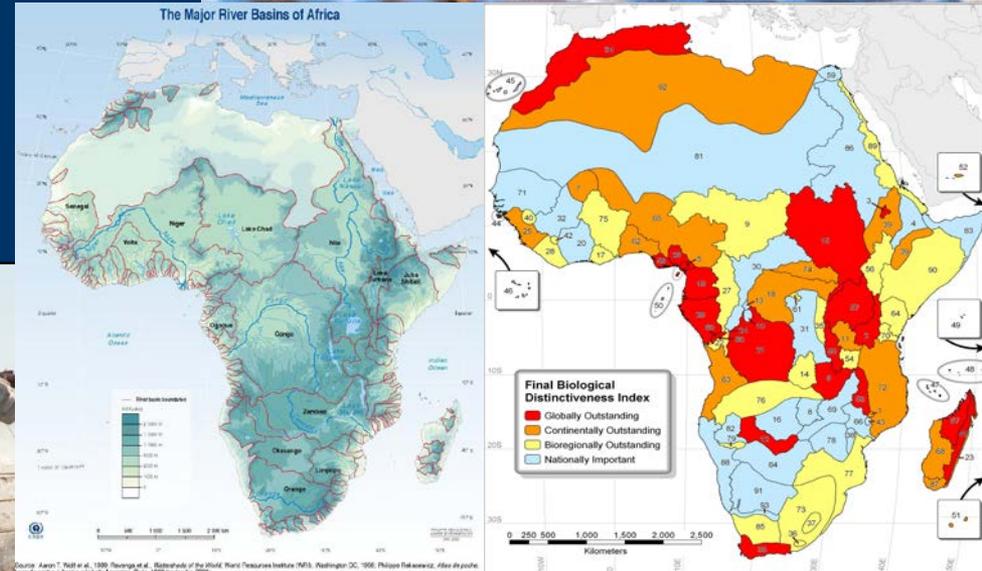


The effect of climate and global change on African water resources

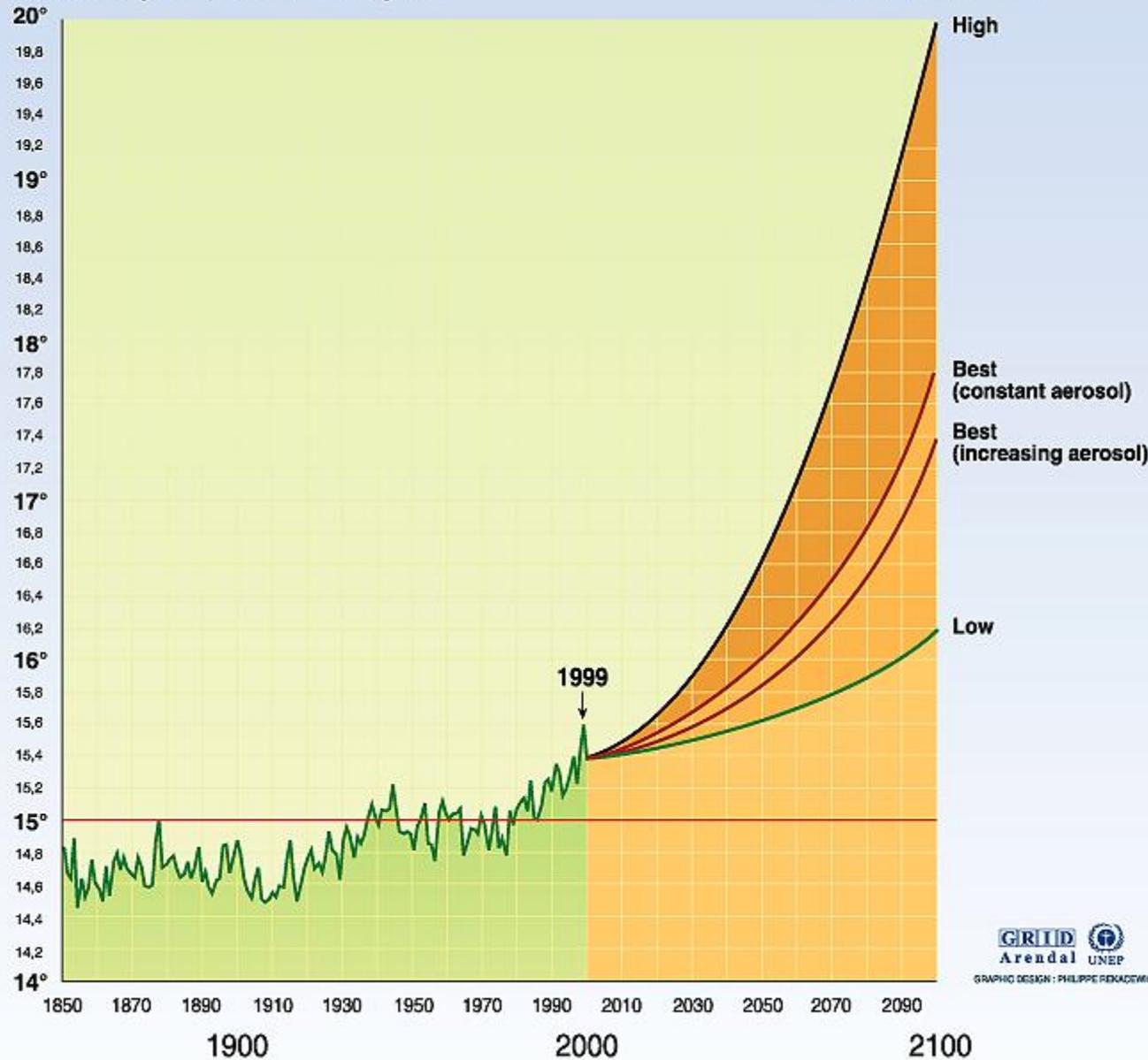


Bernhard Lehner

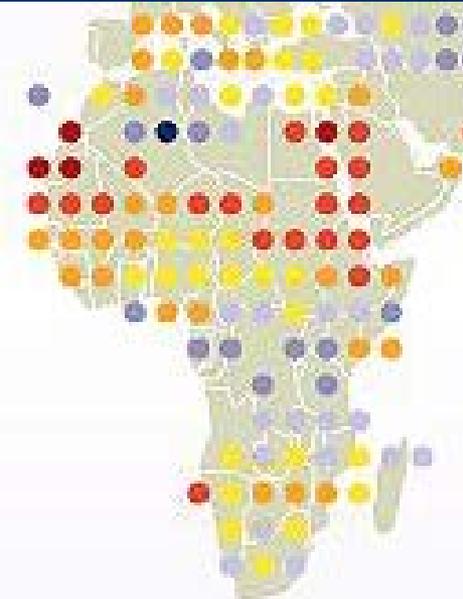
Conservation Science Program,
WWF-US

Projected changes in global temperature: global average 1856-1999 and projection estimates to 2100

Global average temperature in °centigrade



Precipitation



Precipitation decreasing by:

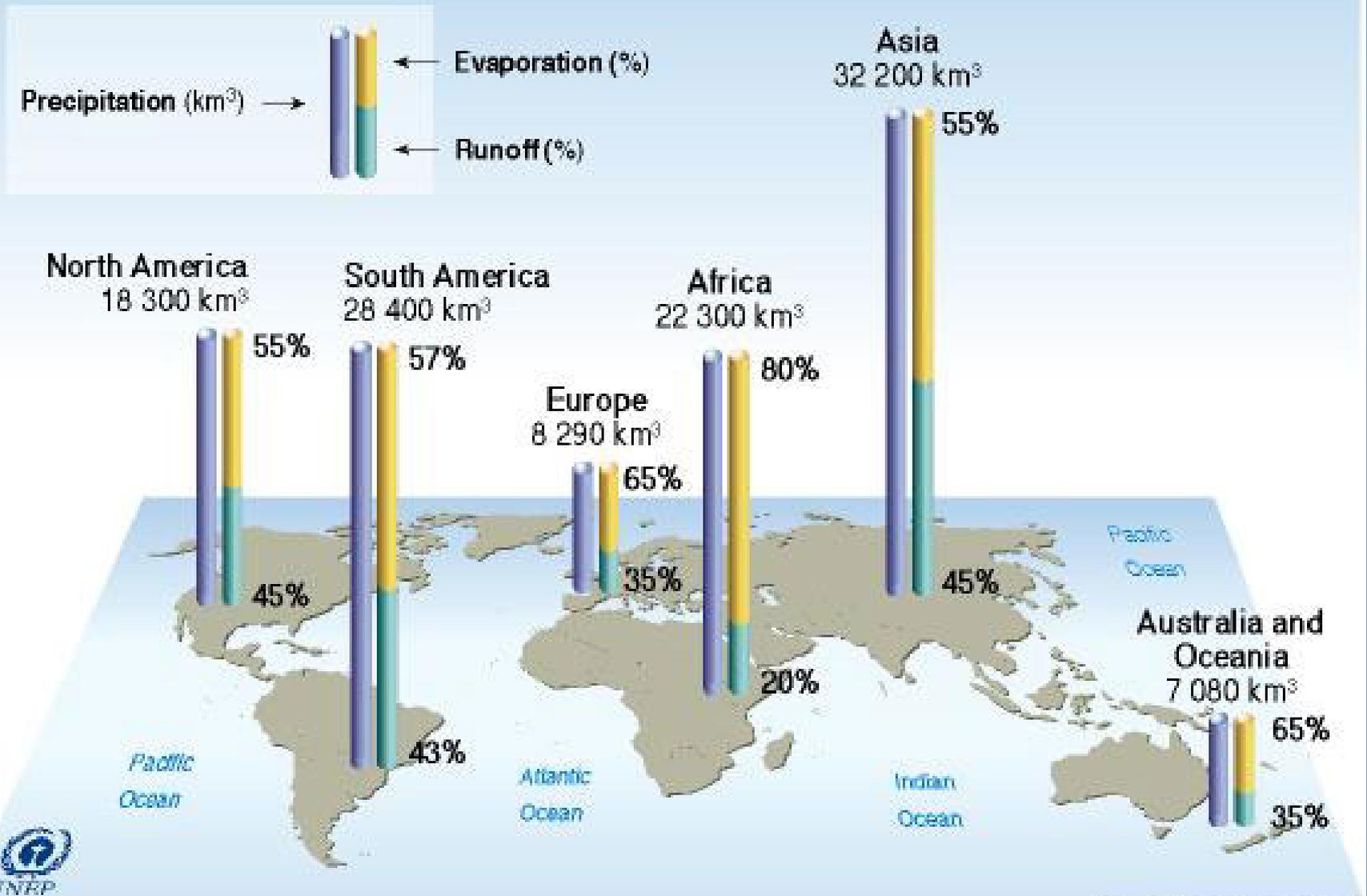
- 20 % ●
 - 10 % ●
 - 5 % ●
 - 2 % ●
- between 1900 and 1994

Precipitation increasing by:

- 2 % ●
 - 5 % ●
 - 10 % ●
 - 20 % ●
- between 1900 and 1994

The World's Surface Water

Precipitation, Evaporation and Runoff by Region



PHILIPPE REKACIEWICZ, MARCH 2002

WaterGAP 2

- Overview -

- Land Cover
- Climate
- ...

**Water
Availability**

Water Availability
• Runoff/Discharge

Water Stress

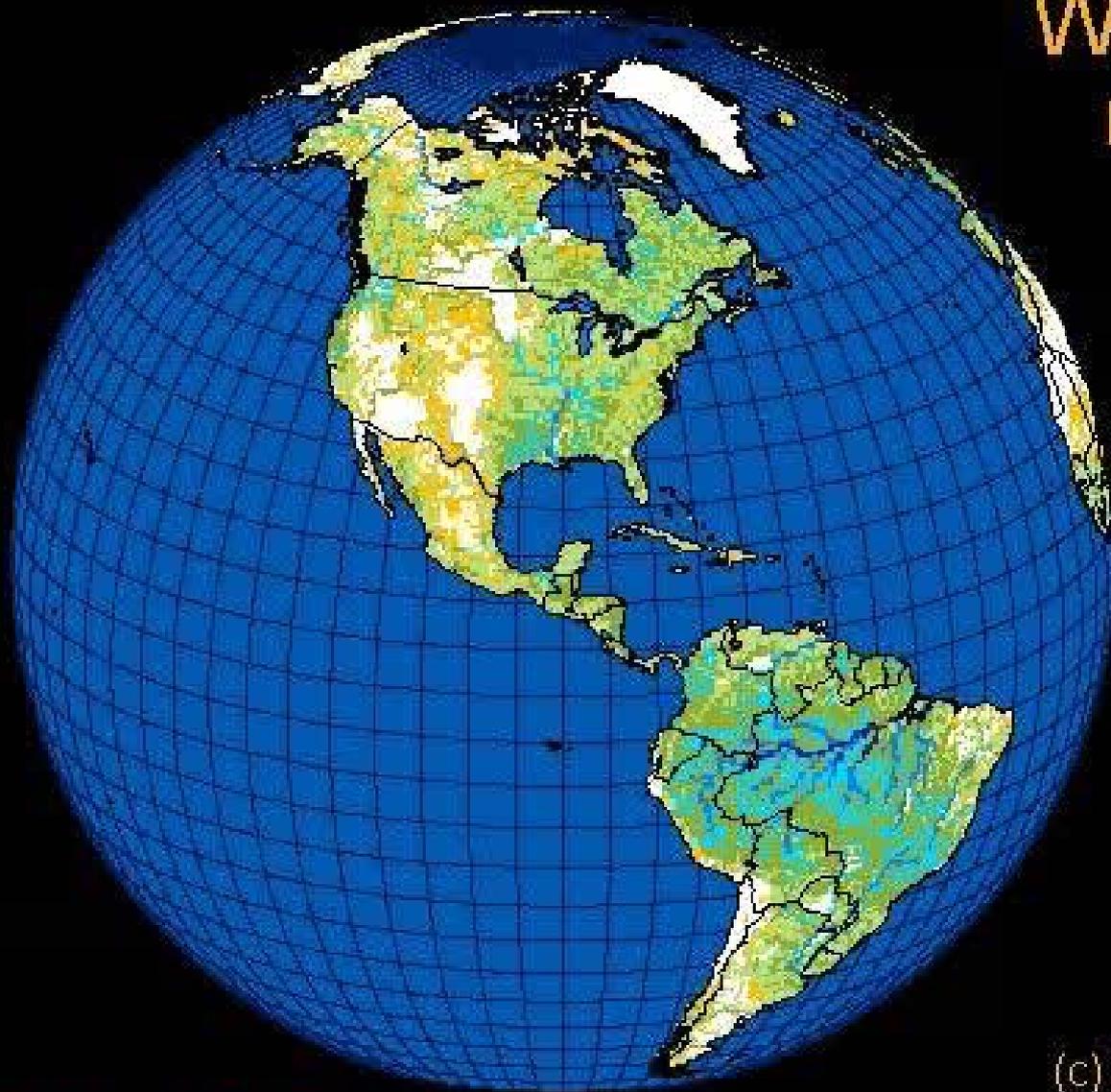
- Population
- Income
- Technology
- Climate

**Water
Withdrawals**

Water Withdrawals
• Domestic
• Industrial
• Irrigation
• Livestock

WaterGAP 2.1

Monthly discharge
1961 to 1990

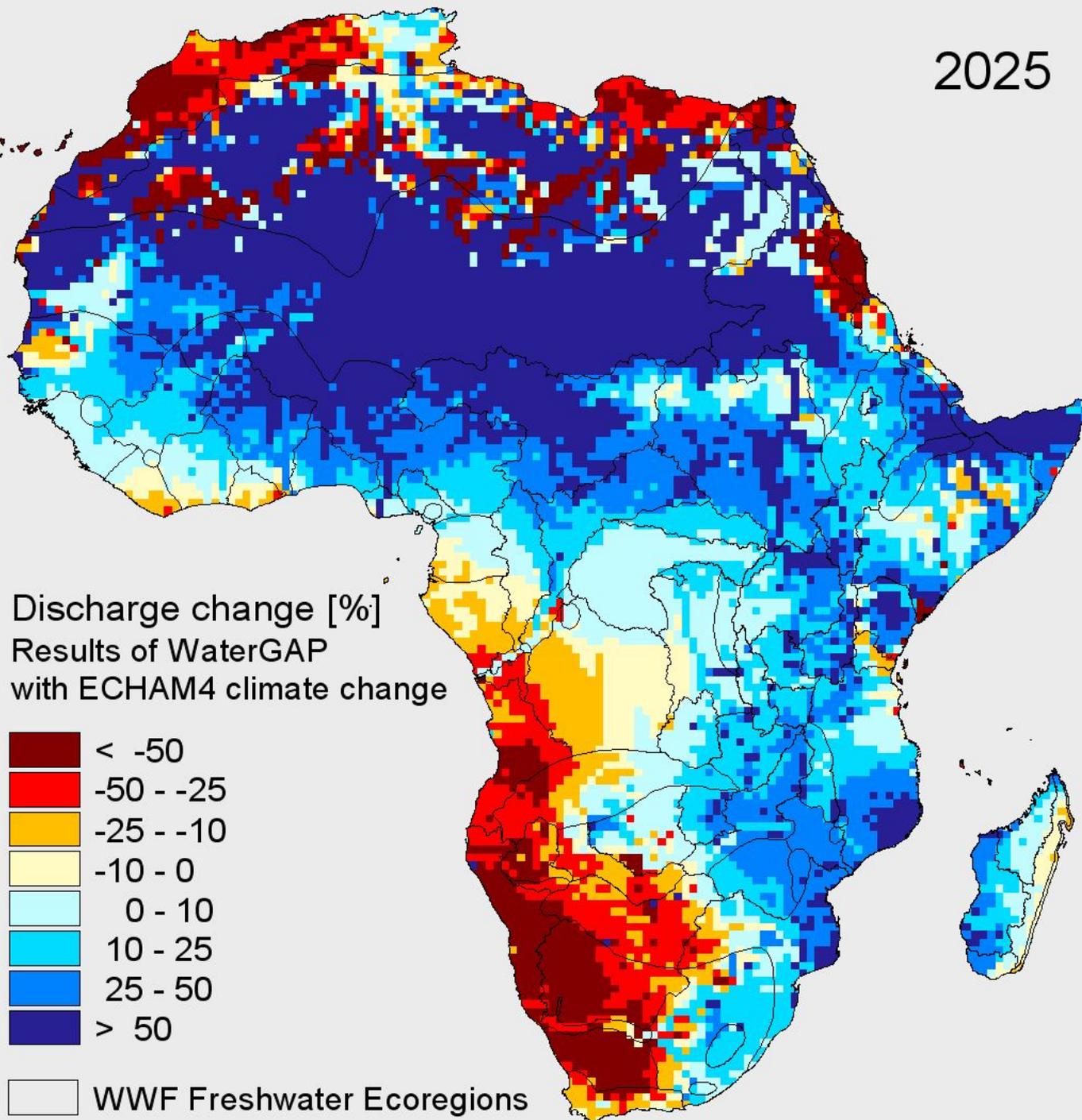


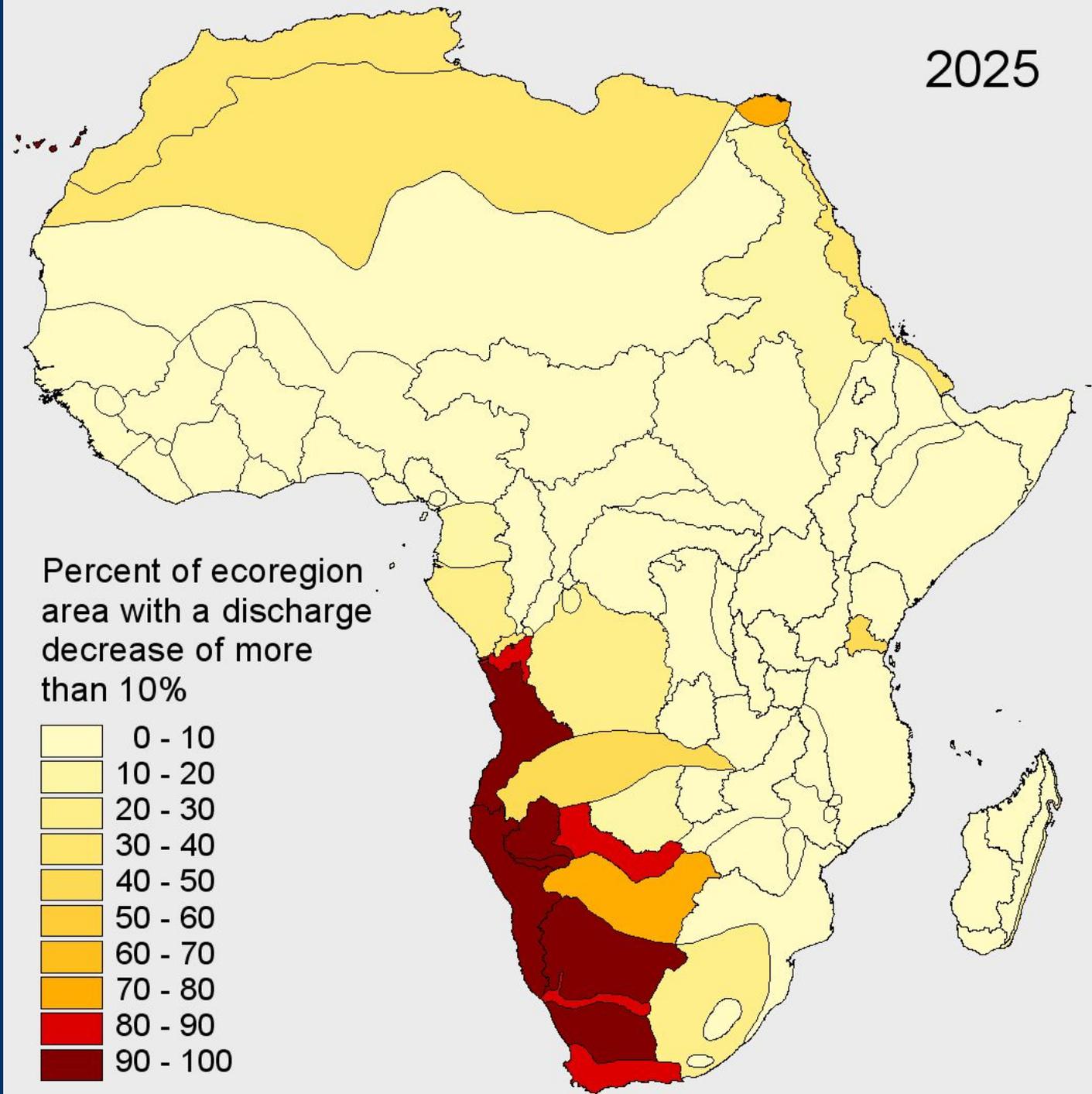
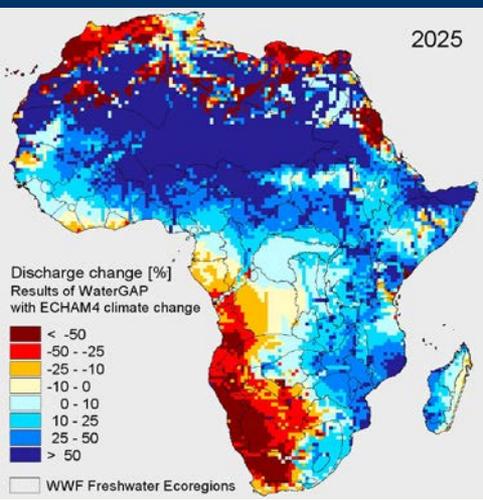
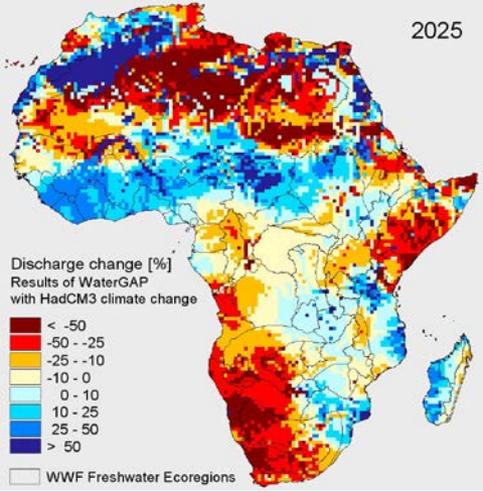
01.1961

(c) Center for Environmental
Systems Research
University of Kassel
December 2001 (BL)

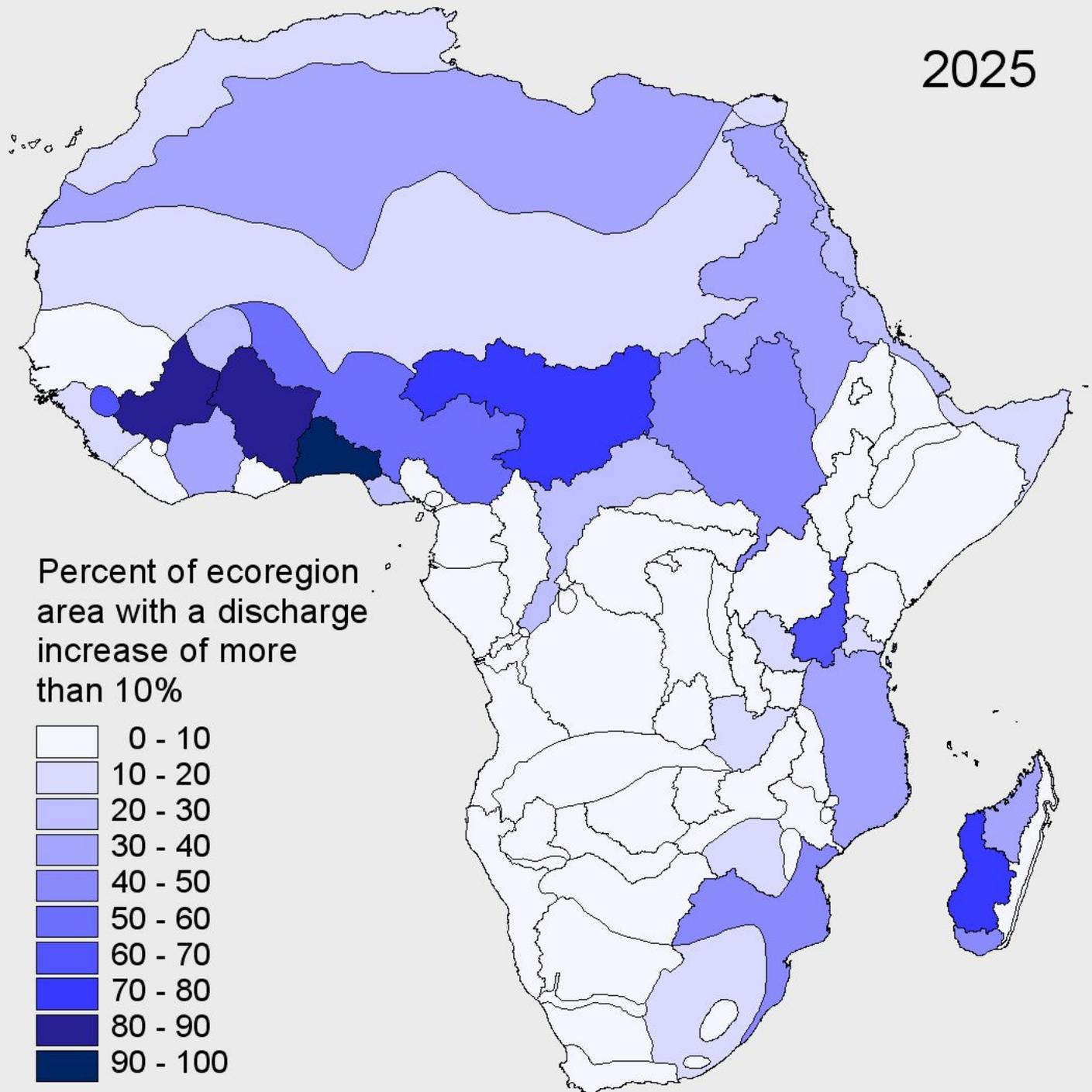
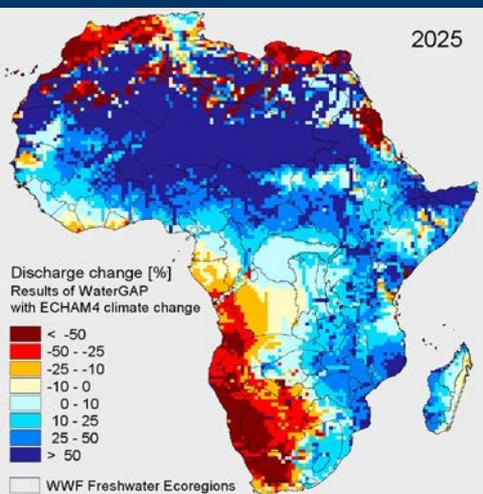
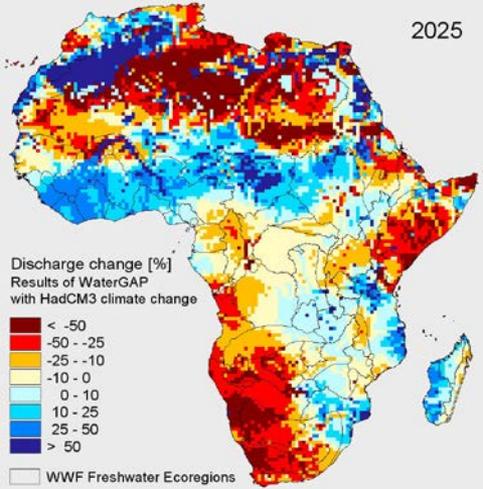
2025

Change
in
AVERAGE
river
discharge



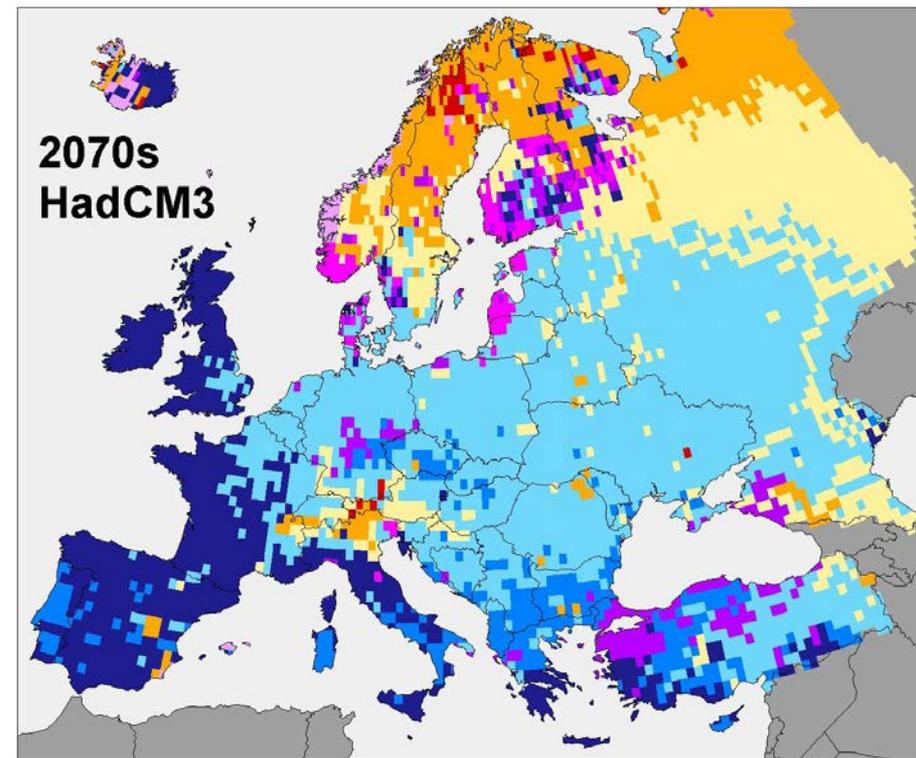
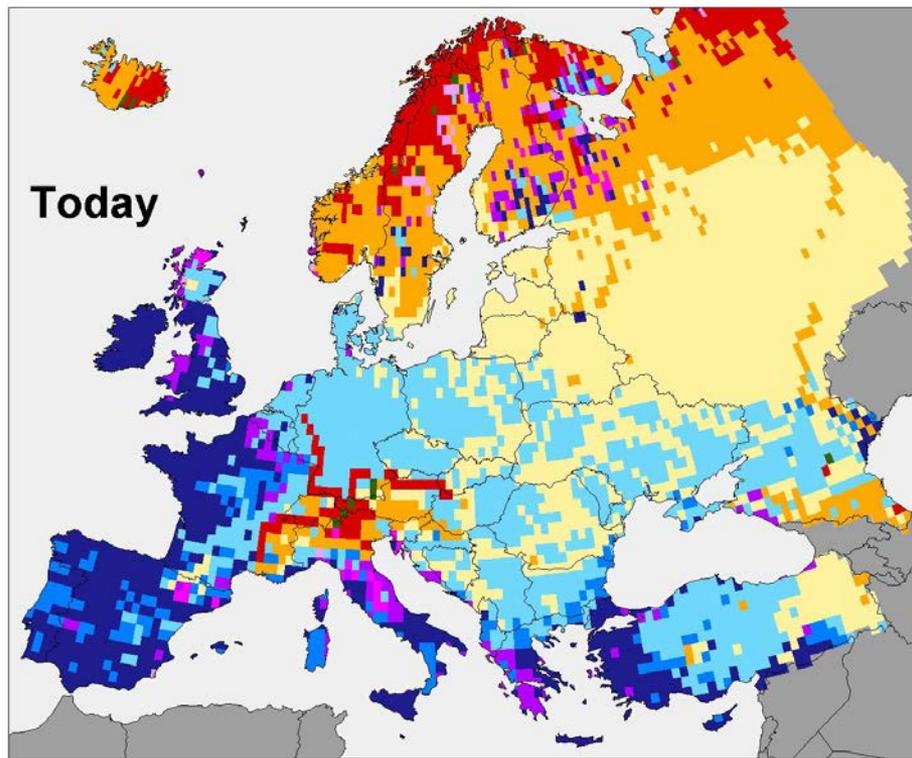


Droughts
?



Floods
?

TIMING of river flows

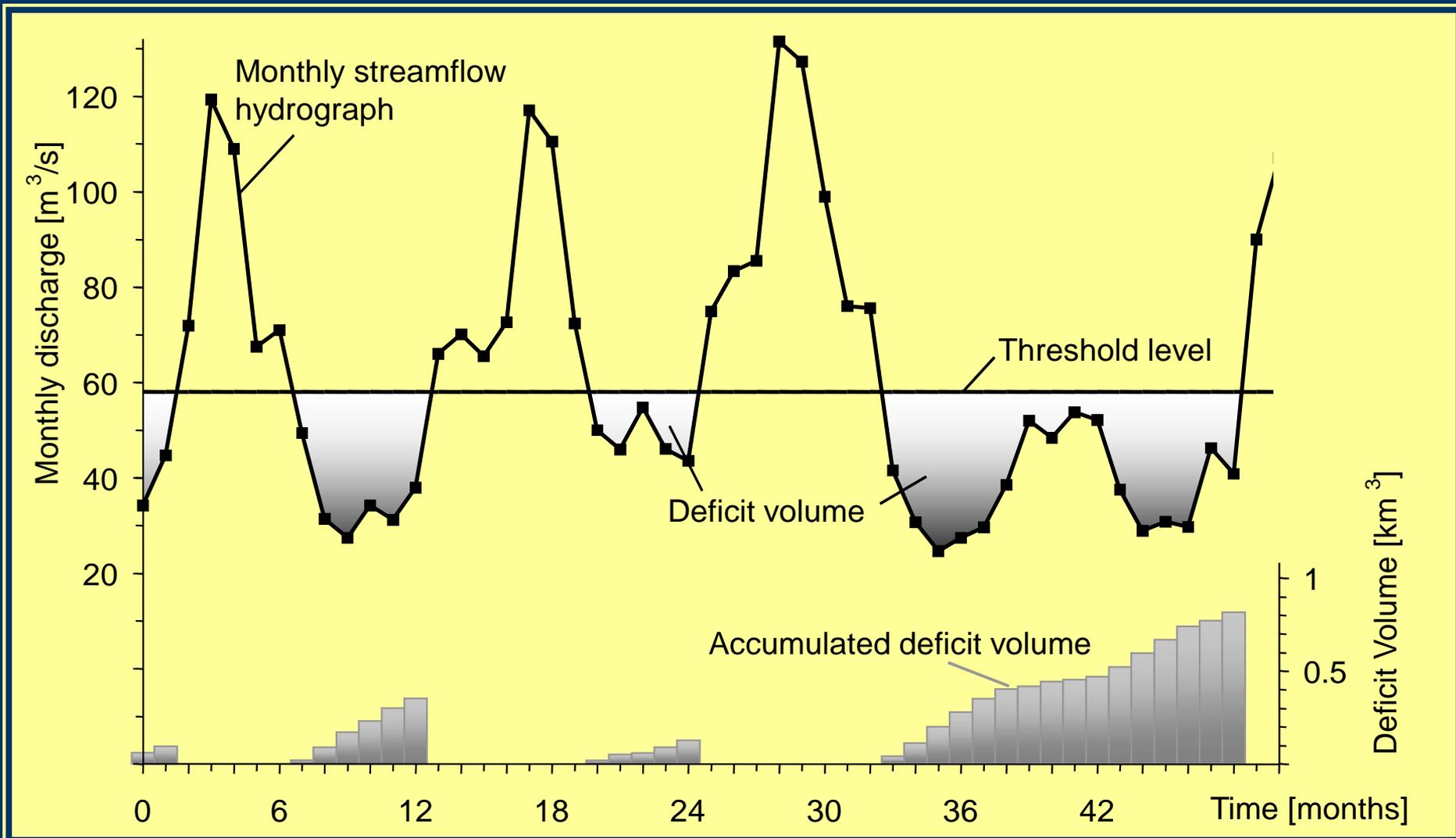


Month with maximum average discharge



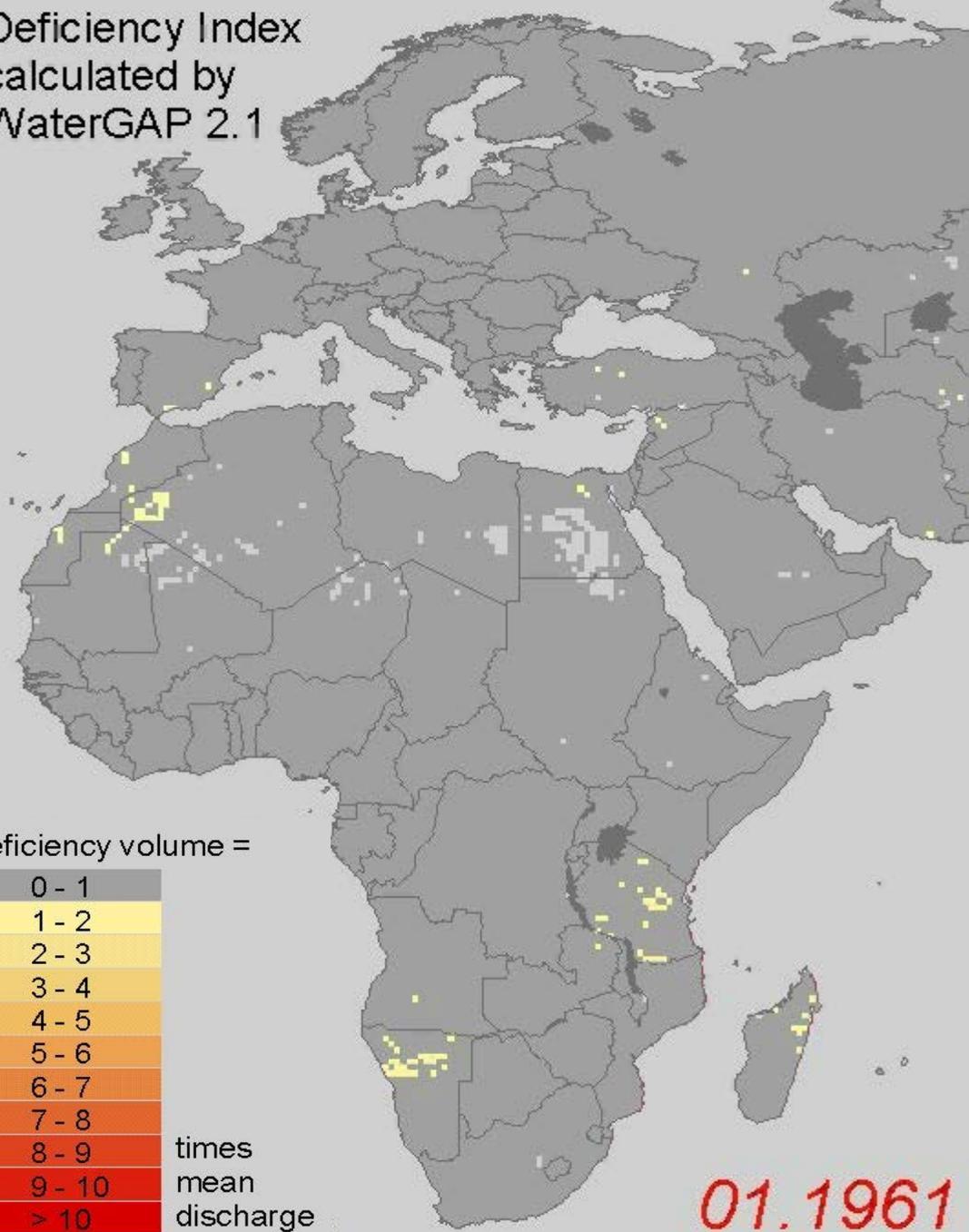
(c) Center for Environmental
Systems Research,
University of Kassel,
June 2001 - WaterGAP 2.1C

DURATION of flow events



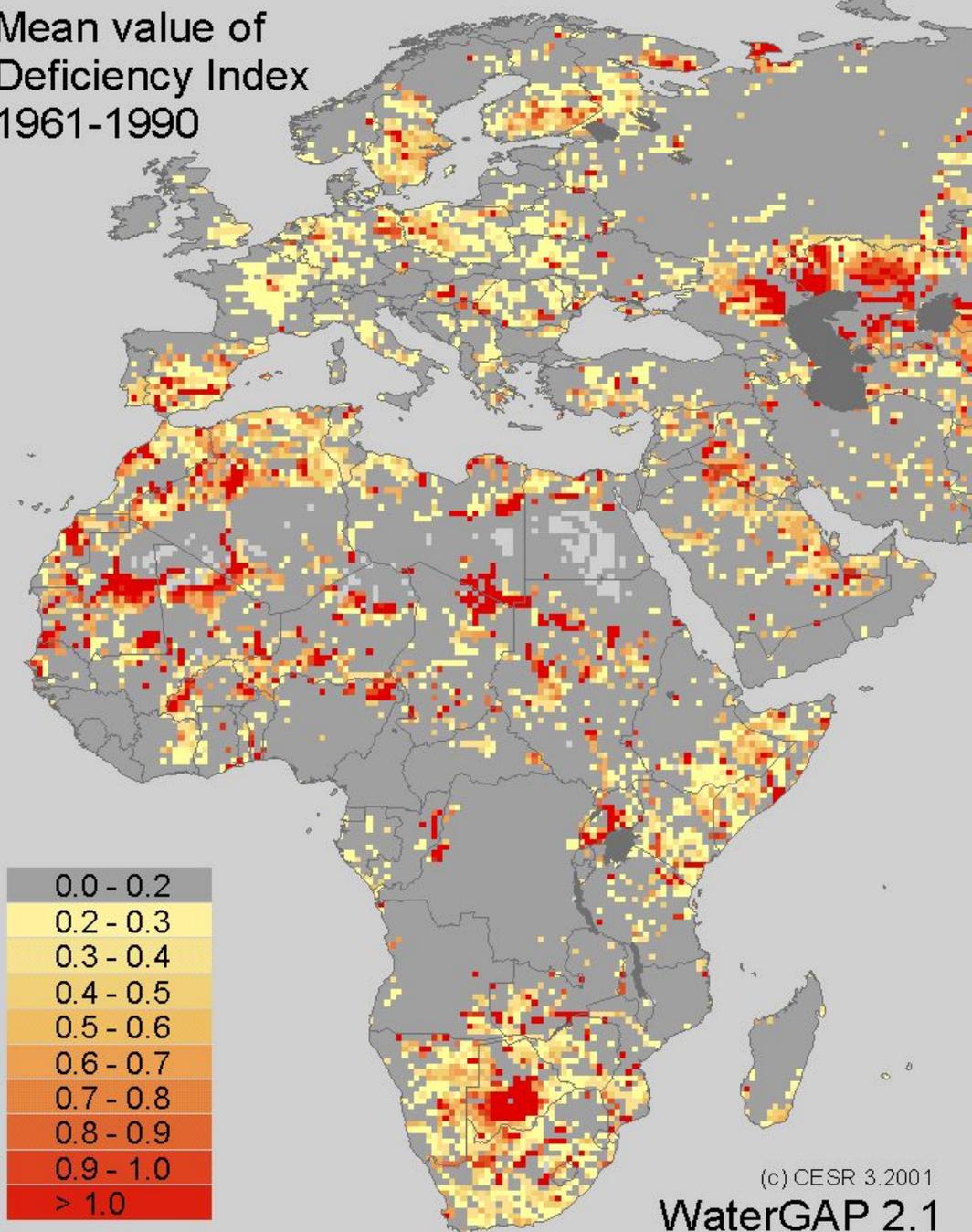
Deficiency Index
calculated by
WaterGAP 2.1

Deficiency volume =



01.1961

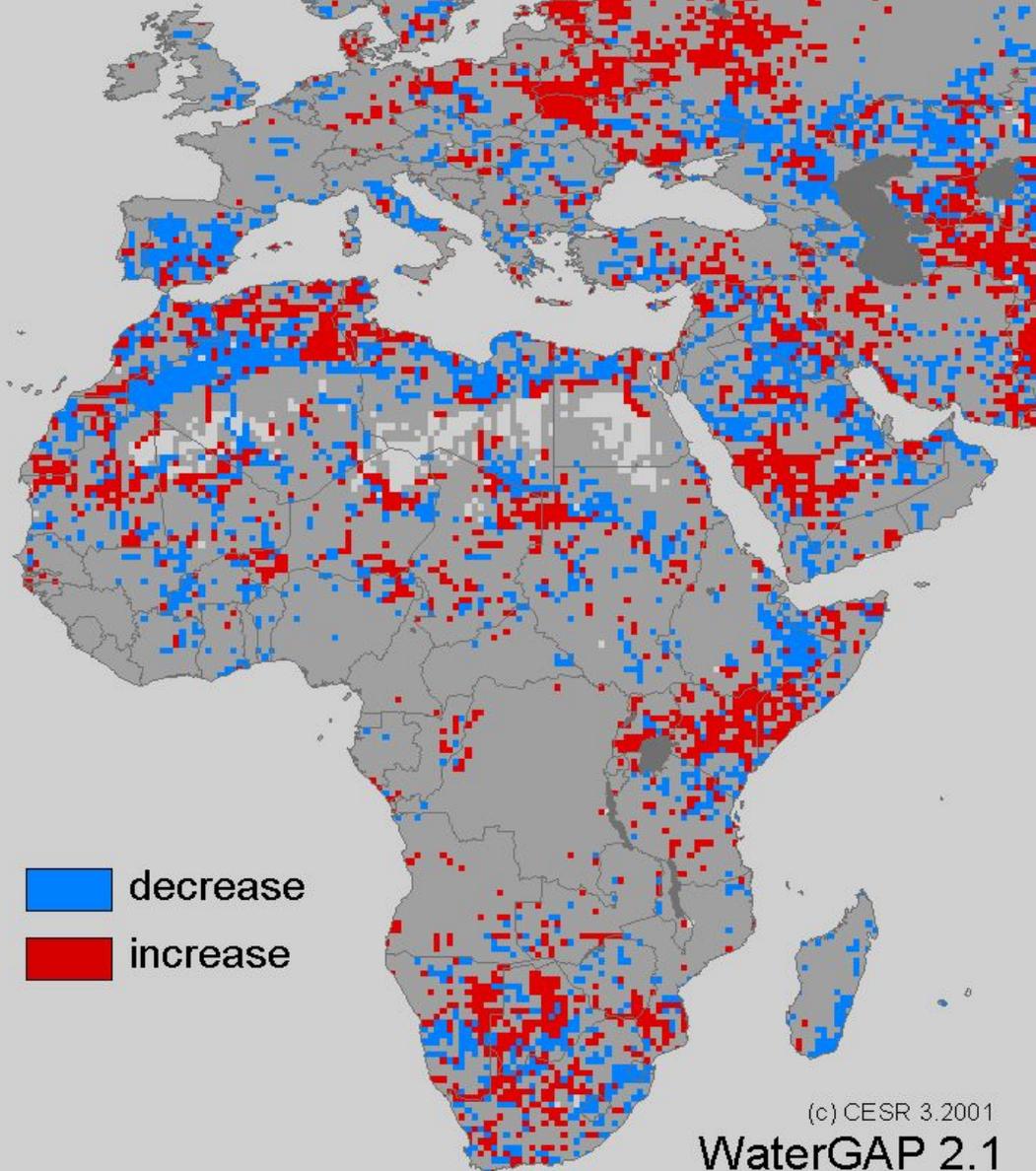
Mean value of
Deficiency Index
1961-1990



(c) CESR 3.2001

WaterGAP 2.1

Change in
Deficiency Index
1975 to 2025



 decrease
 increase

Conclusions

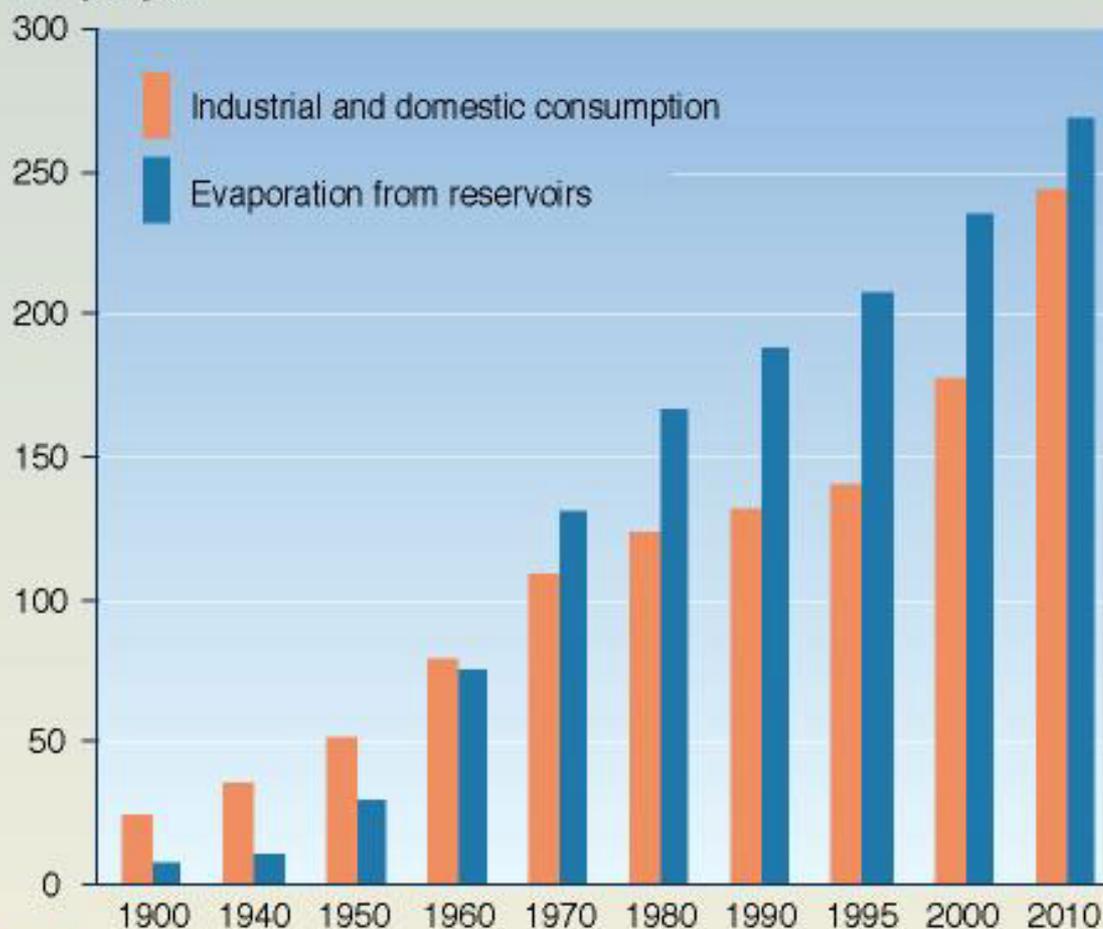
- For studies of climate change impacts on freshwater systems, the climate change signal should be “translated” into hydrological parameters (e.g., flow regimes).
- Not only averages, but timing and duration of flows have to be assessed.
- The uncertainties of climate change scenarios are high! Still, we can analyze concurring trends of multiple model runs and estimate the order of magnitude of possible effects.

~~Recommendations~~ Arguments

- **Resilience:** “The healthier an ecosystem, the lower its vulnerability.”
- **Concurring processes:** “Retaining forest cover and natural retention areas helps to prevent floods, due to reduced runoff generation and flow velocities — as well as droughts, due to infiltration and groundwater recharge.”
- “Planning for environmental flows today increases the window of opportunity for future situations.”
- “Dams are not the answer...”

Industrial and Domestic Consumption Compared with Evaporation from Reservoirs

km³ per year



PHILIPPE FEKACEWICZ
FEBRUARY 2002

Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999.