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Contribution to the Panel Session: Advancing New Methods for the Treatment of Climate Change and Extreme Events

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Part A

"Predicting is a guessing game for fools"

Schwab and Malleret (2020): *The Great Reset*[*]

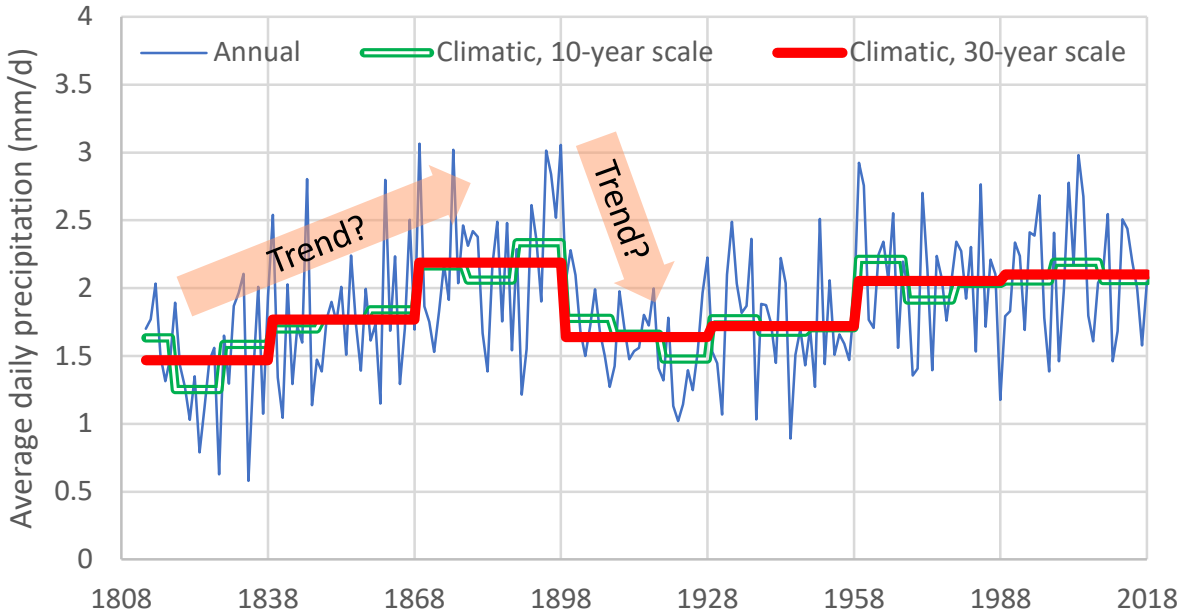
[*]Interestingly, World Economic Forum's "*The Great Reset*", while admitting the futility of predicting, builds upon predicting and, by mixing climate change and Covid-19, supports the necessity for a great reset (see also Koutsoyiannis, 2021b).

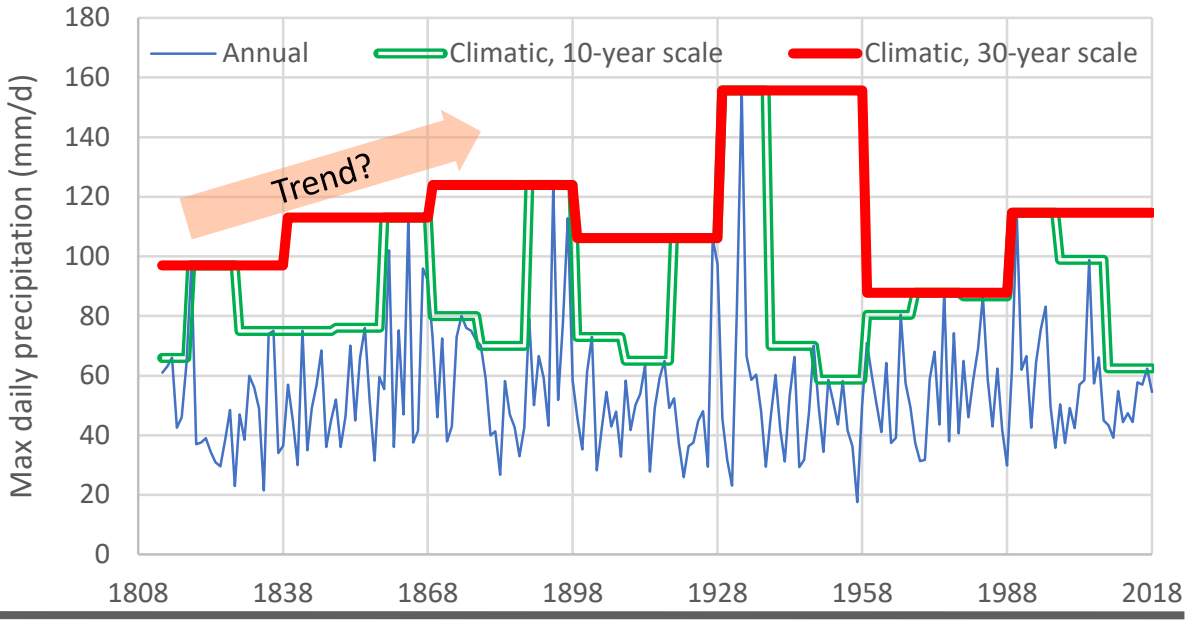
The futility (and actually failure) of predicting climate is examined in Part A, which also tries to provide insights on the discussed question whether the climate models represent the physics, and to address the following question posed to the panelists:

> *Can you talk about current research aimed at reducing the uncertainty in forecasting rainfall with climate prediction models and local downscaling?*

Is climate change a **recent** phenomenon?

- **Dataset details** Station: BOLOGNA, Italy, 44.50°N, 11.35°E, +53.0 m, period: 1813-2018 (206 years); https://climexp.knmi.nl/gdcnprcp.cgi?WMO=ITE00100550
- 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}.





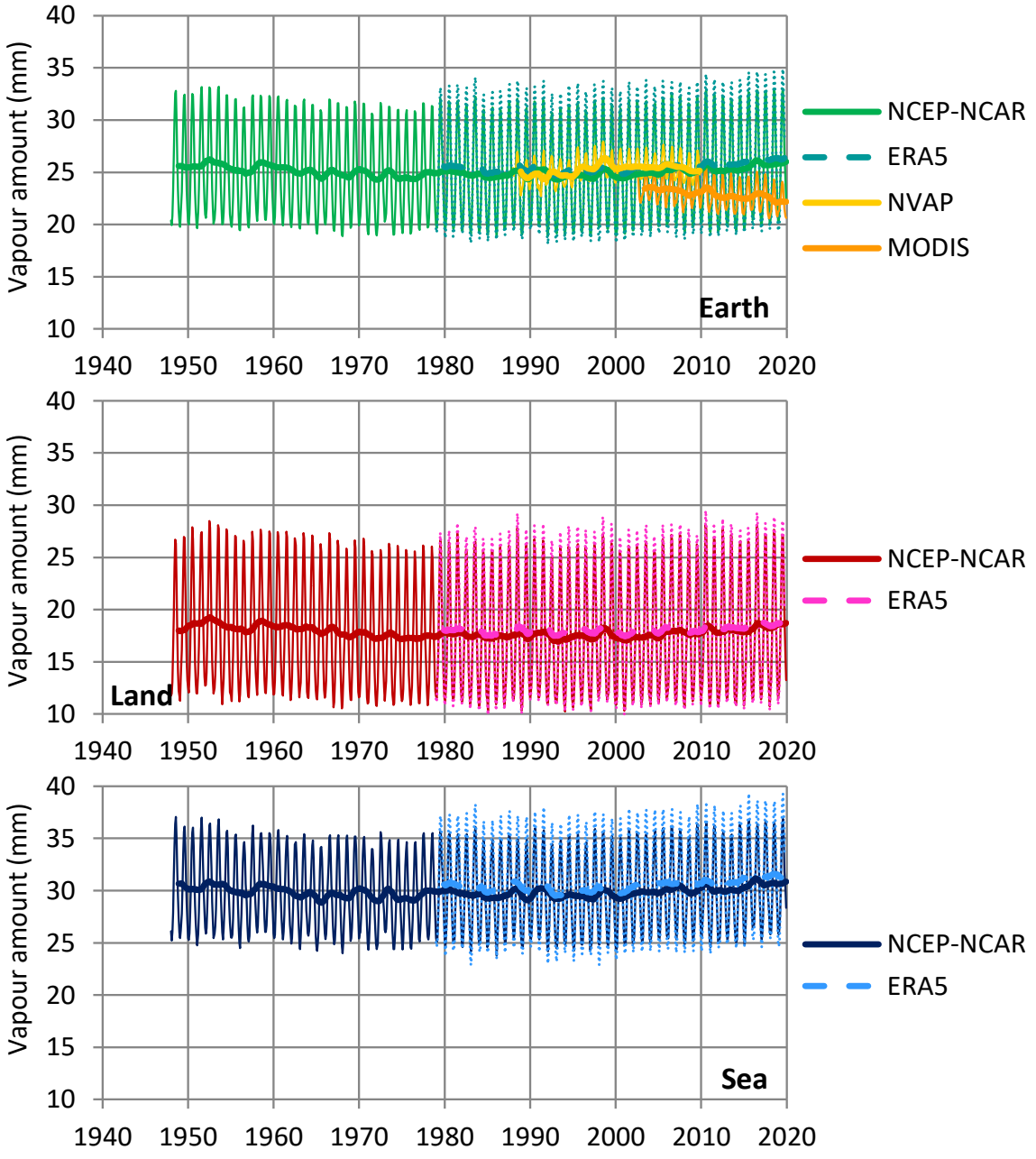
Source of graph: Koutsoyiannis (2021b)

Does atmospheric water show **intensification** of hydrological cycle?

- The water vapour amount in the atmosphere (most often misnamed as *precipitable water*) is fluctuating—not increasing monotonically.
- This falsifies the IPCC (2013) conjecture that it would increase.

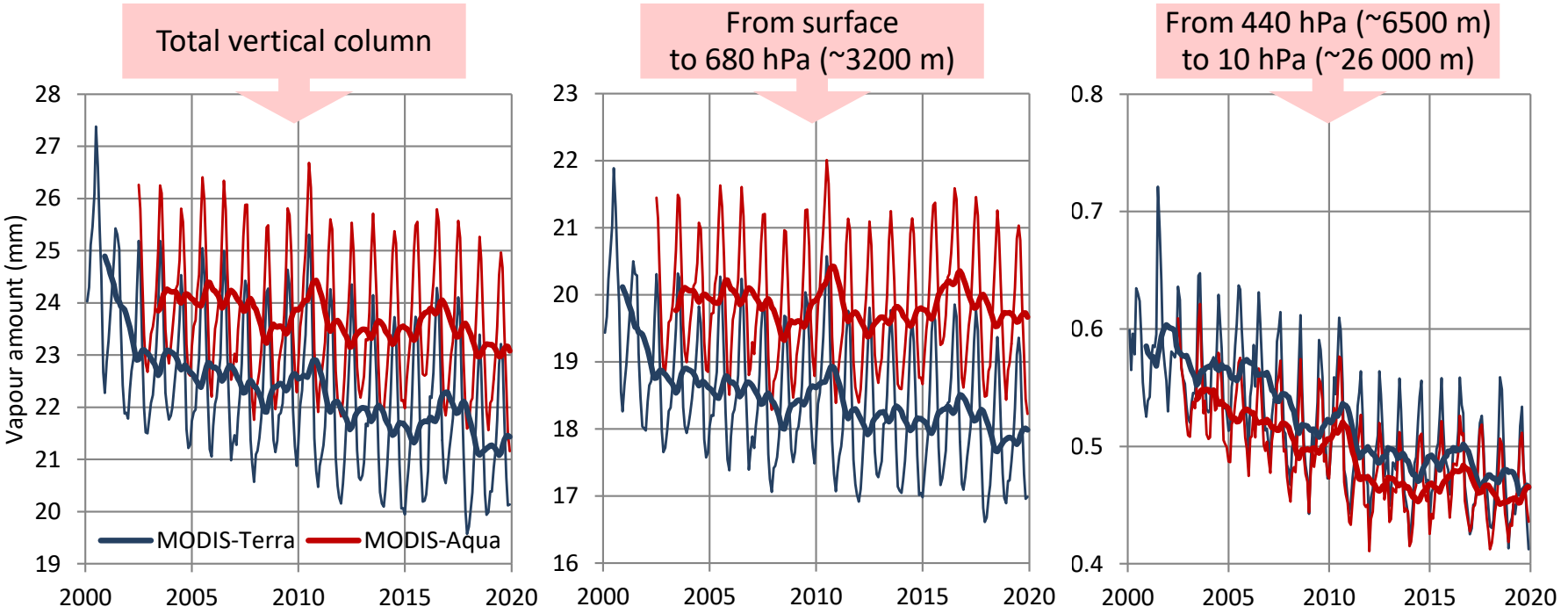
Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

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.



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.

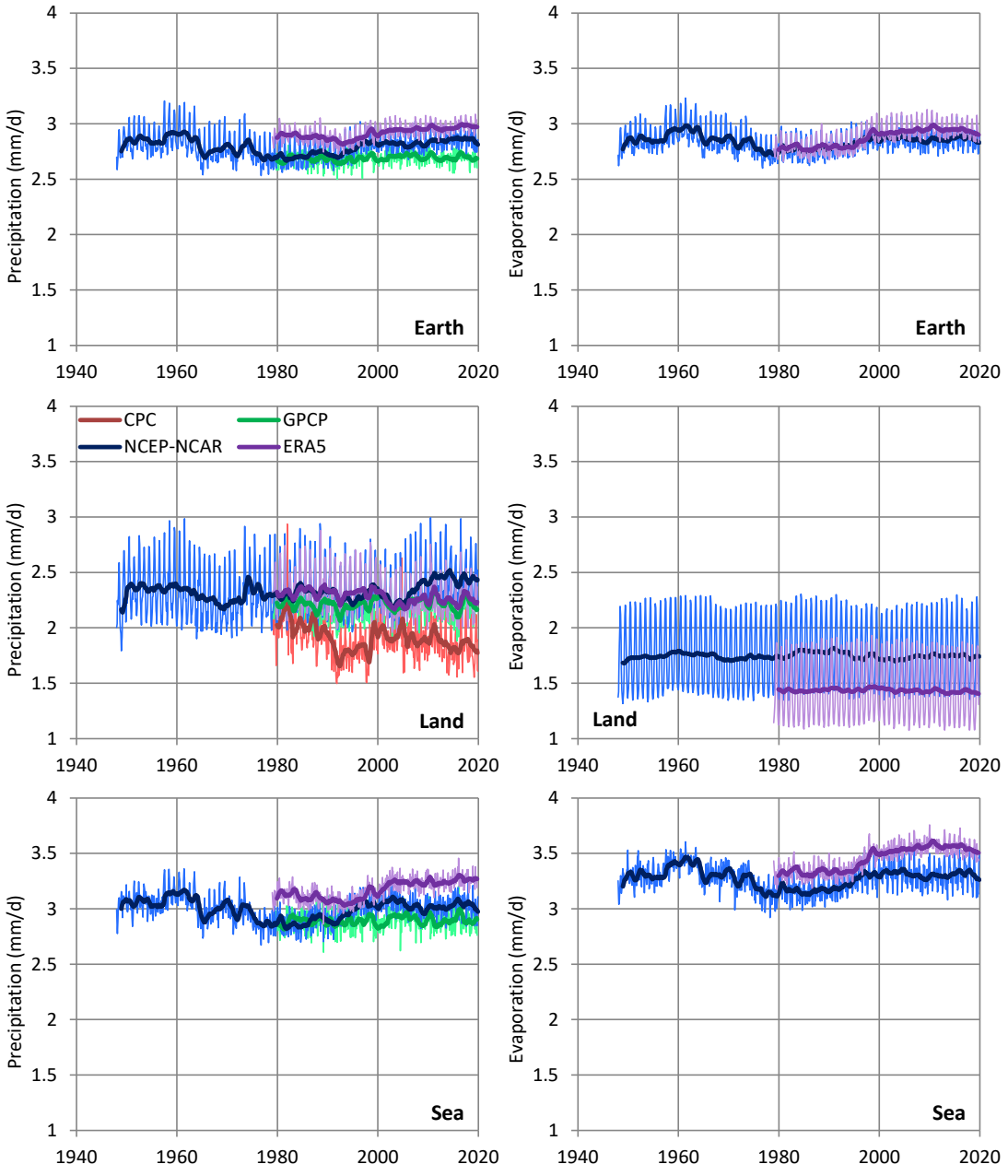


Source of graph: Koutsoyiannis (2020); MODIS data: https://giovanni.gsfc.nasa.gov/giovanni/

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

Do precipitation and evaporation: increase?

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

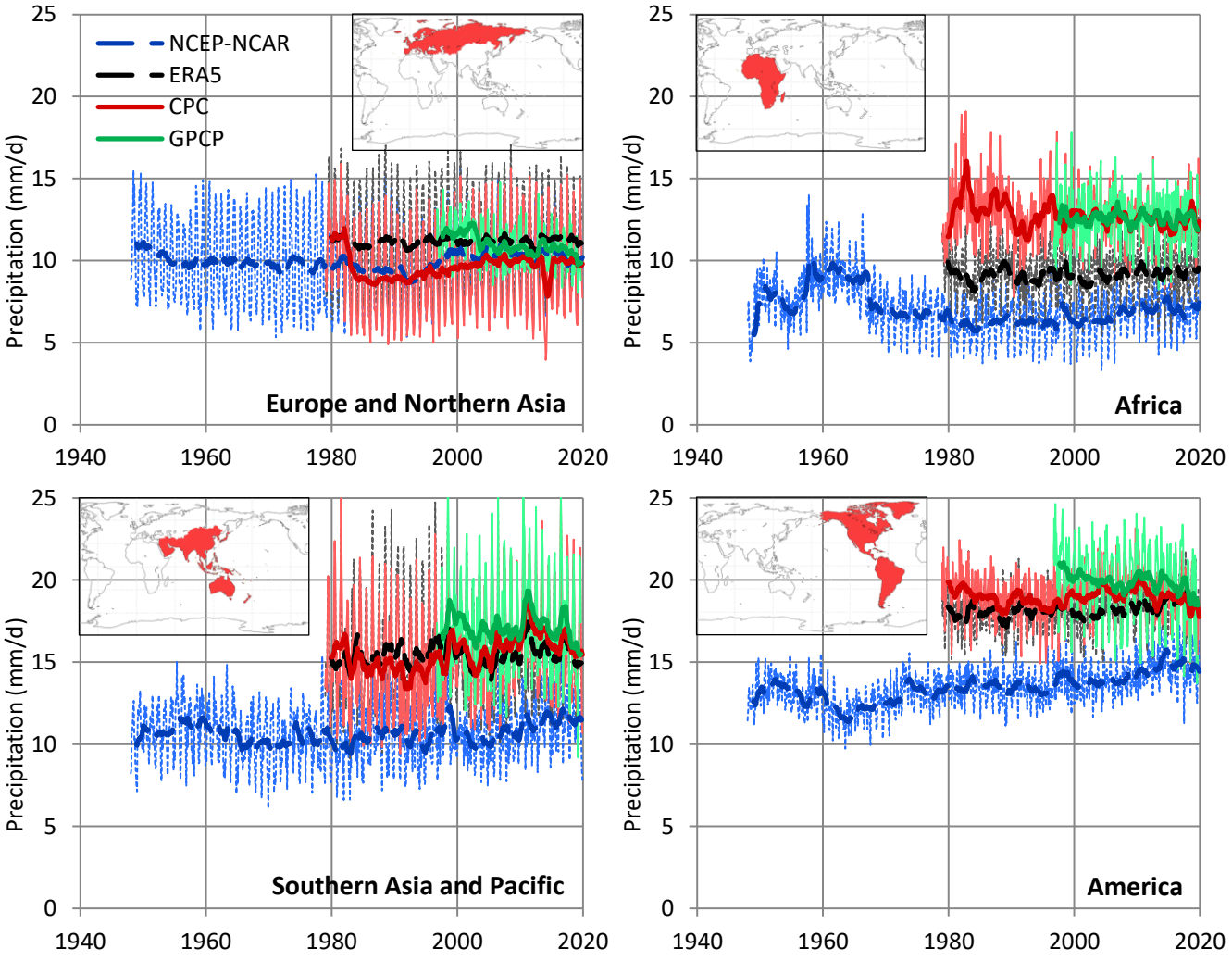


Thin and thick lines of the same colour represent monthly values and running annual averages (right aligned), respectively.

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

Is monthly **maximum** daily precipitation increasing?

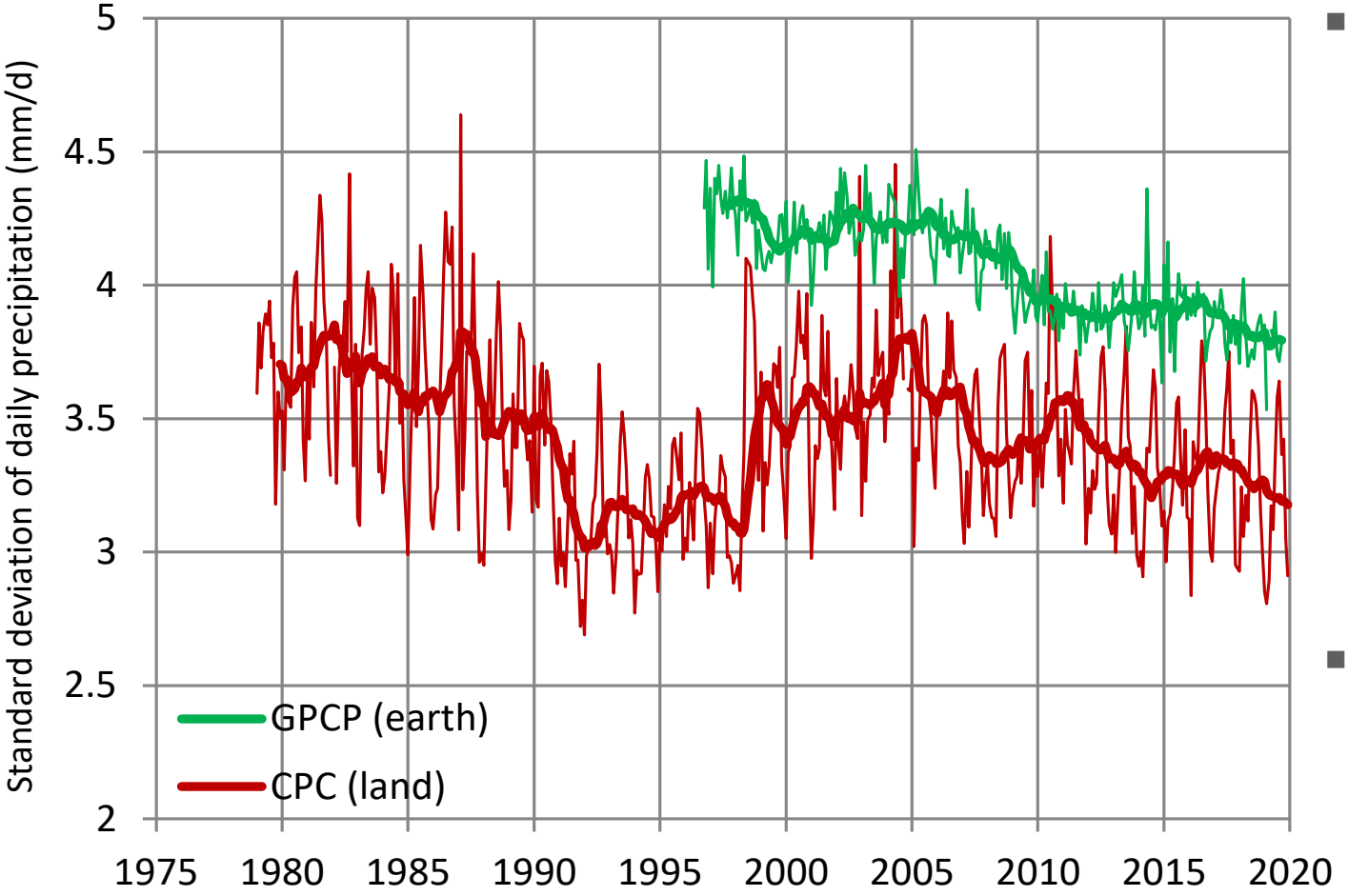
- The graphs show the variation of the monthly maximum daily precipitation areally averaged over the continents.
- In all continents, the monthly maximum daily precipitation is fluctuating—not increasing monotonically.
- In particular, the satellite observations show decreasing, rather than increasing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



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

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

Is daily precipitation **variability** increasing?



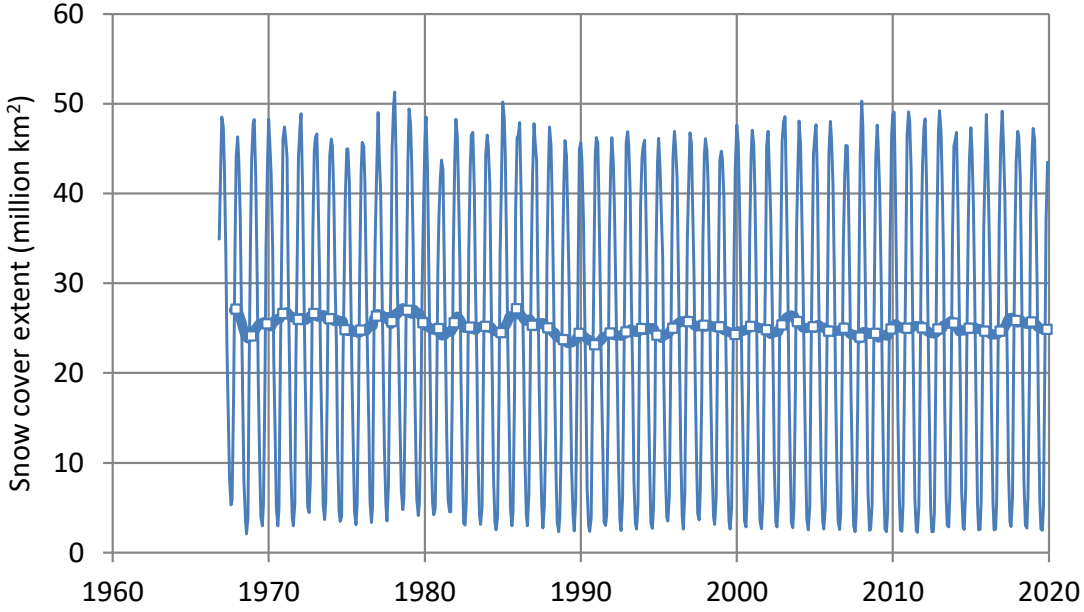
- The standard deviation of daily rainfall, areally averaged, as seen both from CPC and GPCP observational data, decreases, thus signifying deintensification of extremes in the 21st century.
- Again, it will be more prudent to speak about fluctuations rather than deintensification.

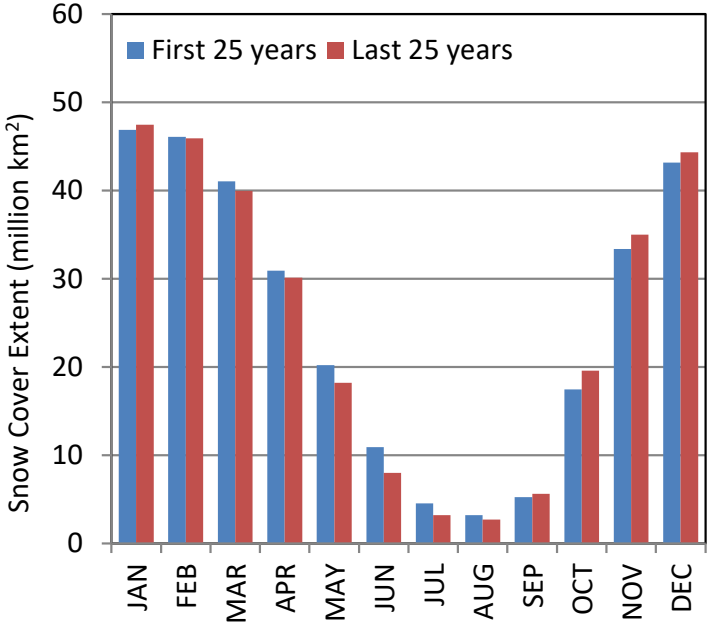
Source of graph: Koutsoyiannis (2020); gauge-based precipitation data gridded over land (CPC), and combined gauge and satellite precipitation data over the entire Earth (GPCP): http://climexp.knmi.nl

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

Does snow tend to disappear?

- The snow part of precipitation is interesting to examine, as snow is more directly related to temperature and also affects Earth's albedo.
- Systematic satellite observations of snow cover extent exist only for the northern hemisphere.
- Despite temperature increase, no noticeable change appears on the annual basis.
- However, there are perceptible changes in the seasonal variation (right panel): in the most recent period the snow cover has decreased during the summer months and increased during the autumn and winter months.





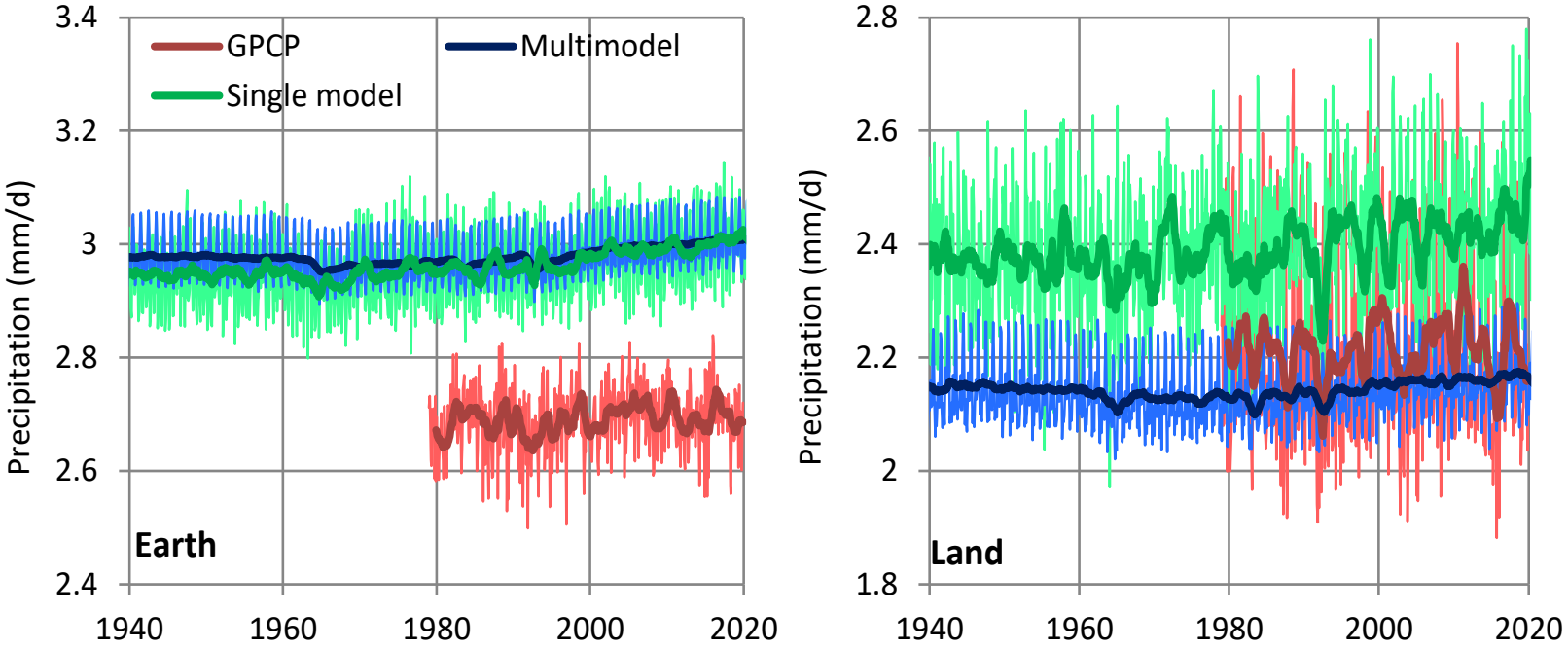
Source of graph: Koutsoyiannis (2020); source of snow cover data: Global Snow Laboratory (GSL), https://climate.rutgers.edu/snowcover/table_area.php

Thin and thick lines represent monthly values and running annual averages (right aligned), respectively. Squares are annual averages aligned at December of each year.

Do climate models provide guidance for the future?

Short answer: **No**.

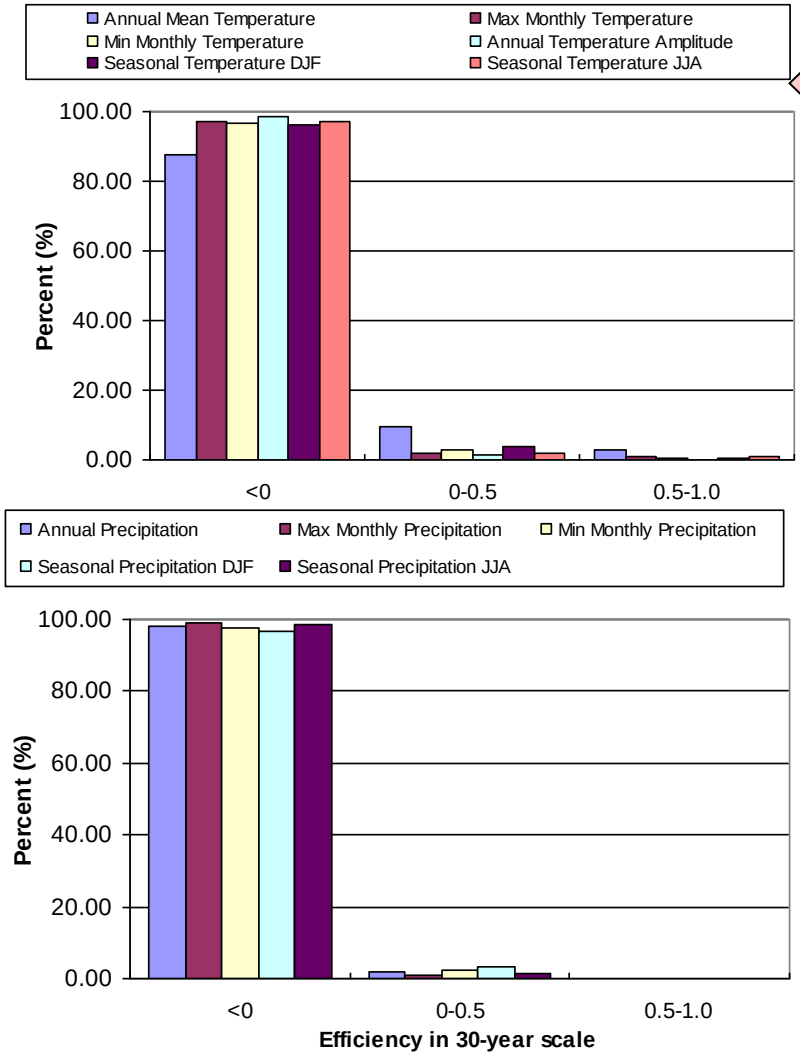
Long answer: They have not provided skill for the past. Notice: (1) the large error of the "Multimodel" ensemble in terms of the mean; (2) the increasing trend of climate model outputs after 1980, which did not appear in reality.



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

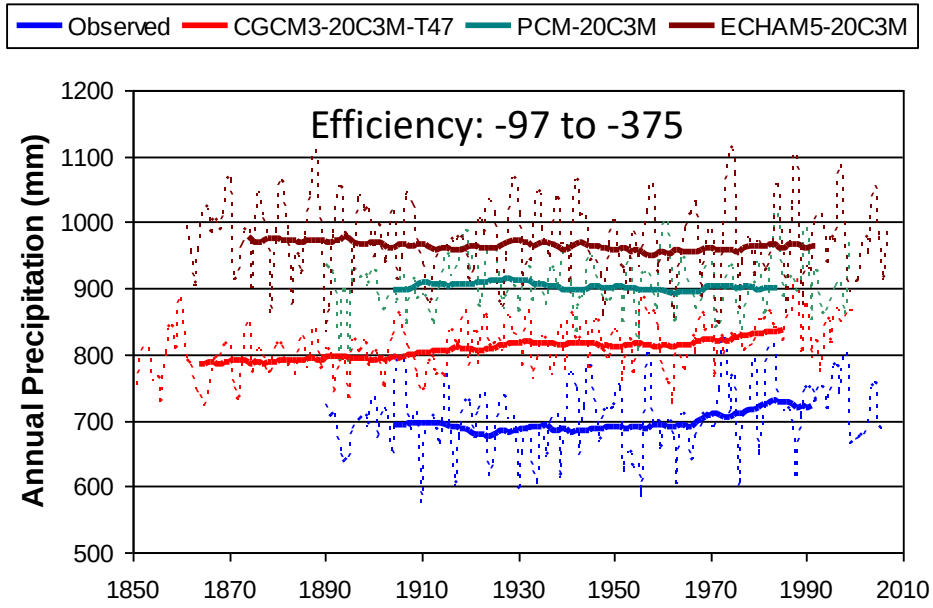
Thin and thick lines represent monthly values and running annual averages (right aligned).

Do climate models reproduce **real-world** rainfall?



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

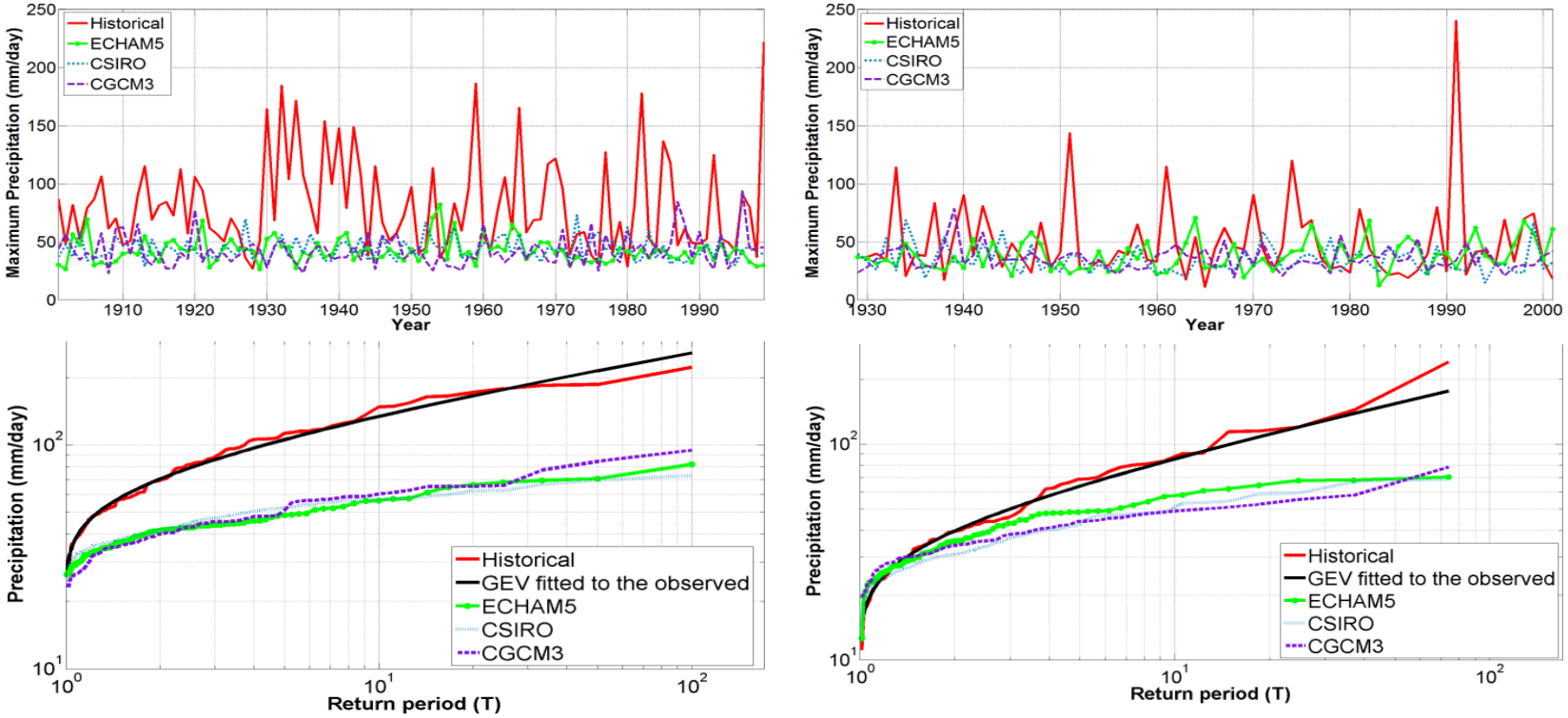
Comparison of 3 IPCC AR4 climate models with reality in sub-continental scale (contiguous USA)



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

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 the size of extreme events.



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

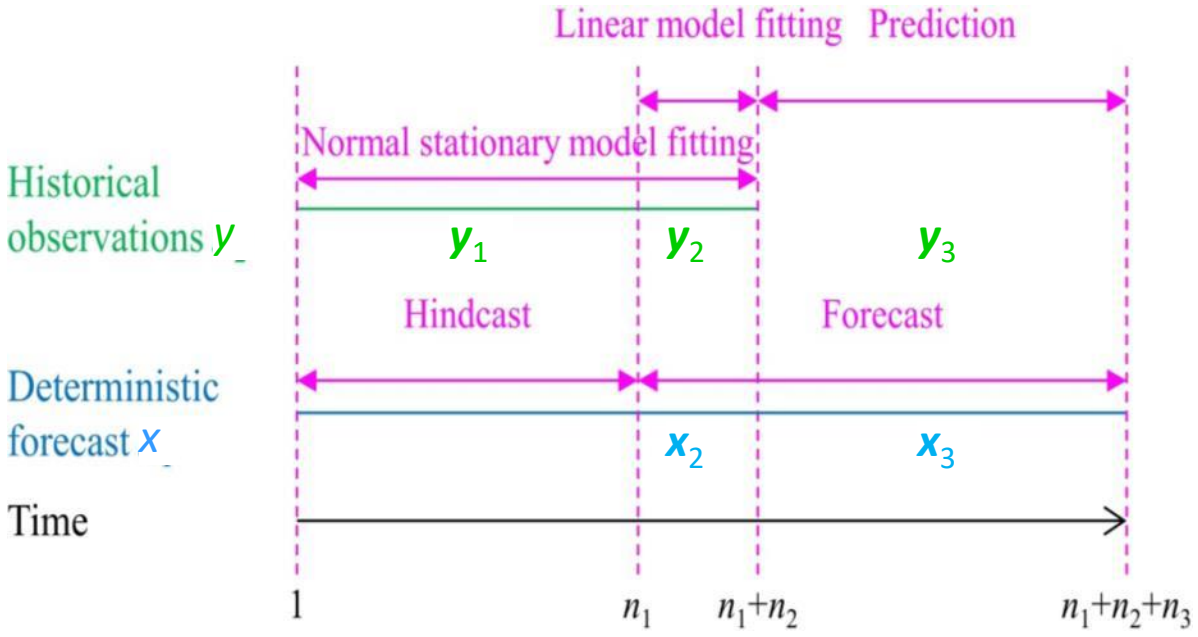
Source: Tsaknias et al. (2016)

Last attempt to utilize climate models: Can we **convert** them to **stochastic**?

- **Yes**, we can: by incorporating one or many deterministic forecasts into an initially independent stochastic model in a Bayesian framework.
- ***If the climate model contains useful information, the stochastic framework will utilize it to improve the stochastic prediction; otherwise it will discard it.***
- With reference to the sketch on the right, we simulate the unknown future $\boldsymbol{y}_3$ conditional on the known past $\boldsymbol{y}_1$, $\boldsymbol{y}_2$ and the deterministic model outputs $\boldsymbol{x}_2$, $\boldsymbol{x}_3$ by

$$h(\boldsymbol{y}_3 | \boldsymbol{y}_1, \boldsymbol{y}_2, \boldsymbol{x}_2, \boldsymbol{x}_3) \propto f(\boldsymbol{x}_3 | \boldsymbol{y}_3)\, g(\boldsymbol{y}_3 | \boldsymbol{y}_1, \boldsymbol{y}_2)$$

where $f(\boldsymbol{x}_3 | \boldsymbol{y}_3)$ is the model likelihood (evaluated from $\boldsymbol{x}_2$ and $\boldsymbol{y}_2$) and the other functions are conditional densities.

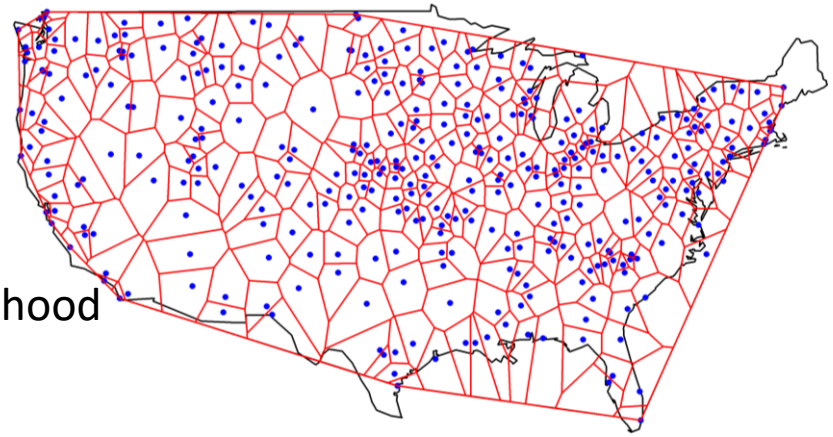


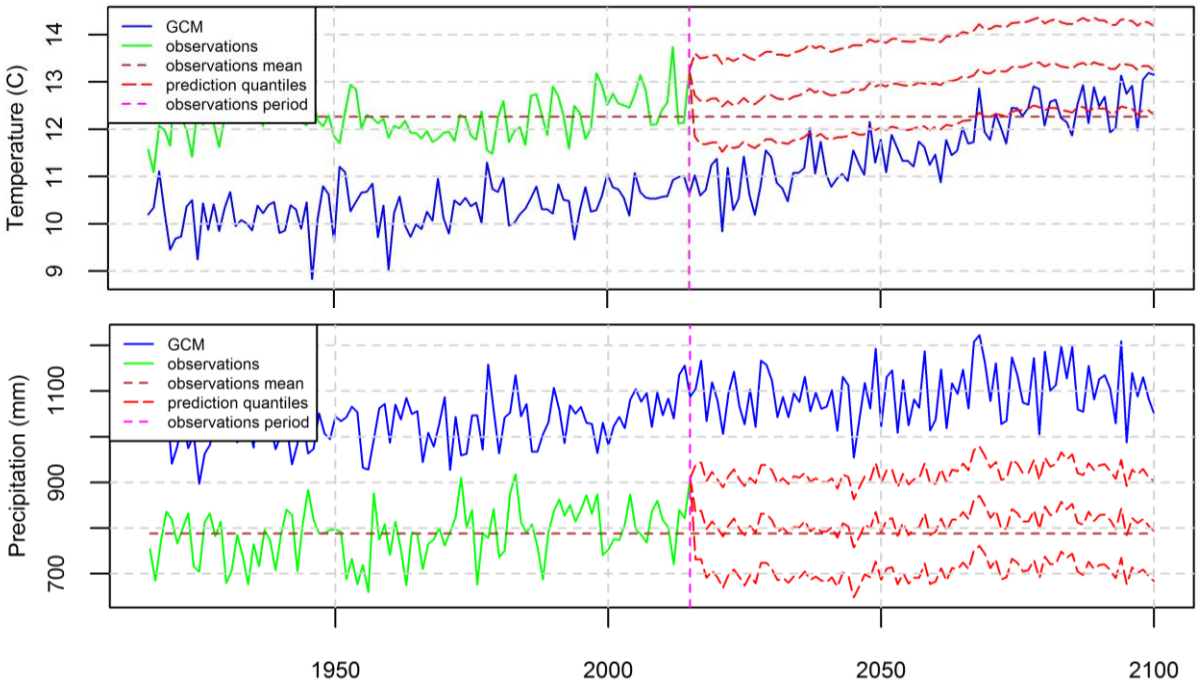
Tyralis and Koutsoyiannis (2017)

Last attempt (2): Application to the climate of the USA

- Historical data for temperature and precipitation from 362 and 319 stations, respectively, have been used to estimate the areal averages (historical observations).
- Deterministic forecasts were taken from 14 different climate models. The model likelihood was evaluated in the period 2006-15.
- The example on temperature (95% prediction intervals) shows a slight increase in annual temperature in the USA if conditioned on the output of MRI-CGCM3 climate model.
- The example on precipitation shows indifference despite conditioning on the GISS-E2-H climate model.

Tyralis and Koutsoyiannis (2017)



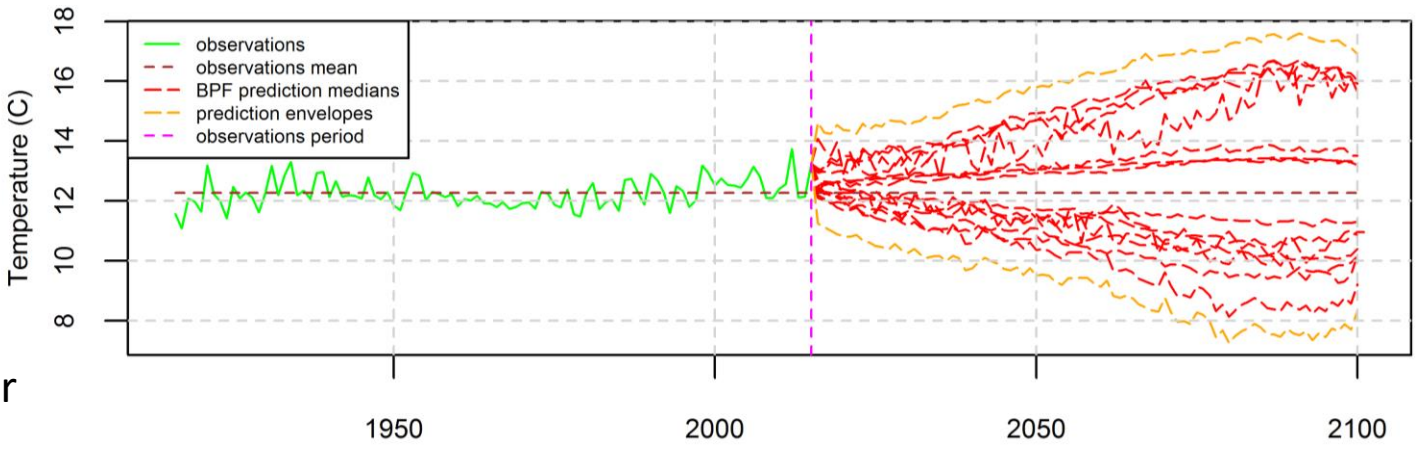


Last attempt (3): **The Bayesian Thistle**

- Some models have negative correlation with historical data.
- As a result, the predicted temperature rise turns into decline in the stochastic framework.
- In turn, this results in huge uncertainty if we take the envelope from many climate models conditioning our stochastic model.
- The resulting shape looks as a **thistle**.

Caution: Envelops and spaghetti graphs are not stochastically sound, but have been popular in climatology communications.

Tyralis and Koutsoyiannis (2017)

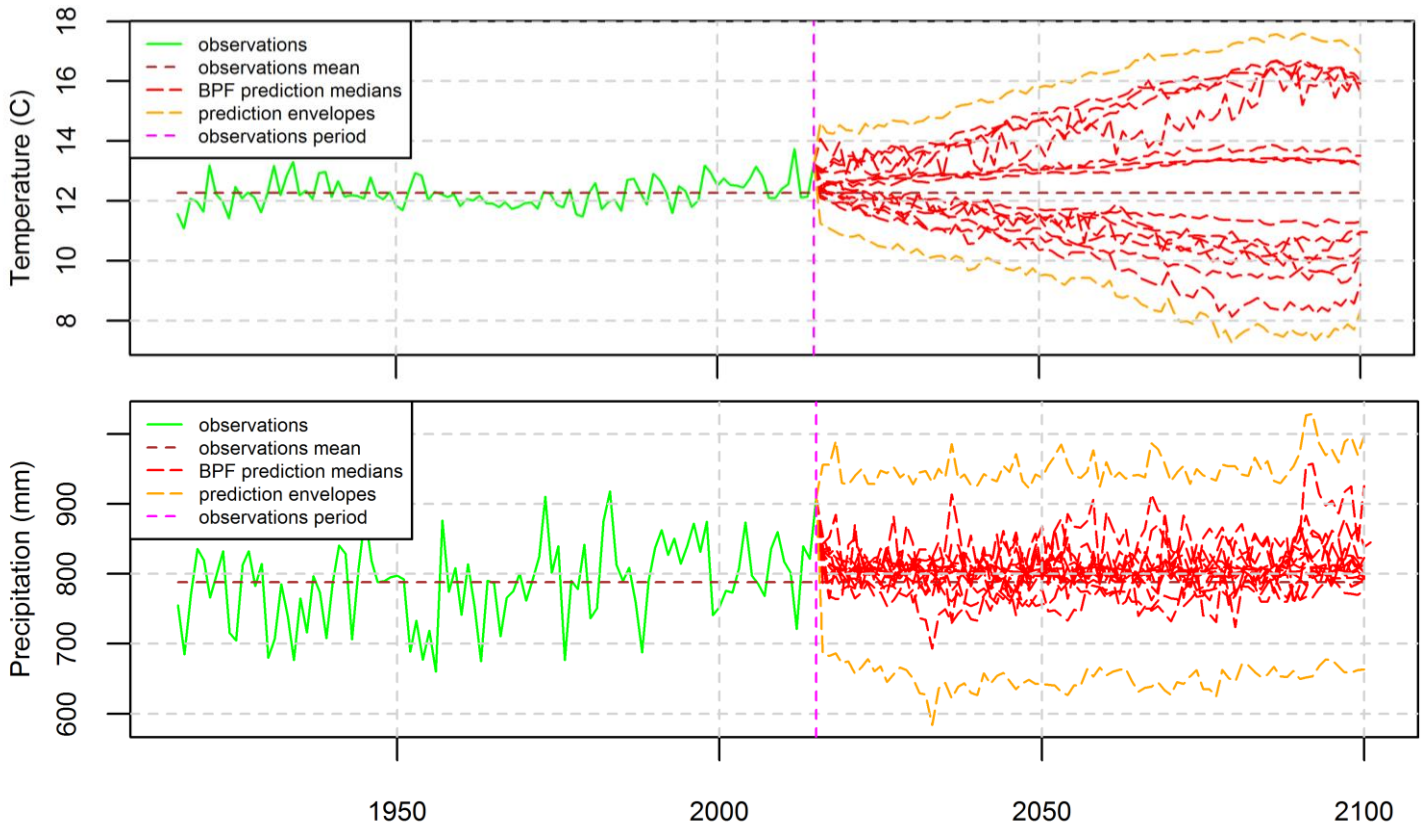


Last attempt (4): Final multimodel results for temperature and precipitation in the USA

- If all models are taken into account, the temperature change up to 2100 could be somewhere in the range −4 to 4 °C.
- Precipitation does not change by conditioning on all models.

  Only its uncertainty increases slightly (±50 mm, if compared to that without conditioning on models).

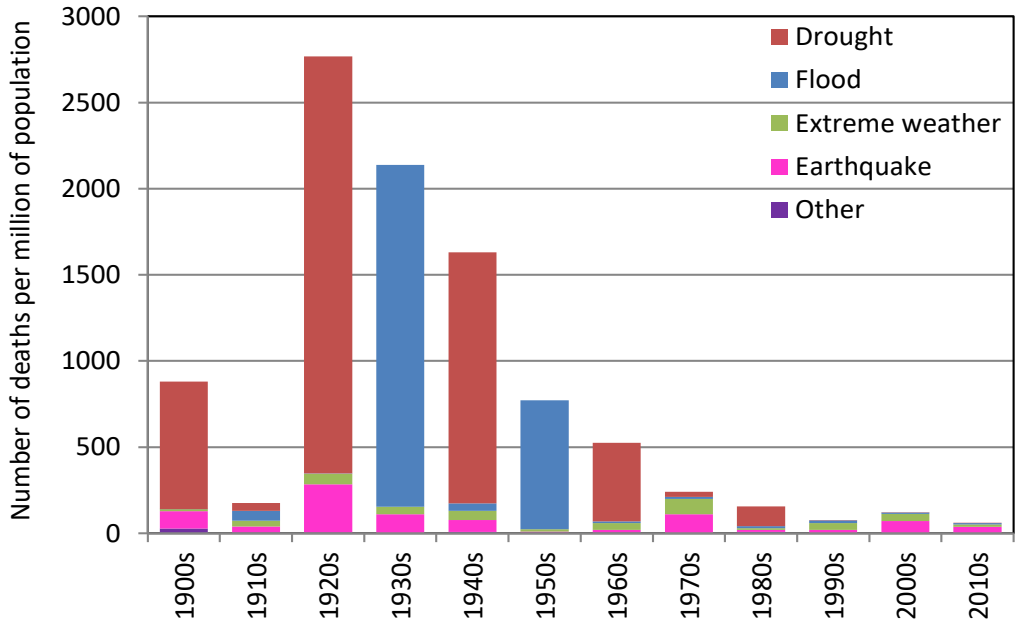
Caution: Same as in the previous slide.

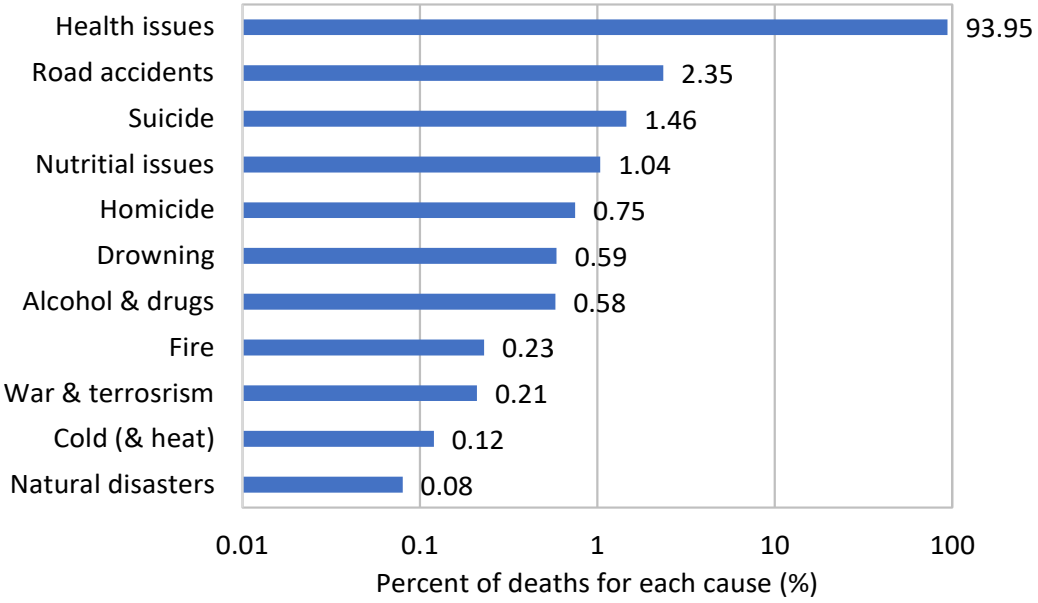


Tyralis and Koutsoyiannis (2017)

Is the **risk** from natural disasters **increasing**?

- **No**. The risk has been drastically decreased.
- Currently the risk from natural disasters is in the bottom of the list.
- We owe that spectacular 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 (2021a).
Data from https://ourworldindata.org/world-population-growth;
https://ourworldindata.org/ofdacred-international-disaster-data

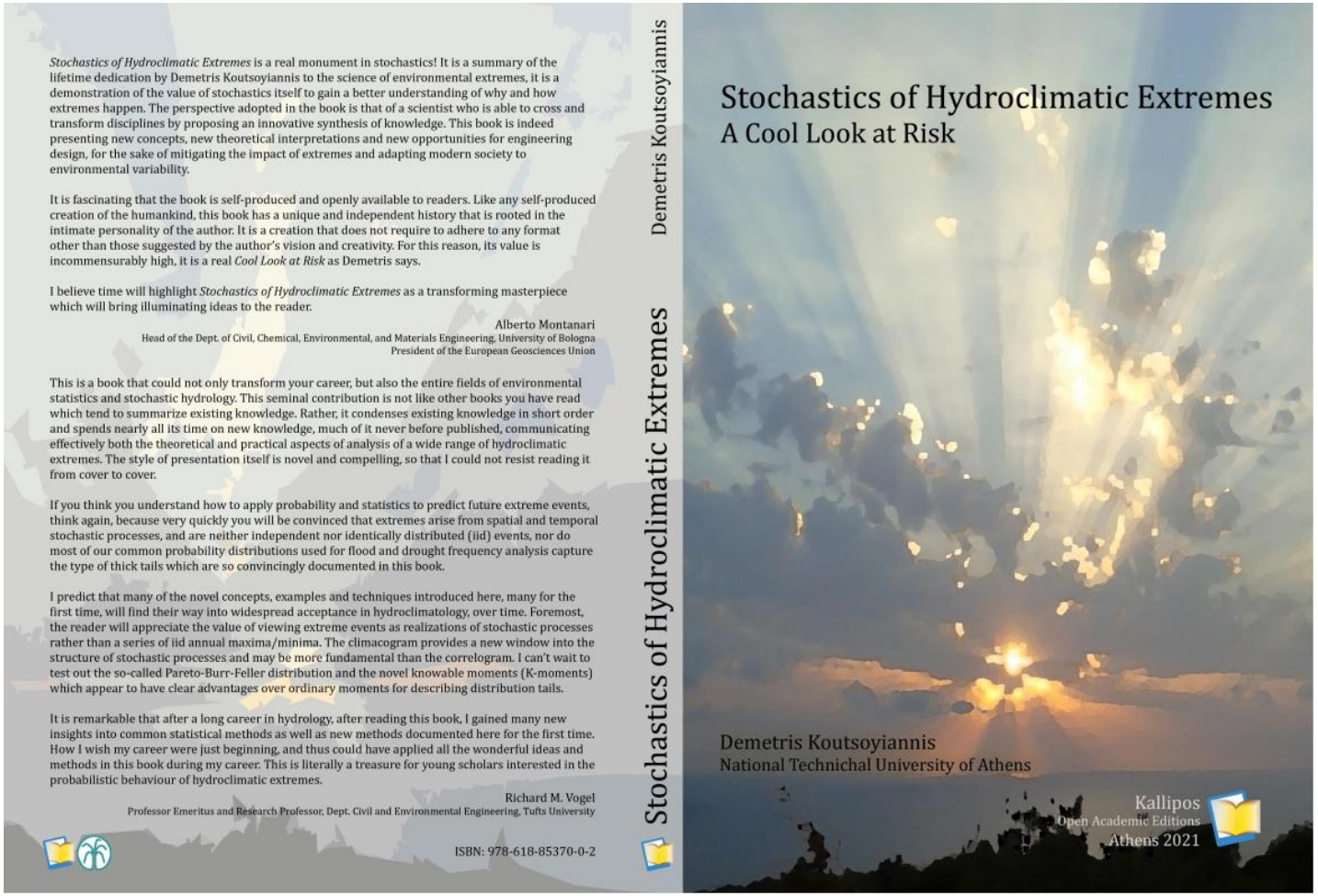
Are there **scientific** methods to deal with hydroclimatic extremes in an ever-changing climate?

Yes, there are. And they are stochastic. See the brand new book:

Stochastics of Hydroclimatic Extremes

Available online for free:

http://www.itia.ntua.gr/2000/



Koutsoyiannis (2021a)

Part B*

"[φιλοσόφους λέγω] τοὺς τῆς ἀληθείας, φιλοθεάμονας"

Πλάτων, Πολιτεία, Ε, 475e

"[I call philosophers§] the lovers of the vision of truth"

Plato, Republic, V, 475e

*This part is meant to address some comments raised during the discussion, which are shown in the next slide.

§While the terms «*επιστήμη*» (*science*) and «*επιστήμων*» (*scientist*) were in use in Ancient Greece, the term «*φυσική φιλοσοφία*» (*natural philosophy*) was more often used for what today we call science (this continued even in the early modern period).

Questions and comments posed by the audience on the relationship of science with fear and money

- *Fear motivates action and allocation of monies. Those are needed to address climate change. So glad to hear the public is concerned.* [This comment followed my mention of the widespread fear of Greeks about climate change—see related slide].
- *Should science serve the public interest, or just pure knowledge? I think science should address irrational fear.*
- *I think the point is that public works projects need monetary allocations. Practitioners need input from scientists to inform their designs, particularly for projects such as hurricane hazard reduction.*
- *Statistical hydrologists don't directly serve the public; they don't read your papers. Your primary audience are the designers and decision makers tasked with protecting the public who follow your recommended design depths with great faith. Also, the fear is not irrational, it's very real.*
- *I agree. I did not think the point was that scientists resort to fear mongering, rather that climate change consequences drive research and decision making.*
- *Agree. In addition: Accurate communication of scientific findings to the public is critical. The information and findings are used to make decisions by designers/decision makers. But the public doesn't always understand the basis.*

My opinions on the questions and comments

- Certainly knowing the truth about how nature works is beneficial for the society. Therefore, it is meaningless to speak about pure knowledge.
- The tool that transforms scientific truth to beneficial action for the society is technology within a strong economy; illustration of this beneficial role in terms of diminishing the risk from natural disasters has been given in a previous slide.
- This is totally different from a "science" that is driven by political or economical interests, which prescribe what is to be studied.
- Promoting fear for money is inconsistent with scientists' role.
- The modern flourish of civilization was based on the freedom of scientific inquiry and opinion.
- The most recent developments, where freedom of scientific inquiry has been diminished as scientific careers depend on raising funds, is a total failure and unavoidably leads to regression and decadence.
- These issues have been discussed and resolved since the 6th century BC, in the dawn of philosophy and science; some examples are given in the slides that follow.

Who are the world champions in climate fear?

https://www.pewresearch.org/global/2019/02/10/climate-change-still-seen-as-the-top-global-threat-but-cyberattacks-a-rising-concern/

Note: Greeks ranked first in climate scare also in earlier polls:
https://www.pewresearch.org/global/2013/06/24/climate-change-and-financial-instability-seen-as-top-global-threats/
https://news.gallup.com/poll/147203/Fewer-Americans-Europeans-View-Global-Warming-Threat.aspx

TOP SIX

Country	Global climate change	The Islamic militant group known as ISIS	Cyberattacks from other countries	North Korea's nuclear program	The condition of the global economy	U.S. power and influence	Russia's power and influence	China's power and influence
Greece	90%	69%	63%	63%	88%	48%	33%	38%
South Korea	86%	63%	81%	67%	74%	67%	44%	82%
France	83%	87%	67%	55%	46%	49%	40%	40%
Spain	81%	75%	59%	59%	57%	42%	41%	35%
Mexico	80%	34%	60%	57%	63%	64%	31%	31%
Japan	75%	52%	81%	73%	52%	66%	49%	69%

BOTTOM SIX

U.S.	59%	62%	74%	58%	44%	*	50%	48%
Indonesia	56%	81%	56%	57%	60%	52%	31%	43%
Poland	55%	59%	53%	53%	23%	18%	65%	26%
Russia	43%	62%	36%	30%	40%	43%	*	20%
Nigeria	41%	61%	47%	41%	49%	39%	33%	30%
Israel	38%	47%	42%	36%	35%	15%	28%	18%

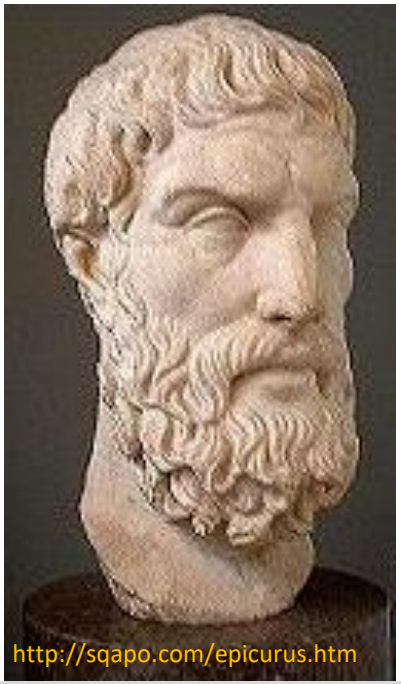
Epicurus's contribution in envisaging the aim of science in dispelling fears and myths, and the role of scientists

- *Οὐκ ἦν **τὸ φοβούμενον λύειν** ὑπὲρ τῶν κυριωτάτων μὴ κατειδότα τίς ἡ **τοῦ σύμπαντος φύσις**, ἀλλ΄ ὑποπτεύοντά τι τῶν κατὰ τοὺς μύθους.*

  *It is impossible for someone to **dispel his fears** about the most important matters if he doesn't know the **nature of the universe** but still gives credence to myths* (Principal Doctrines, 12).

- ***Παρρησία** γὰρ ἔγωγε χρώμενος **φυσιολογῶν** χρησμωδεῖν τὰ συμφέροντα πᾶσιν ἀνθρώποις μᾶλλον ἂν βουλοίμιν, **κἄν μηδεὶς μέλλῃ συνήσειν**, ἢ συγκατατιθέμενος τοῖς δόξαις καρποῦσθαι τὸν πυκνὸν παραπίπτοντα παρὰ τὸν πολλῶν ἔπαινον.*

  *As I **study nature**, I would prefer to **speak all truth bravely** about what is beneficial to all people, **even though it be understood by none**, rather than to conform to popular opinion and thus gain the constant praise of the many* (Vatican Sayings, 29).



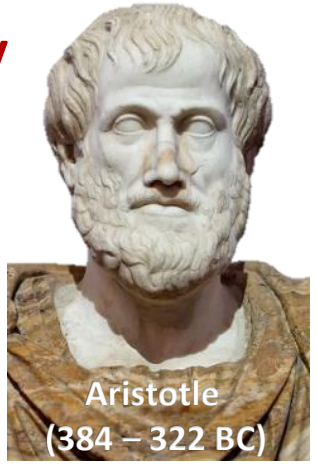
Epicurus
341–270 BC

Science (= pursuit of the truth) vs. sophistry

φίλος μέν Σωκράτης, ἀλλά φιλτάτη ἡ ἀλήθεια.
(Latin version: *Amicus Socrates, sed magis amica veritas*.)

Socrates is dear (friend), but truth is dearest.

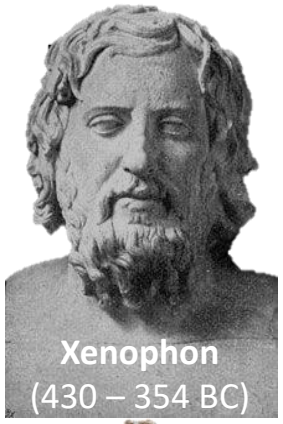
(Ammonius, Life of Aristotle)



ἔστι γὰρ ἡ σοφιστικὴ φαινομένη σοφία οὖσα δ᾽ οὔ, καὶ ὁ σοφιστὴς χρηματιστὴς ἀπὸ φαινομένης σοφίας ἀλλ᾽ οὐκ οὔσης.

Sophistry is the semblance of wisdom without the reality, and the sophist is one who makes money from apparent but unreal wisdom.

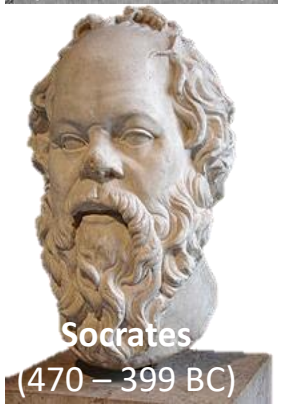
(Aristotle, On Sophistical Refutations, 165a21)



καὶ τὴν σοφίαν ὡσαύτως τοὺς μὲν ἀργυρίου τῷ βουλομένῳ πωλοῦντας σοφιστὰς ὥσπερ πόρνους ἀποκαλοῦσιν.

Those who offer wisdom to all comers for money are known as sophists, just like prostitutors.

(Xenophon, Memorabilia, 1.6.13, quoting Socrates)



Ancient values and modern decadence

Hydrol. Earth Syst. Sci., 25, 2419–2444, 2021
https://doi.org/10.5194/hess-25-2419-2021

Hydrology and Earth System Sciences
Open Access
EGU

From mythology to science: the development of scientific hydrological concepts in Greek antiquity and its relevance to modern hydrology

Demetris Koutsoyiannis and Nikos Mamassis

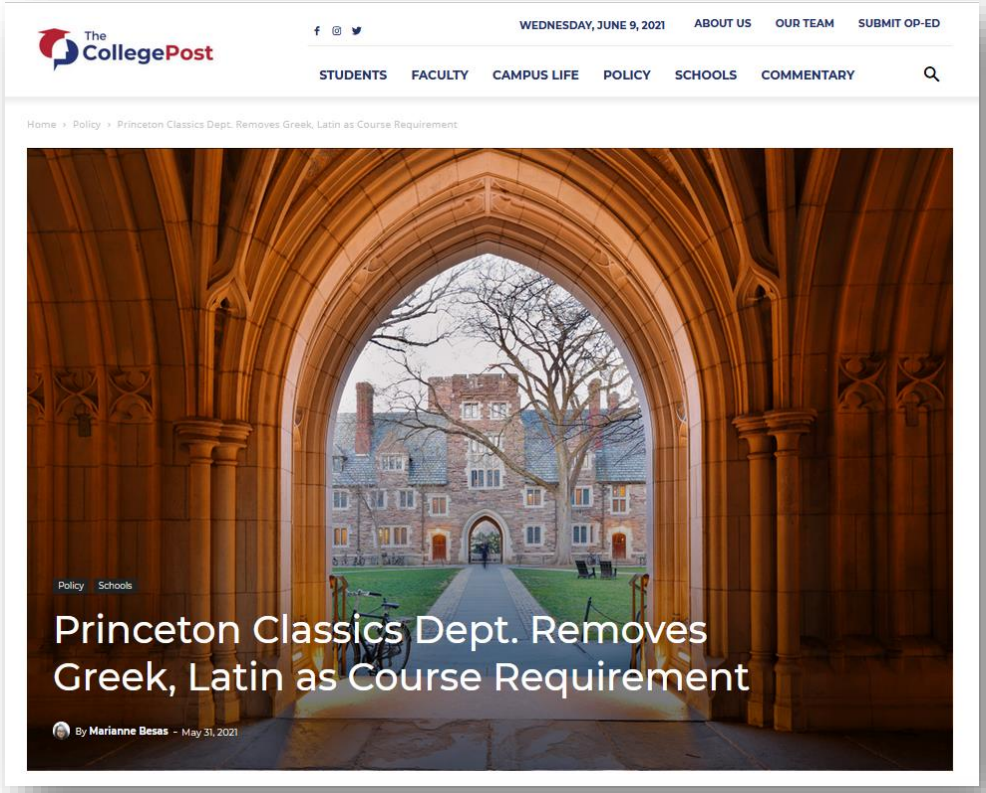
Department of Water Resources and Environmental Engineering, School of Civil Engineering, National Technical University of Athens,

7 Epilogue

Signs of similar decadence are also present in our era, particularly in the Western World, where ideas are being replaced by ideologies and reason by stereotypes of "correctness". Hopefully this is less the case in the Eastern World. As the Earth is round, the very terms "Western" and "Eastern" presuppose some reference point – and this is Greece. We, thus, believe that revisiting the values developed in Greek antiquity is a proper measure against modern decadence.

Koutsoyiannis and Mamassis (2021).

A recent confirmation of the decadence hypothesis



'Splendid Isolation' of Greek and Roman Culture

The Classics Department revealed that the decision to remove the languages as a requirement is a part of efforts to enhance inclusiveness and equity in the curriculum.

Source: https://thecollegepost.com/princeton-removes-greek-latin/
See also: https://classics.princeton.edu/department/equity

- According to Isocrates, "*the name Greeks suggests no longer a race but an intelligence and the title of Greek is applied to those who share our culture rather than to those who share a common descent*" («*τὸ τῶν Ἑλλήνων ὄνομα πεποίηκε μηκέτι τοῦ γένους ἀλλὰ τῆς διανοίας δοκεῖν εἶναι, καὶ μᾶλλον Ἕλληνας καλεῖσθαι τοὺς τῆς παιδεύσεως τῆς ἡμετέρας ἢ τοὺς τῆς κοινῆς φύσεως μετέχοντας*» *Πανηγυρικός, 4,50).*
- Therefore, inclusiveness and equity are guaranteed by definition, assuming adequate intelligence.
- Hence recent developments signify decadence combined with absence of intelligence.

Important note: Modern Greeks, as world champions in climate fear (see slide 20), are also world champions in decadence.

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