EUREAU Workshop on Climate Changes Impact on Water Resources with Emphasis on Potable Water

EUREAU (European Association of Water and Wastewater Services)
Hellenic Union of Water and Wastewater Enterprises
Chania Water and Wastewater Enterprise
Chania, Crete, Greece, 26 June 2008

Climate change as a scapegoat in water science, technology and management

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Presentation available online: http://www.itia.ntua.gr/en/docinfo/865

Clarification of the title

- The **scapegoat** ("azazel" in Hebrew; "αποδιοπομπαίος τράγος" in Greek) was a goat that was driven off into the wilderness as part of the ceremonies in Judaism during the times of the Temple in Jerusalem (Leviticus, 16).
- The word is more widely used as a metaphor, referring to someone who is blamed for misfortunes, generally as a way of distracting attention from the real causes.
[en.wikipedia.org/wiki/Scapegoat]

"The scapegoat", sculpture by Benjamin Davis, The Hermitage Gallery, Worcester, Vermont
[www.hermitage-gallery.com/davisgallery/sculptures.htm]

1. Current "climate" on "climate change"

A characteristic recent example

- Research results linking Climate Change/Global Warming to several aspects of Nature and Life are promoted by regular Press or scientific Press:

ScienceDaily
Your source for the latest research news

Web address:
http://www.sciencedaily.com/releases/2008/05/080515072740.htm

Global Warming May Lead To Increase In Kidney Stones Disease

ScienceDaily (May 15, 2008)
— Rising global temperatures could lead to an increase in kidney stones, according to research presented at the 103rd Annual Scientific Meeting of the American Urological Association (AUA). Dehydration has been linked to stone disease, particularly in warmer climates, and global warming will exacerbate this effect. As a result, the

- They usually predict negative impacts or catastrophes and increased costs:

This could lead to an increase of one to two million lifetime cases of stone disease. The impact of climate-related changes in stone disease will be non-uniformly distributed and likely concentrated in the southern half of the country (linear model) or upper Midwest (non-linear model). The cost associated with treating stone disease could climb as high as one $1 billion annually by 2050, representing a 10-20 percent increase over present-day estimates.

- … and are backed by formal scientific publications.

Journal reference:

1. Pearle MS, Lotan Y, Brikowski T: Predicted climate-related increase in the prevalence and cost of nephrolithiasis in the U.S. J Urol, suppl., 2008; 179: 481, abstract 1407. [link]

A second characteristic recent example

NU Journal of Discovery, May 2008, http://nujournal.net/EarthquakeEnergyRise.pdf 1

Earthquake Energy Rise on Earth

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Results presented in this article indicate that the main danger for humanity on Earth may come not from a slow climate change, but from the rapidly increasing seismic/tectonic activity.

Planetary interior overheating is the most serious consequence of so-called "global warming" and constitutes the main danger for humanity on Earth today.

LiveScience

Global Warming Might Spur Earthquakes and Volcanoes

By Andrea Thompson, LiveScience Staff Writer
posted: 30 August 2007 08:57 am ET

Earthquakes, volcanic eruptions, tsunamis and landslides are some of the additional catastrophes that climate change and its rising sea levels and melting glaciers could bring, a geologist says.

The impact of human-induced global warming on Earth's ice and oceans is already noticeable: Greenland's glaciers are melting at an increasing rate, and sea level rose by a little more than half a foot (0.17 meters) globally in the 20th century, according to the Intergovernmental Panel on Climate Change.

CBS NEWS: Seismic Activity 5 Times More Energetic Than 20 Years Ago Because Of Global Warming

"The research proves that destructive ability of earthquakes on Earth increases alarmingly fast and that this trend is set to continue, unless the problem of 'global warming' is comprehensively and urgently addressed"

(The CBS article appeared on Wednesday 18/6/2008 and disappeared (!?) on Thursday) [www.americanthinker.com/blog/2008/06/cbs_pulls_unvetted_story_blami.html]

The main driver of climate alarmism: politics

- Politicians know the truth, even the scientific truth:
  - **"The inconvenient truth"** (film & book by Al Gore, 2006).
- Politicians and politics-involved scientists want to save the planet and all of us, willing or not to be saved:
  - "I believe it is appropriate to have an over-representation of factual presentations on how dangerous it is" (Al Gore). [www.grist.org/news/maindish/2006/05/09/roberts/]
  - "Unless we announce disasters, no one will listen" (Sir John Houghton, first co-chair of the IPCC, lead editor of the first three Reports, founder of Hadley Centre). [http://www.parliament.uk/documents/upload/EA181%20Philip%20Bratby.doc]
- Financial firms know that politicians are better climate-change consultants than scientists:
  - "**Tony Blair** is due to take his post-prime ministerial earnings to more than £7m this year following his appointment to a six-figure-salary job with Zurich Insurance, **the Swiss financial firm, advising it on climate change**. The company, which could pay out tens of millions of pounds for claims from businesses and householders over **floods, hurricanes and droughts caused by global warming, is taking Blair on to advise it on the implications of climate change**." (The Guardian). [www.guardian.co.uk/politics/2008/jan/29/uk.tonyblair]

The general "climate" for "climate-change skeptics"

- Climate-change skeptics, like terrorists, should be denied media air time (Margaret Beckett, former UK Secretary of State for Environment, Food and Rural Affairs and Foreign Secretary, November 2006; from Brendan O'Neill, A climate of censorship, The Guardian). [commentisfree.guardian.co.uk/brendan_oneill/2006/11/a_climate_of_censorship.html]
- "Everyone who failed to act on climate change [is] as guilty as Austrian child abuser Josef Fritzl" (The Bishop of Stafford, from Times Online, 2 June 2008). [www.timesonline.co.uk/tol/comment/faith/article4048461.ece]
- Does such a "climate" favour scientific progress? (Historical analogies may suggest a positive answer).

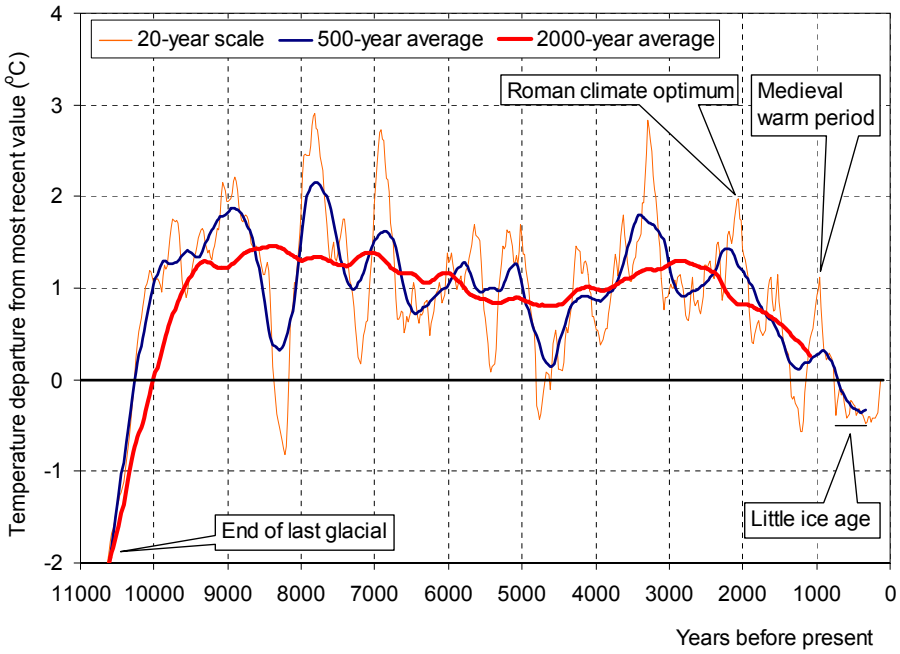
The huge "bearing capacity" of the Climate Change Scapegoat

- "Global **warming** can mean **colder**, it can mean **drier**, it can mean **wetter**." (Stephen Guilbeault, Greenpeace, 2005; Telegraph). [www.telegraph.co.uk/opinion/main.jhtml?xml=/opinion/2005/12/06/do0602.xml]
- We can blame it for any negative sign we see:
  - Hot summers;
  - Cold winters;
  - Floods, typhoons, cyclones, hurricanes;
  - Droughts, desertification.
- We can predict every conceivable catastrophe for the future:
  - All above will worsen, and even …
  - … the Earth can end up like Venus with temperature rises of several hundreds degrees and sulfuric acid rain (Stephen Hawking).

2. Some elementary evidence about climate

Climate has been ever changing. Why not now?

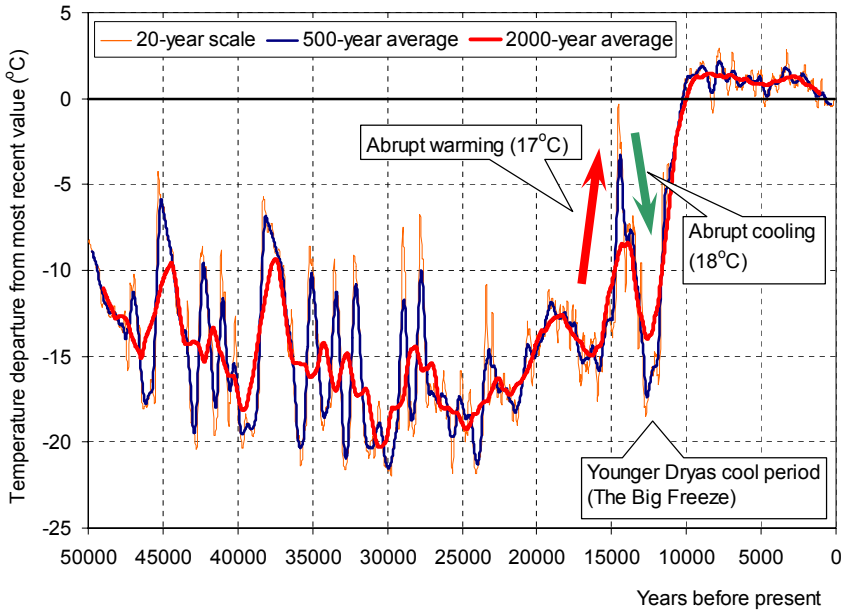
The climate of Greenland during Holocene, as reconstructed from the GISP2 Ice Core (Alley 2000, 2004).



Data from:
ftp.ncdc.noaa.gov/pub/data/paleo/icecore/greenland/summit/gisp2/isotopes/gisp2_temp_accum_alley2000.txt

Climate has been ever changing even on multi-millennial time scales

The climate of Greenland during the last 50 000 years, as reconstructed from the GISP2 Ice Core (Alley 2000, 2004).



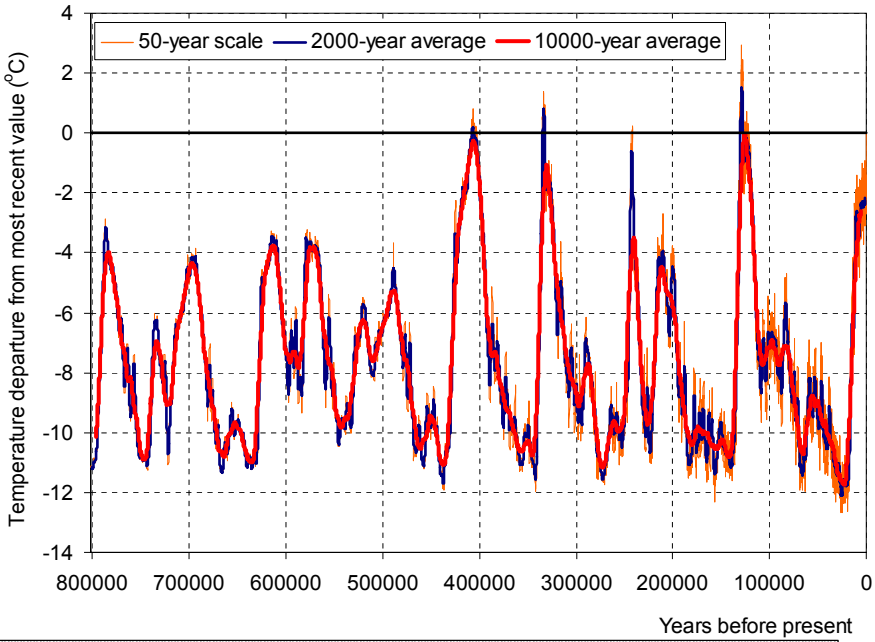
Data from:
ftp.ncdc.noaa.gov/pub/data/paleo/icecore/greenland/summit/gisp2/isotopes/gisp2_temp_accum_alley2000.txt

Climate has been ever changing on all time scales

The reconstructed climate of Antarctica for 800 millennia shows huge fluctuations.

These reflect astronomical influences (the Milankovich cycles).

However, the signature of irregularity is eminent and points to the necessity of a stochastic description of *Hurst-Kolmogorov* type (Koutsoyiannis and Cohn, 2008).



The EPICA, Dome C, Ice Core deuterium proxy data set, Antarctica (Jouzel et al. 2007).

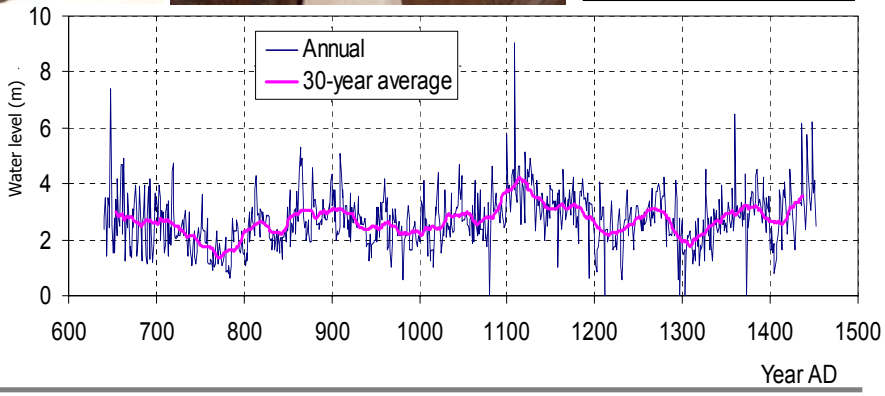
Data from: ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/epica_domec/edc3deuttemp2007.txt

Climatic fluctuations are seen not only in proxies but also in instrumental records

Roda Nilometer

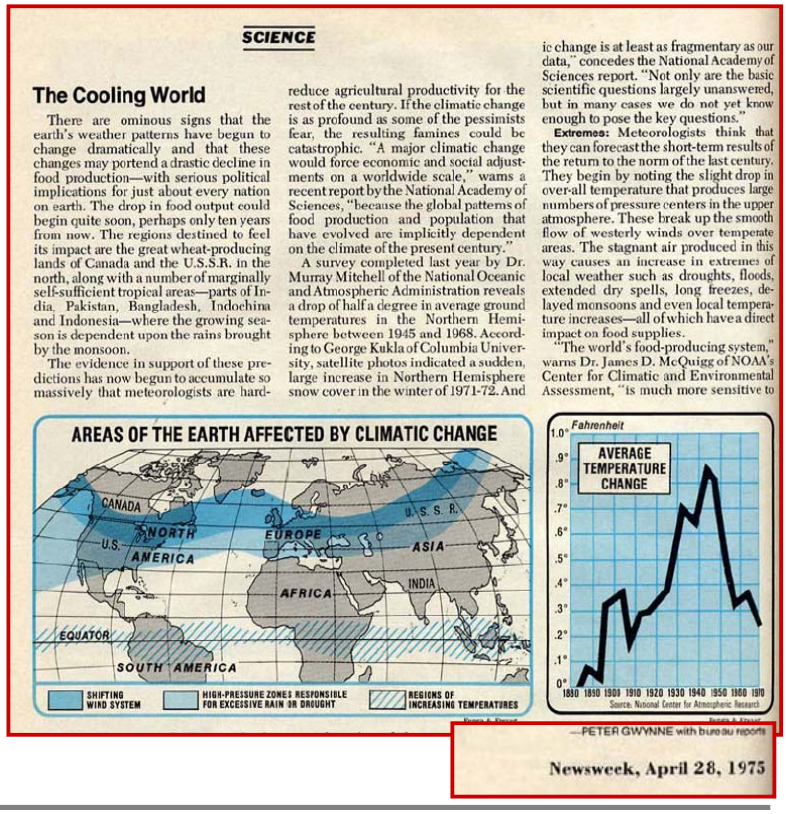
The fluctuating behaviour is verified from the modern record (131 years) of the Nile flows at Aswan

The longest available instrumental hydroclimatic data set (813 years)



Climatic fluctuations trigger various scientific hypotheses

See also: Ponte, L., *The Cooling: Has the Next Ice Age Already Begun?*, Prentice Hall, 1976.



SCIENCE

The Cooling World

There are ominous signs that the earth's weather patterns have begun to change dramatically and that these changes may portend a drastic decline in food production—with serious political implications for just about every nation on earth. The drop in food output could begin quite soon, perhaps only ten years from now. The regions destined to feel its impact are the great wheat-producing lands of Canada and the U.S.S.R. in the north, along with a number of marginally self-sufficient tropical areas—parts of India, Pakistan, Bangladesh, Indochina and Indonesia—where the growing season is dependent upon the rains brought by the monsoon.

The evidence in support of these predictions has now begun to accumulate so massively that meteorologists are hard-

reduce agricultural productivity for the rest of the century. If the climatic change is as profound as some of the pessimists fear, the resulting famines could be catastrophic. "A major climatic change would force economic and social adjustments on a worldwide scale," warns a recent report by the National Academy of Sciences, "because the global patterns of food production and population that have evolved are implicitly dependent on the climate of the present century."

A survey completed last year by Dr. Murray Mitchell of the National Oceanic and Atmospheric Administration reveals a drop of half a degree in average ground temperatures in the Northern Hemisphere between 1945 and 1968. According to George Kukla of Columbia University, satellite photos indicated a sudden, large increase in Northern Hemisphere snow cover in the winter of 1971-72. And

ic change is at least as fragmentary as our data," concedes the National Academy of Sciences report. "Not only are the basic scientific questions largely unanswered, but in many cases we do not yet know enough to pose the key questions."

Extremes: Meteorologists think that they can forecast the short-term results of the return to the norm of the last century. They begin by noting the slight drop in over-all temperature that produces large numbers of pressure centers in the upper atmosphere. These break up the smooth flow of westerly winds over temperate areas. The stagnant air produced in this way causes an increase in extremes of local weather such as droughts, floods, extended dry spells, long freezes, delayed monsoons and even local temperature increases—all of which have a direct impact on food supplies.

"The world's food-producing system," warns Dr. James D. McQuigg of NOAA's Center for Climatic and Environmental Assessment, "is much more sensitive to

AREAS OF THE EARTH AFFECTED BY CLIMATIC CHANGE

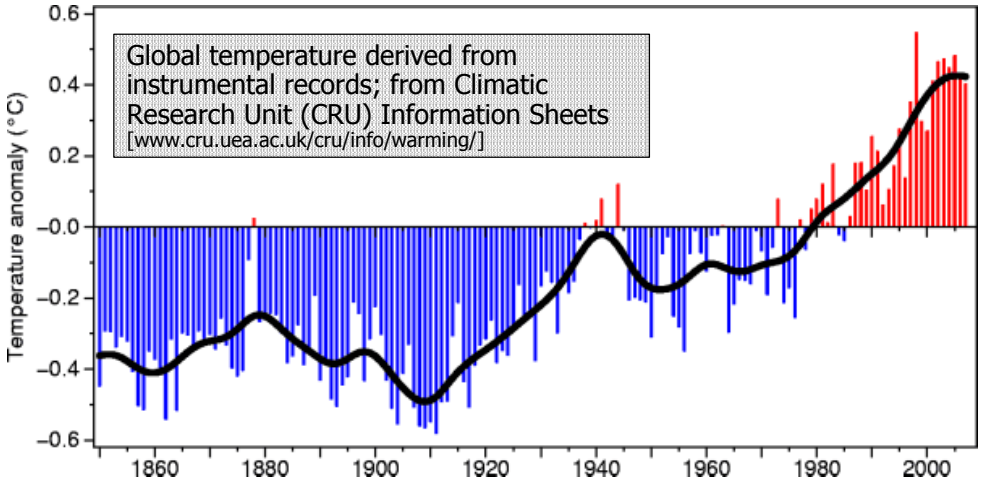
CANADA
U.S.
NORTH AMERICA
EUROPE
U.S.S.R.
ASIA
INDIA
AFRICA
EQUATOR
SOUTH AMERICA
SHIFTING WIND SYSTEM
HIGH-PRESSURE ZONES RESPONSIBLE FOR EXCESSIVE RAIN OR DROUGHT
REGIONS OF INCREASING TEMPERATURES

Fahrenheit
AVERAGE TEMPERATURE CHANGE
1.0°
.9°
.8°
.7°
.6°
.5°
.4°
.3°
.2°
.1°
0°
1880 1890 1900 1910 1920 1930 1940 1950 1960 1970
Source: National Center for Atmospheric Research

—PETER GWYNNE with bureau reports

Newsweek, April 28, 1975

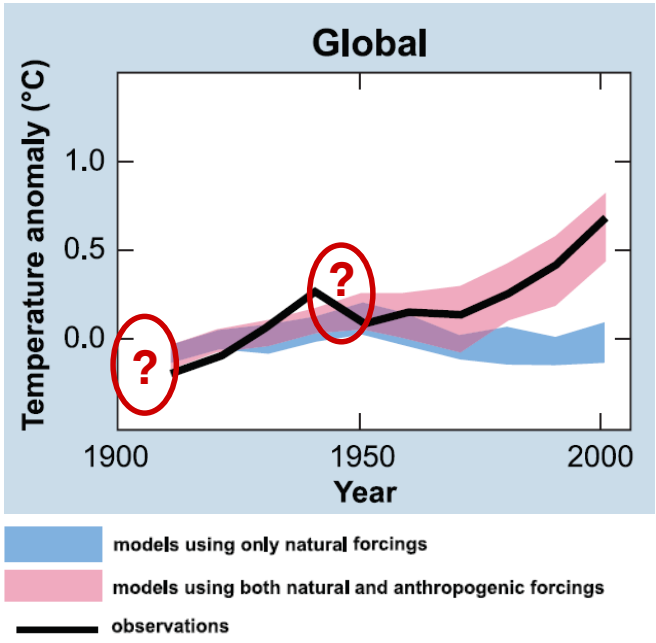
"Global warning" successfully replaced the ñglobal coolingò hypothesis



- Climatic fluctuations (upward and downward trends) appear most of the time.
- Global warming: 1860-1880; 1910-1940; 1970-2000
- Global cooling: 1880-1910; 1940-1955

Is the last warming period different than previous? Is it anthropogenic?

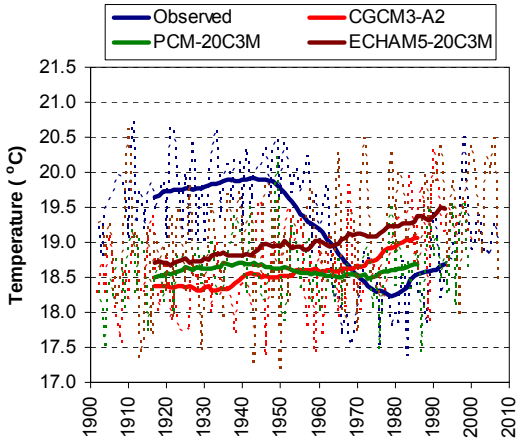
IPCC (2007; Figure SPM.4 partly reproduced here) has concluded that it is likely that there has been significant anthropogenic warming over the past 50 years. The observed patterns of warming, are only simulated by models that include anthropogenic forcing.



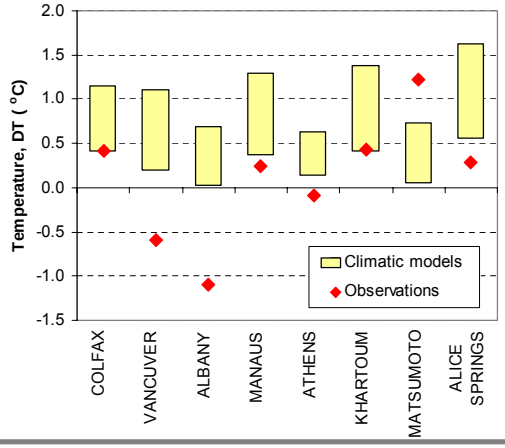
Such an assertion assumes that models well reproduce real-world climate. But do they?

Koutsoyiannis *et al.* (2008) tested retrodictions of three IPCC AR4 and three TAR climatic models at 8 test sites that had long (> 100 years) temperature and precipitation series of observations and found that model outputs are irrelevant with reality.

Comparisons of observed temperature at Albany, Georgia, USA, and modelled temperature by three AR4 models

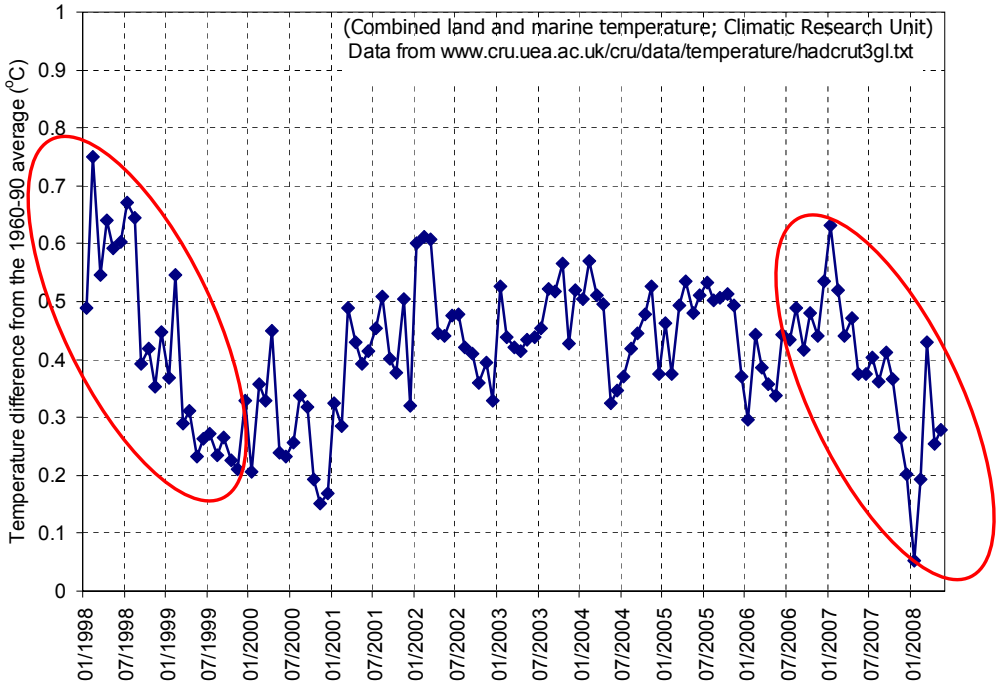


Change of climatic (30-year moving average) temperature (in the 20th century: models vs. reality

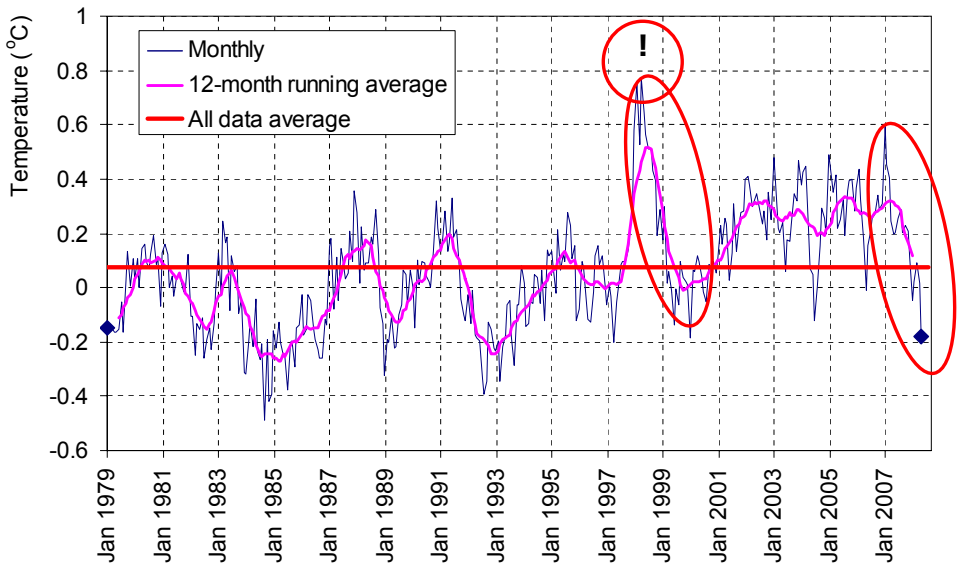


3. Data vs. climate change speculations

Data: Global temperature derived from ground measurements – focus in the last ten years

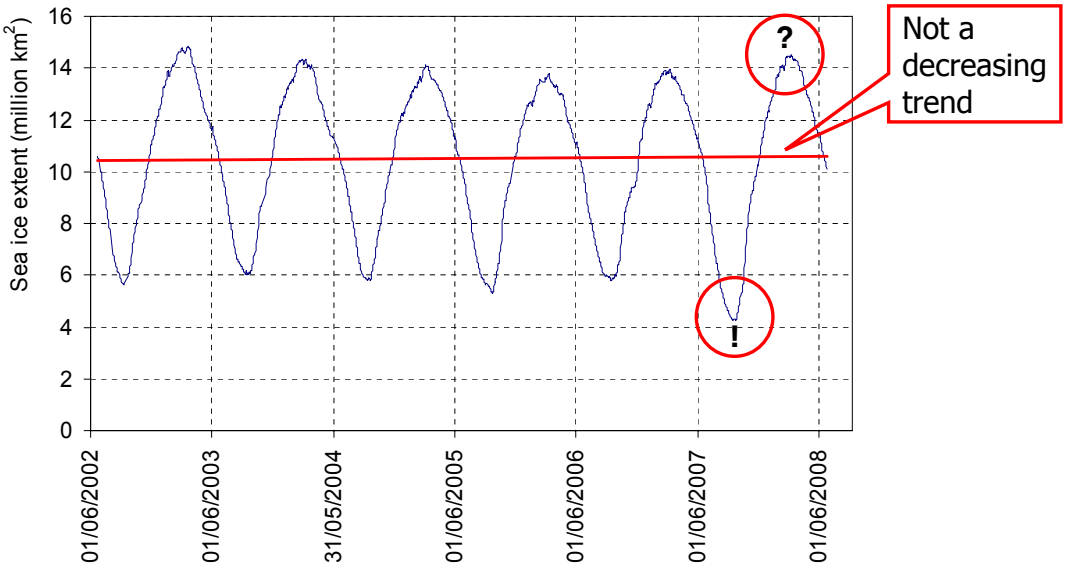


Data: Satellite-derived temperature of lower troposphere



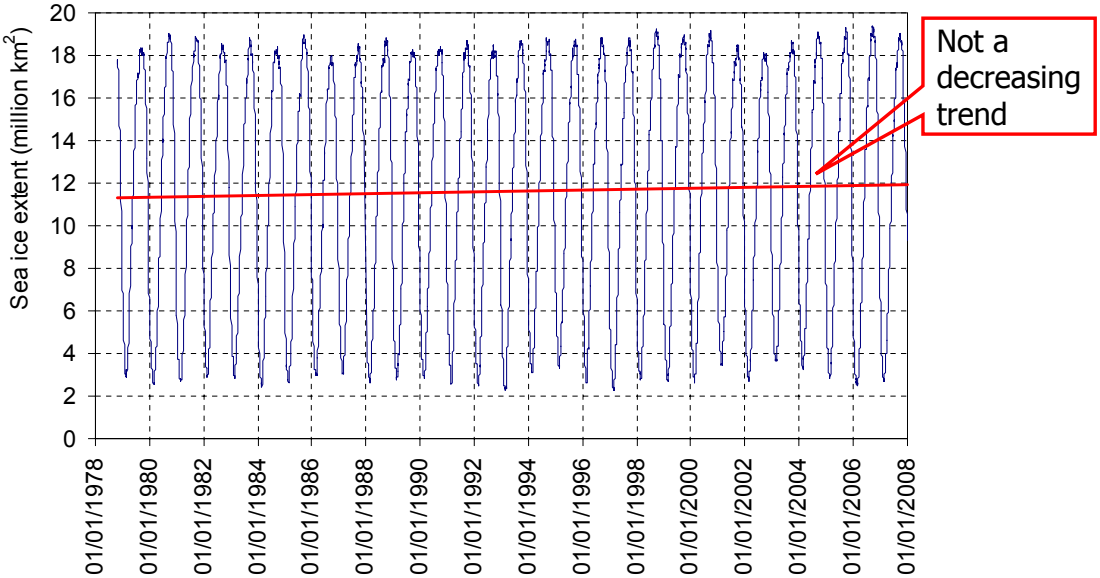
Data from the US National Space and Technology Center (Monthly means of lower troposphere lt5.2**)**
[vortex.nsstc.uah.edu/; vortex.nsstc.uah.edu/public/msu/t2lt/tltglhmam_5.2]

Data: Satellite-derived sea ice extent in the Arctic Ocean



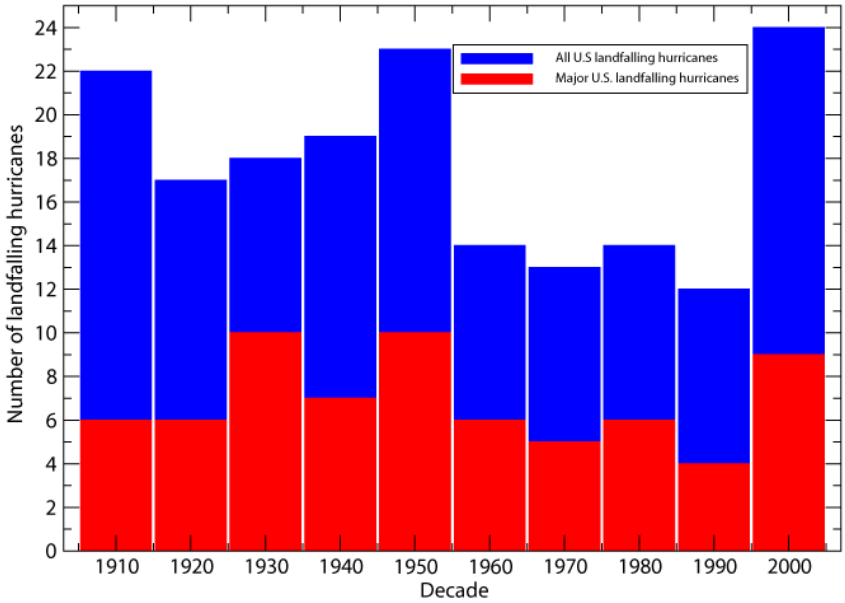
Data from the FIARC-JAXA Information System (IJIS) of the International Arctic Research Center in corporation with the Japan Aerospace Exploration Agency and the Advanced Earth Science and Technology Organization of Japan [http://www.ijis.iarc.uaf.edu/en/home/seaice_extent.htm]

Data: Satellite-derived sea ice extent in Antarctica



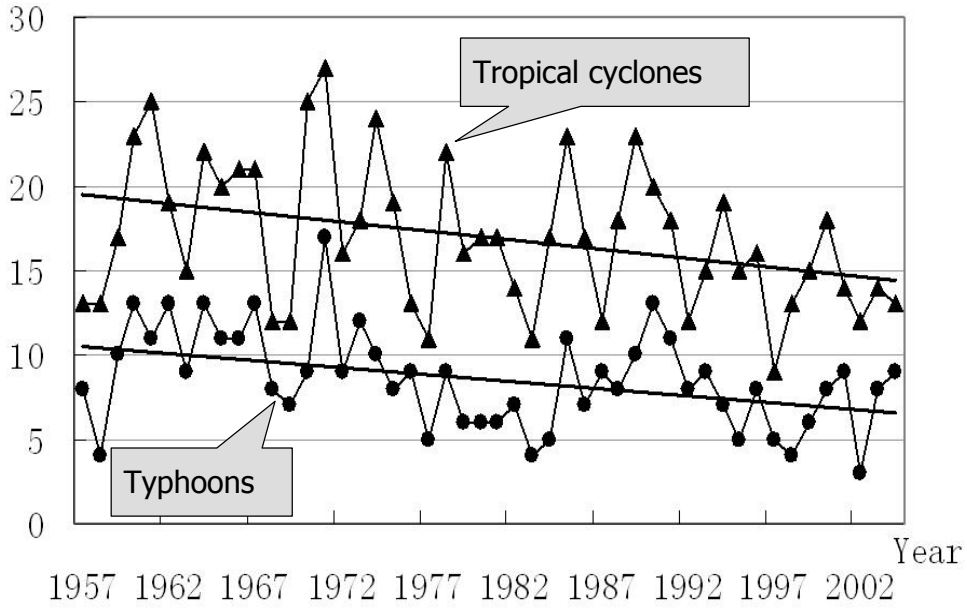
Data from the US National Snow and Ice Data Center
[nsidc.org/data/smmr_ssmi_ancillary/area_extent.html; sidads.colorado.edu/DATASETS/seaice/polar-stereo/trends-climatologies/ice-extent/nasateam/gsfc.nasateam.daily.extent.1978-2007.s]

Data: Hurricanes in the USA



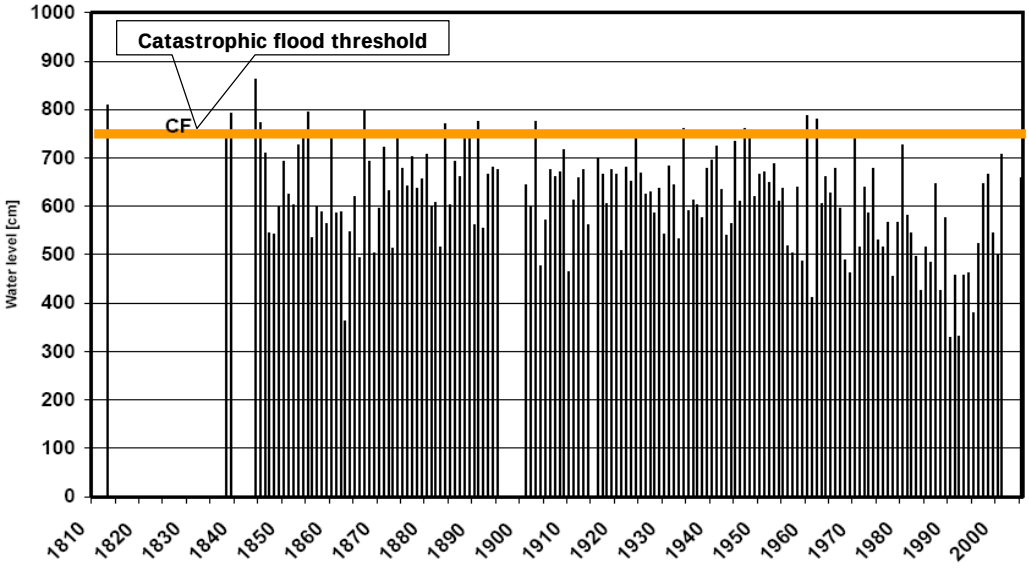
Frequency of hurricanes and major hurricanes (categories 3-5) landfalling in the USA (by decade, 1906-2005)
[www.ncdc.noaa.gov/oa/climate/research/hurricane-climatology.html]

Data: Typhoons and tropical cyclones in China



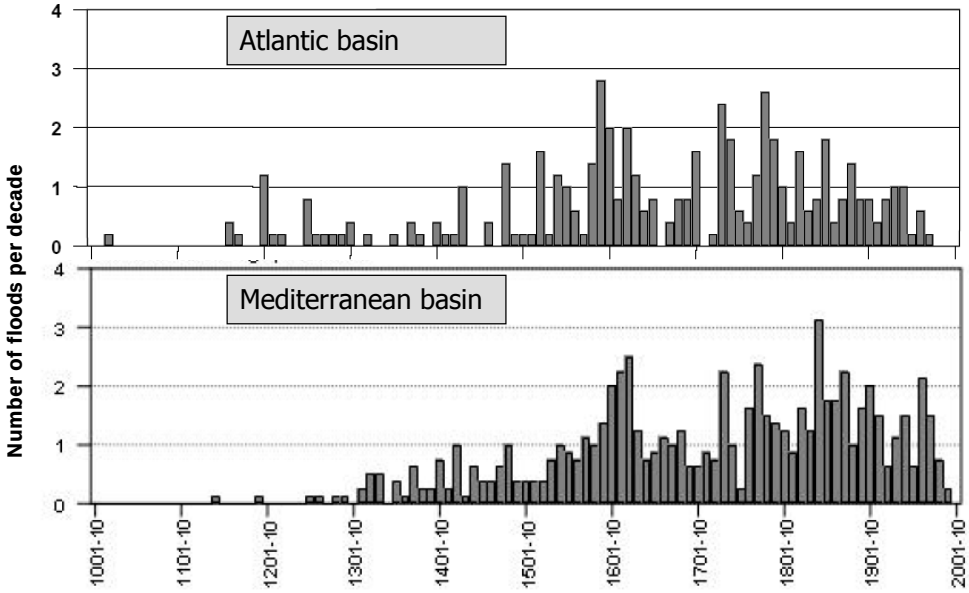
Frequency of tropical cyclones and typhoons (with maximum sustained wind speed > 32.7 m/s) in China; source: Ren *et al.* (2006)

Data: Floods as seen from long time series of river stage



Annual maximum water level (in cm) of the Vistula River in Warsaw, 1813-2005 (Cyberski et al., 2006)

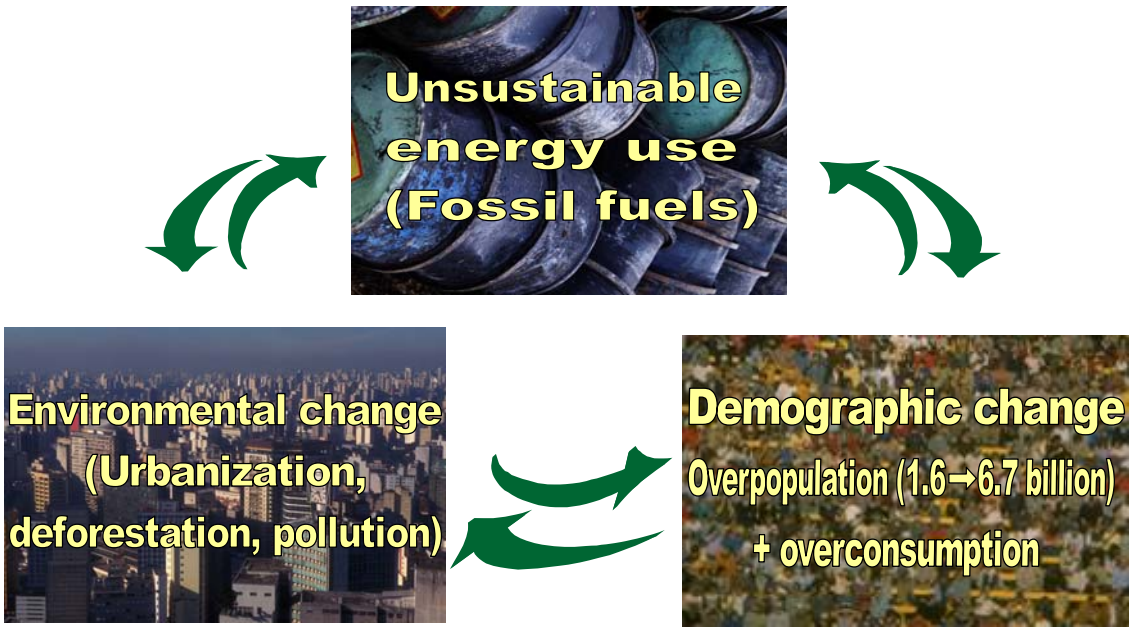
Documents and archives: Historical evidence for floods



Flood frequency in Spain in the last millennium (Barriendos et al., 2006)

4. Seeking real causes for real problems

The real problems: the vicious circle of the 20th century



Effect of demographic change to water resources

- More population increases drinking water consumption.
- Consumerism increases drinking and industrial water consumption.
- Overpopulation and overconsumption increases food production needs.
- Increased food production requires more irrigation water.
- Increased food production rates cannot be sustained with only natural sources and practices; the solar energy, utilized in agriculture for millennia, has been largely replaced by fossil fuel energy.
- Modern agricultural practices, urban agglomerations and industrial activities have polluted water resources (particularly ground water).
- Water pollution decreases availability of drinking water and increases energy needs for treatment.

Urbanization/land use changes and floods

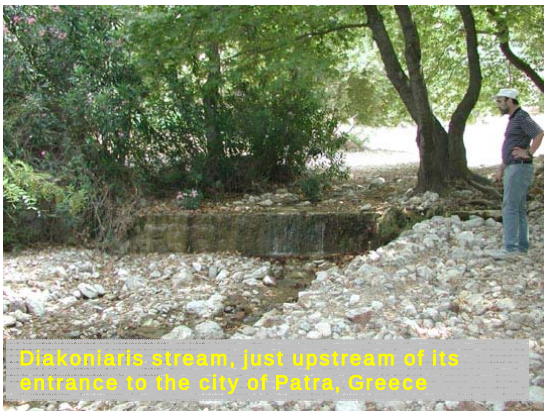
- Assuming that the flood discharge Q is related to the return period T by $Q \sim T^{0.2}$, any relative increase a in the flood discharge due to urbanization will result in a reduction of the effective return period of the flood protection structures given by:

$$T_{\text{urbanized}} = T_{\text{natural}} / (1 + a)^5$$

- For instance for T_{natural} = 50 years and a = 20%, $T_{\text{urbanized}}$ = 20 years:
  - 2.5 times reduction of return period;
  - 2.5 times increase of the frequency of overflows.
- Assuming that the above figures are typical in Greece and that there are 116 cities in Greece with population >15 000, it is expected that each year about 6 cities, on the average, will have severe flood problems.
- The impacts of the flood events become more severe as urban areas grow (there is more property at risk).
- These are irrespective of the climate change hypothesis and indicate a socio-economic mistake on the treatment of floods.
- Much higher return periods should have been adopted in the design and management of flood protection works.

Floods: another socio-technical mistake

- The river morphology (regular bed) is determined by relatively low flows ($T \approx$ 1-2 years).
- Areas close to the regular river bed, but within the flood plain ($T >$ 2 years), have been regarded as safe lands for housing and other activities.
- Thus, even moderate flood events (e.g. $T =$ 10 years) cause big destructions due to mistaken planning.



Diakoniaris stream, just upstream of its entrance to the city of Patra, Greece

Diakoniaris stream, Patra, Greece, just upstream of the outlet to the sea

Floods: technological mistakes

- For a long time the emphasis was given on flood protection **structures**:
  - Target: Cross sections with sufficient discharge capacity to convey the design flood to the recipient;
  - Problem: The design flood (e.g. for $T =$ 50 years or less) can be exceeded;
  - Antidote: Non structural measures such as flood control through urban planning, flood resilient technologies, flood forecast systems.

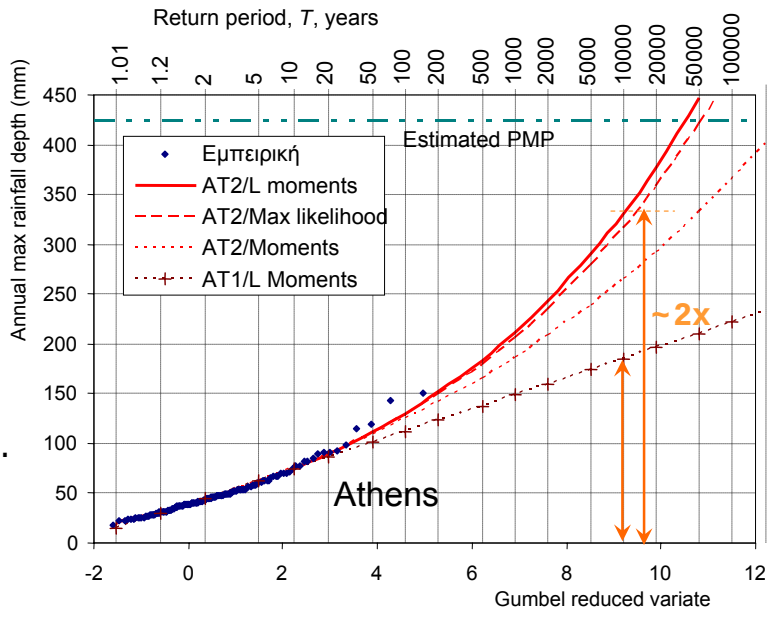
- Several flood studies have considered only a river reach:
  - Target: Remedy of flood problems in a specific area;
  - Problem: Transfer of flooding upstream or downstream;
  - Antidote: Integrated study of basin, source control.

Scientific mistake 1: Storms and floods have an upper physical bound

- The assumption of an upper bound in precipitation, the so called Probable Maximum Precipitation (PMP), has led to the illusion of risk-free structures (e.g. large dams, if they are designed with PMP – a concept that is still in use).
- However, for any value of precipitation depth there is a probability of exceedence (it is not possible to put limits to Nature). This probability decreases for increasing value of precipitation depth.
- This probabilistic logic corresponds to the Aristotelian infinity, which exists *in potentia* («δυνάμει») and not as a real entity (the physical infinity, different from the Cantor's mathematical infinity).

Scientific mistake 2: Nature takes the slowest path to infinity

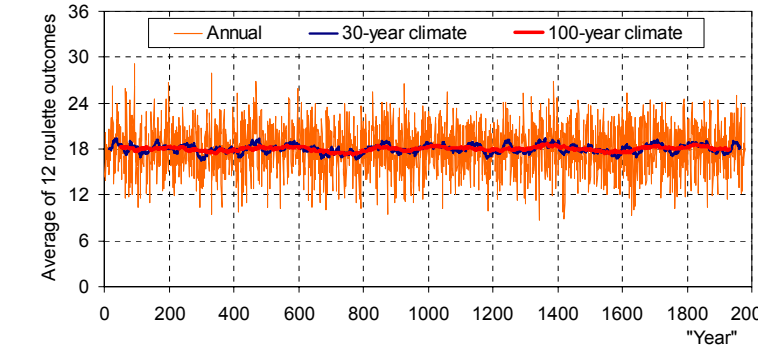
- Technically, the slowest possible growth rate towards infinity corresponds to adopting probability distributions of rainfall or flow of exponential type – or the Gumbel distribution of maxima.
- The Gumbel distribution still dominates in flood studies and research.
- Extended data sets show that this distribution is inappropriate and underestimates risk.

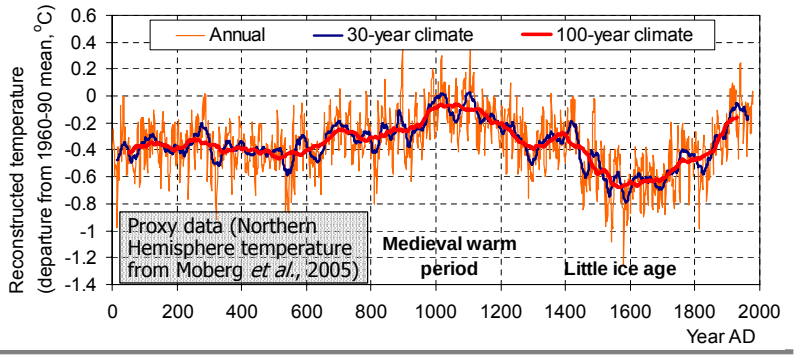


Scientific mistake 3: The natural processes behave like a "roulette wheel"

"Roulette climate"

Real-world or "Hurst-Kolmogorov" climate

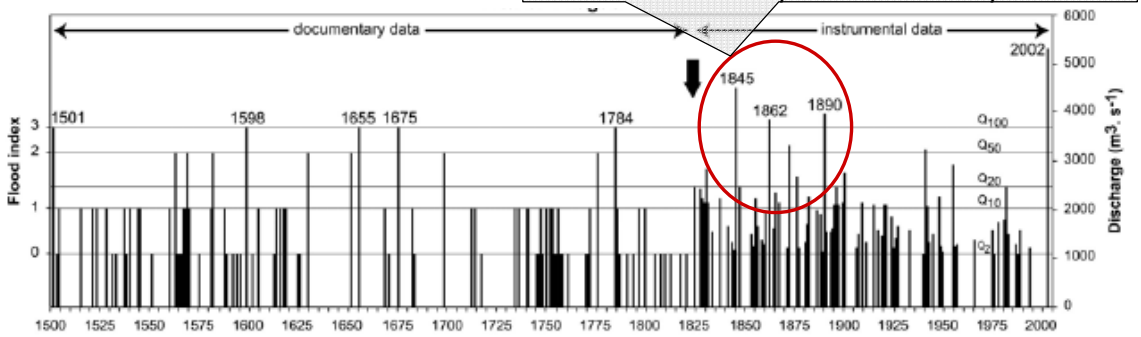




Scientific mistake 3 (cont.): The Hurst-Kolmogorov climate and floods

"Although in random events groups of high or low values do occur, their tendency to occur in natural events is greater. This is the main difference between natural and random events" (Hurst, 1950)

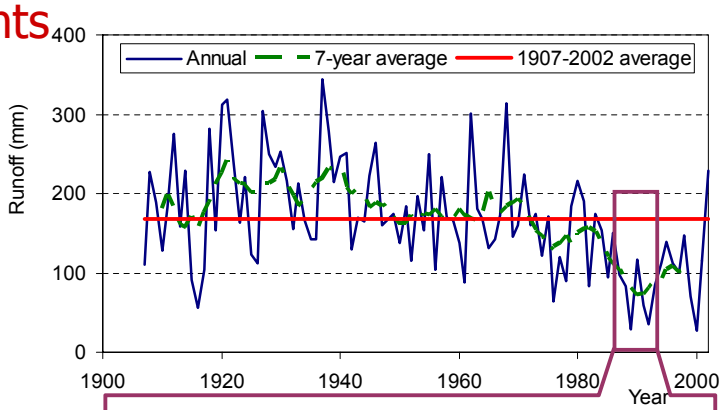
1845-1890: Three flood events greater than the 100-year flood in 45 years
1891-2001: No 100-year flood in 110 years



Flood discharges of the Vltava River in Prague during the last 5 centuries (Brázdil et al., 2006).

Scientific mistake 3 (cont.): The Hurst-Kolmogorov climate and droughts

Time series of the Boeoticos Kephisos river basin, Greece (almost 100 years long)

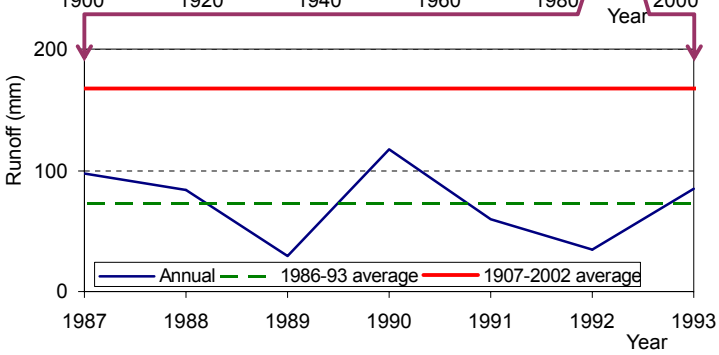


Close-up on a 7-year period with intense and persistent drought:

The 7-year average is lower than half the overall average.

The probability of occurrence of such a drought is:

- ~10^{-5} according to classical statistics;
- ~10^{-2} according to Hurst-Kolmogorov statistics.



Summary of water resources issues

- Current status of water science, technology and management involves a series of misconceptions or mistakes of different types:
  - Socio-economical;
  - Socio-technical;
  - Technological;
  - Scientific.
- All mistakes point to one direction: either increase the related risks or underestimate them (i.e. the actual risks are higher than thought).
- All these are irrelevant with the climate change hypothesis.

Conclusions and discussion

- Climatic changes are the rule in nature.
- Anthropogenic climate change is just a hypothesis with (deliberately) overstated consequences.
- Even if it exits, it is just a symptom of the real illnesses of the current civilization, i.e.:

Unsustainable Energy Use

Environmental Change ↔ Demographic Change

- From a social point of view, the following aphorisms may apply:

  "The one who is punished is no longer the one who did the deed. He is always the scapegoat" (Friedrich Nietzsche).

  "A good scapegoat is almost as good as a solution" (Anonymous).

- These should not apply in science. But the following aphorism may apply also to the scientific community:

  "If only we could also milk the scapegoat!" (Stanislaw Jerszy Lec).

- Reliable remedy of current problems requires correct diagnosis.

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