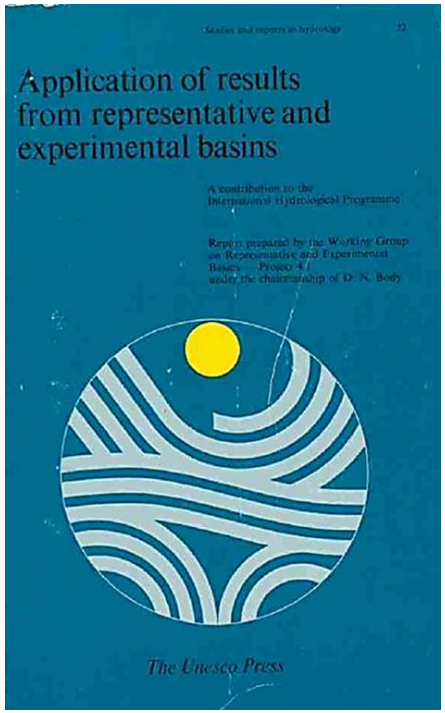
Connections between hydrological science and practice

Anil Mishra

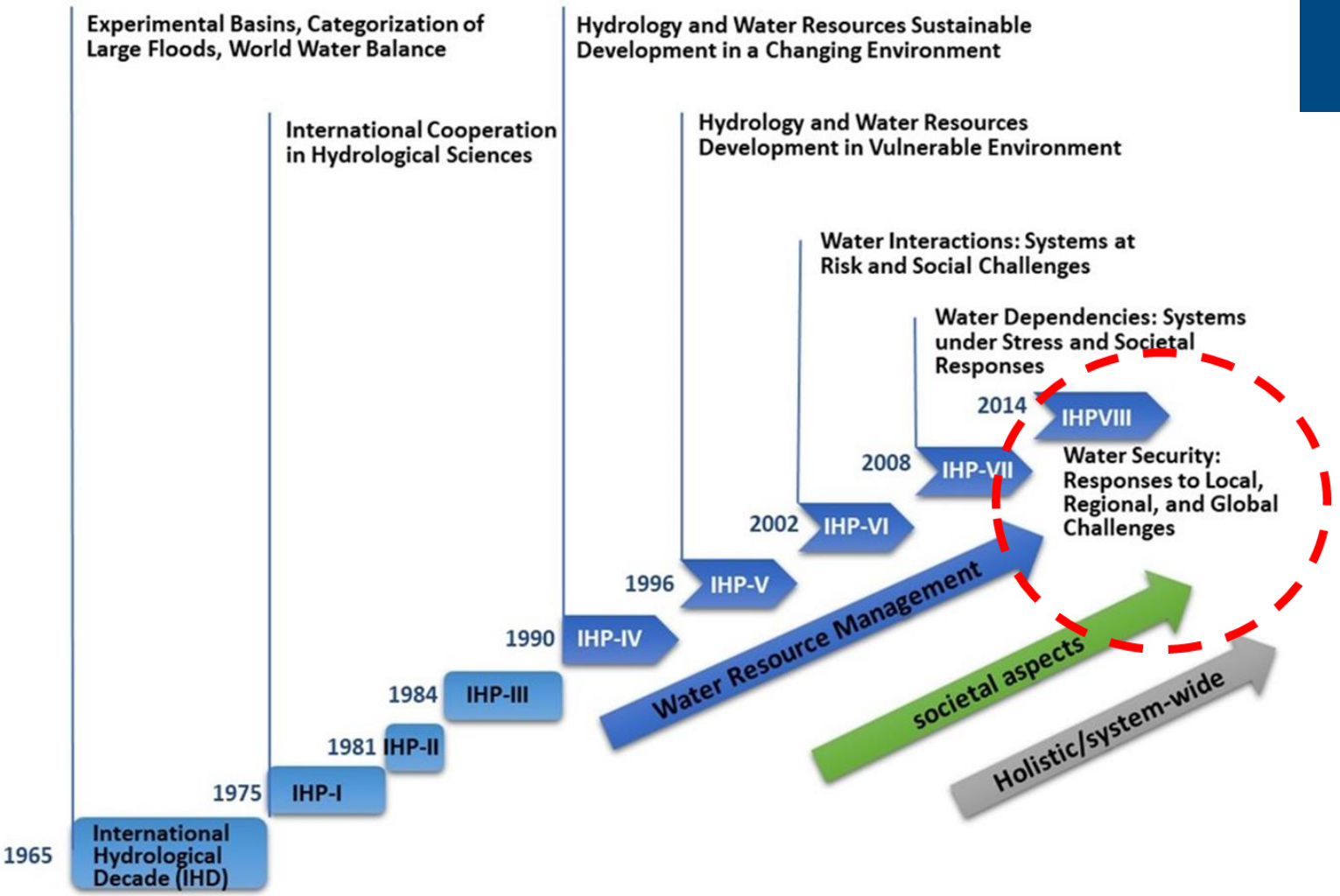
An overview from International Hydrological Programme (IHP) UNESCO



- **International Hydrological Decade (1965-1974)**
- **Application of results from representative and experimental basins**
- **World Water Balance**

United Nations
Educational, Scientific and
Cultural Organization

UNESCO-IHP Flagship Science Programme



Global Risks Landscape 2019: Risk and uncertainty

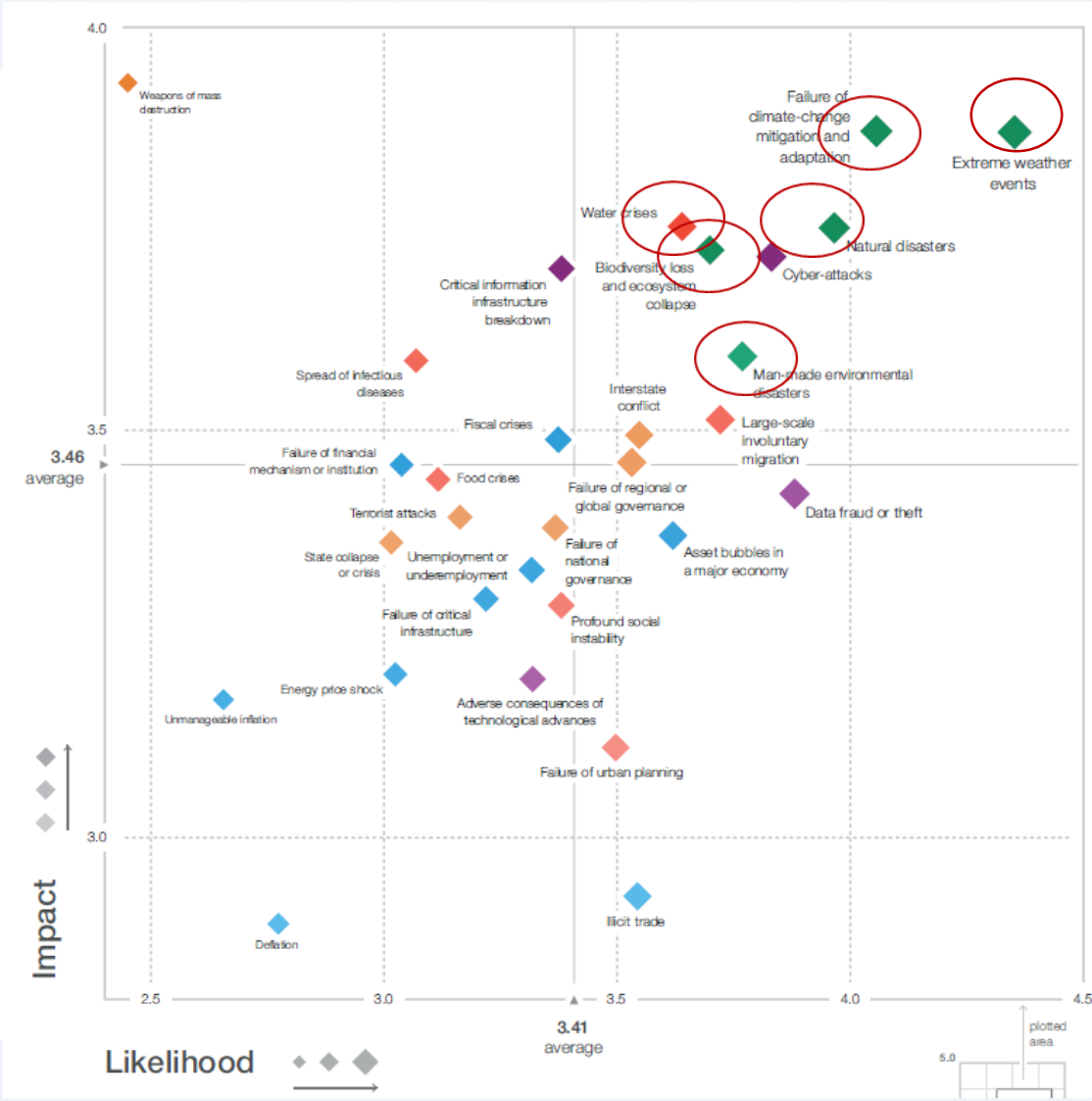
WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Insight Report

The Global Risks Report 2019
14th Edition

In partnership with Marsh & McLennan Companies and Zurich Insurance Group



Global Risks Landscape 2019: Risk and uncertainty

Top 10 risks in terms of

Impact

1. Weapons of mass destruction
2. Failure of climate-change mitigation and adaptation
3. Extreme weather events
4. Water crises
5. Natural disasters
6. Biodiversity loss and ecosystem collapse

Top 10 risks in terms of

Likelihood

1. Extreme weather events
2. Failure of climate-change mitigation and adaptation
3. Natural disasters
4. Data fraud or theft
5. Cyber-attacks
6. Man-made environmental disasters
7. Large-scale involuntary migration
8. Biodiversity loss and ecosystem collapse
9. Water crises

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

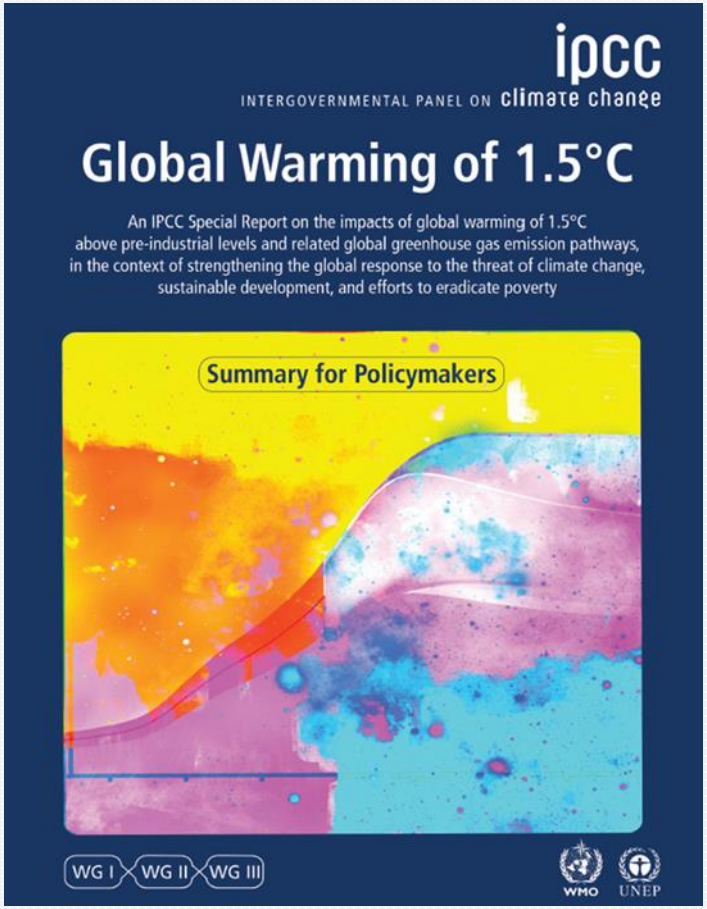
Axis Improve knowledge and innovation to address water security challenges

THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

SDG Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

World Water Development Report (2017)

Climate Change : Global Warming of 1.5 °c



0.5°C difference matters

+1.0°C (today): impacts dedected

+1.5°C: serious impacts

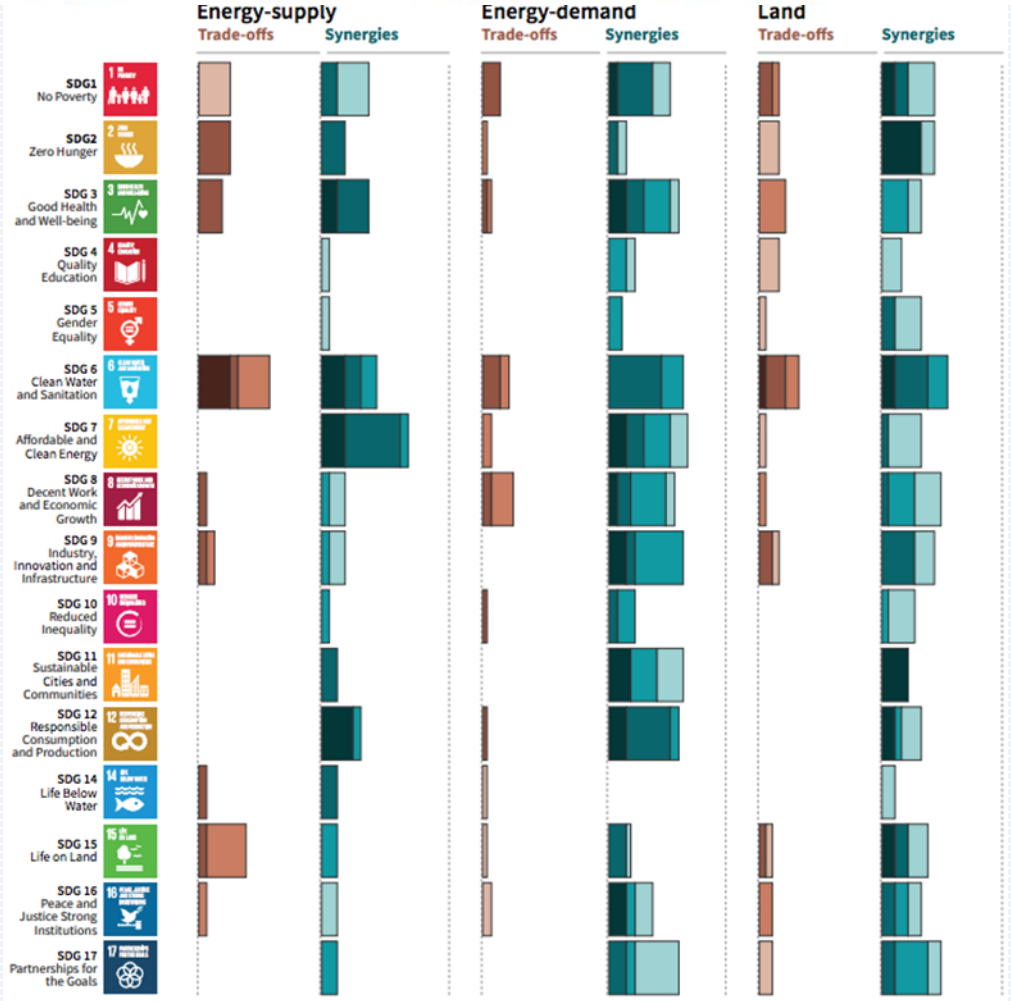
+2.0°C: impacts considerably worse; some will be irreversible

+1.5°C can be reached

with **45%** CO2 reduction by **2030** and **0** net emission by **2050** (one of several emission scenarios)

+1.5°C Emission Paths and SDGs

Indicative linkages between mitigation options and sustainable development using SDGs (The linkages do not show costs and benefits)



Length shows strength of connection

The overall **size of the coloured bars** depict **the relative potential** for synergies and trade-offs between the sectoral mitigation options and the SDGs.

Shades show level of confidence

The shades depict **the level of confidence** of the assessed potential for **Trade-offs/Synergies.**

Very High — Low

Trade-offs/synergies

IPCC Global Warming 1.5 Report

SDG, Paris Agreement Sendai Framework, do we have adequate tools?

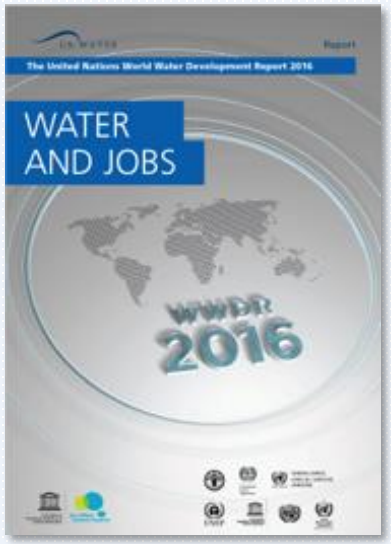
- How to translate those framework into measurable tools?

- Do we have sufficient tools and management option to identify risk and uncertainty of climatic projections and framework provided by global commitment for the water resources management systems?

- Tools and methodologies with engagement by hydrological or meteorological agencies or other relevant institutions.

WATER and JOBS

The United Nations World Water Development Report 2016



Opportunities for current and future employment and decent jobs are dependent upon the sustainable management of water resources and the provision of water-related services

Water-Dependent Jobs

AGRICULTURE

FORESTRY

FISHERIES

ENERGY

RESOURCE-INTENSIVE MANUFACTURING

RECYCLING

BUILDING

TRANSPORT

WWDR 2016

Three out of four jobs that make up the entire global workforce are water-dependent

WWDR 2016

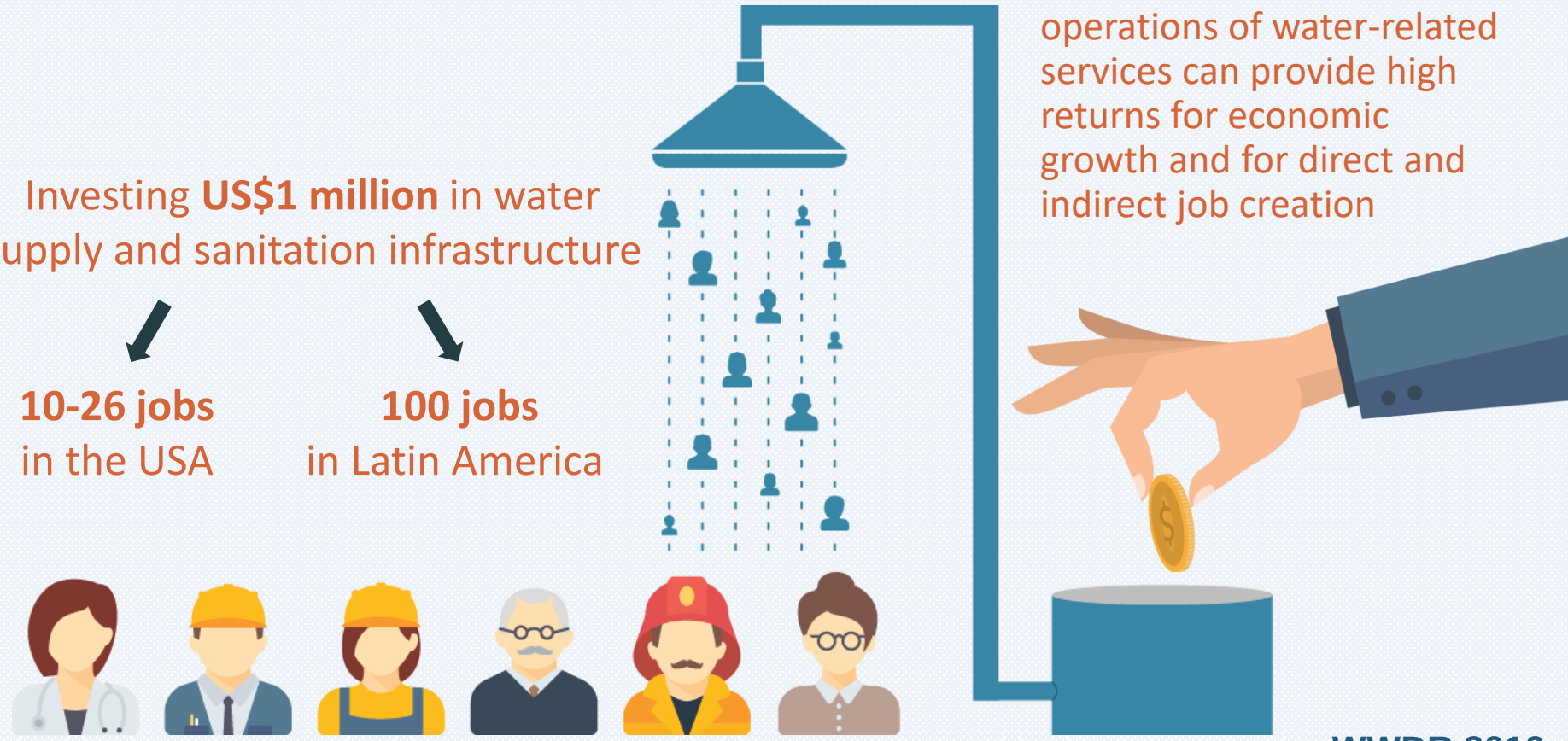
THE MULTIPLIER EFFECT OF INVESTING IN WATER

Investments in infrastructure and operations of water-related services can provide high returns for economic growth and for direct and indirect job creation

Investing **US$1 million** in water supply and sanitation infrastructure

10-26 jobs in the USA

100 jobs in Latin America



WWDR 2016

Water Education – Key for Water Security

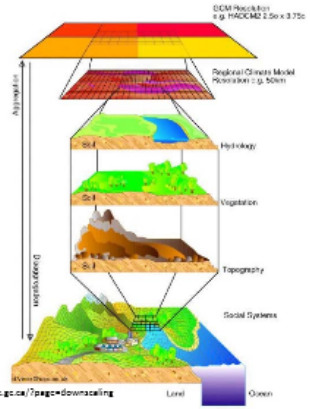
Theme 6

Climate Risk Informed Decision Analysis (CRIDA)

- CRIDA moves away from the 'one size fits all' approach, since adaptation to climate stress is a local process that requires the design of tailored solutions. In this way, CRIDA helps the water resources planner to navigate through an uncertain world toward imperfect but robust and socially acceptable solutions in line with local needs.

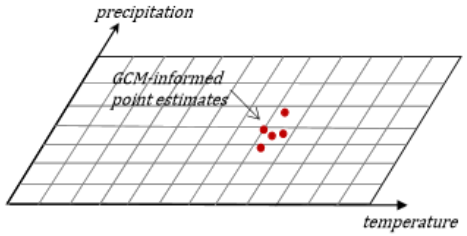
Traditional Approach

1. Downscale a few climate model projections



2. Generate a few water supply series

3. Determine whether system performance is acceptable for these series.

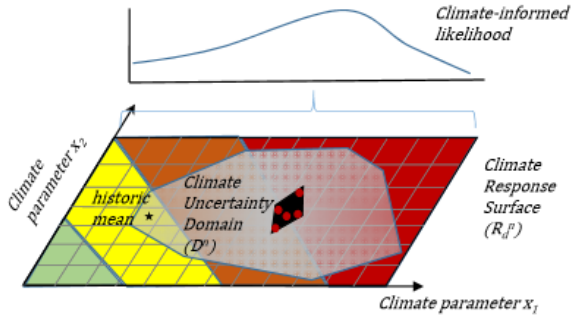


→ *Expected Net Benefits (ENB)*

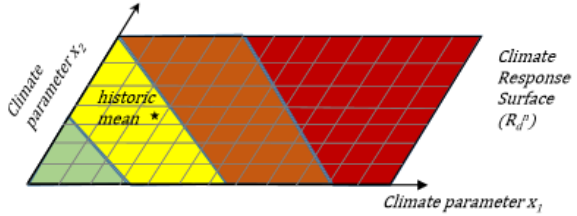
Decision Scaling

→ $Risk\ to\ ENB = \sum_{s=1}^{\Omega} Impact \times Probability$

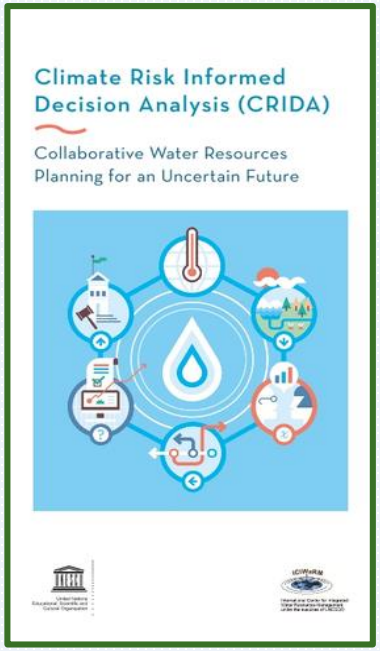
3. Determine climate risks to project performance



2. Map climate domain onto vulnerability domain

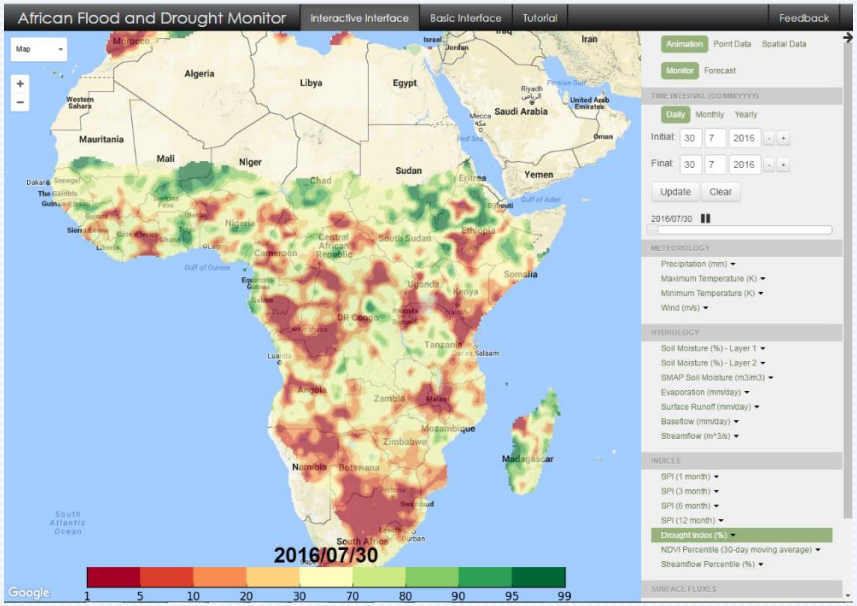


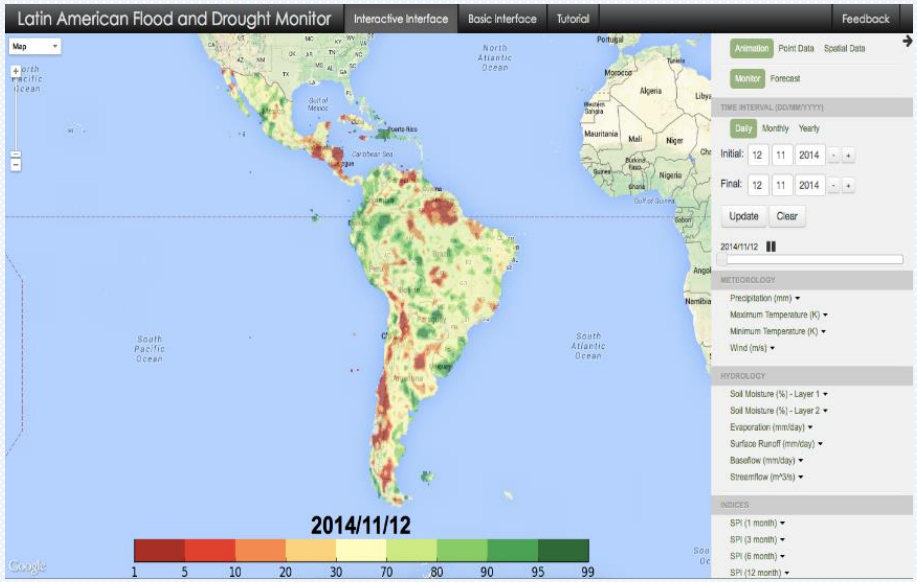
1. Determine the vulnerability domain



Improved climate services for risk management : African and LAC flood and drought Monitors

- Designed to 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.

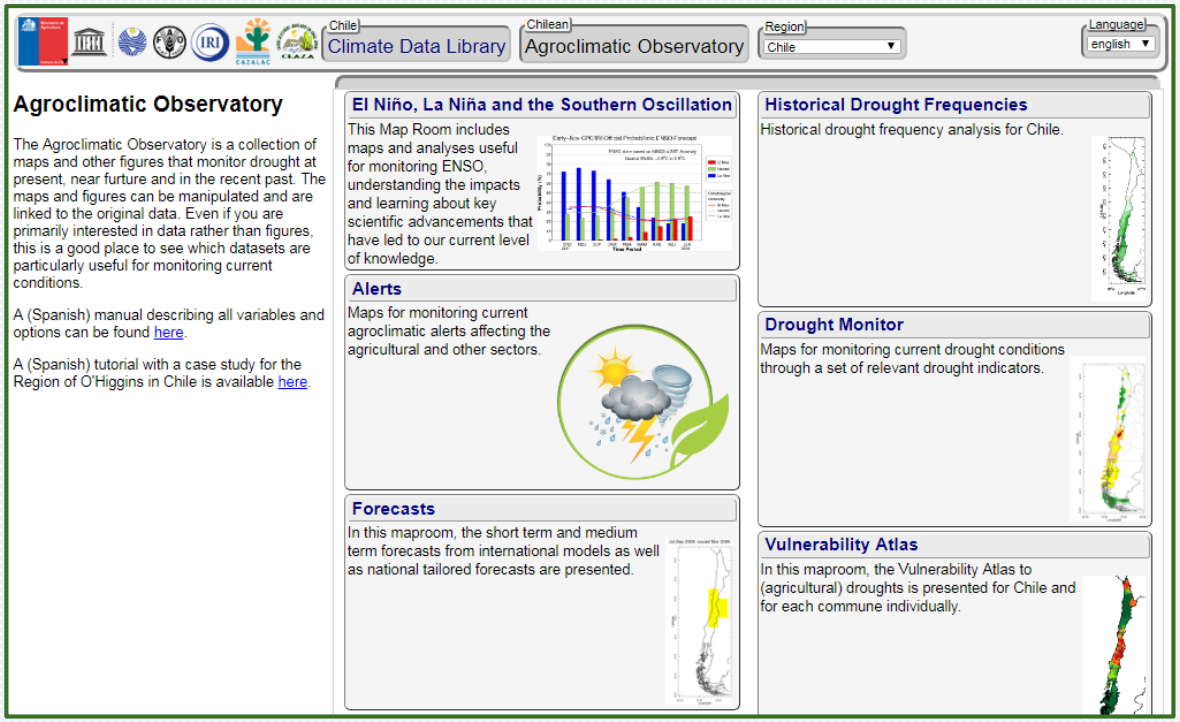




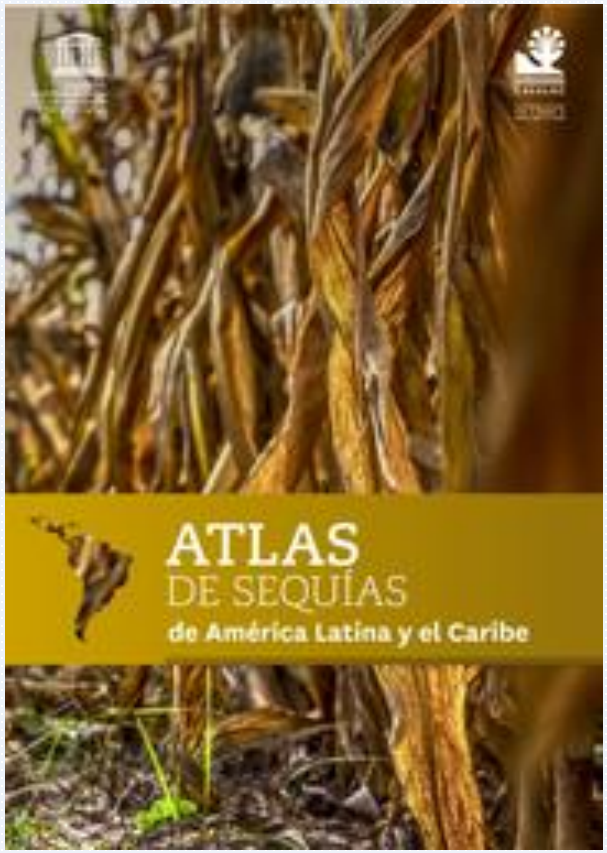
User Interface: http://stream.princeton.edu

National drought monitoring and flood and drought early warning strengthened

- Development of relevant, timely and actionable information
- High resolution local versions in pilot countries
- Support governments in LAC and Africa to integrate information in decision-making
- Publication of guidelines



Chilean Agroclimatic Observatory



Drought Vulnerability Atlas

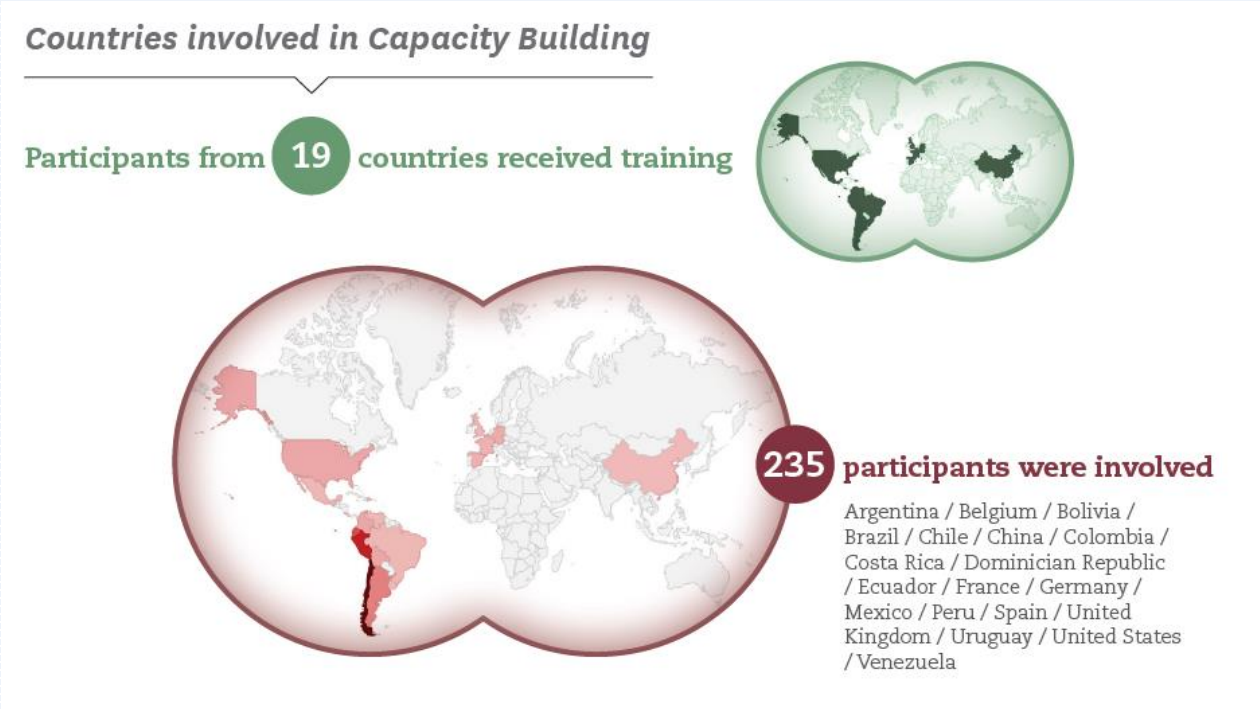
Engagement with local communities through participatory approach and citizen-science

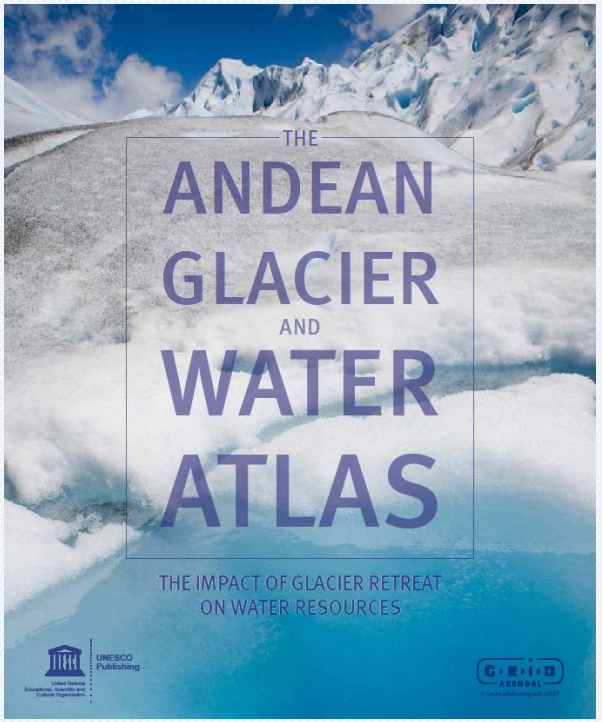
iRain launched at UNFCCC COP22

The Impact of Glacier Retreat in the Andes: results

Outcomes:

- Tools developed to support mountain communities to assess climate risk/vulnerability
- Stakeholders trained in the use of climate information for decision making
- The Andean glacier and Water Atlas: the impact of glacier retreat on water resources





Fifth Workshop on Water Resources in Developing Countries: Hydroclimate Modeling and Analysis Tools

27 May - 07 June 2019
Trieste, Italy

Topics:

- How can precipitation measurements be used to validate model simulations.
- How to use ensembles of high-resolution regional climate model as input of a hydrological model.
- Which is the role of the coupled water cycle in the Regional Earth System models.
- How can the uncertainty in global and regional climate projections be taken into account for hydro-climate simulation.

Deadline:

15 March 2019

ICTP International Centre for Theoretical Physics
www.ictp.it

The UNESCO Water Family

The Water Family by Regions

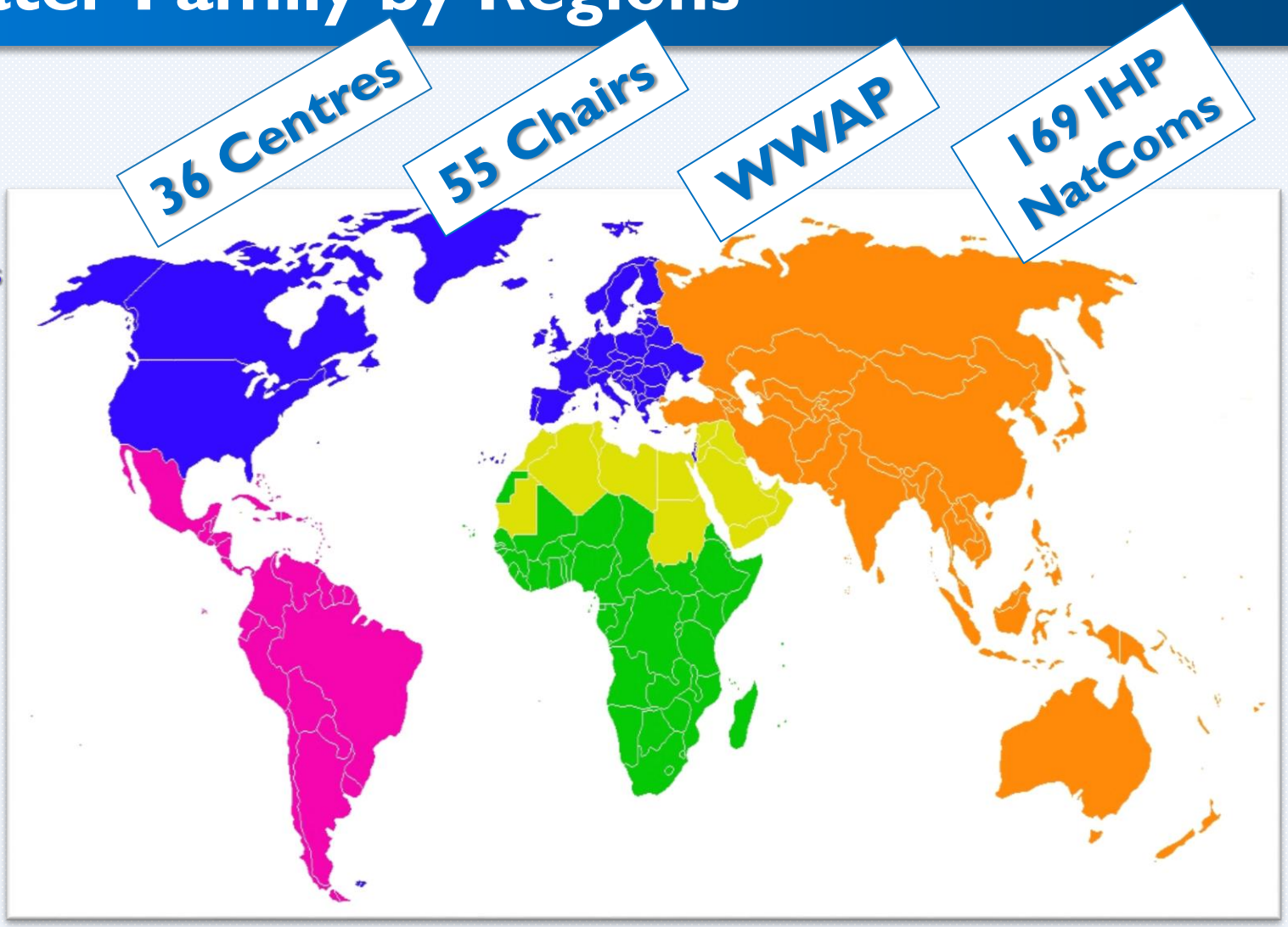
Europe & North America
- 25 Chairs
- 11 Centres

Arab States
- 4 Chairs
- 5 Centres

Latin America & the Caribbean
- 10 Chairs
- 5 Centres

Asia and the Pacific
- 10 Chairs
- 11 Centres

Africa
- 6 Chairs
- 4 Centres



Thanks

Thank you for your kind attention