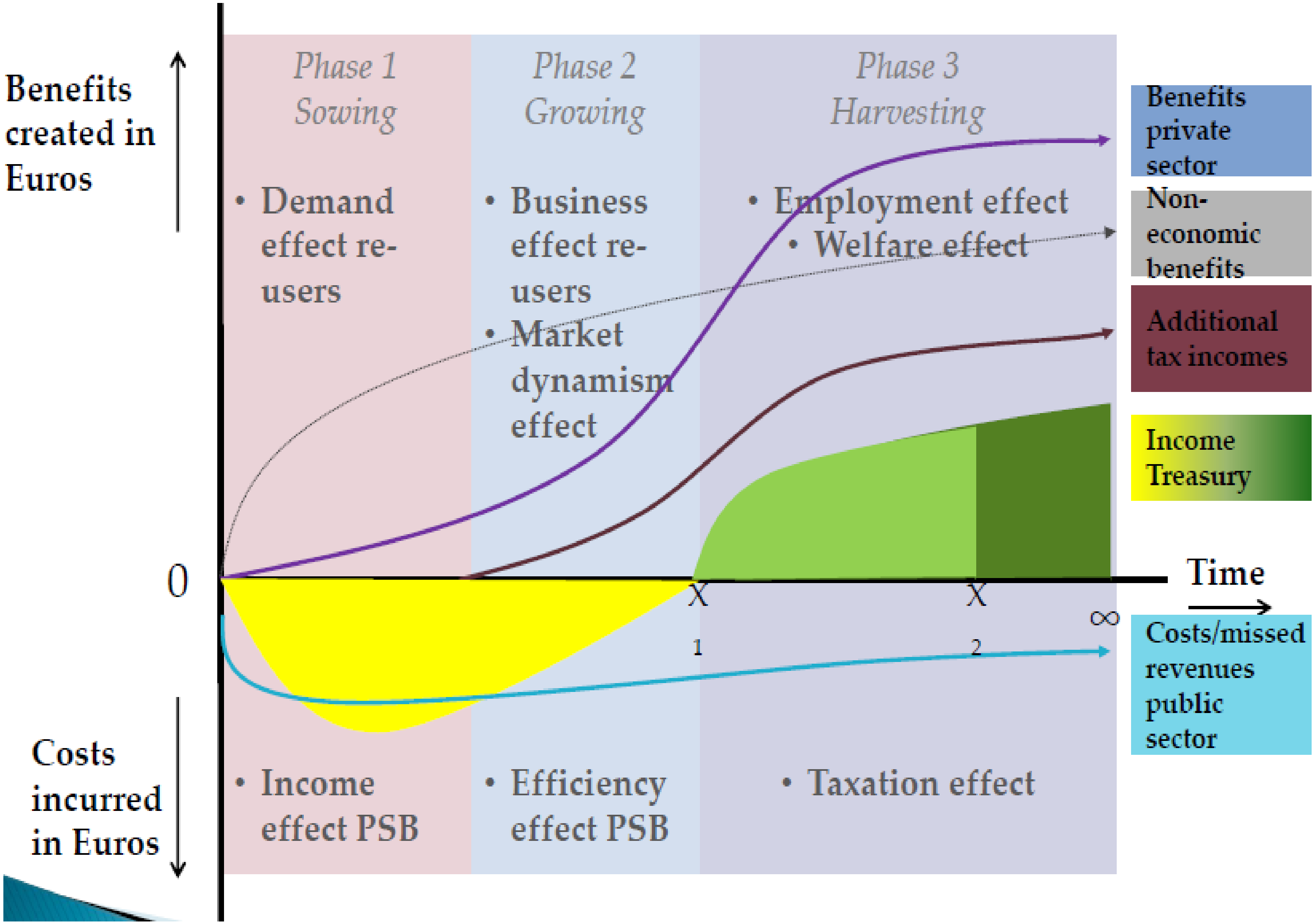
Supply & Demand Public Sector Information



http://vimeo.com/63079712

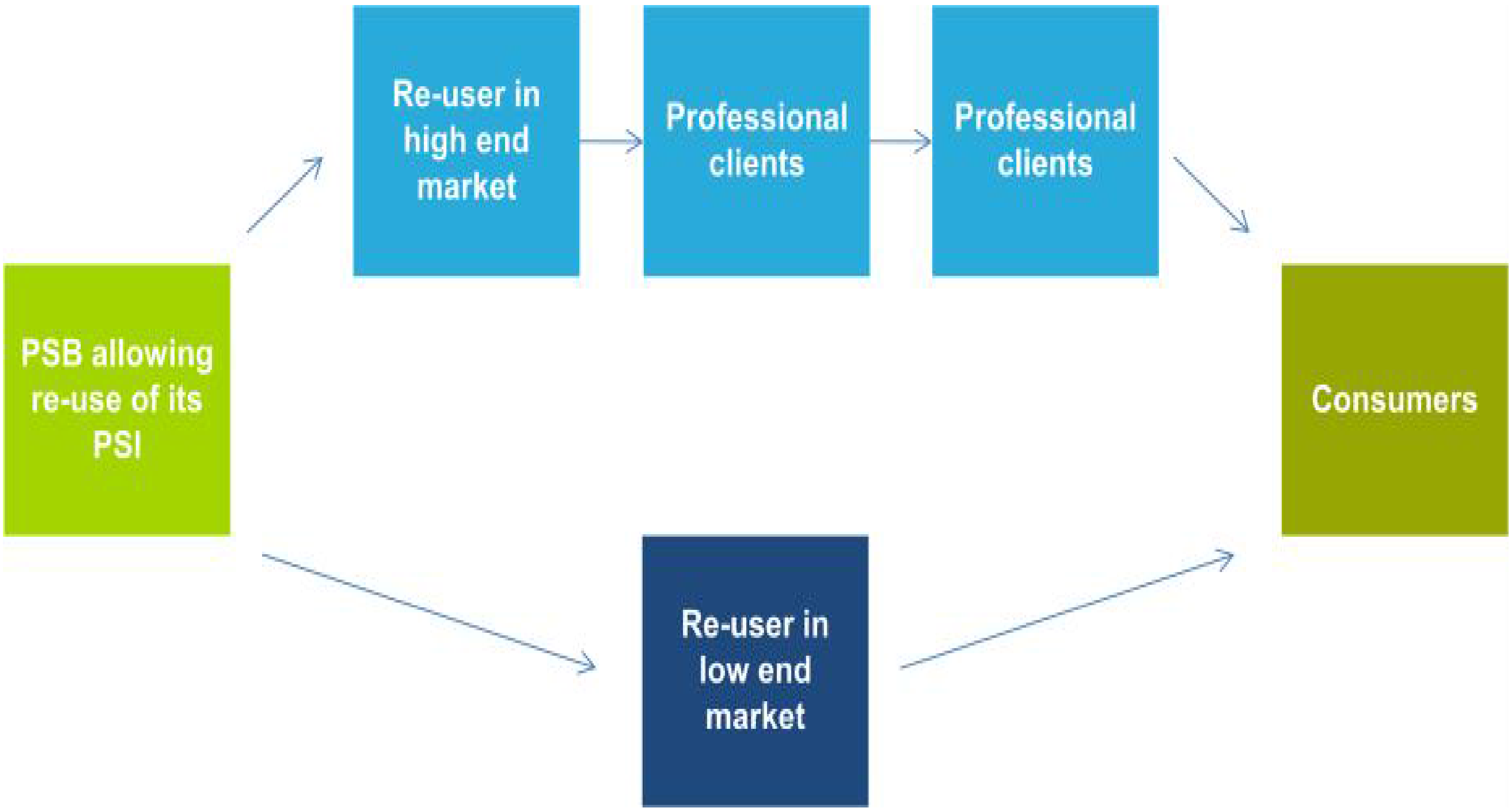
Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Cost-benefit Public Sector Information



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

Re-use of Public Sector Information



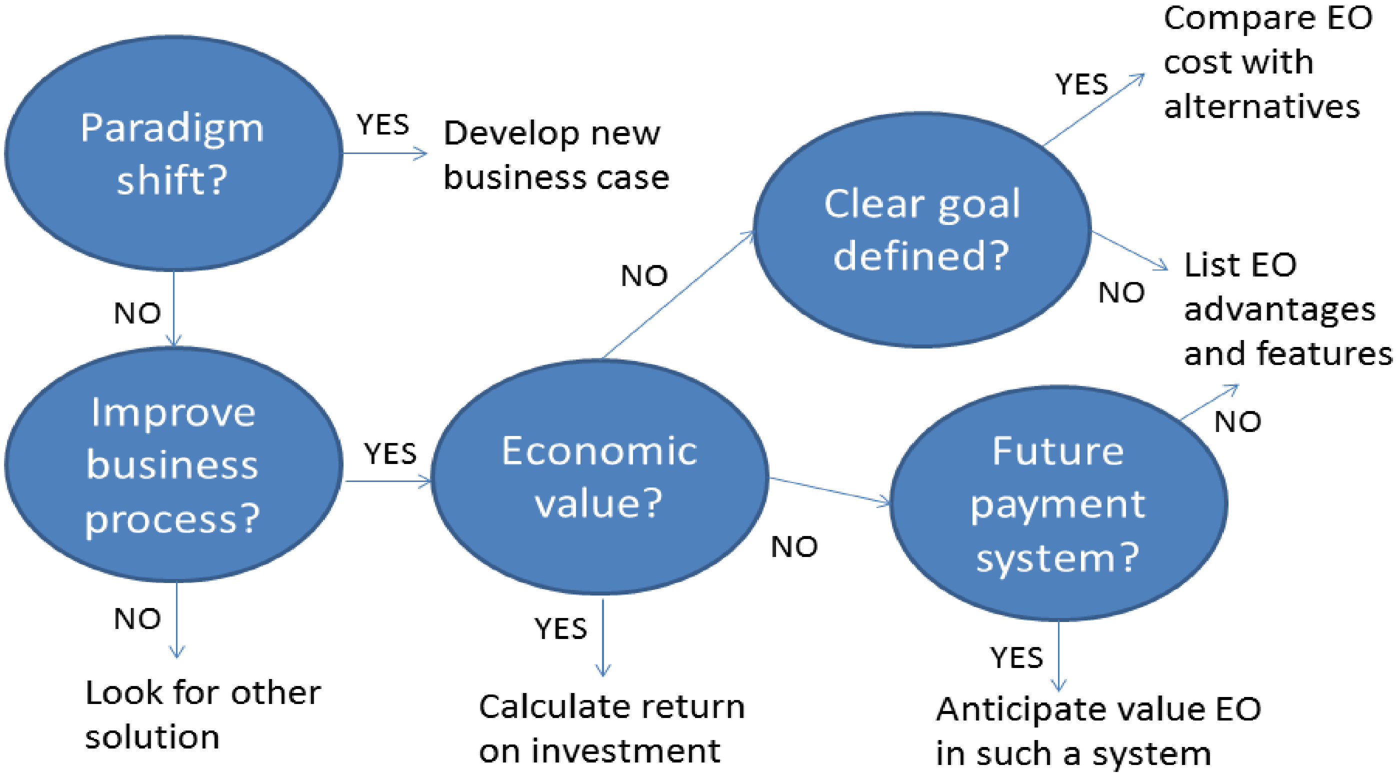
Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

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

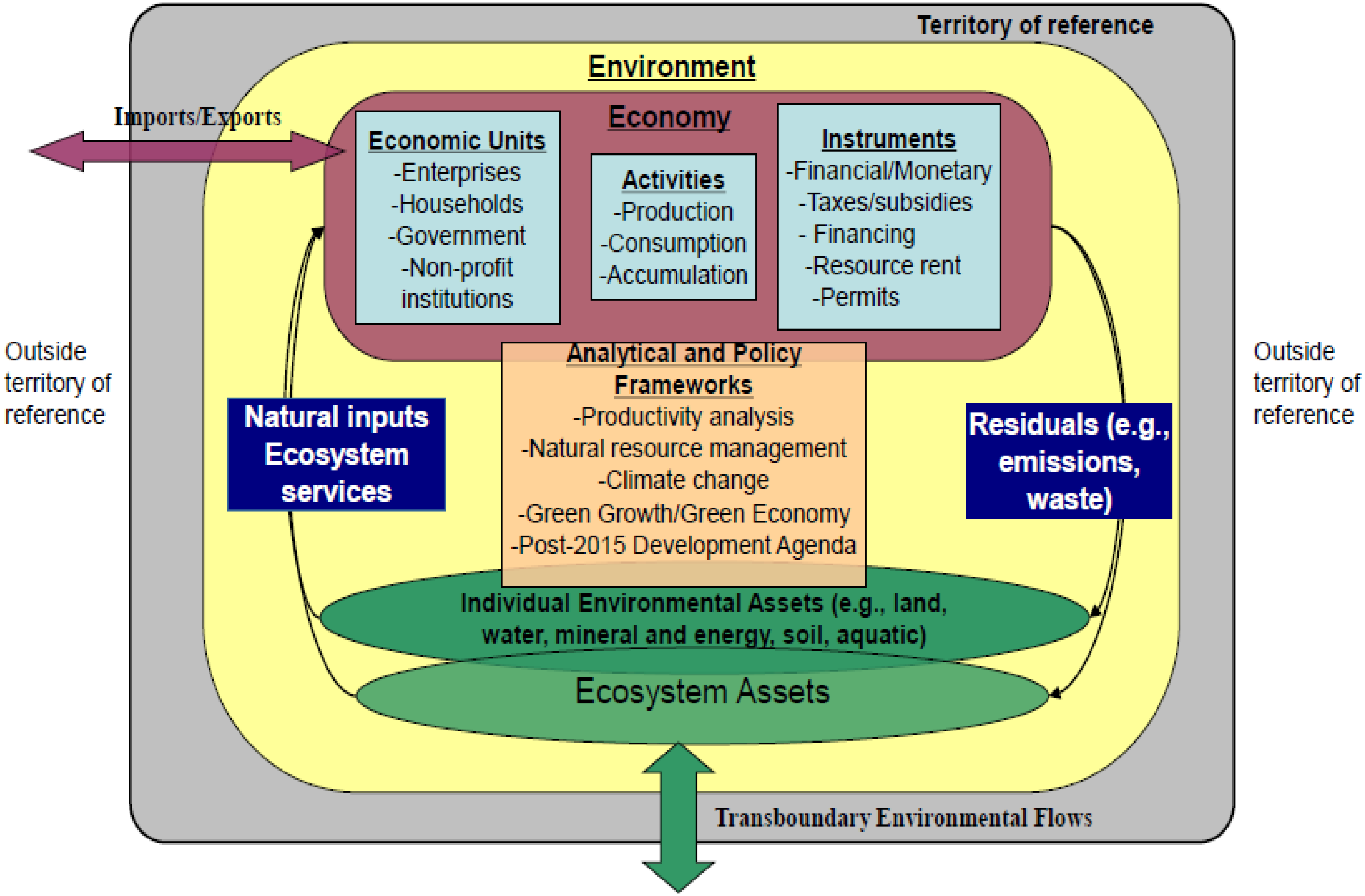
Several attempts have been made to introduce environmental accounting and to enlarge the sphere of the conventional economy to include and quantify impact on ecosystems.

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)

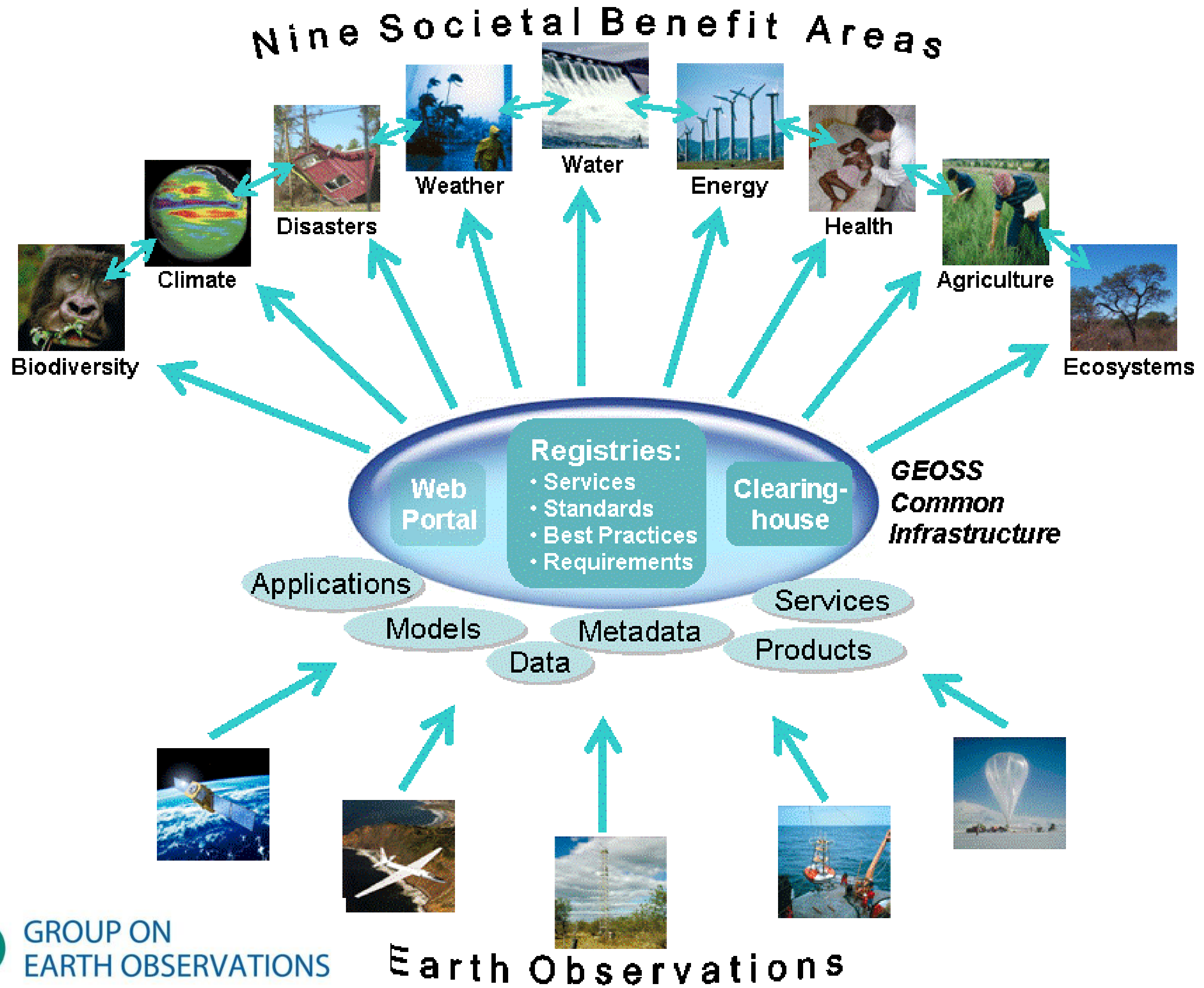
SEEA Conceptual Framework



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



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 *most* 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

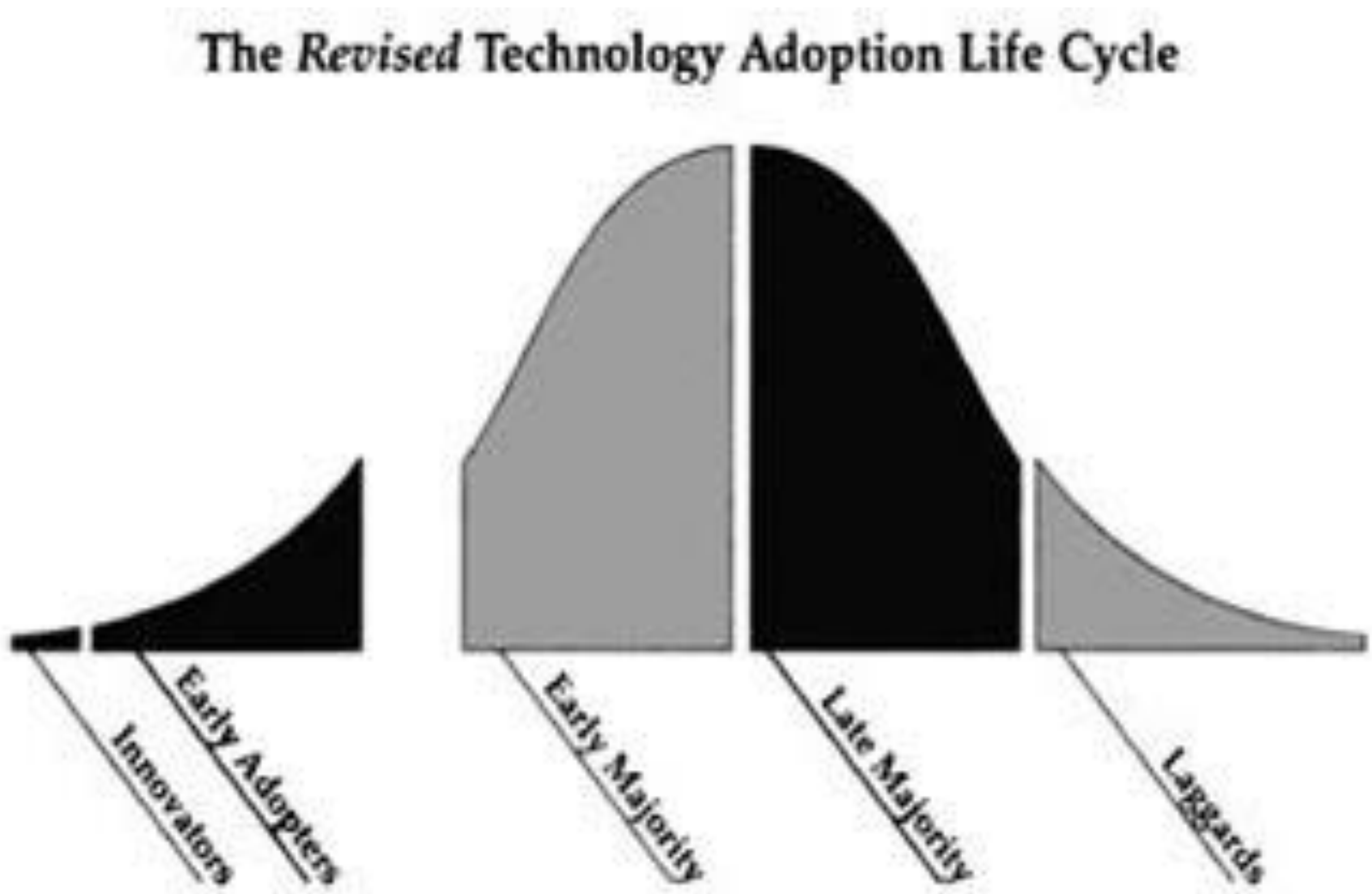
Type	Buyer behaviour	Motivation
Transactional sales	Intrinsic value buyers: "keep it cheap and easy to do business"	Understands the product Perceives it as substitutable Cost focus Resents time 'wasted' with sales people
Consultative sales	Extrinsic value buyers: "I don't know the answer: help me analyse 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



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)

Source: Marketing earth observation products and services (Noort 2013)

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)

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.eopower.eu
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*
www.copernicus.eu/pages-secondaires/publications/copernicus-briefs/

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

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