IWRA Webinar on World Toilet Day 2020 -
Sustainable Sanitation & Climate Change
Thursday, November 19th 2020

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Hydrological Programme

GROUNDWATER CLIMATE CHANGE

United Nations Educational, Scientific and Cultural Organization

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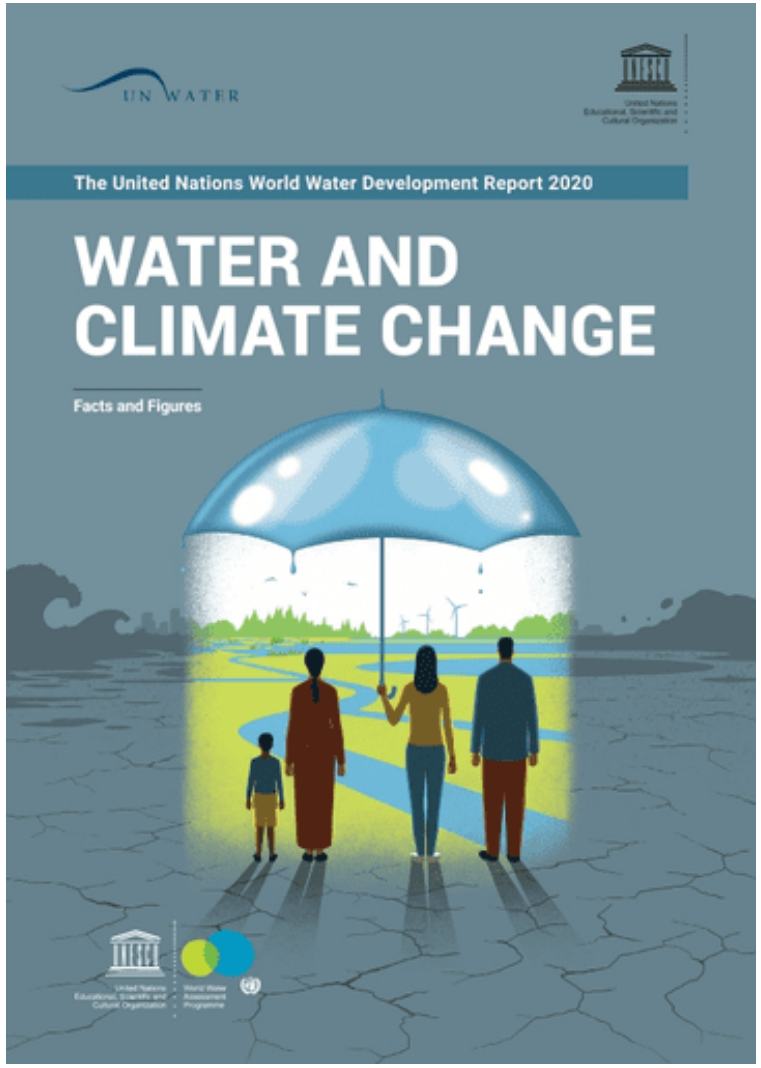
IHP-VIII Water Security:



UNESCO WWAP

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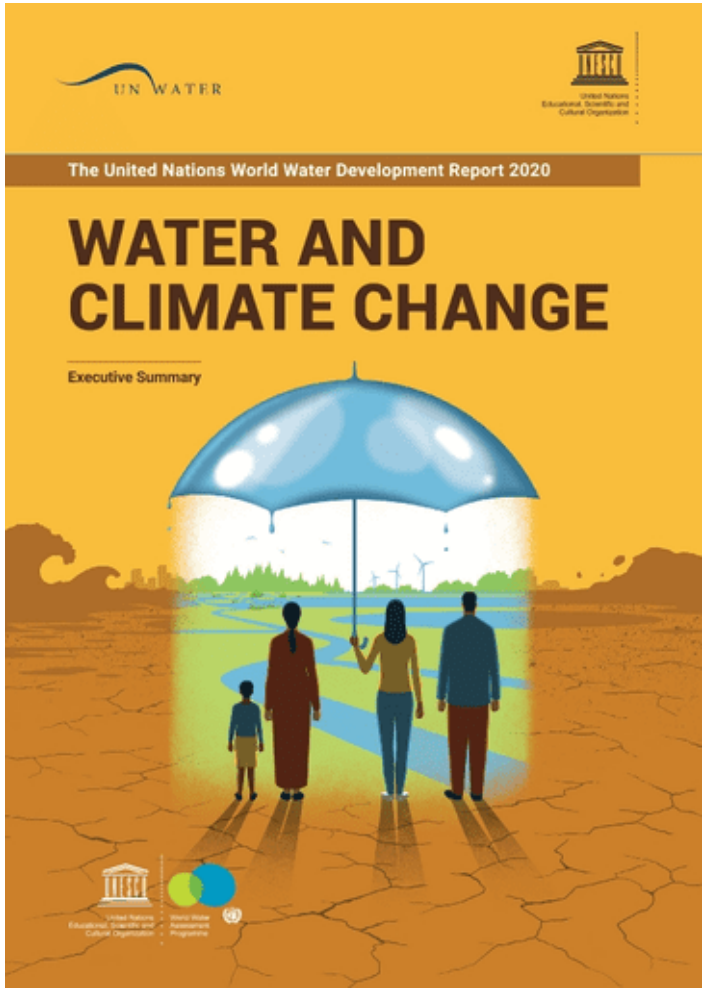
In many regions of the world, aquifers present the largest storage capacity, often orders of magnitude greater than surface water storage.

“Despite the critical importance of groundwater resources in many parts of the world, there have been very few direct studies of the effect(s) of global warming on groundwater recharge”

World Water Development Report 2020 – Water and Climate Change

The 2020 edition of the World Water Development Report (WWDR 2020)

COMBINED WITH A MORE ERRATIC AND UNCERTAIN SUPPLY, CLIMATE CHANGE WILL AGGRAVATE THE SITUATION OF CURRENTLY WATER-STRESSED REGIONS, AND GENERATE WATER STRESS IN REGIONS WHERE WATER RESOURCES ARE STILL ABUNDANT TODAY.



Global water use has increased by a factor of six over the past 100 years and continues to grow steadily at a rate of about 1% per year as a result of increasing population, economic development and shifting consumption patterns. Physical water scarcity is often a seasonal phenomenon, rather than a chronic one, and climate change is likely to cause shifts in seasonal water availability throughout the year in several places.

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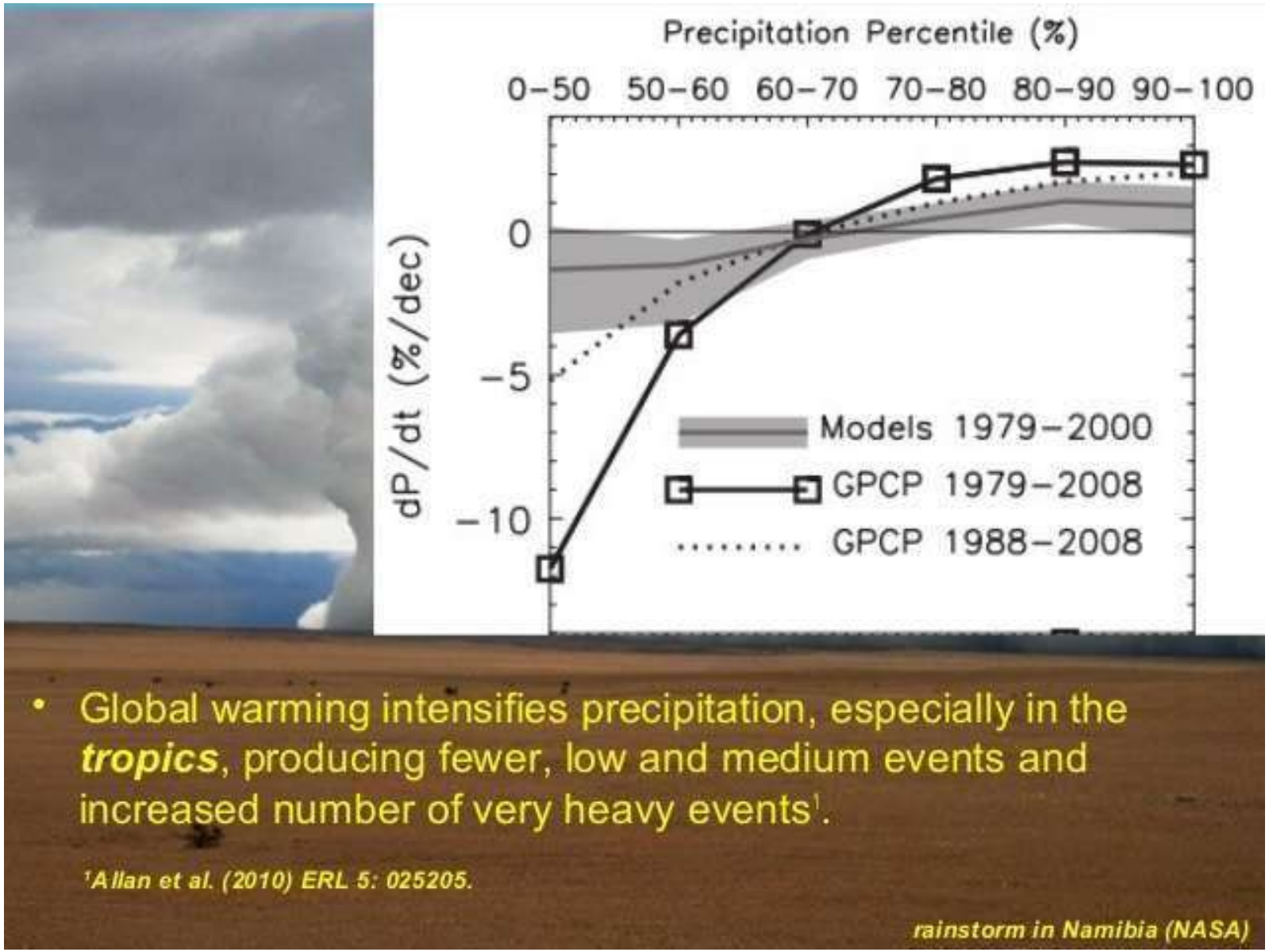
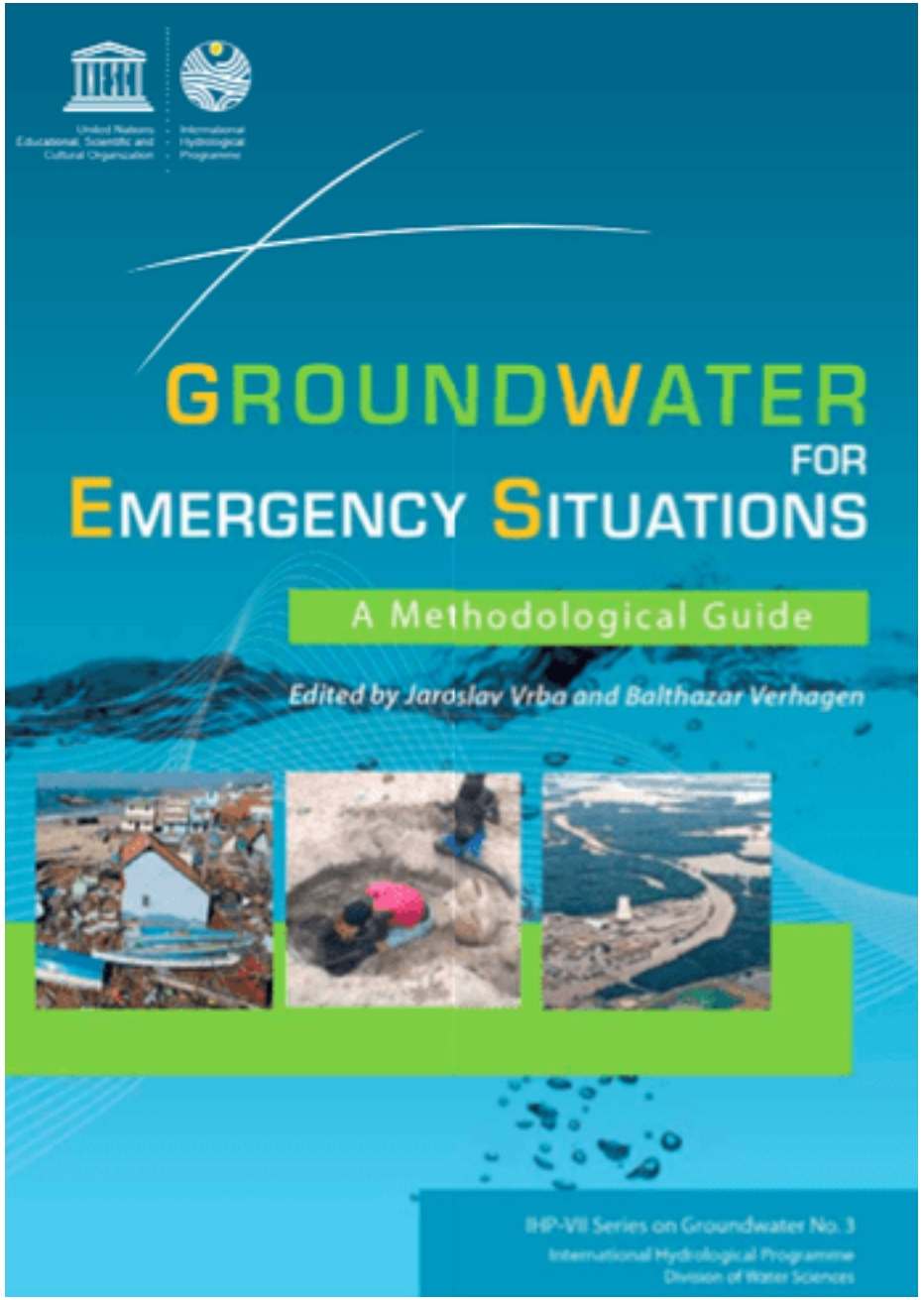


- Global warming intensifies precipitation, especially in the ***tropics***, producing fewer, low and medium events and increased number of very heavy events[1].

[1]*Allan et al. (2010) ERL 5: 025205.*

rainstorm in Namibia (NASA)



CLIMATE CHANGE IMPACTS

ACCELERATION of EXTREME EVENTS

Aquifers can be play crucial role resource in

emergency situations

Vrba, J., Verhagen, B., 2006. Groundwater for emergency situations. A framework document. IHP VI, Series on Groundwater n° 12. UNESCO, Paris.

United Nations Educational, Scientific and Cultural Organization · International Hydrological Programme · GRAPHIC

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GRAPHIC

GRAPHIC
GLOBAL COMMITMENT TO GROUNDWATER AND CLIMATE CHANGE

To better understand the effects of climate change on global groundwater resources, the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) International Hydrological Programme (IHP) initiated the GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climate Change) project in 2004[1].

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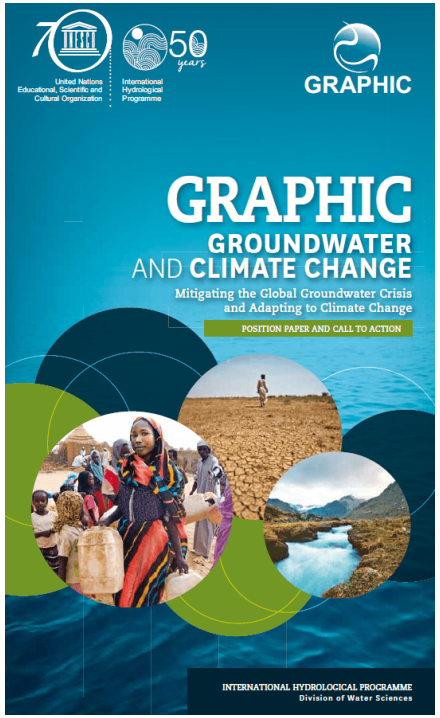
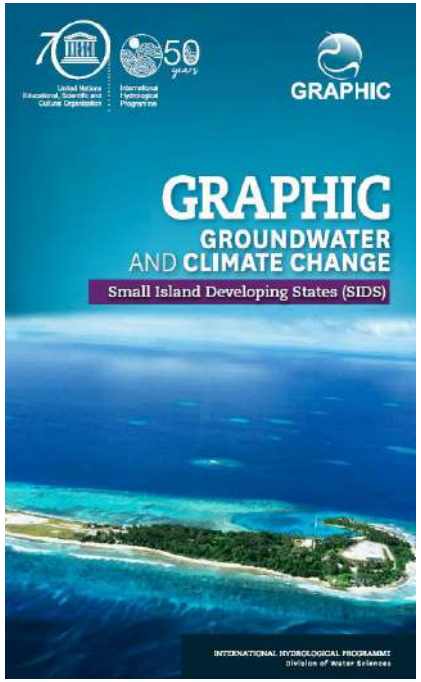
UNESCO GROUNDWATER AND CLIMATE PROJECT

GRAPHIC

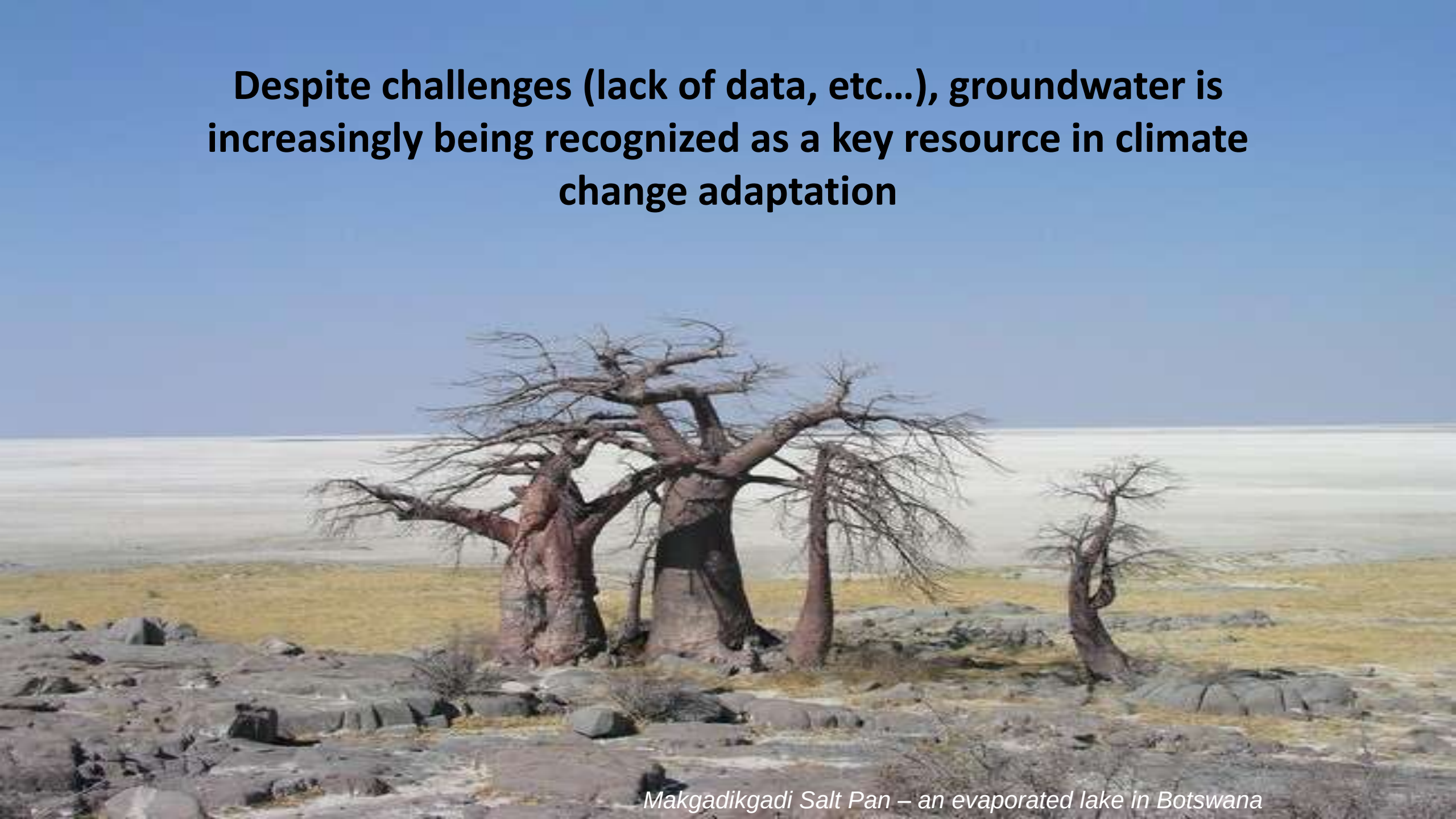
Translate our scientific findings into concrete actions for better management and outline policy relevant recommendations

Launch of GRAPHIC position paper at the COP21





Despite challenges (lack of data, etc…), groundwater is increasingly being recognized as a key resource in climate change adaptation



Makgadikgadi Salt Pan – an evaporated lake in Botswana

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Building Cooperation for Water Security

CAPTURE INTERCONNECTIONS

The common pool resource characteristics of **groundwater,** the close interaction between **groundwater** and land use and the often limited understanding among policy makers of its characteristics and of the geological processes that control its behaviour, are additional challenging features.

GRAPHIC:

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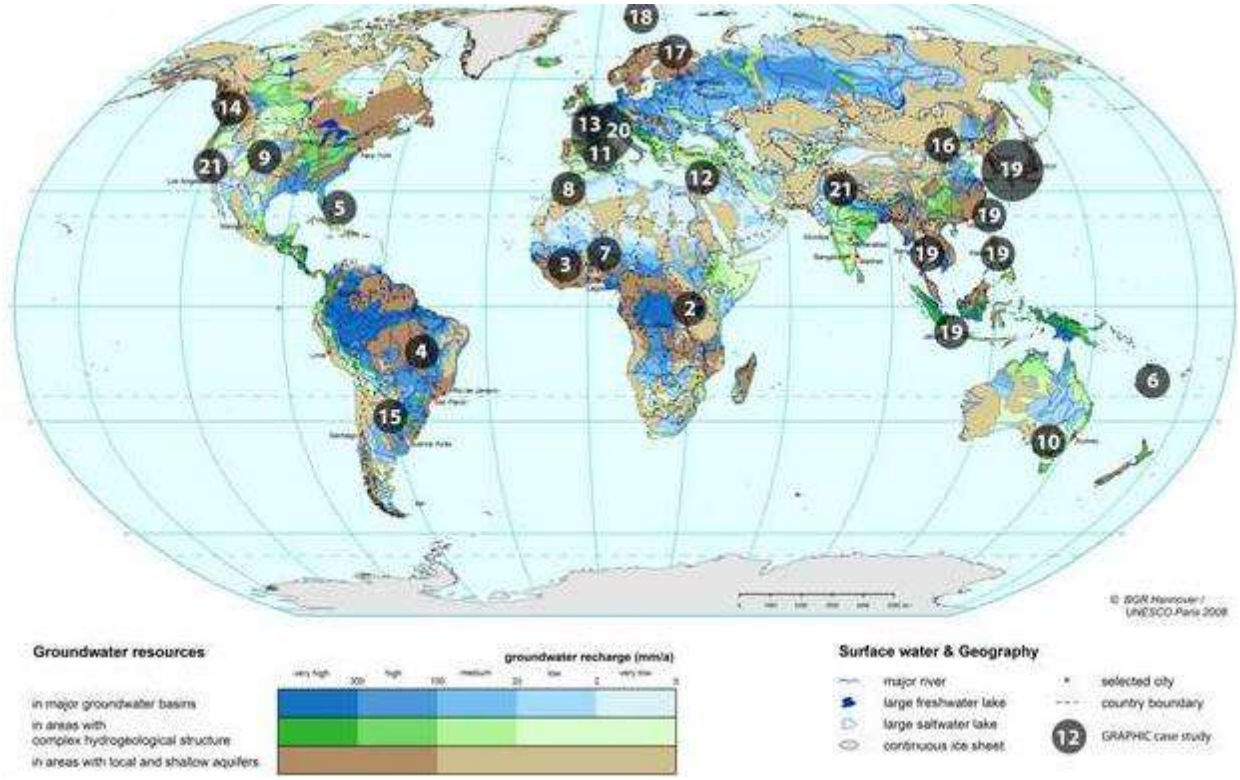
- **GRAPHIC studies in Africa, Asia and Oceania, Europe, Latin America, and the Caribbean, and North America**
- **More than 20 flag case studies**

Flag Basins:

- North West Sahara (Africa)
- Iullemmeden Basin (Africa)
- High Plains (North America)
- Guarani (South America)
- North China Plains (Asia)
- Baltic Artesian Basin (Northern Europe)
- Great Artesian Basin (Oceania)

Several addition study aquifers.



20 GRAPHIC Case Studies

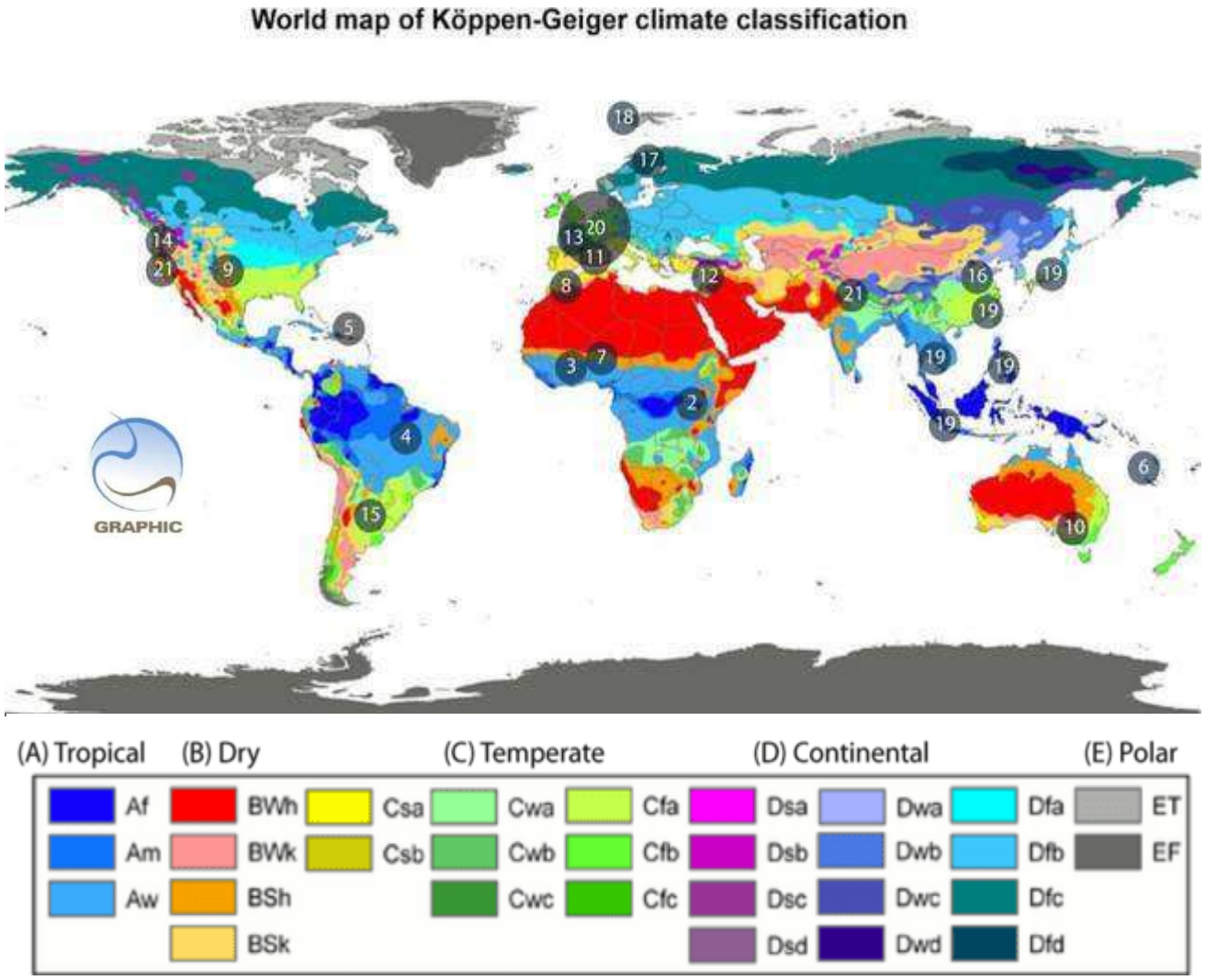
Studies – By Climate Classification

- Tropical: 5
- Dry: 4
- Temperate: 5
- Continental: 2
- Polar: 1
- Mixed climate: 3

Research Themes & Topics:
(climate variability and change)

variety of systems:
- alpine
- agricultural
- island/coastal
- urban

land-use/land cover
storm surge
seawater intrusion
land subsidence
effects on recharge
response to drought
response to permafrost melt
dependent ecosystems (GDE)
falling/rising water tables
groundwater quality
GRACE: GW depletion rates
statistical downscaling; GCMs
ENSO, NAO, PDO, AMO



Major Findings by Climate

Tropical & Dry

GRAPHIC

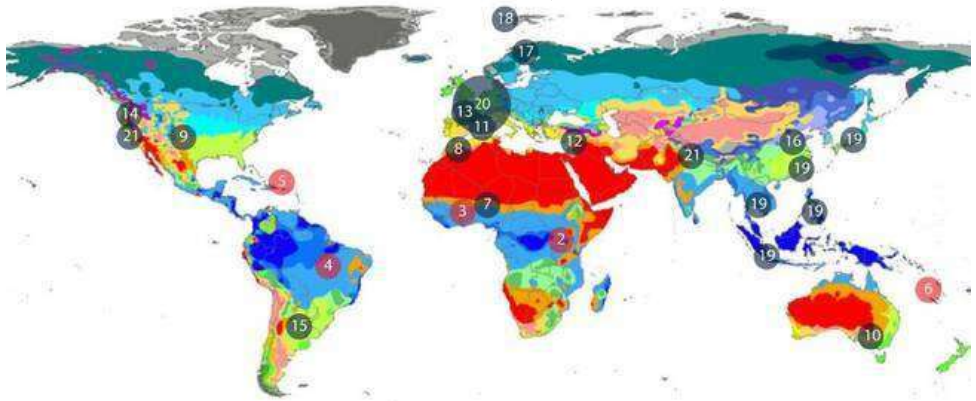
Tropical (sites 2-6)

- Most vulnerable GW resources:
  - Island and coastal systems.
- Limited ability for GCM downscaling for small islands.
- Rapid development in will likely have a greater effect on GW than climate change.

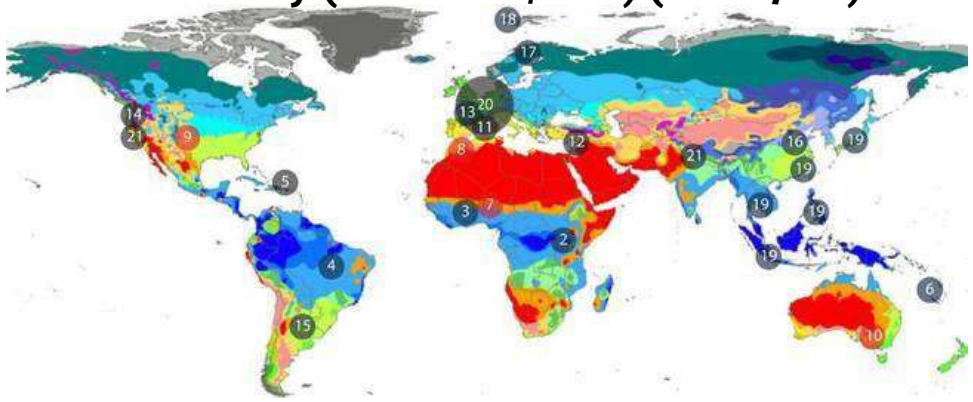
Dry (semi-arid/arid) (sites 7-10)

- Most vulnerable GW resources:
- Rural, developing, and/or economically depressed areas strongly GW dependent
- Important difference exist between SW
- and GW response to climate variability
- and change (temporal lag in vadose zone).

Tropical (sites 2-6)



Dry (semi-arid/arid) (sites 7-10)



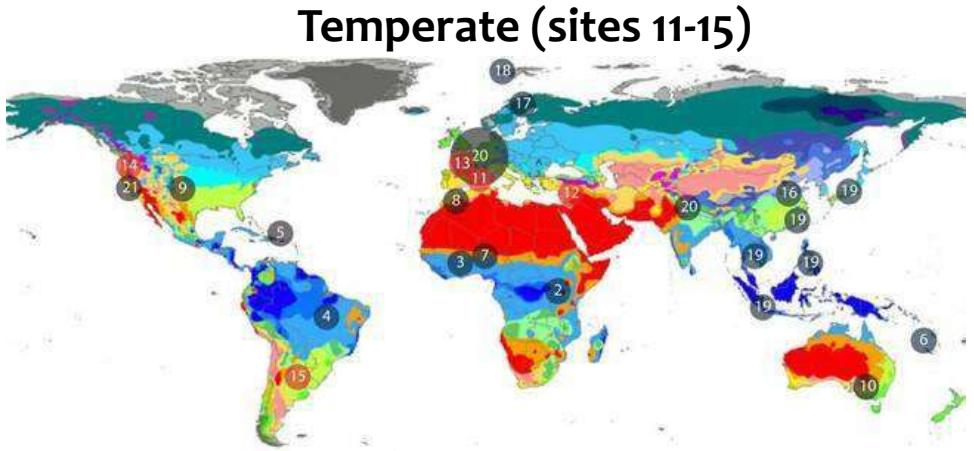
Major Findings by Climate

Temperate & Continental

GRAPHIC

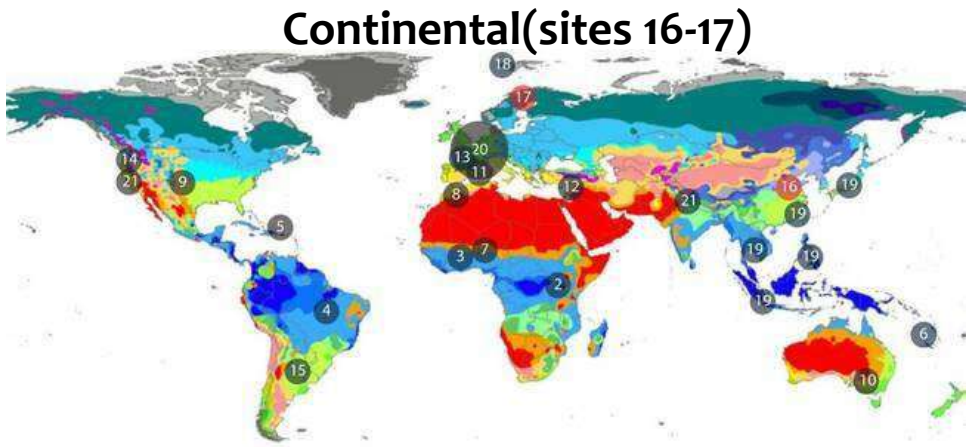
Temperate (sites 11-15)

- Coastal vulnerability
- Land subsidence
- Groundwater Dependent Ecosystems (GDE): received relatively little attention



Continental(sites 16-17)

- Drought management plans must consider sustainability of GW resources.
  - Current response to drought: ad hoc by drilling emergency wells.
  - Shift from crises management to drought preparedness and planned use of GW.



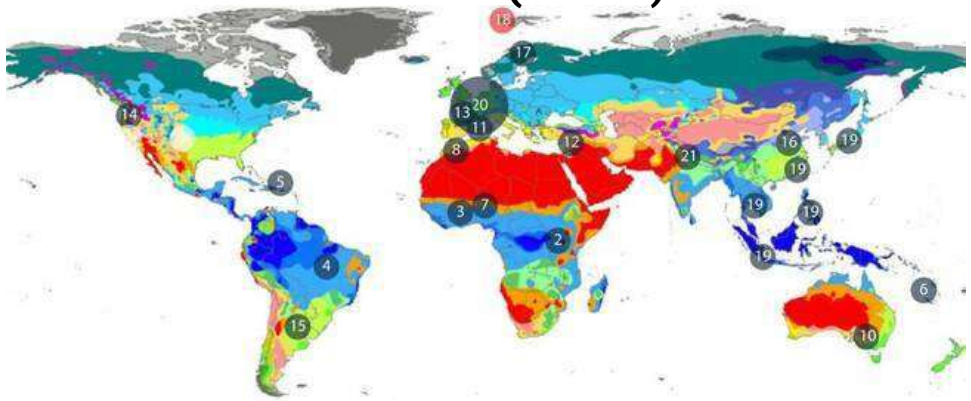
Major Findings by Climate

GRAPHIC

Polar (site 18)

- sparsely populated, but earliest & most profound responses to climate change.
- Least studied aquifer systems:
  - location & extents of aquifers?
  - fundamental processes of recharge & discharge under changing permafrost?
- Need for coordinated monitoring,
- modeling, aquifer characterization.

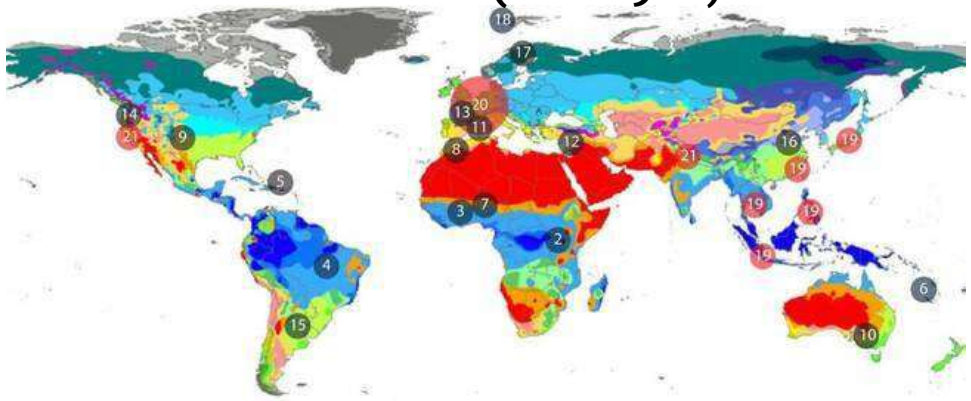
Polar (site 18)



Various (sites 19-21)

- Comprehensive strategy needed to
- monitor global GW.
- Satellite-based methods (GRACE) hold promise, in concert with ground-based measurements.

Various (sites 19-21)



Climate Change and Transboundary Aquifers

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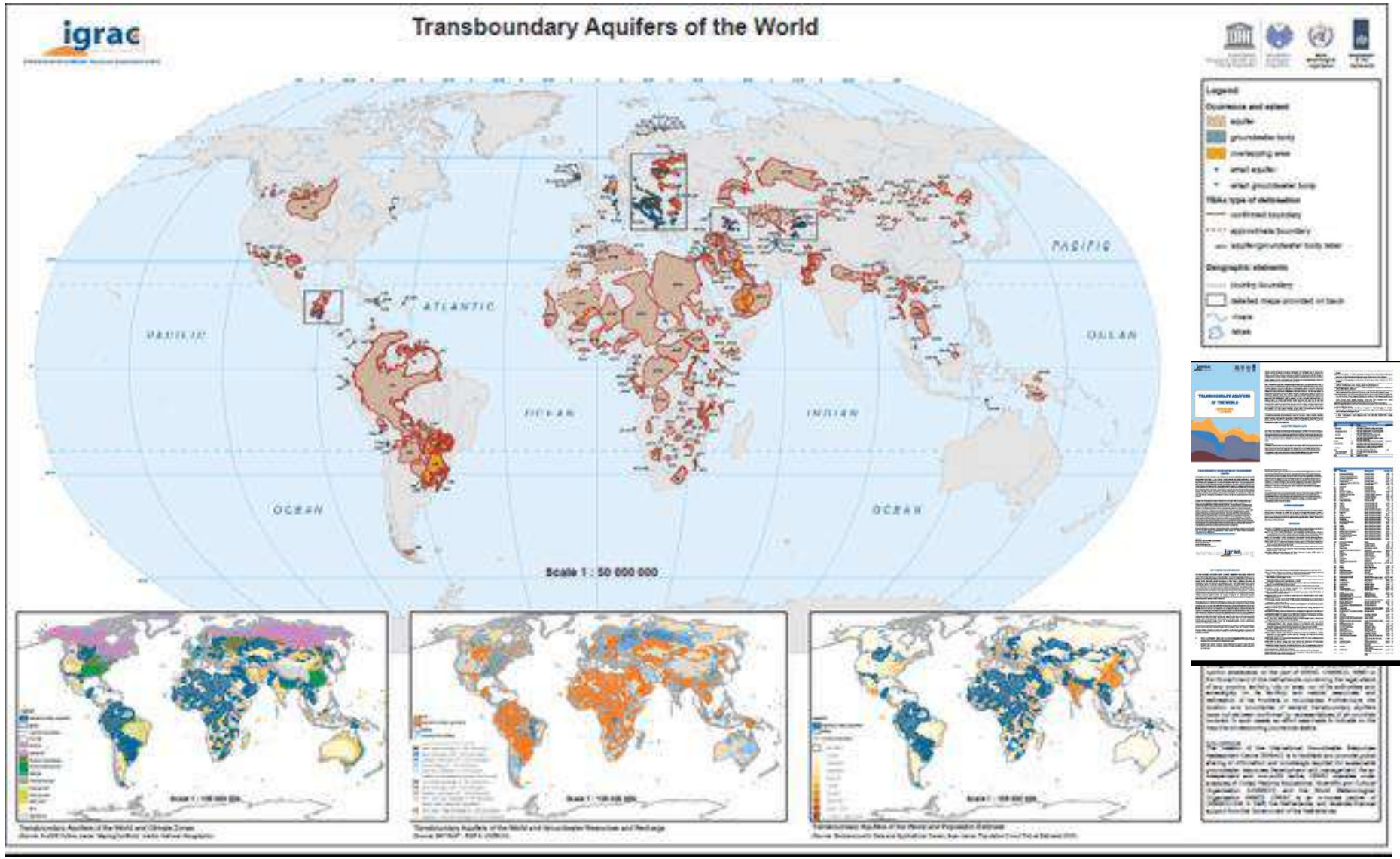
isarm



CLIMATE CHANGES and GROUNDWATER QUALITY

Climate change affects not only **groundwater** quantity, but also its **quality**.
We already know that coastal aquifers can be particularly affected.

Why Do Groundwater Quality Merit Protection?

Groundwater quality merit protection because its secure provision of large portion of the potable water supply available in both urban and rural environments, and plays a fundamental role in the economy as well as in groundwater supporting ecosystems

Worldwide, aquifers are experiencing an increasing threat of pollution from urbanization, industrial development, agricultural activities, and mining enterprises.

Special protection measures are needed for boreholes, wells, and springs

Water movement and contaminant transport from the land surface to aquifers can in many cases be a slow process. It may take years or decades before the impact of a pollution episode by a persistent contaminant becomes fully apparent in groundwater supplies

Despite the increasing interest in climate change and water security, research considering climate change and groundwater quality needs investments .

Thank you