Session 6.4.1

Building the Data Base:

What data should we put in the treasure chest?

Chair: Gordon Young

Questions:

What data and how do we collect them?

For what purposes should we collect data?

We need:
Fundamental knowledge

Obtained through

observation of

and research on:

The geophysical and related biological worlds we live in

Data

- topographic
- hydrographic / bathymetric (for coastal areas)
- geological
- soil characteristics
- climatological
- hydrological – water quantity and quality,
  related to surface and ground water
- flora and fauna
- etc

The societies we have formed

Data

- population characteristics and their projection, with gender specificity
- social preferences, practices and religious beliefs
- vulnerability/resilience of different sections of society
- land use characteristics
- attitudes to risk: to flooding, drought, financial loss
- levels of water-born diseases and their causes
- etc

The built environment we have constructed

Data

- demand for freshwater for urban, agricultural and industrial use

- rate of extraction of freshwater from surface and underground sources

- population served with freshwater and having access to sanitation facilities

- number of dams and their physical and operational characteristics

- number of irrigation works and their physical and operational characteristics

- types of groundwater supplies and pumps and their operating characteristics

- availability of energy sources

- etc

The economic systems we have put in place

Data - current construction and operating costs

- financial resources available for funding water projects: public and private
- household expenditure on water and sewerage service
- sources of revenue from water projects, including charges to users and subsidies
- interest rates and other essential conditions related to the above
- total investment over various time periods in water projects: capital and running costs
- the economic value and efficiency of water use
- contribution of various sectors to the economy
- unaccounted for costs as contribution to our water economy
- ability to pay for services

The institutional arrangements we have devised

Data

- ownership of land and “ownership” of water resources (traditional and current ownership)
- governance, accountability and transparency
- relevant national and international laws
- national and regional water policies
- local rules and regulations
- decision-making power and rights of appeal
- etc

We need: Data needed for ***long-term planning***

- - Long-term projections of population growth and water demand
- - Climatological and hydrological characteristics
- - Periodic review of project implementation and effectiveness
- - Impacts of economic growth on water consumption, particularly in the large water sectors
- - etc

We need: Data for use in ***project design***

- \- Detailed site specific information
- \- Compiled and analyzed over a few years

  – on precipitation, streamflow, available groundwater (quantity and quality) …
  – geological and geo-morphological characteristics
  – on the technical specifications of the works to be installed
  – on the physical, economic and social management practice
  – on the cost effectiveness of increasing supply or moderating demand
  – etc

We need: Data for use in the ***operation of projects***

- Real-time on-line flows of data, including forecasts of the weather and, over the longer-term, the climate
  - rainfall, streamflow, groundwater and soil moisture levels
  - demands for freshwater, hydropower, etc
  - cash flow
  - overall performance of the project in relation to expectations
  - etc

Key elements

Wilhelm Struckmeier – International Association of Hydrogeologists

- Temporal and spatial frequency in all data collection programmes

- Note: we usually need groundwater data with less frequency but usually with greater spatial density than surface water due to the different timescales of movement

- Critical need for quality assurance and recognition of the limits to data accuracy

- Co-ordination of collection programmes

  e.g. water quantity/quality, and economic/governance/social

EXAMPLES OF

THE NEED FOR DATA

AND

THE MEANS OF COLLECTING THEM

CONTRIBUTIONS FROM MEMBERS OF THE 6.4.1 PANEL

GLOBAL DATA SETS

Surely we have all the data we need – look at the global data bases

GEO GROUP ON EARTH OBSERVATIONS

GCOS Global Climate Observing System

Ensuring the Availability of Global Observations for Climate

WMO IOC UNEP ICSU

GTOS

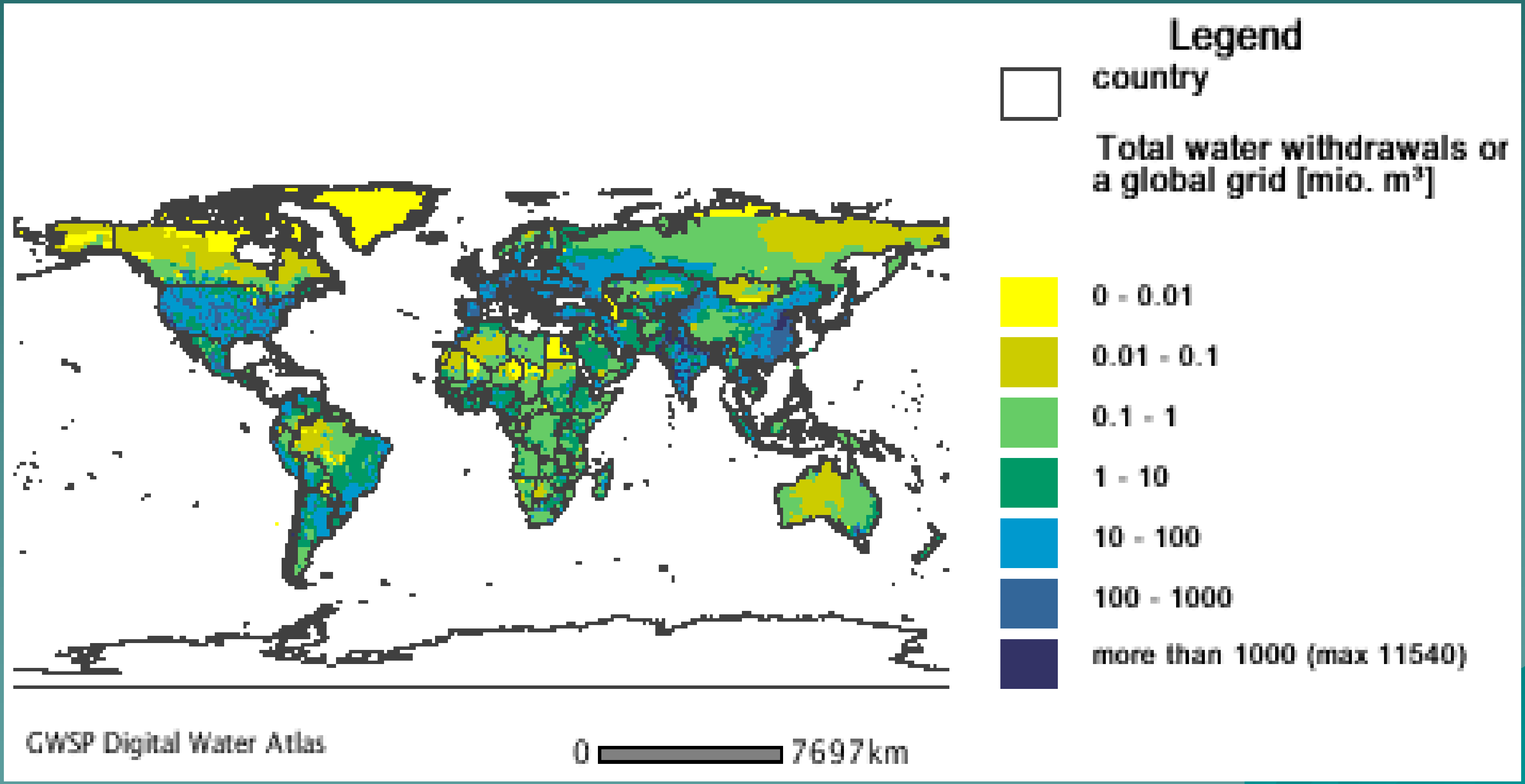
GLOBAL TERRESTRIAL OBSERVING SYSTEM

GOOS

Global Ocean Observing System

CEOS

"GWSP Digital Water Atlas (2008). Map 20: Water Withdrawals (total) (V1.0) - available online at http://atlas.gwsp.org."



BUT

- what is behind what we see?

- note that we more often use indicators rather than the raw data

- what has gone into these various indicators?

- Session 6.4.2 – this afternoon:

More key elements

- Ever increasing number of global data initiatives
- All based on the same ever diminishing national data programmes, maintained by the few dedicated individuals who collect the actual data
- Need to focus more on providing resources for those who actually collect the basic data.
- Recognize the role volunteers and NGOs

Even more key elements

- The scale issue.
- Global maps are very important for some stakeholders.
- Badly need information at the scale at which water management and project design and implementation take place.
- Need downscaling from global climate change scenario outputs.

WATER MONITORING

Stéphane SIMONET
Water Monitoring Alliance (WMA) - World Water Council

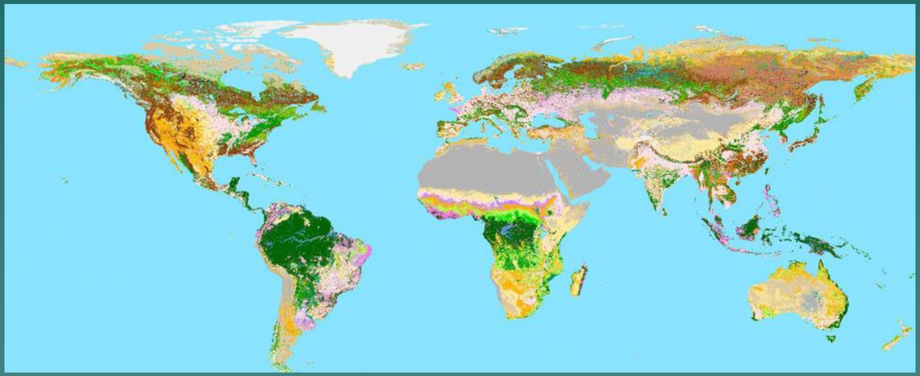
- Availability of reliable data is critical
- A profusion of heterogeneous monitoring activities
- Very difficult to aggregate data at higher level to generation of policy-relevant information
- Limited exchange of information because of lack of contact between those responsible
- Design and nature of most monitoring initiatives are still very much “supply-side” and should better account for the “demand-side”

FOOD PRODUCTION v. WATER

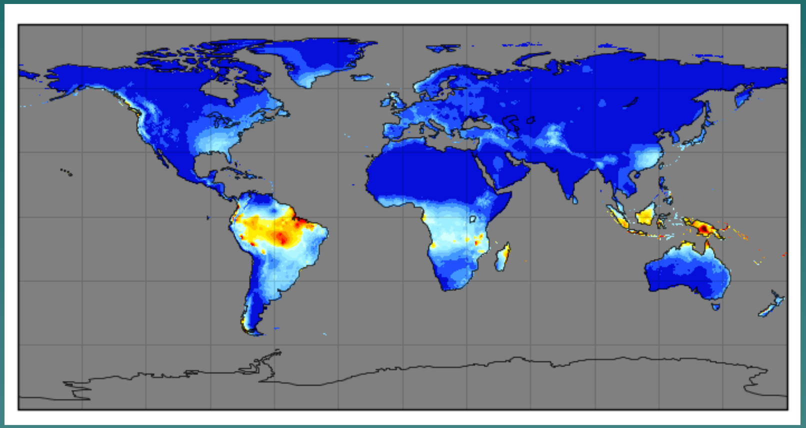
Paul West: The Nature Conservancy & University of Wisconsin, USA

- Need to assess the effects of land use change on water availability and water quality
- A lot of valuable data sets are available or can be derived

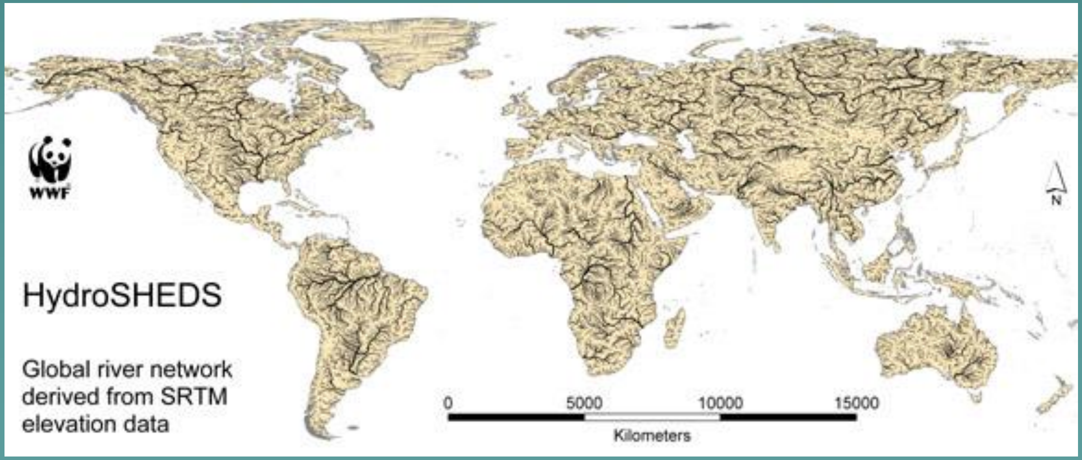
GLOBAL DATA SOURCES I



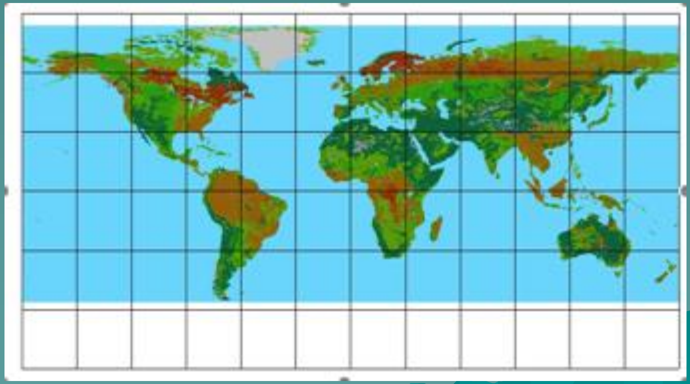
landcover (Bartholomé and Belward 2005)



climatology (New et al. 2002, Hijmans et al. 2005, Kalnay et al. 1996)

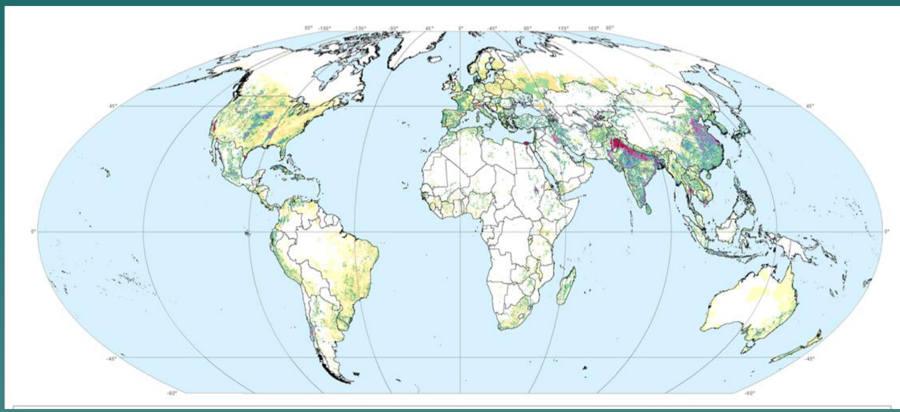


Elevation and river network (Lehner et al. 2006)

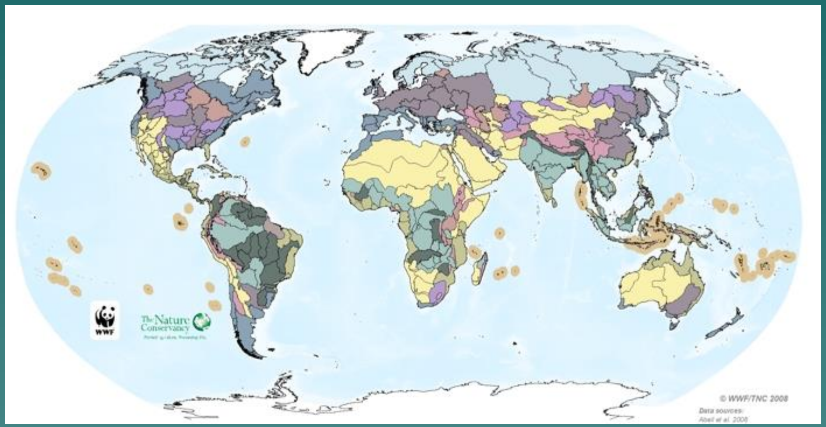


soils (Batjes 2006)

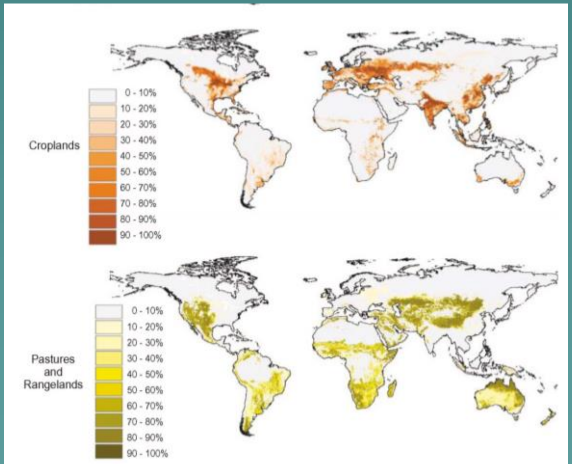
GLOBAL DATA SOURCES II



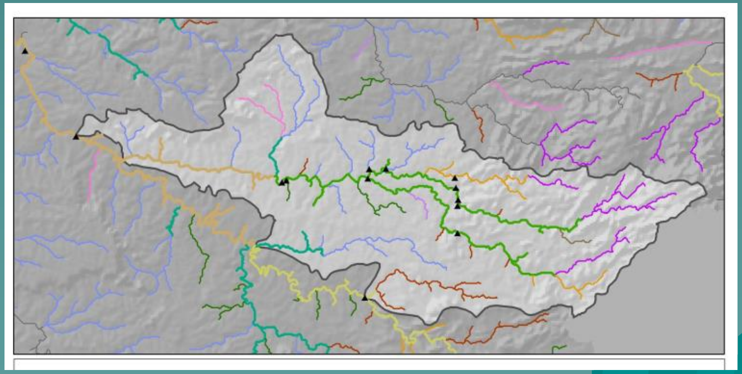
Irrigation (Siebert et al. 2007)



Freshwater ecoregions (Abell et al. 2008)



Agricultural lands (Ramankutty et al. 2008, Monfreda et al. 2008)



Continent-wide stream classification (Petry et al. in prep)

FOOD PRODUCTION v. WATER

Paul West: The Nature Conservancy & University of Wisconsin, USA

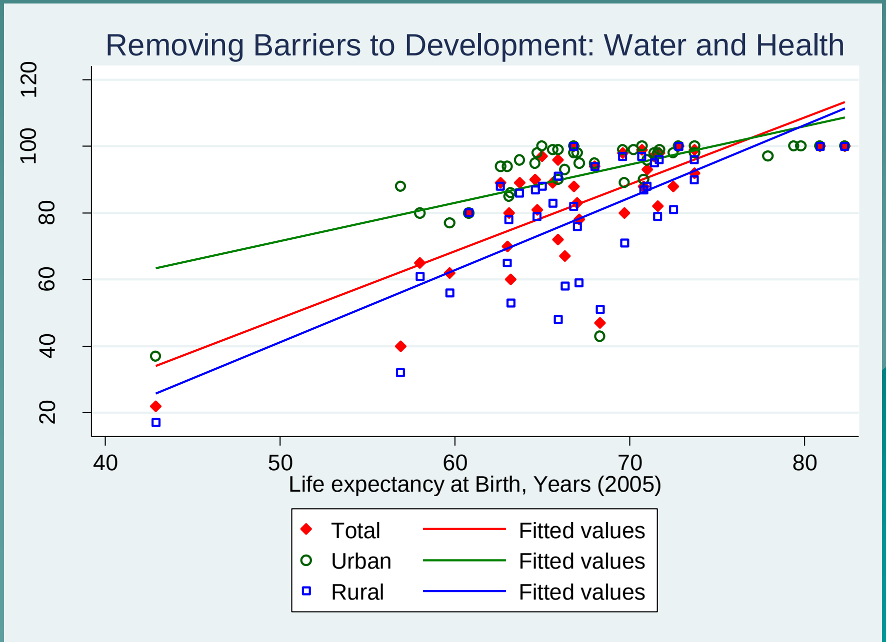
- A lot of valuable data sets are available or can be derived, BUT …

  \- we lack critical land use data sets of high enough quality e.g. inadequate spatial resolution of fertilizer application, point source pollution and water transfers

BUILDING A DATABASE ON WATER SECURITY

Le-Huu Ti UN/ESCAP

- Policy and decision makers are usually shocked to learn of the “insecurity” of their water situation.
- “Water insecurity” concepts are mainly sector-oriented.
- ESCAP recently introduced a new concept of “water security”
  - based on the holistic approach to integrated water resources management.
  - viewed from two perspectives:
    - barriers to development
    - facilitators for development



FLOOD FORECASTING

- Need for specific local data transmitted and analyzed in real-time
- Now well established on major rivers and in developed countries
- But major problems in developing countries and on minor rivers where flash floods (FF) can cause much death and destruction
- National, even local, responsibility, but …

GFFGS – Global FF Guidance System of USA

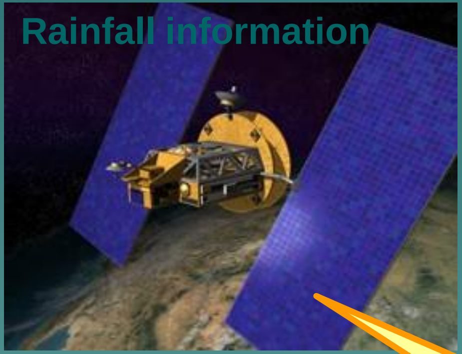
GFAS – Global Flood Alert System of Japan

GFAS (Global Flood Alert System)

International Flood Network, Japan

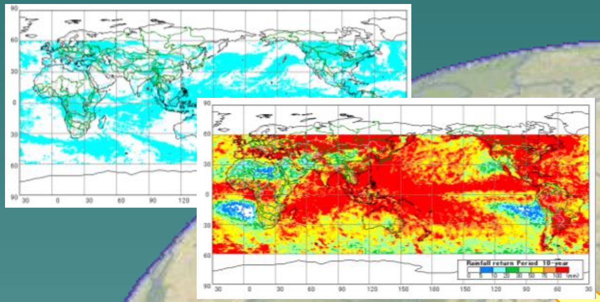
GFAS = **rainfall alert** + **flood alert** using satellite information

Satellite Observations

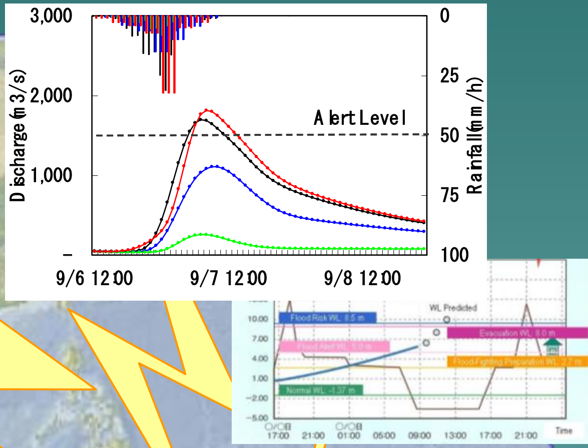


GFAS-Rainfall

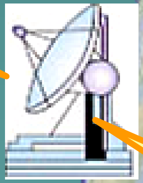
since 2003



GFAS-Streamflow



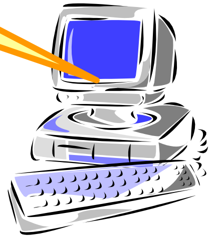
Ground stations



Real Time Processing

Rainfall analysis

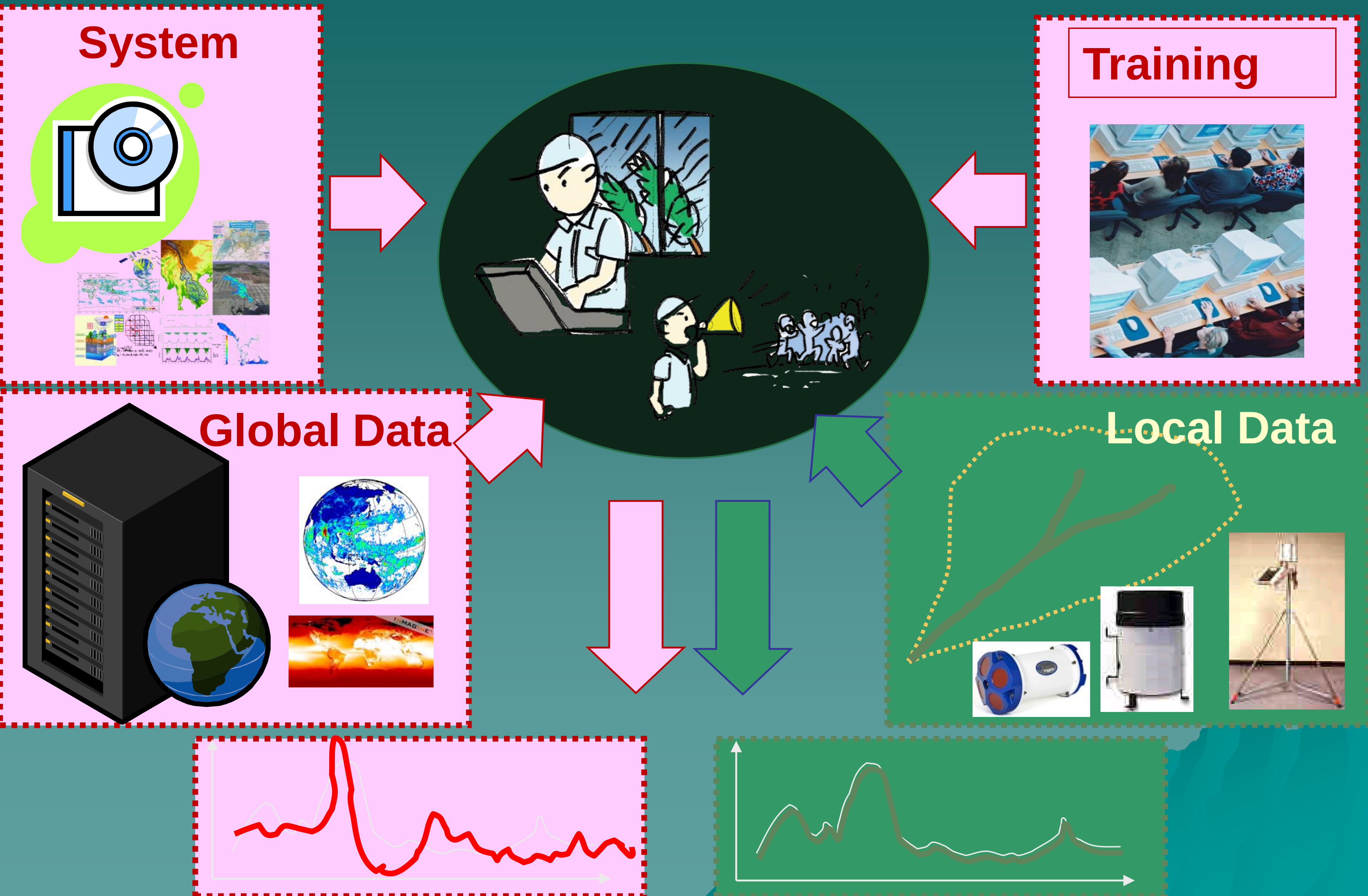
Stream flow simulation



Rainfall Alert

Flood Alert

GFAS Promoting local ownership of flood forecasts



HYDROMET NETWORK IN TURKEY

Turkish National Hydrology Commission
Prof. Dr. A. Ünal Sorman

Rainfall data

- Turkish State Meteorological Service (DMI) established in 1937
- State Hydraulics Works (DSI) established in 1956
- General Directorate of Agricultural Research (TAGEM) established in 1984

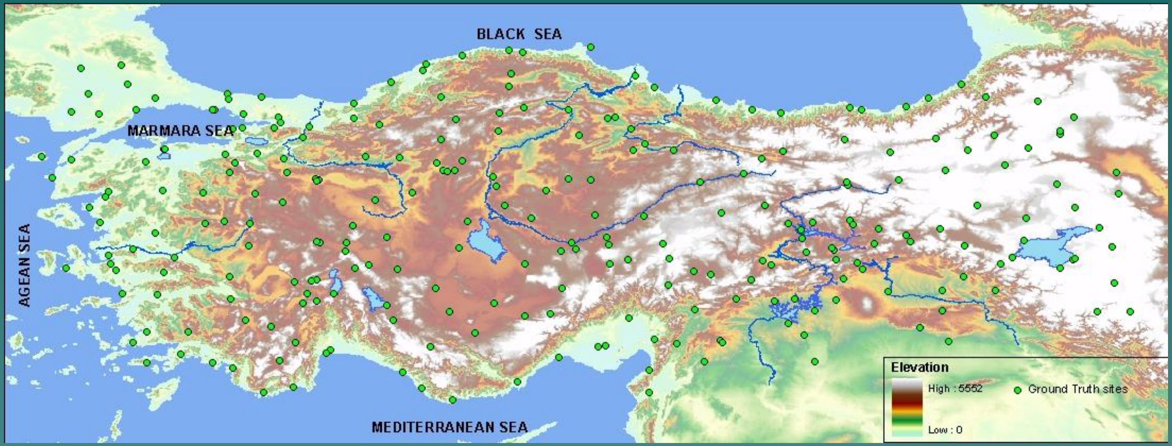
Streamflow data - governmental organizations

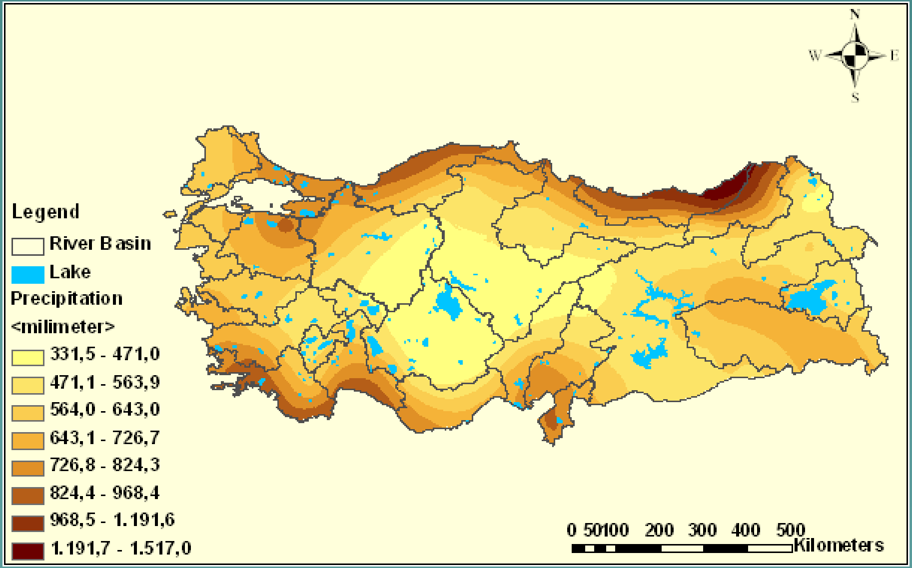
- Electrical Power Resources Survey and Development Administration (EIEI) for large river basins
- DSI for medium size catchments
- TAGEM for small agricultural experimental basins

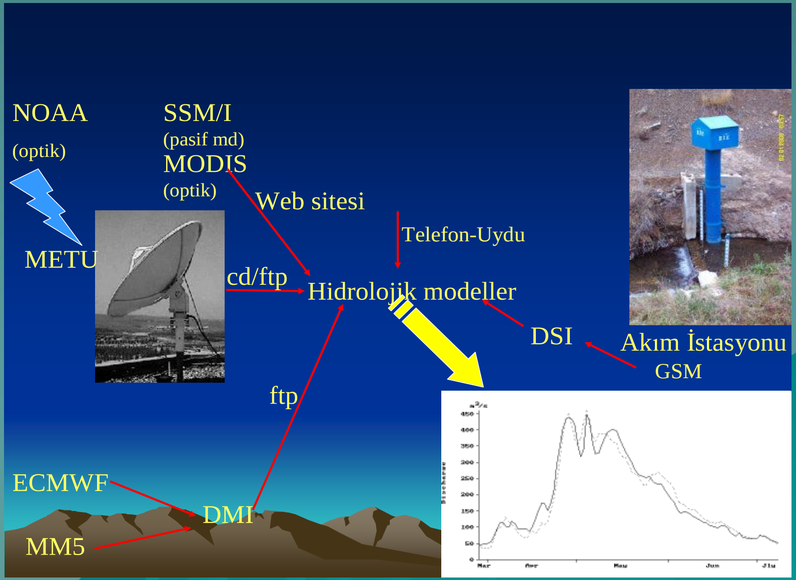
HYDROMET NETWORK IN TURKEY

Rainfall	897
Evaporation	260
Streamflow/Water level	1600
Groundwater	660
Water Quality	1130
Sediment	120

HYDROMET NETWORK IN TURKEY







HIGH MOUNTAINS

Basanta Shrestha - International Centre for Integrated Mountain Development (ICIMOD), Nepal

- Concern for water issues in the region has dramatically increased in recent years especially due to climatic change phenomena
- Threat to role of Hindu Kush-Himalayas (HKH) region as a ‘water tower’ of Asia
- Yet, routine data collections in mountainous regions are hampered by highly inaccessible terrain, harsh climatic conditions and lack of investments in mountain regions.
- Data measurements are often limited to the plains.

WiFi network in Imja for early warning systems

ICIMOD

METEOROLOGICAL AND HYDROLOGICAL : GROUND-BASED INSTRUMENTATION

Traditional methods

New technical developments

Measurements of water quality

Be aware of major systematic and random errors in all such measurements

- - instrumental errors
- - siting errors
- - errors from frequency/timing of measurement

INSTRUMENT MANUFACTURERS

Martin Schinnerl, OTT

The trend is clear:

- to reduce costs – move from passive to active data transmission & use standard com protocols (IP, etc)

- get online data

- improve or ensure the quality of data - redundant sensors for verification and redundant com ways to ensure data transmission

OTT ADC – Current Meter

For use in all weather conditions

Hydroradar OTT RLS


LogoSens 2
LogoSens 2
stollmann
PCU 12
96E MSN 702531/702532/702533

INSTRUMENT MANUFACTURERS

Martin Schinnerl, OTT

Trend is to use contact-free sensors

- radar, ultrasonic
- reduce civil work costs
- from pure information to prediction – "online" data feeds actual running prediction models

Precipitation monitoring

- low maintenance cost weighing precipitation gauges with intensity range up to 2,000 mm/h

INSTRUMENT MANUFACTURERS

Martin Schinnerl, OTT

Discharge measurements

- acoustic meters with automatic discharge computation
- Shift from use of ultrasonic transit time systems to ultrasonic Doppler systems

REMOTE SENSING

Ian Cluckie, University of Swansea
Al Pietroniro, Environment Canada

Radar, airborne and satellite platforms

How much data for a rainstorm?

- A single raingauge – 2 MB
- A conventional weather radar – about 0.25 GB
- A sophisticated dual-polarization weather radar - about 3 GB
- A coupled modelling system – about 10 GB

Satellite Earth Observation

Polar Orbiting
800 km
1/16ϕ

Geostationary

35000 km
3ϕ

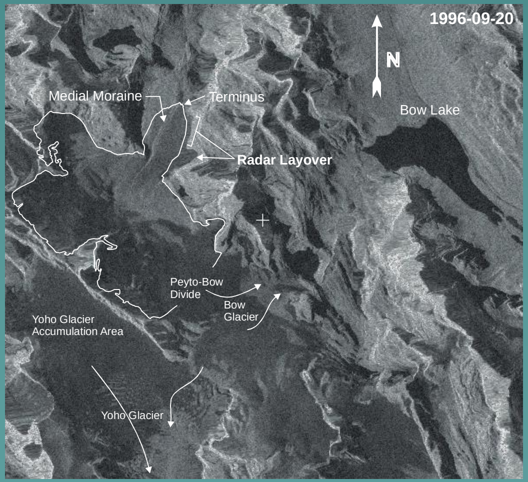
Three levels

1. Use of spatial data sources and imagery to identify items of interest such as snow covered areas, water extent (depth) or plumes. (monitoring)
2. Obtain data such as land cover, geological features, or other hydrologic parameters through interpretation and classification of remotely sensed data. (modelling)
3. Use of digital data to estimate hydrologic state variable directly. This is normally achieved through correlation of known hydrometric data with remotely sensed data or data assimilation.

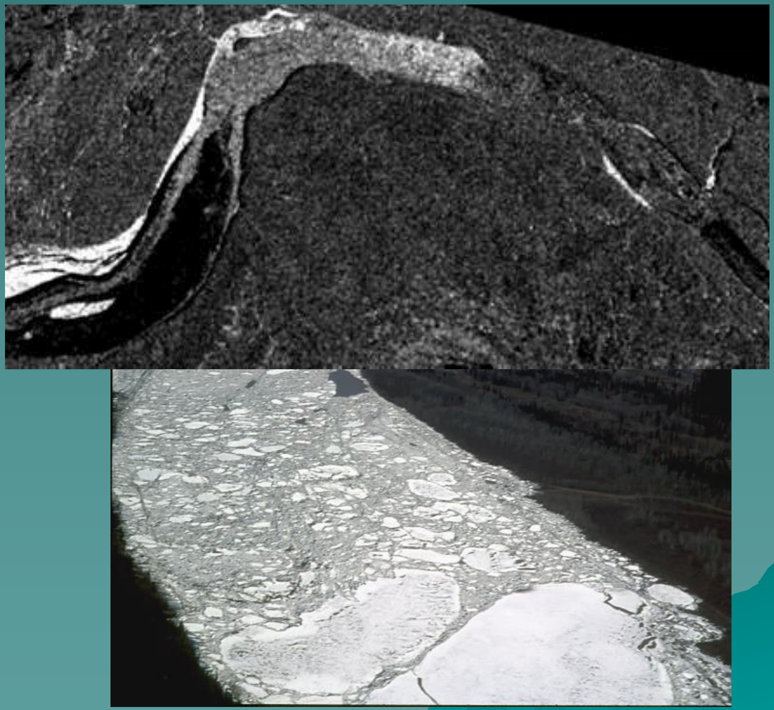
Snow and ice extent

Landsat TM imagery used for discrimination of ice and snow albedo.

The snow line position derived from Radarsat



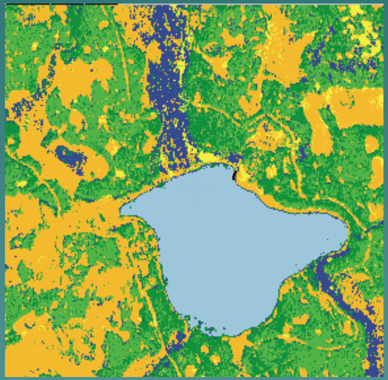
Detection of river ice jams using Radarsat



- Comparison of resolution difference for a northern wetland complex

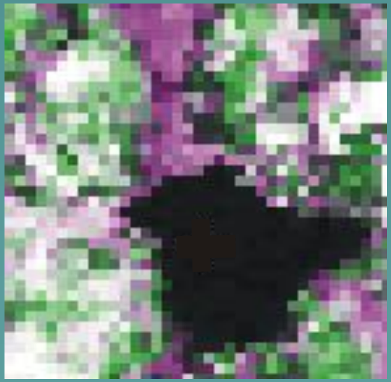
- Ikonos satellite has 5 m resolution

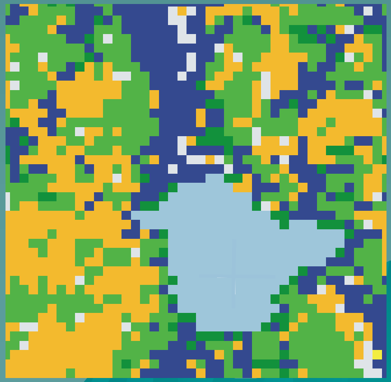
IKONOS



Landsat

- Landsat has 25 m
- Connectivity details are misrepresented at the Landsat scale





Remote sensing: a synopsis

- The variables for which remotely sensed data have been used most:

  land cover, water extent and snow extent.

- Algorithms for using satellite data in hydrology (particularly modeling) are limited in the areas and times to which they can be applied.

- Users need to be made more aware of the usefulness of the data.

- The host of new satellite and airborne platforms will provide interesting and meaningful applications for the next five years

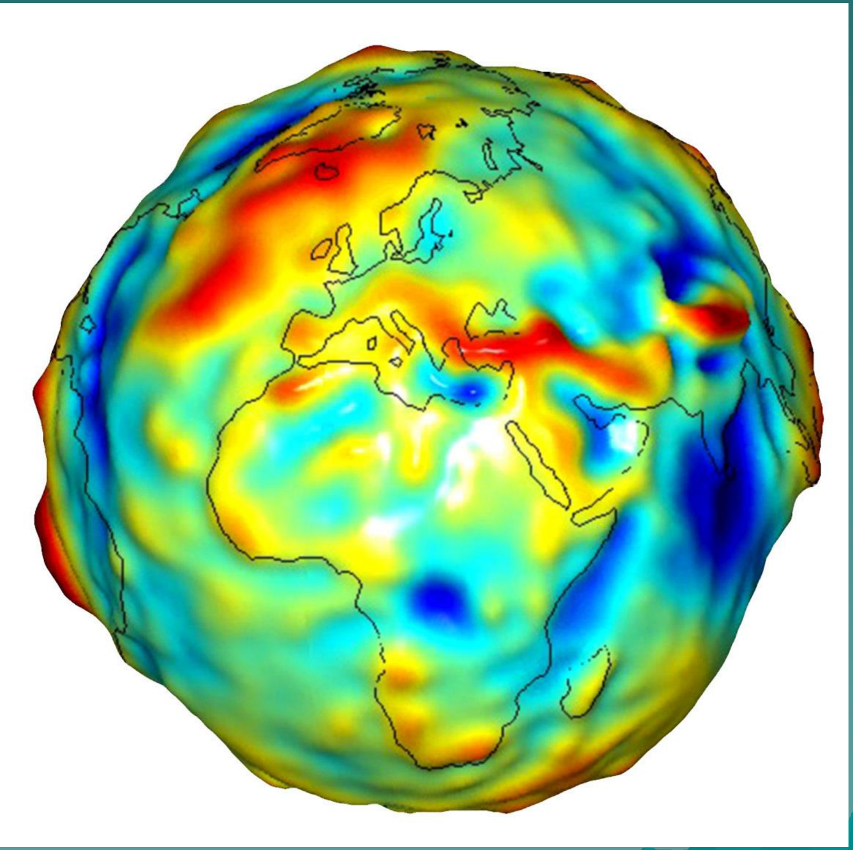
- Despite years of promise, direct measurement of water cycle state-variables is still largely experimental and not used in operational hydrology.

REMOTE SENSING

New sensors or old sensors yielding new data streams

See for example the data provided by the GRACE satellites:

- Launched to provide gravimetric data
- Now proving useful for studies of changes in distribution of freshwater across the world

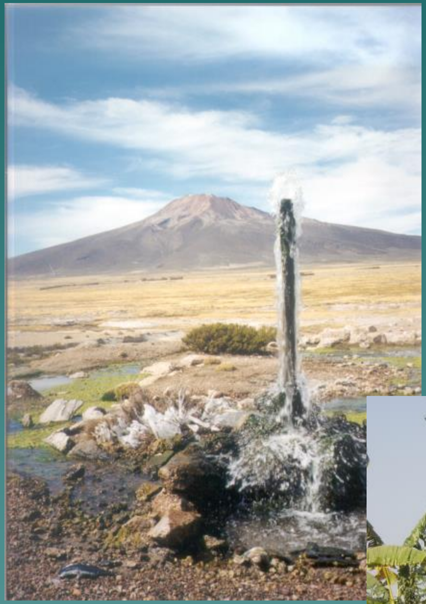


GRACE: Gravity Recovery and Climate Experiment

ISOTOPE HYDROLOGY

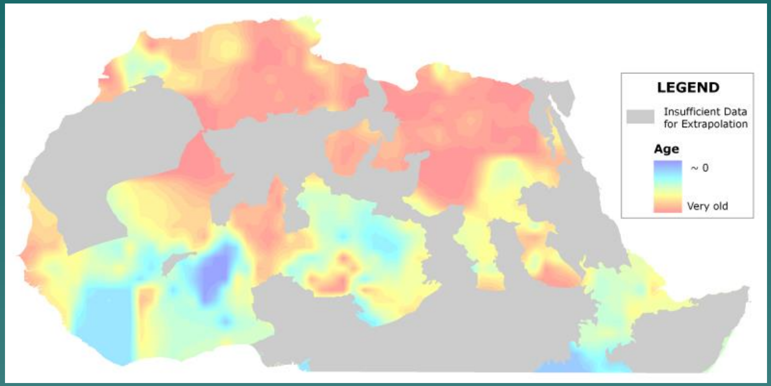
Pradeep Aggarwal
International Atomic Energy Agency (IAEA)

- Groundwater taken from a well in only 5 minutes may have rained on earth 50,000 or more years ago!
- River flow in dry season sustained by groundwater discharge
- Climate change impacts tempered by availability of old groundwater



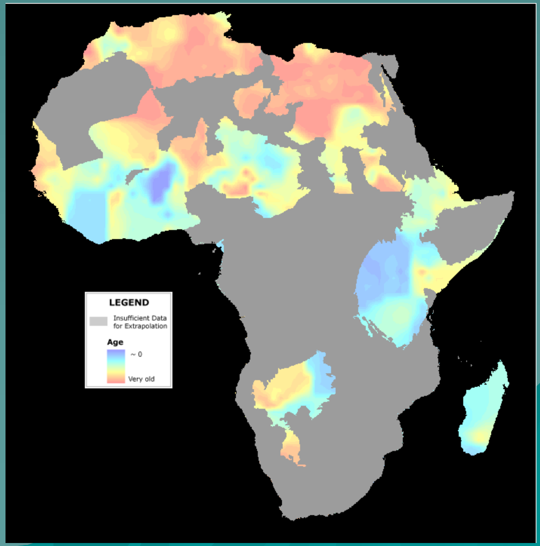
Groundwater resources in most countries are not fully mapped and sustainably managed

Isotope hydrology: Search for a solution



- uses “fingerprints” of naturally occurring radioactive and stable isotopes
- maps the age of water
- relatively small investments of effort and resources for integrated time and space information on water resources

Map of Africa (below) or north Africa (above) showing the occurrence of present-day (blue) and very old (red and yellow) water



INVOLVE LOCAL PEOPLE

- To help identify the need for data
- To provide local knowledge/wisdom and data
- To have a sense of "ownership" for local monitoring efforts
- To become volunteer observers

- World Water Monitoring Day – 18 September

http://www.worldwatermonitoringday.org

SOCIAL ASPECTS

- Official statistics – do not tell the whole story – and may be well out-of-date
- Opinion polls and surveys – suffer from well-known sampling problems and the challenge of posing the "right" questions to the right people
- Since 1990, WHO and UNICEF have run the Joint Monitoring Programme for Water Supply and Sanitation (JMP)

GENDER

Sara Ahmed - Gender and Water Alliance (GWA)

- We will not know the society we serve – and so cannot serve that society in the full sense of the term, if we do not:

  distinguish between women, men and children in demographic studies and record their social, economic and practical position in society

- Beware least we see people as only resources: as 'objects' of our need to assess, plan, etc.

- Need to combine quantitative and qualitative methods: collect numerical data as well as talk to people about how they perceive change.

- Monitoring as empowering processes - building self-sustainable, decentralised data “banks”.

- Participatory processes can exclude those with little voice – for example, women and men from socially marginalised classes, castes, religious or ethnic groups.


THE LIE OF THE LAND
HOW DO YOU MAKE A LIVING HERE? DO WOMEN WORK?
NO, WE DON'T WORK... WE JUST STAY AT HOME...
... AND FETCH THE WATER, FIND THE FIREWOOD, AND LOOK AFTER THE CATTLE...
...AND PREPARE THE GARDEN, AND PLANT THE SEEDS...
... AND DO THE WEEDING, THEN HARVEST THE CROPS, AND SELL THEM IN THE MARKET...
... AND BUY FOOD AT THE MARKET, COOK MEALS, AND DO THE HOUSEHOLD CHORES...
...ATTEND THE WOMEN'S GROUP MEETINGS FOR OUR COMMUNAL TASKS - LIKE MAKING BRICKS FOR THE SCHOOL BUILDING...
...AND WASHING AND MENDING THE CLOTHES FOR THE CHILDREN WE BEAR AND RAISE... THAT'S ALL...
...SO, NO, WE DON'T WORK!
MMM... I JUST WANTED TO CHECK!

ECONOMIC DATA

Needed, *inter alia*:

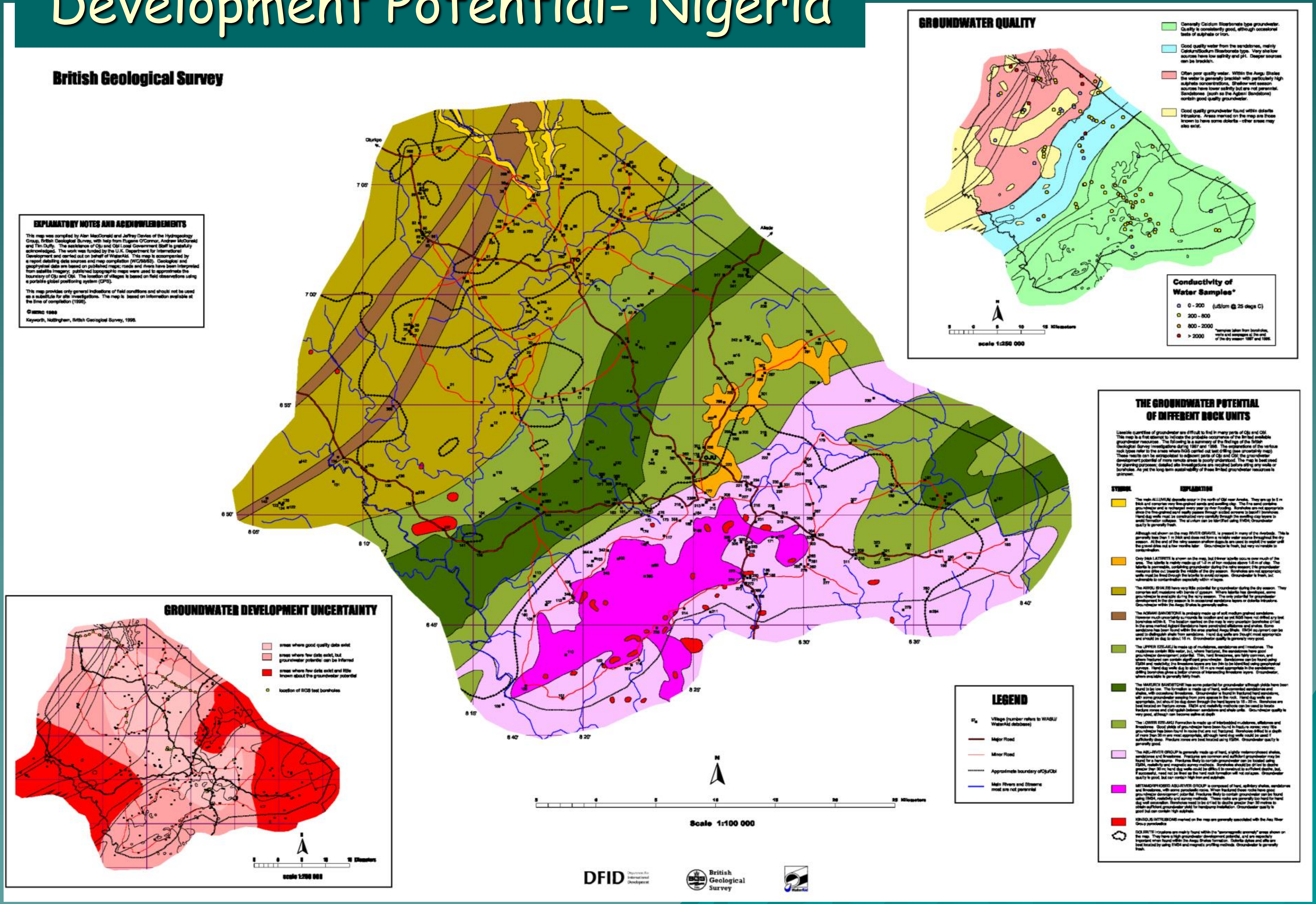
- - to assess relative benefits and costs of projected schemes
- - to foresee sources of funding for construction and operation
- - to evaluate performance in financial terms

More on this will be discussed in session 6.4.2 and in the debate on financial matters at this Forum – Theme 5

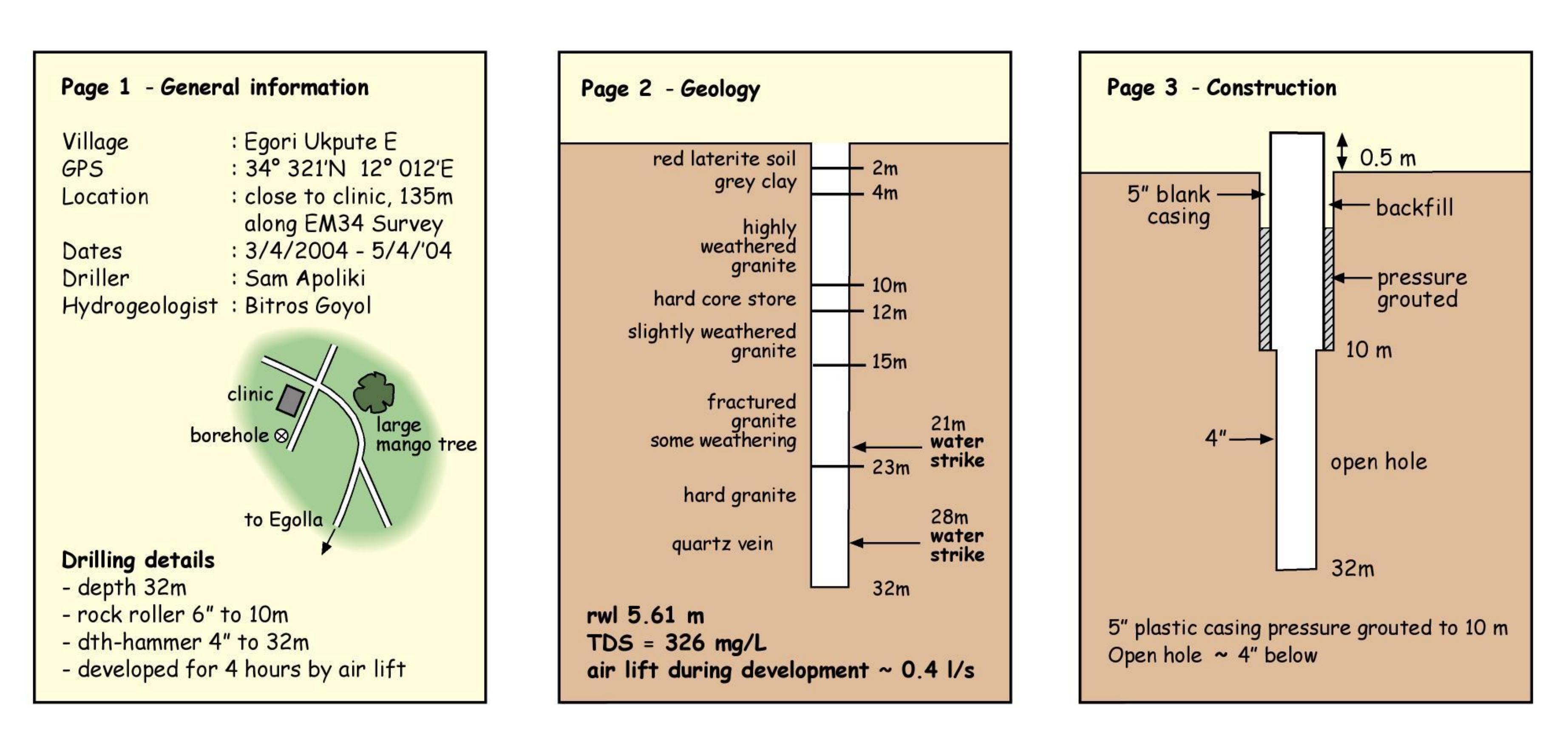
Note: Aldo Baietti (World Bank) is concerned at the lack of information as to the amount of finance, both private and public, that is being channelled into the water sector

THANK YOU

Map of Groundwater Development Potential- Nigeria



Proper data recording in water supply programmes is essential



Cannot do this without data, and without turning the data into useable information!!!!