



World Meteorological Organization
weather, climate and water

WMO's Expectations on Application of Satellite Information in Hydrology and Water Resources

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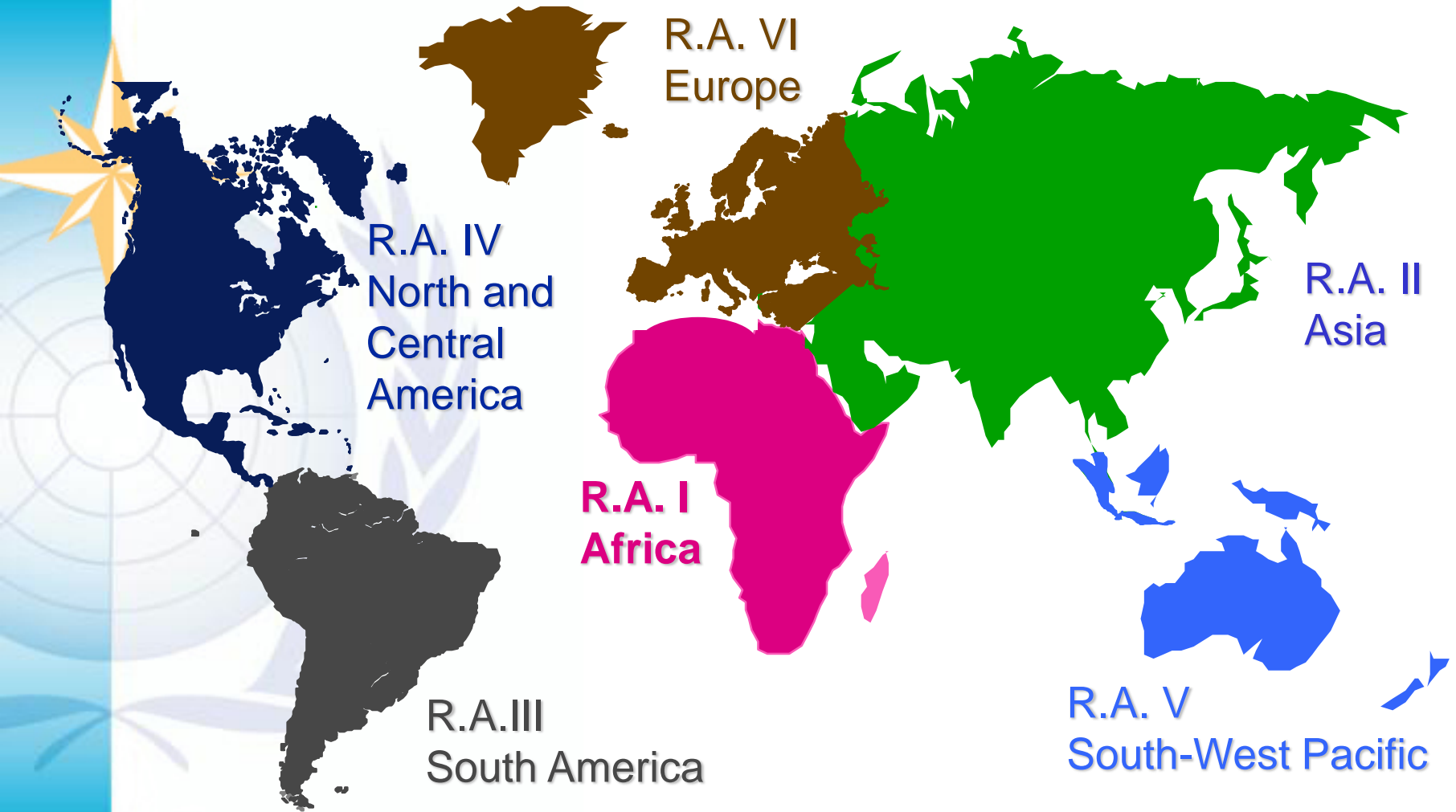
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World Meteorological Organization (WMO)

Among other things:

- Co-ordinates global scientific activities to allow increasingly prompt and accurate weather and **water resources** information for national, regional and international users.
- Promote policy of free and unrestricted exchange of meteorological data.
- Stressing the need for freely sharing hydrological information.

WMO- Regional Associations



WMO - Technical Commissions

Basic Commissions

- ◆ **Commission for Basic Systems (CBS)**
- ◆ **Commission for Instruments and Methods of Observations (CIMO)**
- ◆ **Commission for Hydrology (CHy)**
- ◆ **Commission for Atmospheric Sciences (CAS)**

Applications Commissions

- ◆ **Commission for Aeronautical Meteorology (CAeM)**
- ◆ **Commission for Agricultural Meteorology (CAgM)**
- ◆ **Commission for Marine Meteorology (CMM)**
- ◆ **Commission for Climatology (CCI)**

Role of WMO in the field of Hydrology and Water Resources

WMO Convention

Art: 2(e): "to promote activities in operational hydrology and close co-operation between Meteorological and Hydrological Services"



Hydrology and Water Resources Programme

Hydrology and Water Resources Programme

- ★ Concentrates on promoting world-wide cooperation in evaluation of water resources and development of hydrological networks and services
- ★ Concerned with the assessment of quantity and quality of water resources
- ★ Standardization of all aspects of hydrological observations and organized transfer of hydrological techniques and technology

Hydrology and Water Resources Programme

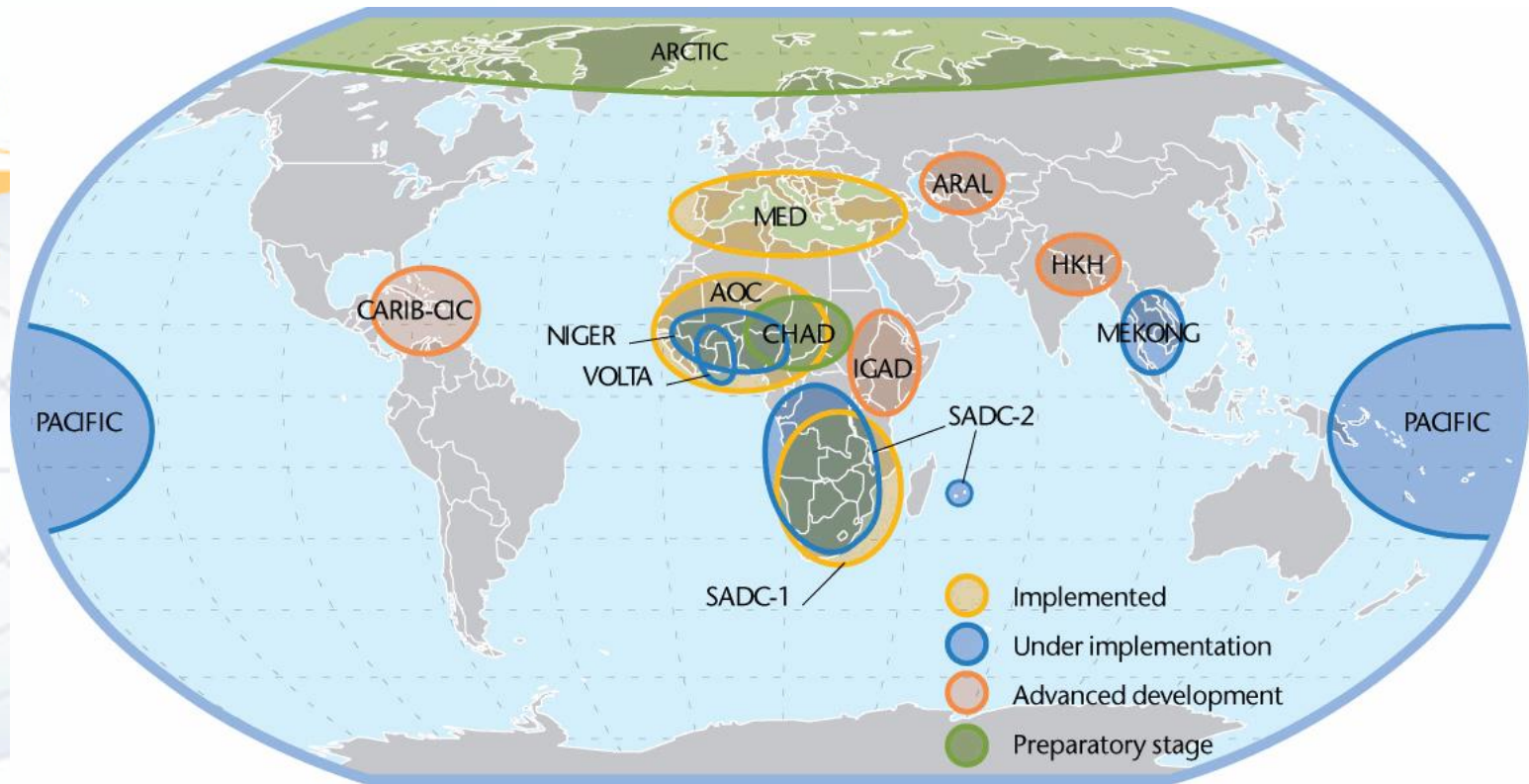
- Programme on Basic Systems in Hydrology (including WHYCOS)
- Programme on Hydrological Forecasting and Applications
- Programme on Capacity Building in Hydrology and Water Resources
- Programme on Water-related Issues

WHAT IS WHYCOS

- * A system for building the capacity of water resources management at the national, river basin, regional and global levels
- * Aims at promoting cooperation in the collection, transmission, processing, archiving and use of hydrological data and information

WHYCOS addresses the needs and requirements of the basins like integrated management of the water resources, flood forecasting, water quality monitoring, etc.

World Hydrologic Cycle Observation System



WHYCOS is conceived as a tool for improving the collection, dissemination and use of high quality, standardized and consistent hydrological and related data at the national, river basin, regional and international levels.

Integrated Flood Management

FOUR OBJECTIVES:

- Minimize loss of life,
- Optimize effective use of flood plains
- Sustainable development
- Environmental Preservation

FIVE Guiding principles:

- River Basin as a management unit
- Risk management principles
- Mix of Structural and non-structural measures
- Multi-hazard approach
- Building societal resilience





WMO / GWP Integrated Drought Management Programme (IDMP)

Outcomes WMO/GWP IDM



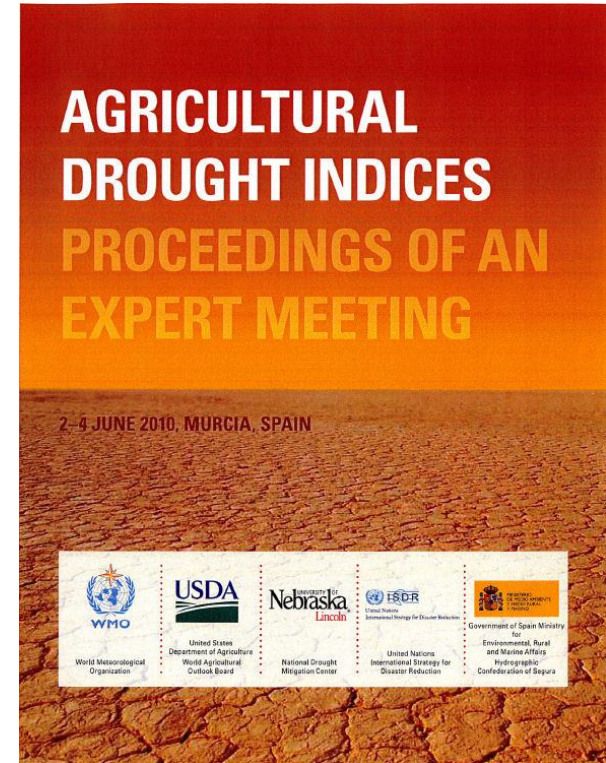
The IDMP aims to add value and close the gaps with regard to:

- **Better scientific understanding** of, and inputs for, drought management;
- **Improved knowledge base**, with better access to information and products;
- **Capacity for drought risk assessment, monitoring, prediction and early warning;**
- **Improved policy and planning for drought preparedness** and mitigation across sectors; and
- **Drought risk reduction and response.**

Development of Tools



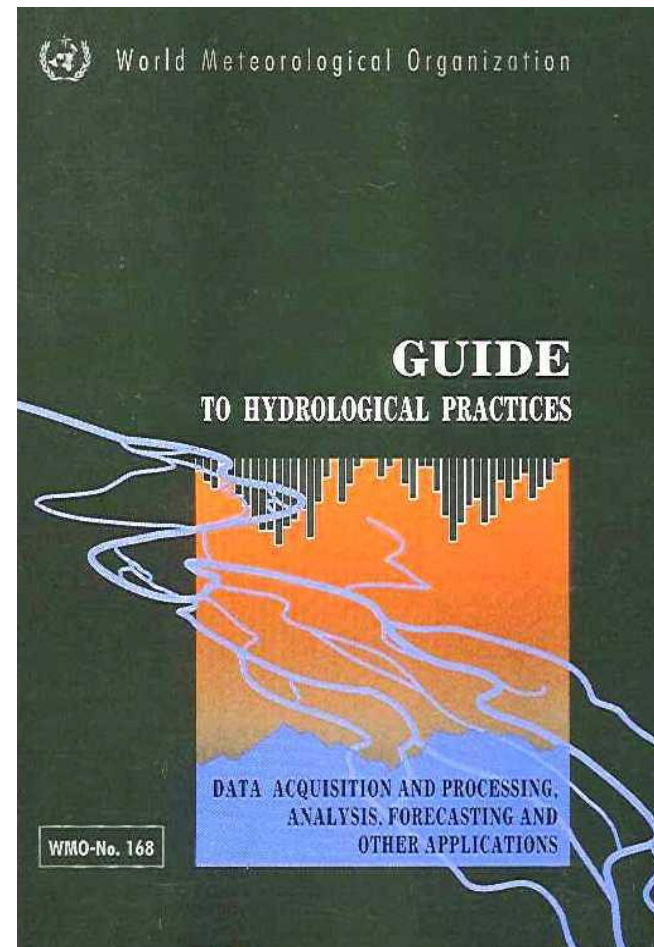
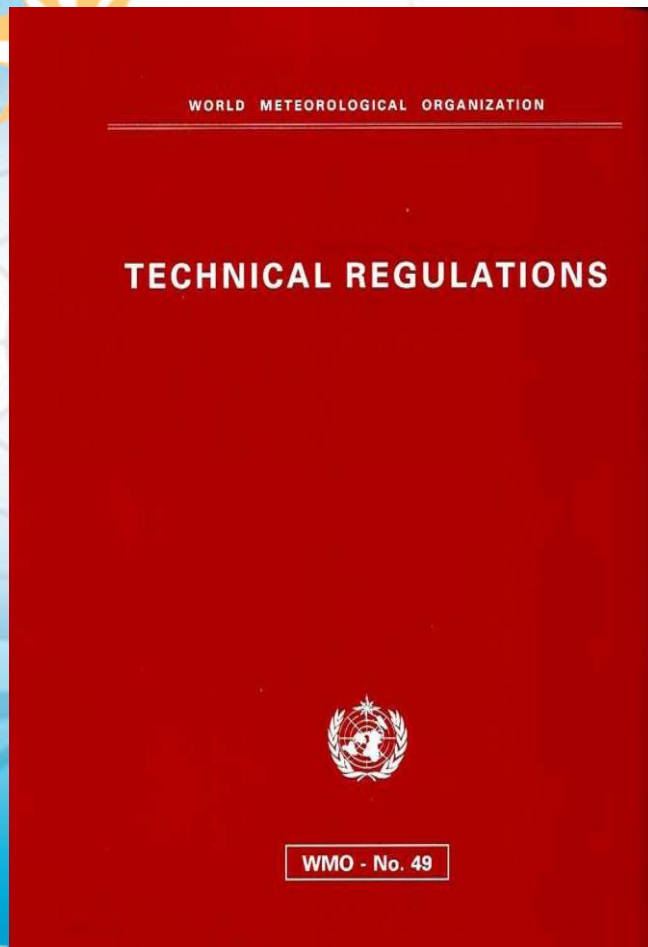
- Tools and guidelines to support the integrated management of droughts
- Currently development of National Drought Management Policy Guidelines
- Early Warning Systems and Drought Indicators envisioned




Quality Management Framework

- Hydrological Standards and Regulations
- Measurement Procedures
- Standardisation of new Technological processes
- Equipment calibration
- Procedure for data processing
- Safety considerations
- Targeted at National Hydrological Services(NHSs)/ National Meteorological and Hydrological Services (NMHS)

Guide to Hydrological Practices and Technical Regulations



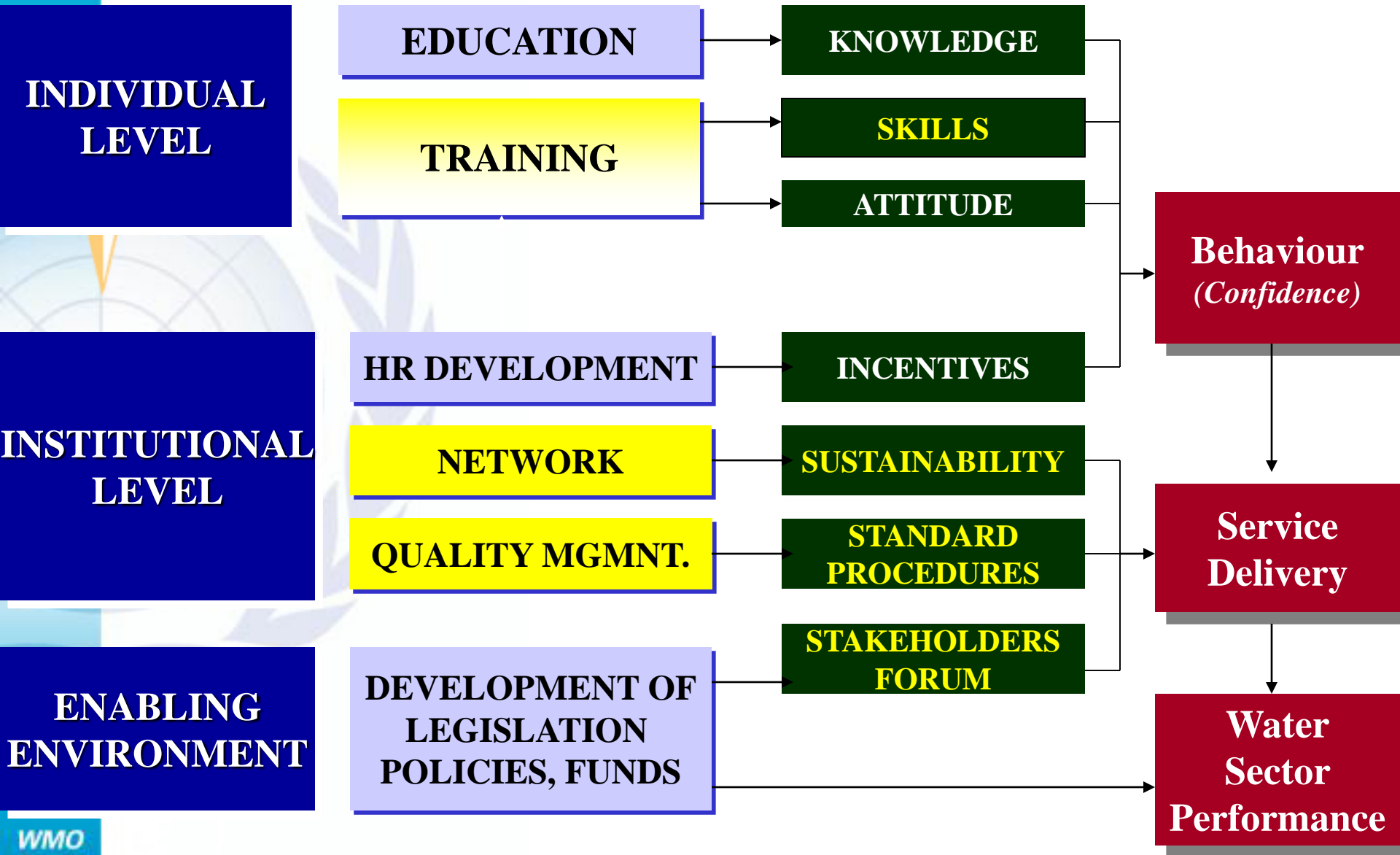
Guide to Hydrological Practices and Technical Regulations



As a general principle, **the Technical Regulations** set out the standards of hydrological practices which NHSs should implement and

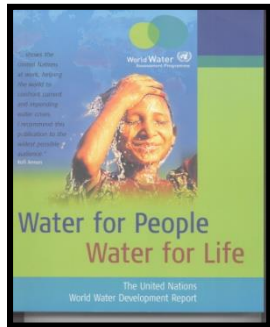
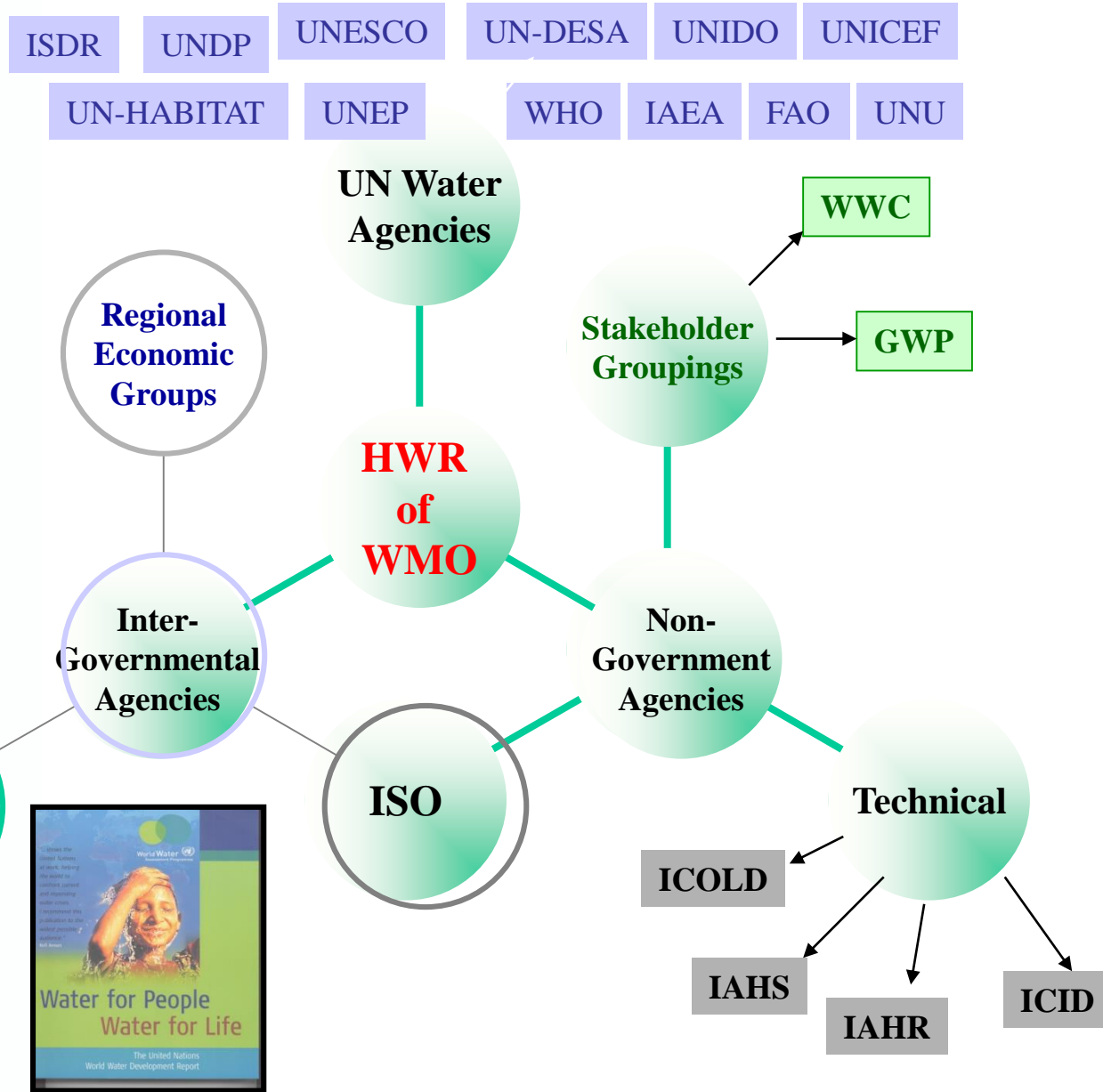
the Guide to Hydrological Practices describes the methods needed to implement the recommended practices.

CAPACITY BUILDING



Maintains WMO's important role in international activities relating to water-resource assessment and hydrological forecasting and the Organization's collaboration with other agencies within the UN system.

Water-related Issues



WMO Space Programme

The WMO SP has 4 main components:

- integrated space-based observing system;
- Availability and use of satellite data and products:
- Information and training
- Space weather coordination

WMO Space Programme

- Availability and use of satellite data and products:
 - currently more focus on applications in meteorology
 - applications for hydrology are mainly provision of precipitation, soil moisture and snow data and hydrological validation
 - interface with hydrological modeling resulting in significant improvements in hydrological modeling

WMO Space Programme

- **Information and training**
 - the Virtual Laboratory for Training and Education in Satellite Meteorology and Environmental Applications (VLab)
 - ensures websites and portals provide guidance on the availability and usability of satellite data, products and services
- ❖ **Need more training for hydrologists and more guidance on availability of data and products for application in hydrology**

WMO Space Programme

- Limited application of satellite data and information in some WMO-sponsored programmes:
 - Flash Flood Guidance System (FFGS) implemented in sub-regions eg. Southern Africa Region FFGS. More FFGSs are being implemented in other WMO Regions (in collaboration with HRC in San Diego, USA and USAID)
 - Severe Weather Forecasting Demonstration Projects (SWFDP).

Needs of Hydrological Community

In addition to improved hydrological modeling, the needs of the hydrological community include:

- High resolution satellite data and products
- Satellite altimetry data with very high resolution is key and can transform how hydrological monitoring is currently being done
- Hydrological monitoring in data-sparse or remote areas and in ungauged catchments
- In-filling of gaps in hydrological data sets using satellite data

Needs of Hydrological Community

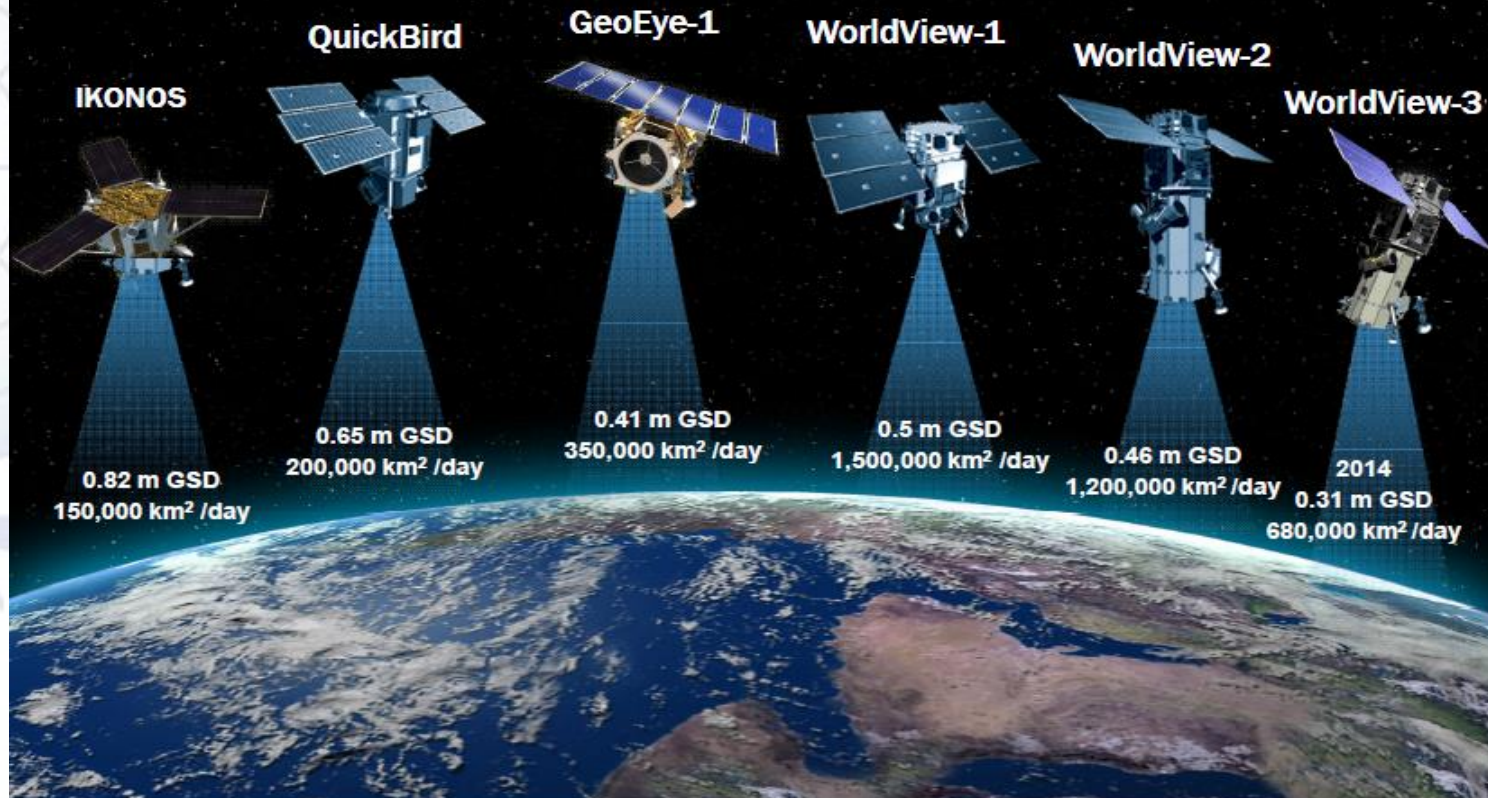
- Flood management - Mapping of water bodies, flood inundated areas, flood plain deliniation, etc.
- Can satellite data improve lead times of hydrological forecasts?????????
- Location of Aquifers (and their extent if possible)
- Land use changes and their impacts on water quality
- IWRM including transboundary water resources management

Satellite Data from other sources

The hydrological community is being exposed to other sources of satellite data, information, products and capabilities available for application in hydrology and water resources management.

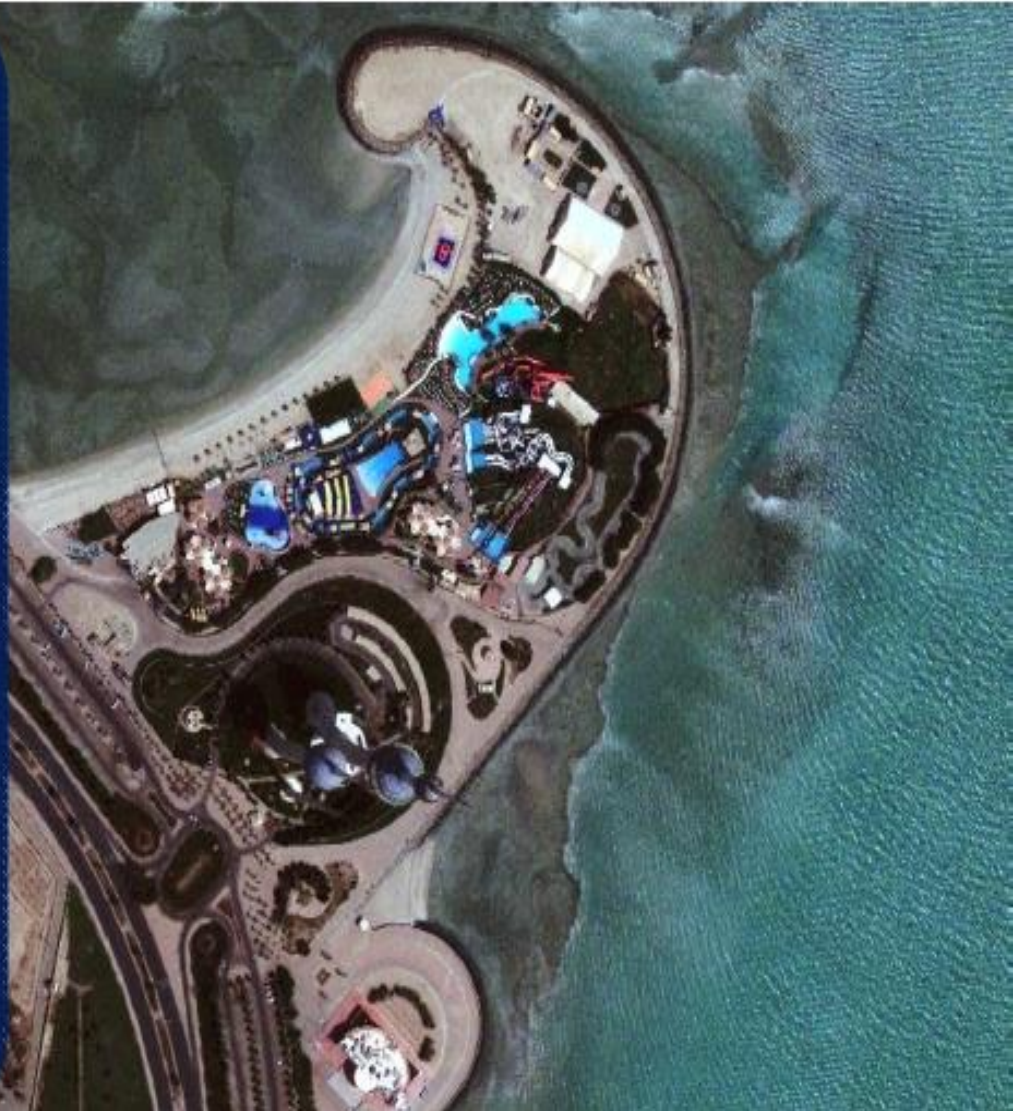
The Digital Globe Constellation

The DigitalGlobe Constellation



Properties (GeoEye-1, WV1 & WV2)

- *Spatial Resolution* 0.50 meter
- *Spectral Resolution* 4 Bands: R, G, B and NIR
- *Spectral Resolution* 8 Bands For WV2
- *2 to 3 days Revisit Time*



Properties (IKONOS, QuickBird)

- *Spatial Resolution 0.60 to 0.82 meter*
- *Spectral Resolution 4 Bands: R, G, B and NIR*
- *2 to 3 days Revisit Time*



Airbus Defense and Space (ADS)

Airbus Defense and Space (ADS)

- SPOT 5
- SPOT 6 Launched in 2012
- SPOT 7 Launched in June 2014
- Pleiades 1A & 1B
- WorldDEM



SPOT 5

SPOT 5

SPOT 5 Spatial Resolution of 2.5m
and 5m resolution

Launched on the 3rd to 4th May
2002.



SPOT 6 & 7

SPOT 6 & 7

- A constellation of two high-resolution, wide-swath sensors.
- Latest Launch with a 1.5m spatial resolution
- Spot 6 Launched on September 9, 2012
- Spot 7 Latest launch on June 30, 2014



Pleiades 1A & 1B

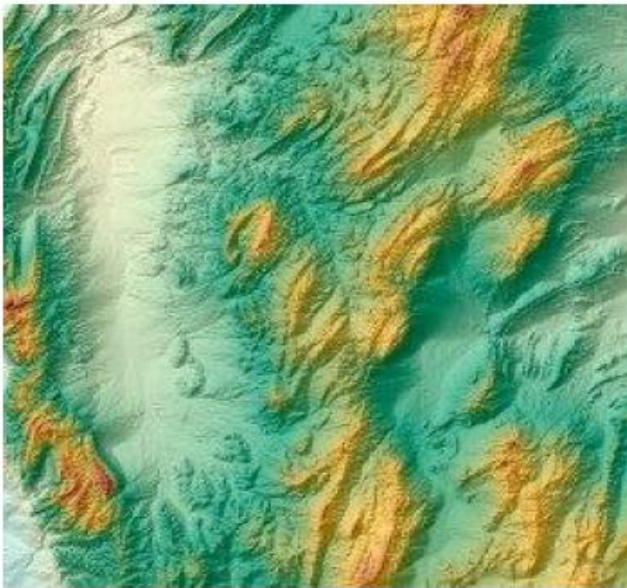
Pleiades 1A & 1B

- A constellation of two identical very-high-resolution optical satellites
- 0.5m spatial resolution
- Pleiades 1A launched on December 16, 2011.
- Pleiades 1B launched on December 2, 2012.



WorldDEM

WorldDEM



- Pole-to-pole coverage:
Homogenous standardized DEM
for any spot on Earth
- Unique quality: Superior terrain
information anywhere on Earth
- 12m accuracy raster
- Easy access

BlackBridge (RapidEye)

BlackBridge

BlackBridge Medium Resolution Satellite 5m



www.blackbridge.com

Summary satellite resolution

Summary

Very High Resolution Satellite Imagery (<1m spatial resolution)

- GeoEye-1, WorldView1, WorldView2, WorldView 3 (New), QuickBird, Pleiades 1A & B

High Resolution Satellite Imagery (1m-2.5m spatial resolution)

- IKONOS, SPOT 6 & SPOT 7 .

Medium Resolution Satellite Imagery (2.5m-10m spatial resolution)

- SPOT 5, RapidEye

Low Resolution Satellite Imagery (>10m spatial resolution)

- SPOT 1- 4,

The TIGER Initiative

- **TIGER-NET** is part of the **TIGER Initiative**
- Develop and provide an *open-source Water Observation and Information System (WOIS)* to support monitoring, assessment and inventory of water resources. Launched in March 2012 at WWF in Marseilles
- **WOIS** is aimed at enabling African water experts to produce and apply a range of satellite earth observation based information products for IWRM in Africa.

The TIGER Initiative

WOIS is a multi-purpose system consisting of:-

- a storage container for geodata
- extraction and processing of EO data through customized facilities
- integrative tools and models for decision support eg. hydrological modeling and GIS visualisation and analysis tools

The TIGER Initiative

System key advantages

- Open source – cost and license free
- Easily transferable – easy to operate
- Capabilities include:
 - retrieving, storing and processing EO satellite data as well as integrating in-situ data
 - producing EO-based water related information products
 - integrating hydrological modeling functions

System key advantages cont'd

- supporting decisions based on full GIS framework
- mapping and reporting functionality
- integrating and linking to existing user systems
- scaling up for future applications and demands
- supporting the full observational capacity of upcoming Sentinels

The TIGER Capacity Building Facility

- Responsible for implementing the capacity building element within the TIGER Initiative
- Has installed and trained eight African transboundary and national Water Authorities, namely,
- Lake Chad Basin Commission, Nile Basin Initiative, Volta Basin Authority, Zambezi Watercourse Commission, and national water authorities in Namibia, South Africa, Zambia and Mettelsat of DR Congo

Concluding Remarks (1/2)



To most hydrologists, accessing and application of satellite data and products is a highly specialized activity.

- Data types available **where** to find and **how** to access such
- Data sets with statements on uncertainty associated with the data will improve confidence in using satellite data
- How to analyse and use satellite data for applications, including simplified data assimilation tools

Concluding Remarks (2/2)

- Develop products, tools and a HelpDesk function to support the hydrology user community
- Consider offering training for the hydrology community in use of satellite data in hydrology and water resources. This will require a collaborative effort between the satellite and hydrology communities. WMO is well positioned to facilitate this.
- TIGER approach is worth considering with some adaptation.



Thank you !