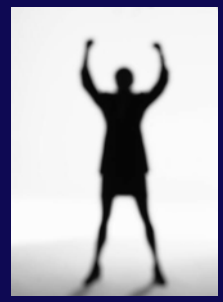
International Hydrological Programme (IHP)

Global Earth Observation System of Systems (GEOSS)

- The cycle is changing?
- Increased risks?
- Growing vulnerability?
- More disasters ?
- Less water for people?
- Crisis is looming?
- What crisis?
- Global or local?



First message:

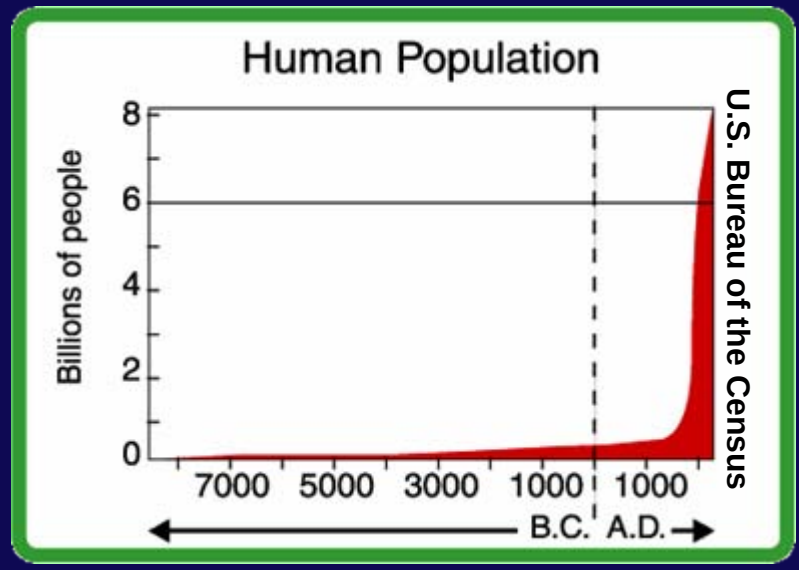
Humans are changing the global water system in a globally-significant way

without…..

adequate knowledge of the system and thus its response to change

Global change drivers

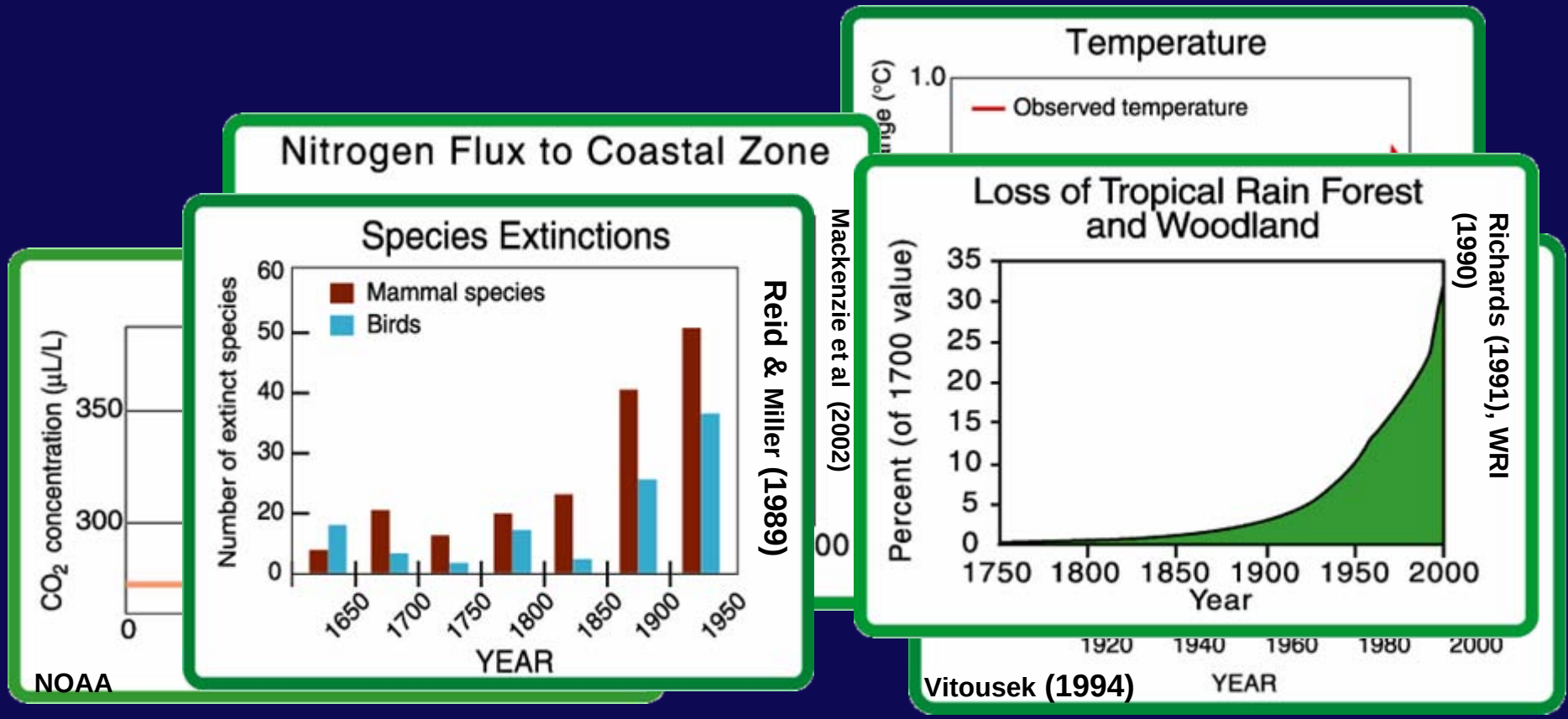
- Population growth, movement and age structures
- Geo-political changes and realignments
- Trade and subsidies
- Technological changes
- Climate change

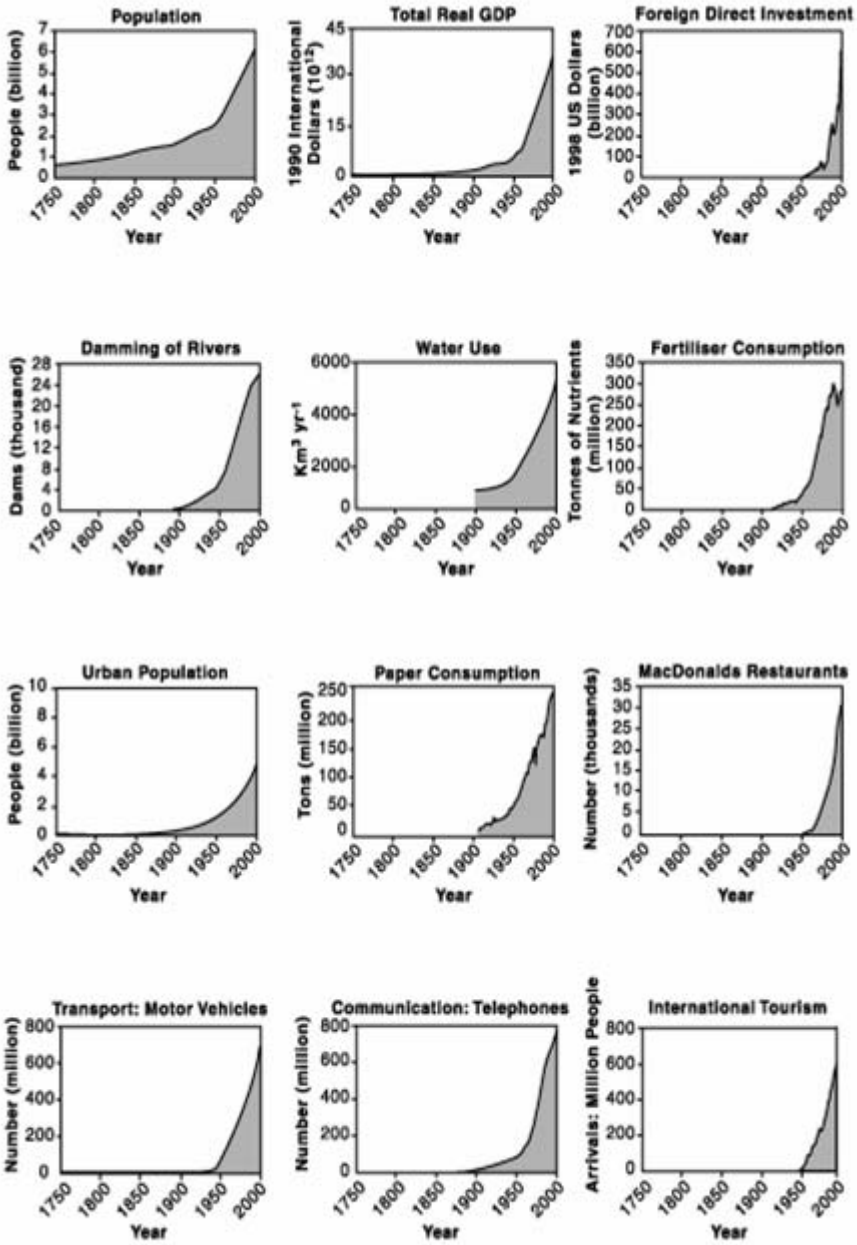


Global change impacts

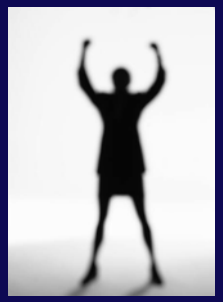
- Global change is more than global climate variability/change
- It has natural PLUS human/social dimensions
- A constellation of changes, many global in domain

For example, we see large changes in:

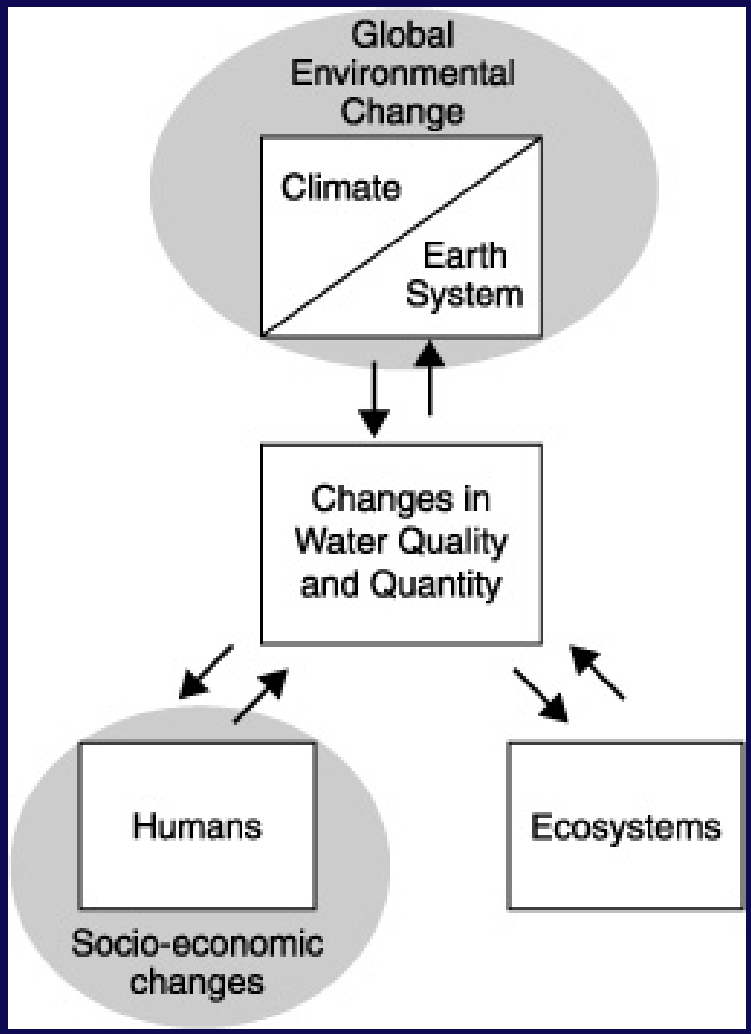



Population
People (billion)
Year
Total Real GDP
1990 International Dollars (10^{12})
Year
Foreign Direct Investment
1998 US Dollars (billion)
Year
Damming of Rivers
Dams (thousand)
Year
Water Use
$Km^3\ yr^{-1}$
Year
Fertiliser Consumption
Tonnes of Nutrients (million)
Year
Urban Population
People (billion)
Year
Paper Consumption
Tons (million)
Year
MacDonalds Restaurants
Number (thousands)
Year
Transport: Motor Vehicles
Number (million)
Year
Communication: Telephones
Number (million)
Year
International Tourism
Arrivals: Million People
Year

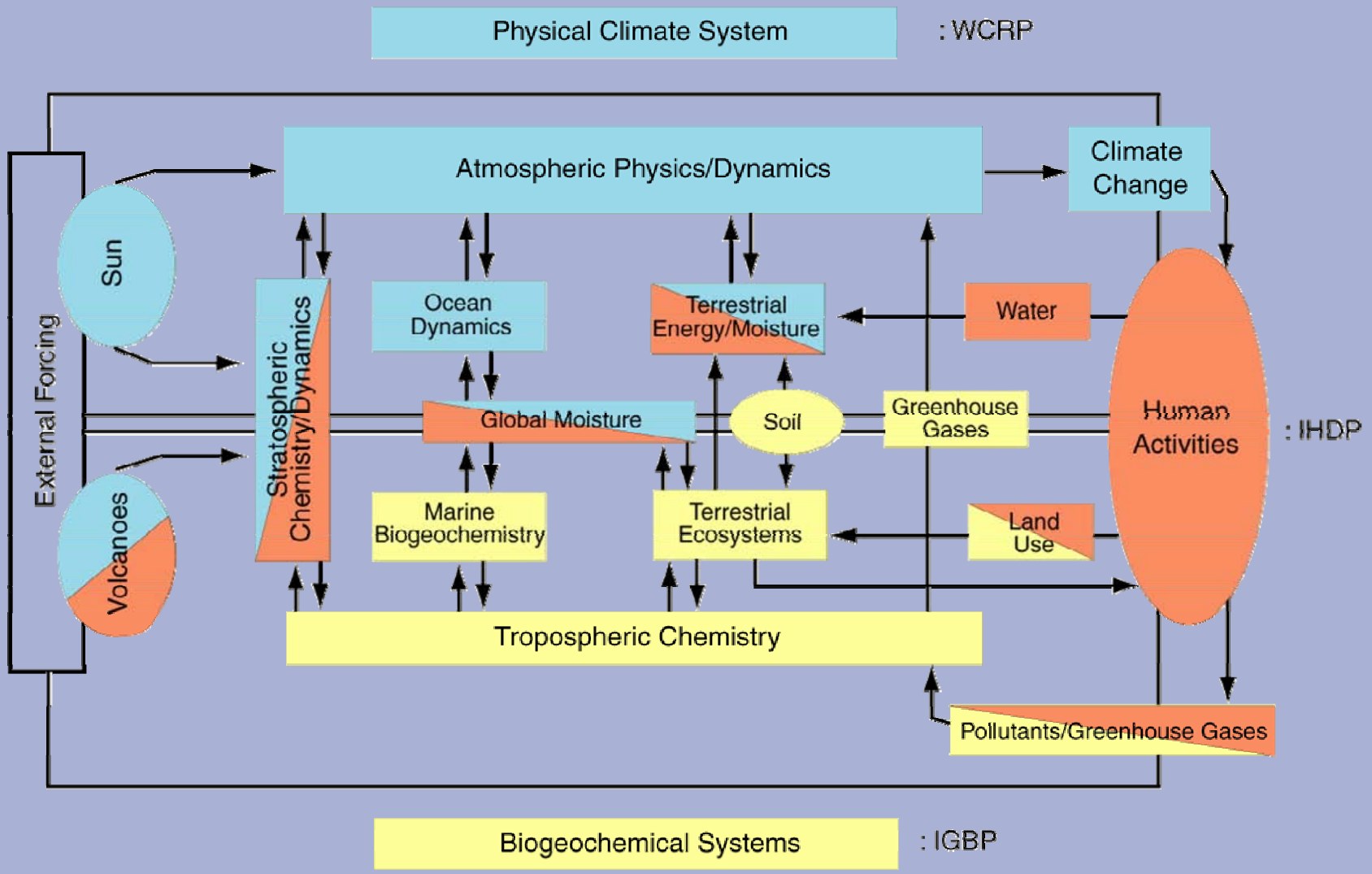
The Global Water System

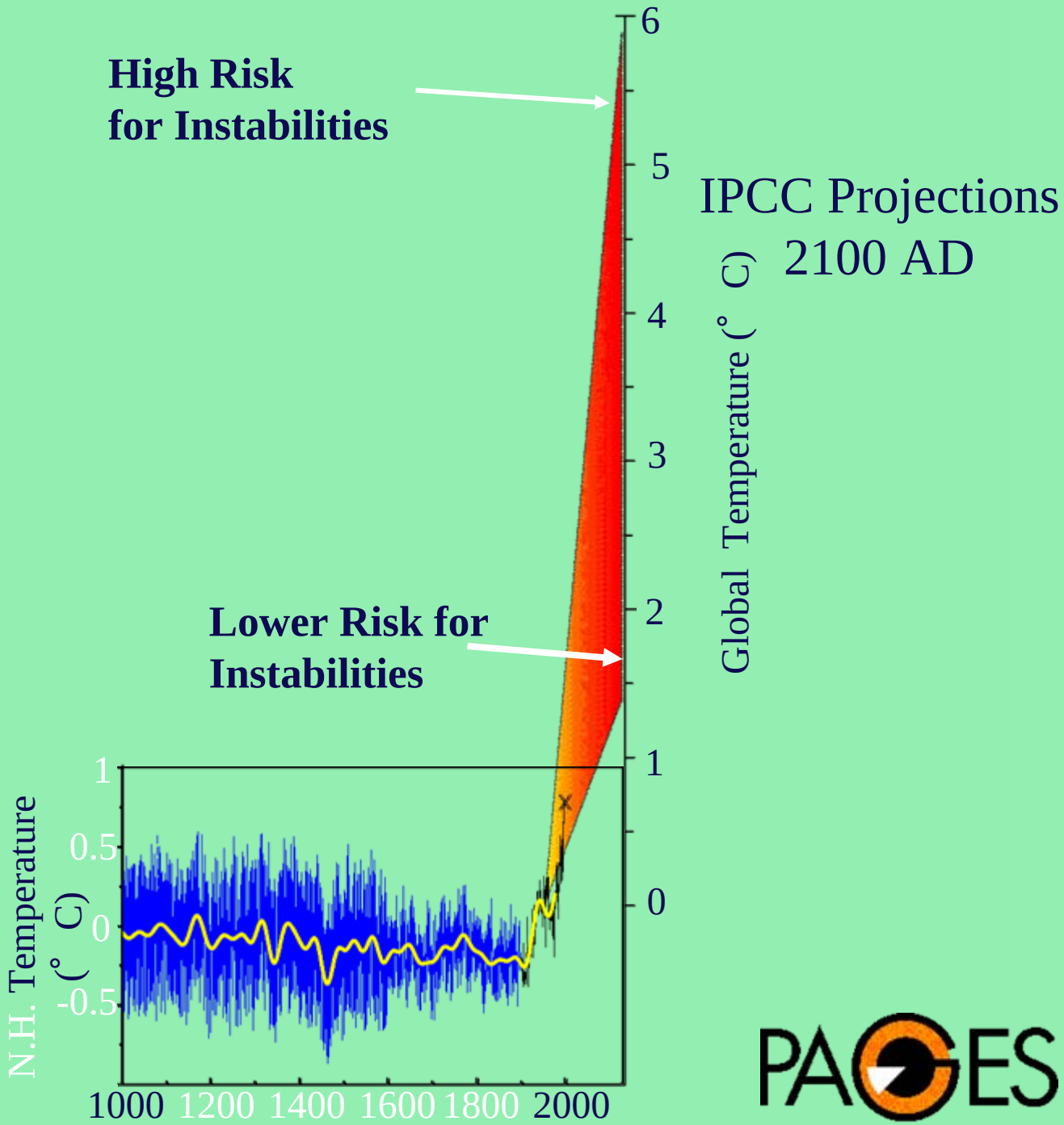


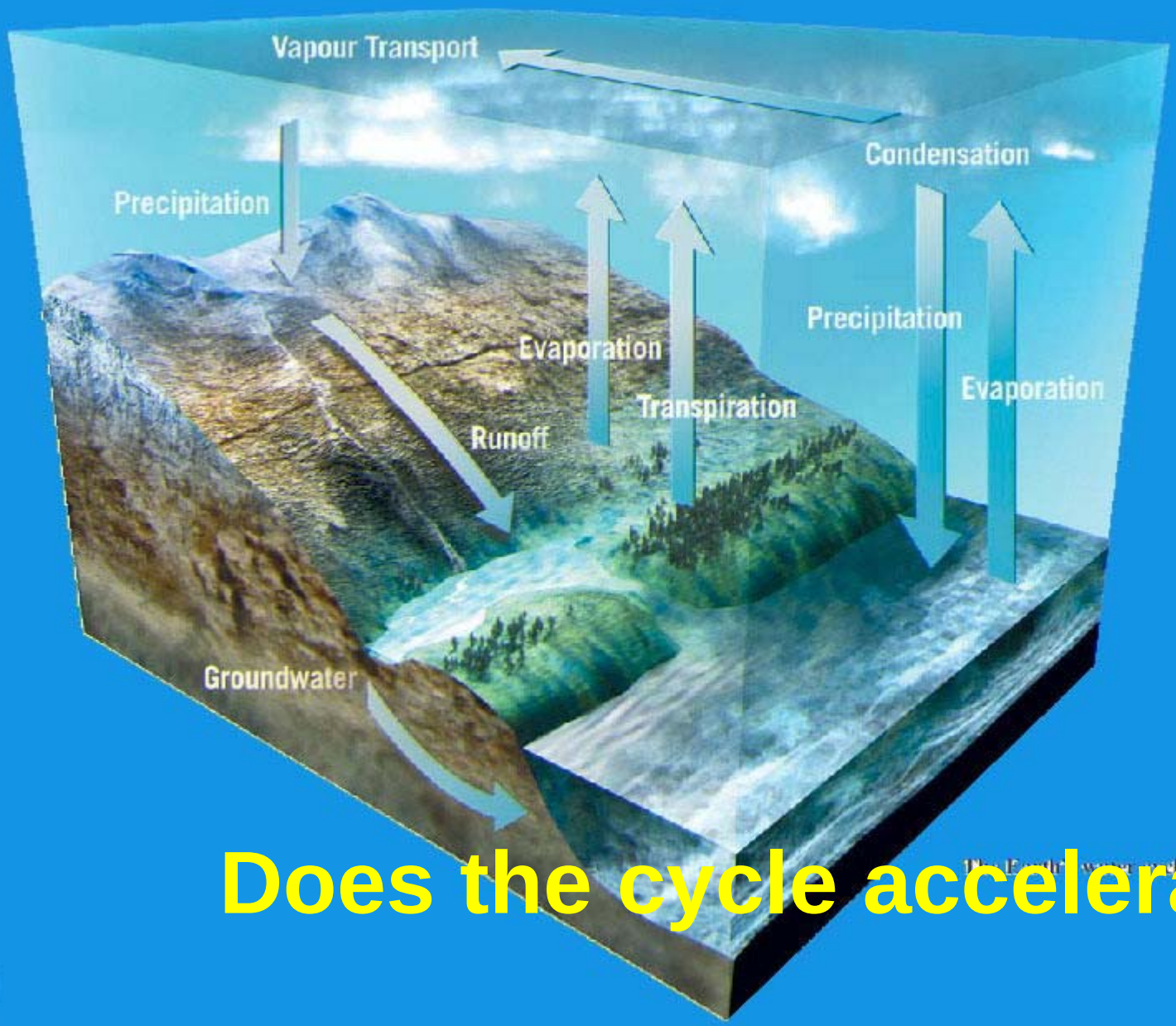
- Water ***Cycling*** Deeply Embedded in Earth System
- Interconnections are Strong
- Change to One Part Reverberates Throughout



The Earth System: Coupling the Physical, Biogeochemical and Human Components




High Risk
for Instabilities
Lower Risk for
Instabilities
IPCC Projections
2100 AD
Global Temperature (° C)
6
5
4
3
2
1
0
N.H. Temperature
(° C)
1
0.5
0
-0.5
1000
1200
1400
1600
1800
2000

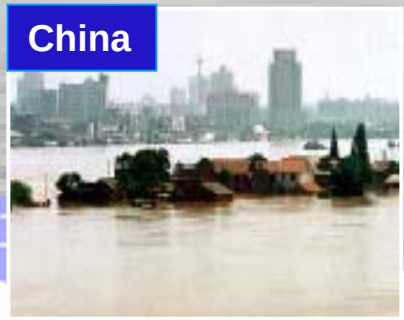


Does the cycle accelerate?

Major floods and droughts worldwide in 2002

Germany

China



Korea

Flood Drought

Austria
Czech
Russia
France
Turkey
Afghanistan
China
Korea
Senegal
Nepal
Bangladesh
India
Philippines
Ethiopia
Vietnam
Sri Lanka
Indonesia
Kenya
Micronesia

USA

USA
Mexico
Haiti/ Jamaica
Ecuador
Peru
Bolivia
Uruguay

Kenya

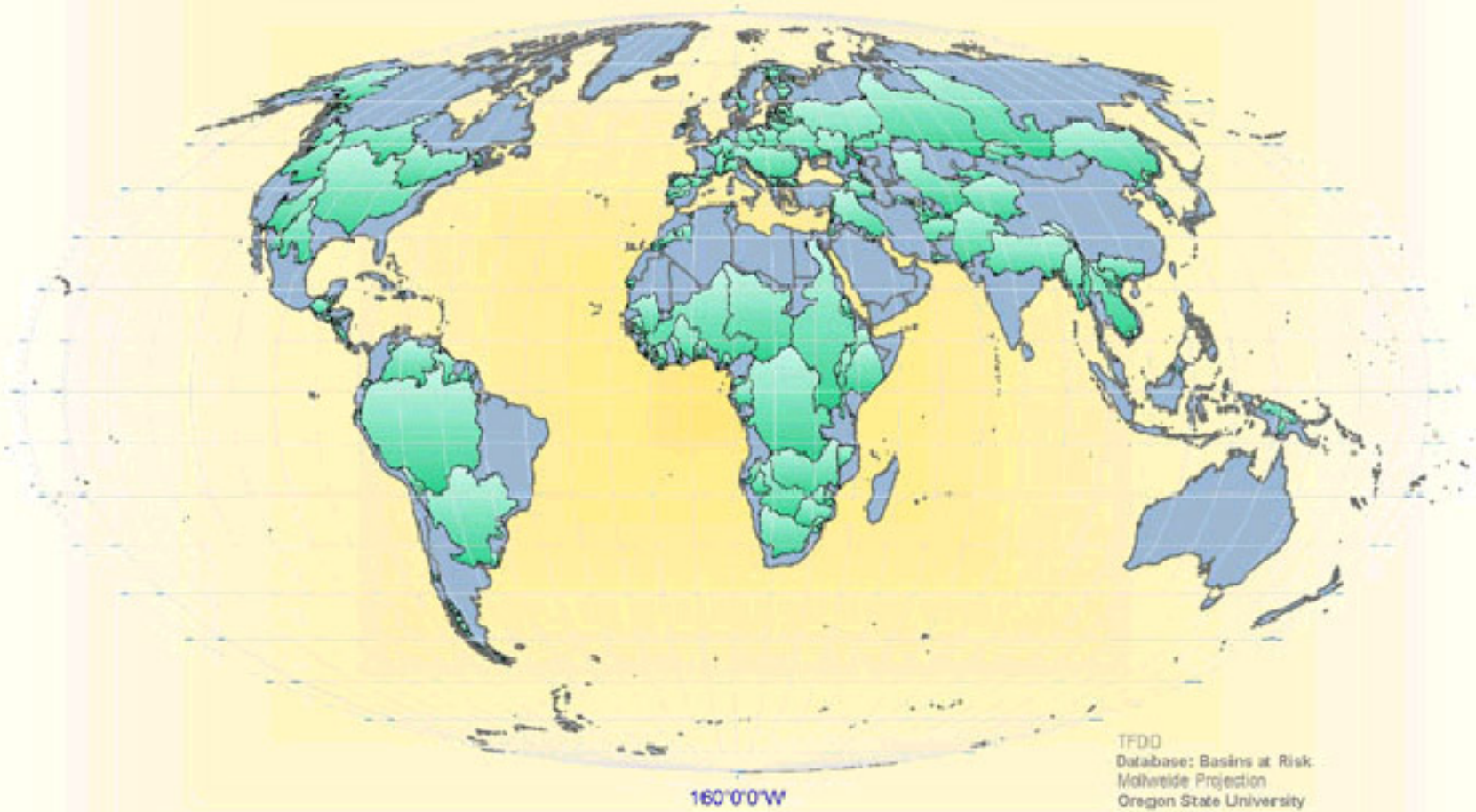
There is pressing need to develop advanced risk management on water hazard in order to secure human life and ensure sustainable socio-economic development and poverty alleviation.

GLOBAL FRESHWATER RESOURCES

Relation between water availability and population

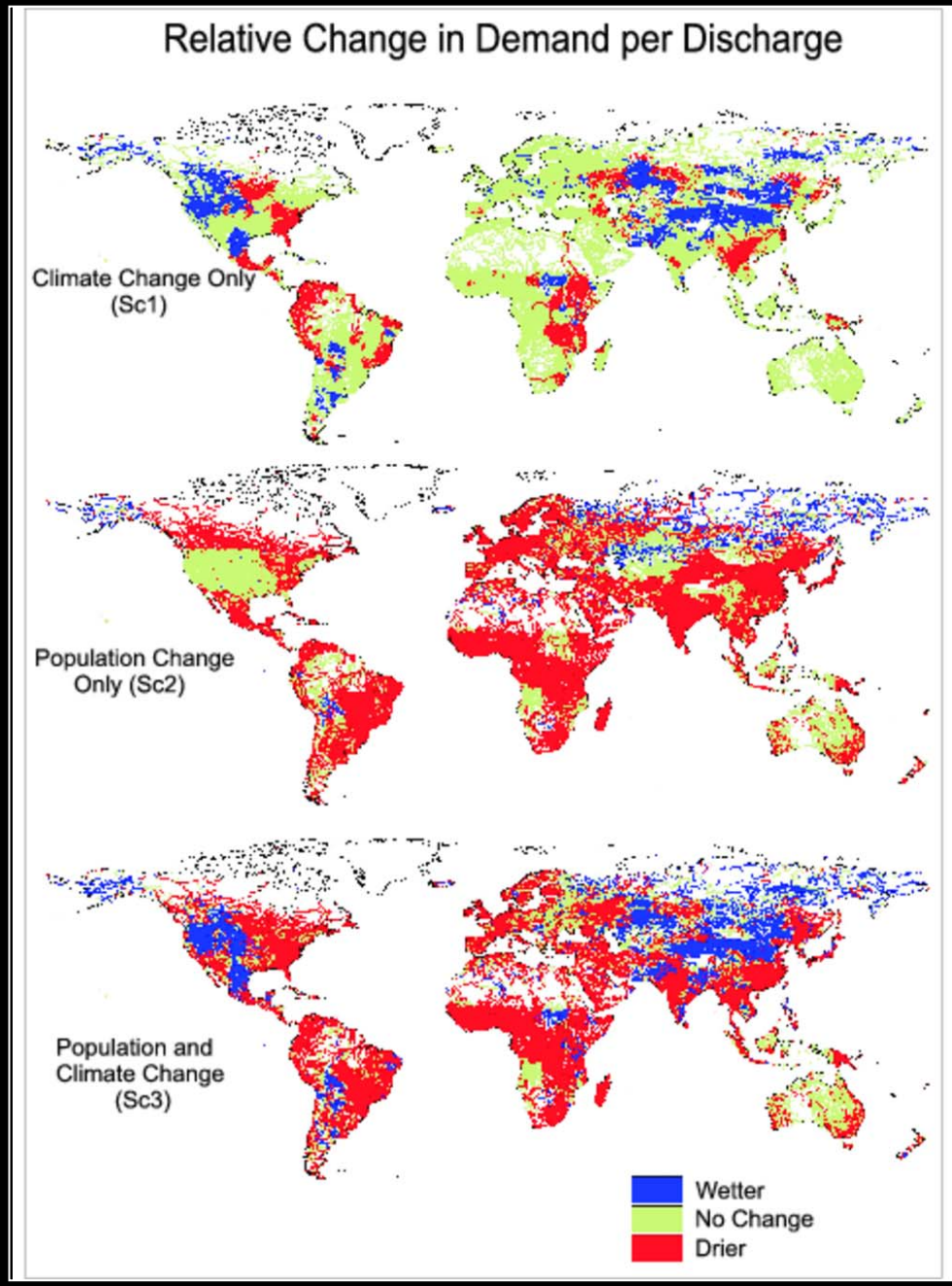
World Water Assessment Programme

International Basins of the World



Water Stress Changes to 2025

- 80% of future stress from **population** & **development**, not **climate change**!
- Correct Priorities?
  (E.g. 85% US global change research funding to climate and carbon)

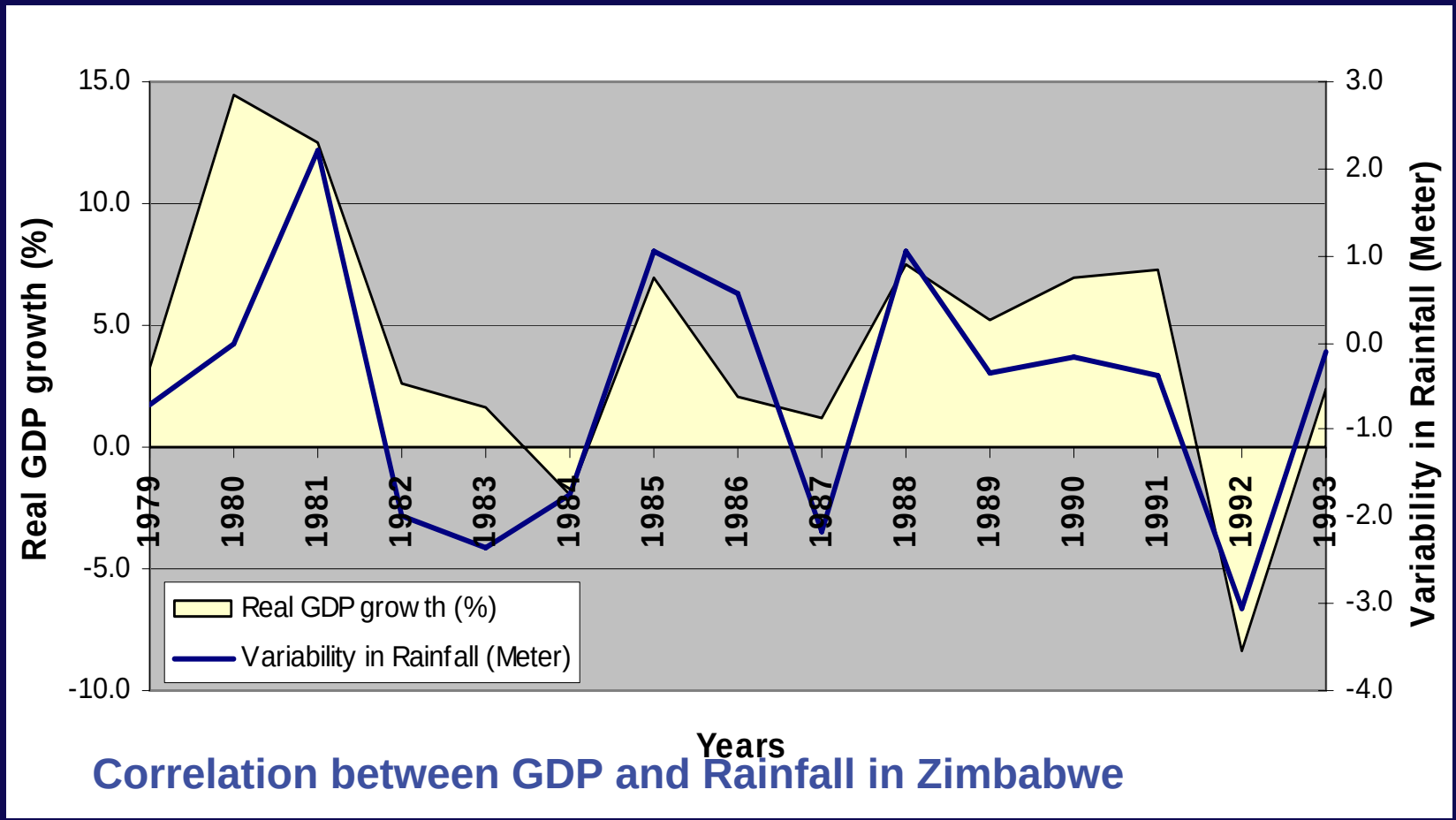


UNH

Vörösmarty et al. 2000

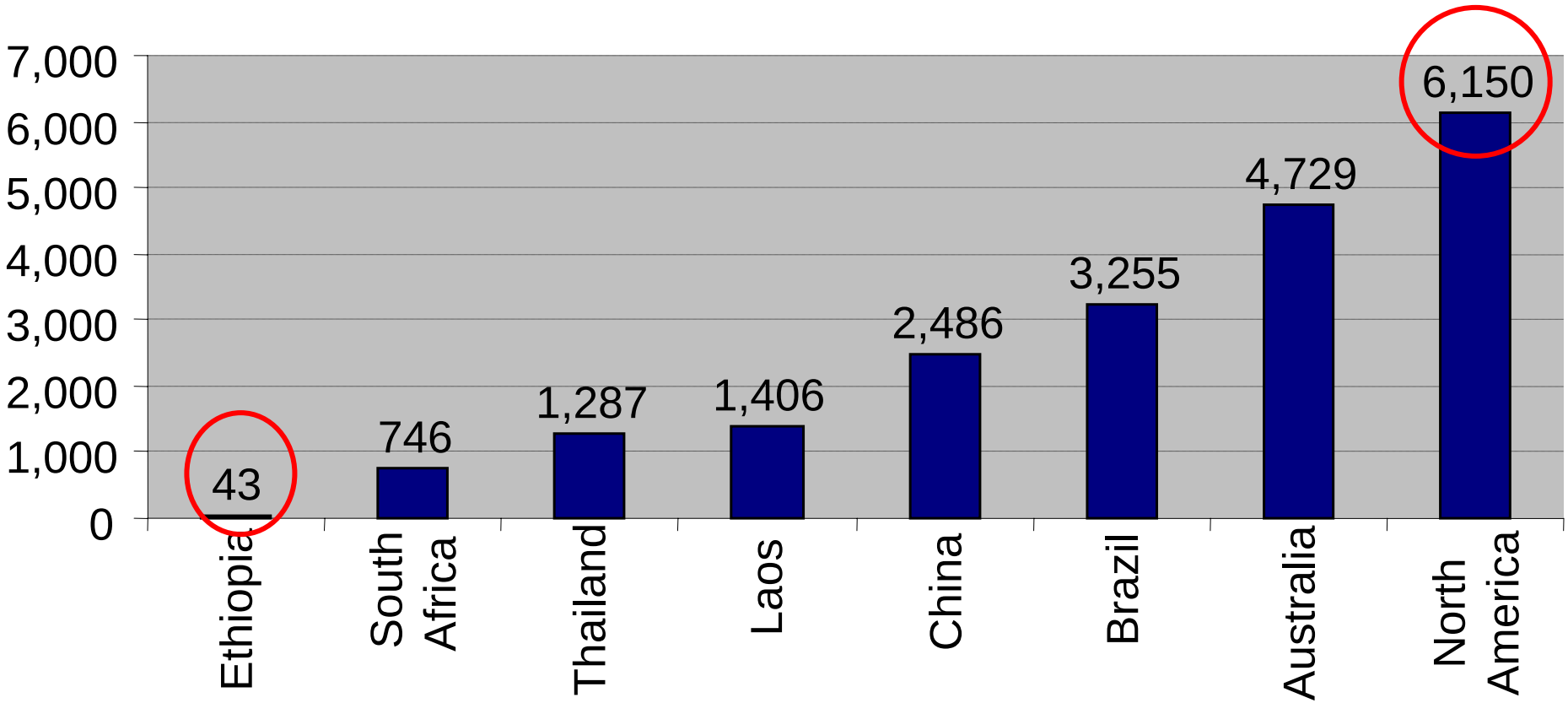
Rainfall affects growth..

the case of Zimbabwe



Correlation between GDP and Rainfall in Zimbabwe

Infrastructure gap: Water storage



UN Convention on the Law of Non-Navigational Uses of Transboundary Watercourses 1997

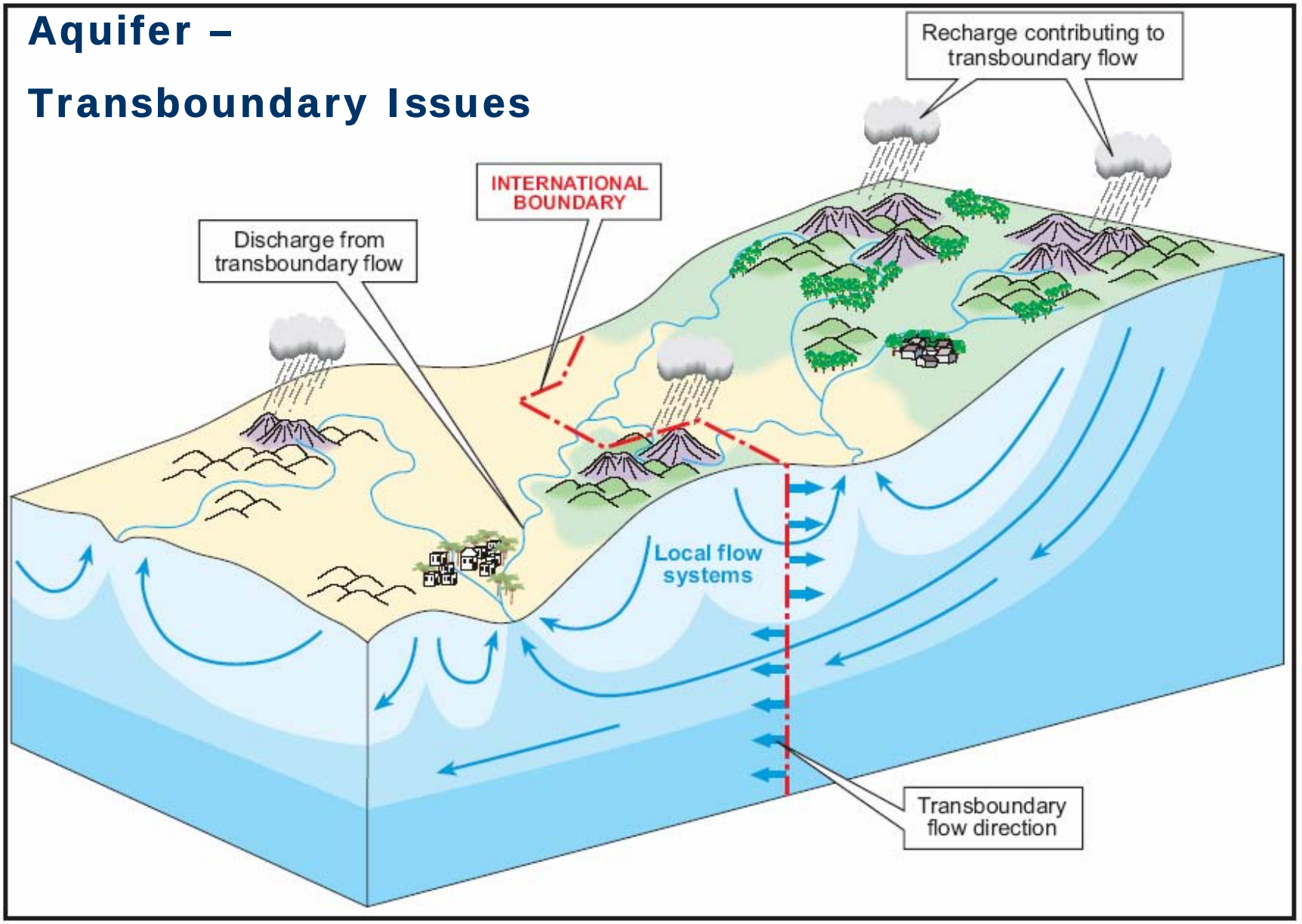
- Consistent with state practice
- Comprises earlier efforts of codification
- Adopted equitable utilization as leading principles of international water law, with a list of factors to be used for determination of equitability of share
- Adopted the principle of “no significant harm”
- Ratification process en route

Needed:	35
Obtained:	16

(Not yet in force after 27 years of negotiation)

Aquifer –

Transboundary Issues



Water hazard as a major challenge

- Intensifying and increasing occurrence of water related hazard in many part of the world
- Serious concern on climate change such as extreme hydrologic events and sea level rising

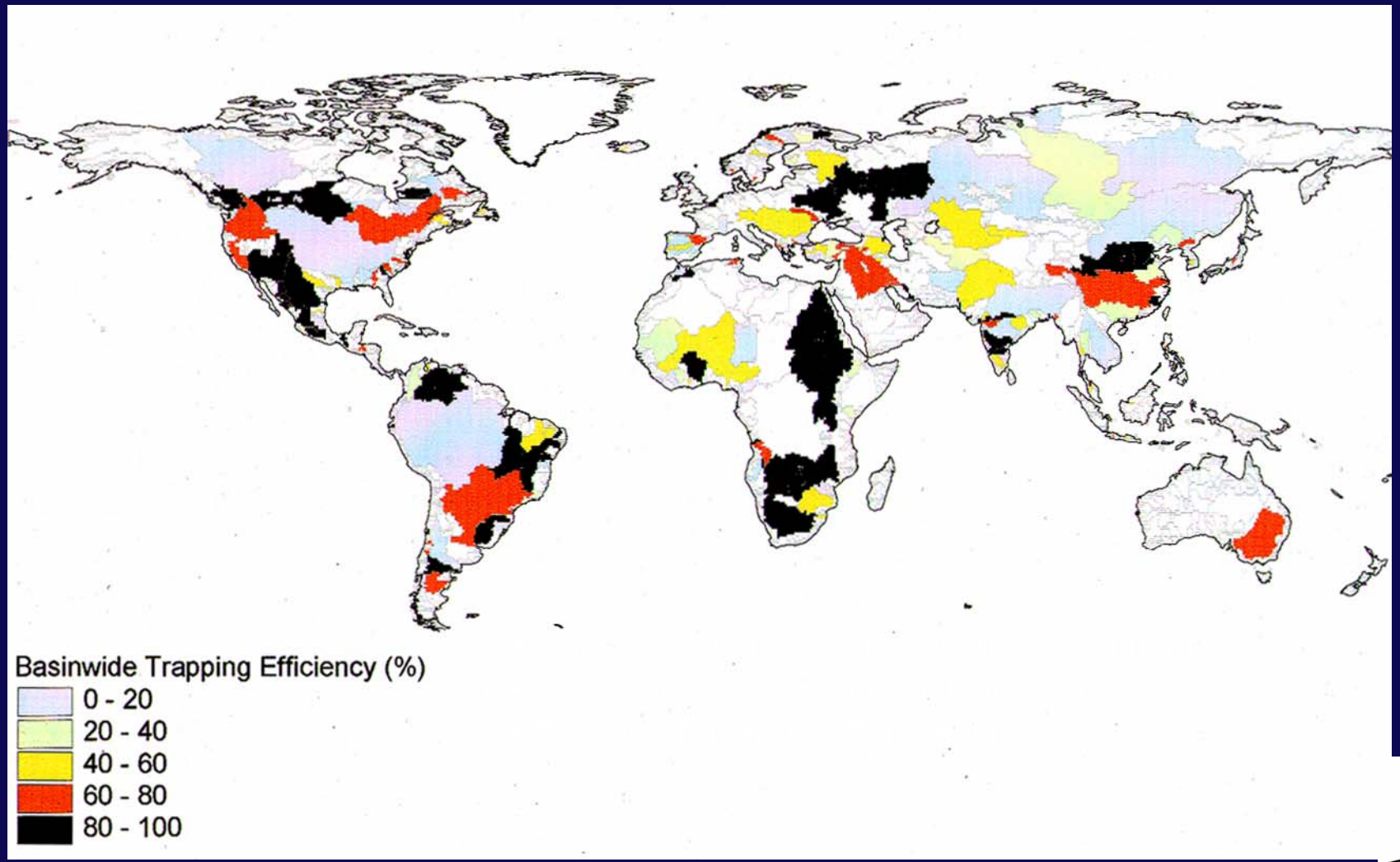


Fukuoka Flood in 1999

(Source : MLIT)

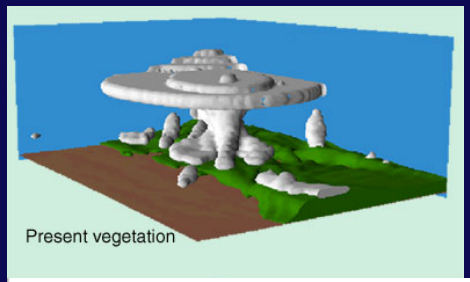
Human Fingerprint on Land-to-Ocean Linkages

--Intercepted sediments that "nourish" our coastlines



UNH

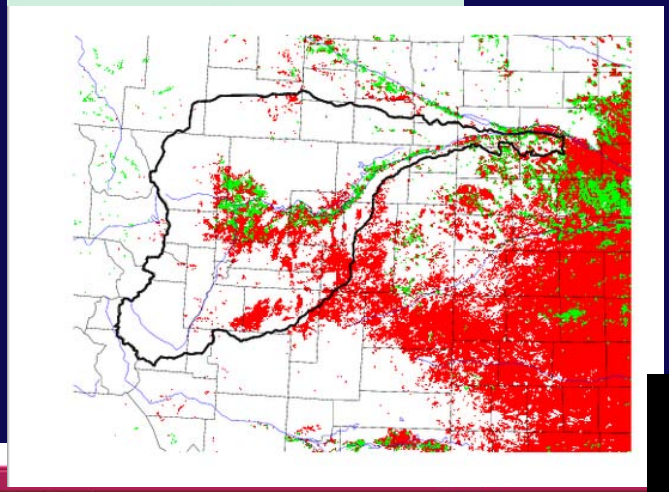
Vörösmarty et al. 2003

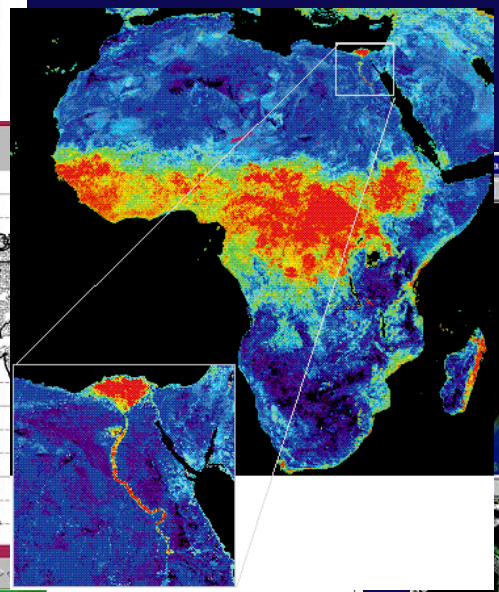


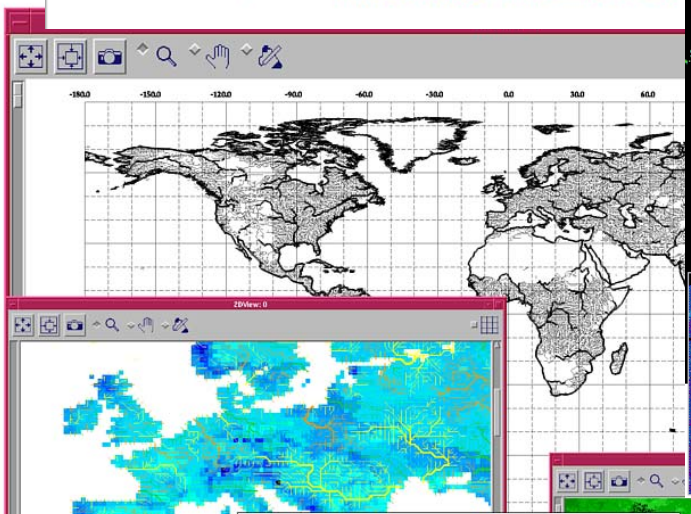
High Technology Earth Systems Tools

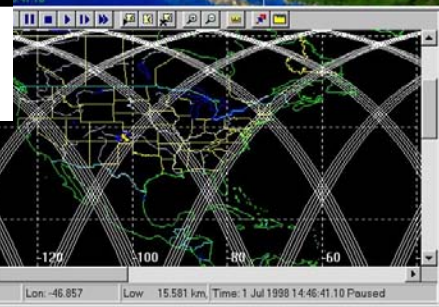
- Satellite data
- Simulation models
- Geospatial analysis tools

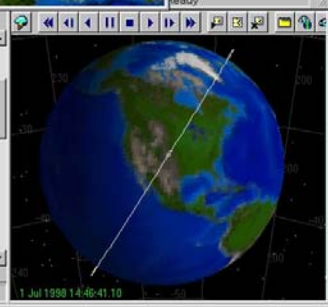
They show promise but…

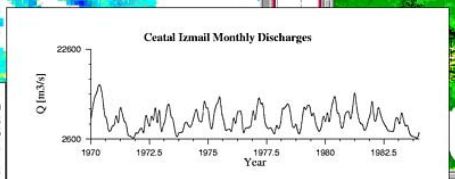


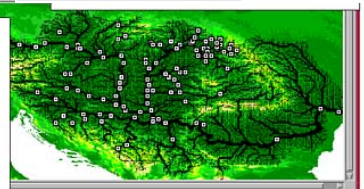












The data issue: a major source of risk and vulnerability in river basins

- The case of Africa
- Interconnectedness through data
- Local data networks:

  The ethical choice vs.

  The global needs to mimimize bias
- GEOSS: space and in situ observations
- Will data secrecy be gone?
- Will it be replaced by sharing?
- What is the way out of trouble?

WATER EDUCATION AND CAPACITY BUILDING

International Hydrological Programme

The challenge we all have

How to put water in the minds of people?