Overview of the State of Water resources at a global scale under changing climate

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World Meteorological Organization (WMO)

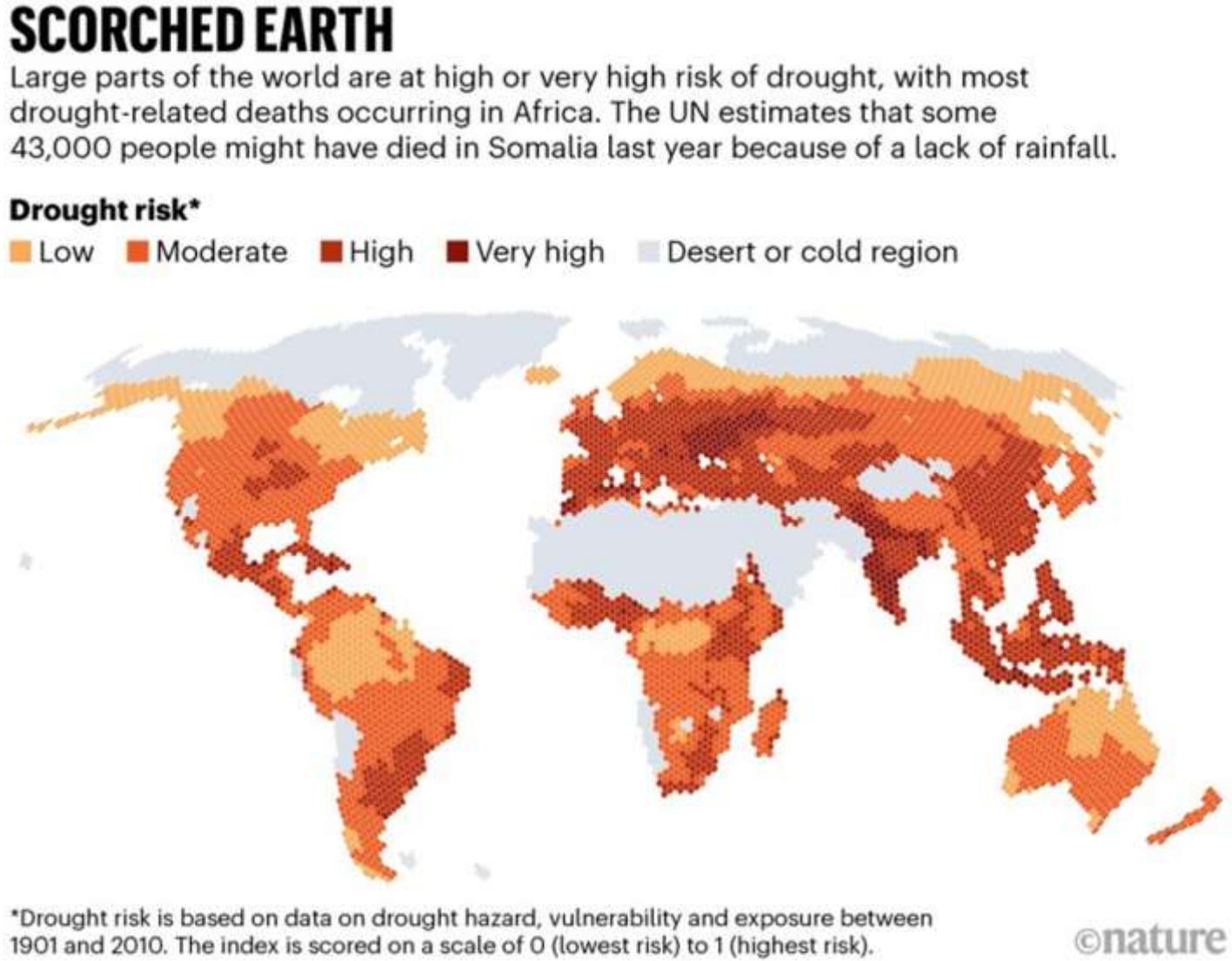
Strategic Roundtable on Increasing Resilience to Climate Change in the Water and Sanitation Sector
13 – 14 November 2023 | Geneva

Background – Drought Risk

Almost half of the global population live in areas that suffer from water scarcity for at least 1 month every year

World water development report 2018

The world faces a water crisis – Nature 2023



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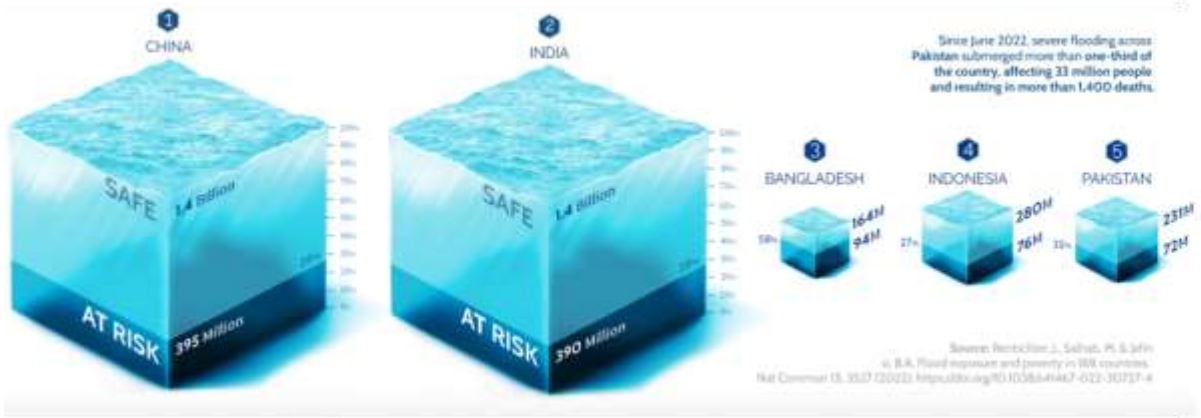
Background – Flood Risk

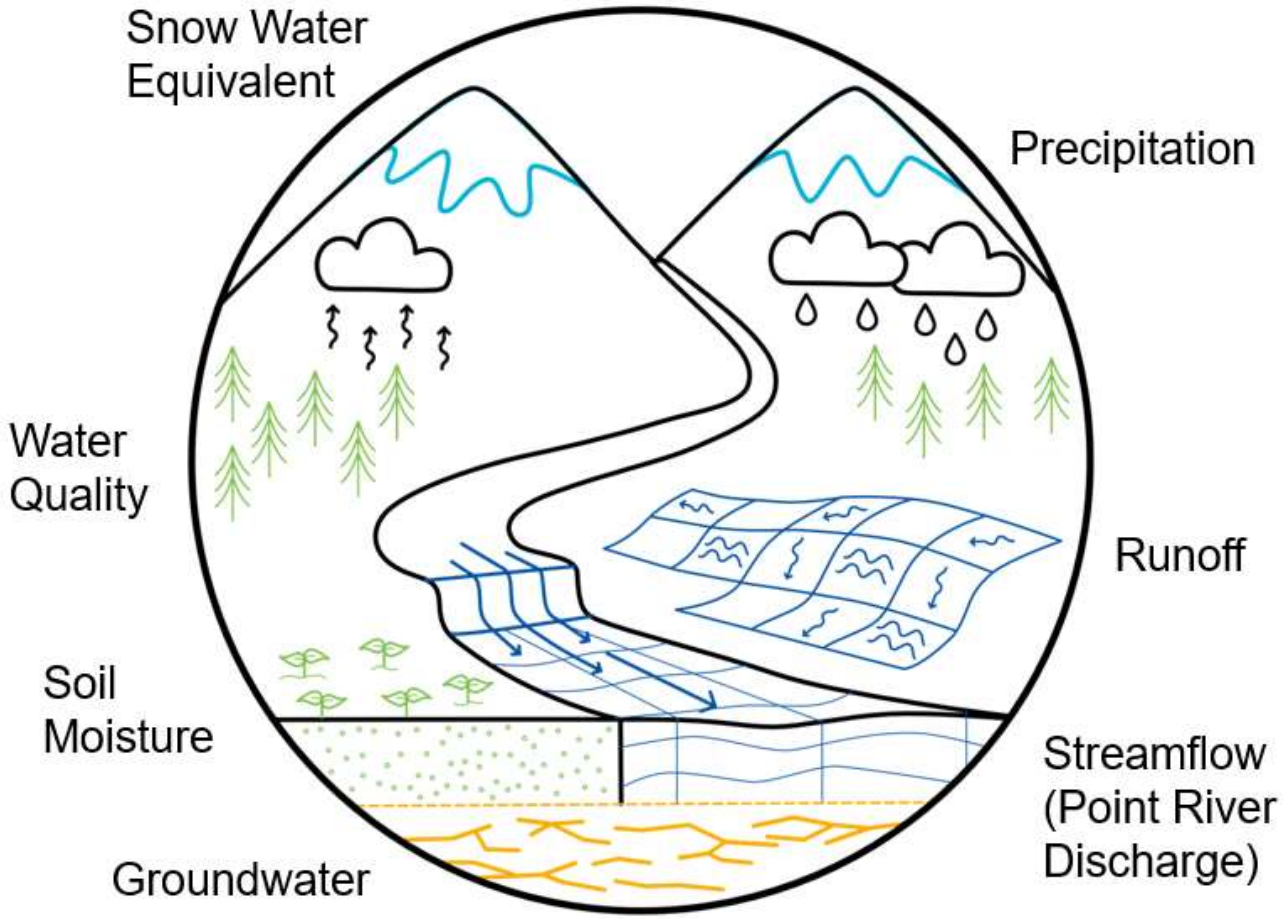
1.81bn people directly exposed to 1-in-100 year floods



Nature Communications 2022
plotted by "visual capitalist"

Key messages

- The State of the Global Hydrological cycle is **changing rapidly** due to various factors
- We need to **monitor** and **assess** these changes and patterns to be able to plan our resources and adapt better
- Monitoring is **crucial** for Early Warnings for All



The State of Global Water Resources 2022

- **Quantitative assessment** of global water resources in the last year
- Status of **data availability and data sharing** at a global scale
- **Innovative methodology** to overcome the gaps in available observations
- **19 contributing institutions** (academia, research institutes, private sector, and more)

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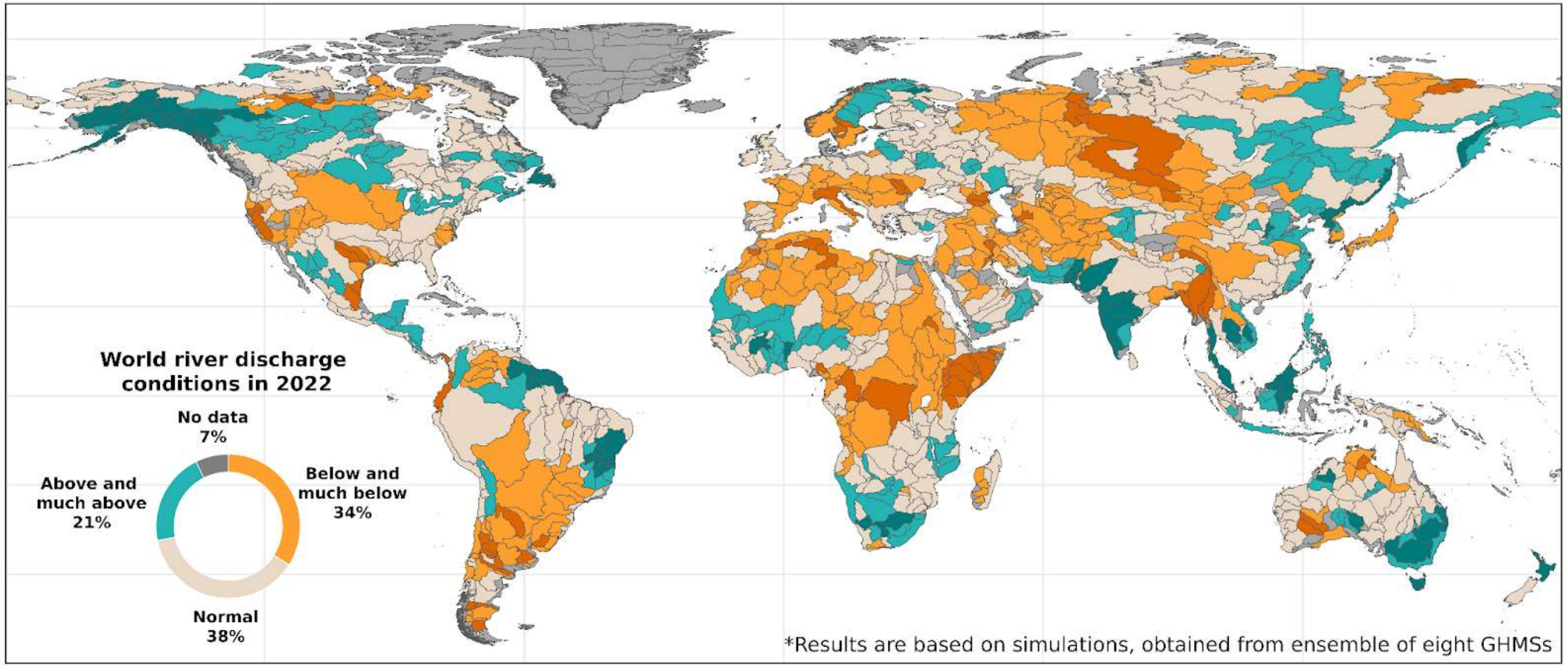
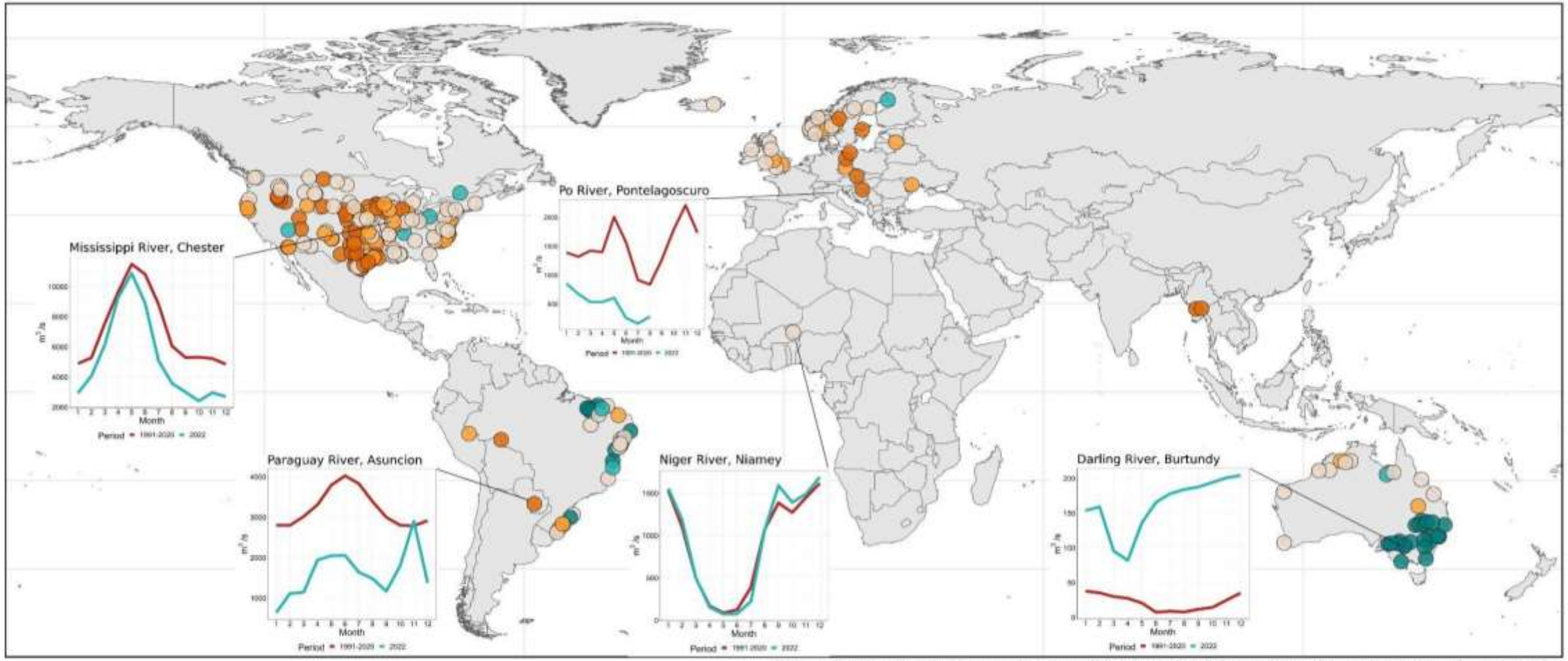
River discharge status 2022



River discharge in 2022 w.r.t. the hydrological normal for each basin
(calculated based on 30 years historic data, 1991-2020)

River discharge status 2022 (based on in-situ data)



*Results for the UK are not quality-checked from October to December 2022.

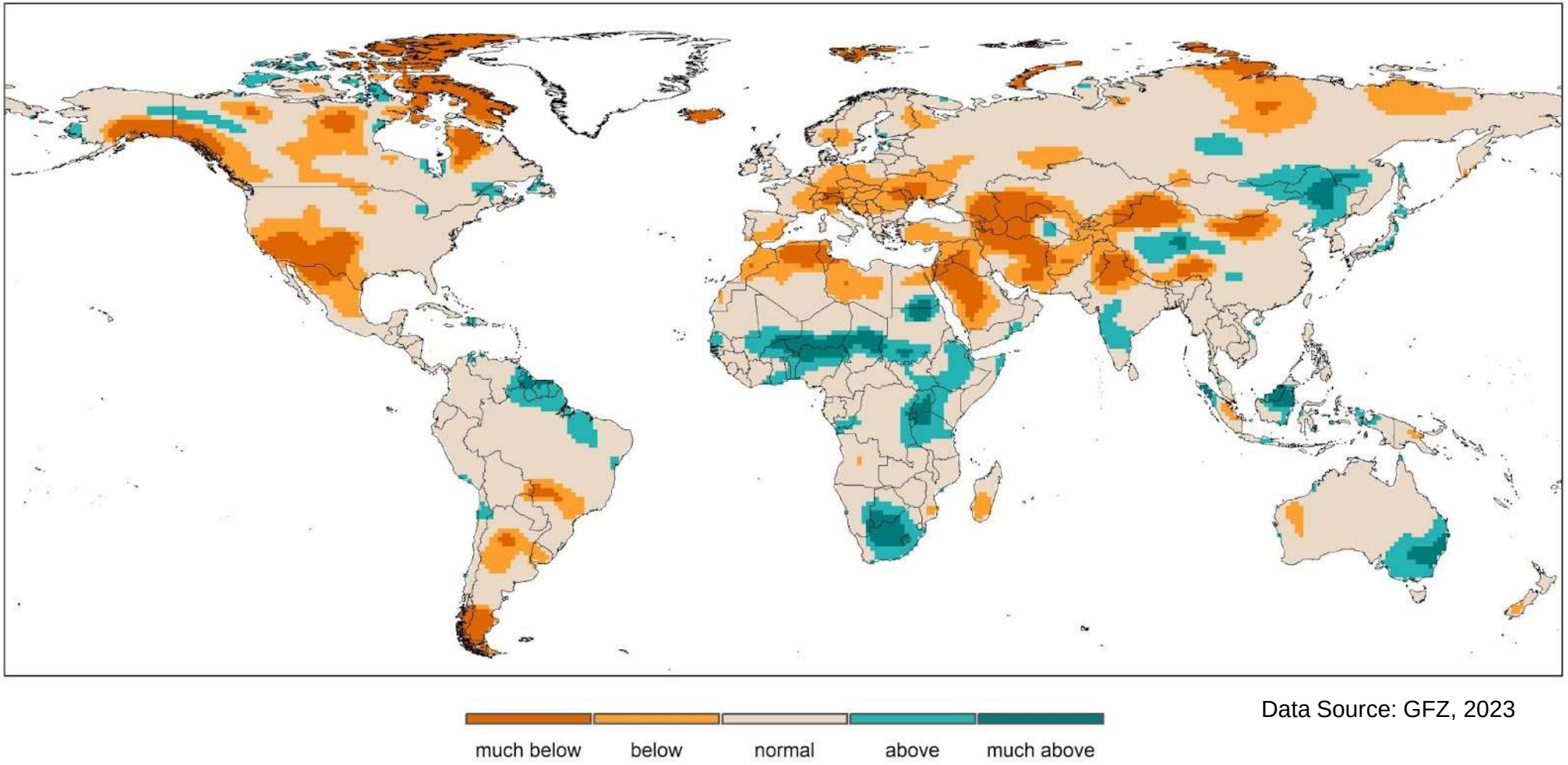
much below | below | normal | above | much above

River discharge in 2022 w.r.t. the hydrological normal for each basin

(calculated based on at least 20 years historic data, 2001-2020)

Status of Total Terrestrial Water Storage in 2022

TWS = ∑ Groundwater, Soil Moisture, Rivers, Lakes, Reservoirs, Snow & ice storage etc.

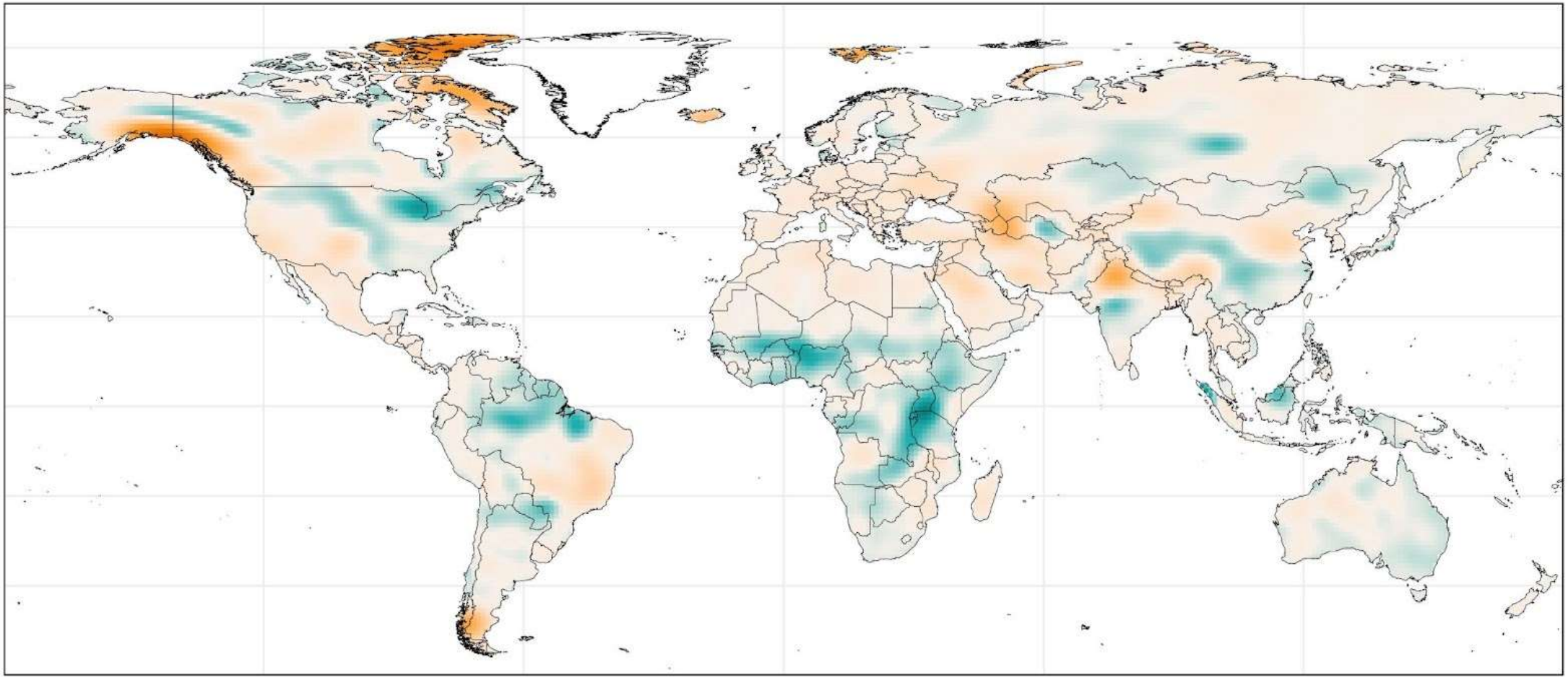


Data Source: GFZ, 2023

TWS in 2022 w.r.t. the historic normal (2002-2020)

Trends in Total Terrestrial Water Storage

TWS = ∑ Groundwater, Soil Moisture, Rivers, Lakes, Reservoirs, Snow & ice storage etc.

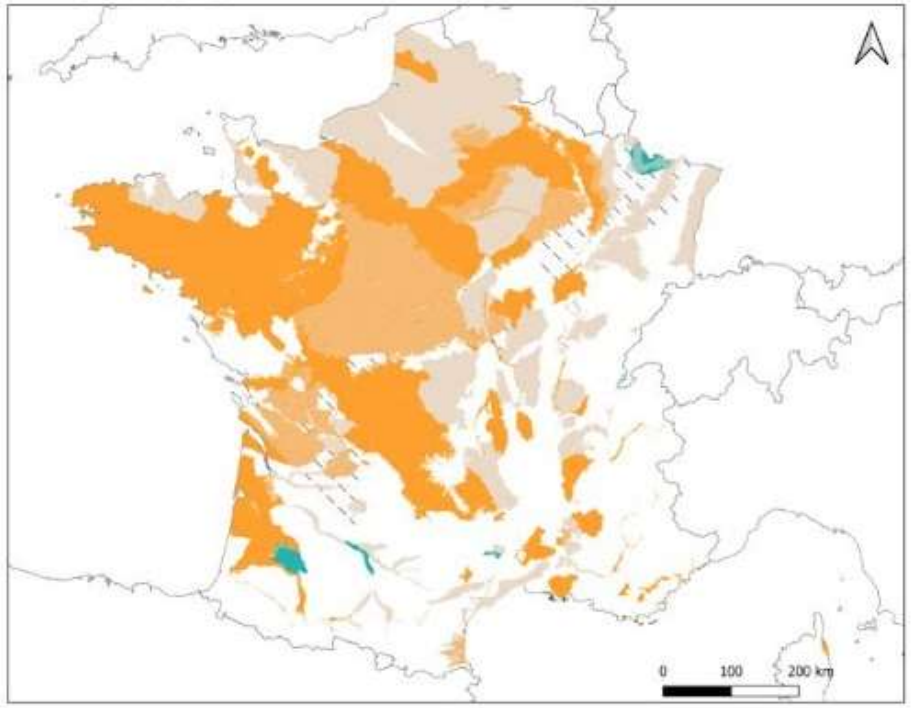


Data Source: GFZ, 2023

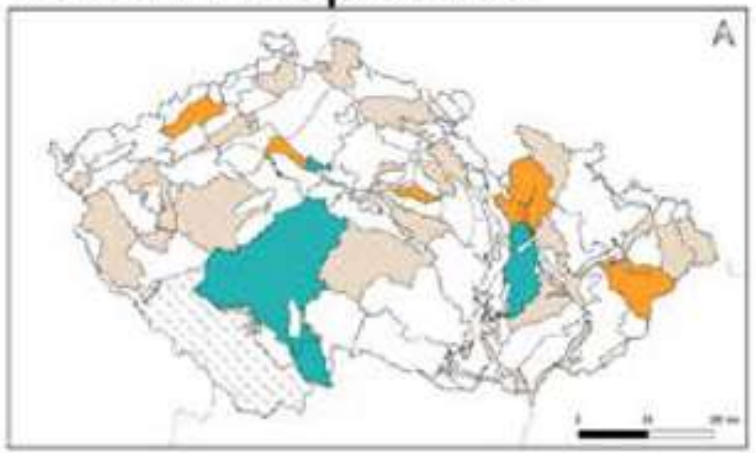
TWS change between 2002 - 2022

Groundwater status in 2022

France



Czech Republic

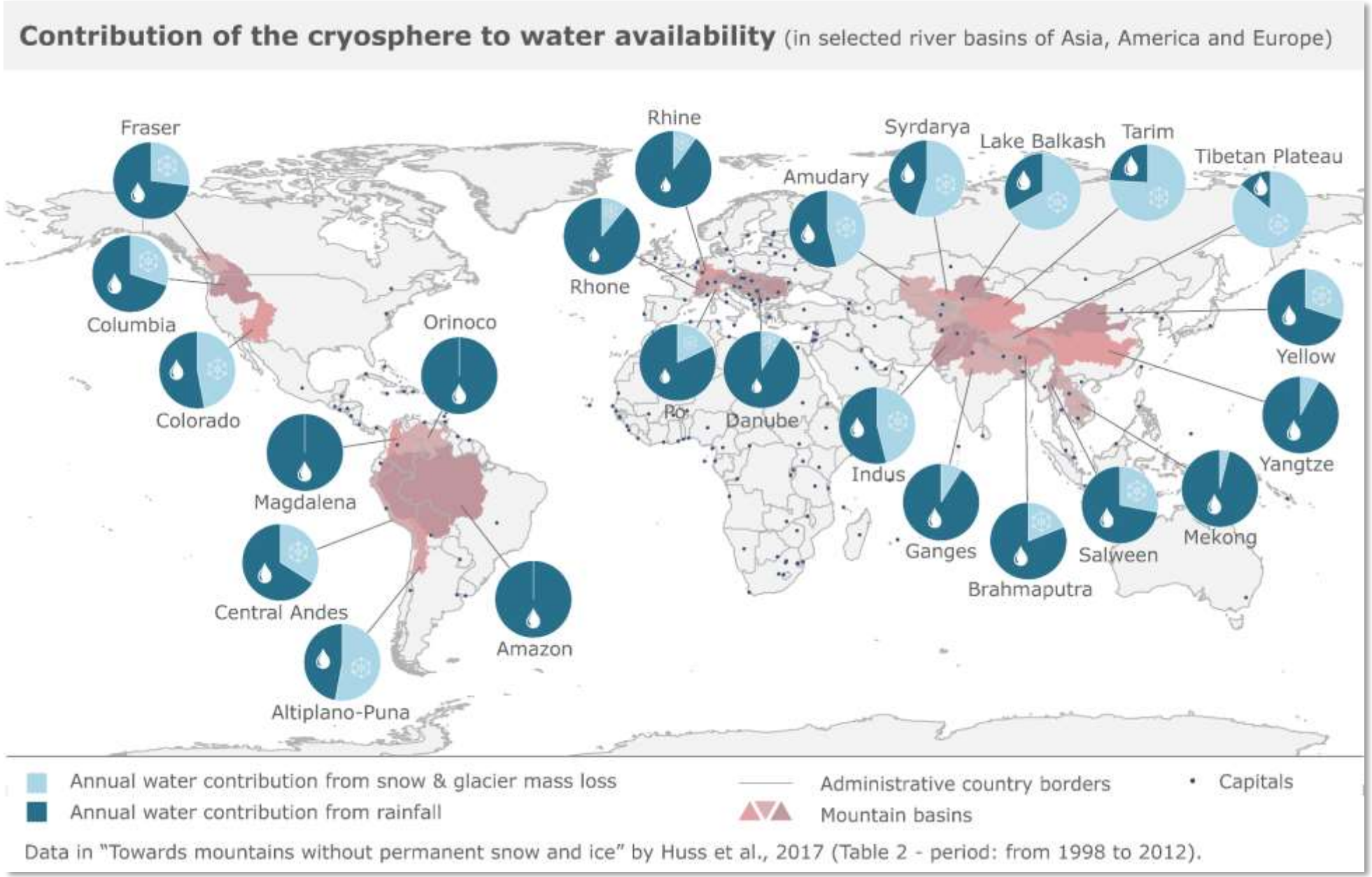


Based on in situ data – Historic period: 2013-2020

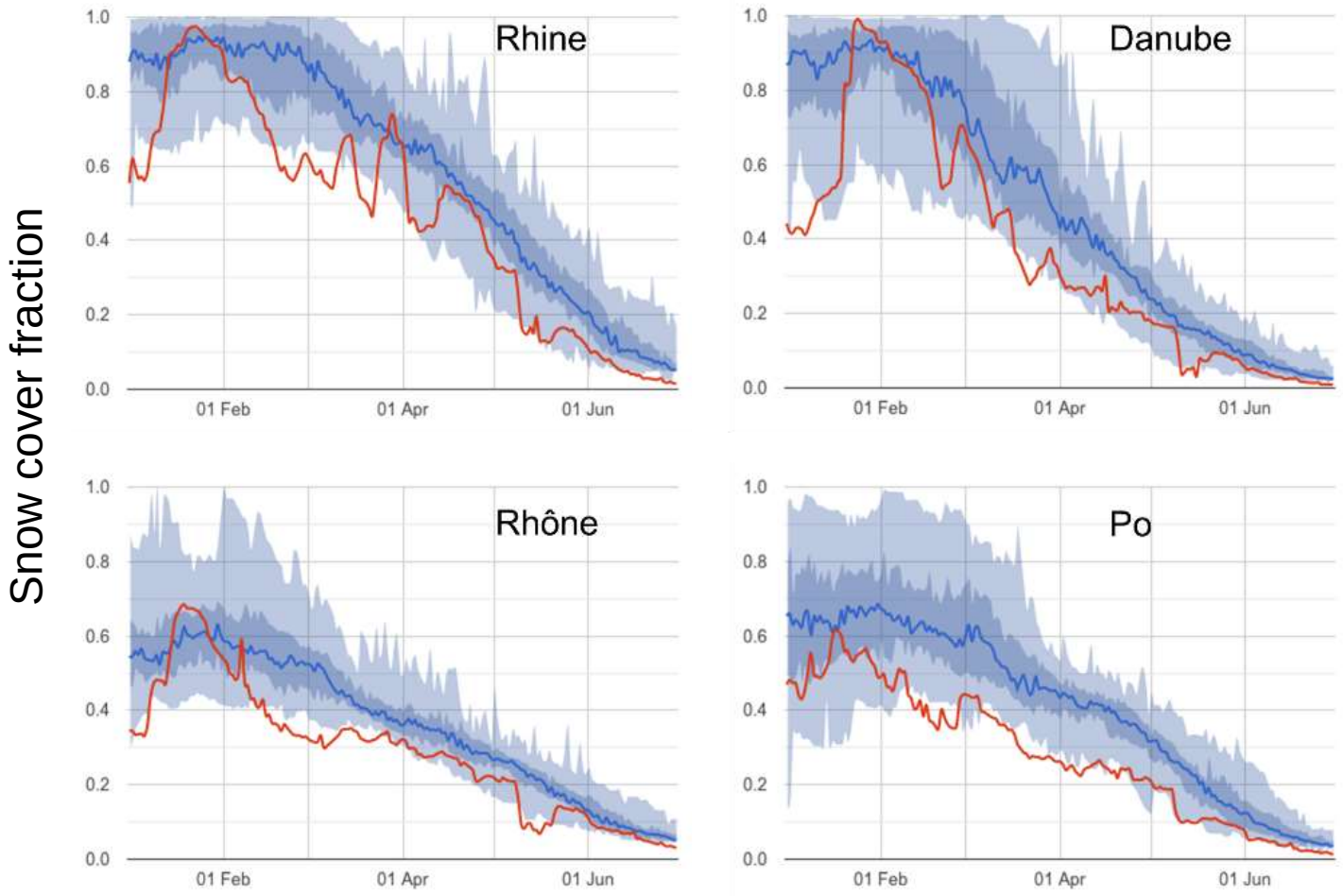
Groundwater Level Rank
- Above normal
- Normal
- Below normal
- Insufficient data points
- No data points available or selected

Source: IGRAC, 2023

Importance of Cryosphere for downstream hydrology

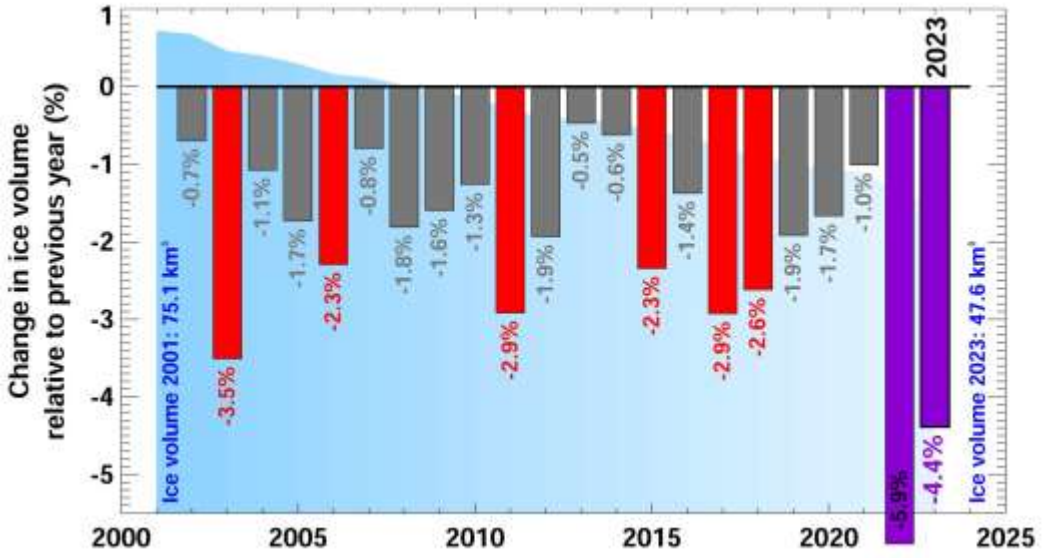


Case Studies: Europe - Snow cover and Glaciers in 2022



Source: Centre d'études spatiales de la biosphère, France, 2023

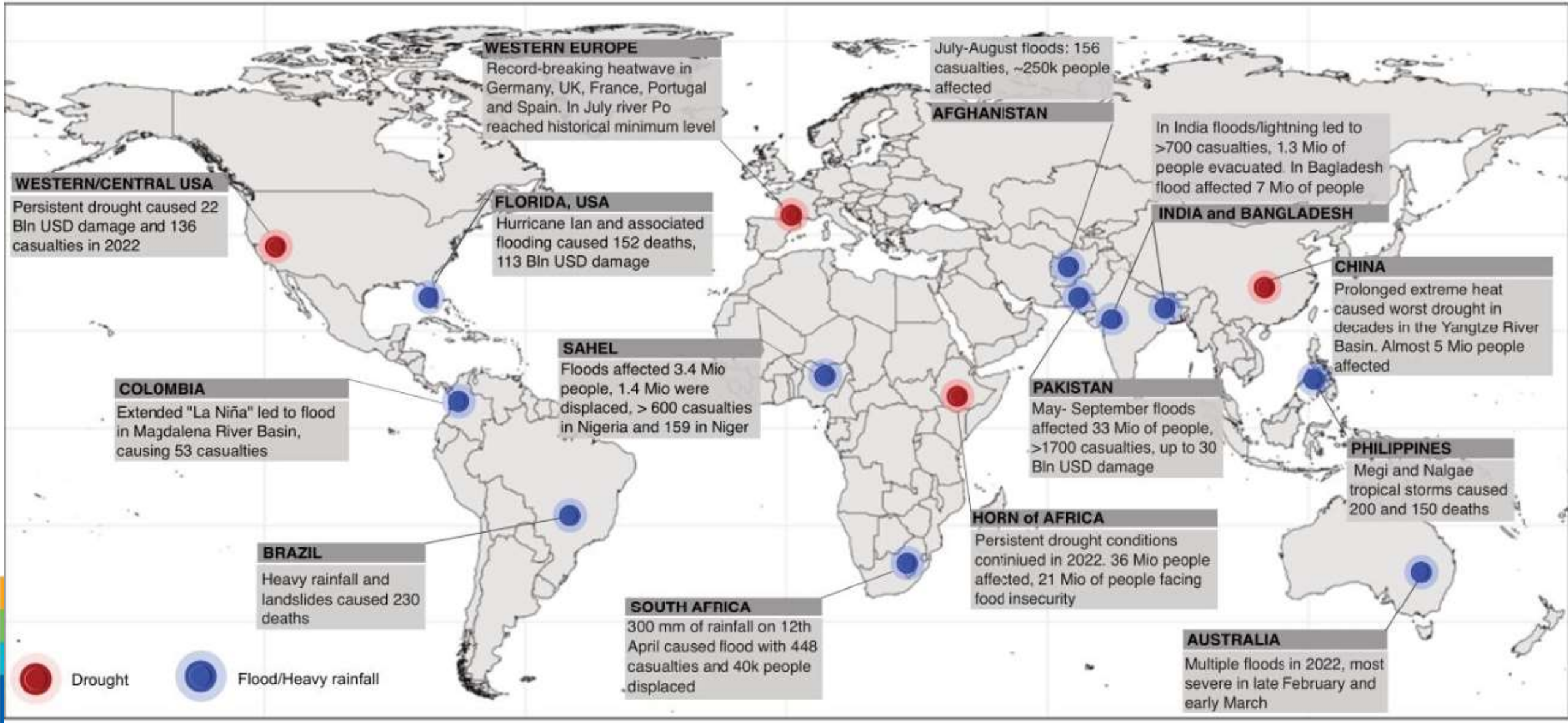
Historic snow cover fraction in each catchment, in comparison to 30 years climate average.



Switzerland loses 10% of ice volume in the last 2 years

Source: Swiss Commission for Cryosphere observation, 2023

Selected High Impact Hydrological Events in 2022



Sources: WMO Global State of the Climate Report 2022, EM-DAT, 2023; World Bank; ReliefWeb and others

Hydrological Status and Outlook System (HydroSOS)

An overview of the current hydrological status

including groundwater, river flow and soil moisture

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

For example indicating drought and flood susceptibility

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

over coming weeks and months

Added value of these products

- Potential of creating easy to understand **global overview and graphical summaries** of different hydrological variables (river flow, groundwater, TWS, etc.) at a global scale (standardized, consistent, authoritative)

- Such **independent assessments** of the state of global water resources that can to:

1. Help in **identification of hotspots** at a global scale to inform planning and policy making
2. Enable **inter-annual comparisons** to differentiate short-term effects from long-term trends in the factors driving water distribution patterns
3. **Inform and guide inter-governmental** discussions related to (shared) water resources

Collaborative process

GFZ Helmholtz Centre Potsdam

Universiteit Utrecht

JAXA

NASA

Nanjing University of Information Science & Technology 1960

Institute of Industrial Science · The University of Tokyo

SMHI

ECMWF

Deltares

SENCKENBERG world of biodiversity

igrac International Groundwater Resources Assessment Centre

GWF Global Water Futures

DHI

University of Saskatchewan

BYU Civil & Construction Engineering

GRDC

JG|U Johannes Gutenberg Universität Mainz

ISMN

UFZ Helmholtz Centre for Environmental Research

WMO IMO-WMO

Thank you!

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Thank you

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ORGANIZATION

Future Developments

- Future reports to include more in-situ data, and contribution from Members including soil moisture, snow cover and reservoir inflow
- Additional streamflow data – Members are encouraged to suggest gauge locations based on available data
- Strengthen Earth System approach and analyze the relative changes in the various components in the water cycle (also at regional scales)
- Regional State of Water Resources reports could be produced
- Operational HydroSOS to generate the Annual Global State of the Water report in the future