Addressing Water Security: Climate Impacts and Adaptation Responses in Africa, Asia and Latin America and Caribbean

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Vörösmarty et al. (2010): Nearly 80% of the world’s population is exposed to high levels of threat to water security. Massive investment in water technology enables rich nations to offset high stressor levels without remedying their underlying causes, whereas less wealthy nations remain vulnerable.
Water security key challenges of the 21st century

85% of the human population live in arid areas. By 2030, half of the population will be living in areas of high water stress.

750 million people lack access to safe water and 2.5 billion to adequate sanitation.

6-8 million human beings are killed each year from water-related disasters and diseases.

85% of the world’s total wastewater is discharged without adequate or any treatment.

50% decline in population of freshwater species in just thirty years.

445 transboundary aquifers shared by 2-4 countries

Source: Data collected by UNESCO-IHP a and IPCC AR5 WG2 SPM (2014)
Population Growth and Water Stress

- The world population is projected to increase by 1.1 Billion in the next 15 years.

  2016: 7.4 Billion
  2030: 8.5 Billion

- Projections suggest that water supply may face a 40% shortfall in water availability by 2030.

- Improvements in technology and infrastructure could reduce the gap to 30%.

Projected global water supply in 2030 (trillion cubic meters) McKInsey 2010
Nearly 80% of the world’s population is exposed to high levels of threat to water security.
There has been increased heat-related mortality and decreased cold-related mortality.

For some regions local changes in temperature and rainfall have altered the distribution of some waterborne illnesses and disease vectors.

- Glaciers continue to shrink almost worldwide affecting runoff and water resources downstream.
- Changing precipitation or melting snow and ice are altering hydrological systems, affecting water resources in terms of quantity and quality.
INCREASING WATER SCARCITY

2/3 of the world's population currently live in areas that experience water scarcity for at least one month a year.

Number of weather-related disasters reported per country (1995-2015)

Trends in the number of disasters by major category (weather-related & geophysical 1995-2015)

From CRED & WMO 2015
Disasters affect us differently

Occurrence (a) and death tolls (b) for storms (1995-2015) broken down by national income bracket

(a) Occurrence
- 141 disasters (7%)
- 829 disasters (41%)
- 524 disasters (26%)

(b) Death tolls
- 6,900 deaths (3%)
- 9,200 deaths (4%)
- 11,600 deaths (5%)

Economic losses in absolute values and as a percentage of GDP from weather-related disasters (1995-2015)

From CRED & WMO 2015
Axis Improve knowledge and innovation to address water security challenges

IHP-VIII Responses: 6 Themes, 3 Axes 2014-2021

Axis Improve knowledge and innovation to address water security challenges

Axis 1
Mobilizing International cooperation to Improve knowledge and innovation to address water security challenges

Axis 2
Strengthening the Science-Policy interface to reach water security at local, national, regional, and global levels

Axis 3
Developing institutional and human capacities for water security and sustainability

Water security, addressing local, regional and global challenges
IHP plays a vital role in providing a scientific knowledge base for policy advice to manage and cope with challenges to water resources, including disasters and floods, and to increase the resilience of natural and human systems with an emphasis on vulnerable communities, and

Promoting international cooperation to mobilize research and supporting human and technical capacity building, IHP contributes to the implementation of UN goals and commitments such as the Sustainable Development Goals.
Flagship projects/initiatives

A wide spectrum of projects and initiatives are implemented to enable water security.
Global In situ Observing Systems: Limited coverage!

Global Precipitation Gage Network (GPCC) (2016)

Global Runoff Gage Network (GRDC)
Addressing Water Security: Climate Impacts and Adaptation Responses in Africa, Asia and Latin America and Caribbean

- Vulnerability Assessment, Mapping and Implementation of Adaptation Strategies
- Raise Awareness on Potential Impacts of Climate Change on Mountain Glaciers and Downstream Water Supply
- Development of a Global Knowledge Forum
Identifying the frequency of drought events:
   a. How rare is the current drought?
   b. How large a drought should we plan for?
   c. How rare is the drought of record?

A long-term regional activity, spanning the 2008-2015 period:
- 12494 precipitation stations analyzed
- From 21 countries in the region
- More than 10 regional workshops were organized
- Funding provided through multiple sources
Three types of maps available for 21 countries in the region:

Increasing climate change preparedness:

- Greater understanding and knowledge regarding water-related vulnerabilities
- Enabling early-warning of water-related disasters across sectors
- Greater understanding of the linkages between various sectors
National and Regional Drought Observatories

a. Place current droughts into context
b. Unlocking national datasets for monitoring different aspects of drought and climate risks
c. Drought early warning for pro-active drought management and policy
African and LAC Droughts monitors:

Strengthen the capacity of African and LAC countries for near real-time monitoring and seasonal forecasting to raise awareness of the impact of floods and droughts on vulnerable and disadvantaged groups.

User Interface: http://stream.princeton.edu
Providing the Tools to Identify Climate Risks

Monitoring and Early Warning of Droughts and Floods

User Interface: http://stream.princeton.edu
G-WADI Geo-Server

Algorithm

Web Services

Applications

Drought Management  Flood Forecasting  Water Resources

Center for Hydrometeorology & Remote Sensing, University of California, Irvine
Calibration of the Geoserver using Local Datasets

Both over- and underestimation is removed from the satellite precipitation estimates.
G-WADI geoserver application in Namibia

Namibia Daily Flood Bulletin

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HYDROLOGICAL SERVICES NAMIBIA- DAILY FLOOD BULLETIN: 15 March 2016
Climate Risk Informed Decision Analysis (CRIDA)

Providing insight in the range of expected climatic variability

**OBSERVED CLIMATE**
- Natural variability
- Decadal Oscillations

**FUTURE CLIMATE**
- Climate Change Projections

Graph showing observed and future climate maximum temperature trends from 1970 to 2070.
A bottom-up approach to utilize the information in the GCMs

**Climate Risk Informed Decision Analysis (CRIDA)**

Identify the Water Security Risk first

**Traditional Approach**
1. Downscale a few climate model projections
2. Generate a few water supply series
3. Determine whether system performance is acceptable for these series.

**Decision Scaling (CRIDA)**
1. Determine the vulnerability domain
2. Map climate domain onto vulnerability domain
3. Determine climate risks to project performance

Risk to ENB = \( \sum_{k=1}^{n} \text{Impact} \times \text{Probability} \)
Field course on glacier monitoring and mass balance (Valdivia Chile, 2012). Co-organized in partnership with ACCION and GTNH-LAC

International Workshop 'Development of near-term climate scenarios (2020-2035) for vulnerable watersheds’ 2014


IPCC’s Fifth Assessment Report WG-2 on Impacts, Adaptation and Vulnerability (AR5) 2014: Risks and Challenges

- Sustainable Development Goals
  - 1: No Poverty
  - 6: Clean Water and Sanitation
  - 11: Sustainable Cities and Communities
  - 13: Climate Action

- COP21: Paris Agreement

IHP contributing to SDGs mainly:

- Goal 6: Ensure availability and sustainable management of water and sanitation for all
- Goal 13: Take urgent action to combat climate change and its impacts
- Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 17: Strengthen the means of implementation and revitalise the global partnership for sustainable development
IHP contributes to SDGs & the 2030 Agenda as a whole

SDGs

IHPI contributes to SDGs and the 2030 Agenda as a whole

Namibia uses IHP-supported G-WADI’s Precipitation Estimates in their Daily Flood Bulletin

Rainmapper, A New Mobile Device Application for Real-time Global Precipitation Monitoring

New brochures for ‘Latin American Flood and Drought Monitor’ and ‘Latin American & Caribbean Drought Atlas’

Technical training session on PERSIANN held during Thai Hydrologist Association’s (THA) 2015 conference
Water is also a key player in other global agendas

- **Paris Agreement on Climate Change:** Water cycle is linked to GHG emission and its sustainable management plays a crucial role in combating global warming.

- **Sendai Framework for Disaster Risk Reduction 2015-2030:** Reduce loss and damage by water-related disasters and increase international cooperation, national and local DRR strategies and access to early warning systems and information.
The Glacier App

- Information system on worldwide glacier changes, bringing scientifically sound facts and figures to decision-makers.

Rainmapper App

- Web application for local and global real-time precipitation.
- It was used in July 2014 to track Typhoon Rammasun (considered one of the only two category 5 super typhoons on record in the South China Sea) across the Philippines.
Innovative tools to support informed decision making

Water and Climate Day - COP22
Launching of the iRain Mobile App

1. Visualize real-time global satellite precipitation observations
2. View rainfall movement as an animation
3. Share real-time rainfall data
4. Download the App here: App store, Google play
5. Report rainfall at their location and view reports of others

iRain launching at COP22
Among the raising awareness activities: exhibition showcasing satellite images aerial and ground pictures was presented during COP21 in Paris.
Save the date
Knowledge Forum on WATER SECURITY and CLIMATE CHANGE

2017
UNESCO Headquarters, Paris
18-20 October

Forum highlights:
- Showcase of water security projects and products from partners
- Science Policy dialogue
- Innovative visions from young researchers and professionals

Recent publications
Thank you!

http://en.unesco.org/themes/water-security/hydrology