# GEOSS Joint Asia-Africa Water Cycle Symposium


University of Tokyo
25 – 27 November 2013

**Session 2 GEOSS Capability and Needs of Stakeholders**

*Chaired by Dr. Richard Lawford*

**Speeches:**

His Excellency Mr. Farukh Amil, *Ambassador of Pakistan*
His Excellency Mr. Madan Kumar Bhattarai, *Ambassador of Nepal*

**Key Notes:**

Douglas Cripe, *Group on Earth Observations (GEO)*
Toshio Koike*, The University of Tokyo (UTokyo)*

**Panel Discussion:**

- Masami Fuwa, *Japan International Cooperation Agency (JICA)*
- Venkatachalam Anbumozhi*, Asian Development Bank Institute (ADBI)*
- Masayuki Tamagawa, *African Development Bank (AfDB)*
- Mikio Ishiwatari, *World Bank (WB)*
- Yoshiaki Kinoshita, *Ministry of Education, Culture, Sports, Science and Technology (MEXT)*
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GROUP ON EARTH OBSERVATIONS

# GEOSS Response: Work Plan

1 Infrastructure
- Observation networks
- Access to EO

2 Institutions & Develoment
- Data Sharing
- Capacity Building

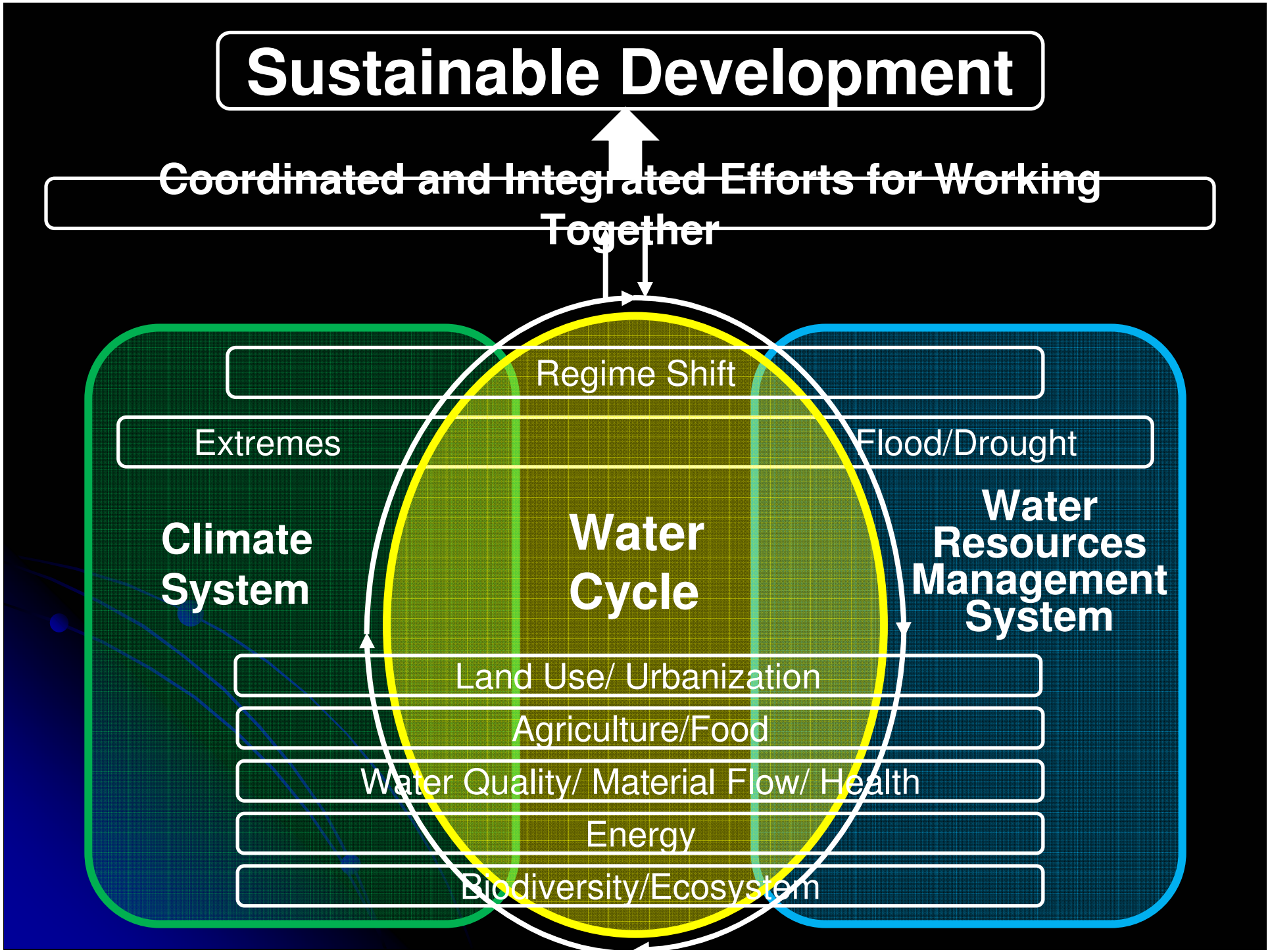
3 Societal Benefits
- Water Task
- Coordination

GROUP ON EARTH OBSERVATIONS

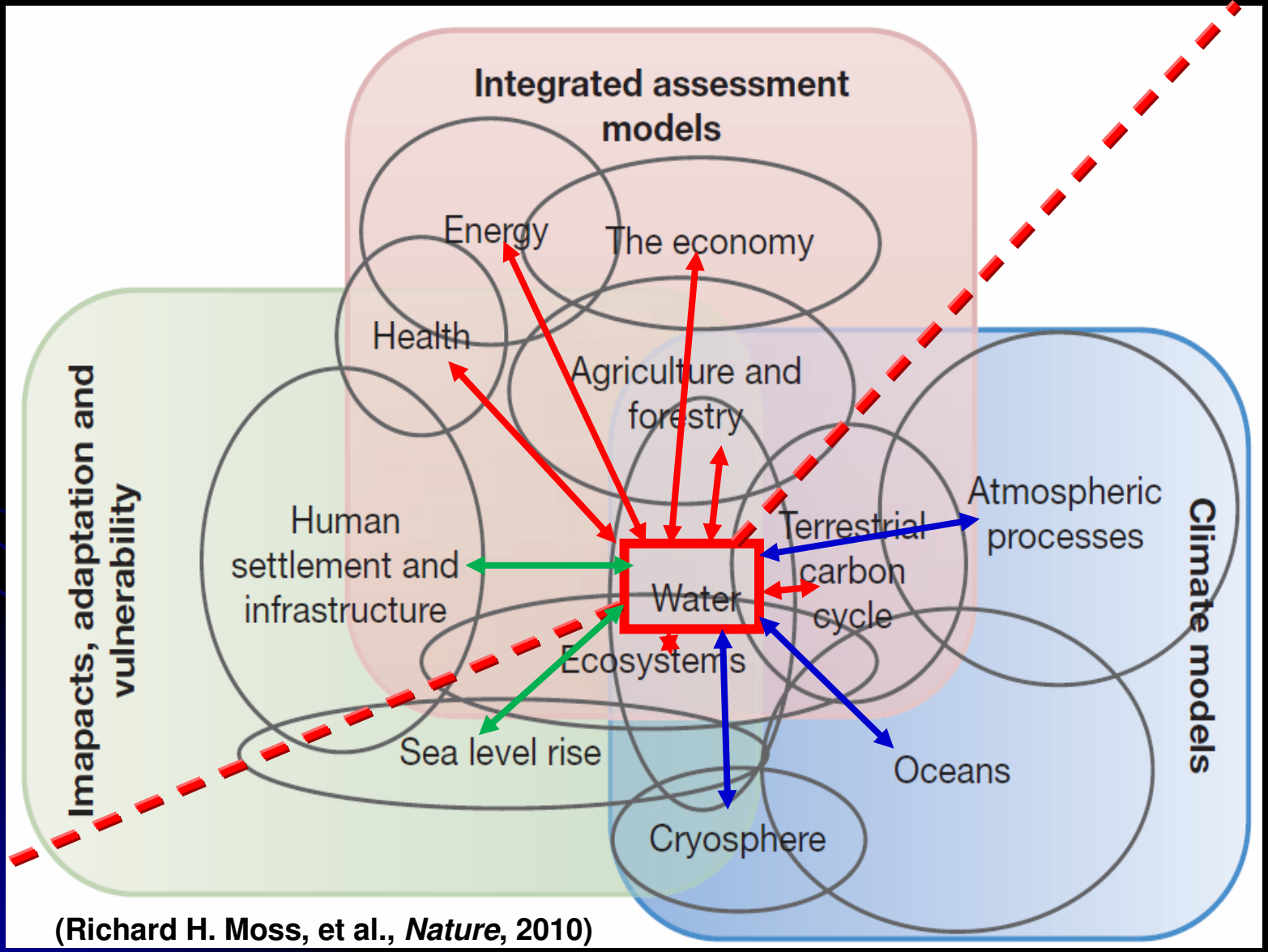
# Observational Data/Information Needs

**Global observations of water cycle variables needed for 4 purposes:**

- **to characterize variability, explore predicitability of global energy and water cycle (requires longterm records of significant climate and hydrologic indicators)**
- **to understand complex processes involved in global energy and water cycle in order to model them**
- **to initialize models (NWP, GCM/RCM/CRM) (requires observation-based determination of relevant state parameters)**
- **to develop decision support products/applications for managment/sustainable develoment of the world's water resources (and other water-dependent environmental resources)**


Sustainable Development
Coordinated and Integrated Efforts for Working Together
Regime Shift
Extremes
Flood/Drought
Climate System
Water Cycle
Water Resources Management System
Land Use/ Urbanization
Agriculture/Food
Water Quality/ Material Flow/ Health
Energy
Biodiversity/Ecosystem

# Water is a Key
# bridging between climate processes and societal benefits.




(Richard H. Moss, et al., *Nature*, 2010)

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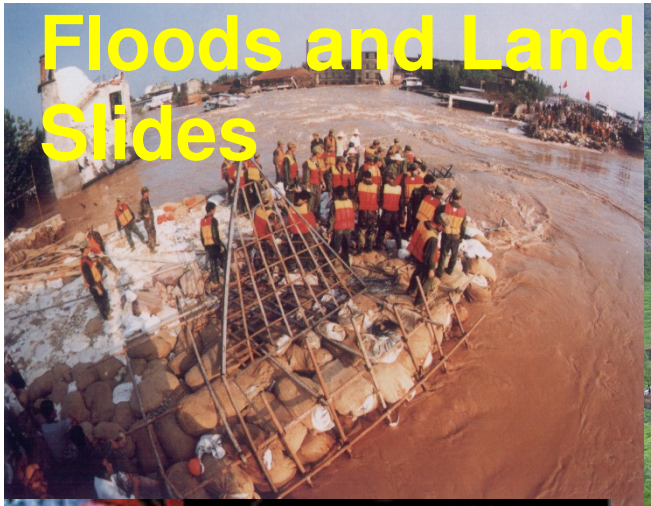
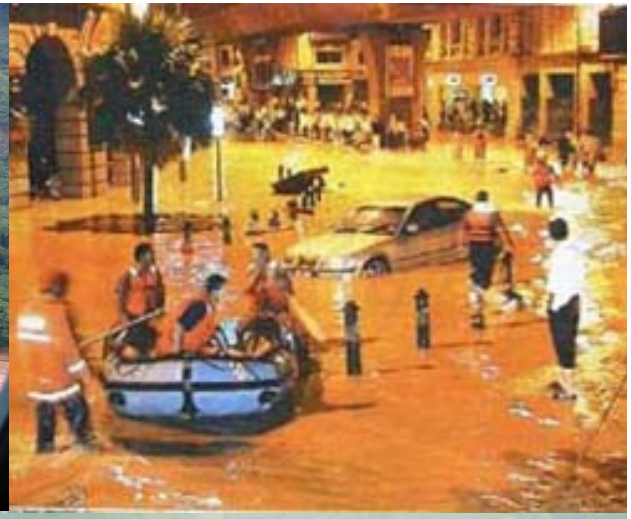
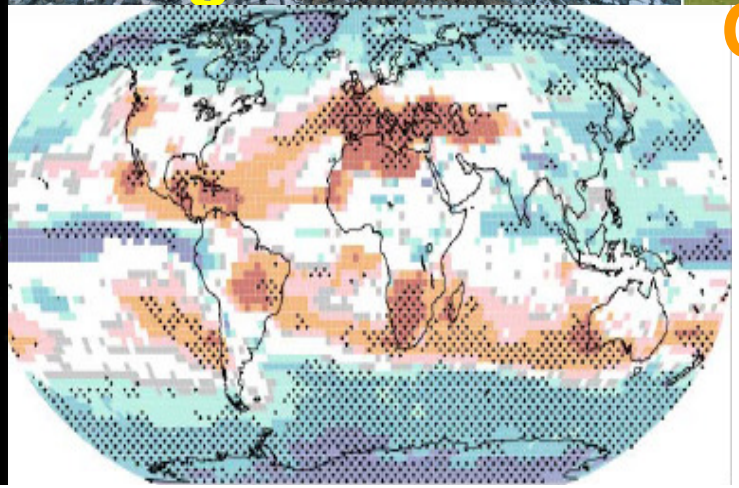
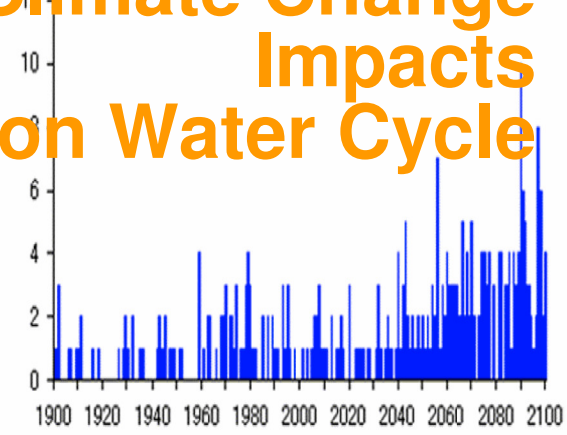


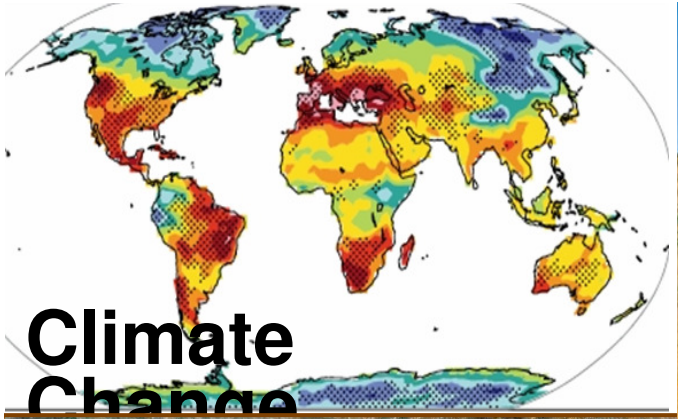





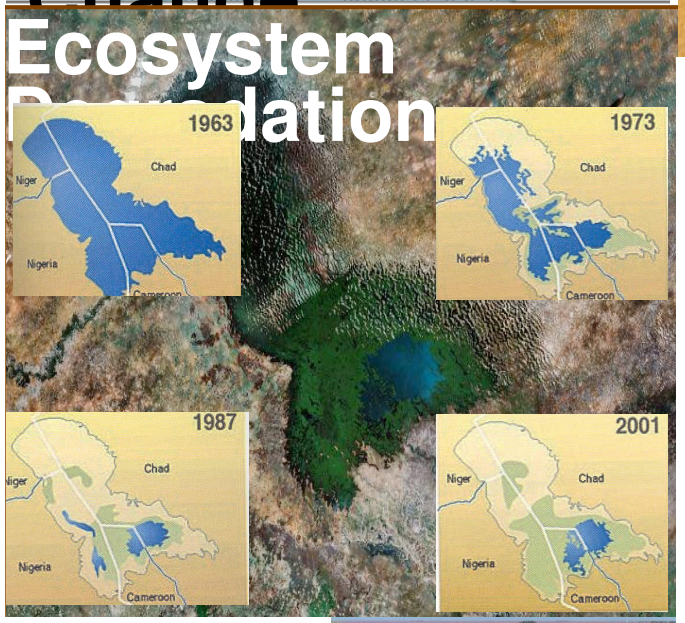


Climate Change Impacts on Water Cycle

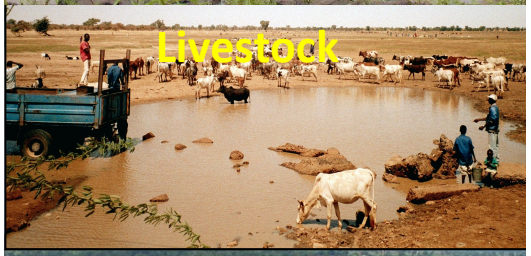




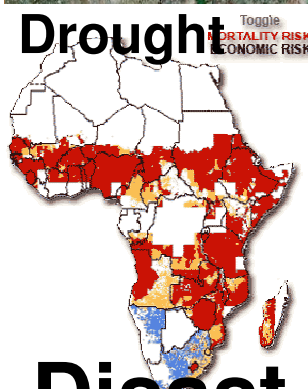


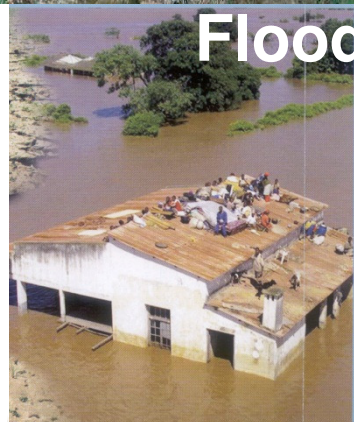




- On track to meet the MDG drinking water target: only 26 of the 53 countries
- Water related diseases: more than 80% → deaths for children under 5
- Deficient agricultural water management: e.g. only 10% of irrigable lands are actually irrigated in WA.
- Hydropower development < 7% of the potential
- 5-25% of GDP due to droughts and floods in affected countries
- Climate impacts are greatest in poor countries.





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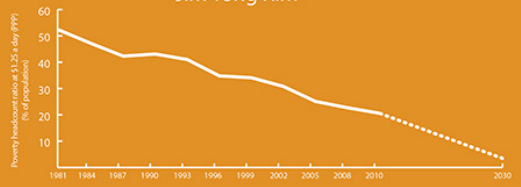
## END EXTREME POVERTY.

**Goal:** Decrease the percentage of people living on less than US$1.25 a day to no more than 3 percent by 2030.

*"To reach the 2030 goal, we must halve poverty once, then halve it again, and then nearly halve it a third time—all in less than one generation."*

— Jim Yong Kim




# POVERTY

+ ENVIRONMENTAL, SOCIAL, AND ECONOMIC SUSTAINABILITY

2030

*Growth of the bottom 40 percent that is consistently lower than the average growth should be a cause for concern. No country has transited beyond middle-income status while maintaining high levels of inequality.*

# PROSPERITY

## PROMOTE SHARED PROSPERITY.

**Goal:** Foster the welfare and income growth of the bottom 40 percent of the population in every developing country.

ADBInstitute

# Strategies for Adaptive Capacity Building

# Observation, Projection, and Integration

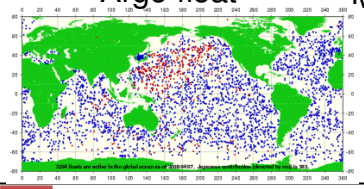
## Earth Observation

✓ Observing the ocean, land and atmosphere by earth observing satellites research vessels, buoy etc.

①Satellite observation data
Satellite remote sensing


②Ocean Observation data
Triton buoy

Argo float



③Land observation data
Moisturization of Siberian Area


Promotion Strategy on Earth Observation

## Projection

✓ Generating projection information applicable to adaptation using the Earth Simulator (a super computer)

Earth Simulator

## Integration

✓ Providing the scientifically and socially valuable information by processing various kinds of earth observation data to foreign or domestic institutes

DIAS

Observation based on needs

Promotion of data use/sharing

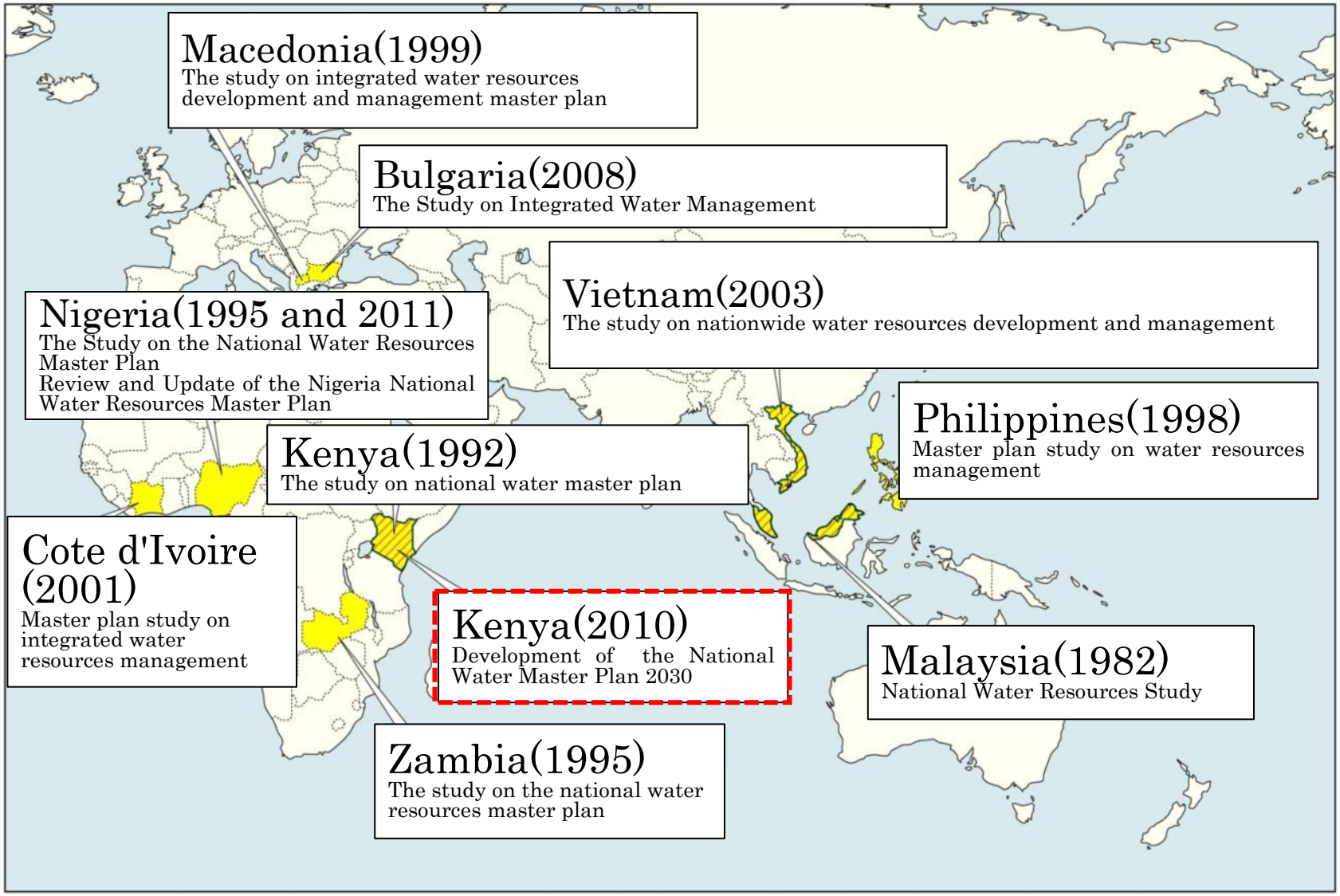
Overseas Institutes

**Needs**

**Contribution to social needs**

**Climate Change, Water resource management, Prevention or reduction of disasters, Weather, Energy, Agriculture/Desert, Biodiversity etc.**

# JICA's cooperation in formulation of National Water Resources Master Plans



# Proposed goals by the High-Level Panel (May 2013)


**Goal 1:End poverty**


Goal 2:Empower girls and women and achieve gender equality


Goal 3:Provide quality education and lifelong learning


Goal 4:Ensure healthy lives


Goal 5:Ensure food security and good nutrition


**Goal 6:Achieve universal access to water and sanitation**


Goal 7:Secure sustainable energy


Goal 8:Create jobs, sustainable livelihood, and equitable growth


Goal 9:Manage natural resource assets sustainable


Goal 10:Ensure good governance and effective institutions


Goal 11:Ensure stable and peaceful societies

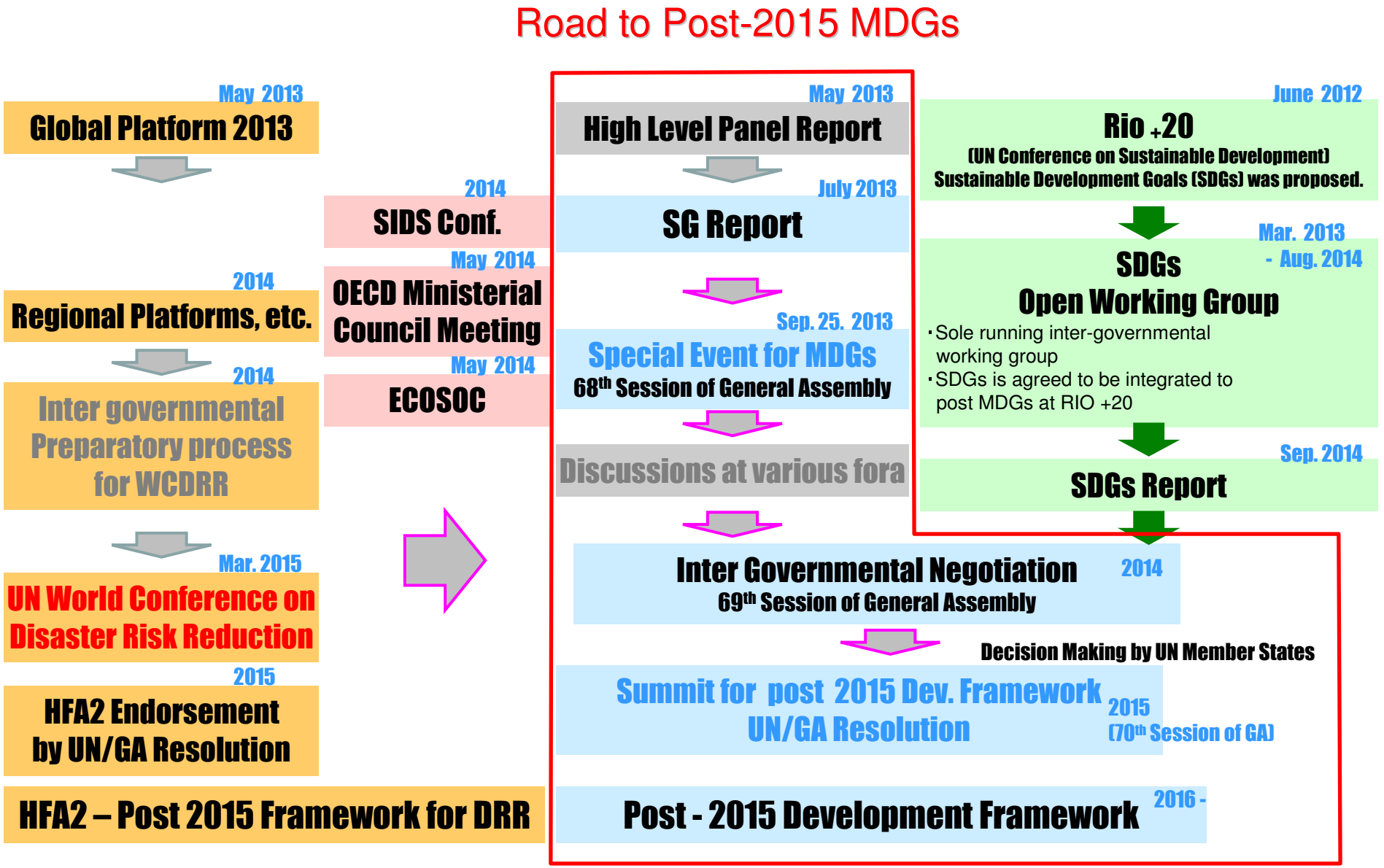

Goal 12:Create a global enabling environment and catalyze long-term finance

- Target 1d "Build resilience and reduce deaths from natural disasters by x%"
- 6a. Provide universal access to safe drinking water at home, and in schools, health centers, and refugee camps
- 6b. End open defecation and ensure universal access to sanitation at school and work, and increase access to sanitation at home by x%
- 6c. Bring freshwater withdrawals in line with supply and increase water efficiency in agriculture by x%, industry by y% and urban areas by z%
- 6d. Recycle or treat all municipal and industrial wastewater prior to discharge

✓ Target on disaster risk reduction
✓ Independent water & sanitation goal
✓ Target on wastewater treatment

Source: "The Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda" (May 2013) <*http://www.un.org/sg/management/beyond2015.shtml*>

# Road to Post-2015 Development Framework



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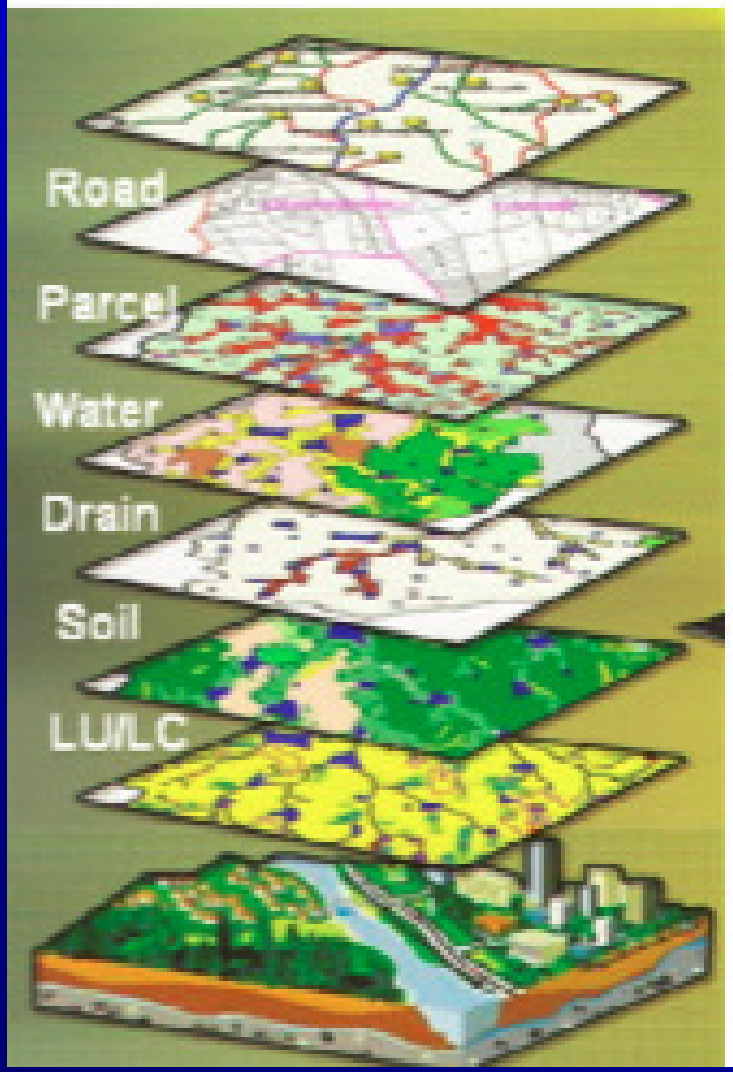


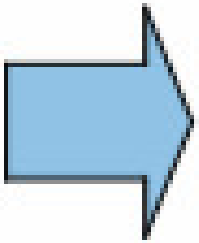

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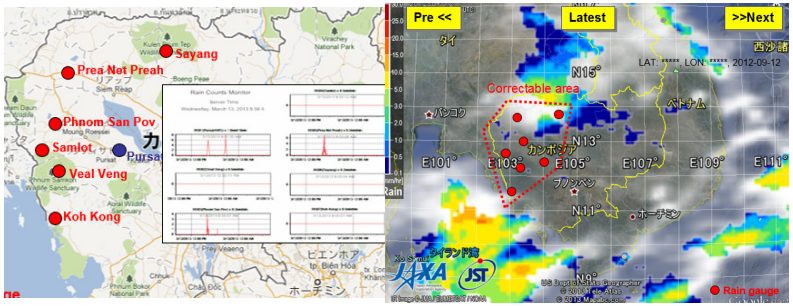
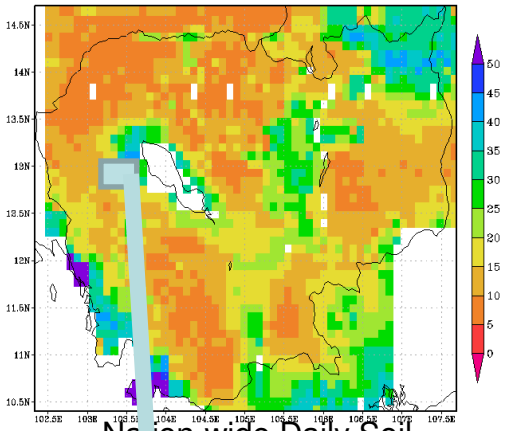
# Water-Climate-Agriculture Workbench in Cambodia


Stakeholder Meeting

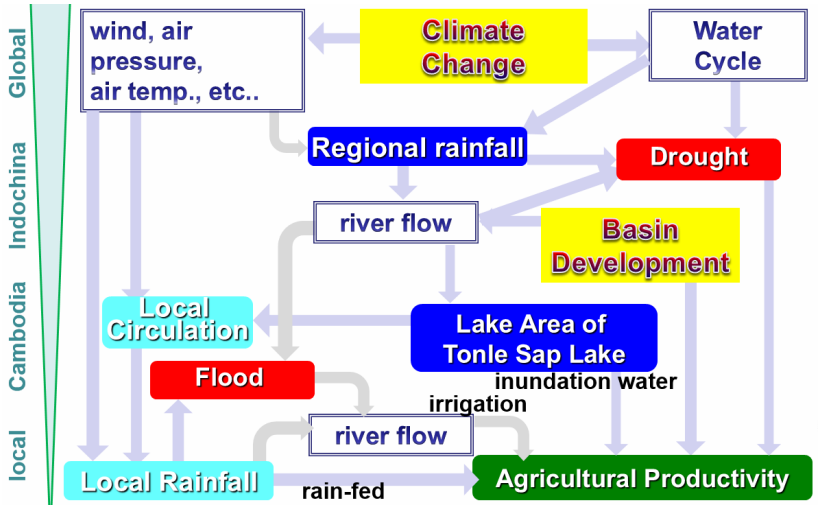



Real-time Rain Gauge → Satellite Data Correction → Wide Data Dissemination

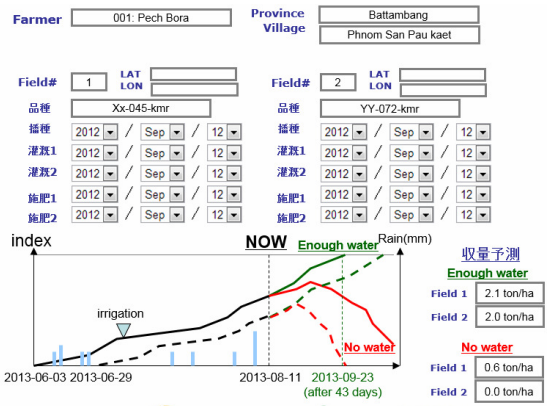
Famers' Needs & Experiences



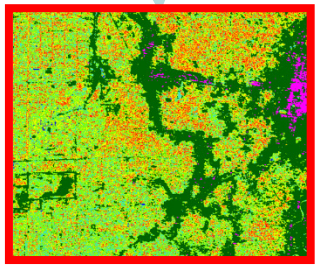
Nation-wide Daily Soil Moisture from Satellite



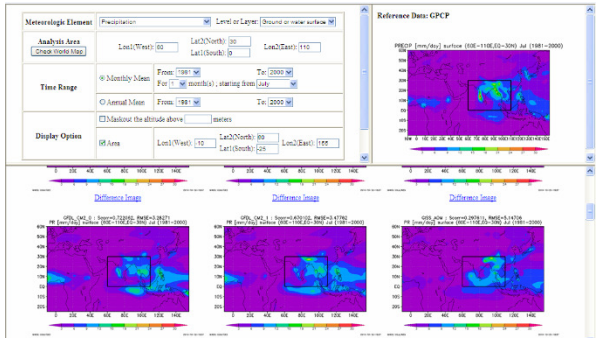

Holistic View of Water-Climate-Agriculture Problems




Water Cycle-Rice Production Coupled Model

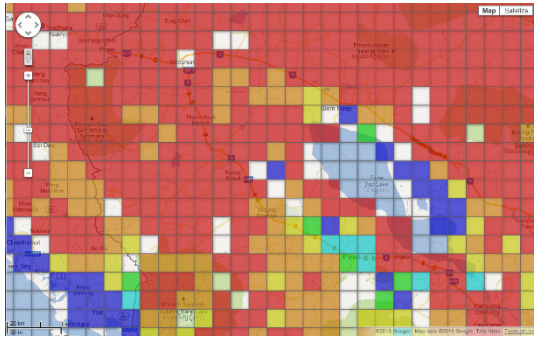


Local Information



Climate Change Analysis Tools

OJT for Local Practitioners



Rice Production Monitoring

# Co-design and Co-produce through discussions with users and stakeholders

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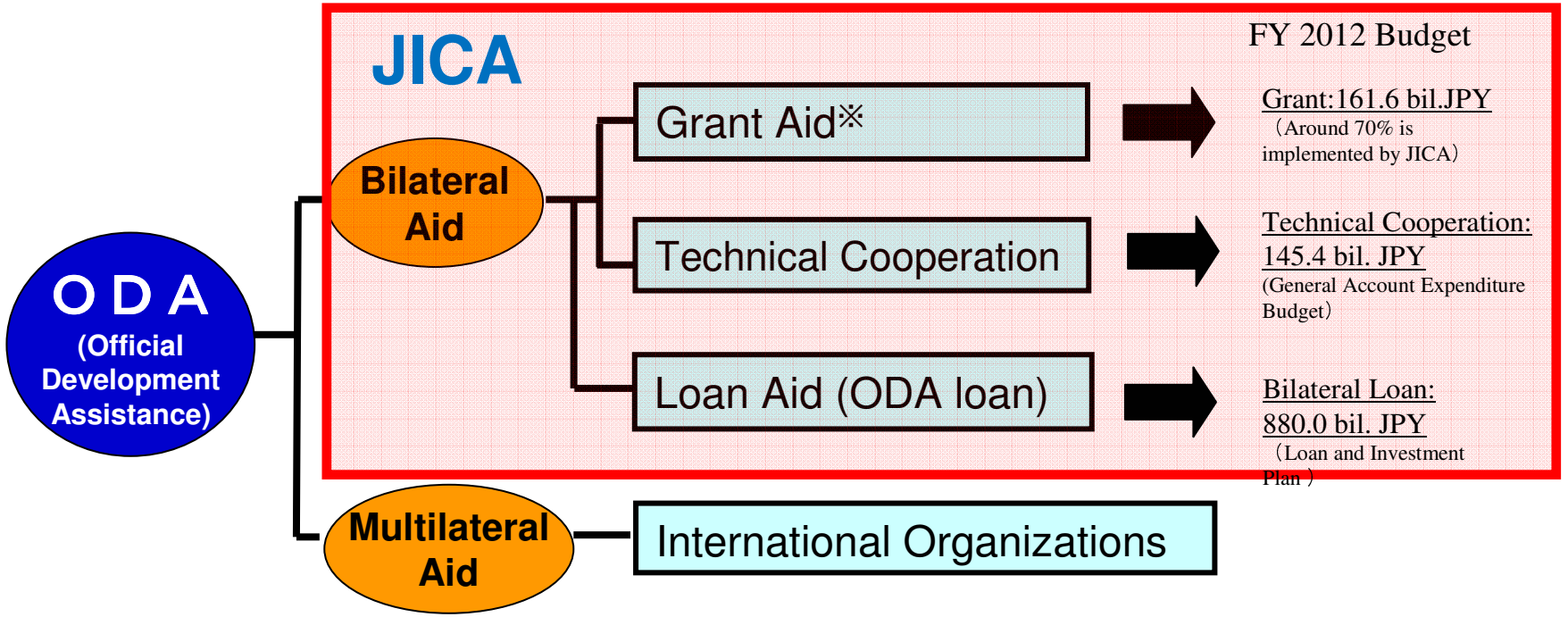
# Climate change funds: global and ADB initiatives

| | Mitigation | Adaptation | Both |
|---|---|---|---|
| INTERNAL - developing Asia | Clean Energy Financing Partnership Facility ($90 m)<br><br>Carbon Market Initiative Funds<br>▪ Asia-Pacific Carbon Fund ($151 m to 2012)<br>▪ Future Carbon Fund (target $100m for post 2012) | Small Grants for Promoting Climate Change Adaptation ($1.2 m)<br><br>Water Financing Partnership Facility ($65 m, including adaptation)<br><br>Poverty and Environment Fund ($3.6 m, including adaptation) | Climate Change Fund ($40 m) |
| EXTERNAL - Global | Global Environment Facility (GEF) Climate Change Focal Area ($250 m/ year)<br><br>Clean Technology Fund of the Climate Investment Funds (WB as Trustee) (target $5 b for 2009-2012) | Least Developed Countries Fund (GEF as administrator) ($189 m - $58m committed)<br><br>Strategic Priority on Adaptation (art of GEF Trust Fund) ($50 m – now fully committed)<br><br>Adaptation Fund (GEF as administrator in cooperation with UNFCCC) ($100 m) | Special Climate Change Fund (GEF as administrator) (adaptation priority, $80m - $67m committed; mitigation, target $15m)<br><br>Strategic Climate Fund of the Climate Investment Funds (WB Trustee)<br>Target:<br>- Pilot Program for Climate Resilience $500 m<br>- Forest Investment Prog. $500 m<br>- Greening Energy Access $500 m |

# Japanese ODA and JICA

- JICA is the implementing agency of Japanese bilateral ODA
- An agreement between governments of a recipient country and Japan, based on an official request through the diplomatic channel, is a prerequisite




※Non-project Assistance and Emergency Grant Assistance remain with MOFA

**Session3. Water cycle Observations and Integrated Water Resources Management (IWRM)** *Chaired by Dr. Douglas Cripe*

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Dr. Sivaji Chadaram, *Counsellor, Embassy of India*

**Key Notes:**

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# ANCIENT IRRIGATION IN SRI LANKA

CECAR-ASIA
SUB THEME 2

The ancient irrigation systems have been built from 5th century BC to 12th century AD for 17 centuries. For example, the medium size Basavakkulama tank with a water spread of 107 ha was built around 300 B.C.

Main features

- Sustainability
- Evolution and development over a long period of time
- Technological innovation, macro-micro integration of systems and governance

# Conclusions

- IWRM serves as an important tool in supporting sustainable development objectives.
- Consideration of environmental, economic and social dimensions helps in understanding constraints for sustainable development when we plan IWRM strategies.
- In addition to maximizing benefits, we need to link the effects of global change on local sustainability as well as impacts of local developments on global sustainability.

UNITED NATIONS UNIVERSITY
UNU-ISP

# IWRM at Rio +20

## Rio +20 Outcome Document " The Future We Want" (June 2012)

### Water and sanitation

.....

120. We reaffirm the commitments made in the Johannesburg Plan of Implementation and Millennium Declaration regarding halving by 2015 the proportion of people without access to safe drinking water and basic sanitation and the development of integrated water resources management and water efficiency plans, ensuring sustainable water use. We commit to the progressive realization of access to safe and affordable drinking water and basic sanitation for all, as necessary for poverty eradication, women's empowerment, and to protect human health, and to significantly improve the implementation of integrated water resource management at all levels as appropriate. In this regard, we reiterate our commitments to support these efforts in particular in developing countries through the mobilization of resources from all sources, capacity building and technology transfer.

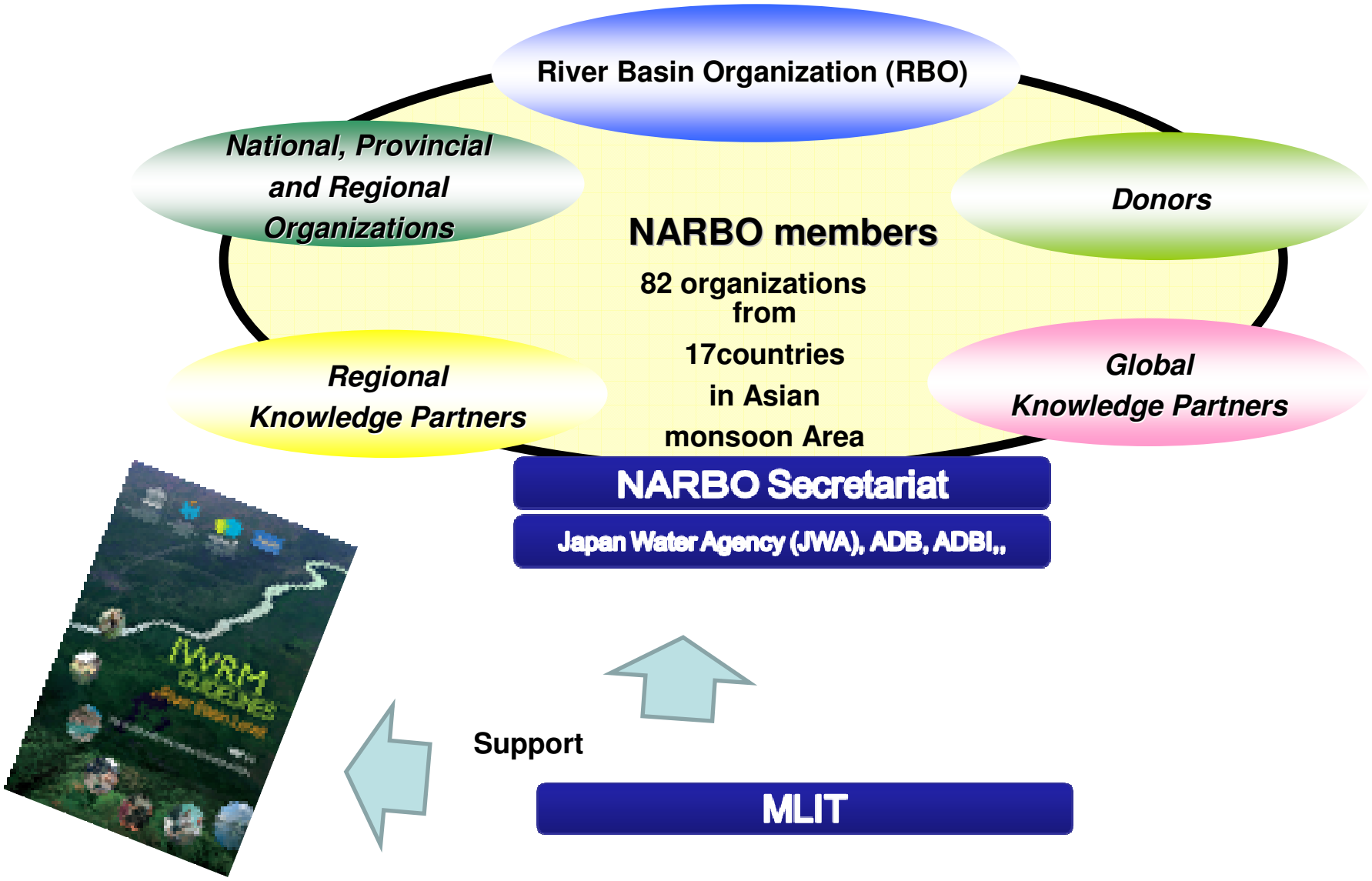
http://www.un.org/en/sustainablefuture/

.....


"Global Map and IWRM for Sustainable Development" Seminar by MLIT, Japan at Rio +20 Japan Pavilion

"Flood Management in Japan" Short Lecture by MLIT, Japan at Rio +20 **GEO** booth

# IWRM guideline and NARBO(Network of Asian River Basin Organization)




## IWRM guideline at River Basin Level

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## Session3. Water cycle Observations and Integrated Water Resources Management (IWRM)

*Chaired by Dr. Douglas Cripe*

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# Status of the IWRM Concept

The concept of IWRM remains valid today because it provides a framework for integration within river basins. It is of particular importance for Earth observations because it strengthens the rationale for global mapping and free data exchange.

Earth observations can provide a platform for strengthening IWRM since satellite data products are spatially consistent and are not constrained by borders.

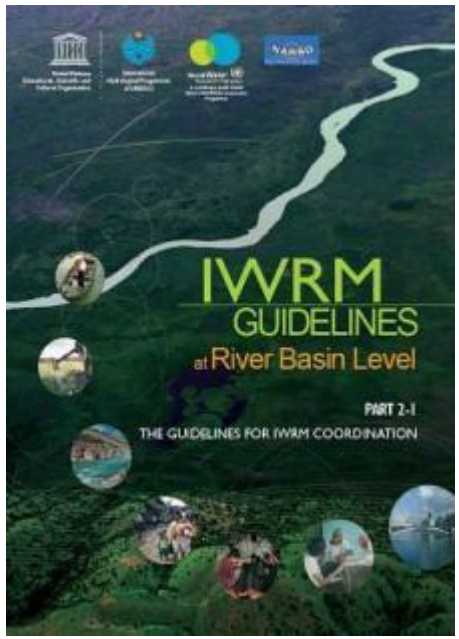
IWRM is difficult to implement in transboundary basins because of national or state differences, priorities and related issues of trust. Can the benefits of Earth Observations provide a reason for nations to lower their barriers and work together for a common goal?

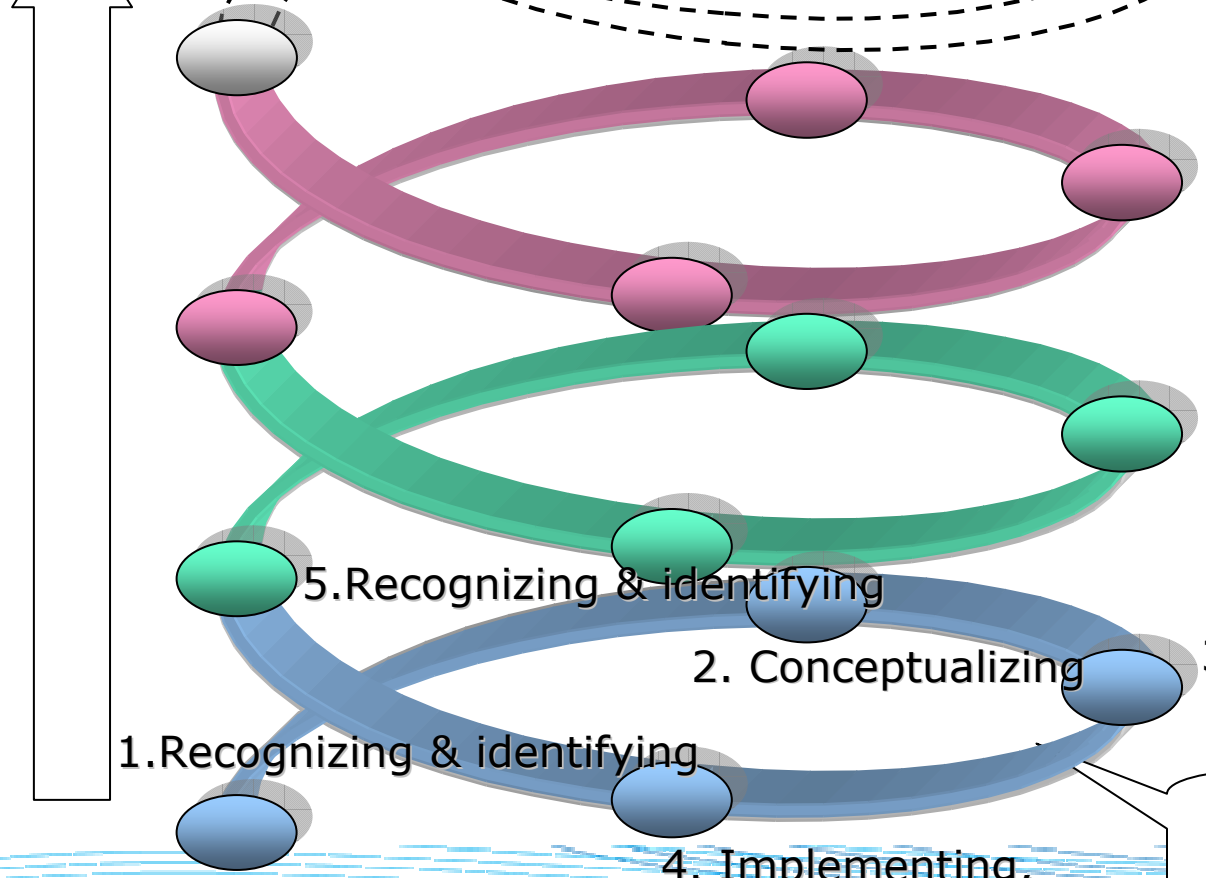
In areas where Basin authorities exist it is important for GEO to support their efforts to implement IWRM.

IWRM has implications for water use for a number of sectors, many of which may resist the implementation of IWRM. Where basin authorities do not exist, it is better to start small with a Nexus like the WEF Nexus to see if a coordinated effort for a transboundary basin can begin for water in this set of sectors and then be broadened to a wider rage of sectors.

# "IWRM Spiral" concept model

**Progress of IWRM**




**IWRM Process**

# IWRM planning

- What do we need to know
  - Resource availability: water
  - Rainfall; intensity and temporal distribution
  - Land cover/land use changes
- Challenge: estimate resources (rain) and demands under global change
- Downscaling future climate projections to local scale
- Incorporating uncertainty : adaptive future planning
- Develop local capacity for longterm planning

UNITED NATIONS UNIVERSITY
UNU-ISP

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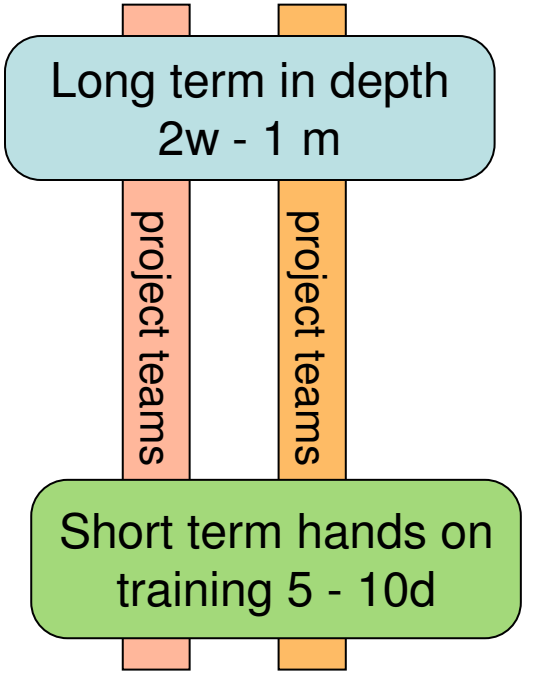
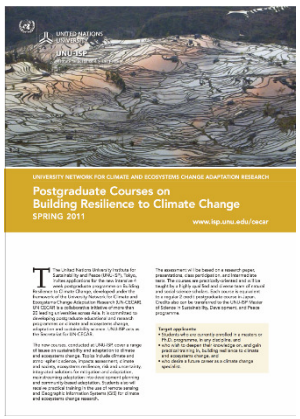
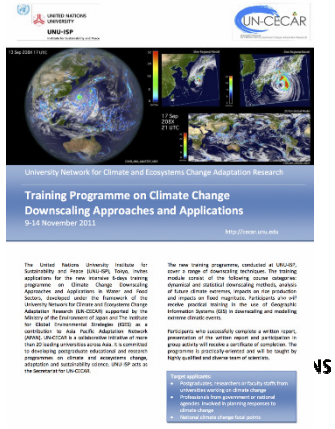
# Capacity Development Programs

- The programs should not be a one time event
- Should not develop programs to train specific teams but rather develop programs that can be used to train teams.
- Programs should consist of long term in depth courses as well as short term hands on training, that are run independently.
- GEO can provide valuable support to these programs by providing global to local connectivity, information on data repositories and their use, and supporting continuity through pilot projects (field stations)



# Integrating Education, Research and Capacity Development

- Higher Education Sector to customize global knowledge and lead development
- Capacity development programs for training a large number of international competent professionals and policymakers.


UNU-ISP

# Networking with Scientists, Researchers and Other networks

i ; GEO-UNESCO Joint Workshop on Earth Observations and Capacity Development for Integrated Water Resources Management at River Basins in Africa (Nairobi, KENYA 12-16 January, 2012)

ii ; The 5th GEOSS Asia-Pacific Symposium, The 9th AWCI International Coordination Group (ICG) Meeting and the Workshop on Climate Change Adaptation organized by APWF (Tokyo, 2-4 April, 29 September-2 October, 2012)

Nairobi, Kenya ,12 - 16 January 2012

GEOSS-AP Symposium in Tokyo, 2012

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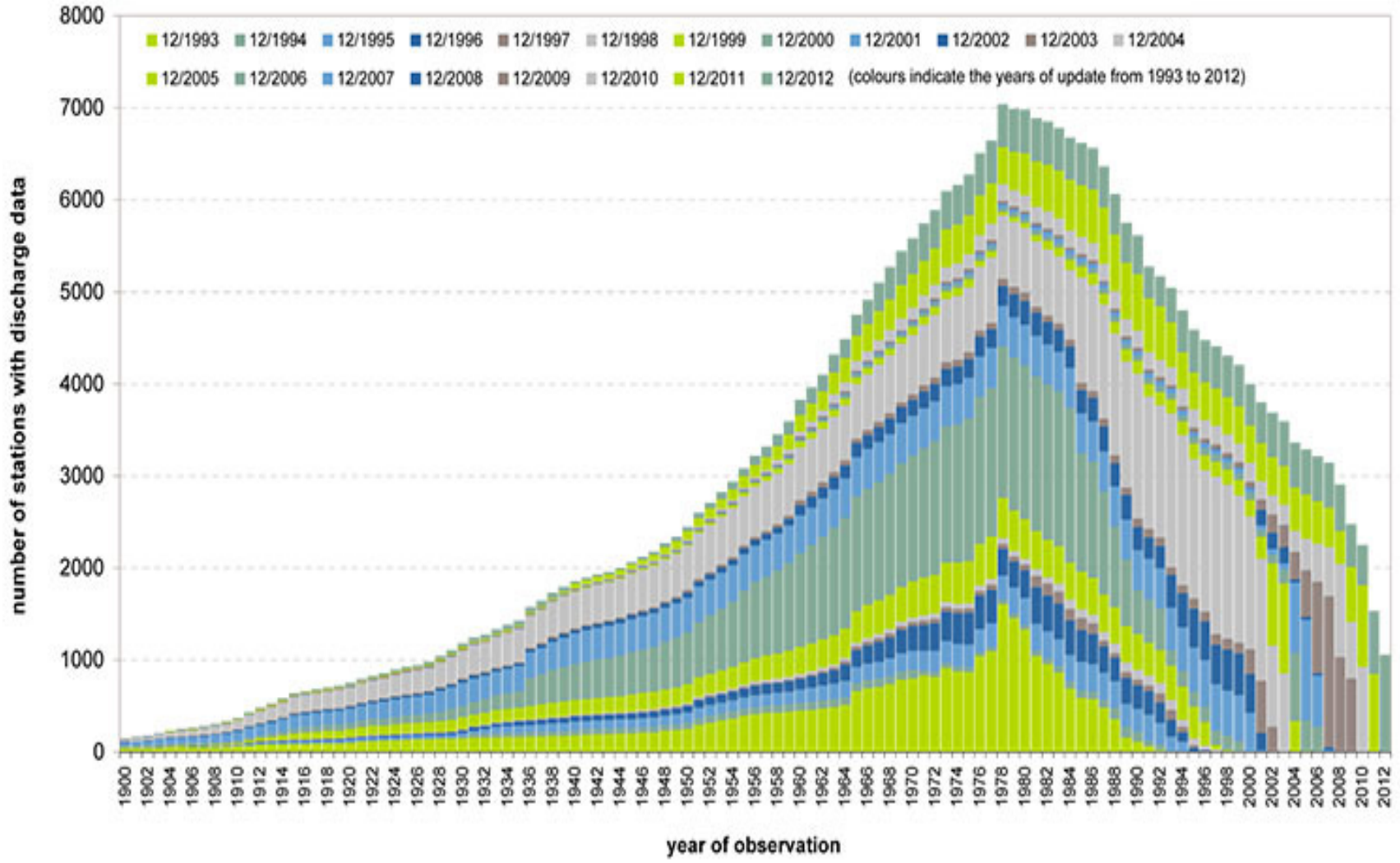
# Data Gaps

- Insufficient hydrological and meteorological In-Situ data Network
- Cryosphere is much behind the atmosphere and hydrosphere
- Limited access to satellite data and unavailability of representative data sets

# Global Runoff Data Base: temporal distribution of river discharge data




GRDC, 08/02/2013

## Why are in-situ networks diminishing in capability?

National budget constraints result in decisions to reduce funding spent on maintaining in-situ networks in order to support other national priorities.

The importance of in-situ measurements is not fully understood by nations (including some GEO members) which do not recognize the need to support stations for the benefit of the global community.

The value of in-situ measurements and the benefits of upgrading local technologies to maintain the information services are not fully recognized by international agencies who could support such networks in developing countries.

# Initiatives

- AWCI/GEOSS is entering into second phase of Water Cycle Integration
- DIAS is a land mark achievement of AWCI where 20 Asian nations have been contributing with data sharing in 18 river basins
- WMO has recently introduced new initiative on Global Cryospheric Watch
- Geo has made a significant progress during the last decade through GEOSS and data portals

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# Satellite Data Game Changer

- ***Satellite observation has been undergoing major changes for last 10 years***
  - Google Earth in 2005
  - GEOSS: societal benefit and open and free data policy
  - Landsat data for free
  - Copernicus open and free data policy approved
- ***JAXA is changing its data policy and business models***
  - data policy change:
    - Open and free for low/medium resolution environmental satellite data
    - Commercial distribution by private sector for high resolution data
  - business model change
    - Global initiatives with UN organizations
    - Regional sustainable development with JICA and ADB
    - Local services with private sectors and end users

***JAXA is looking forward to developing innovative satellite data applications and solution services in cooperation with users.***


SDGs

# Proposed goals by the High-Level Panel (May 2013)


**Goal 1:End poverty**


Goal 2:Empower girls and women and achieve gender equality


Goal 3:Provide quality education and lifelong learning


Goal 4:Ensure healthy lives


Goal 5:Ensure food security and good nutrition


**Goal 6:Achieve universal access to water and sanitation**


Goal 7:Secure sustainable energy


Goal 8:Create jobs, sustainable livelihood, and equitable growth


Goal 9:Manage natural resource assets sustainable


Goal 10:Ensure good governance and effective institutions


Goal 11:Ensure stable and peaceful societies


Goal 12:Create a global enabling environment and catalyze long-term finance

- Target 1d ”Build resilience and reduce deaths from natural disasters by x%”
- 6a. Provide universal access to safe drinking water at home, and in schools, health centers, and refugee camps
- 6b. End open defecation and ensure universal access to sanitation at school and work, and increase access to sanitation at home by x%
- 6c. Bring freshwater withdrawals in line with supply and increase water efficiency in agriculture by x%, industry by y% and urban areas by z%
- 6d. Recycle or treat all municipal and industrial wastewater prior to discharge

✓ Target on disaster risk reduction
✓ Independent water & sanitation goal
✓ Target on wastewater treatment

Source: “The Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda” (May 2013) <*http://www.un.org/sg/management/beyond2015.shtml*>

**Session 4. Contributions by Earth Observation & Science Communities**

*Chaired by Prof. Toshio Koike*

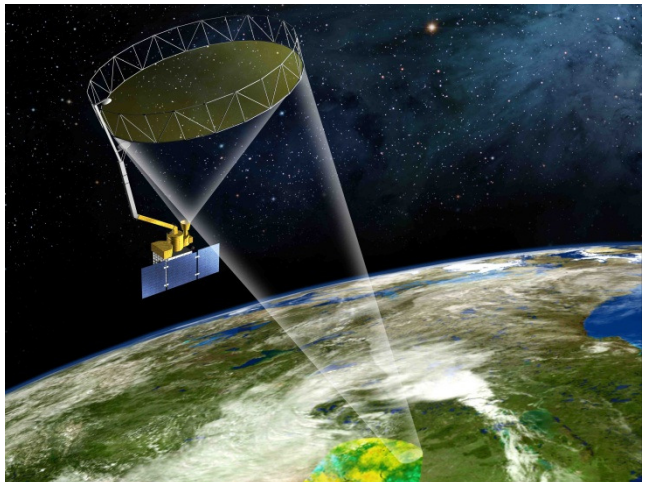
1.Christine Lee, *National Aeronautics and Space Administration (NASA)*
2.Martin Medina, *National Oceanic and Atmospheric Administration (NOAA)*
3. Kazuo Umezawa, *Japan Aerospace Exploration Agency (JAXA)*
4.Bruno Meyer, *South African National Space Agency (SANSA)*
5.Richard Lawford, *Integrated Global Water Cycle Observations (IGWCO)*
6.Osamu Ochiai, *Group on Earth Observations (GEO)*
7.Kazutoshi Onogi, *Japan Meteorological Agency (JMA)*
8.Yasushi Izumikawa, *Japan Meteorological Agency (JMA)*
9.Yoichi Iwami*, International Center for Water Hazard and Risk Management (ICHARM)*
10.Sam Benedict, *Global Energy and Water Exchanges Project (GEWEX)*:
11.Anette Johnson*, Swiss Federal Institute of Aquatic Science and Technology* (*Eawag*)

# WATER SATELLITE MISSIONS

*(Launching in 2014)*

**The Global Precipitation Measurement (GPM) Mission (en route to Japan)**

- International network of satellites that provide the next-generation global observations of rain and snow
- Planned Launch of Core Observatory for 2014



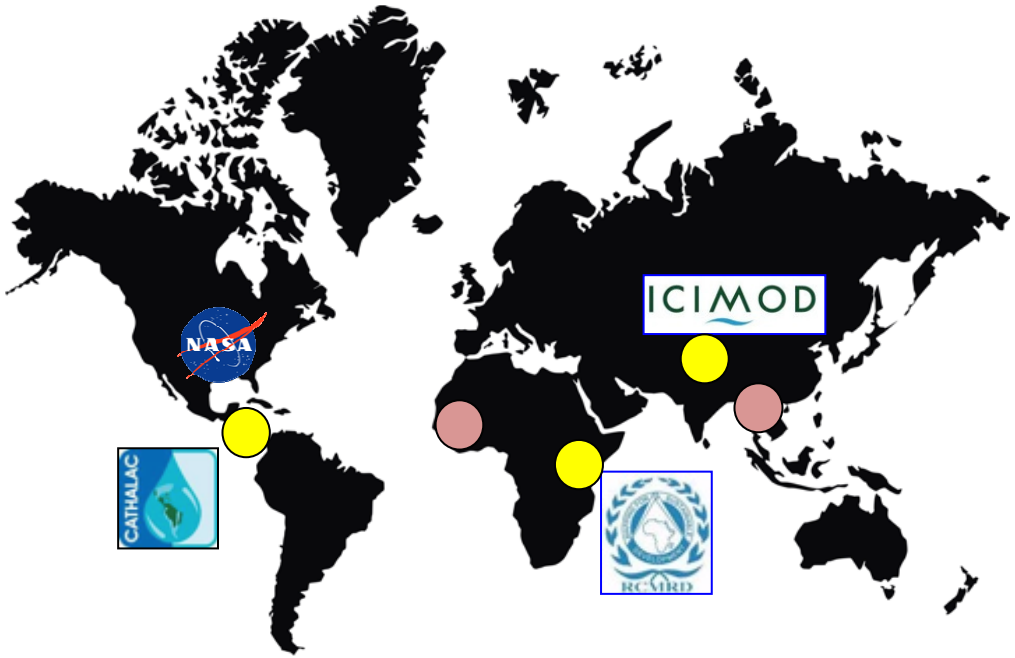
**The Soil Moisture Active Passive (SMAP) Mission**

- Global observations of mapped soil moisture and freeze/thaw data with unprecedented accuracy, resolution, and coverage
- Planned Launch for 2014

# Capacity Building and Applications: SERVIR

A NASA-USAID partnership to improve environmental management and resilience to climate change by strengthening the capacity of governments and other key stakeholders to integrate Earth observation information and geospatial technologies into development decision-making

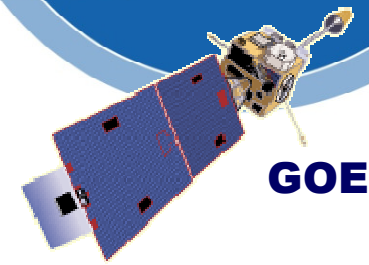
Administrator Rajiv Shah of USAID and Administrator Charlie Bolden come together to sign an MOU for the partnership.



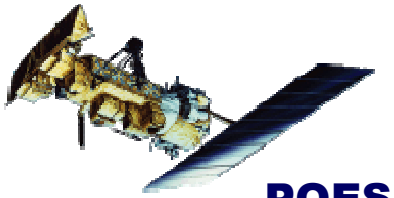
# NOAA Satellites

## Current Satellite Programs

- 24/7 Satellite operations and product processing
  - Geostationary satellites (GOES)
  - Polar-orbiting satellites (POES)



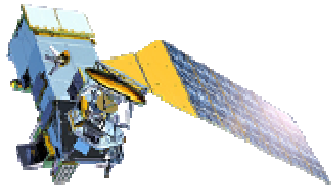
GOES



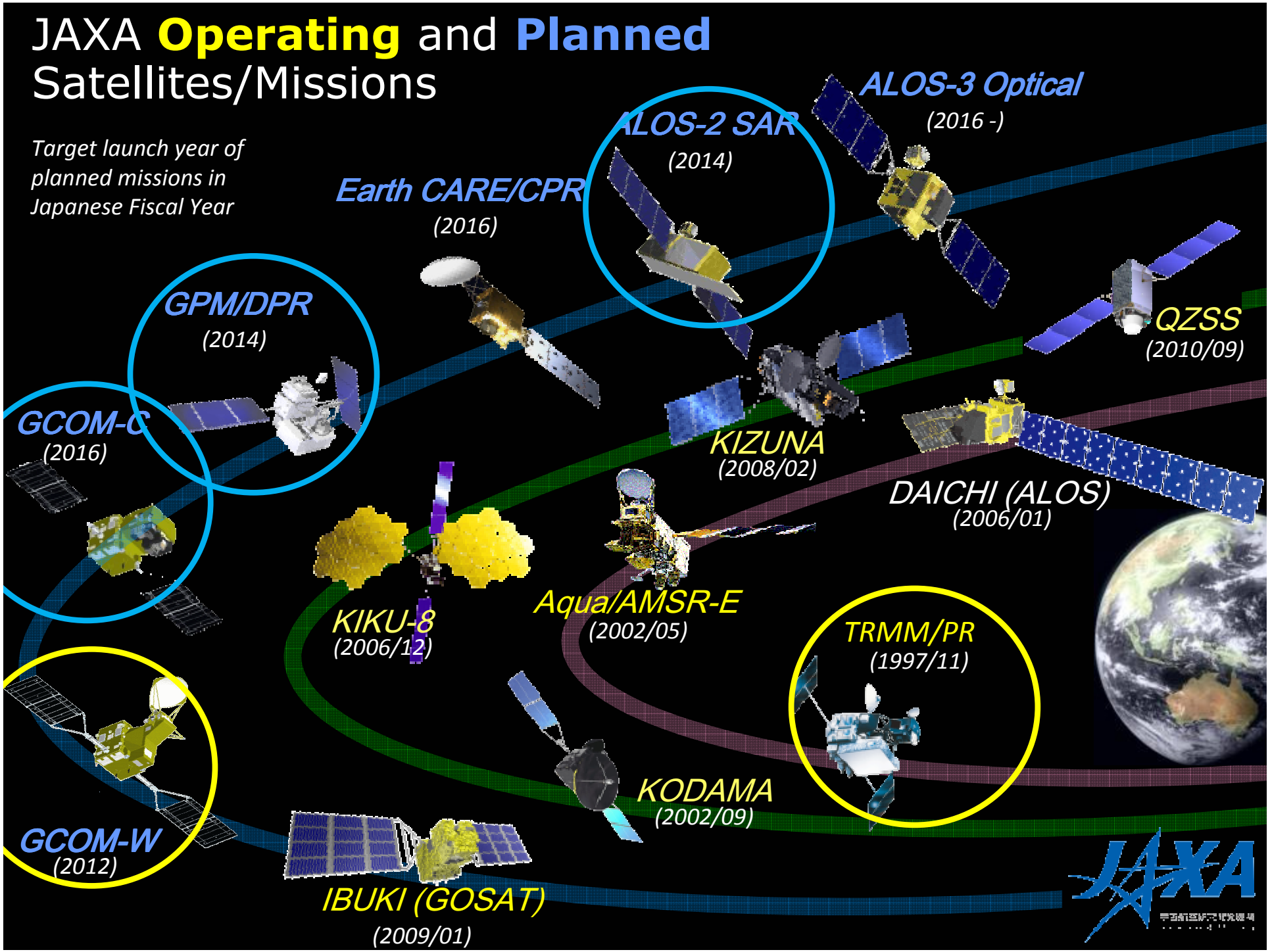
POES

## Future Satellite Programs

- Joint Polar Satellite System (JPSS, formerly NPOESS)
- GOES-R



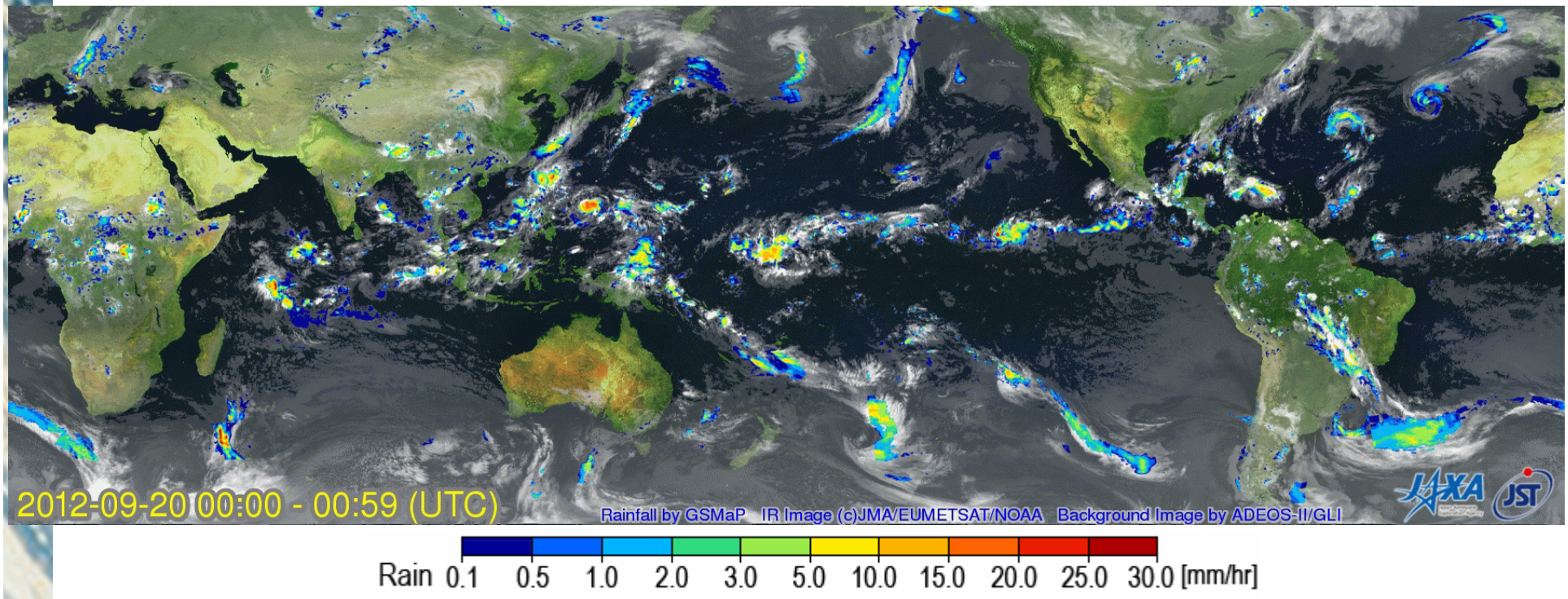
NPOESS


JAXA Operating and Planned Satellites/Missions
Target launch year of planned missions in Japanese Fiscal Year
ALOS-3 Optical
(2016 -)
ALOS-2 SAR
(2014)
Earth CARE/CPR
(2016)
GPM/DPR
(2014)
QZSS
(2010/09)
GCOM-C
(2016)
KIZUNA
(2008/02)
DAICHI (ALOS)
(2006/01)
KIKU-8
(2006/12)
Aqua/AMSR-E
(2002/05)
TRMM/PR
(1997/11)
KODAMA
(2002/09)
GCOM-W
(2012)
IBUKI (GOSAT)
(2009/01)
JAXA

# JAXA/EORC Global Rainfall Watch

http://sharaku.eorc.jaxa.jp/GSMaP/

3-hourly animation of Typhoon 17 and global rainfall observed by GSMaP_NRT from 20 Sep. to 1 Oct., 2012.




**JAXA/EORC Global Rainfall Watch** web site releases GSMaP_NRT products by merging TRMM and a number of passive microwave radiometers with geo-stationary IR information. Providing hourly and 0.1-degree grid data 4-hour after observation.

- browse images, Google Earth KMZ files, 24-hour animations
- binary data for research purposes
- reanalysis version (GSMaP_MVK) from Mar. 2000 to Nov. 2010 is also available

# SANSA South African National Space Agency

*"In Service of humanity"*
*(http://www.sansa.org.za)*

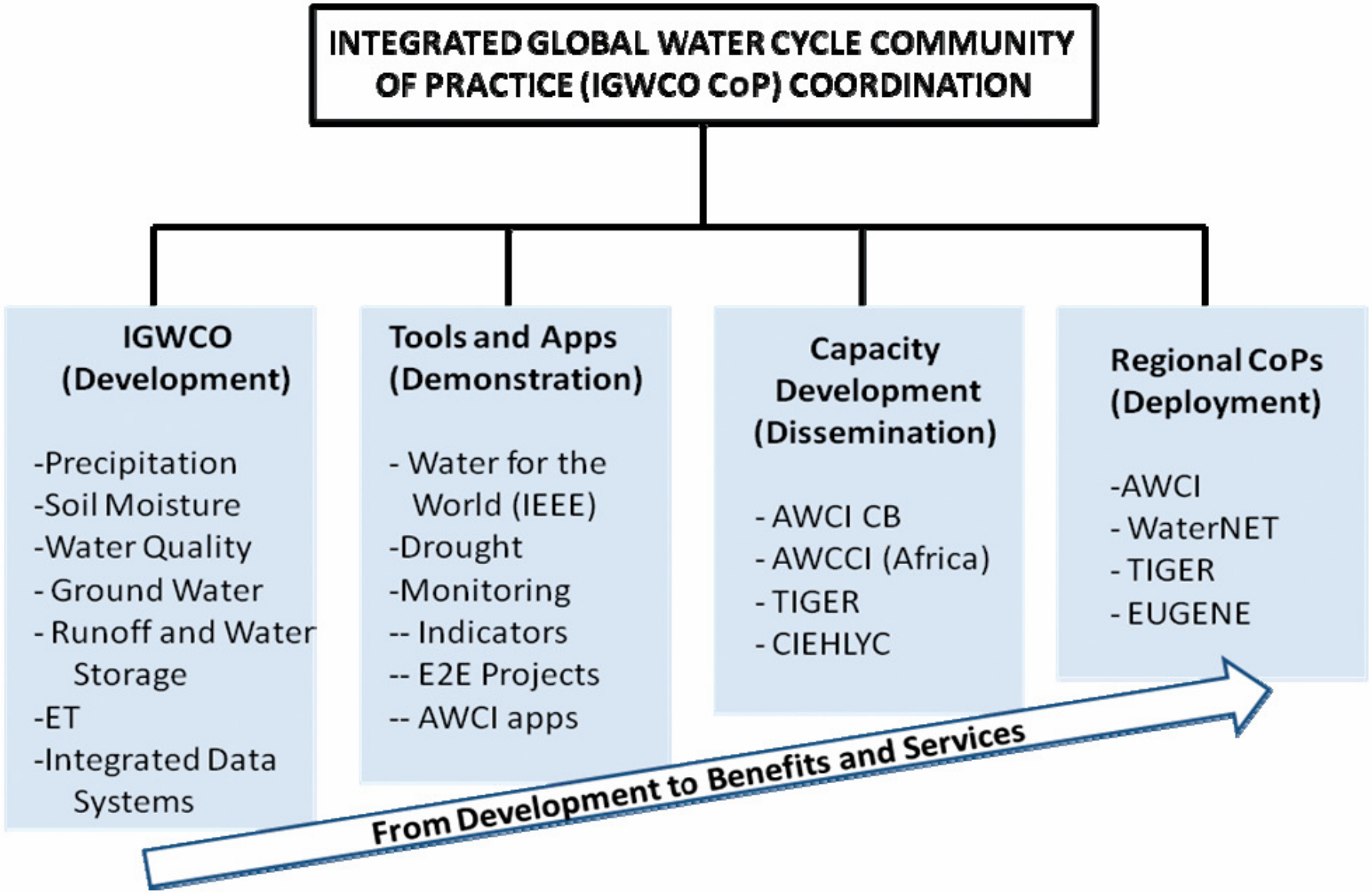
SANSA is mandated by the SANSA Act, 36 of 2008, to:

-Promote the peaceful use of space;
-Support the creation of an environment conducive to industrial development in space technology;
-Foster research in space science, communications, navigation and space physics;
-Advance scientific, engineering and technological competencies and capabilities through human capital development (HCD), outreach programmes and infrastructure development; and
-Forster international cooperation in space related activities.

SANSA proposes to create 5 Value propositions


## SA Space domain role players

# In 2014, IGWCO will place more emphasis on user engagement



# Enabling a System of Systems





Data Providers successfully Tested (coming soon)

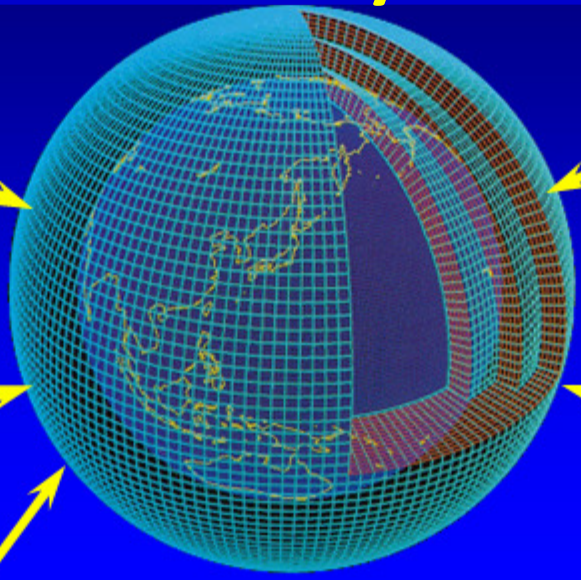
# Reanalysis

Satellite

Surface, Upper

Ship, aircraft

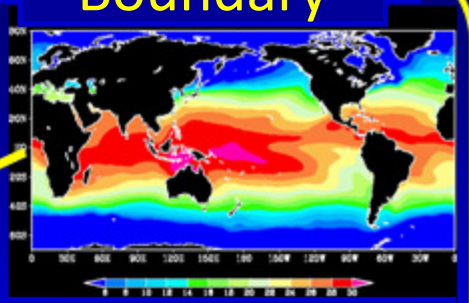
Observation



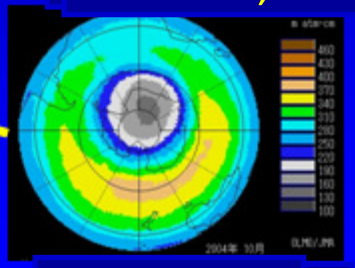
Assimilate past observational data

Data assimilation cycle

Boundary



SST, sea ice



ozone

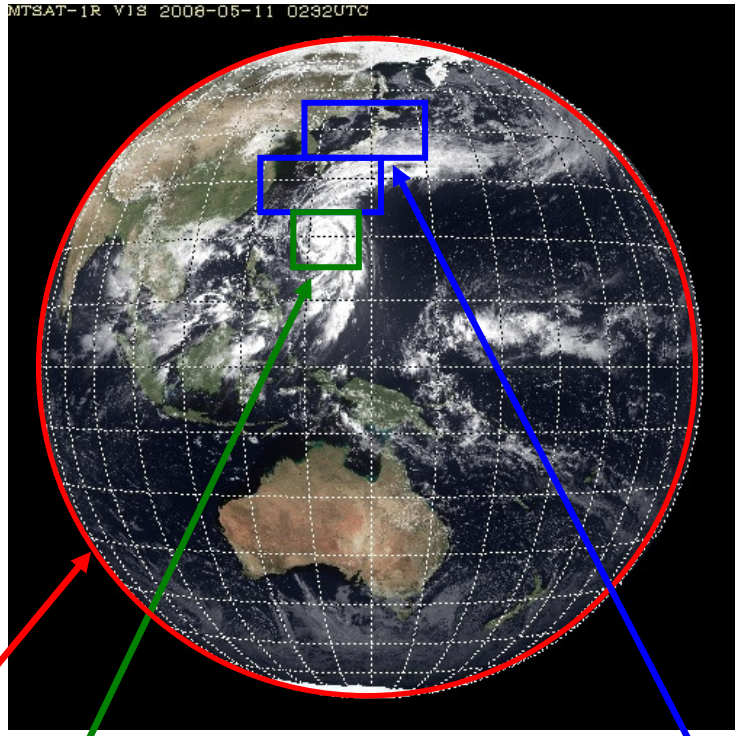
Consistent quality Reanalysis Product

- Provide Initial Condition and Verification data for seasonal forecast
- Climate Monitoring
- Research on climate system and water circulation etc.

# Himawari-8/9: Specification of Observation

## Channels of the Advanced Himawari Imager (AHI)

| Channel | Central Wavelength [$\mu$ m] | Spatial Resolution | |
|---|---|---|---|
| 1 | 0.43 – 0.48 | 1 km | RGB Composited True Color Image |
| 2 | 0.50 – 0.52 | 1 km | |
| 3 | 0.63 – 0.66 | 0.5 km | |
| 4 | 0.85 – 0.87 | 1 km | |
| 5 | 1.60 – 1.62 | 2 km | |
| 6 | 2.25 – 2.27 | 2 km | |
| 7 | 3.74 – 3.96 | 2 km | |
| 8 | 6.06 – 6.43 | 2 km | Water Vapor |
| 9 | 6.89 – 7.01 | 2 km | |
| 10 | 7.26 – 7.43 | 2 km | |
| 11 | 8.44 – 8.76 | 2 km | $SO_2$ |
| 12 | 9.54 – 9.72 | 2 km | $O_3$ |
| 13 | 10.3 – 10.6 | 2 km | Atmospheric Windows |
| 14 | 11.1 – 11.3 | 2 km | |
| 15 | 12.2 – 12.5 | 2 km | |
| 16 | 13.2 – 13.4 | 2 km | $CO_2$ |




**Full disk**
Interval: **10 minutes** (6 times per hour)

**Region: Japan**
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 2000 x 1000 km x 2

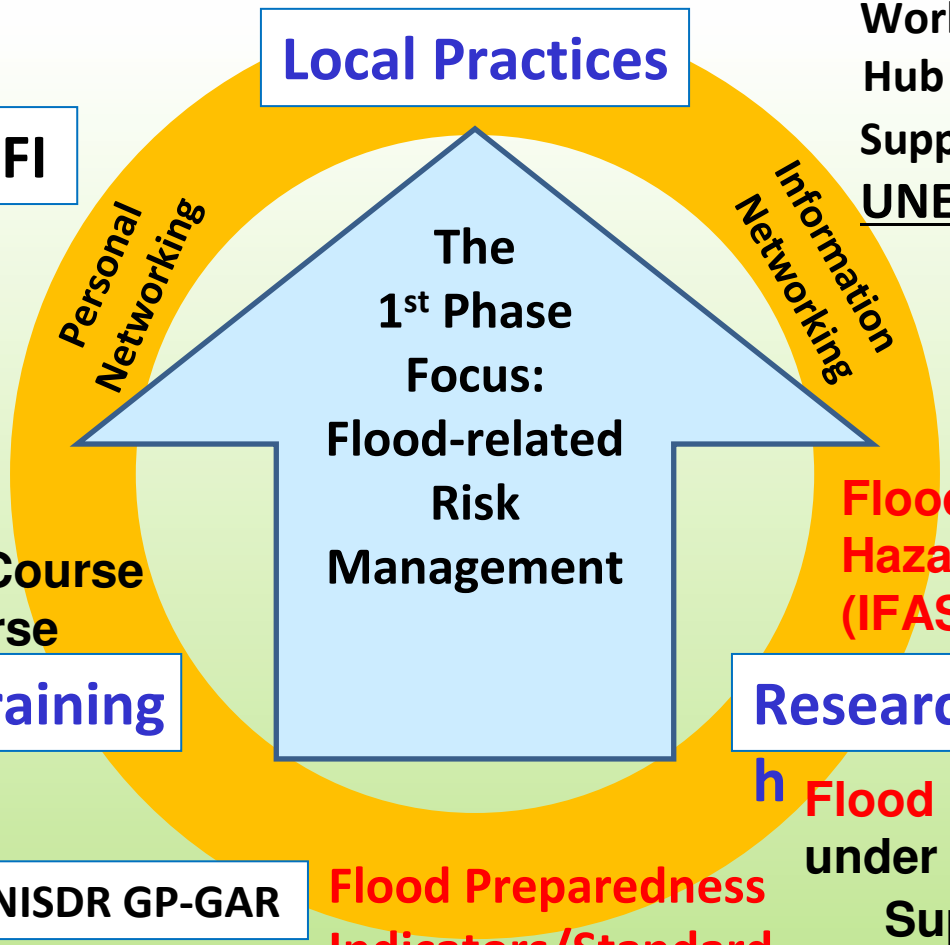
**Region: Typhoon**
Interval: **2.5 minutes** (4 times in 10 minutes)
Dimension: EW x NS: 1000 x 1000 km

**Number of Channels: 5 ⇨ 16**

**Interval: 30/60 min. ⇨ 10min.**

# ICHARM's Philosophy: **Localism**

**Delivering best available knowledge to local practices**




IRDR

UNESCO Centers

IFI

WWAP, AWDO

WWF, APWF

- Master Course
  **Hazard Mapping Course**
  **River & Dam Course**
  **Supported by JICA**
- Ph.D. Course

**Working as a Knowledge Hub on W&D through TA**
**Supported by ADB**
**UNESCO Pakistan Project**

Sentinel Asia

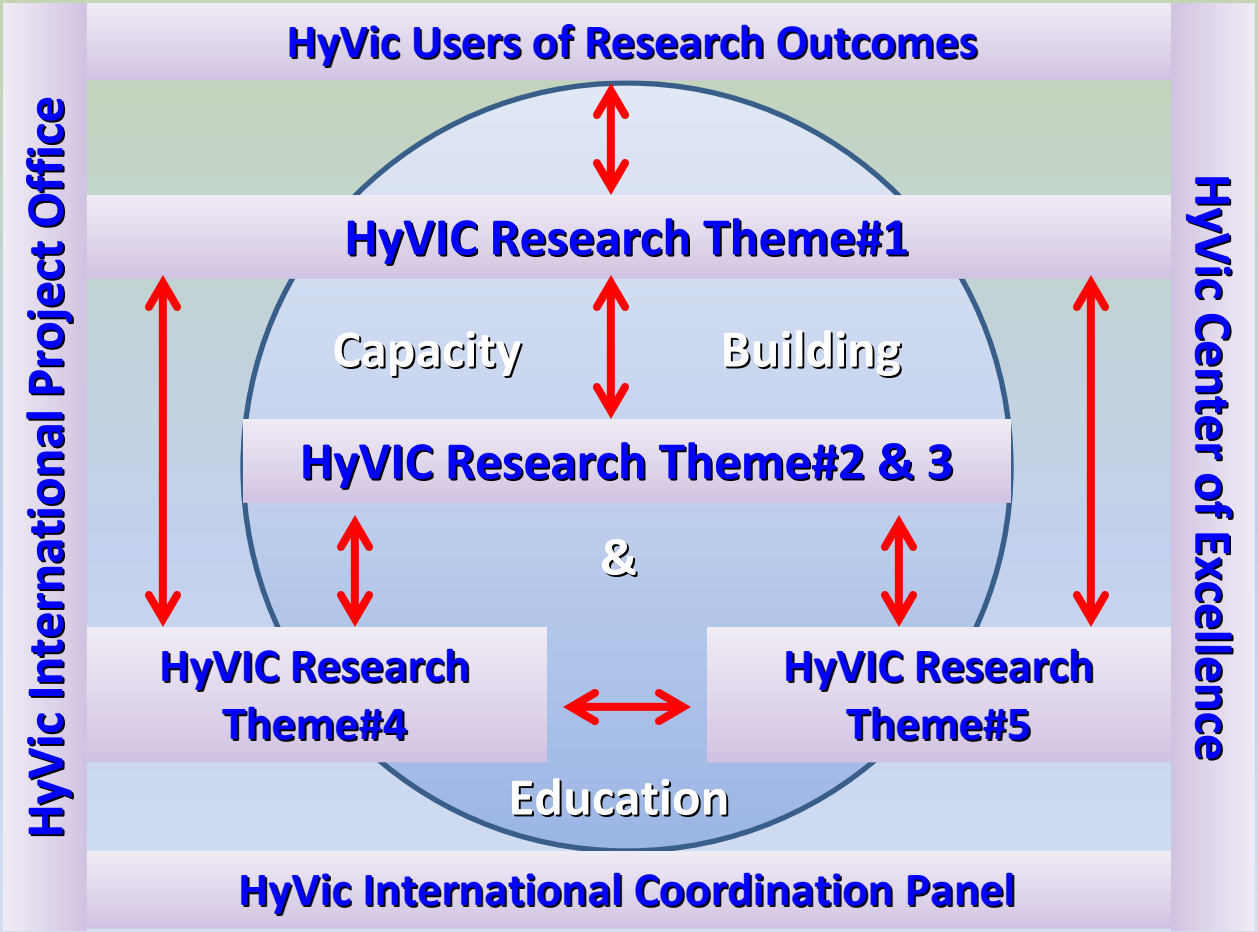
IFNet/GFAS

**Flood Alert system**
**Hazard mapping**
**(IFAS, BTOP, RRI models)**

**Flood risk assessment under climate change**
**Supported by MEXT**
**(Sousei Program)**

**Flood Preparedness Indicators/Standard**

# HyVIC Components



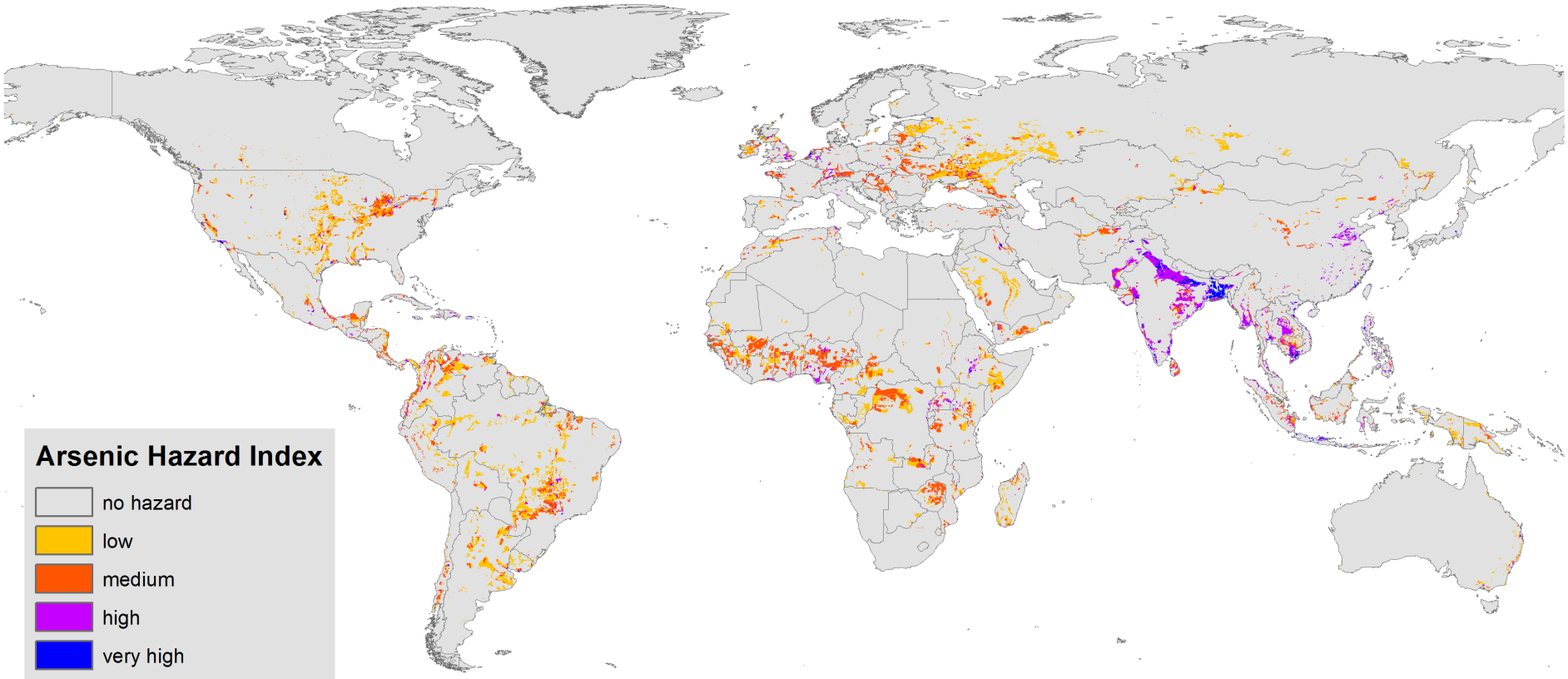

**HyVIC Research Theme-1:** Translational Research Interface with Applications
**HyVIC Research Theme-2:** Severe Weather and Water Currents (collaboration with WWRP-LVP)
**HyVIC Research Theme-3:** Lake Victoria Basin Water Budget
**HyVIC Research Theme-4:** HyVic Earth System Model (EaSM)
**HyVIC Research Theme-5:** Observation of the Hydroclimatological System



*(Customized from GFCS)*

# Number of locally affected lives becomes global challenge

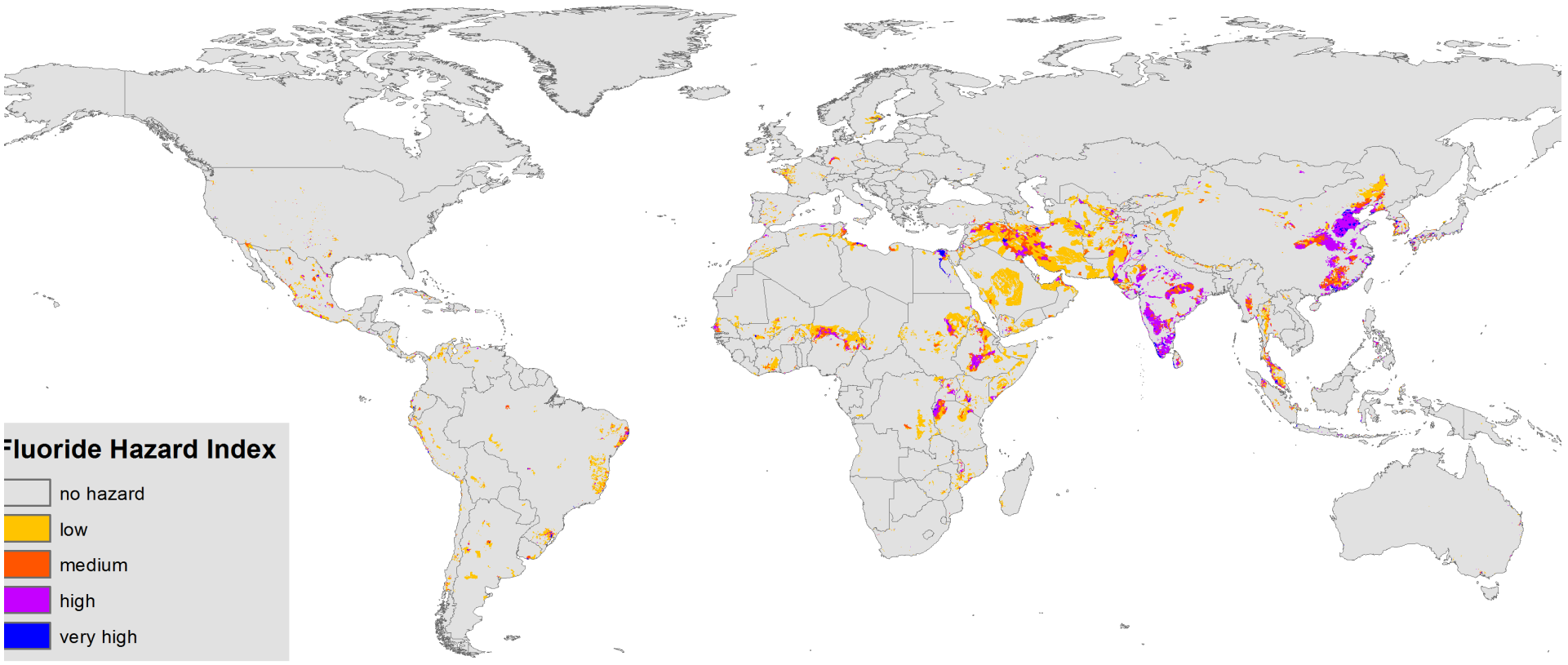
>50% probability of contaminated groundwater overlain with population density




Population living in arsenic hazard areas:
754 million (2010 population estimate, SEDAC)
1/3 drinking groundwater? ⇒ about 250 million

# Number of locally affected lives becomes global challenge

>50% probability of contaminated groundwater overlain with population density




Population living in fluoride hazard areas:
561 million (2010 population estimate, SEDAC)
1/3 drinking groundwater? ⇒ about 200 million

6. African Session *Chaired by Prof. S.B. Weerakoon*

Key Note:
Abou Amani, United Nations Educational, Scientific and Cultural Organization (UNESCO)

Introduction to Projects
Kenya, Morocco, Tunisia, Niger River, Volta River, Lake Chad

7. Asian Session *Chaired by Prof. Zoubeida Bargaoui & Dr. Johnson Oguntola*

Key Note:
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Introduction to Projects
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United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

UN WATER World Water Day 2013 International Year of Water Cooperation

# Access to safe drinking water

35% do not have access to safe drinking water

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

# Water for heath

UN WATER World Water Day 2013 International Year of Water Cooperation

- Less  than 40% of Sanitation coverage in many African countries
- More than 80% of deseases are water related and borne diseases (Malaria, cholera, Guinea Worm,..)
- These deseases are mainly responsible for number of deaths for children under five

# Water for Food




Majority of the population has agriculture as main activities

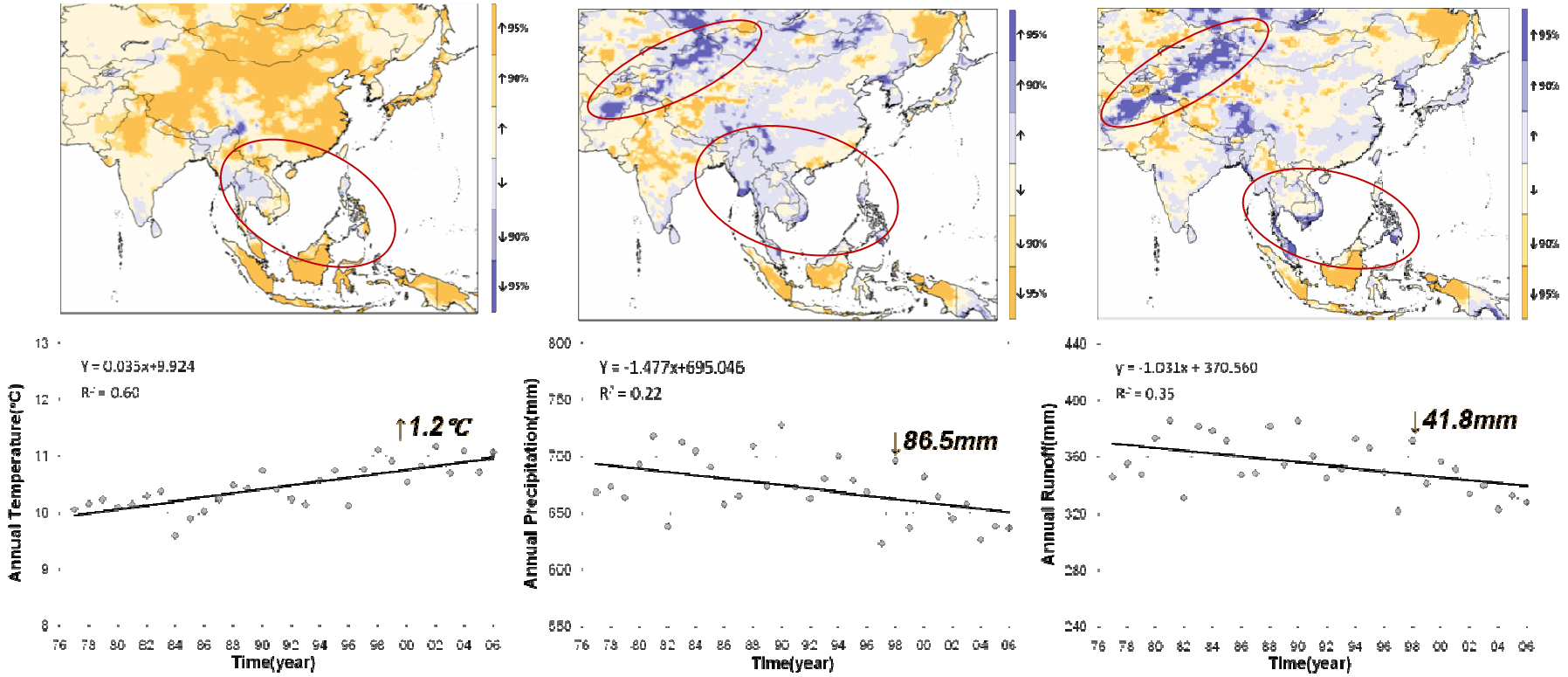
Agriculture is generally rainfed

Many African countries continue to struggle with food insecurity

# Trend analysis of historical climate and hydrology

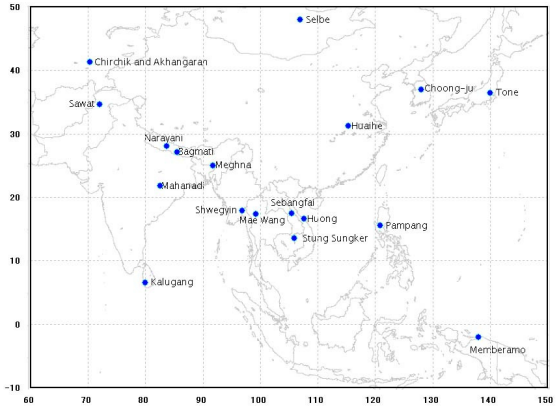
## ➢ Annual average temperature, precipitation and runoff

- Increasing trend of T and decreasing trends of P & Q over the region during last 30 years
- The opposite trends of T in northern regions of Southeast Asia and of P & Q in northern regions of Southeast Asia and northeastern regions of South Asia




<Temperature> <Precipitation> <Runoff>

| Div. | Country | Basin | Year | |
|---|---|---|---|---|
| | | | 2020s | 2080s |
| East Asia | Japan | Tone | 0.5 | 1.2 |
| | Korea | Chungju-dam | 15.4 | 21.2 |
| | Mongolia | Selbe | -0.1 | 16.7 |
| East South Asia | Myanmar | Shwegylin | -7.1 | 0.4 |
| | Lao PDR | Sebangfai | -11.3 | 8.8 |
| | Thailand | Mae Wang | -11.7 | 4.3 |
| | Cambodia | Sangker | -12.8 | -0.6 |
| | Malaysia | Langat | -1.2 | 6.2 |
| | Vietnam | Huong | -10.9 | -2.7 |
| | Philippines | Pampanga | 0.6 | 6.5 |
| | Indonesia | Mamberamo | 9.2 | 28.0 |
| South Asia | Bangladesh | Meghna | -9.7 | 6.1 |
| | Bhutan | Punatsangchhu | -11.0 | 3.8 |
| | India | Seonath | 18.8 | 19.5 |
| | Nepal | Bagmati | -0.8 | 10.8 |
| | Sri Lanka | Kalu Ganga | 0.0 | 10.3 |
| | Pakistan | Gilgit | -3.5 | -19.9 |
| Central Asia | Uzbekistan | Chirchik -Okhangaran | 3.1 | -3.9 |



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