WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO Hydrological Research Strategy and Activities 2022-2030

Stefan Uhlenbrook and MANY other

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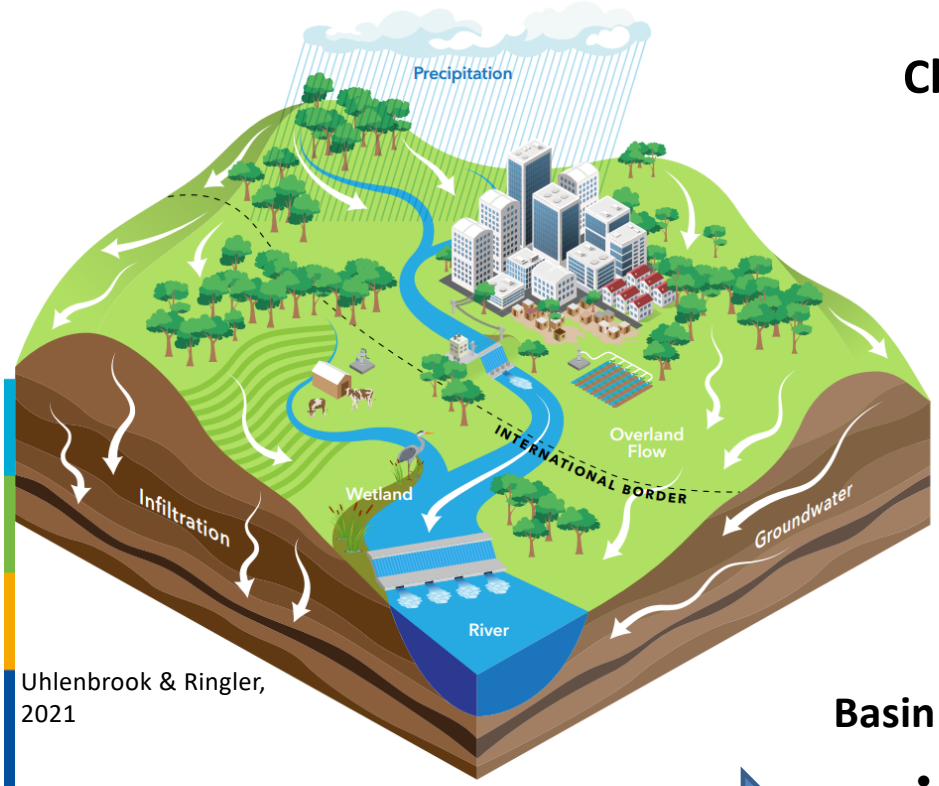
World Meteorological Organization
Organisation météorologique mondiale

How to improve hydrological information and services?
(observations, modelling and forecasting)



Uhlenbrook & Ringler, 2021

Challenges include:

- **Climate change and change of hydro-meteorological characteristics**
- **Need of an Earth systems approach**
- **Change of water availability and increasing water demand of society**
- **Human interventions, the need to develop water resources**
- **Lack of data and information, systems understanding**

➢ ***Operational hydrology/water management needs to address these challenges***

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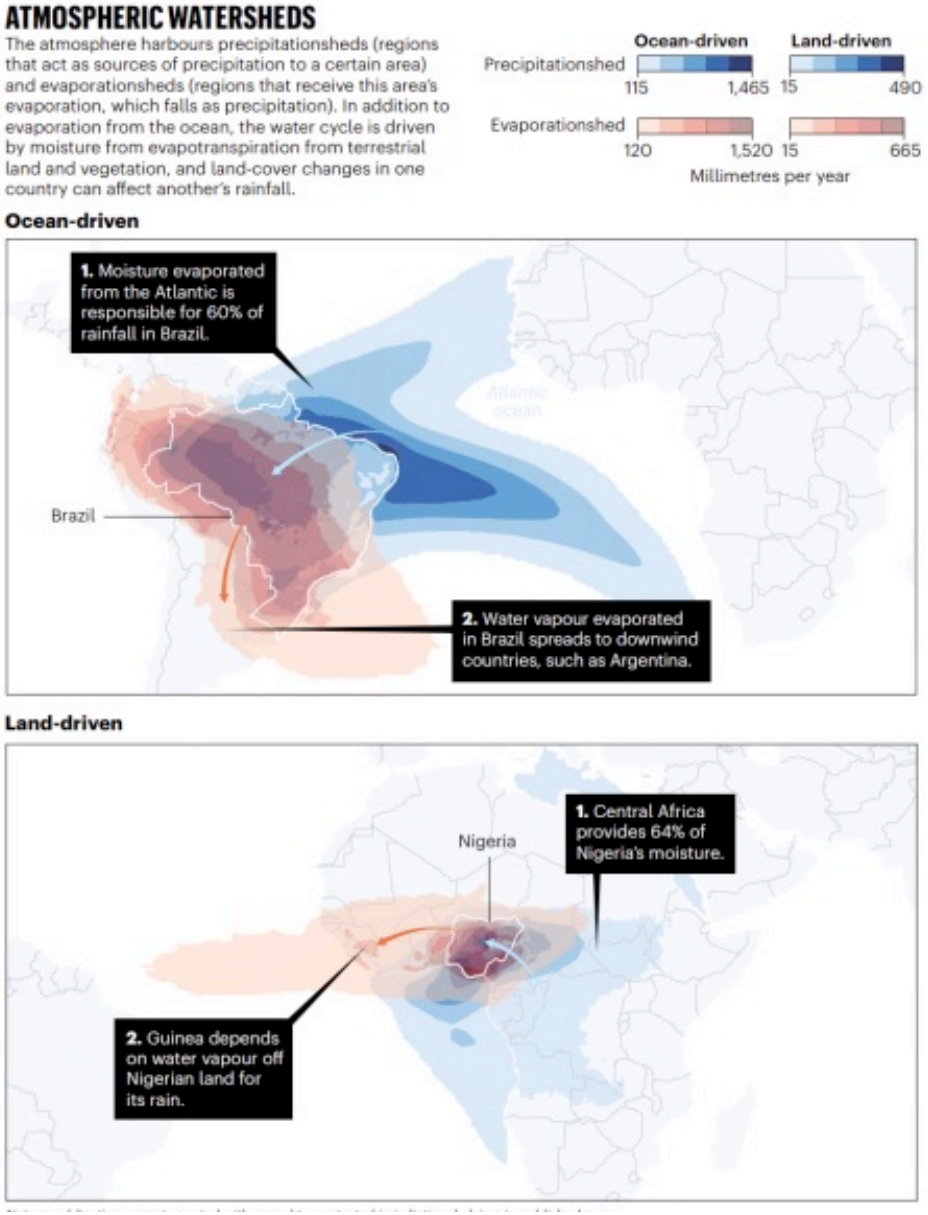
Basin approach – data & information is critical:

- **Water management, DRR**
- **Quantification and accounting of WEFE resources interactions**
- **Upstream-downstream inter-dependencies**
- **Shared benefits and trade-offs across countries and sectors**

A reminder …



Rockstrom et al., 2023, *Nature*

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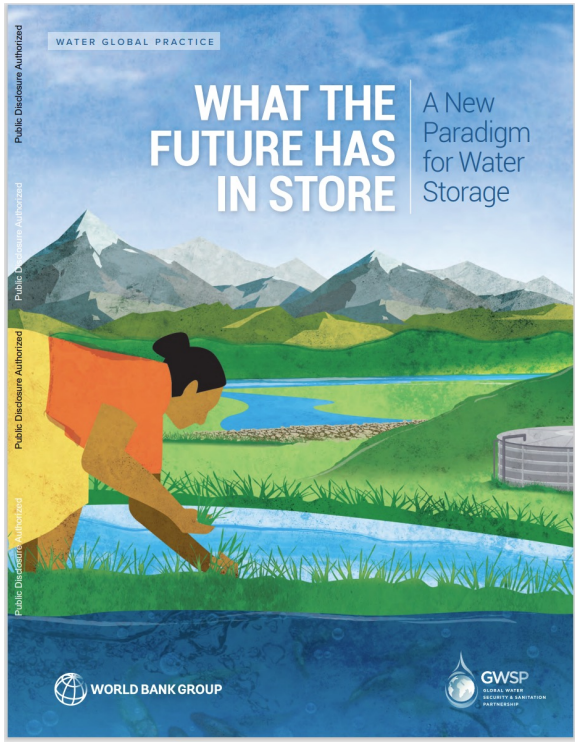
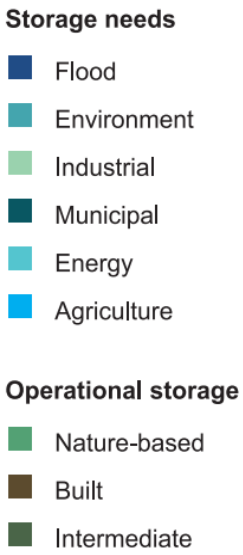
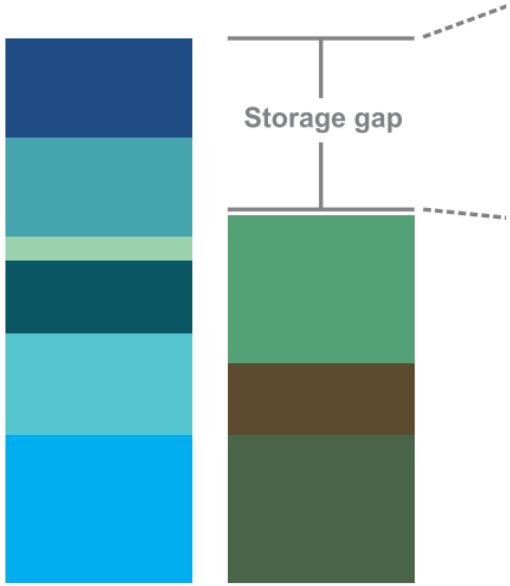
Example: Integrated Water Storage Management



Integrated Water Storage Management

A growing water storage gap needs an *integrated approach*





Source: Yu et al., 2021

WMO Resolution 25 (CG-18) in 2019

Basis for WMO Plan of Action for Hydrology - eight **Long-term Ambitions**:

1. No one is surprised by a **flood**
2. Everyone is prepared for **drought**
3. Hydro-climate and meteorological data support the **food security** agenda
4. **High-quality** data supports science
5. **Science** provides a sound basis for operational hydrology
6. We have a thorough **knowledge of the water resources** of our world
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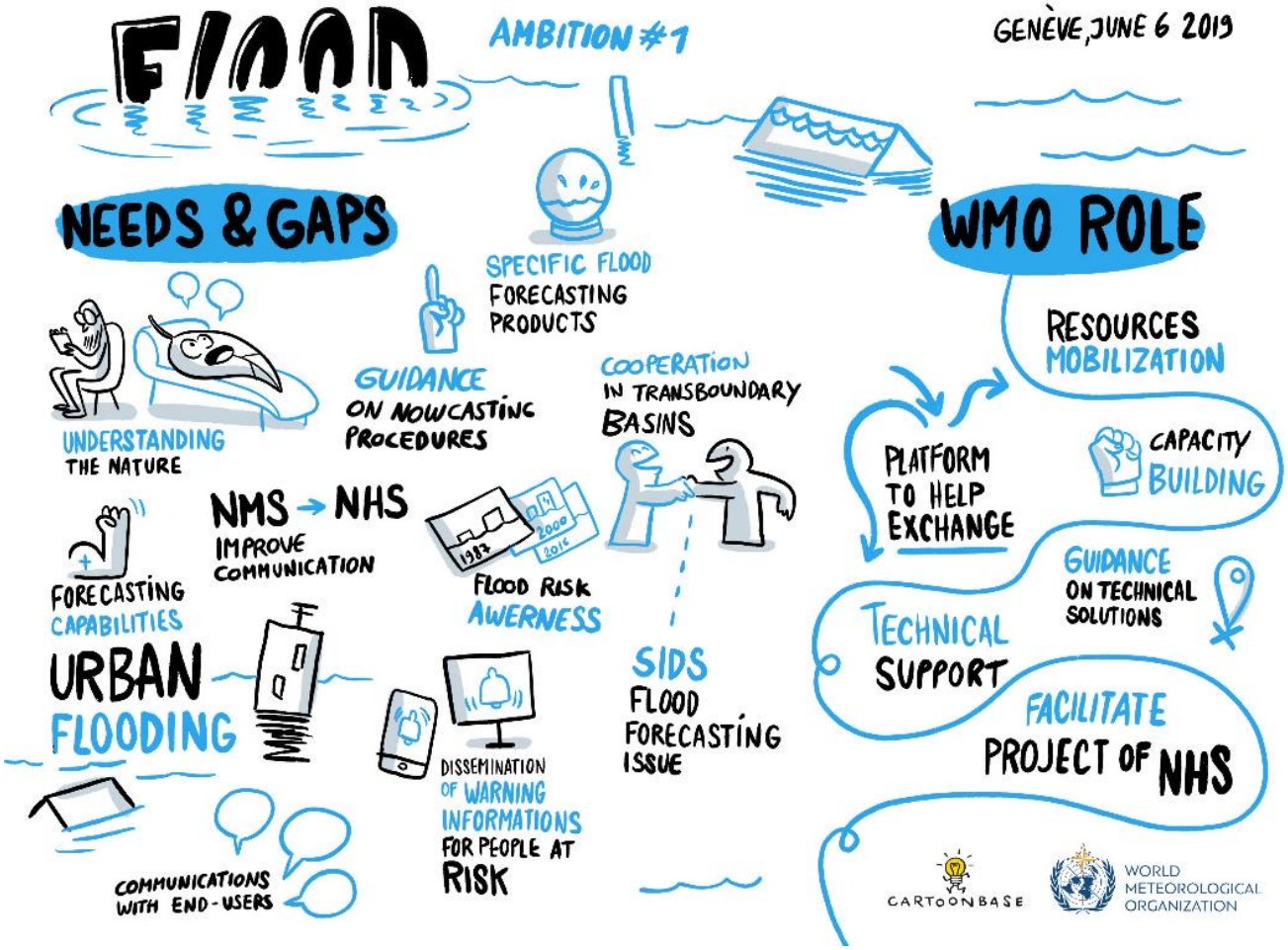
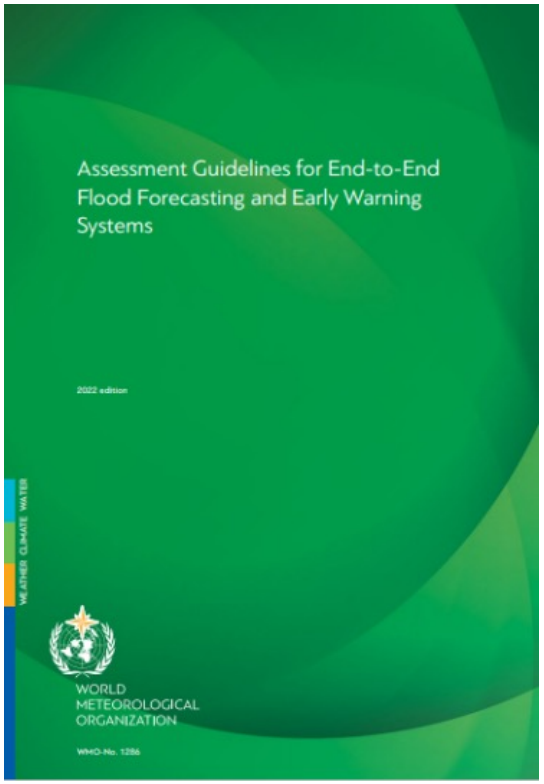
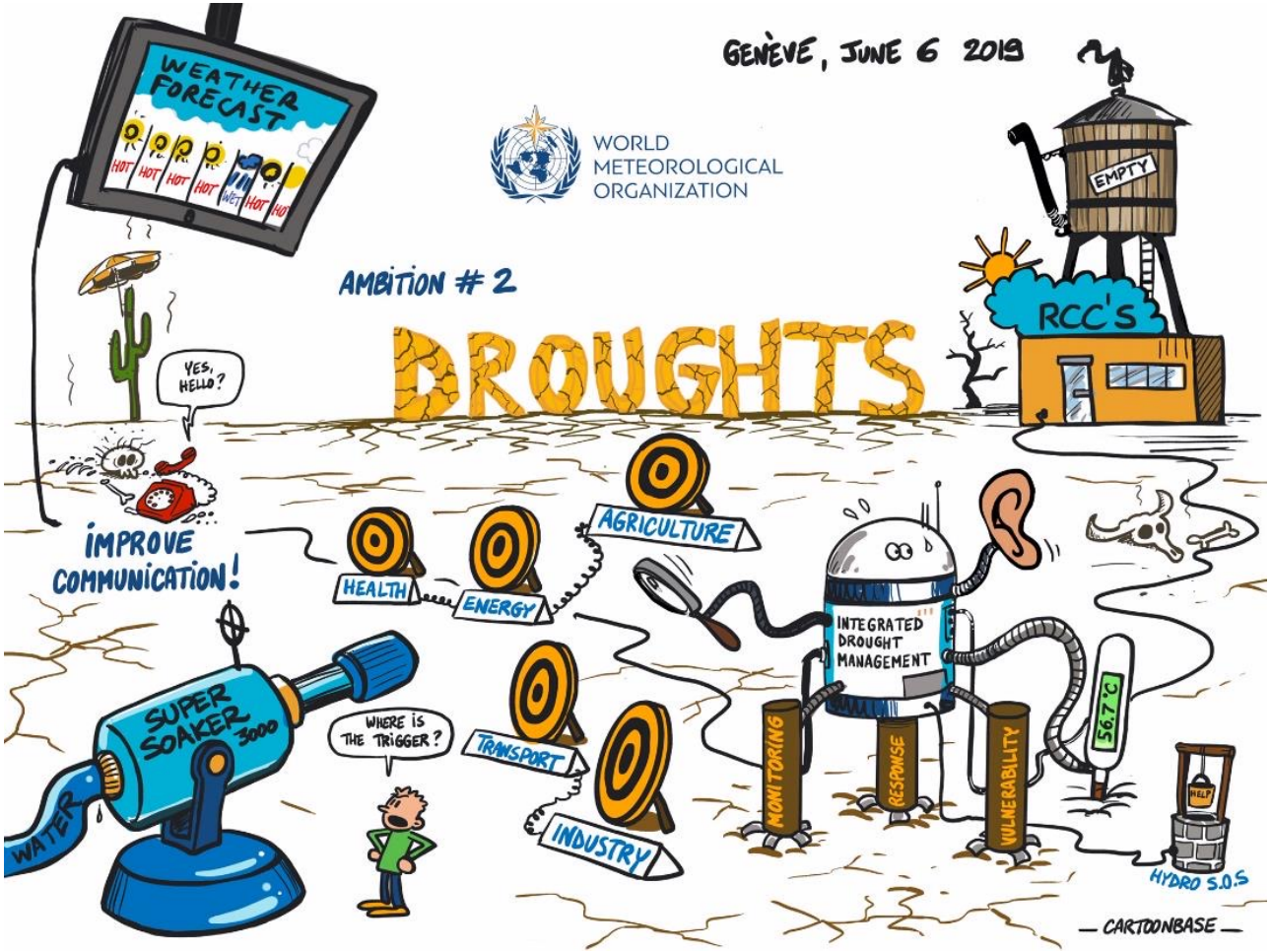
1. No one is surprised by a flood





2. Everyone is prepared for drought



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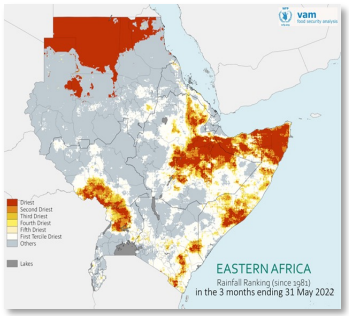
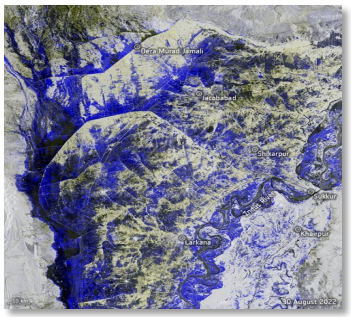
5 top high impact events in 2022

1



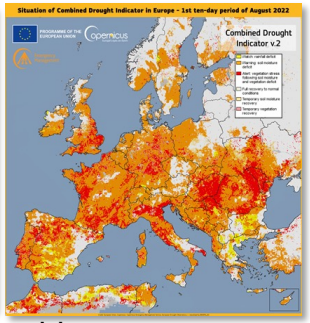
Drought in Greater Horn of Africa

2



Floods in Pakistan

3

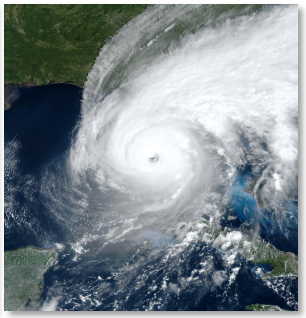


Heat, drought and wildfire - Europe

4

Heat and drought - China:

5



Hurricane Ian USA, Cuba

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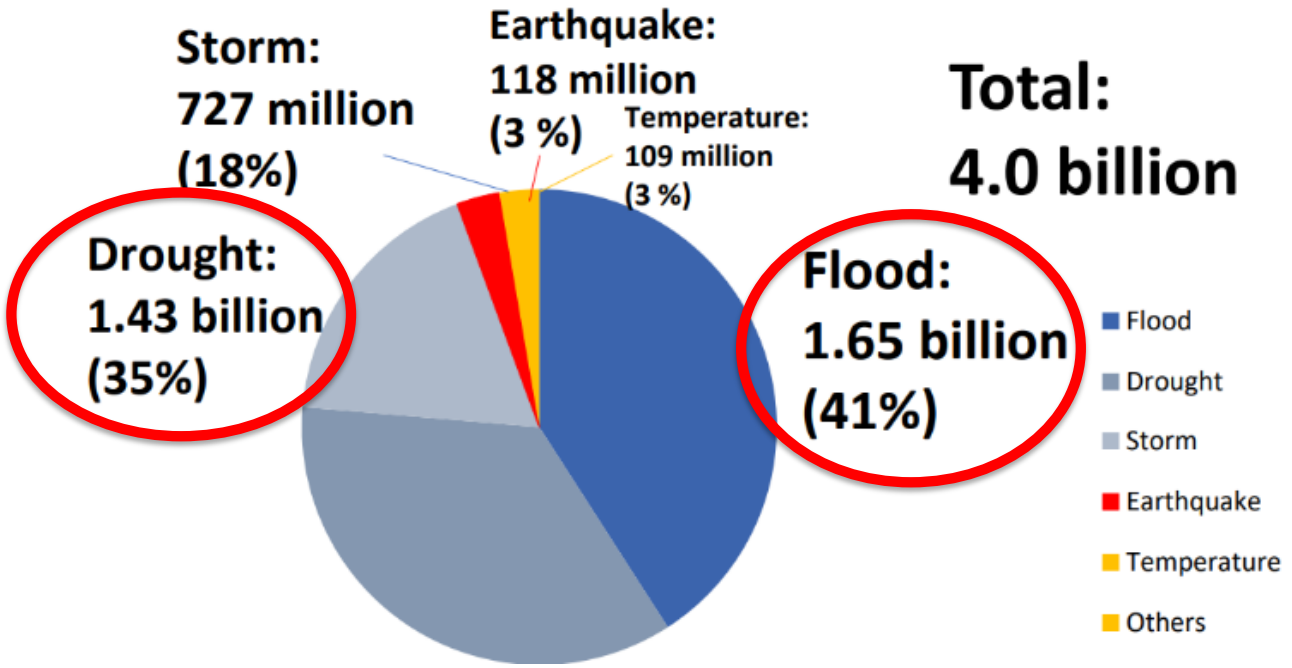
Number of people affected by disasters (2000-2019)



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Courtesy: Kenzo Hiroki, 2022

WMO Resolution 25 (CG-18) in 2019

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5. Science provides a sound basis for operational hydrology

Enable the conduct of science that advances the implementation of the hydro research agenda

The Hydrology Research Strategy

Purpose: To accelerate research that improves the delivery and use of hydrologic data, information, and services and responds directly to the needs of National Hydrological and Meteorological Service providers – particularly in low-resource settings.

Objectives:

Generate hydrologic and cryospheric information to better assess and manage of water resources

Increase access to hydrometeorological data that can inform decision making

Improve hydrological forecasting

Photos :
- Georgian Hydrometeorological Department (NMHS)
- Junior A. Mathurin, Water Resources Management Agency - St.Lucia
- Photo: Kari Norwegianwoman/NVE - Licensing: CC BY-SA 4.0

WMO Hydrological Research Strategy 2022-2030

1. Improve **hydrological monitoring** to enhance understanding and assessments
    1. Data collection
    2. Design and evaluation of monitoring networks

2. Improve **hydrological forecasting**
    1. Hydro/cryosphere modelling and forecasting
    2. Precipitation estimation and forecasting
    3. Understanding and predicting hydrological extremes
    4. Human-water-ecosystem interactions

3. Methods, procedures for **collection/analysis/ communication of data** to users
    1. Data processing and quality control
    2. Data storage, access and dissemination
    3. Communication

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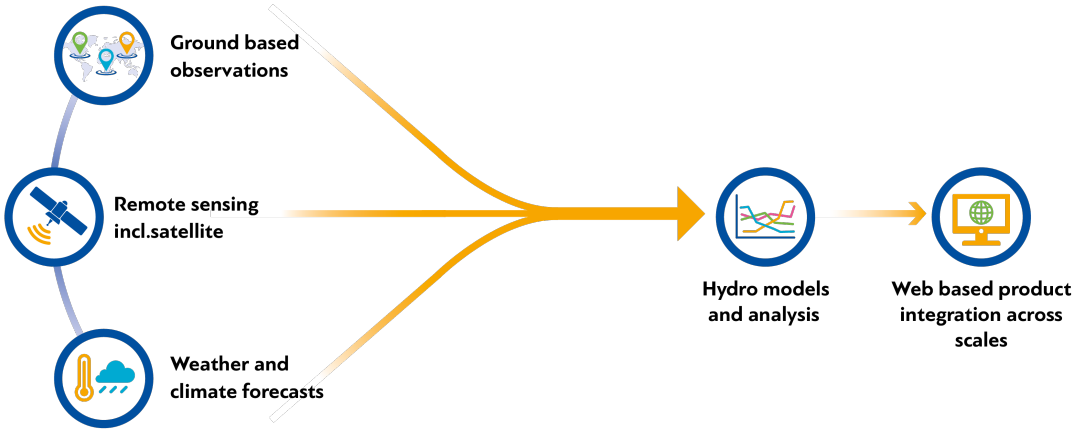
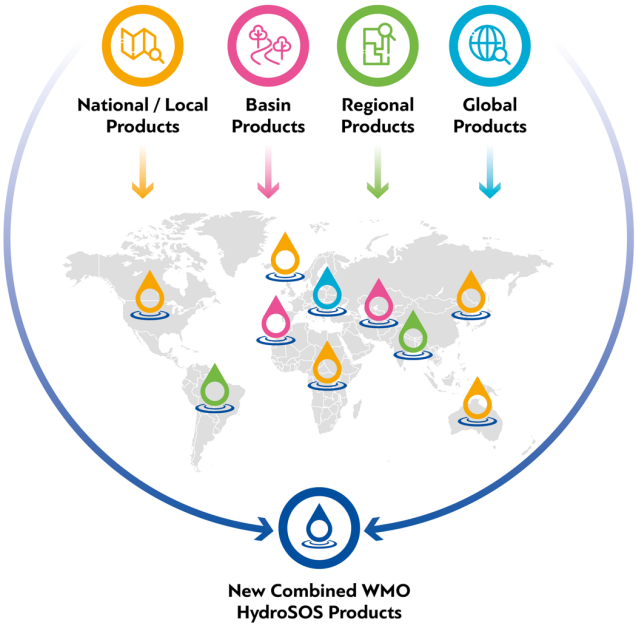
Vision of HydroSOS:
From Data to Information to Decision and Policy Support





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Globally consistent and accessible water information across scales:
basin, national, regional and global scales

What will HydroSOS provide?

An overview of the current global hydrological status

An appraisal of where the current status is significantly different from 'normal'

An assessment of whether this is likely to get better or worse

Current Status and Seasonal to Sub-seasonal Forecasts

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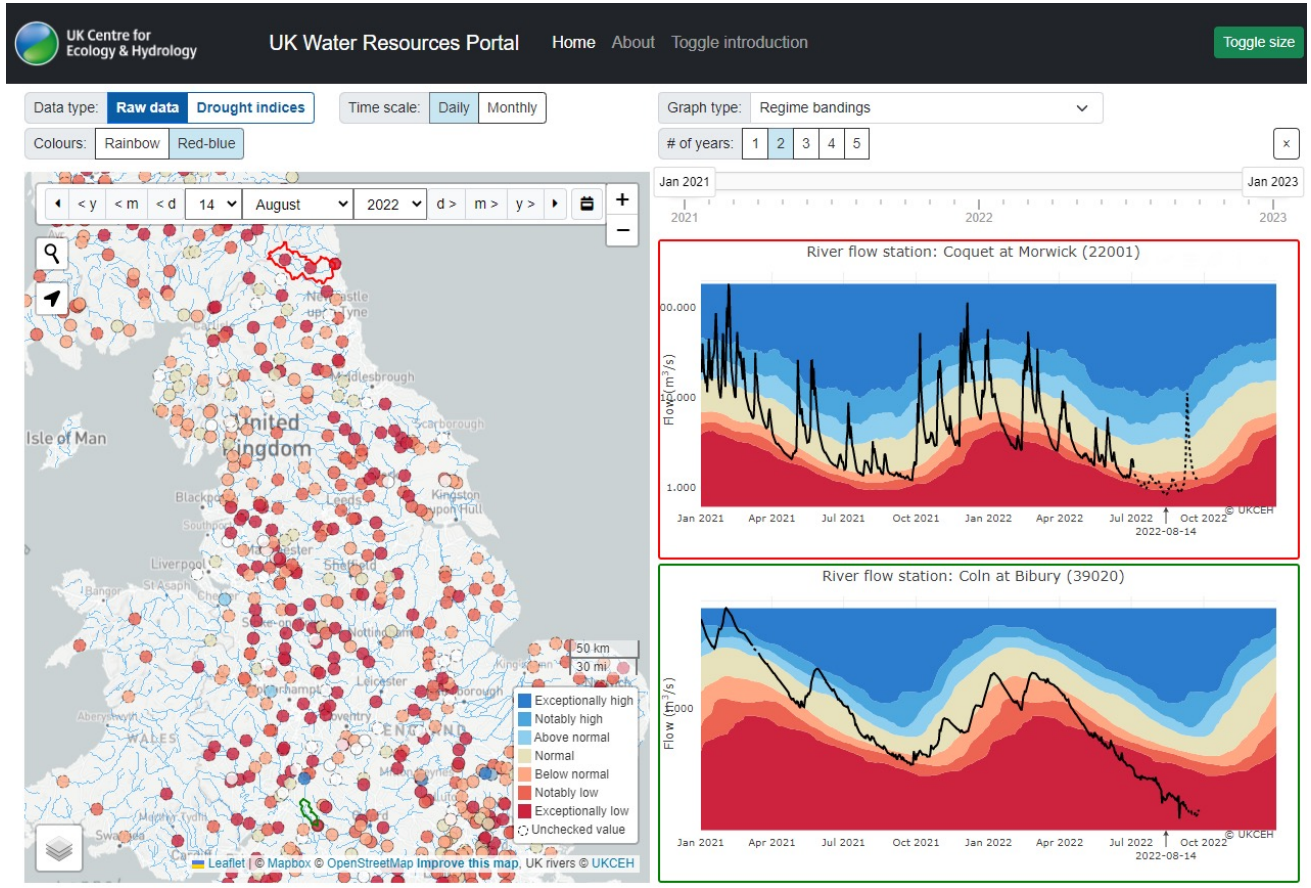
Example Products: Hydrological Status



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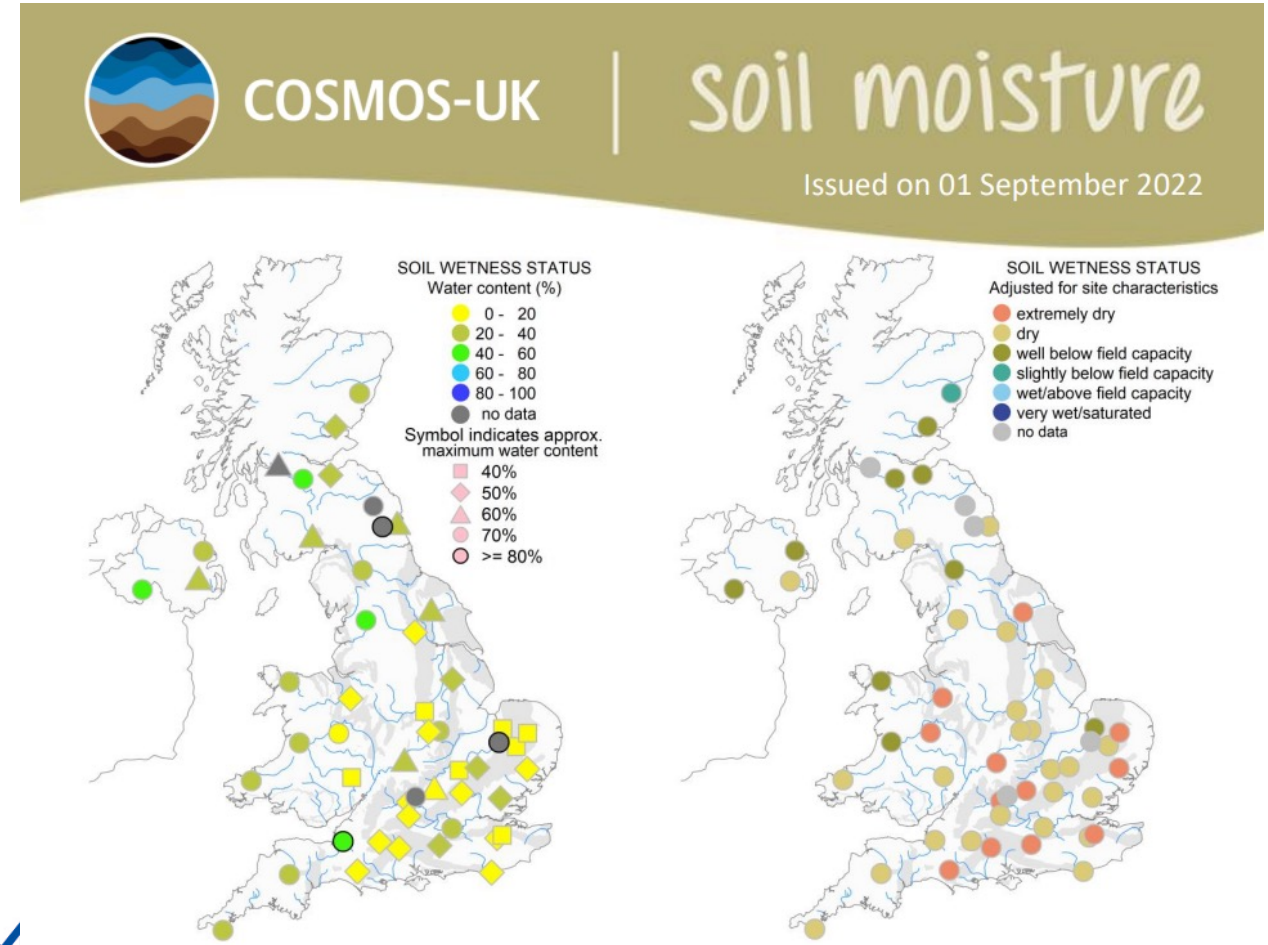
https://eip.ceh.ac.uk/hydrology/water-resources/

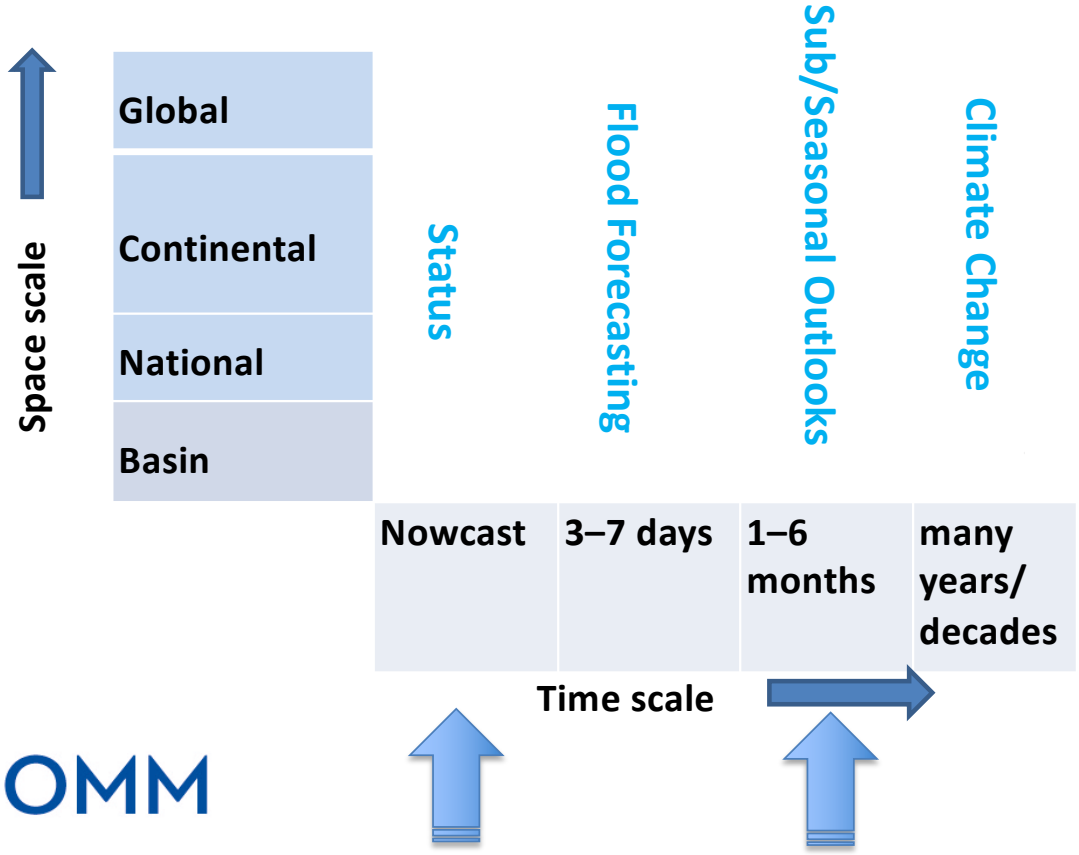
Courtesy: Alan Jenkins, CEH, Oct 2022

Example Products: Soil Moisture Status



Courtesy:
Alan Jenkins, CEH,
Oct 2022

Hydroclimate services across various scales



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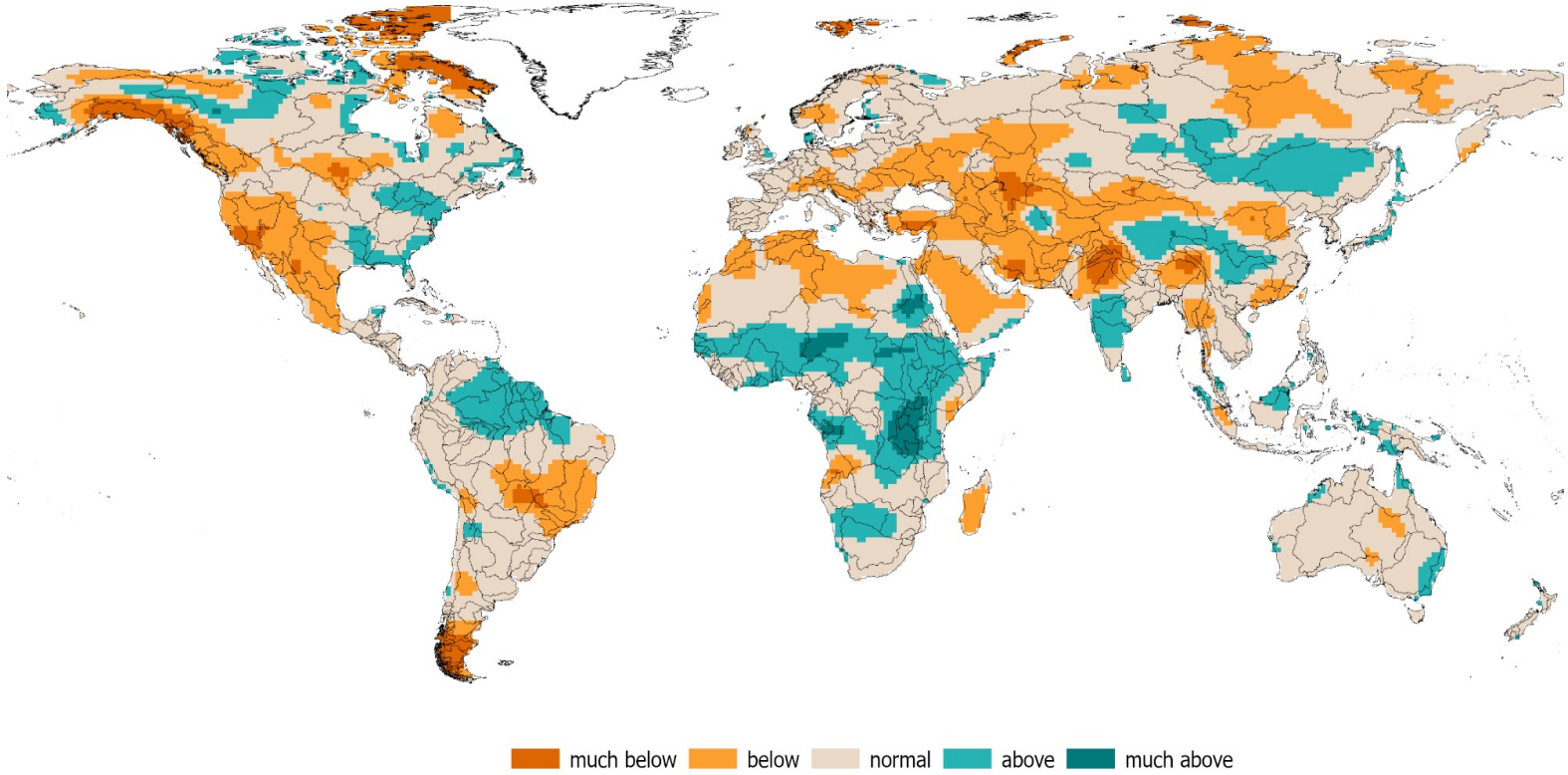
Example global outputs 1st Annual State of Water Report (WMO, 2022)

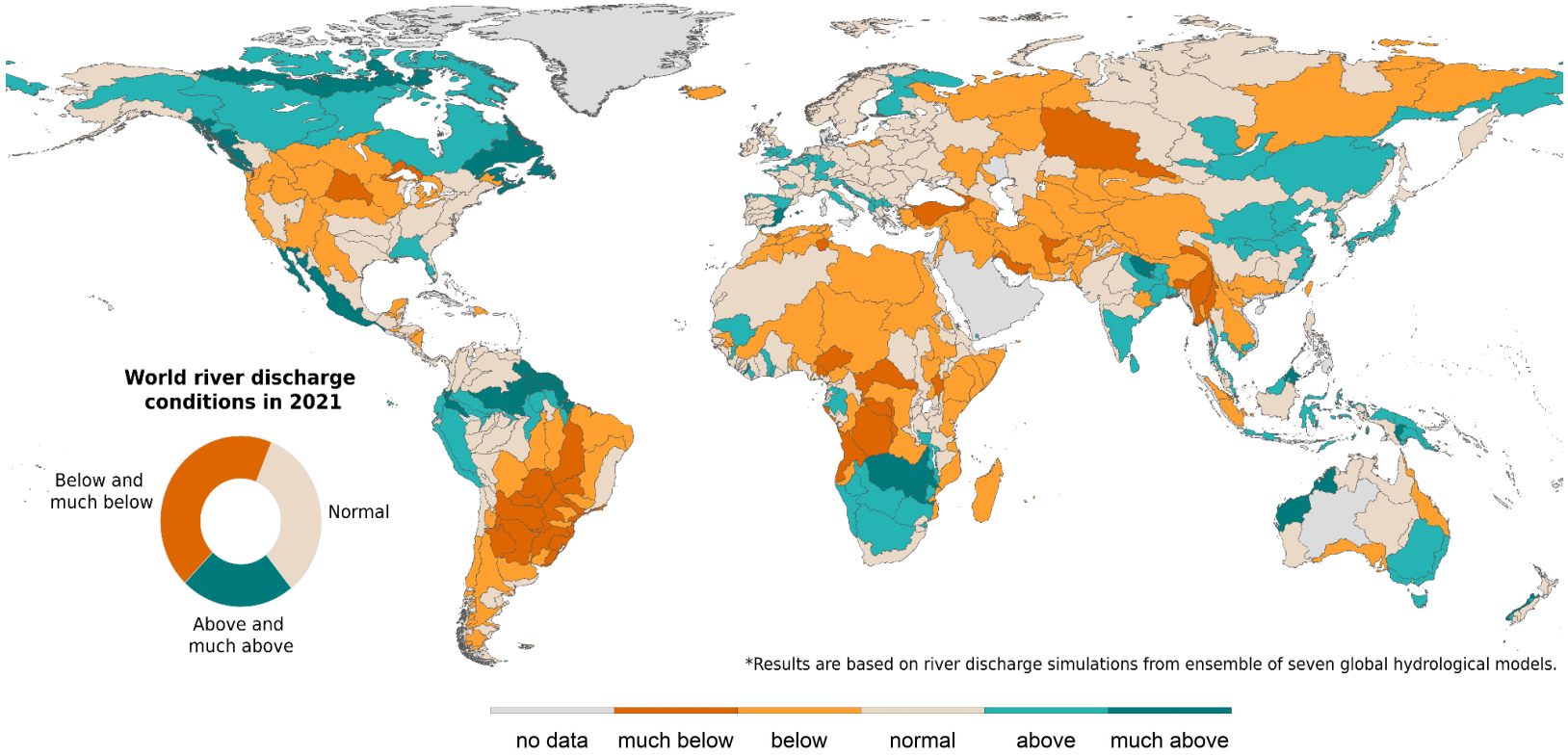


TWS in 2021 ranked with respect to the historic period (2002-2020)

Data source: GFZ, 2022

Example global long term outputs 1st Annual State of Water Report

(WMO, 2022)



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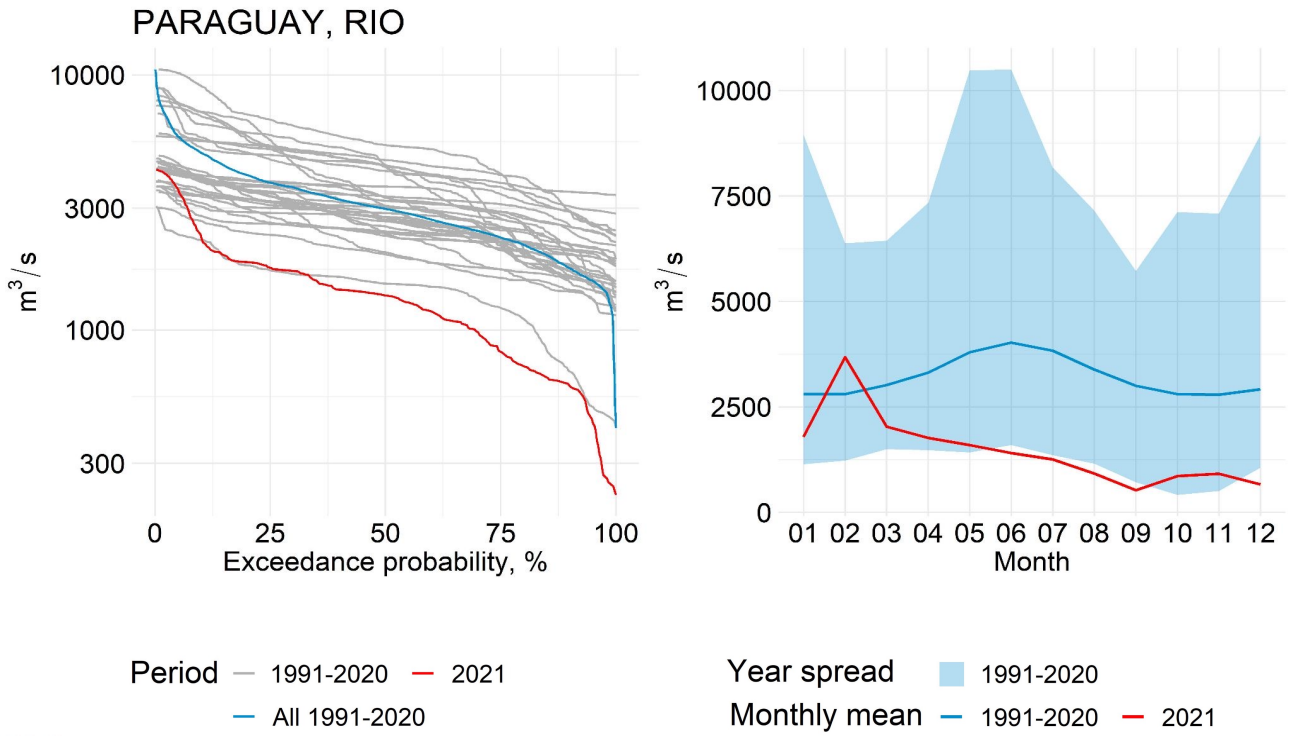
Streamflow in 2021 w.r.t. the hydrological normal for 515 basins

(calculated based on 30 years historic data, 1991-2020)

Streamflow Trends 2021 – Country Examples

Example: Paraguay



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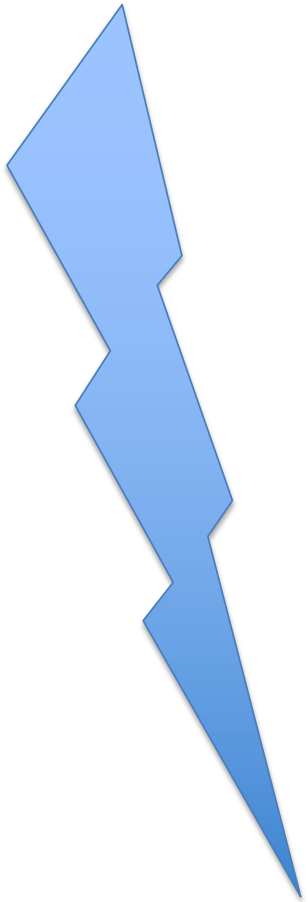

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A generation lost or found?
Picture: Carl Ganter, Circle of Blue, 2022