



Climate Change and Water Security: IHP prospective

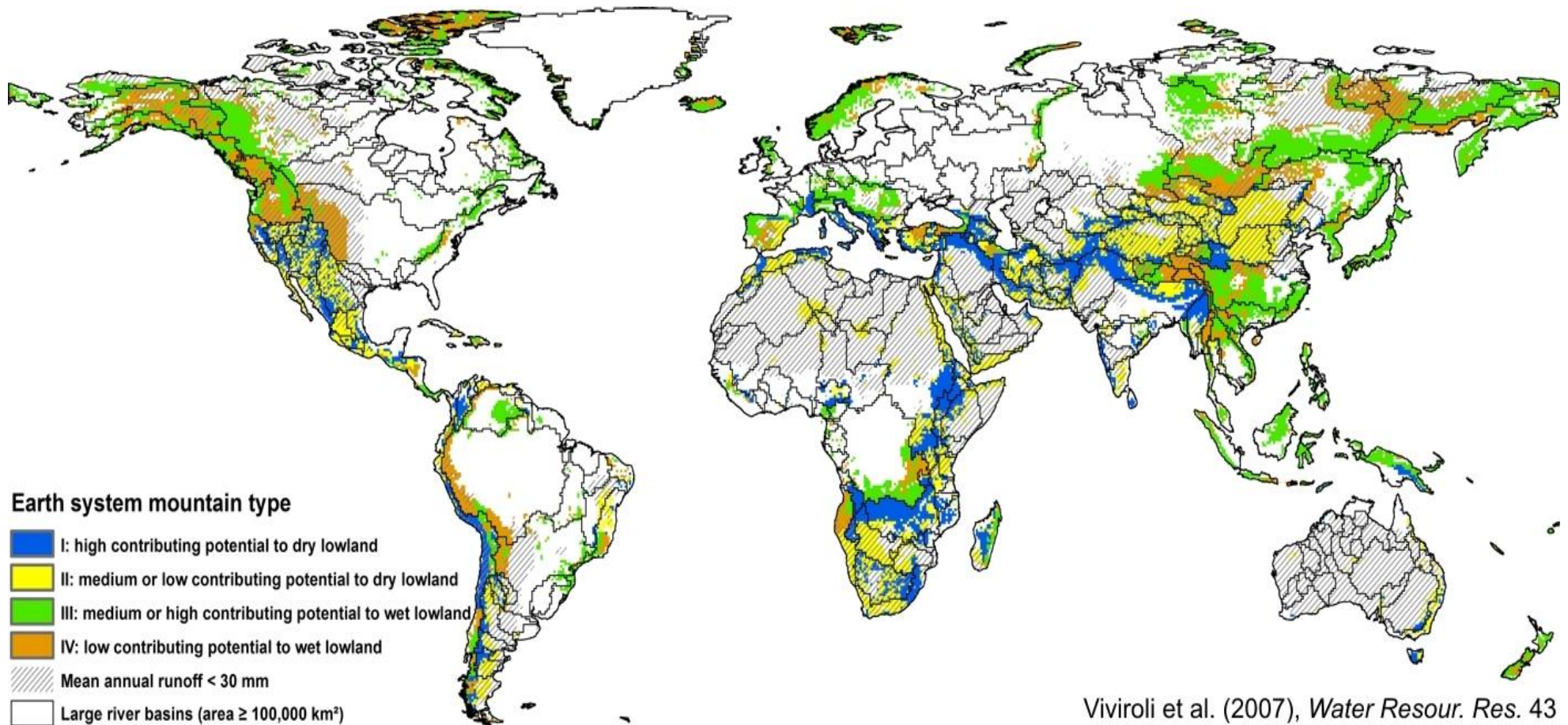
Dr. Anil Mishra, Dr. Koen Verbist, and Dr. Abou Amani

International Hydrological Programme (IHP)

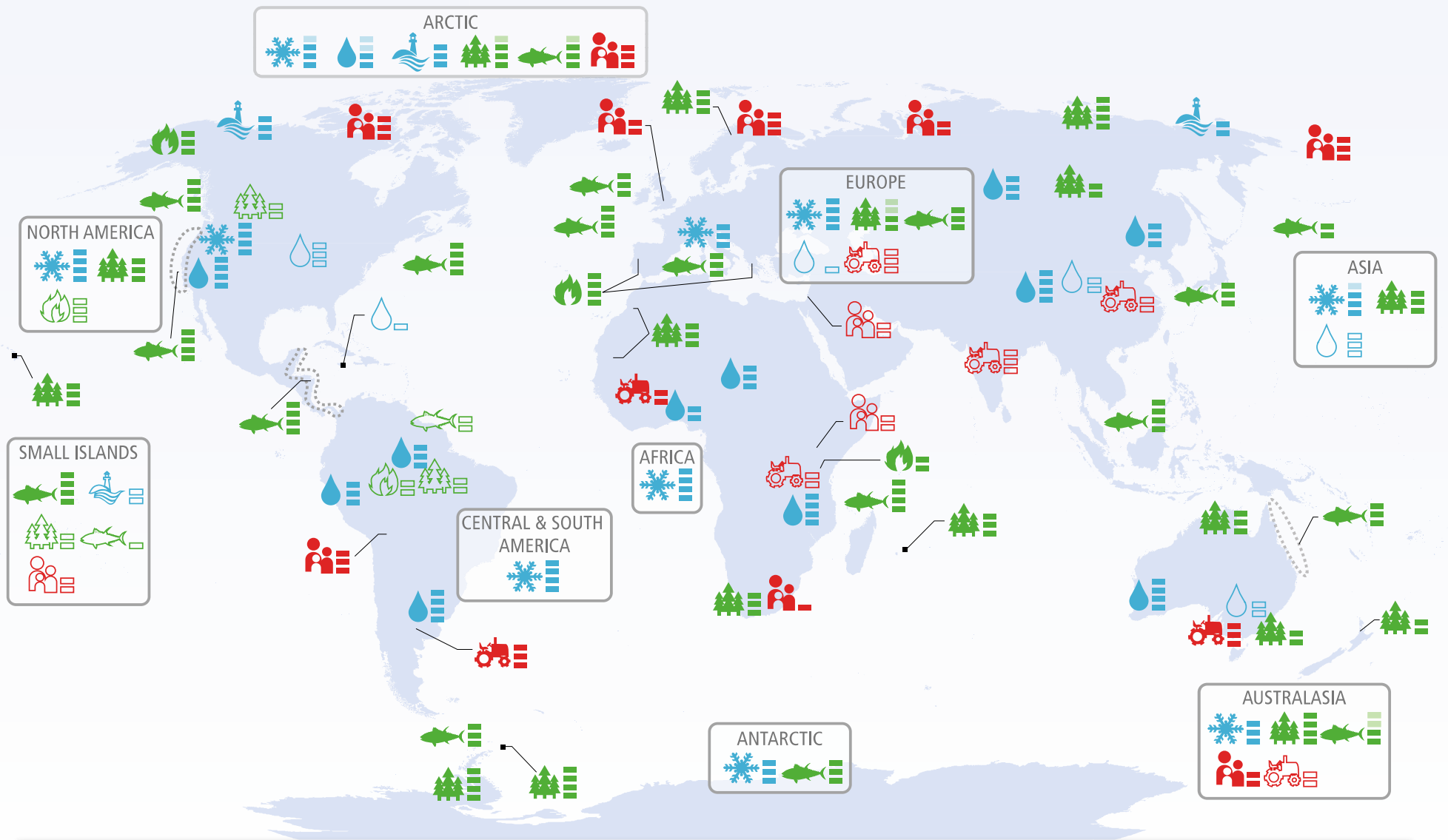
Division of Water Sciences, UNESCO

Mountain Ecosystem Services

Provisioning services: Water



Viviroli et al. (2007), *Water Resour. Res.* 43



Confidence in attribution to climate change

■ very low ■ low ■ med ■ high ■ very high
 ■ □ indicates confidence range

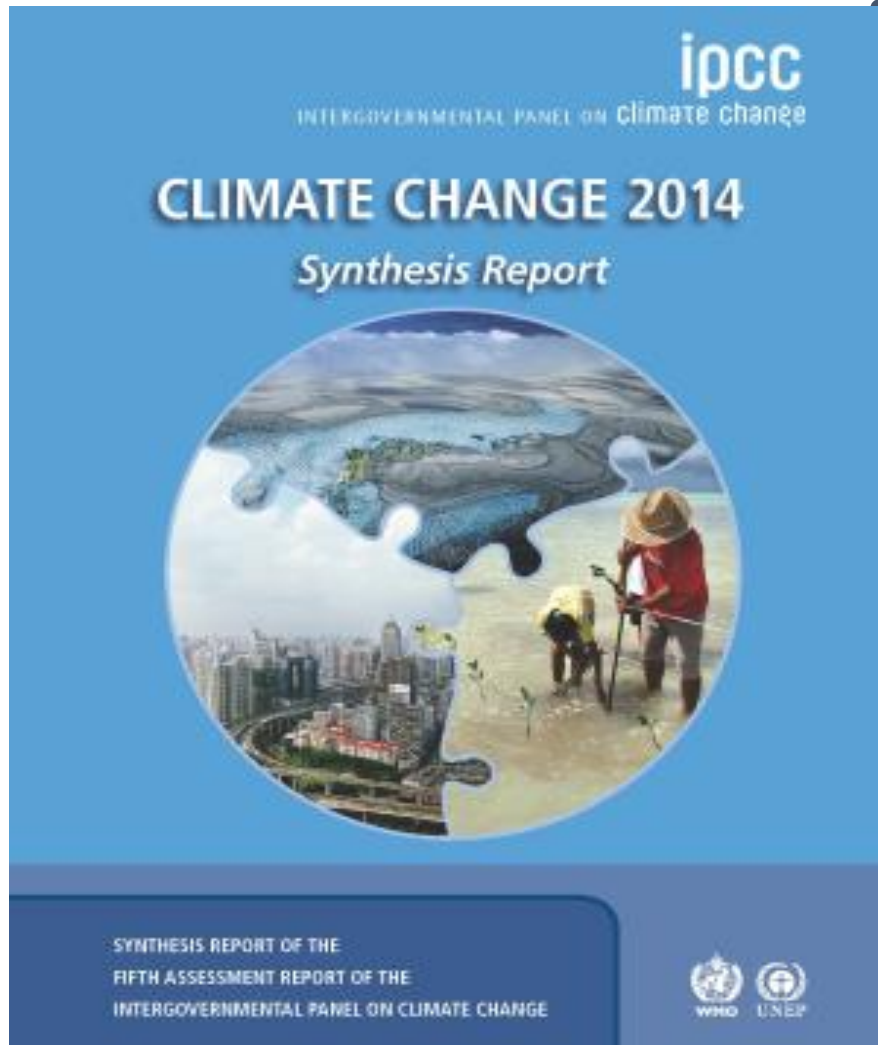
Observed impacts attributed to climate change for

Physical systems		Biological systems		Human and managed systems		Regional-scale impacts

■ Glaciers, snow, ice, and/or permafrost
 ■ Rivers, lakes, floods, and/or drought
 ■ Coastal erosion and/or sea level effects
 ■ Terrestrial ecosystems
 ■ Wildfire
 ■ Marine ecosystems
 ■ Food production
 ■ Livelihoods, health, and/or economics

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

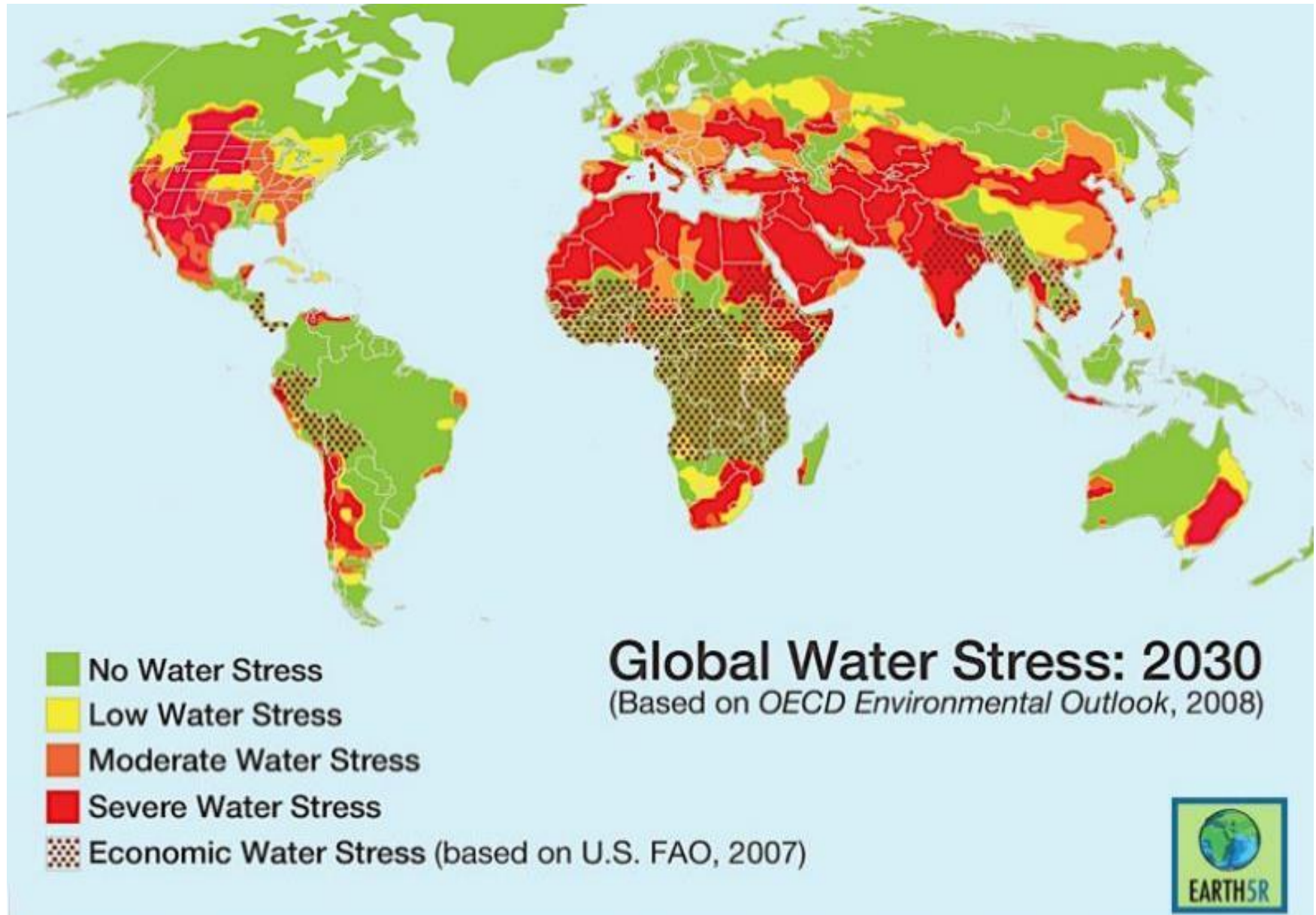
IPCC-2014



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.

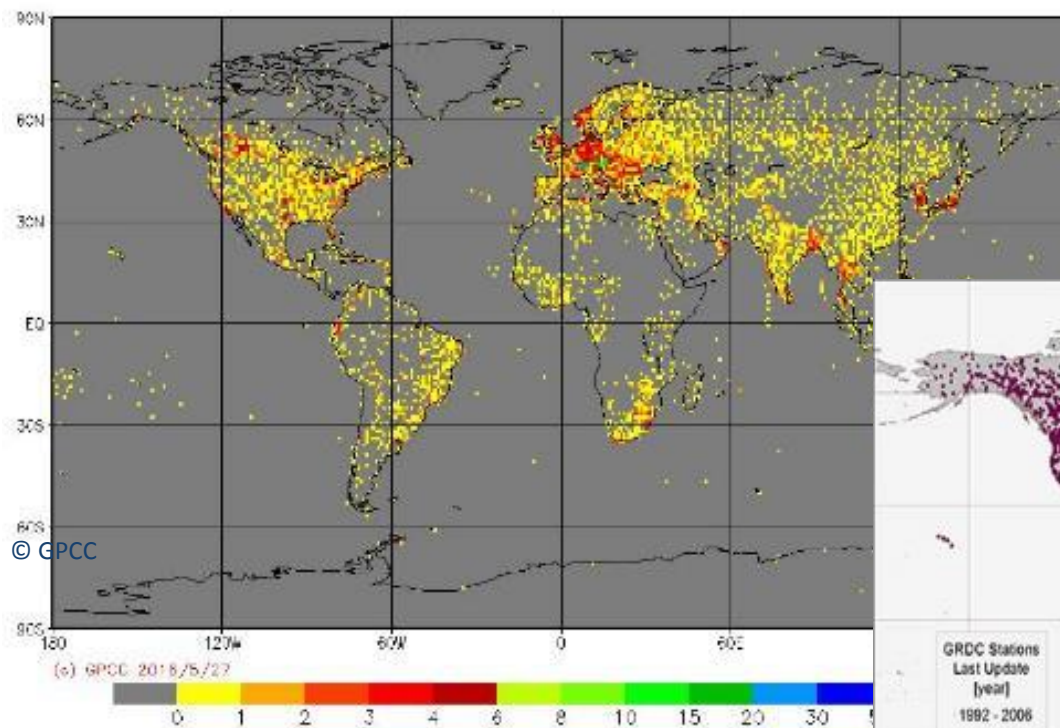
Population Growth and Water Stress



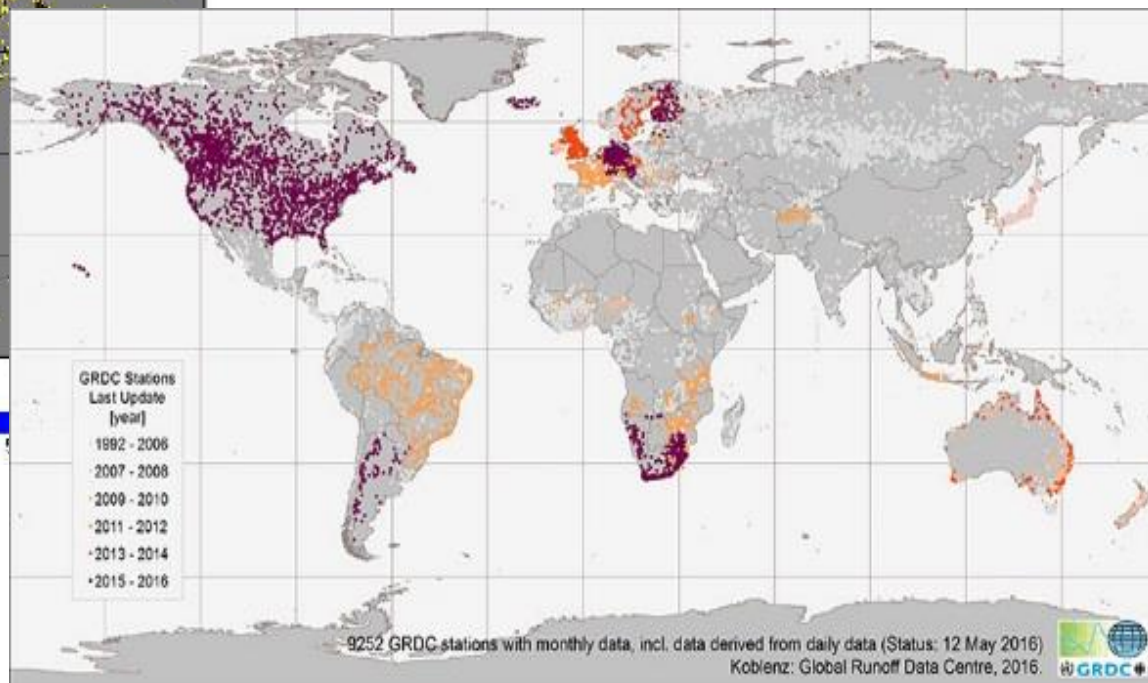
Nearly 80% of the world's population is exposed to high levels of threat to water security

Global In situ Observing Systems: Limited coverage!

GPCC Monitoring Product Version 5 Gauge-Based Analysis 1.0 degree number of stations per grid for February 2016

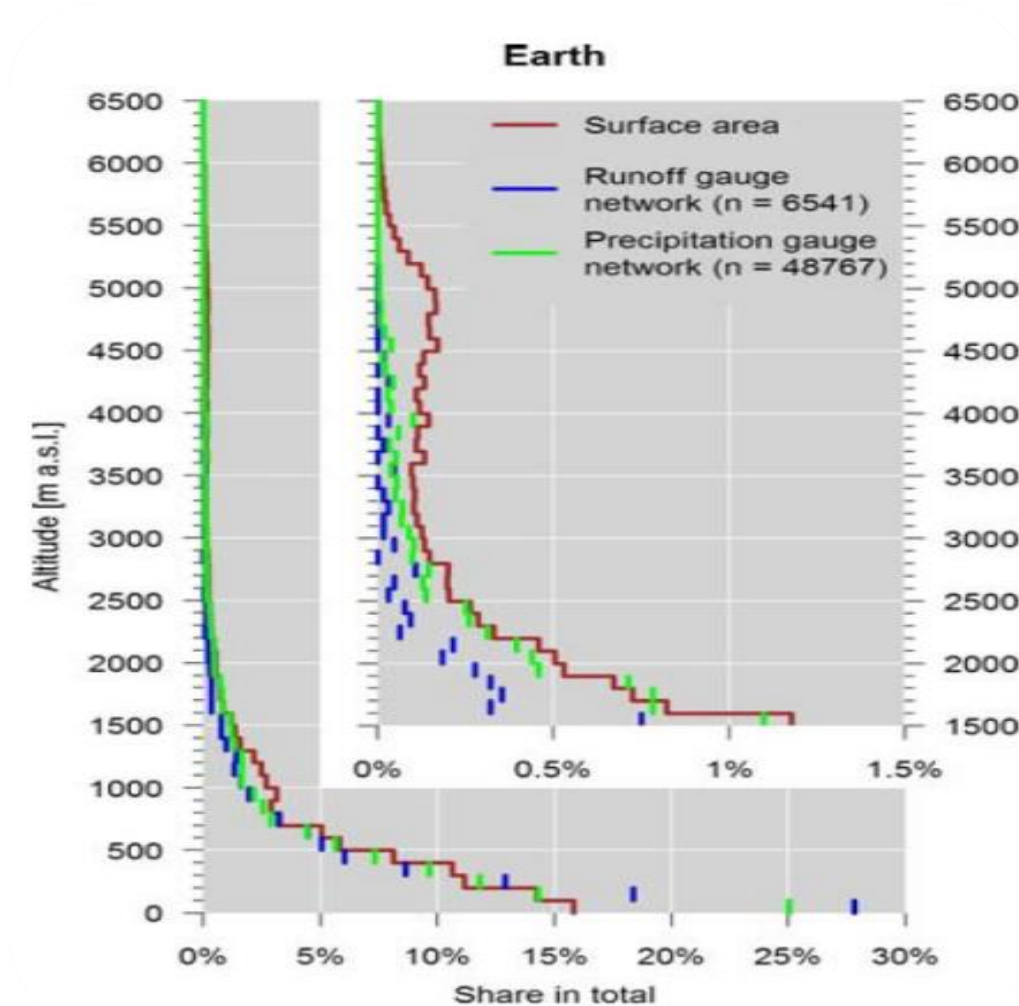


Global Runoff Gage Network (GRDC)



Global Precipitation Gage Network (GPCC) (2016)

Alpine Regions are Data Scarce



Altitudinal distribution of global runoff stations represented in the GRDC archive and global precipitation station network represented in the GPCP archive compared to global hypsography of the land surface area (without Greenland and Antarctica). The inset shows a magnification for altitudes above 1500ma.s.l. (Viviroli et al. 2011).

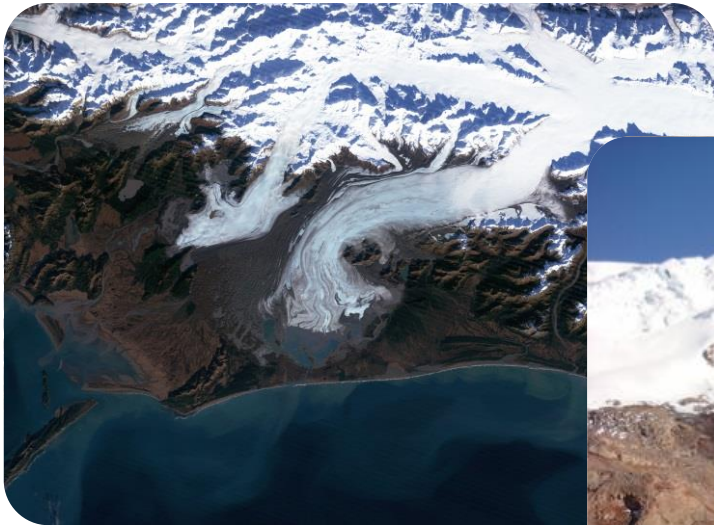
IHP-VIII Responses: 6 Themes, 3 Axes 2014-2021

Axis Improve knowledge and innovation to address water security challenges



Worldwide inventory of existing perennial ice and snow masses

The **need** for a **worldwide inventory** of existing **perennial ice and snow masses** was first considered during the International Hydrological Decade, declared by UNESCO for 1965-1974.



IHP provides a scientific knowledge platform

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



The Hubbard Glacier is overwhelmed on 14 August 2002 in the second largest GLOF in historical times.



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**.



Addressing Water Security: Climate Impacts and Adaptation Responses in Africa, the Americas, Asia and Europe

**VULNERABILITY
ASSESSMENT,
MAPPING AND
IMPLEMENTATION
OF ADAPTATION
STRATEGIES**

**RAISE AWARENESS
ON POTENTIAL
IMPACTS OF CLIMATE
CHANGE ON
MOUNTAIN
GLACIERS AND
DOWNSTREAM
WATER SUPPLY**



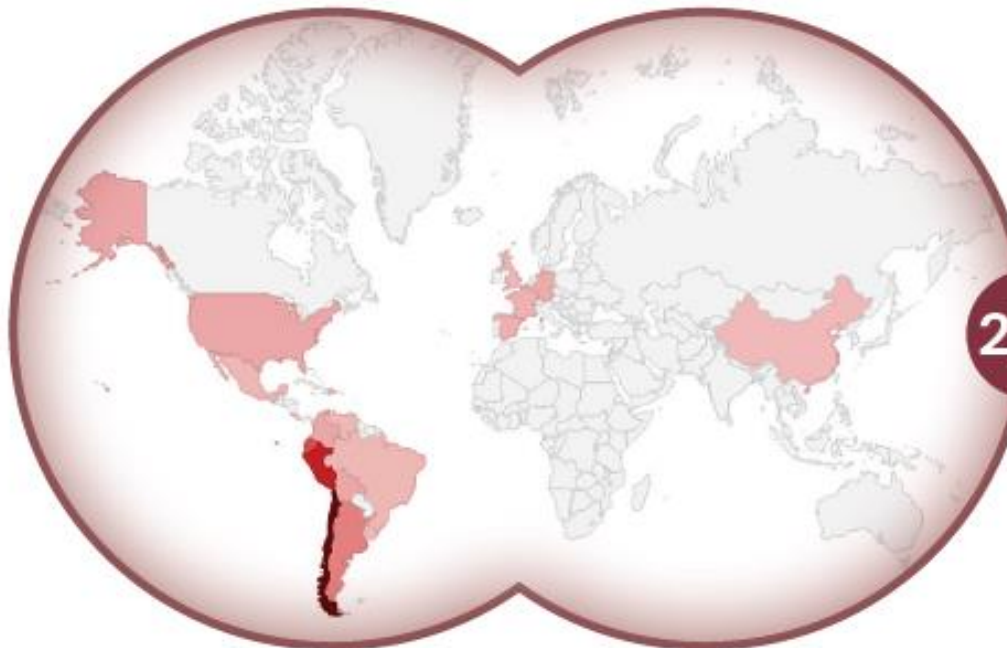
**DEVELOPMENT
OF A GLOBAL
KNOWLEDGE
FORUM**



The Impact of Glacier Melt on Water Resources: International Network for Adaptation Strategies

Countries involved in Capacity Building

Participants from **19** countries received training



235 participants were involved

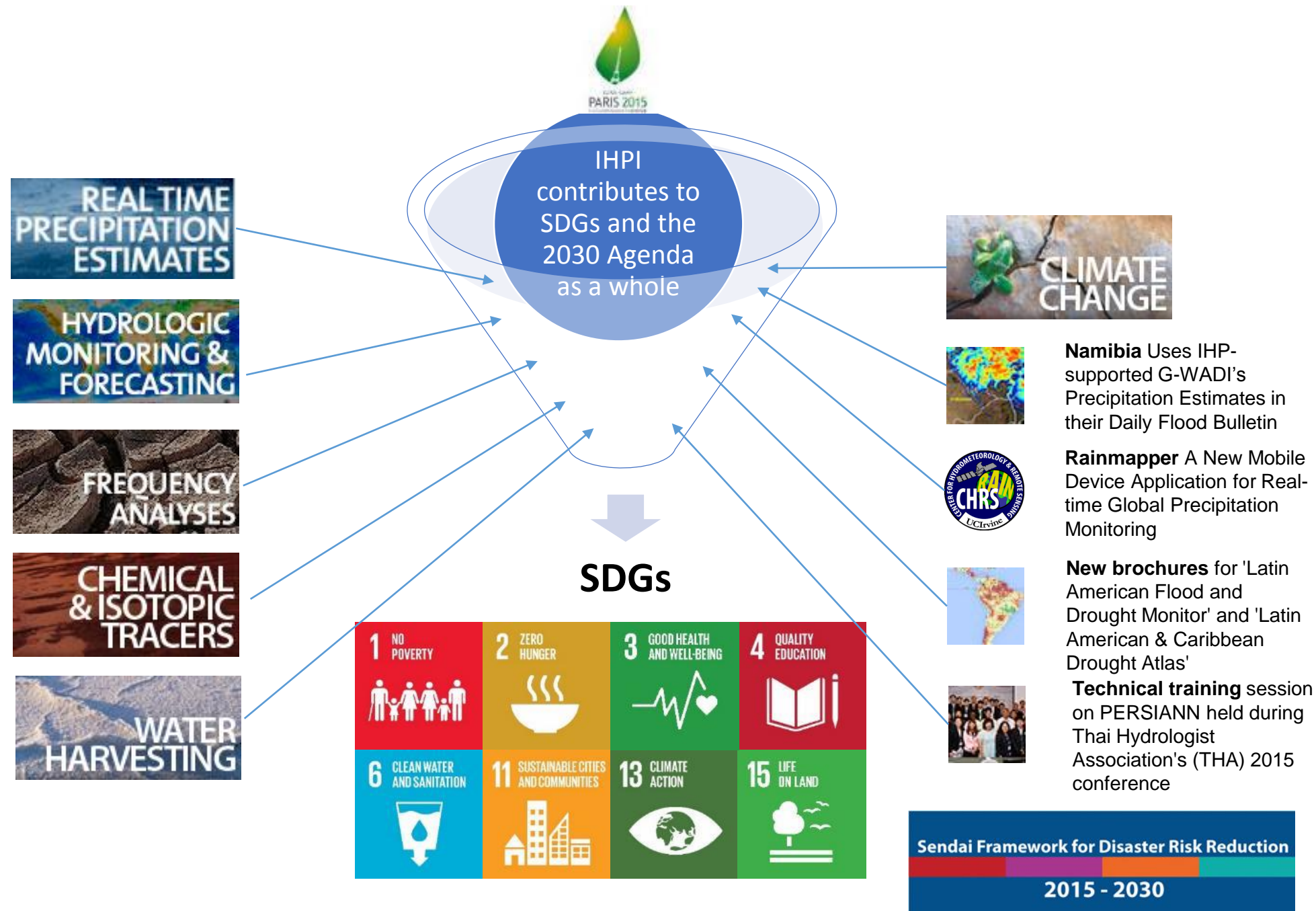
Argentina / Belgium / Bolivia /
Brazil / Chile / China / Colombia /
Costa Rica / Dominican Republic
/ Ecuador / France / Germany /
Mexico / Peru / Spain / United
Kingdom / Uruguay / United States
/ Venezuela

G-WADI



G-WADI's mission is to strengthen the capacity to manage the water resources of arid and semi-arid areas around the globe through a network of international and regional cooperation.

IHP contributes to SDGs & the 2030 Agenda as a whole



Data & tools to support informed decision making

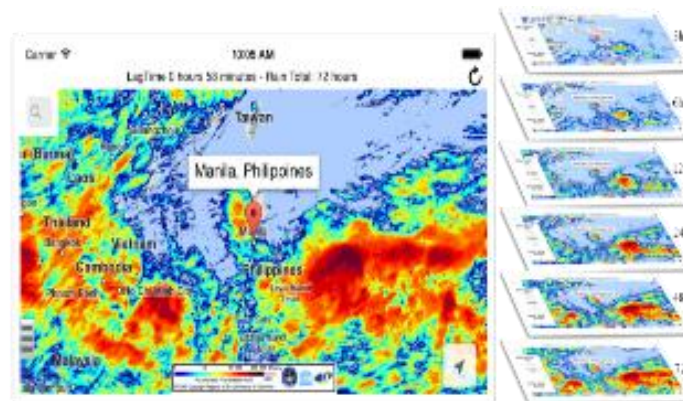
The Glacier App



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



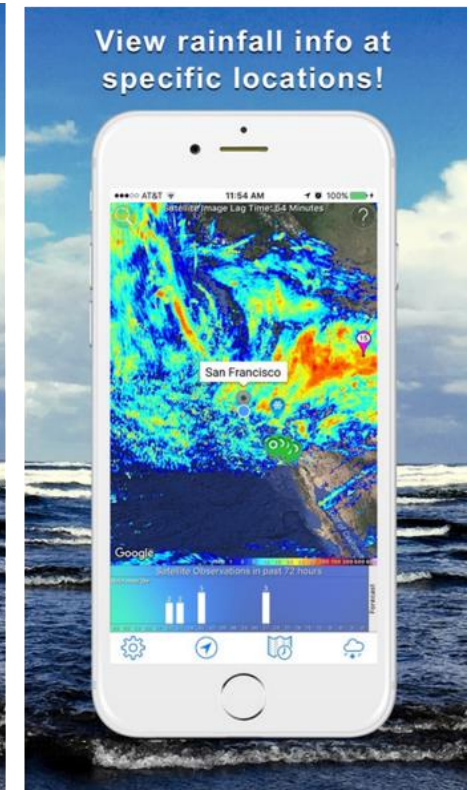
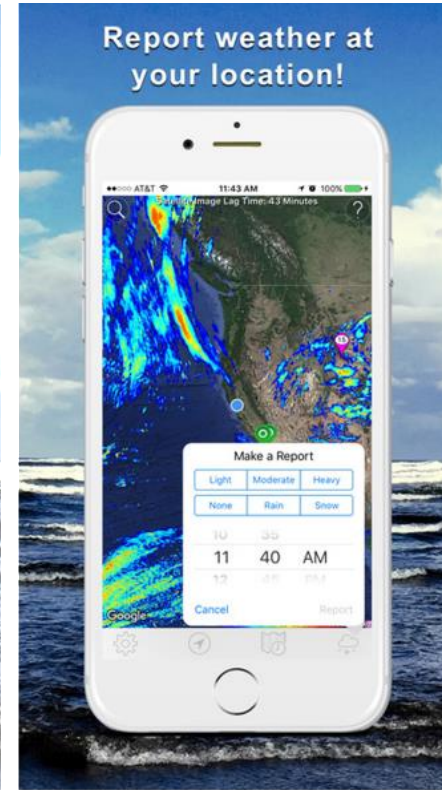
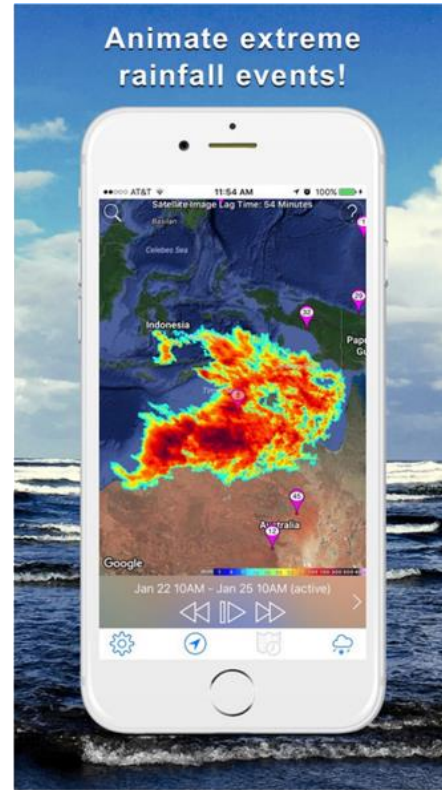
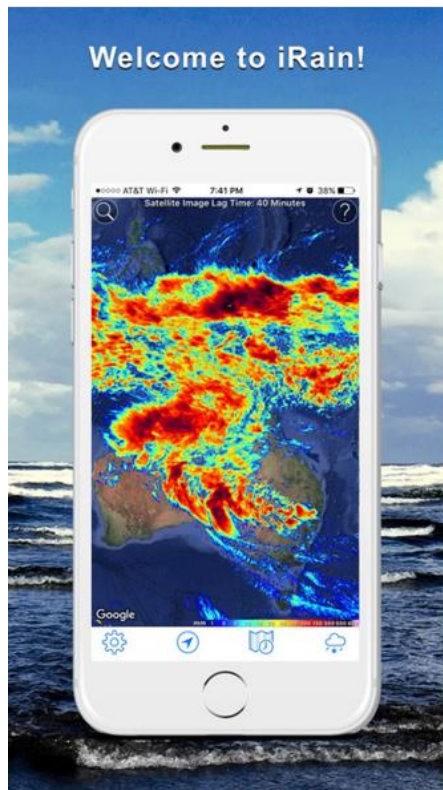
Rainmapper App



- Web application for local and global real-time precipitation.
- It was used in July 2014 **to track Typhoon Rammason** (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

iRain launching at COP22



Exhibition Mountains: Early Warning Systems for Climate Change



United Nations
Educational, Scientific and
Cultural Organization

International
Hydrological
Programme

Among the raising awareness activities: exhibition showcasing satellite images aerial and ground pictures was presented during COP21 in Paris.



Schéma d'un glacier Diagram of a glacier

UNESCO
International Hydrological Programme
L'Agence Française pour l'Observation de la Terre

Un bilan de santé pour la Terre The Earth needs a health check

UNESCO
International Hydrological Programme
L'Agence Française pour l'Observation de la Terre



Jungfrau-Aletsch : Une belle région menacée Jungfrau-Aletsch: A beautiful region under stress

UNESCO
International Hydrological Programme
L'Agence Française pour l'Observation de la Terre

missions to rainfall
The Jungfrau-Aletsch region is a natural heritage site of the Alps, located in the Swiss Alps. It is a UNESCO World Heritage site, known for its exceptional natural beauty and its role as a water tower for the region. The region is home to the largest glacier in the Alps, the Aletsch Glacier, which is a vital source of water for the region. The glacier is retreating rapidly, and this is a clear sign of climate change. The region is also home to many rare and endangered species, and the loss of the glacier would have a devastating impact on the region's biodiversity.



The Impact of Glacier Melt on Water Resources: International Network for Adaptation Strategies

Capacity building of the Andean Countries



New Publication:
Mass Balance Manual (2015)

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

e-Hughes-Songyi/CC BY (flickr)



Mountain Ecosystem Services and Climate Change

A Global Overview of Potential Threats and Strategies for Adaptation



Flanders
State of the Art

ACCOMPLISHMENT REPORT

THE IMPACT OF GLACIER RETREAT IN THE ANDES

International Multidisciplinary Network
for Adaptation Strategies

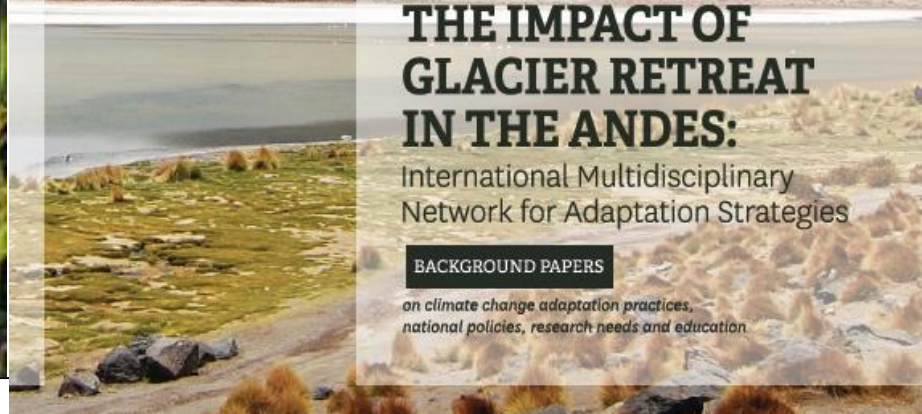


THE IMPACT OF GLACIER RETREAT IN THE ANDES:

International Multidisciplinary
Network for Adaptation Strategies

BACKGROUND PAPERS

on climate change adaptation practices,
national policies, research needs and education.





The Impact of Glacier Melt on Water Resources: International Network for Adaptation Strategies

Outreach to decision makers and the general public

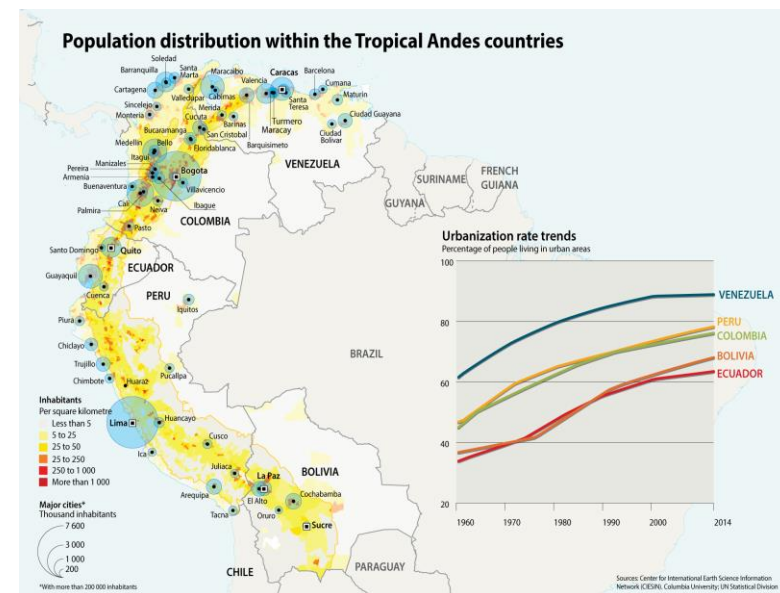
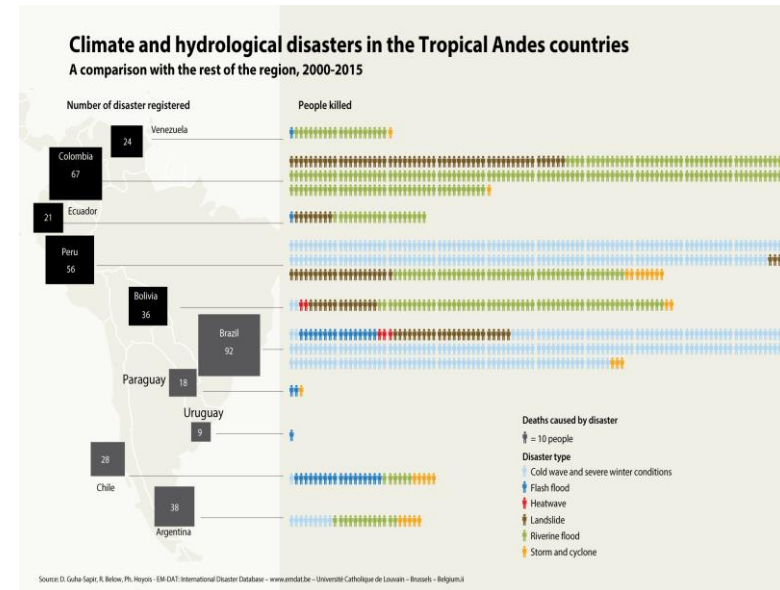
Policy briefs for Decision Makers



Exhibitions for the General Public



The Water Vulnerability Atlas of the Andean Region



International Workshop on Deficit Irrigation and Water Use Efficiency

Identifying case studies in Latin America, and particularly
in Bolivia, Chile and Peru

Workshop in La Paz, Bolivia 2018



Quinoa production in Bolivian Highlands

Knowledge Forum on Water Security and Climate Change



The project aims to implement activities to develop adaptation strategies that contribute to achieving water security within the context of climate change impacts, focusing on vulnerable regions such as mountains, and arid and semi-arid regions.



Tools for water security



Case studies



Citizen Science



Publications

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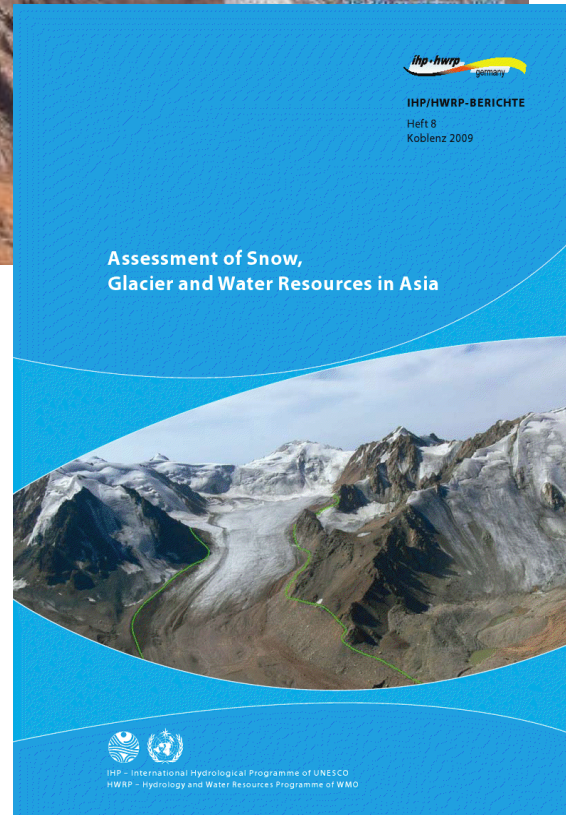
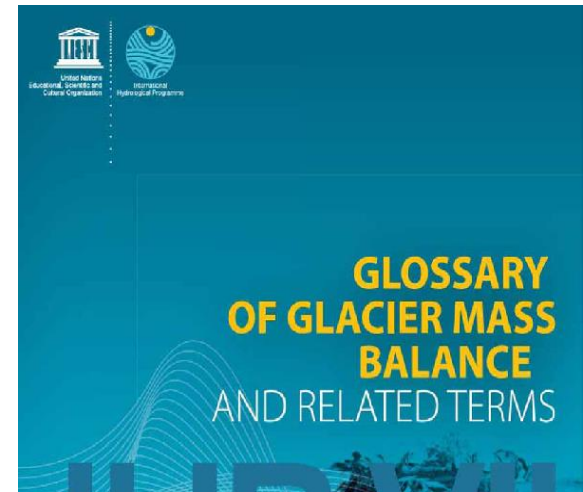
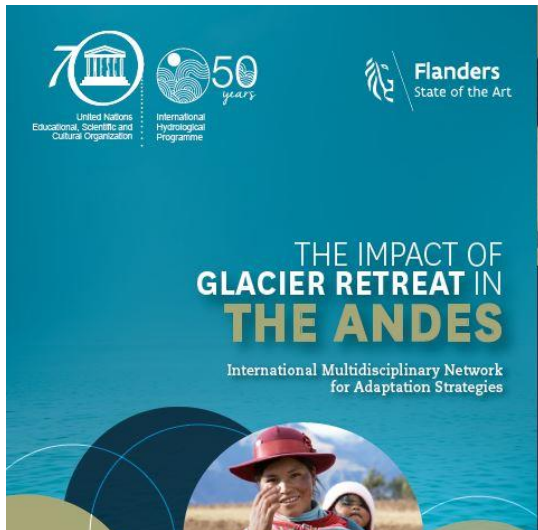
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Publications



Thank you!

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

