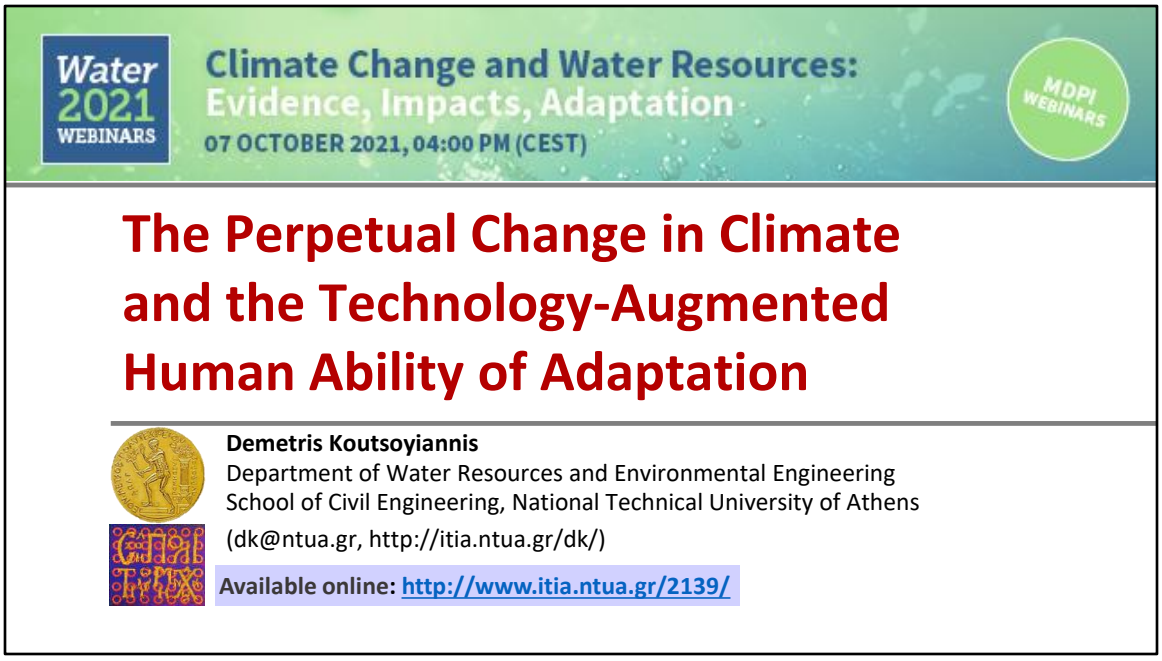

Good afternoon and welcome. I would like to thank the organizers and in particular Thanasis Loukas for this invitation. Also, thanks to all of you for coming.
As you see, the presentation is available on line and you can download it and examine it later if you wish.
I will speak about the perpetual change in climate and the diachronic ability of humans to adapt to this change. An ability which in the last century or so has been augmented by modern technology. That is the title of my presentation.

Μωραίνει Κύριος ὃν βούλεται ἀπολέσαι
Quem vult Deus perire dementat prius
Whom God wishes to destroy, He first deprives of reason

Note: The saying is an **ancient Greek proverb**, which is used in several versions also in Latin and in modern languages. Both **Sophocles and Euripides** provide some poetic variants of it, while the Latin version stems from **Publilius Syrus**. The verb «**μωραίνω**» of the Greek version has produced in English the words "**moron**" and "**moronity**". A strong modern Greek version (from Epirus) is «*Πρώτα παίρνει ο Θεός τη γνώση, κι ύστερα το βιο*» ("*First God takes out the knowledge, and after the life*" where *life* includes also the *living*). See details in Politis (1902).

To make it more fun, I also added a subtitle and this is "Μωραίνει Κύριος ὃν βούλεται ἀπολέσαι". That's an ancient Greek proverb—I also give the Latin version and its translation to English: "Whom God wishes to destroy, He first deprives of reason". Perhaps you are able to discern part of the Greek version as from the verb "μωραίνω" and the noun "μωρία" the English words moron and moronity have been produced.

Whom does He deprive of reason?

Alternative 1

Alternative 2

THE LANCET
Oncology

Access provided by National Metsovian Polytechnic

EDITORIAL | VOLUME 22, ISSUE 10, P1341, OCTOBER 01, 2021

Climate crisis and cancer: the need for urgent action

The Lancet Oncology

Published: October, 2021 • DOI: https://doi.org/10.1016/S1470-2045(21)00534-9 • Check for updates

The 26th UN Climate Change Conference of the Parties (COP26), hosted by the UK from Oct 31 to Nov 12, 2021, will see world leaders coming together to tackle the ongoing climate crisis and implement measures to reduce carbon emissions to reach net zero by 2050. On Sept 5, 2021, more than 200 leading health journals worldwide, including *The Lancet*, published a joint Comment on the climate emergency calling for urgent action from world leaders to keep average global temperature increases to less than 1·5°C and reduce the impacts on health from climate change. The *Lancet* Countdown on Health and Climate Change is also bringing together experts from across the globe to assess how climate change is affecting our health, including cancer, and how the world, in turn, is responding.

The Lancet Oncology (2021—published a week ago)

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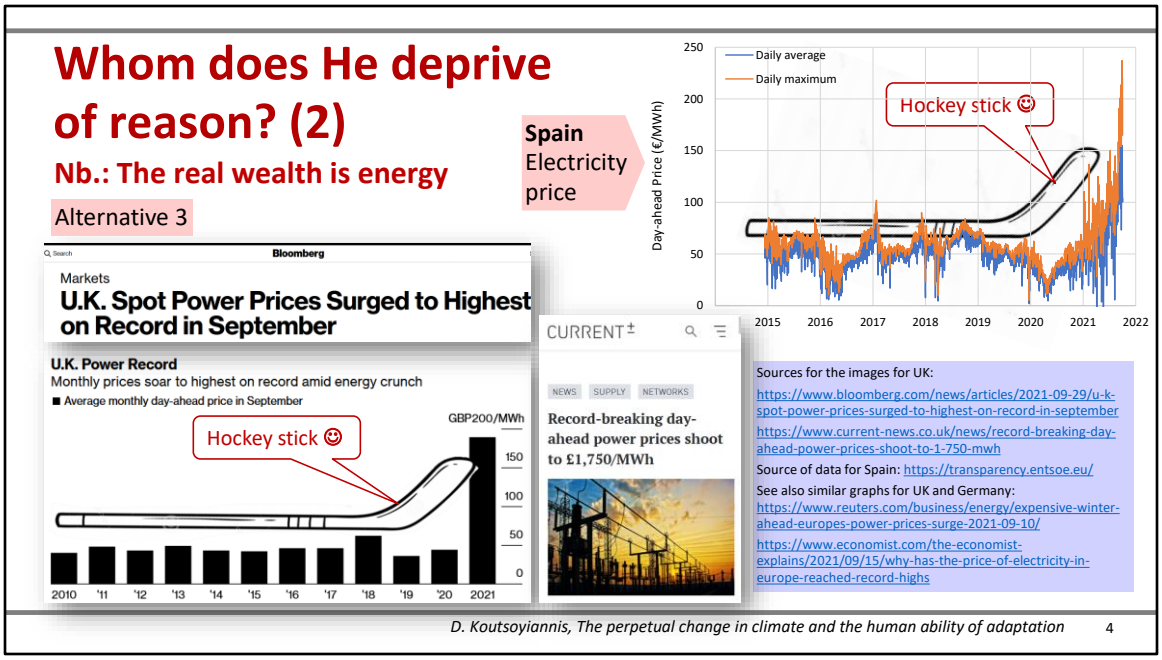
And to make it stronger, I have put a dilemma or trilemma for you to decide. Whom does He deprive of reason?

I offer myself as a first alternative. Please consider it and judge what I am saying.

As a second alternative, I have chosen a recent article from a scientific journal, among the myriads of publications that link climate change with everything bad that happens or may potentially happen in the future. This is an Editorial from the journal Lancet, published a week ago, linking the so called “climate crisis” with cancer and calling for “urgent action”.



I am giving a third alternative related to energy and the recent developments in its prices in Europe.

The real wealth of nations and societies is energy. Most people have forgotten this simple truth and try to see existential crises in diverse imaginative scenarios. In my view, those who are interested about existential crises should focus on energy availability.

Yesterday I watched in the news a European officer saying that to deal with the energy problem we should meet the climate policy targets. A spectacular reversal of reason!

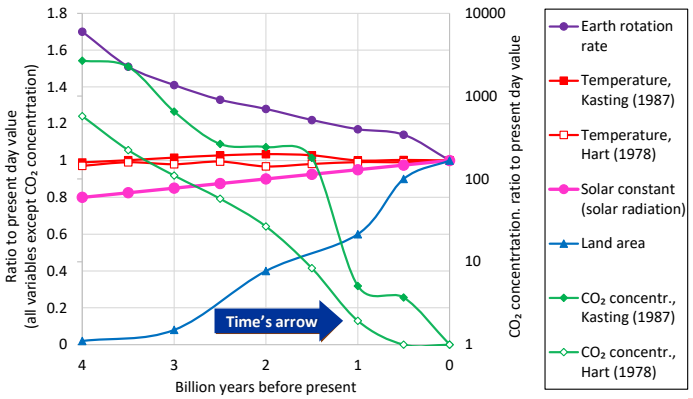
But of course the elevation of energy prices are related to climate policies. So let's see on what evidence these policies are based on.

Question A

What do we know about the perpetual change in climate?

I give you plenty of time to solve the trilemma. I will also try to give you some hints. In the title of my presentation, I highlight the perpetual change in the climate. So let's see this in more detail.

Climate has been changing for 4.5 billion years



"***Πάντα ρεῖ***" (*Everything flows*): Heraclitus, quoted in Plato's Cratylus, 339-340

"***Μεταβάλλει τῷ χρόνῳ πάντα***" (*Everything changes in course of time*), Aristotle, Meteorologica, I.14, 353a 16

- The graph has been constructed from estimates by Kuhn et al. (1989). Temperature is expressed in K and corresponds to 35° latitude; a change in the temperature ratio by 10% corresponds to ~29 K.
- Although the estimates are dated and uncertain, evidence shows existence of liquid water on Earth even in the early period, when the solar activity was smaller by 20-25% (the faint young Sun problem; Feulner, 2012).

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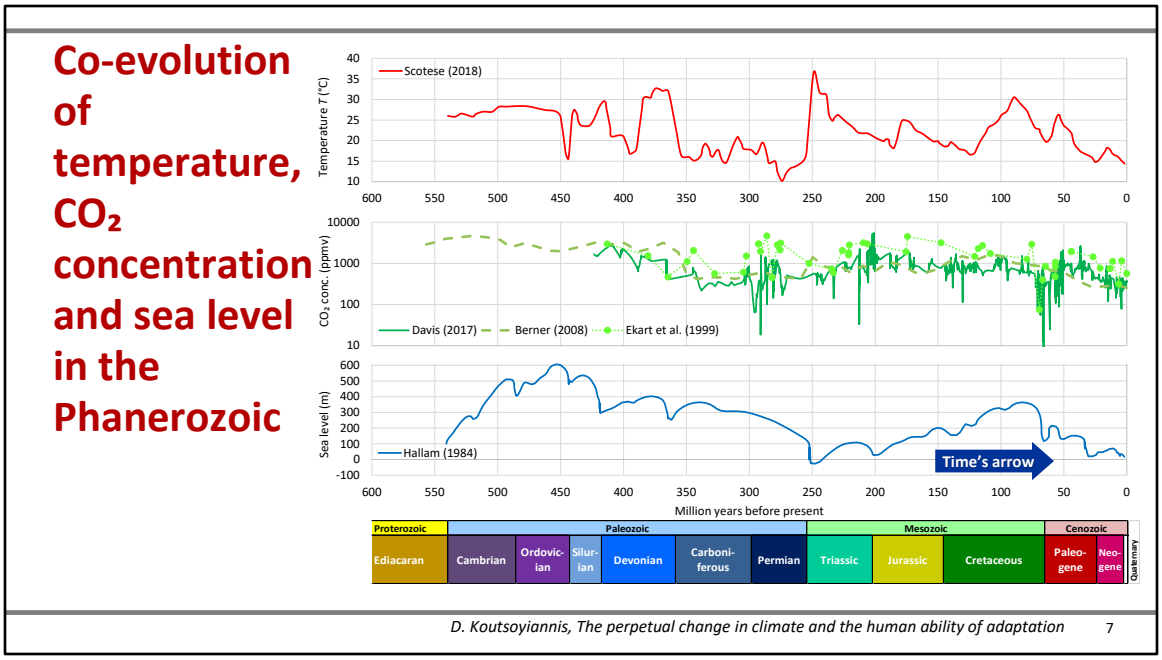
Geosciences and mostly geology combined with astrophysics and paleontology have given some indications about the evolution of Earth.
You see in the graph, constructed from the indicated sources, several interesting things. For instance, in the cradle of Earth, the solar radiation was smaller than today, 80% or 75% of the current value. Yet, paradoxically there was liquid water on Earth. The paradox is known as the faint young Sun problem.
The Earth's rotation was 70% higher and this is also related to climate.
The CO2 concentration was much higher. It has varied by 4 orders of magnitude.
What it remained fairly constant, was temperature—if we express it in its natural units of kelvins.



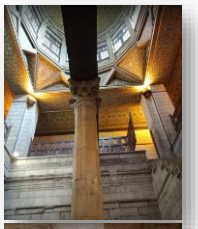
Constant? Not exactly. In the upper graph we see that it varied by about 25 degrees Celsius or 25 kelvins.

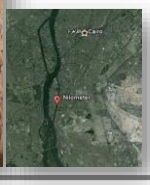
Now we have made a focus on the last 550 million years, using proxy data, for the Phanerozoic Eon. Phanerozoic is a Greek word meaning visible life.

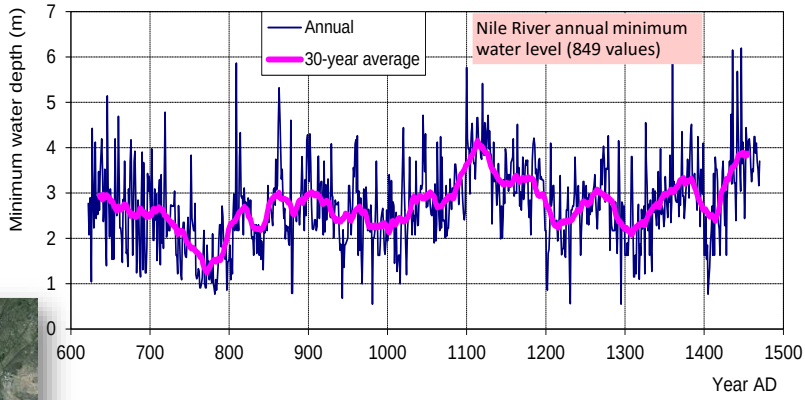
In the second graph you see that the CO2 concentration has varied by two orders of magnitude, not necessarily in phase with the temperature variation.

And most spectacularly, 100 million years ago the sea level was about 300 metres higher than today and perhaps 600 metres higher in the more distant past.

Instrumental data: The Roda Nilometer (the longest instrumental record on Earth)







Graph and data from Koutsoyiannis (2013); the data can be downloaded from https://www.itia.ntua.gr/1351/

Photos by Loai Samen and Mohamd Mubarak; Google maps, https://goo.gl/maps/T8NUgoDAorK2 and https://goo.gl/maps/dsdJHJYVv572

Well, these were proxy data and involve a great deal of uncertainty, both in the magnitude and in the timing. So, let's see some instrumental data, which are more accurate.

The longest instrumental data set is that of the Nilometer located in the Roda island in Cairo. It started in the 7th century, during a hectic period where power alternated among Byzantines, Persians and Arabs. The record continued systematically through 8 centuries in the Arab period but became sporadic in the Ottoman period which followed.

Overall, there is a period of 849 years with very, very few missing data.

The figure shows in blue the minimum water level each year. The pink curve shows the rolling average at a scale of 30 years which has been typical as a climatic scale.

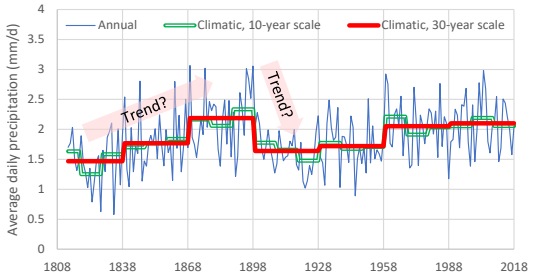
The Nile's basin covers more than 3 million km^2, about 10% of Africa, and goes south beyond the equator and the Lake Victoria. Thus, it represents the climate of a very large area.

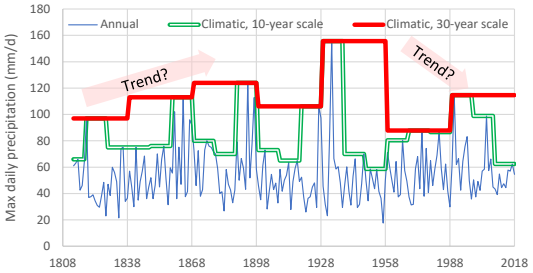
So the climatic minimum water depth in the Nile was a little higher than 1 m in 780 and a little higher than 4 m in 1120. A fourfold climatic change, right?

Modern long records of instrumental data: Rainfall in Bologna

- The mean annual values for 50 years after 1820 show an upward trend. A classical statistical test for a linear trend using merely these data values would reject the stationarity hypothesis at a *p*-value of 7.7×10^{-4}.
- "Trends" are for kids. **Adults** use better descriptions of **long-term variability**, such as **Hurst-Kolmogorov (HK) dynamics**.

Dataset details Station: BOLOGNA, Italy, 44.50°N, 11.35°E, +53.0 m
Period: 1813-2018 (206 years)
Source of graphs: Koutsoyiannis (2021b)
Sources of data: also detailed in Koutsoyiannis (2021b)





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The Nilometer record was kept before the development of modern science. Let's see a modern record.
Here, in blue, is the annual rainfall in Bologna, with a record length of 206 years. The red lines represent the climate at a scale of 30 years.
The message is similar. We have long term variability. In the kindergarten this is referred to and studied as "trends". For adults, there are better descriptions such as the Hurst-Kolmogorov dynamics.

Catastrophic events: The Dust Bowl – the drought-related disaster in the Southern Great Plains in USA (1930s)

- During the 1930s, the USA experienced one of the **most devastating droughts**, which affected almost 2/3 of the country and parts of Mexico and Canada (Schubert et al., 2004).
- The drought became infamous for the numerous **dust storms** that occurred in the Southern Great Plains.
- **Dust clouds** from the Northern Great Plains **reached even the East Coast** and enveloped it from Virginia to New England (Lee and Gill, 2015).

Source of the photos: https://en.wikipedia.org/wiki/Dust_Bowl
Upper: A dust storm approaches Stratford, Texas, in 1935.
Lower: Buried machinery in a barn lot; Dallas, South Dakota, May 1936

Our mass media have convinced most of us thar the extreme climatic events are due to anthropogenic climate change. A next step would be to convince us that what our wrongdoing of today has an effect also in the past. Indeed, this would be a very nice post-modern explanation of what happened in the 1930s.
I mean the big drought that affected 2/3 of the USA and beyond, which became known as the Dust Bowl, because of the tremendous dust clouds accompanying it, which are shown in the photos.

Question B

Why climate mitigation does not make sense?

Reply: Mitigation presupposes prediction

but: *"Predicting is a guessing game for fools"*

*(Schwab and Malleret, 2020; The Great Reset)**

*Interestingly, **World Economic Forum's "The Great Reset"**, while admitting the futility of predicting, builds upon predicting and, by mixing the "**Covid-19 pandemic**" (appearing 14 times) along with "**climate change**" (appearing 37 times), supports the idea of **a great reset** (see also Koutsoyiannis, 2021a).

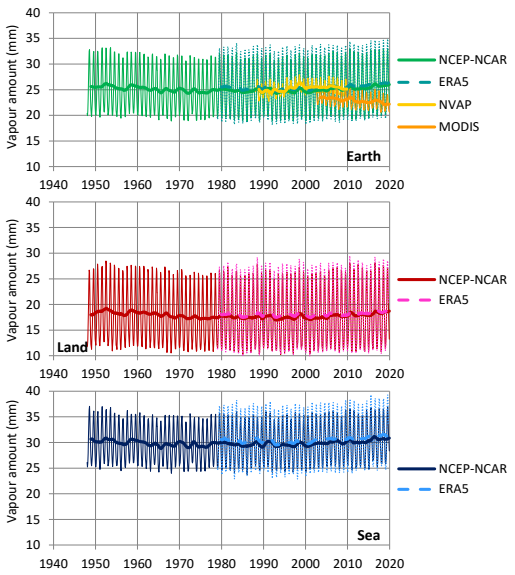
Explanation why climatic predictions have been irrelevant to reality are provided in the next slides.

That was about the perpetual climate change. Now I will show a few slides related to the question: Why climate mitigation does not make sense? I give the immediate reply: Mitigation presupposes prediction but: "Predicting is a guessing game for fools". This is quoted from Schwab's and World Economic Forum's book "The Great Reset". Interestingly, the book builds upon this fools' game of predicting and, by mixing the "Covid-19 pandemic" along with "climate change" predictions, advocates the idea of a global great reset.

In the next slides I will provide explanation why climatic predictions are irrelevant to reality.

Does atmospheric water show intensification of hydrological cycle?

- IPCC (2013a) conjectured that the **water vapour** amount in the atmosphere **would increase** and the **hydrological cycle would intensify**.
- However, the water vapour amount is fluctuating—not increasing monotonically (**prediction falsified**).



Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

Source of graph: Koutsoyiannis (2020); reanalysis data (NCEP-NCAR & ERA5): http://climexp.knmi.nl; satellite data, NVAP: Vonder Haar et al. (2012) (Figure 4c, after digitization); satellite data, MODIS: https://giovanni.gsfc.nasa.gov/giovanni/; averages from Terra and Aqua platforms.

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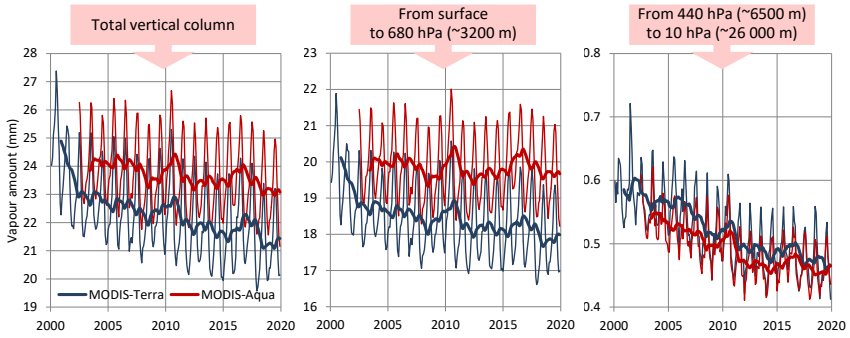
Since the workshop is organized by the journal Water I will bypass temperature and speak about the water, starting from the atmospheric water.
The IPCC conjectured that the water vapour amount in the atmosphere would increase and the hydrological cycle would intensify.
I have examined a huge amount of atmospheric, ground and satellite data and I published my global analyses in the EGU journal Hydrology and Earth System Sciences, after open review.
You see in this slide that the water vapour amount in the atmosphere is fluctuating—not increasing monotonically. This means that the IPCC prediction is falsified.

Do satellite data of the 21st century show increasing presence of water vapour amount?

- Both Terra and Aqua satellite platforms for all atmospheric levels suggest **decreasing** trends.
- Hence, the data are **opposite to the IPCC conjecture**. Apparently this suggests that climate models do not represent the physics correctly.



Source of graph: Koutsoyiannis (2020); MODIS data: https://giovanni.gsfc.nasa.gov/giovanni/

Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

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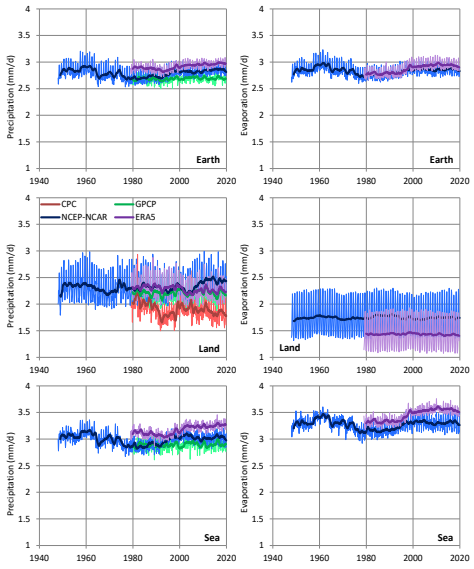
Most interesting are the satellite data of atmospheric water. They clearly show that in the 21st century the atmospheric water is decreasing. Just the opposite to the IPCC conjecture.

Do precipitation and evaporation increase?

- Both precipitation and evaporation are **fluctuating**—not increasing monotonically.
- Hence, **the IPCC conjecture is falsified**.



Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

Source of graph: Koutsoyiannis (2020); reanalysis data (NCEP-NCAR & ERA5), gauge-based precipitation data gridded over land (CPC), and combined gauge and satellite precipitation data over a global grid (GPCP): http://climexp.knmi.nl

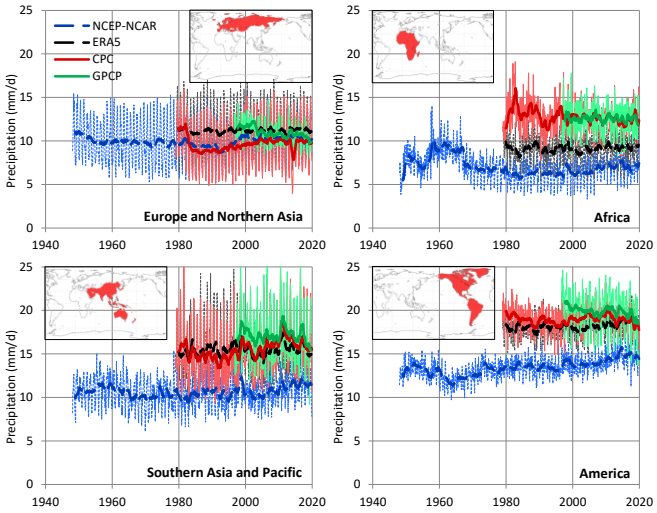
I have to skip some slides because of the limited time. If you download the presentation or my paper I mentioned, you may see some other similar graphs showing additional falsifications of IPCC conjectures. This graph is for precipitation and evaporation.

Is monthly maximum daily precipitation increasing?

- The graphs show the variation of an index of **extreme rainfall**, which is the monthly maximum daily precipitation, areally averaged over the continents.
- In all continents, this index is **fluctuating**—not increasing monotonically.
- In particular, the satellite observations show **decreasing**, rather than increasing trends in the 21st century.

Thin and thick lines represent monthly values and running annual averages (right aligned).

Source of graph: Koutsoyiannis (2020); reanalysis data (NCEP-NCAR & ERA5, gauge-based precipitation data gridded over land (CPC), and combined gauge and satellite precipitation data over a global grid (GPCP): http://climexp.knmi.nl



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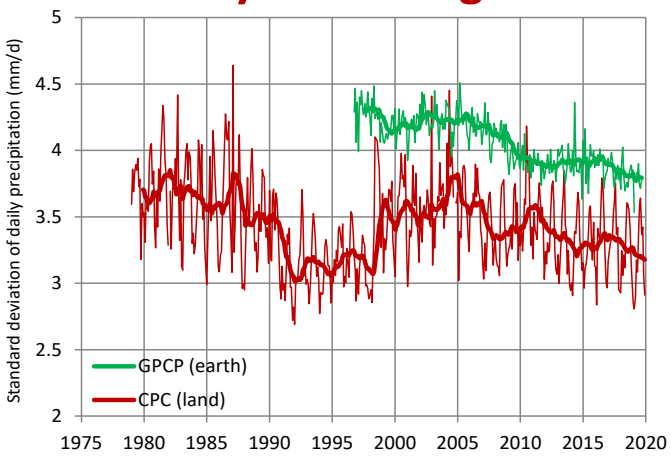
Similar things for extreme rainfall.

Is daily precipitation variability increasing?

- The standard deviation of daily rainfall, areally averaged, as seen both from CPC and GPCP observational data, decreases, thus **signifying deintensification of extremes** in the 21st century.
- Again, it will be more prudent to speak about **fluctuations** rather than deintensification.



Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

Source of graph: Koutsoyiannis (2020); gauge-based precipitation data gridded over land (CPC), and combined gauge and satellite precipitation data over the entire Earth (GPCP): http://climexp.knmi.nl

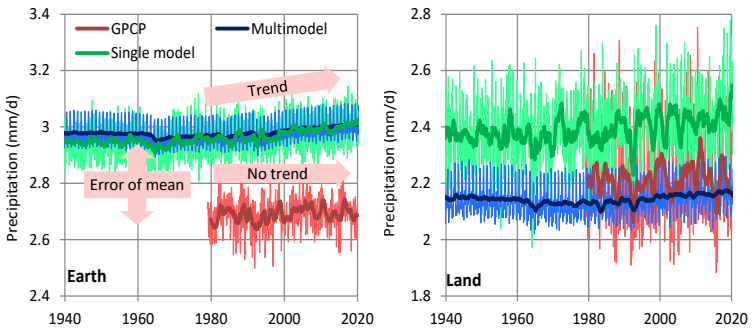
.. and for daily precipitation variability, which in the 21st century has been decreasing, signifying less frequent extreme events over the entire globe.

Do climate models provide guidance for the future?

- Short answer: No.
- Long answer: They have not provided skill for the past. Notice: (1) the **large error** of the "Multimodel" ensemble in terms of the mean; (2) the increasing trend of climate model outputs after 1980, which **did not appear in reality**.

Thin and thick lines represent monthly values and running annual averages (right aligned).

Source of graph: Koutsoyiannis (2020); observations come from the combined gauge and satellite precipitation data over a global grid (GPCP); climate model outputs are for the scenario "RCP8.5" (frequently referred to as "business as usual"); "Multimodel" refers to CMIP5 scenario runs (entries: CMIP5 mean – rcp85) and "Single model" refers to CCSM4 – rcp85 (ensemble member 0), where CCSM4 stands for Community Climate System Model version 4, released by NCAR. Data and model outputs are accessed through http://climexp.knmi.nl

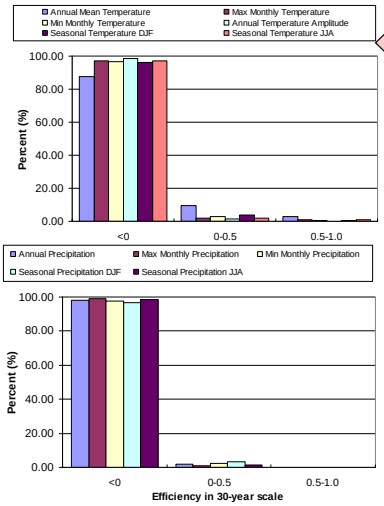


Another graph showing that we should not trust and use climate models.
See the departures of model predictions and reality in terms of magnitude and trends.

Do climate models reproduce real-world rainfall?

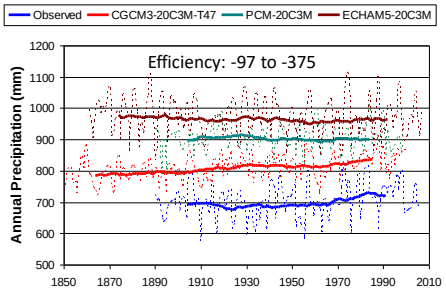
- Short answer: No.
- Long answer: Simulations of point rainfall have mostly **negative efficiencies**. Areal rainfall simulations are **irrelevant to reality** even at climatic scales.

Source: Anagnostopoulos, et al. (2010); see also reviews by Pielke Sr. (2017) and Essex and Tsonis (2018)



Comparison of 3 IPCC TAR and 3 IPCC AR4 climate models with historical series of more than 100 years length in 55 stations worldwide

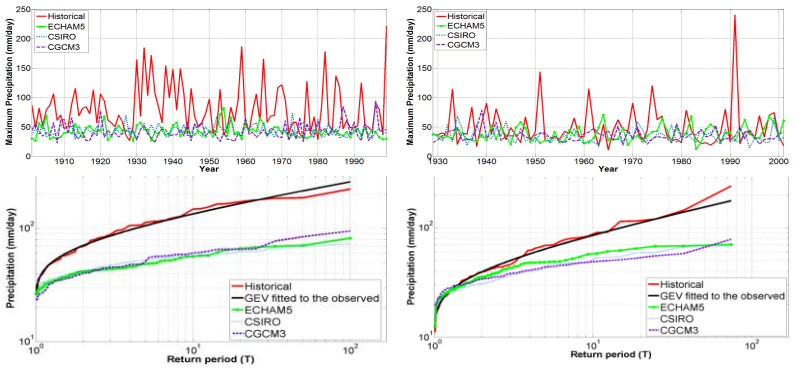
Comparison of 3 IPCC AR4 climate models with reality in sub-continental scale (contiguous USA)



I have also published with coauthors several other papers showing that climate model outputs are irrelevant to reality. One example here, for the contiguous USA.

Do climate models simulate the real-world rainfall extremes?

- Tsaknias et al. (2016—multirejected paper) tested the reproduction of extreme events by three climate models of the IPCC AR4 at 8 test sites in the Mediterranean which had long time series of temperature and precipitation.
- They concluded that model results are **irrelevant to reality** as they seriously underestimate extreme events.



Upper row: Daily annual maximum precipitation at Perpignan and Torrevieja; Lower row: empirical distribution functions of the data in upper row

Source: Tsaknias et al. (2016)

This one is a multirejected paper, by my former students and myself showing the real rainfall extremes in red lines and climate model predictions in other colours. The graphs are for two locations in the Mediterranean.
You see that the discrepancies reach almost one order of magnitude! I guess that's the reason why this paper is multirejected.

Question C

Why adaptation is always necessary– and effective?

And now the final part related to adaptation. As I noted, the change of climate is perpetual and therefore the adaptation to the changing conditions has been and will also be perpetual.

Adaptation will be the dominant response

- It is **agnostic**
  – indifferent to natural *vs* human-caused changes
- It is **proportional**
  – adapt more if the change is greater
- It is **local**
  – politically palatable as spending is "here and now"
  – does not require global consensus
- It is **autonomous**
  – It will happen on its own
- It is **effective**
  But adaptation is much easier if you're richer
  (*and we know what we're adapting to*)

Source: This slide is copied from Koonin (2021b) and is explained in Koonin (2015, 2021a).

Koonin also cites IPCC (2013b) according to which "*For most economic sectors, the impact of climate change will be small relative to the impacts of other drivers*".

He estimates that, even under extreme scenarios of temperature **increase by 8 °C**, the economic **impact on the global GDP will be less than 15%**.

Compare this with the economic impact of the increased price of energy in just one month.

This slide I reproduce verbatim from a recent presentation by Steven Koonin, with his kind permission. Koonin was undersecretary of energy in the USA (or vice minister, in the European terminology) during the presidency of Obama. He says "Adaptation will be the dominant response" I would rephrase "will be" to "…has been and hopefully will be…". Let's read the slide, which I fully endorse.

[…]

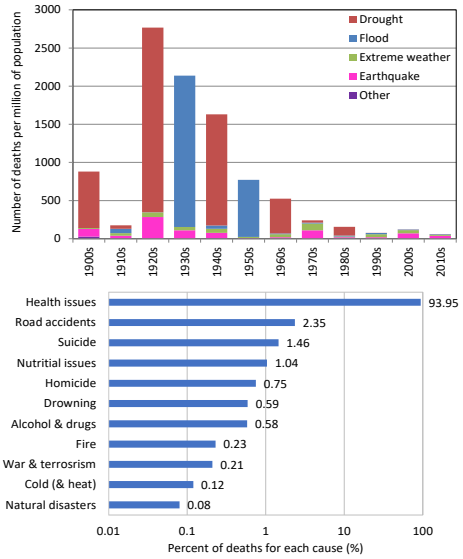
Furthermore Koonin estimates that even in the case of a terrible increase of temperature by 8 °C, the economic impact on the global GDP would be less than 15%.

Compare this with the economic impact of the increased price of energy in just one month.

Adaptation to natural disasters: Has it worked in the last century?

- The **risk from natural disasters** has been **spectacularly decreased**.
- Currently, it is in the bottom of the list of risks from all hazards.
- We **owe that decrease to engineering and technology**.
- Instead of casting pessimistic prophesies for the future, in the last century engineers improved hydro-technology, water management, and risk assessment and reduction.

Source: Koutsoyiannis (2021b).
Data from https://ourworldindata.org/world-population-growth; https://ourworldindata.org/ofdacred-international-disaster-data



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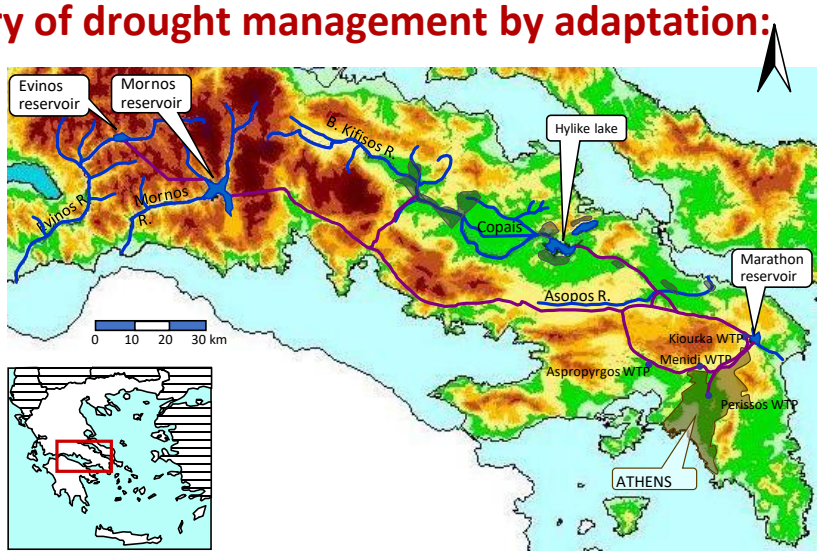
As I stressed in the previous slide, adaptation **has been** the dominant response. And in the 20th century, it was combined with the spectacular developments in technology, energy availability and strong economies. The results were also spectacular. We have diminished the impacts of natural disasters. Compare the victims of droughts and floods in 1920s and 1930s with those of the most recent decade.

Also notice in the bottom graph that currently, the risk from natural disasters is in the bottom of the list of risks from all hazards. Only 0.08% of causes of death.

A success story of drought management by adaptation: The Athens water supply and the 7-year drought around 1990



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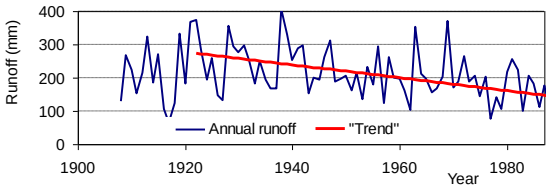
I will close with a success story related to Athens, in which I was personally involved 30 years ago. A prolonged drought lasting 7 years that shook Athens. In the map you see that Athens, which has always been a dry area, has a very extended water supply system covering a big part of Greece. The system contained three reservoirs when the drought started, and four when it ended. The last one is the Evinos reservoir.

Climatic conditions at one of the catchments supplying Athens

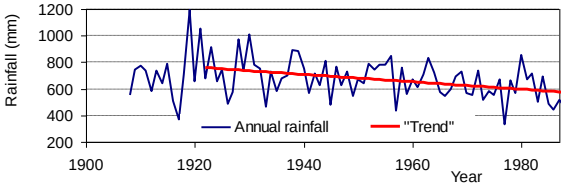
The historical time series of Boeoticos Kephisos runoff up to 1986/87

A multi-year «trend» is observed



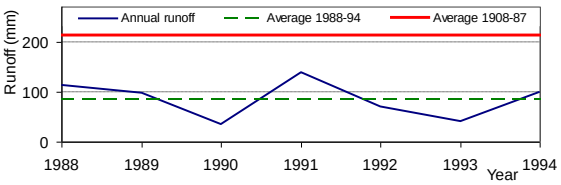
A similar «trend» in the rainfall time series

Explains the «trend» in runoff



Next was a shocking drought

Intense and persistent: Mean flow less than half compared to historical average; duration 7 years



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Here I show the historical runoff and rainfall in one of the basins supplying Athens. The one with the longest record.

Up to the late nineteen eighties, we had noticed a gradual decreasing of runoff, as well as one in rainfall which explained the decreasing runoff. And then there was a radical downward shift, halving runoff for about seven years.

Handling the long-lasting drought in Athens

- Close collaboration of (a) the National Technical University of Athens, (b) the Athens Water Supply and Sewerage Company (EYDAP), and (c) The Ministry of Environment and Public Works.
- Understanding that droughts are **regular natural events**—not associated to human influences.
- Proper modelling the drought within a **stochastic Hurst-Kolmogorov framework** (Koutsoyiannis, 2011).
- Development of a sophisticated **decision support system** (Koutsoyiannis et al., 2003).
- Transparency and veritable information to the **population** of Athens, and its **engagement in the management of the crisis**.
- Design and implementation of an increasing block rate **pricing structure**, combined with water **conservation legislation measures** (Xenos et al., 2002).
- Increased water supply through **technological measures** (see next slide).

To handle this difficult condition we took several measures and built a proper theoretical and practical framework.

Results of the crisis management

- **Not even in one house in not even one day** throughout this 7-year period was there a **water supply failure** due to the drought.
- The water **consumption** of Athens was **decreased by 1/3**.
- New groundwater resources were exploited.
- **In 1.5 year**, a new tunnel was constructed and operated, **diverting water from the Evinos River** to Athens.
- In another 4 years, the new dam on the Evinos River was completed, thus increasing the water quantity transferred to Athens.
- Now Athens has a perfect water supply system.

The results of the crisis management were quite satisfactory.

A plausible scenario for handling the next drought in Athens

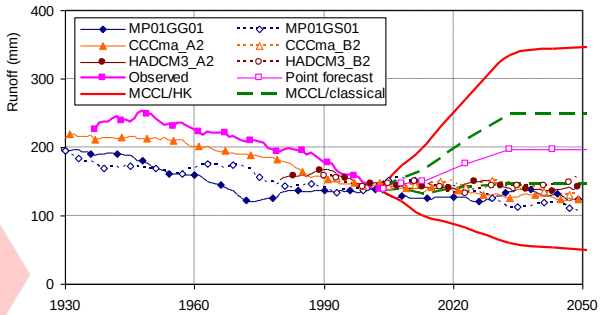
- The drought will be attributed to the **anthropogenic climate change**.
- It will be managed by the newly established **Greek Ministry of Climate Crisis**.
- Climate modellers will be appointed to run global and regional climate models, which will predict that the situation will be persistently worsening in the coming years.
- Urgent measures to **immediately shut down the lignite power stations** will be taken.

As nowadays many are keen to see scenarios, let me offer one. What will happen in handling the next drought in Athens.

Rejected approach 1: Based on climate-models

- Outputs from **3 climate models for 2 future scenarios** were used (Koutsoyiannis et al., 2007).
- The **original climate model outputs** (not shown) had **no relation to reality** (highly negative efficiencies at the annual time scale and above).
- After adaptations (or "**cosmetic lifting**", also known as "downscaling") the climate model outputs improved with respect to reality, thus achieving about zero efficiencies at the annual time scale.
- **For the past**, despite adaptations, the proximity of models with reality was **not satisfactory.**
- **For the future**, the runoff obtained by adapted climate models was **too stable**.
- **Conclusion: It is dangerous** (too risky) **to use climate model projections**.

Boeoticos Kephisos runoff produced with downscaled climate model outputs, superimposed to Monte Carlo confidence limits (MCCL) produced with HK statistics under stationarity



Source of graph and analyses: Koutsoyiannis et al. (2007).

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We also studied additional approaches which we rejected as they would lead to failures. This one, was published in the journal of Hydrometeorology. It was rejected as a dangerous one, from an engineering point of view. Believe it or not, it would lead to too stable runoff, severely underestimating the natural variability and uncertainty.

Rejected approach 2: Trend based

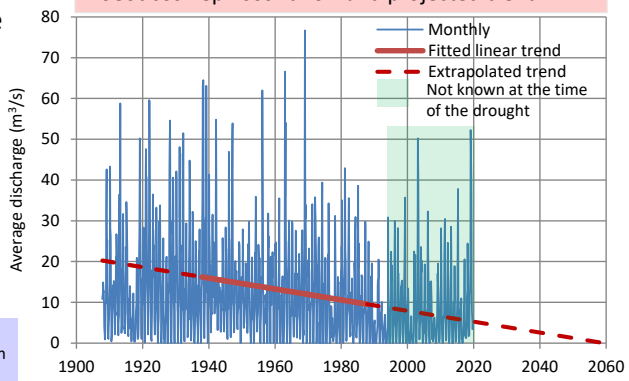
- The "trend model" is **worse than** that of a constant average (see table).
- According to the "trend model", the flows would **disappear** a little after 2050…
- In reality **all three reservoirs spilled** in 2006 and again two of them in 2020 and 2021.
- **Conclusion**: It is **absurd** to use such simplistic methods such as **trend extrapolations**.

Source: Koutsoyiannis (2021b).
See additional evidence about the inappropriateness of trends in Iliopoulou and Koutsoyiannis (2020).

Root mean square errors (in m^3/s) for the two validation periods for the linear-trend model and the constant-mean model, fitted to the calibration period (1937-87)

Validation period	1907-37	1987-2019
Assuming linear trend	13.4	12.7
Assuming constant mean	9.3	10.3

Boeoticos Kephisos runoff and projected trend



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Another trendy scenario which we rejected: Using trends. Now we have ex-post data that confirm and vindicate our choice to reject this approach . Indeed in 2006 all three reservoirs spilled and again two of them in 2020 and 2021.

Concluding remarks

- Change is Nature's style. It occurs at all time scales.
- Change is unpredictable.
- *"The future is unknowable, but the past should give us hope"* (Winston Churchill, 1958).
- In the past, adaptation has been the humans' response to change.
- If we return to reason, this will also be the case in the future.
- Technology has augmented the human ability of adaptation. The results have been spectacular in the last century.
- Human adaptation requires human intelligence. On the contrary, «μωρία» (moronity) results in devastation.

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