No way, José! Yet another crisis? What?? WATER??!!?? Oh, please, NOOO!

World Water Scenarios and the UN: Water as a source of conflict or a potential peace builder?

András SZÖLLÖSI-NAGY

National University of Public Service, Budapest, Hungary iASK, Köszeg
UNESCO International Hydrological Programme
Sustainable Water Futures Programme, Brisbane, Australian

HYPO/THESIS TESTING

IN THE PAST, UP TO THE MODERN TIMES,
WATER HAS SHAPED HUMAN
CIVILIZATIONS

IN THE FUTURE
IT IS THE HUMAN CIVILIZATION THAT WILL
SHAPE WATER

THERE IS A TWO-WAY FEEDBACK BETWEEN WATER AND CIVILIZATION THAT IS VITAL

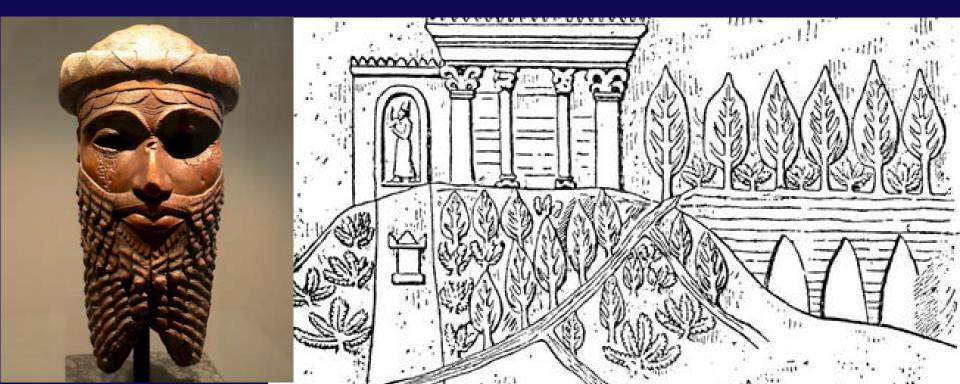


EXAMPLES

Water Supply Aqueduc of Jerwan, Nineveh

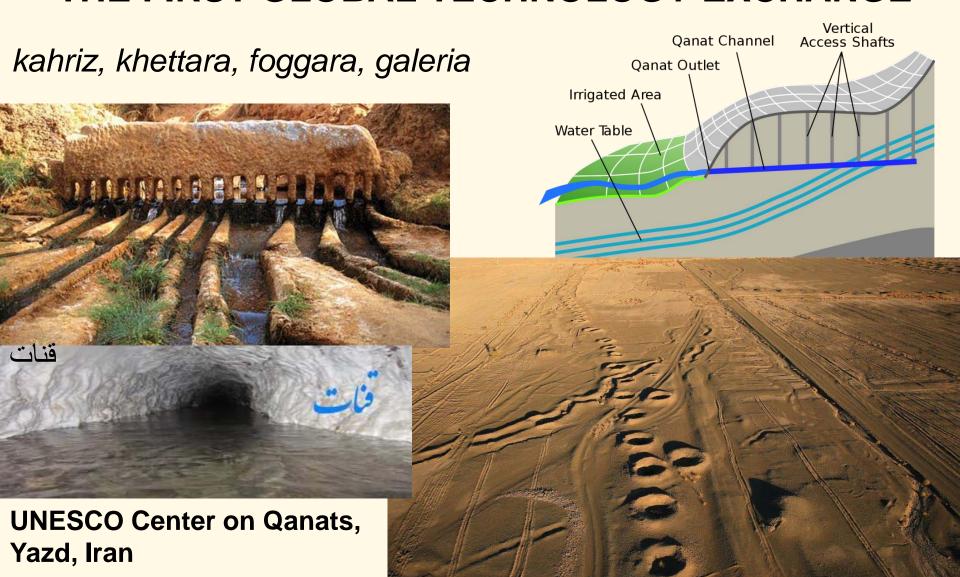
Head of king Maništušu

Temple of Ištar,

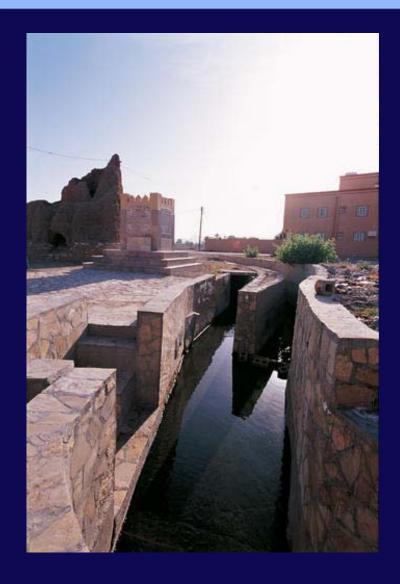


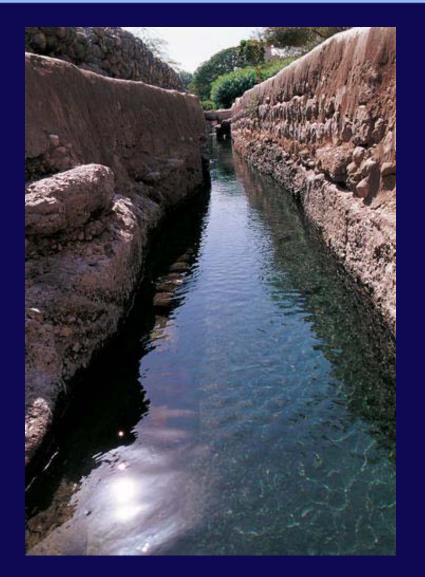
QANAT

THE FIRST GLOBAL TECHNOLOGY EXCHANGE









Irrigation System of Aflaj, Oman



Tribunal de les Aigües de València, Spain

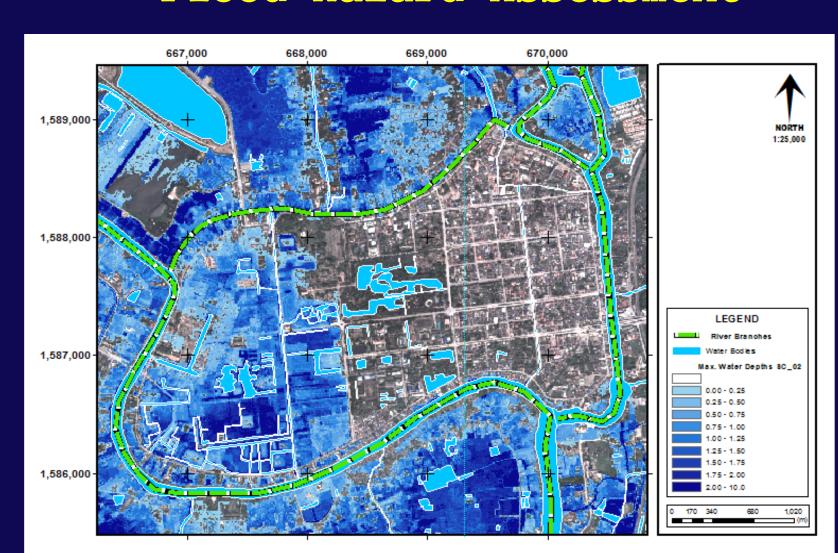




Ayutthaya flood, 2011



Model-based Flood Hazard Assessment



HOW CAN WE INCORPORATE CULTURE AND HERITAGE INTO WATER RESOURCES DEVELOPMENT AND MANAGEMENT?

ISN'T IT A KEY TO SUSTAINABLE DEVELPMENT?

Sustainable Development Goals (SDGs)





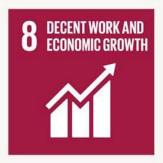


























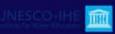


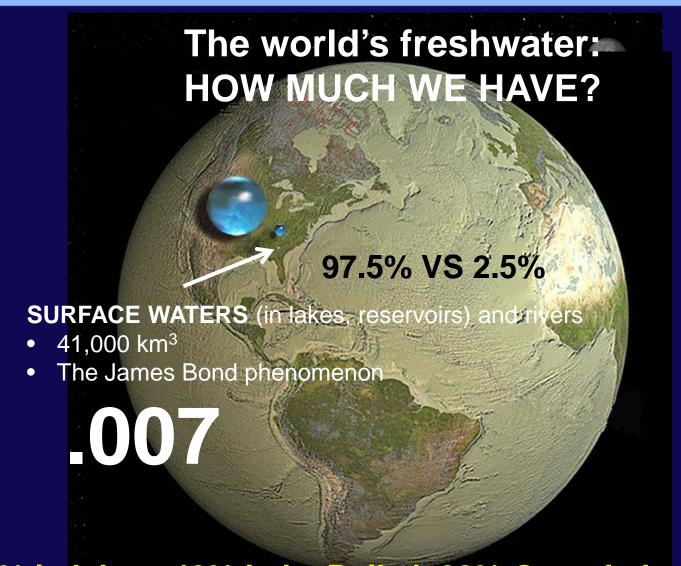




WATER AS THE CENTER PIECE OF THE SDGs



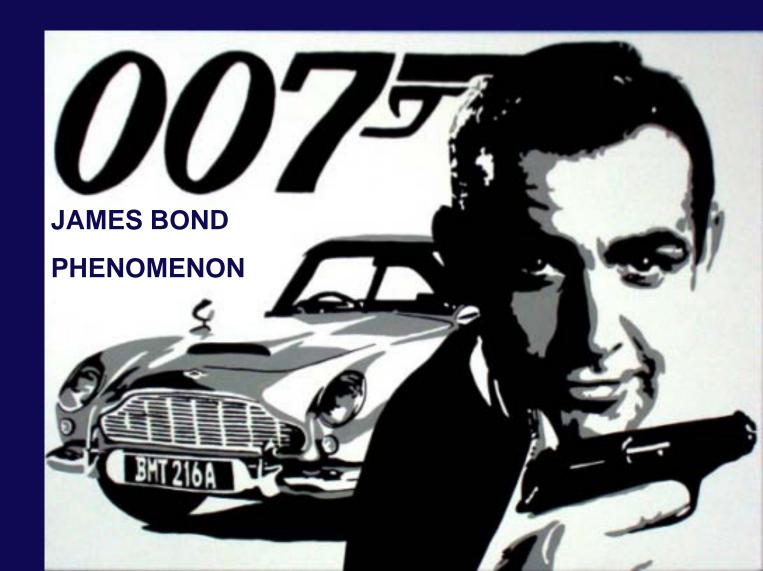




(90% in lakes: 40% Lake Baikal, 20% Great Lakes, The rest in smaller smaller ponds, like Lake Balaton)



VERY LIMITED AMOUNT OF EASILY ACCESSIBLE WATER



GLOBAL FRESHWATER RESOURCES

Relation between water availability and population

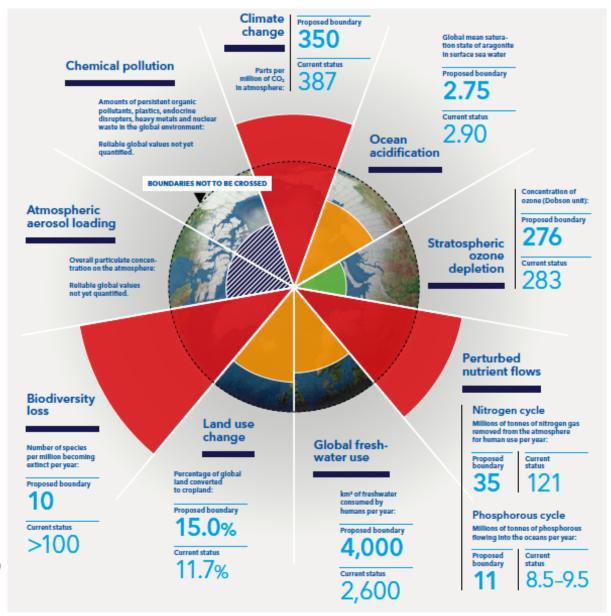




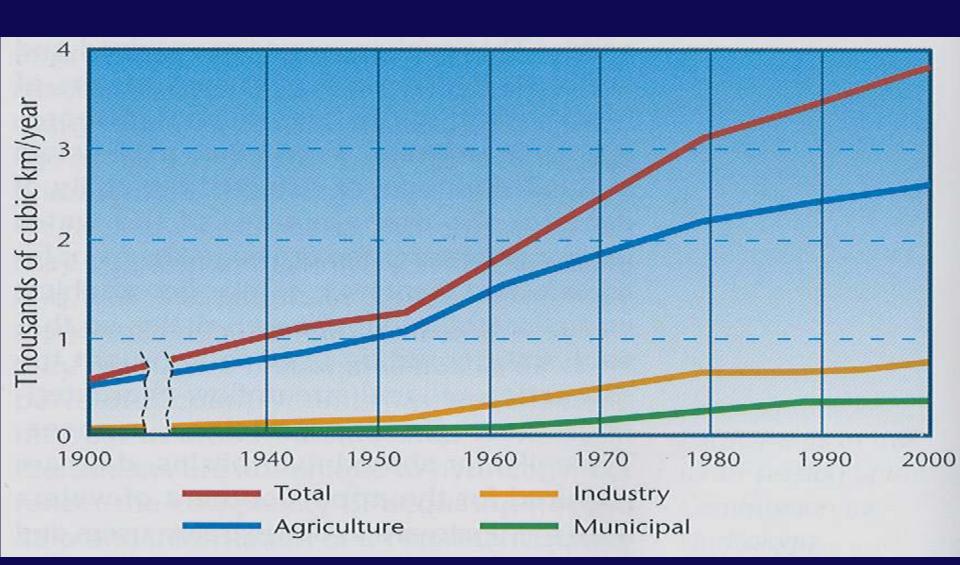


- Areas where we have exceeded the boundaries and are continuing to move further beyond them.
- Areas where we are still below the boundary values, but are moving towards them.
- Area where international political agreements have allowed us to start moving away from a boundary in the correct direction.
- Areas where no boundary values were established.

Rockström, et al., Nature, 2009 DNV GL Report 2014



TRENDS OF NON-SUSTAINABLE WATER USE [1000 KM3/YR]



IS THERE A LOOMING WATER CRISES?

Is the time of easy water over?





GLOBAL TRENDS 2030:

ALTERNATIVE WORLDS

WHEE OF NATIONAL AND STATE OF STATE OF

a publication of the National Intelligence Council



- Individual Empowerment.
- The Diffusion of Power.
- Demographic Patterns.
- The Growing Nexus among Food, Water, and Energy







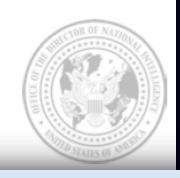




National Intelligence Council (2012)

GLOBAL TRENDS 2030:

ALTERNATIVE WORLDS



a publication of the National Intelligence Council

Four overarching megatrends will shape the world in 2030:

"Water may become a more significant)

source of contention than energy or

minerals out to 2030 at both the intrastate)

and interstate levels."

The Growing Nexus among Food, Water, and Energy

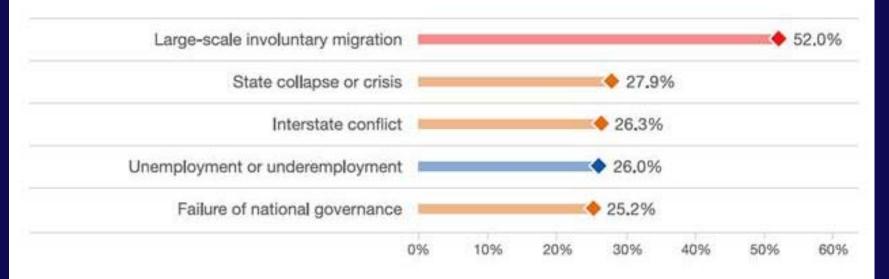


The Global Risks of Highest Concern, 2016

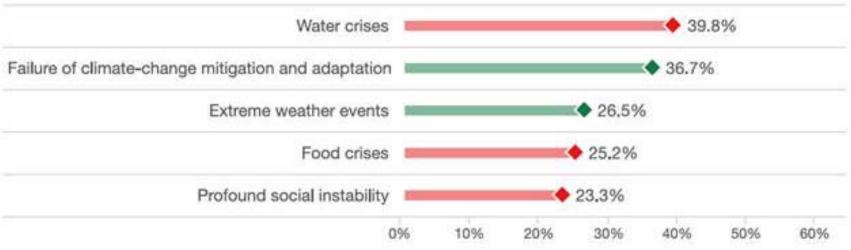


Percent of participants mentioning the respective risk to be of high concern for the time frame of 18 months or 10 years, respectively. Participants could name up to five risks in each time frame, in each category, the risks are sorted by the total sum of mentions.

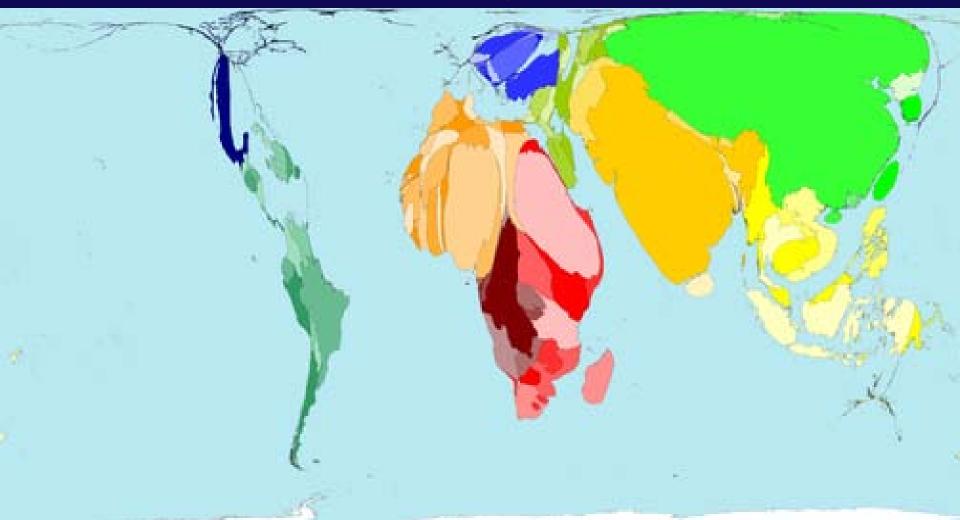
For the next 18 months



For the next 10 years



Area proportional with non-access to drinking water 2011



Water security key challenges of the 21st century





of the human population live in arid areas. By 2030, half of the population will be living in areas of high water stress.

85%



of the world's total wastewater is discharged without adequate or any treatment.

750

million people lack access to safe water and 2.5 billion to adequate sanitation.



decline in population of freshwater species in just thirty years.

6-8

million human beings are killed each year from water-related disasters and diseases.

600



transboundary aquifers shared by 2-4 countries

SUPERIMPOSED ON ALL THIS ...



HEADLINE NEWS!!!!!

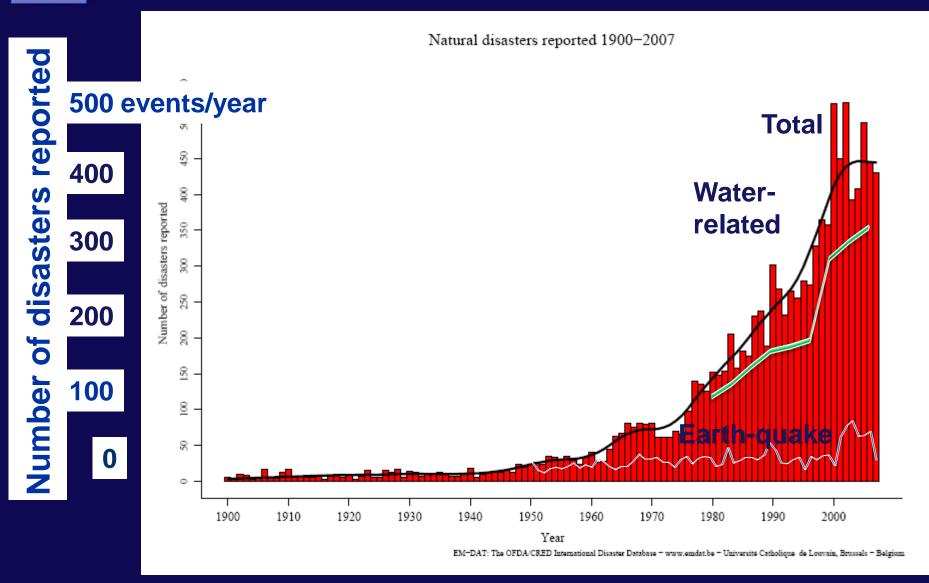
The climate is changing !!!

(Yap, for 4 billion years now ...)





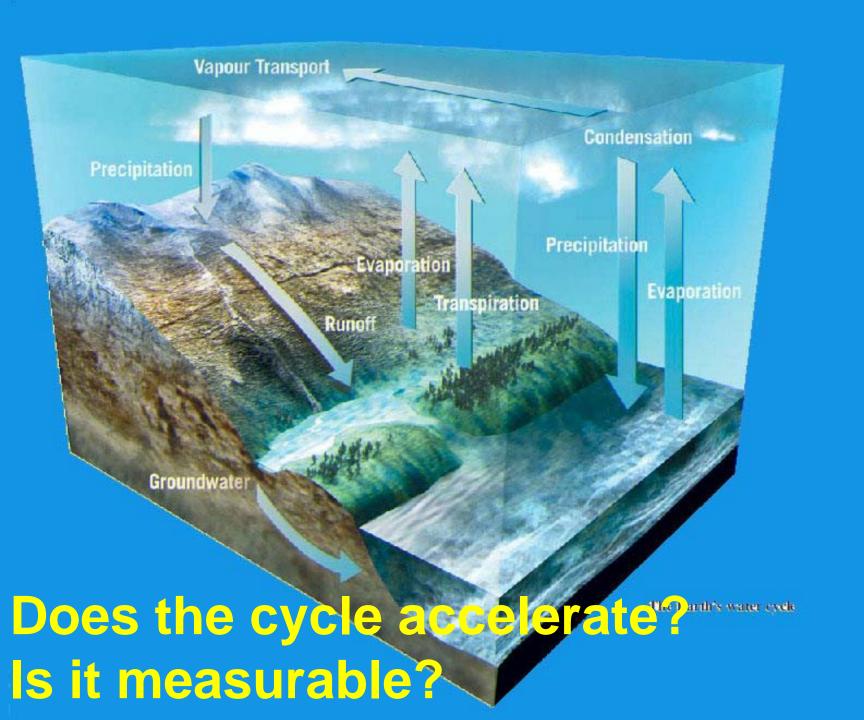
Number of natural disaster events since 1900 to 2007





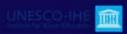


- Is the cycle changing?
- Increased risks?
- Growing vulnerability?
- More disasters ?
- Less water for people?
- Crisis is looming?
- What crisis?
- Resource?
- Governance?
- Global or local?



LOOMING WATER CRISES

The time of easy water is over



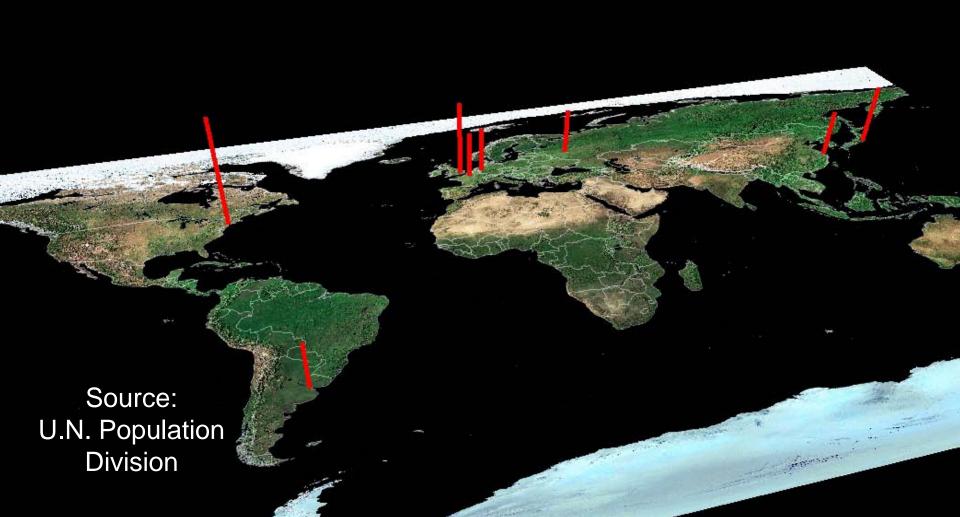
THE DRIVERS

KEY CHANGES SINCE 1900

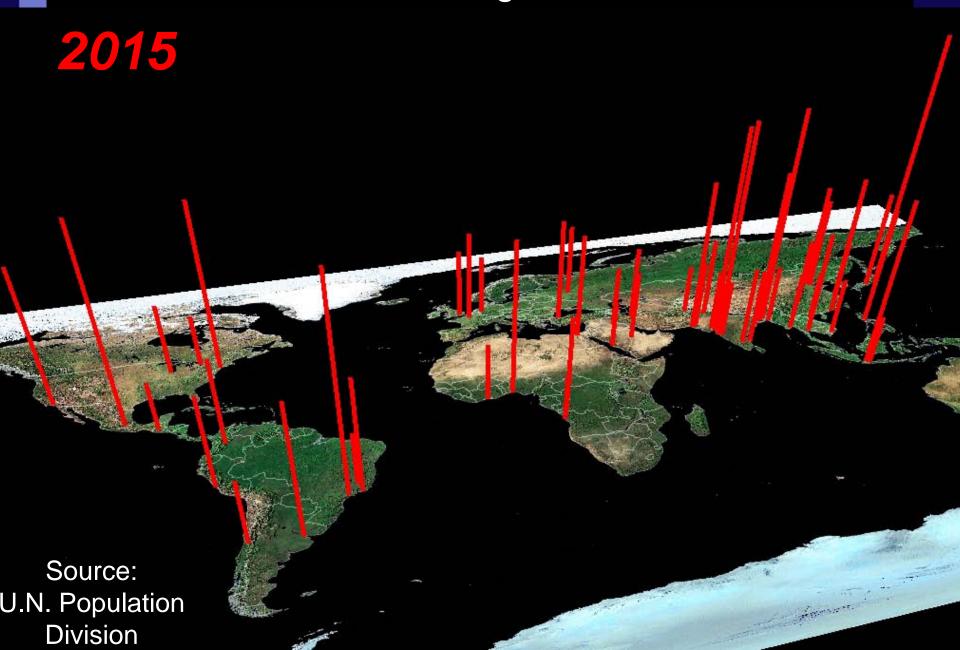
- The world's population has increased 3-fold
- Water withdrawal has increased 6-fold
- The area of cropland has almost doubled
- The area of pasture has decreased by about 75%
- The area covered by tropical forests has decreased by about 25%.
- Dams now intercept ca. 40% of the runoff from the continents

World Cities exceeding 5 million residents

1950



World Cities exceeding 5 million residents



Global change drivers:

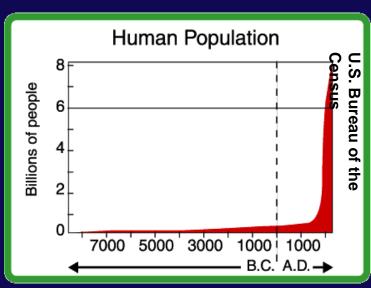
 Population growth, movement, migration and age structures

Geo-political changes and

realignments

Trade and subsidies

- Technological changes
- Climate change





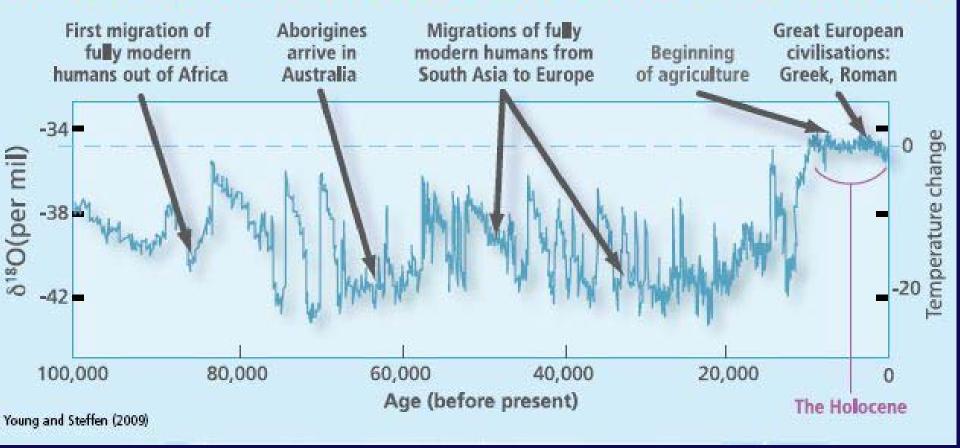






THE GREAT MIGRATION WAVES OF THE PAST 100,00 YEARS

HUMAN DEVELOPMENT AND GLACIAL-INTERGLACIAL CYCLING



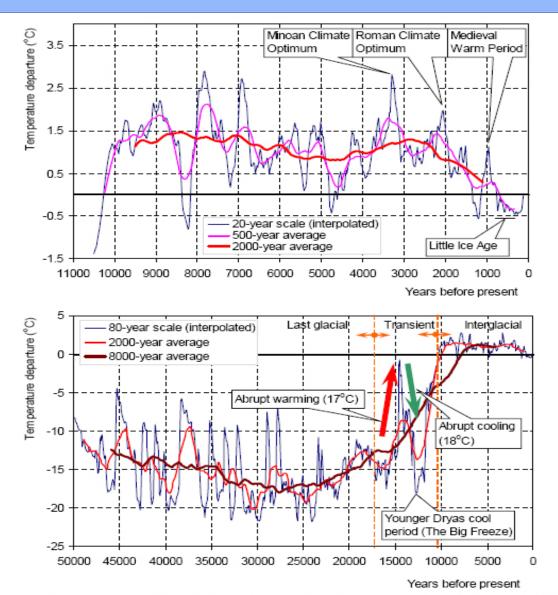
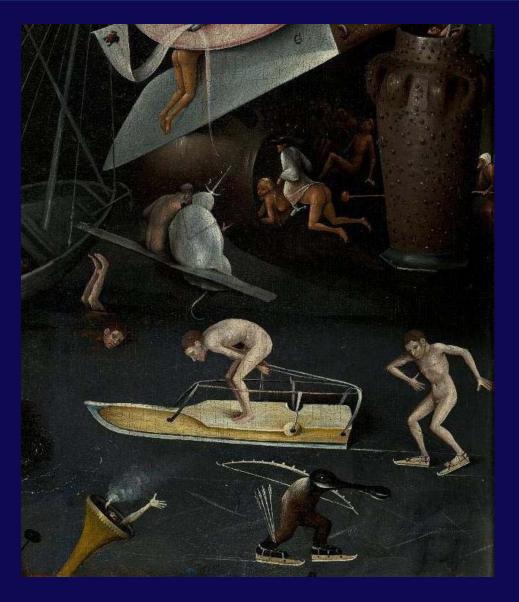


Fig. 3 Times series plot of the temperature in Greenland, as reconstructed from the GISP2 Ice Core (Alley 2000, 2004; temperature departures from the most recent value, which is -31.6°C; data from ftp.ncdc.noaa.gov/pub/data/paleo/icecore/greenland/summit/gisp2/isotopes/gisp2_temp_accum_alley20_00.txt): (a) during the Holocene (current interglacial period), with marking of the most prominent recent lows and highs; and (b) the entire record with marking of the most prominent abrupt warming and cooling episodes (in a transient period between the current interglacial and the last glacial period) that ended with the Younger Dryas cool period.





Pieter Breugel, the Elder



Hieronymus Bosch

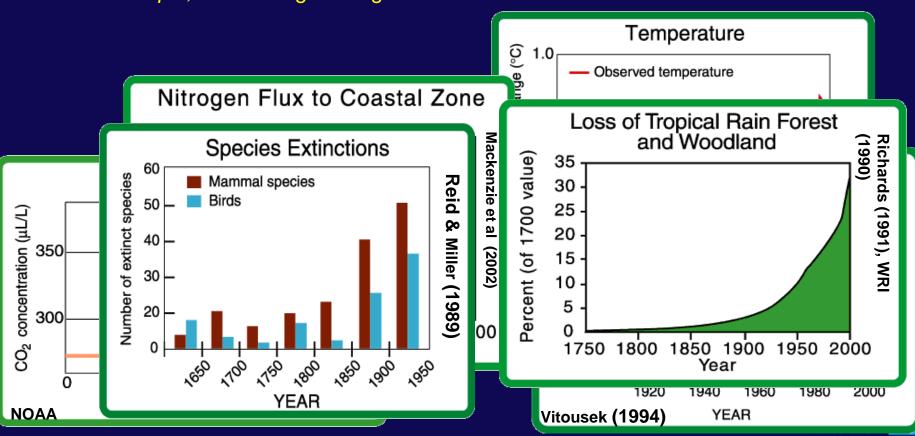


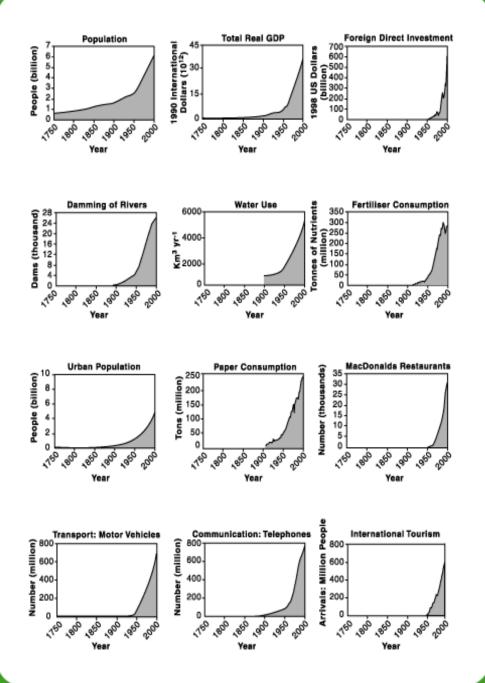
THE IMPACTS

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:





STATIONARITY IS DEAD

The story of the 200-year flood

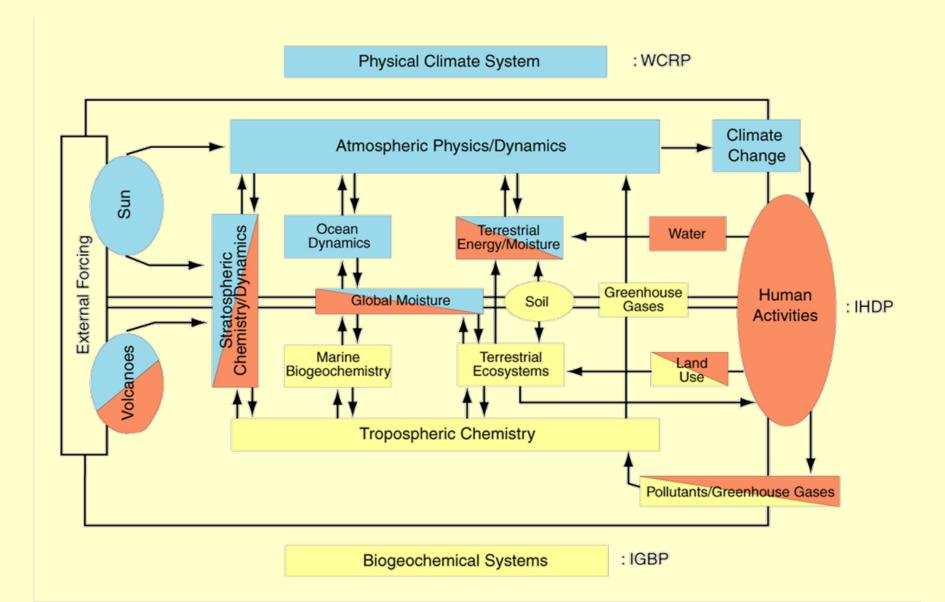
New technologies are needed

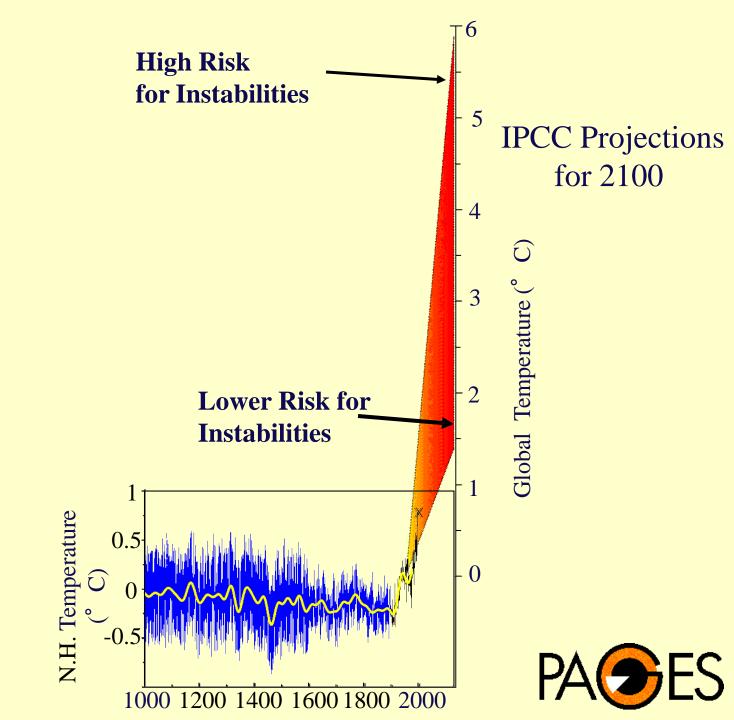


ANTROPOCEN



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



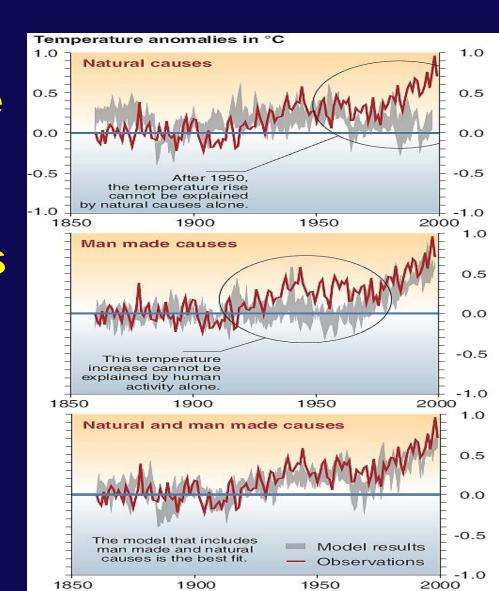


Climate change: What do we know?

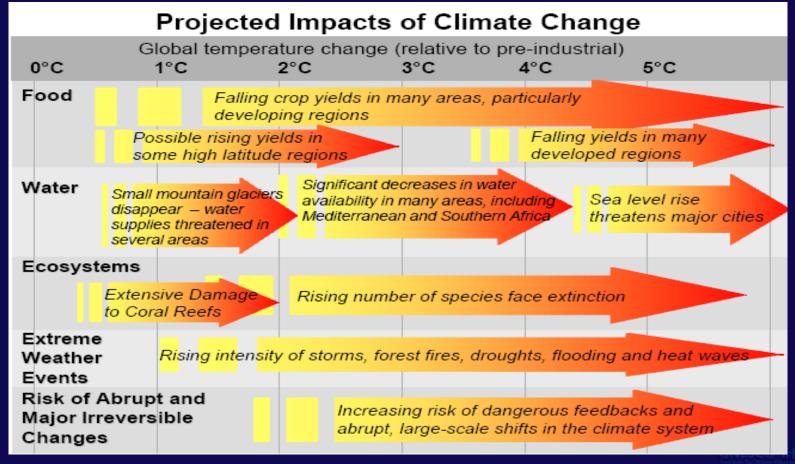
Global Mean Temperature have increased

Greenhouse Gases play a role

Reducing Emissions alone will not avoid impacts



Climate change is effecting our environment, our societies and our cultures





Expected Impacts of Global Changes on Water Resources

WILL WE HAVE MORE FLOODS?



Water hazards and related nexi are major challenges

- 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 rise



Major floods and droughts worldwide



Flood Disaster in Pakistan (August, 2010)







Flood Disaster in Korea (September 21, 2010)





Rio de Janneiro, Brasil (January, 2011)



Flood Disaster in Brisbane, Australia (January, 2011)

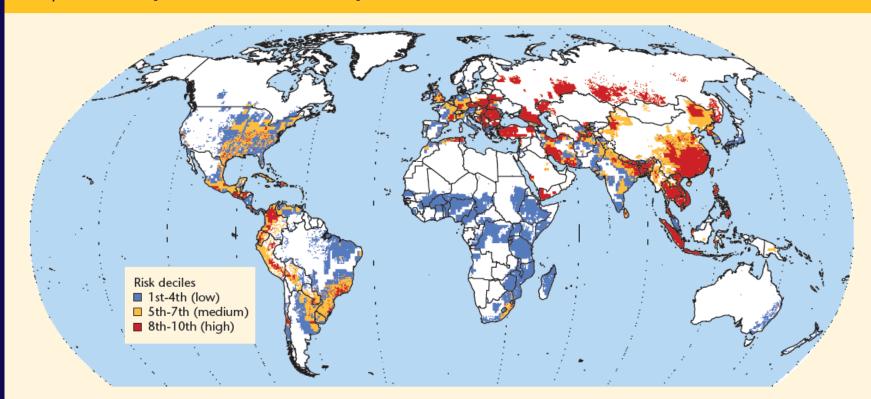






FLOOD LOSSES IN FUNCTION OF GDP

Map 10.3 Impact of flood losses (comparative losses based on national GDP)



Note: Deciles refer to the level of risk, normalized for comparing 10 categories. **Source:** Based on Dilley et al. 2005.

1910: PARIS FLOOD

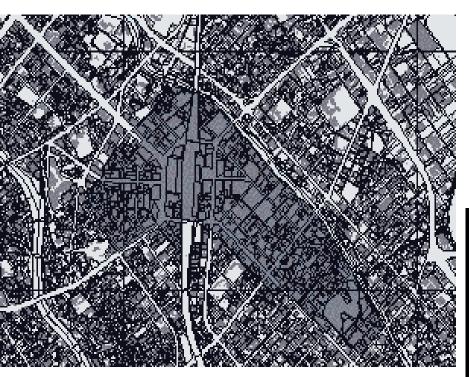






Fukuoka Flash Flood in 1999

- □ Urban expansion taking place downward → Underground flood risk
- □ Recent developments → Long term risks are not experienced



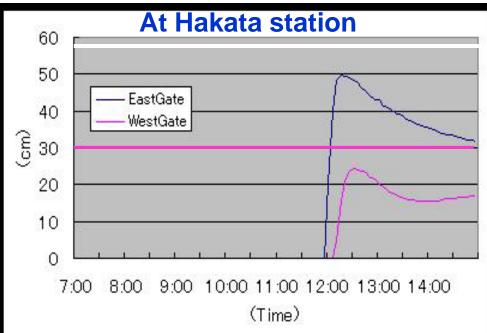
Volume of water entered into underground space:

•2,017 m3 (simulated volume)•1,320 m3 (total pumped water

(Source: Herat, UNU)

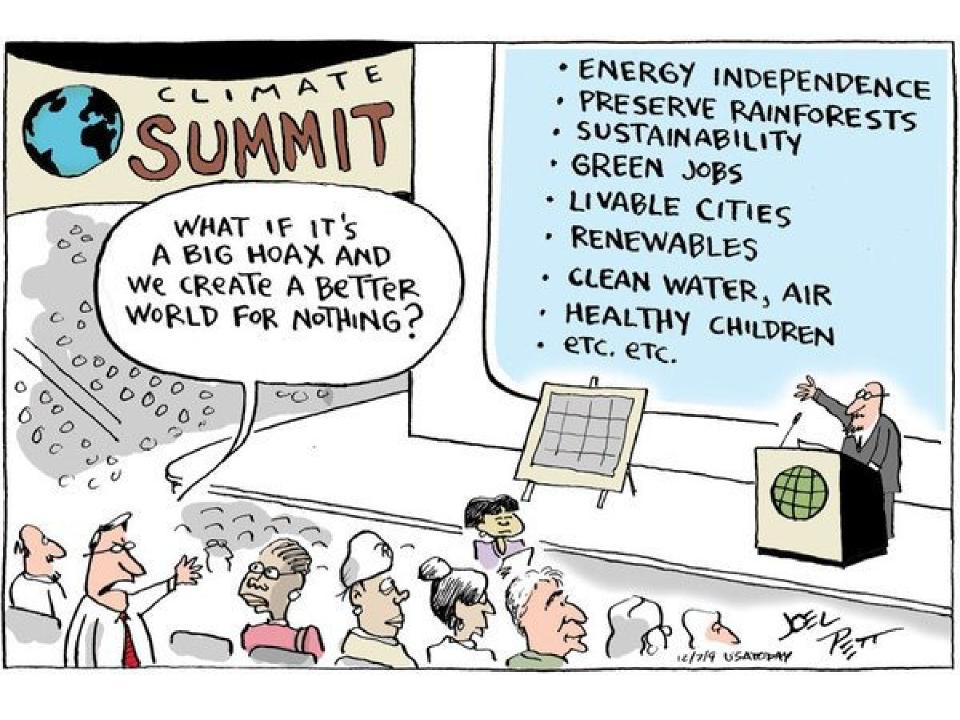


Fukuoka flash flood simulation

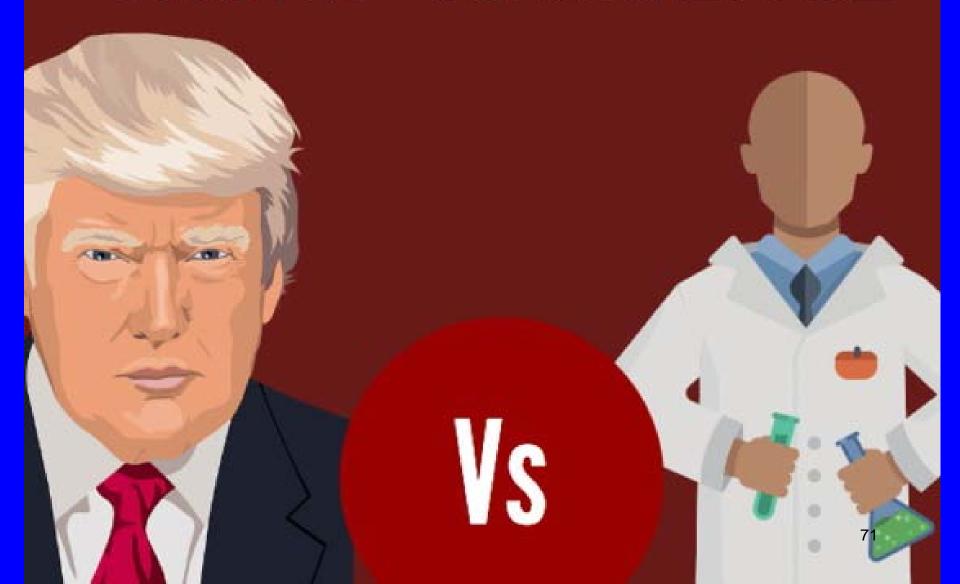




NOT TOO MUCH HOPE ...



TRUMP VS SCIENCE



CLIMATE CHANGE IS ALL ABOUT WATER

KEY TO SUSTAINABILITY:

CLIMATE ADAPTIVE WATER STRATEGIES

DO WE HAVE A CHOICE?

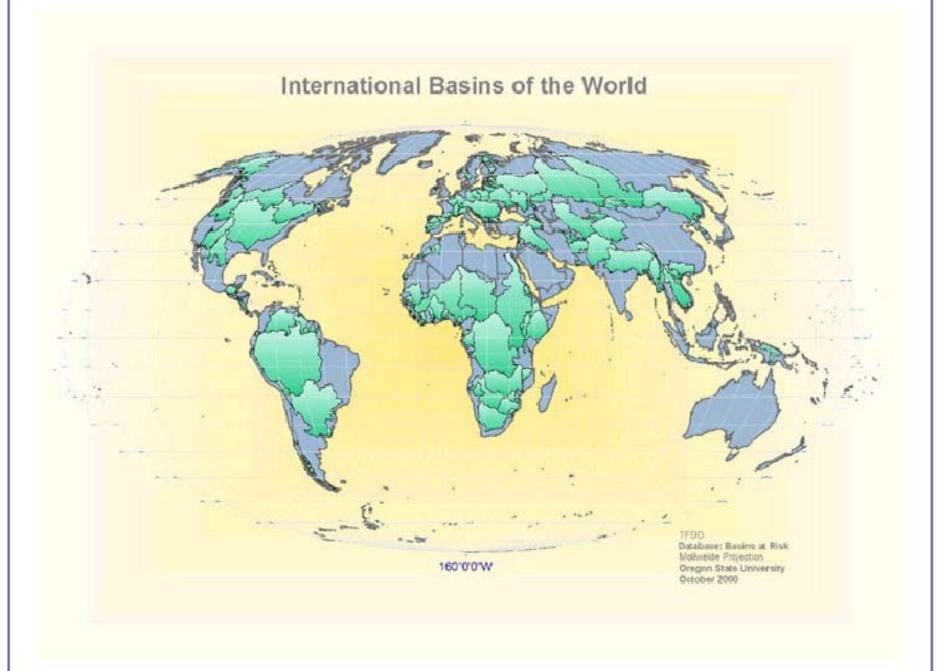
WE NEED TO INCREASE THE RESILIENCE OF OUR SYSTEMS



ADAPTATION OPTIONS:

- MORE STORAGE
- MORE HYDROPOWER
- MORE GROUNDWATER USE
- MORE INLAND NAVIGATION
- MORE CONSERVATION
- INTERBASIN WATER TRANSFER
- BETTER WATER GOVERNANCE
- BUT AREN'T THESE CONTRADICTORY?

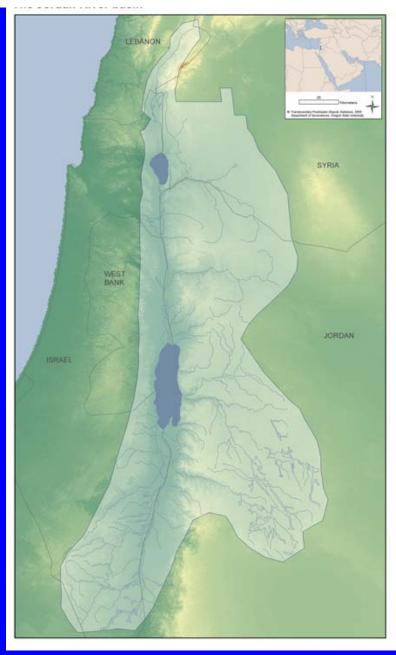
WAR OVER WATER OR TRANSBOUNDARY COOPERATION OVER WATER?



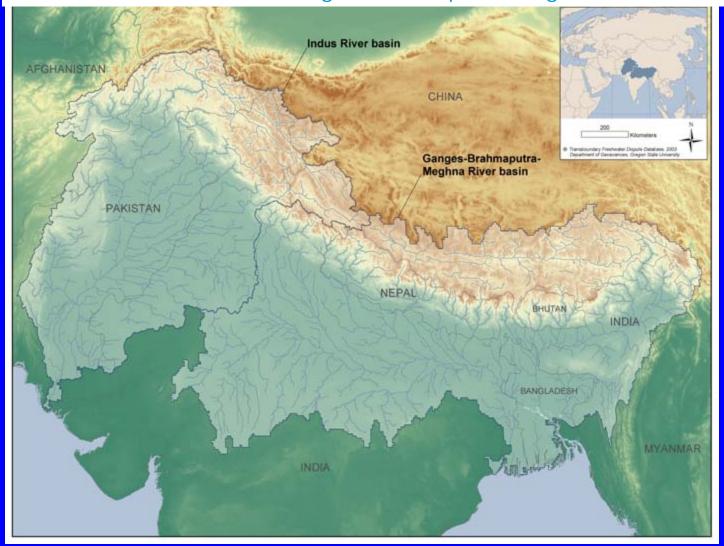
The Nile River basin



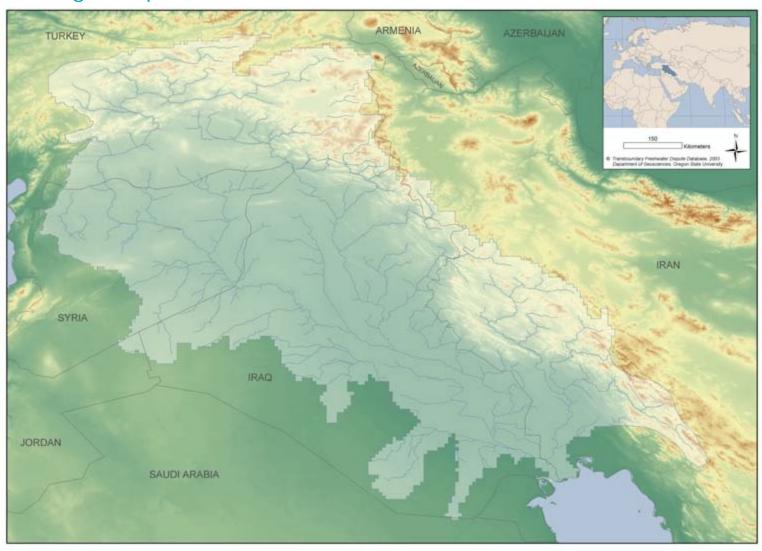
The Jordan River basin



The Indus River and the Ganges Brahmaputra-Maghna River Basin



The Tigris Euphrates basin



The Aral Sea basin





Nurek dam built in the Soviet years



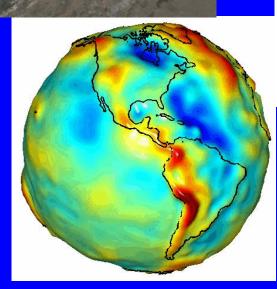
WATER IS A SOURCE OF COOPERATION: WATER CONNECTS AND DOES NOT DIVIDE

THE DATA ISSUE

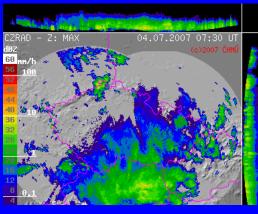
IF YOU CAN'T MEASURE IT (NEAR) REAL TIME AND IF YOU DON'T HAVE THE RIGHT DIGITAL **TECHNOLOGY** YOU CAN'T MANAGE IT.

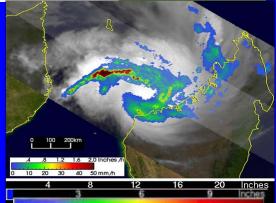
DATA SECRECY: NEW TECHNOLOGIES OFFER NEW OPPORTUNITIES FOR TRUST BUILDING

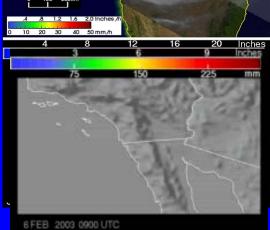
Remotely sensed data

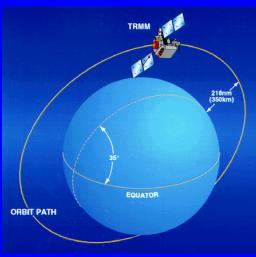


AND THE PROPERTY OF THE PROP









GRACE

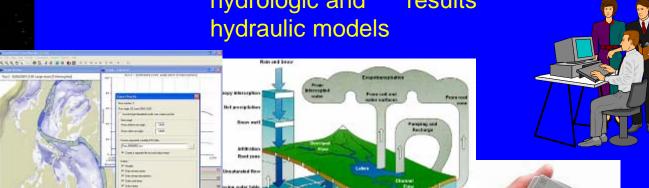
(Source: D. Solomatine)

Flow of information in a Hydroinformatics systems Data → Models → Knowledge → Decisions

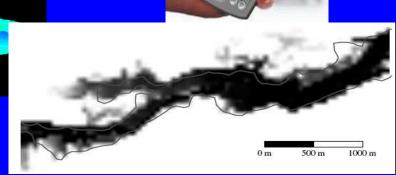
Earth observation, Numerical Weather monitoring Prediction Models

Data modelling, integration with hydrologic and hydraulic models

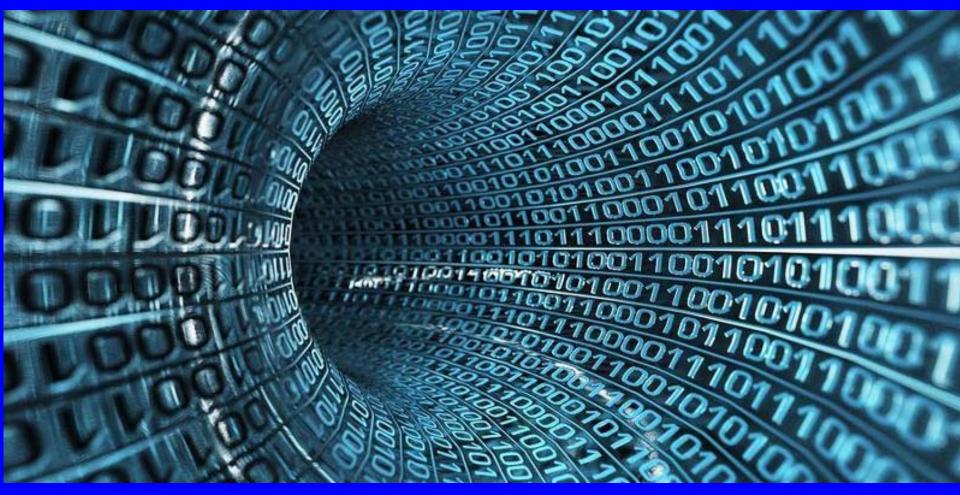
Access to Decision modelling support results







BIG DATA



Data revolution:

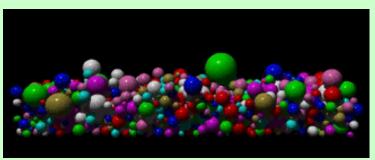
Terra bytes Petabytes Exabytes ... Terra Hertz speed

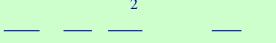
SCIENCE TECHNOLOGY MODELING



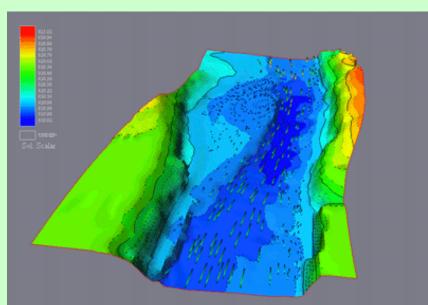
Modeling is the heart ...

Technologies support the whole information cycle, and *integrate data, models, and humans*







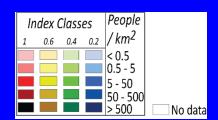


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Near real-time assessment of water conflict potential and involuntary migration

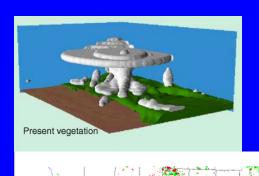
Composite index of conflict potential

- _
- •
- •



DIGITAL WATER MANAGEMENT INTEGRATED SYSTEMS

(IoT, AI)



High Precision Earth Systems Tools

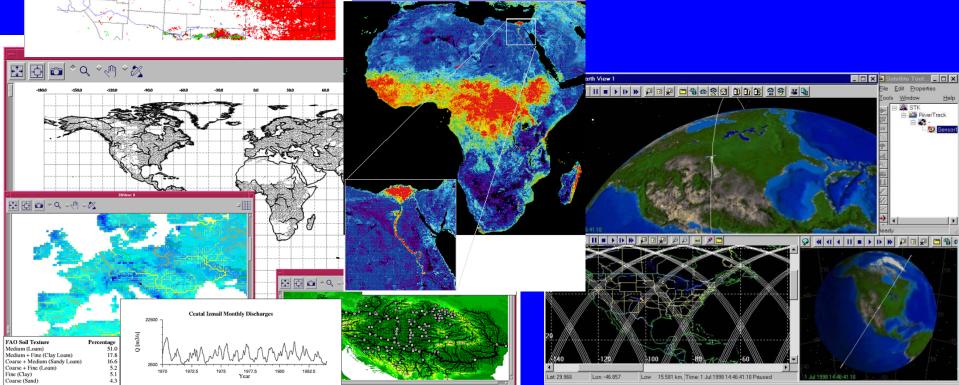
Satellite data

Data assimilation

Simulation models

Geospatial analysis / GIS

Huge progress but...



Our capacity to monitor remains limited

LOOMING WATER CRISES

The time of easy water is indeed over

Where do we go from here?



WILL THERE BE ENOUGH **WATER FOR** THE HUMANS AND THE **ENVIRONMENT** IN THE 21ST CENTURY?



YES, BUT

WE NEED SOLUTIONS NOW

IS MORE TECHNOLOGY THE ANSWER?

NO

It is part of the answer only

We need to generate...

The political will to ... DO IT

The capacity to ...

DO IT RIGHT

The resources to ...
 NOW

DO IT RIGHT



WATER IS AN ETHICAL ISSUE

THE ANSWER IS ESSENTIALLY CULTURAL

The challenge we all have





CAPACITY DEVELOPMENT, CADACITY DEVELOPMENT

110

FINAL MESSAGE:

"Anybody who can solve the problems of water will be worthy of two Nobel Prizes, one for peace and one for science."

(President John. F. Kennedy)