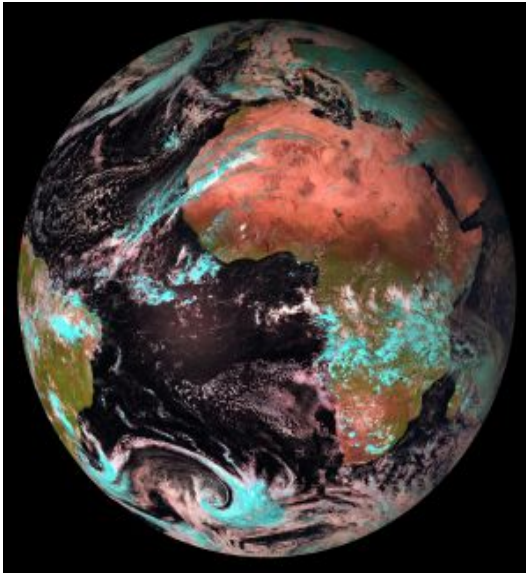


Building Capacity in Earth Observation for Water Management



Chris Mannaerts
Department of Water Resources
ITC

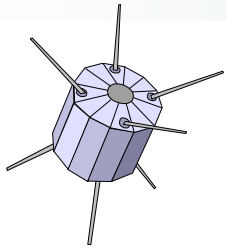


Overview

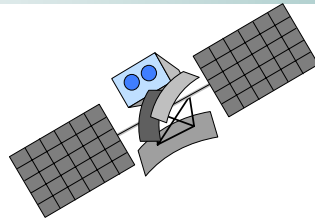
- Developments in EO for water
- Changes faced by water mgt organizations
- Repercussions of changes on human capacity
- Some curriculum concepts for EO in water
- From a data web to an e-science Infrastructure



Developments in Earth Observation for Water



IGOS-P



IGWCO

CEOS

GMES (EU)

ESA

JAXA

NASA

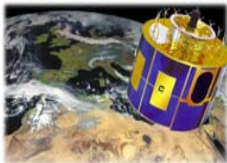
FAO

SPOT

UNESCO-IHP

IWMI

EUMETSAT



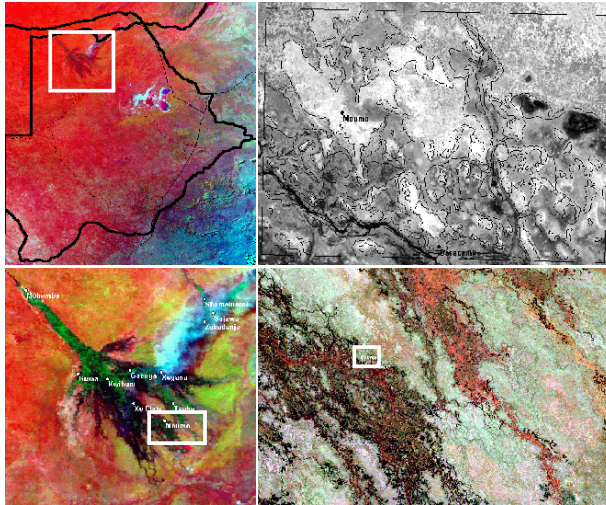
WMO

Water Management from Space :

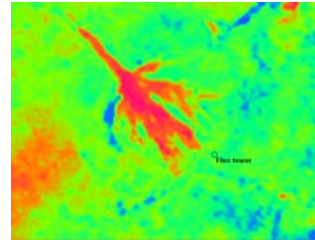
- *Precipitation*
- *Evapotranspiration*
- *Soil Moisture*
- *Groundwater storage*
- *Lake, river stage levels*
- *Water quality*
- *Digital terrain*
- ...

Developments in EO for Water (samples, 1)

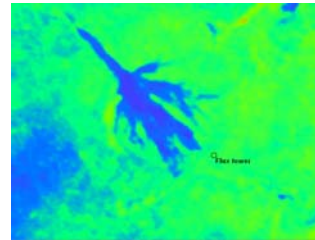
Botswana, Okavango delta



Multi scale imaging

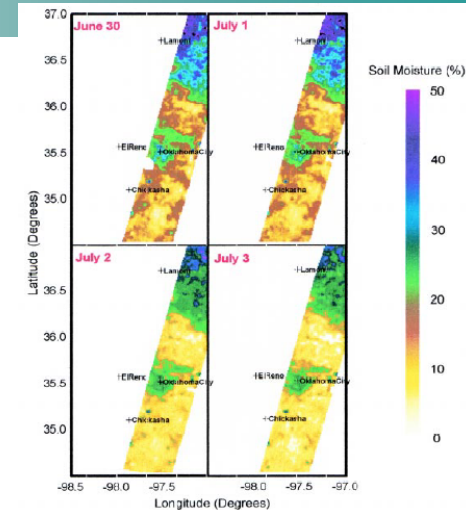


Ln



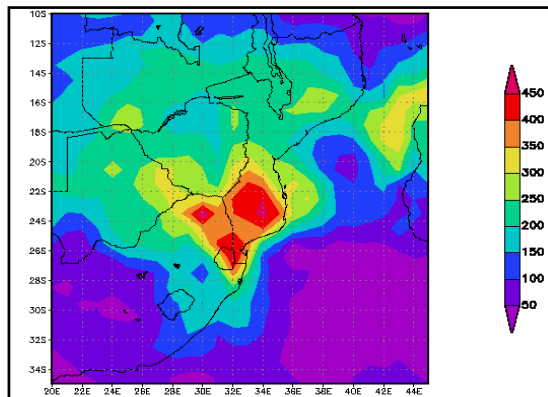
H

Evaporative fluxes

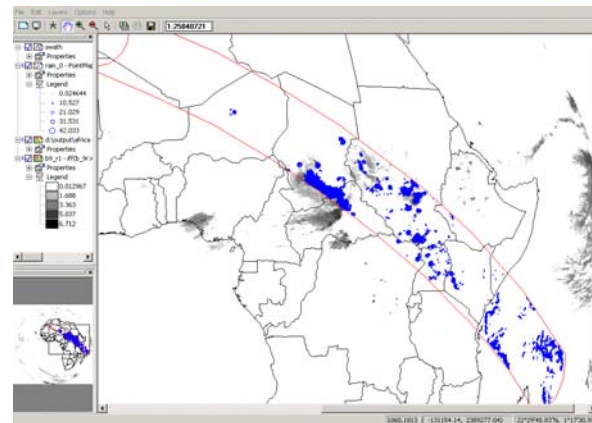


© Entekhabi

Soil moisture



Satellite Precipitation
Limpopo floods 2000, Mozambique

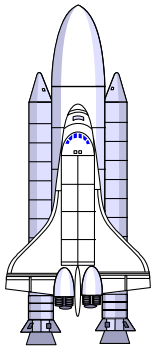


Correlation TRMM
MSG (meteosat-8)

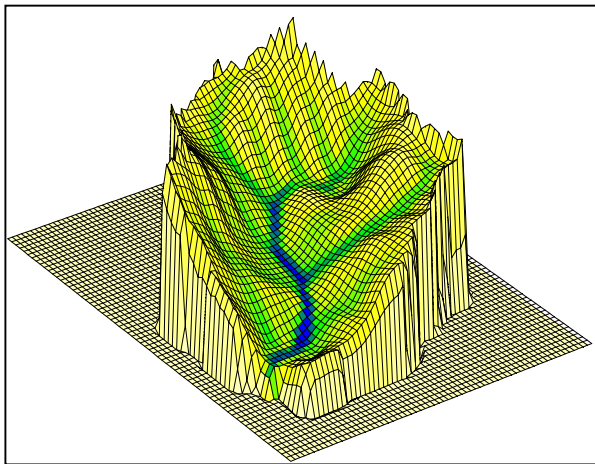


Water quality

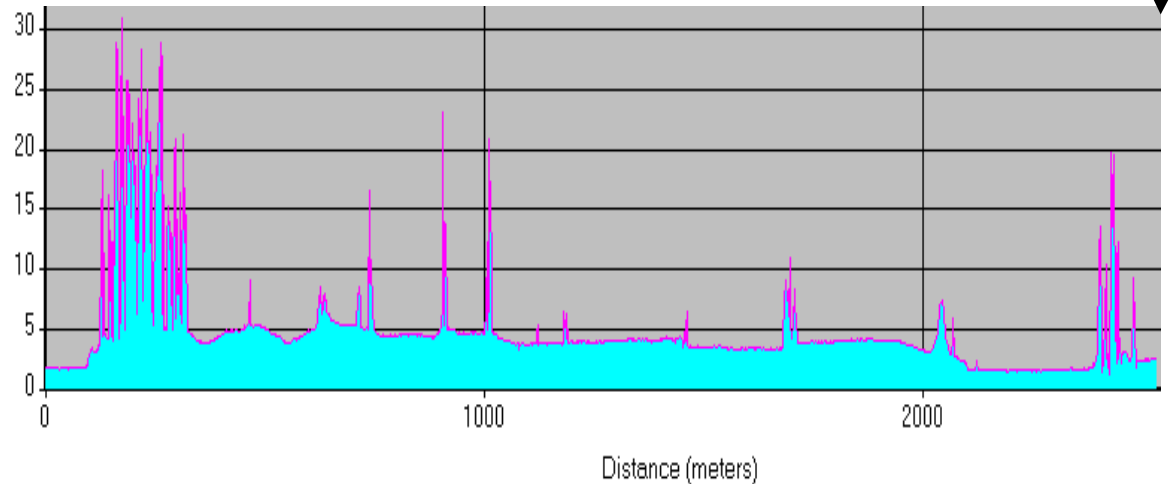
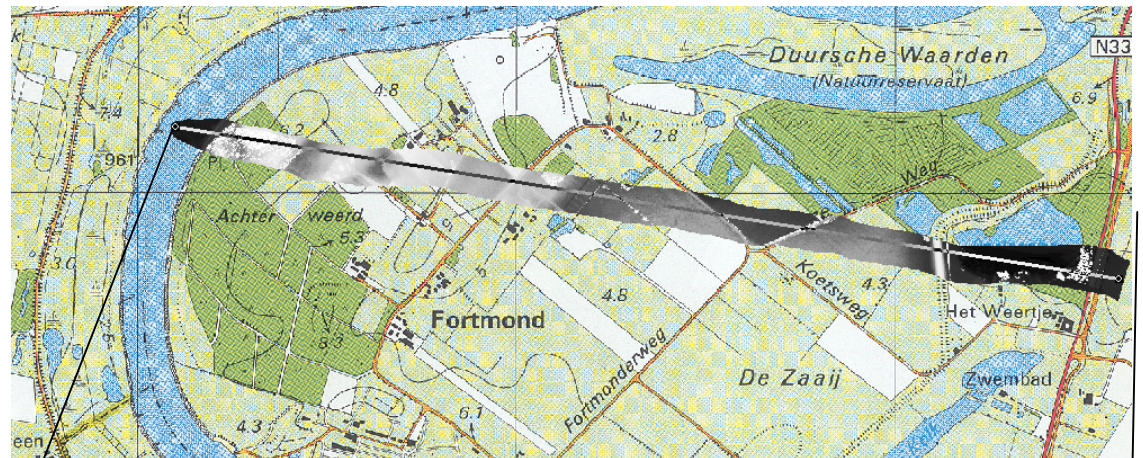
Developments in EO for Water (samples, 2)



SRTM data
for topography
and digital
Terrain analysis



LIDAR data (processed to terrain elevation)



Changes faced by water resource sector



- Satellite data provision
- www availability through active archives
- Sensor & mobile monitoring technology, telemetry, geo positioning systems,
- New science elements -> quantitative RS
- New data technologies -> Geo Informatics, GIS, spatial data infrastructure (SDI),...
- Globalization, communications, networks,...

Repercussions for water resource sector



- Adapt to new data types i.e. RS data
- Use new geospatial data storage, analysis and interpretation technologies (GIS)
- Coupled data capture using ground stations (+ mobile - gps) and remote sensors
- Data ownership ? (redundancy)
- Provide timely water information -> public (e.g. rainfall forecasts, flood risk,...);
- *Changing roles -> changing capabilities*

Basic issues in capacity building



- What is capacity building ?
- How much is required ?
- What type: different levels, scientific, professional ?
- How to sustain Capacity Building ?

What is capacity building?



PURPOSE	FOCUS
Human resources development	Supply of scientists, technicians and professionals; focus on individuals
Organisational strengthening	Strengthen the management capacity of organisations
Institutional strengthening	Strengthen the capacity of organisations to develop & negotiate appropriate mandates and modus operandi as well as appropriate (new) legal and regulatory frameworks

What type of capacity is required ?



- Scientific experts, program managers e.g. universities, gvt. agencies, private companies, ngo's...
- Professional users of remotely sensed water information : water boards, municipalities, ngo's, private C^o,...
- Policy & decision makers: legislation and institutional aspects,...
- Other...

Differentiation in capacity building



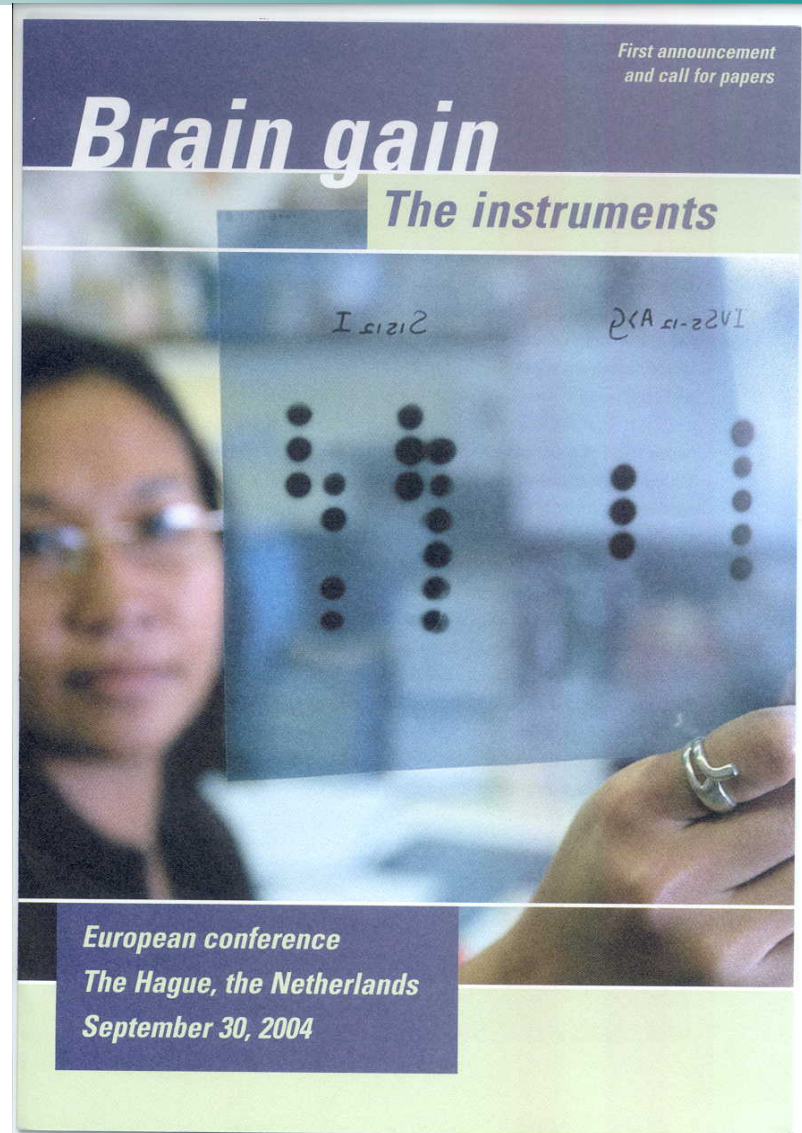
Context	<i>Process</i>	Data acquisition	Storage & retrieval	Processing & presentation	Dissemination & use
Application domain					
Technology					
Information management					
Inst. setting & policy					

() ITC generic template used for its various research & education themes: Geosciences & hazards, Water resources, Natural Resources, Urban & spatial Planning, Geo Informatics,..)*

Sustainability of capacity building

- Academic
- Institutional
- Financial

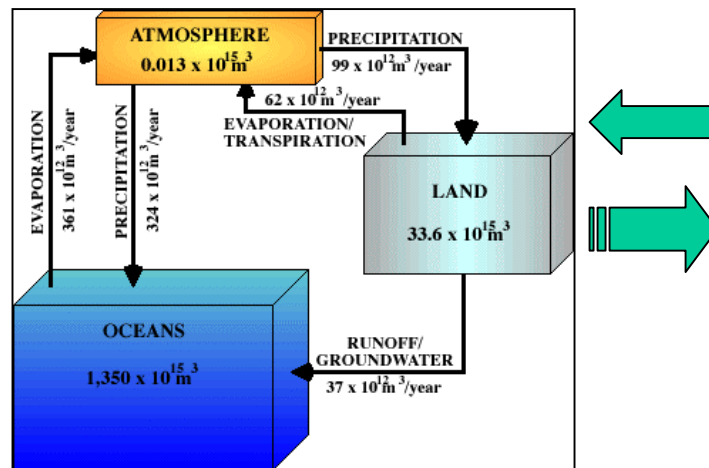
- Retaining capacity
 - Effects of economic development
 - Conflicting policies may occur



Some contrasts between RS scientists and operational water managers



- Water cycle vs. water chain thinking
- Spatial data vs. point observations
- Large scale vs. local scale (problems)
- Standardized methods (legal aspects of data and methods, ISO certification issues, ...)
- Other..



Water chain
Water storage, supply,
Water distribution,
Use, consumption, ET
Waste water streams
Treatment (y/n)
Reuse, discharge (y/n)

Several Opportunities



- Basin thinking more & more established in professional water sector
 - Physical and spatial unit -> water and energy, geochemical budgets applicable
 - Management unit (e.g. eu_wfd, us_tmdl..)
 - An opportunity for water sector and quantitative EO science to meet
- Data provision & access technology
 - In several agencies well done and facilitated
 - Data policy issues
- Data integration (ground & satellite data)
 - New methods tested and validated...

Adding a 5th dimension



- 1 State-of-the-art RS observing platforms acquire high quality data sets (ok)
- 2 RS data active archives (ok)
- 3 Potential user can view, browse data (ok)
- 4 Potential user today provided with simplified RS processing - visualization tools
- **5?** How to get RS data into day-to-day water management applications e.g. surveillance of levels, monitoring chl-a, ET estimates, etc.

Capacity building approach in EO for H₂O



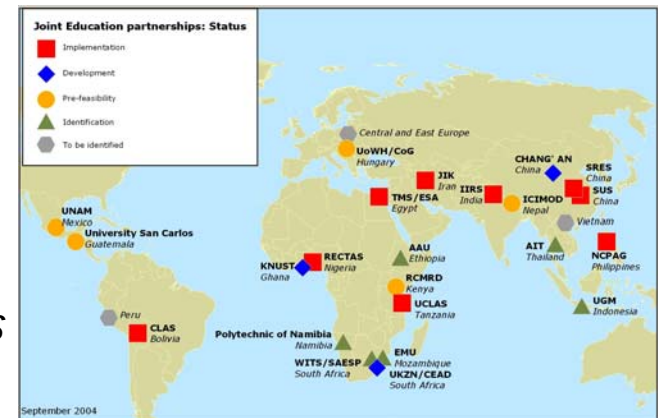
- New appropriate curriculum development
 - Observation
 - Satellite sensors, selection (to meet research question or application objective)
 - Quantitative data processing, radiative transfer concepts, corrections, ...
 - Ground (sensor) measurement (calibration, validation, ancillary data,..)
 - Model
 - Model selection a/o building (appropriate space - time scale with respect to hydrologic process and data)
 - Satellite data - model integration
 - Merging other data sources : e.g. chemical, isotopes, socio-economic, other..
 - Product
 - Water & environmental management scenarios,
 - Advice to client, water user information provision (service element)

Capacity building approach in EO for H₂O



- **Non allied research and knowledge transfer:**
 - not per-se using 1 single sensor, appropriateness evaluation, availability of missions,
 - cost/benefit approach, etc....
- **Researchers, educators and clients under 1 roof**
 - Continuous interaction, exchange of ideas, cross-referencing
 - Contact with world and progress in field
- **Using decentralized concept**
 - International partnerships
 - Asia, Africa, America and Europe

ITC DCE programs

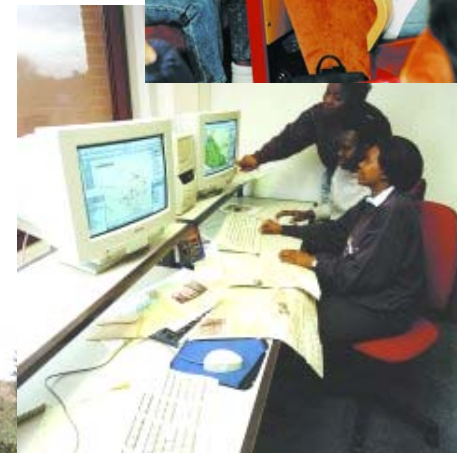


Capacity building in EO for WM



- In ITC, the scheme is under development;
- Specialization in specific water theme after initial course theory work:
 - Water & energy budgets
 - Groundwater fluxes
 - Watershed - surface water flows
 - Freshwater quality & coastal zones
- A blend of course work, computer lab and field monitoring (world wide global coverage,...)
- Ground station training at a Hydrological RS observatory field site in cooperation with local water board

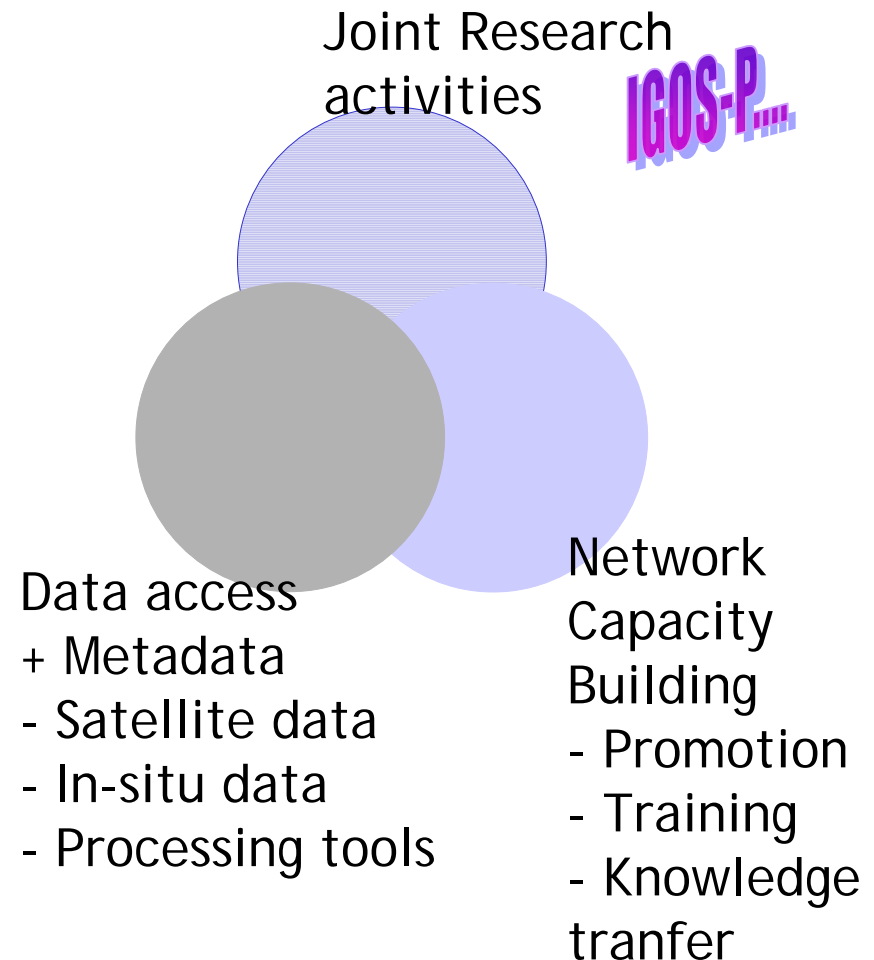
Under construction



A concept for integration of capacity building in Earth Observation actions of agencies, orgs.



- From a web of Sensor data to an e-Science Infrastructure
- CB Network with Int'l partnerships
- Cost efficient for both client and donor
- Workshop with
 - Data, space agencies
 - Research Consortiums
 - Education Application





Thank you

ITC: A global capacity building project in EO

