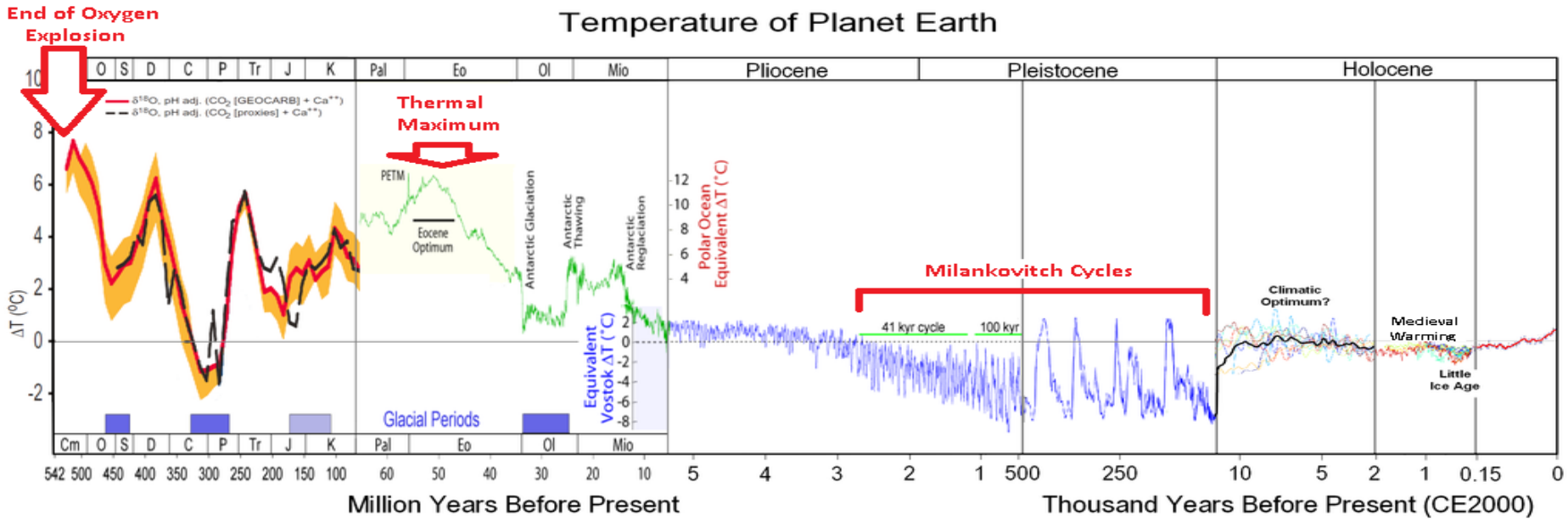
DiSTAR Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II
SCUOLA POLITECNICA E DELLE SCIENZE DI BASE

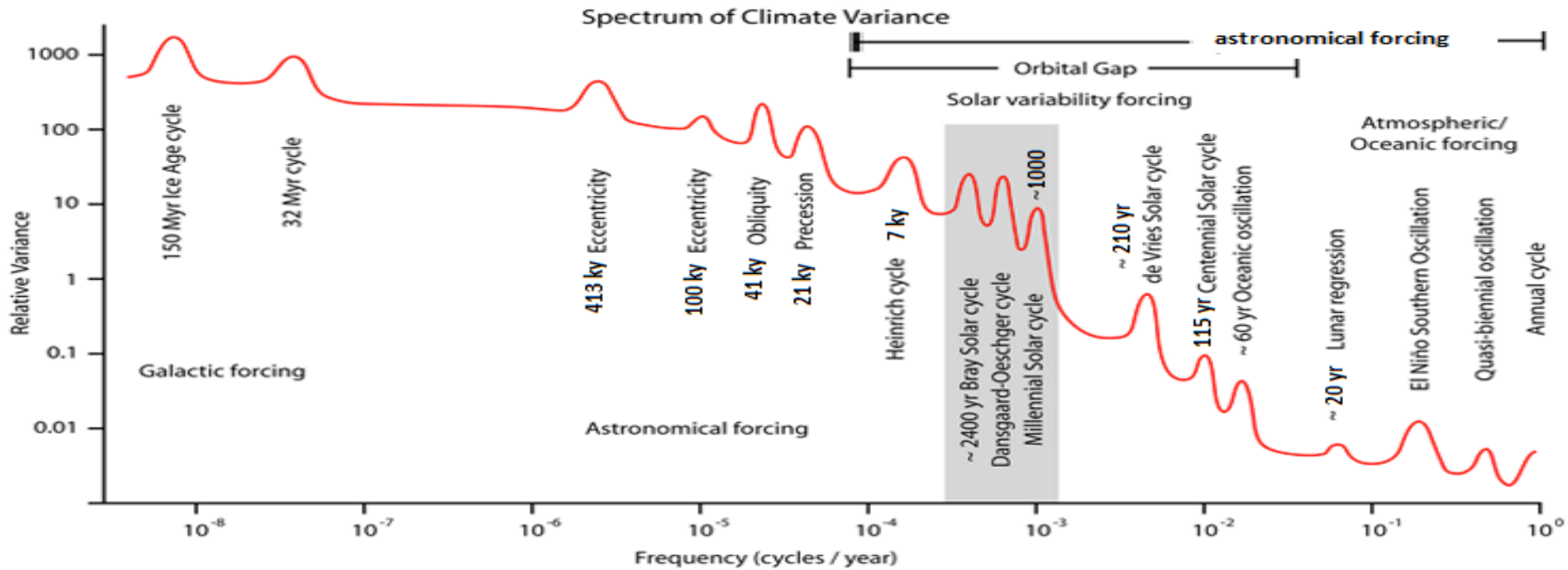
Climate Data versus Climate Models: high ECS is not supported

Prof. Nicola Scafetta

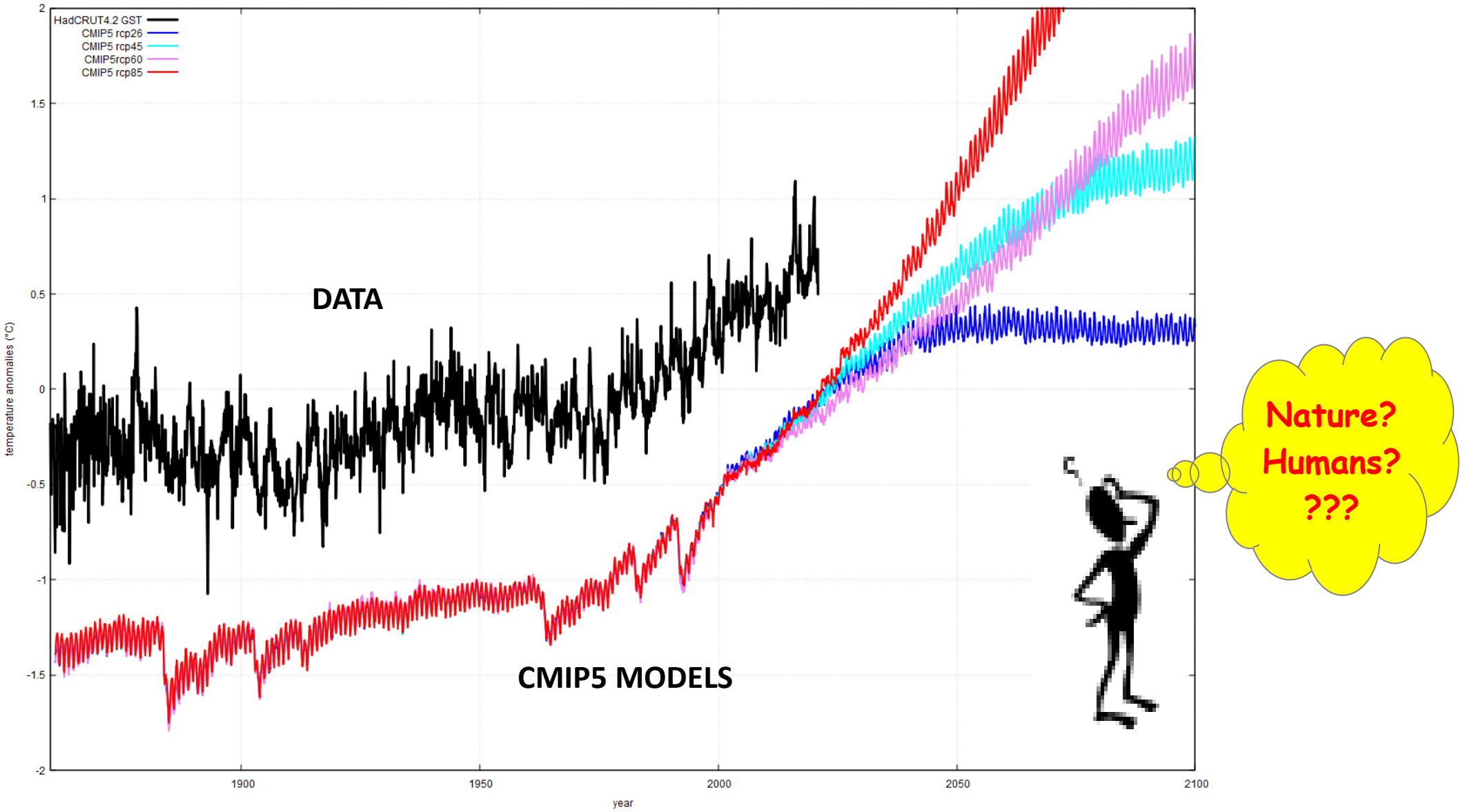
At the EIKE conference on climate and energy in Gera, Germany

13 November 2021


Temperature of Planet Earth
End of Oxygen Explosion
Thermal Maximum
PETM
Eocene Optimum
Antarctic Glaciation
Antarctic Thawing
Antarctic Reglaciation
Polar Ocean Equivalent ΔT (°C)
Equivalent Vostok ΔT (°C)
Glacial Periods
Milankovitch Cycles
41 kyr cycle
100 kyr
Climatic Optimum?
Medieval Warming
Little Ice Age
ΔT (°C)
Cm O S D C P Tr J K
Pal Eo Ol Mio
Pliocene
Pleistocene
Holocene
542 500 450 400 350 300 250 200 150 100 60 50 40 30 20 10 5 4 3 2 1 500 250 10 5 2 1 0.15 0
Million Years Before Present
Thousand Years Before Present (CE2000)

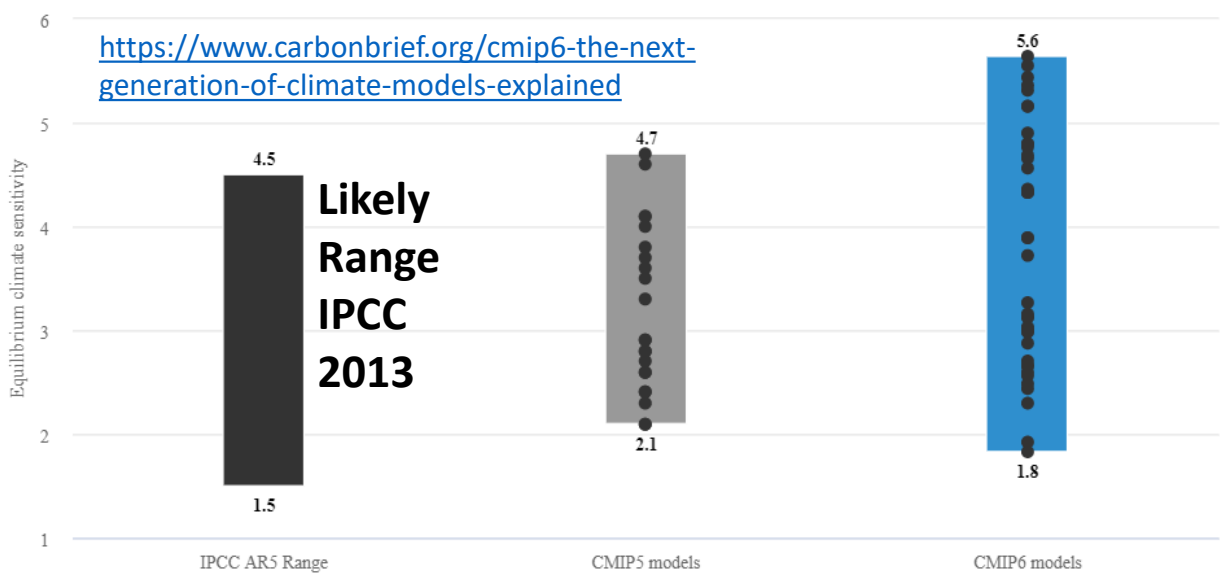

Spectrum of Climate Variance
astronomical forcing
Orbital Gap
Solar variability forcing
Atmospheric/ Oceanic forcing
Relative Variance
1000
100
10
1
0.1
0.01
150 Myr Ice Age cycle
32 Myr cycle
413 ky Eccentricity
100 ky Eccentricity
41 ky Obliquity
21 ky Precession
Heinrich cycle 7 ky
~ 2400 yr Bray Solar cycle
Dansgaard-Oeschger cycle
Millennial Solar cycle
~1000
~ 210 yr de Vries Solar cycle
115 yr Centennial Solar cycle
~ 60 yr Oceanic oscillation
~ 20 yr Lunar regression
El Niño Southern Oscillation
Quasi-biennial oscillation
Annual cycle
Galactic forcing
Astronomical forcing
10⁻⁸ 10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻² 10⁻¹ 10⁰
Frequency (cycles / year)

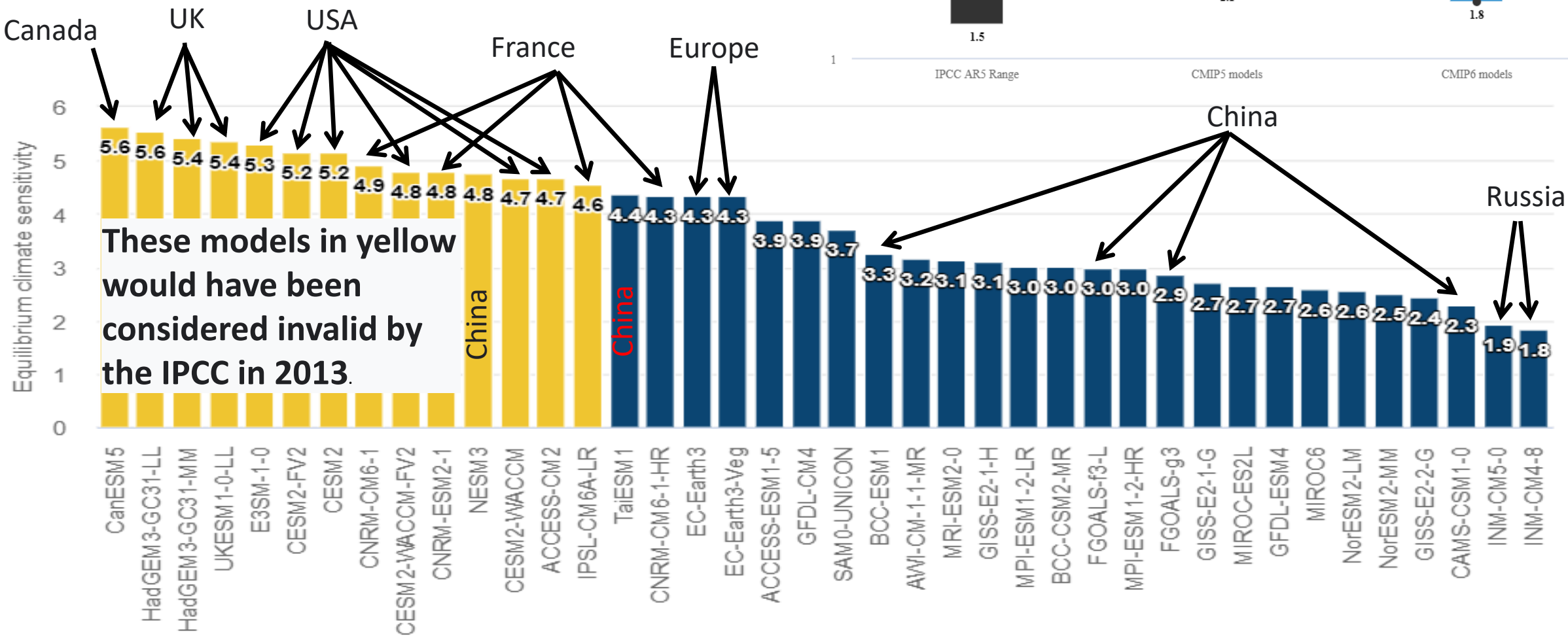
Global Warming and Climate Models



Global Climate Models (CMIP6) and the Equilibrium Climate Sensitivity (ECS)

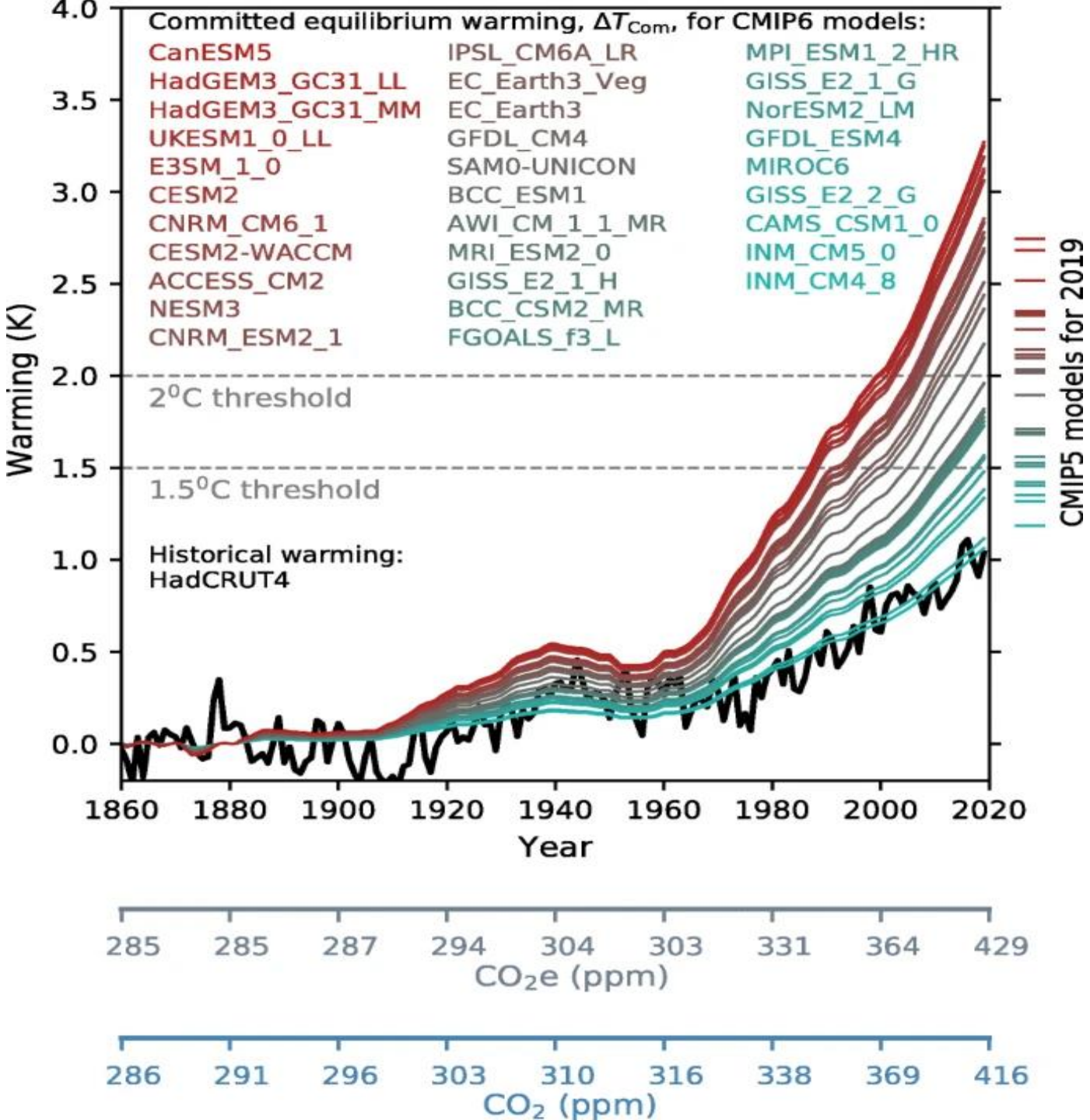
ECS is an estimate of the eventual steady-state **global warming** at double CO_2.





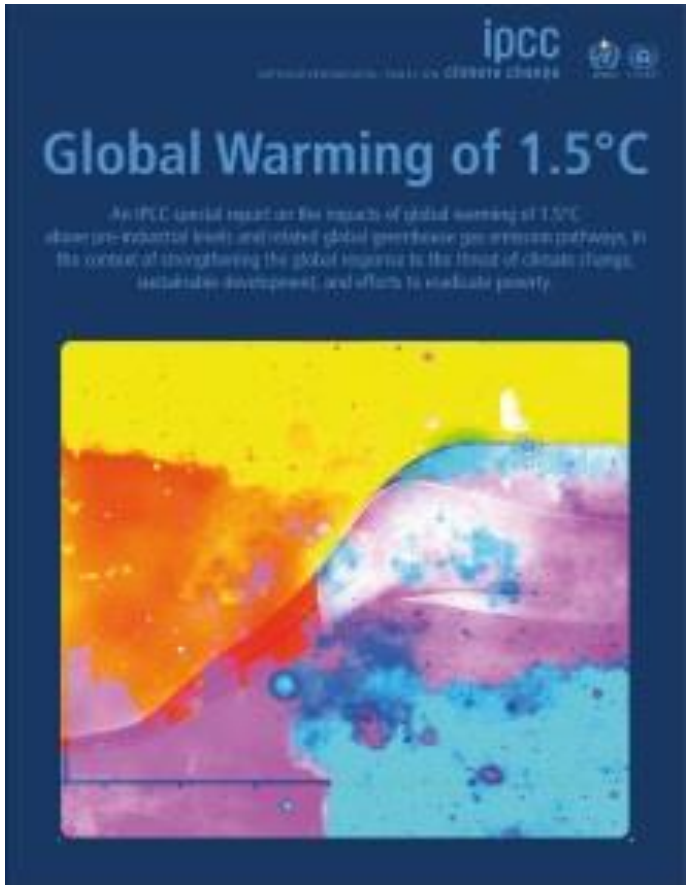
According to the CMIP6 and CMIP5 GCMs even if we stop today the anthropogenic emissions the climate will continue to warms up to 3.5 °C depending on the ECS of the model.

Thus, the claim is that not only we need to reduce the emissions, but we need to stop them and even extract CO2 from the atmosphere.



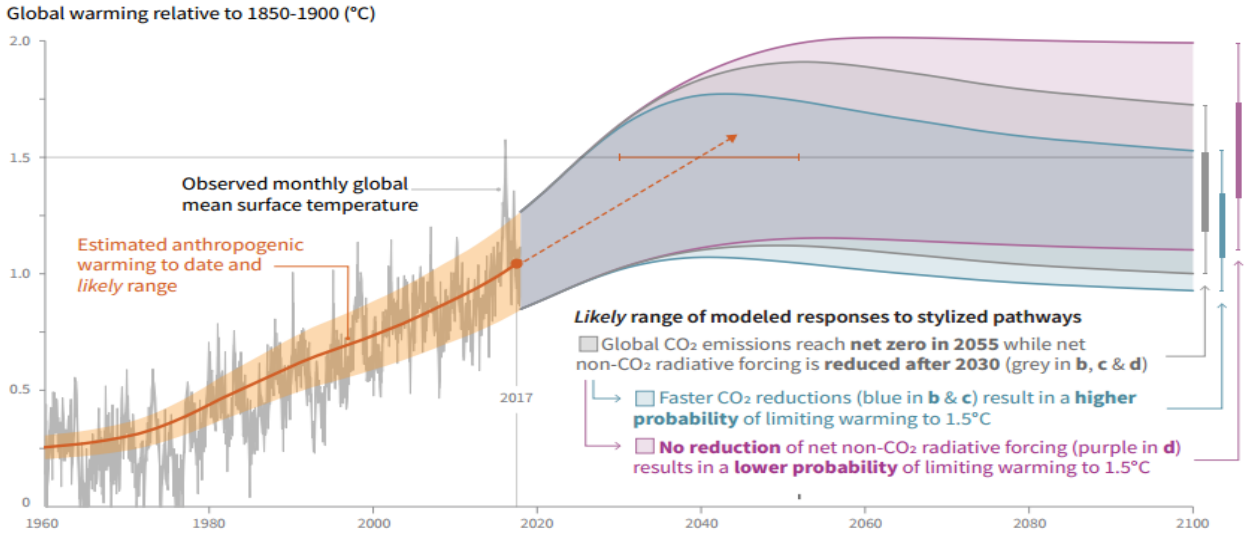
Huntingford, C., Williamson, M.S. & Nijsse, F.J.M.M. CMIP6 climate models imply high committed warming. *Climatic Change* **162,** 1515–1520 (2020). https://doi.org/10.1007/s10584-020-02849-5

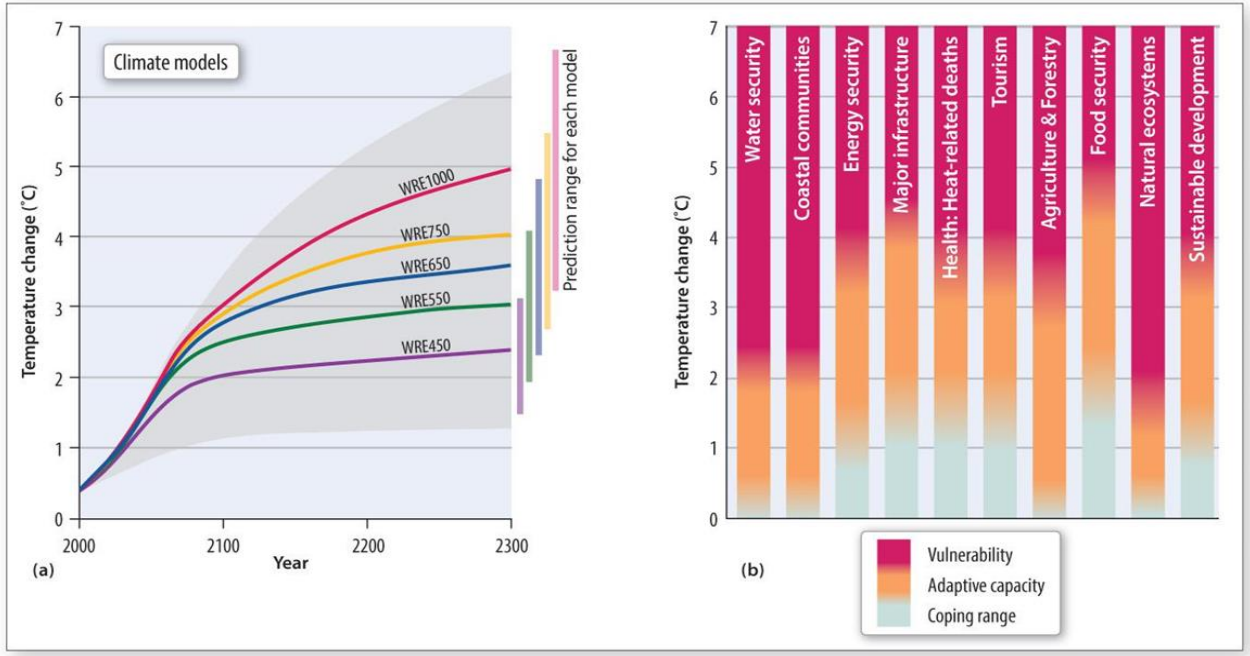
Paris Agreement IPCC SR1.5 (2018)



Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C

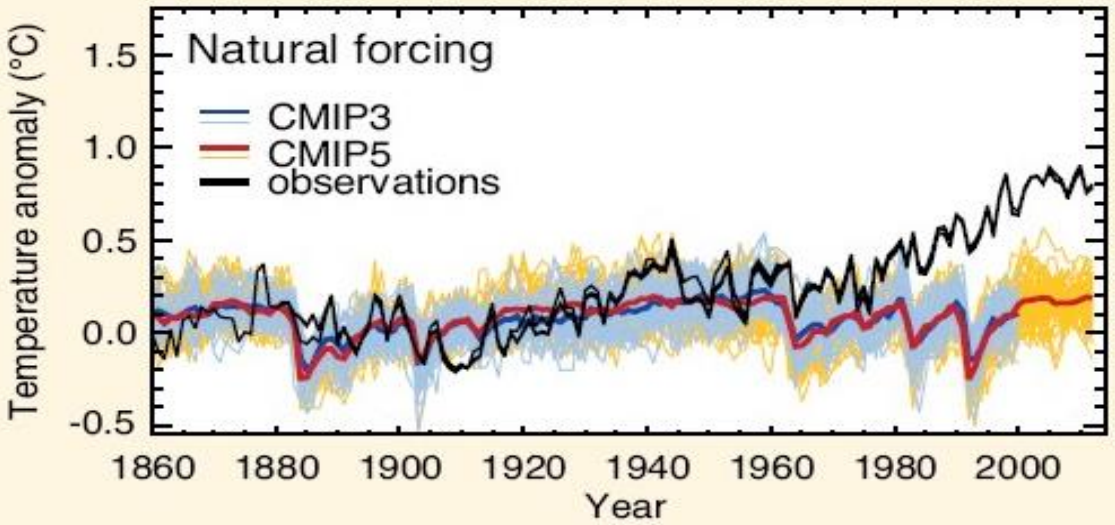
a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

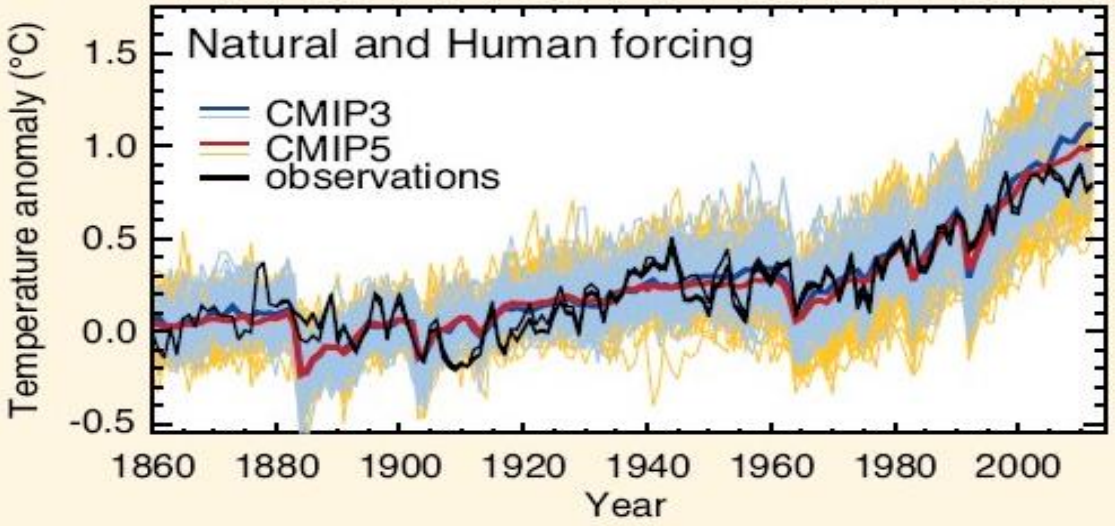




The Anthropogenic Global Warming theory of the IPCC:

“100% of the warming since 1850-1900 is due to humans”





Without anthropogenic contribution, climate models do not reproduce any warming since 1850-1900

With the anthropogenic contribution, climate models reproduce the warming since 1850-1900

What needs to be done to validate the climate models? Look at the past!

It must be demonstrated that the models are able to reproduce the planet's surface climate temperature when humans were unable to alter it with the emission of CO2 using fossil fuels and more.

In 2001 the IPCC alarmed the world. What happened?

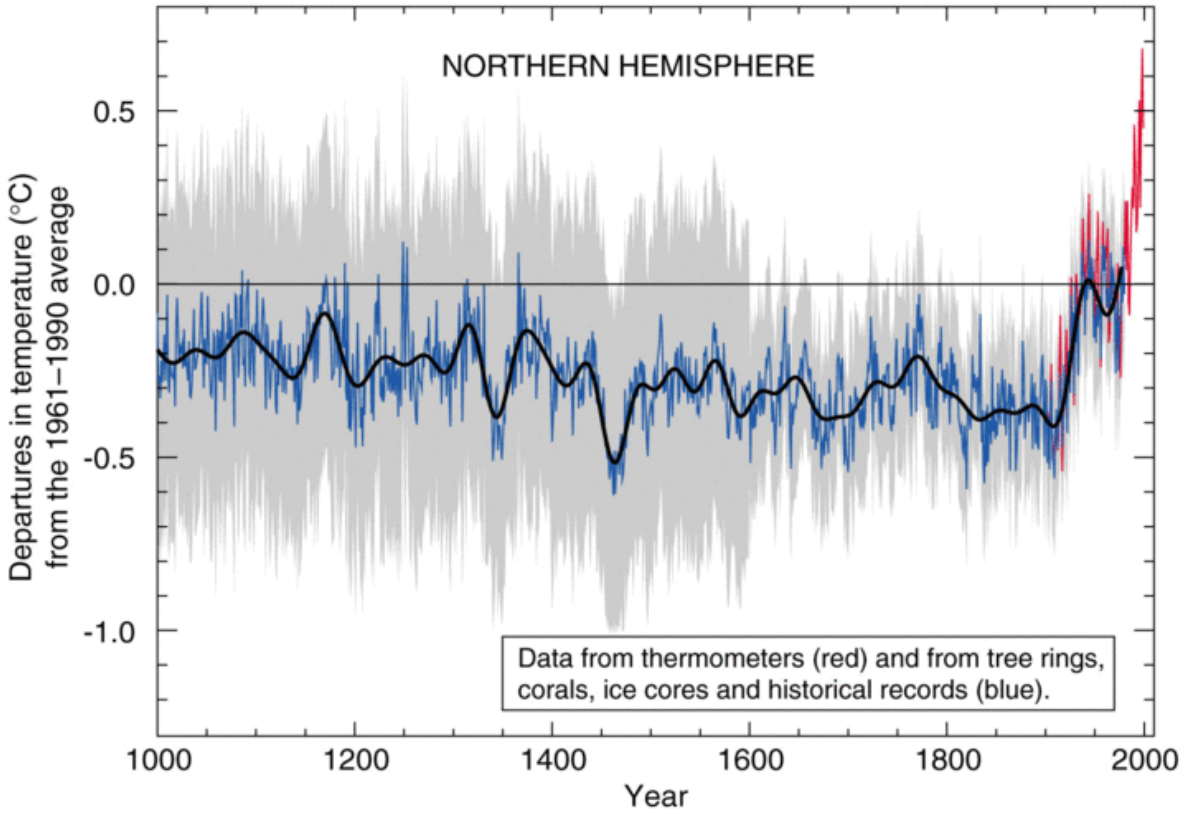


Figure 1: «Hockey Stick»

CLIMATE CHANGE 2001
The Scientific Basis

Indicators of the human influence on the atmosphere during the Industrial Era

(a) Global atmospheric concentrations of three well mixed greenhouse gases

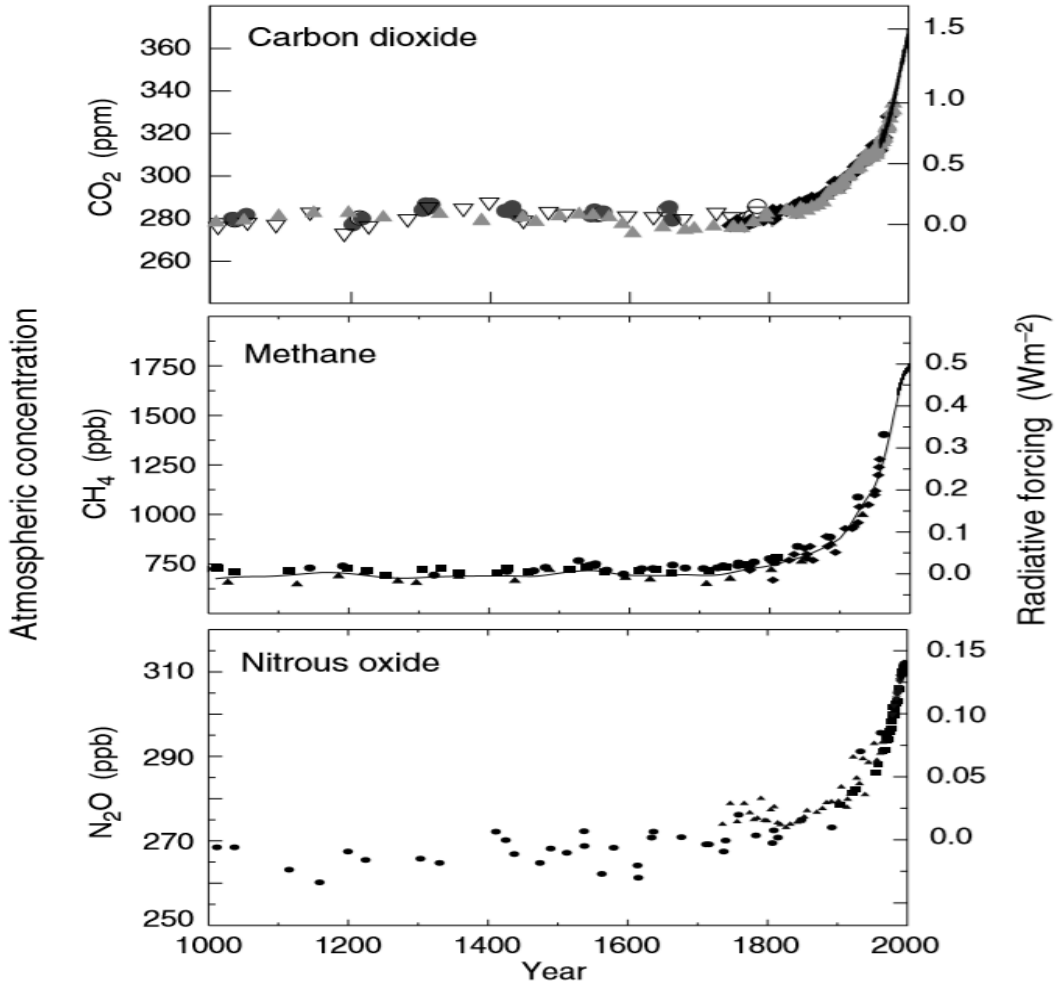
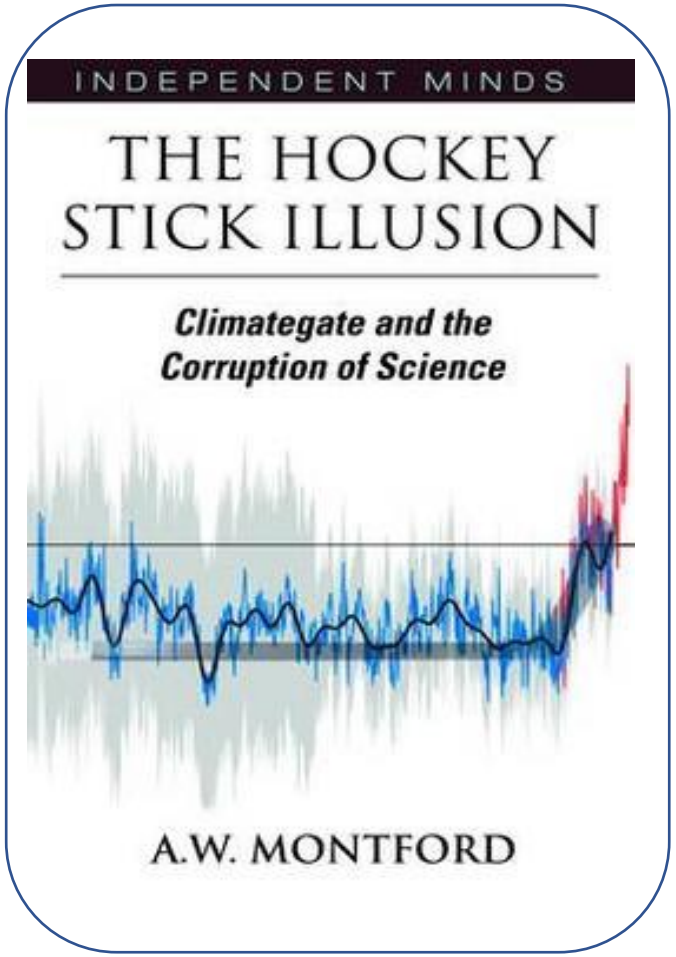
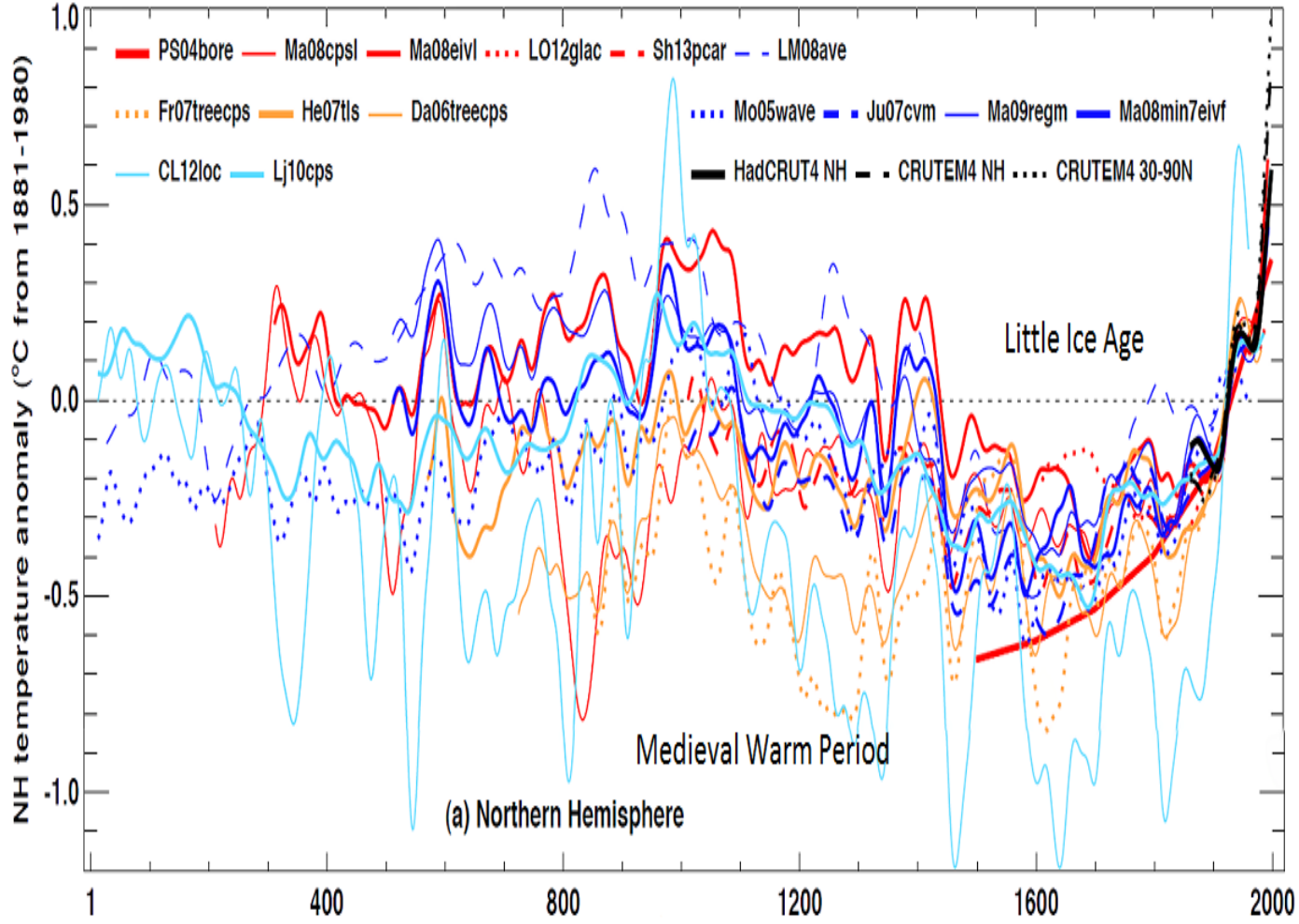


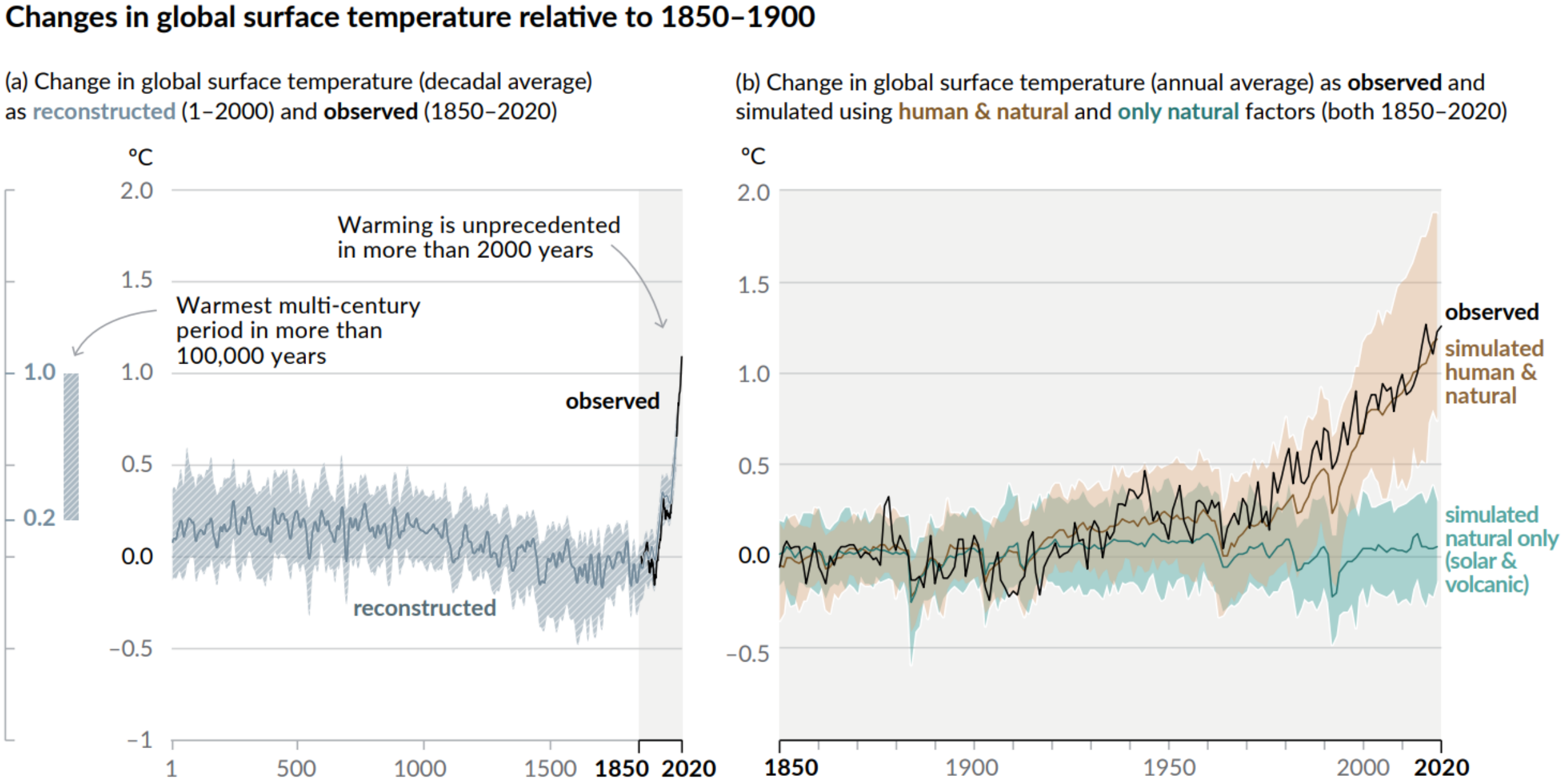
Figure 2: «Hockey Stick»

The anthropic thesis was believed due to one reconstruction of the Northern Hemisphere temperature showing little climatic variation during the pre-industrial period.
The IPCC used it in 2001 and 2007 and then abandoned it in 2013.





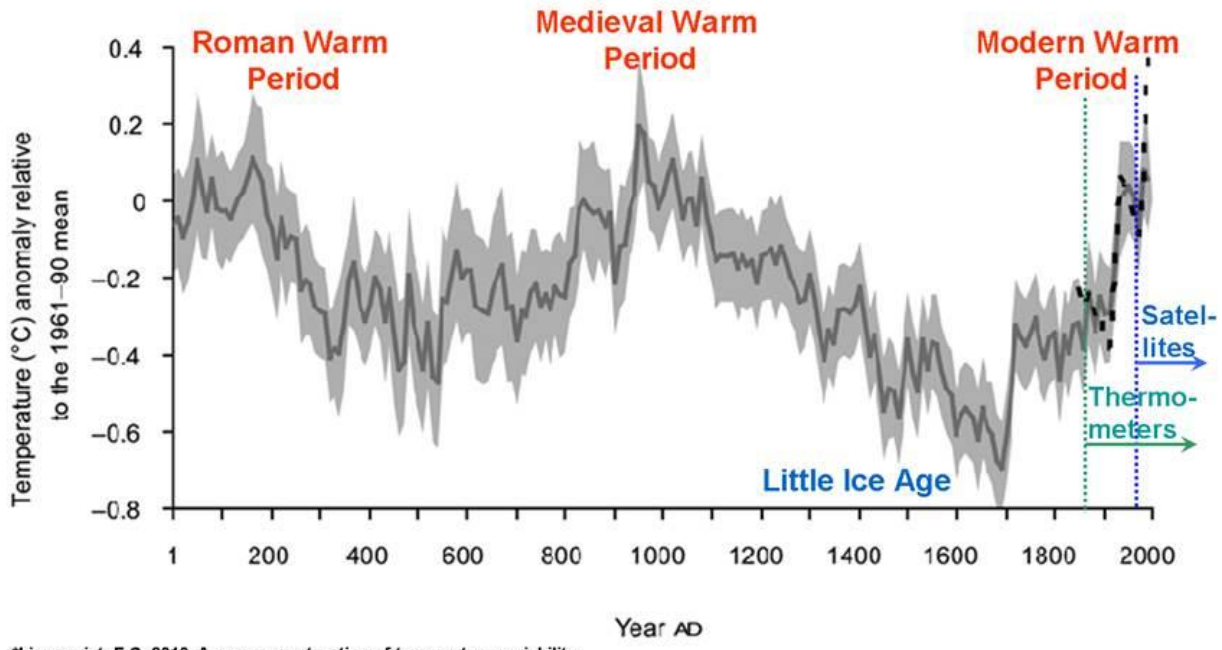
The IPCC AR6 «new» Hockey Stick argument



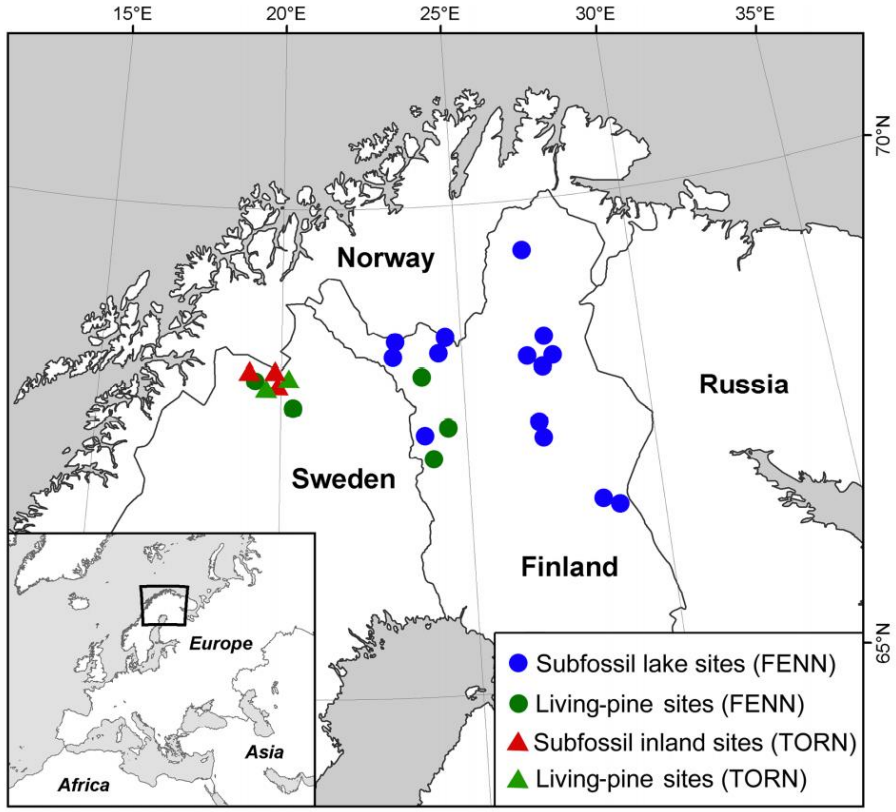
- L’ “Hockey Stick” disappears.
- A great millennial cycle appears.

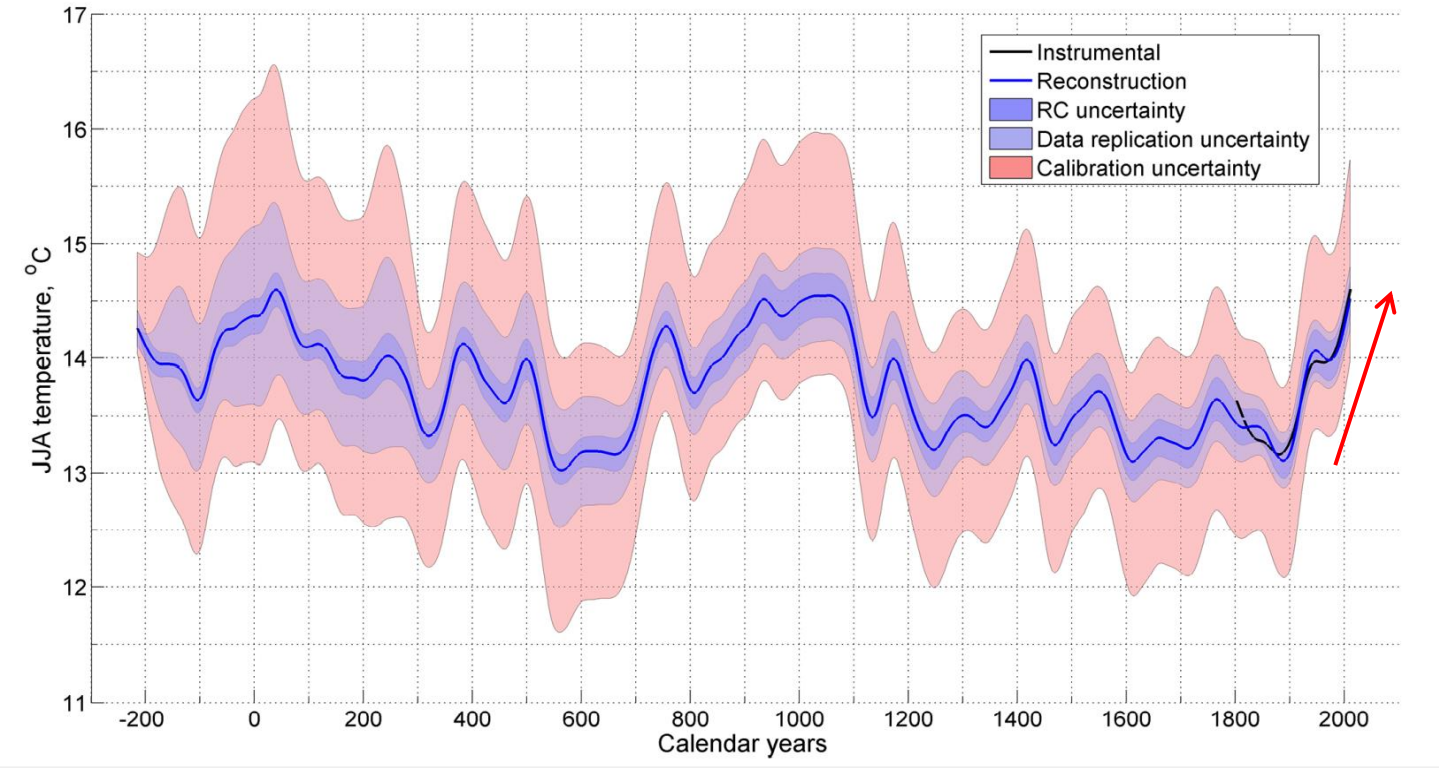
Nearly Every Century Experiences Global Warming or Cooling

Temperature Reconstruction* for N. Hemisphere, 1 - 2000 AD
Shows Modern Warm Period Not Exceptional



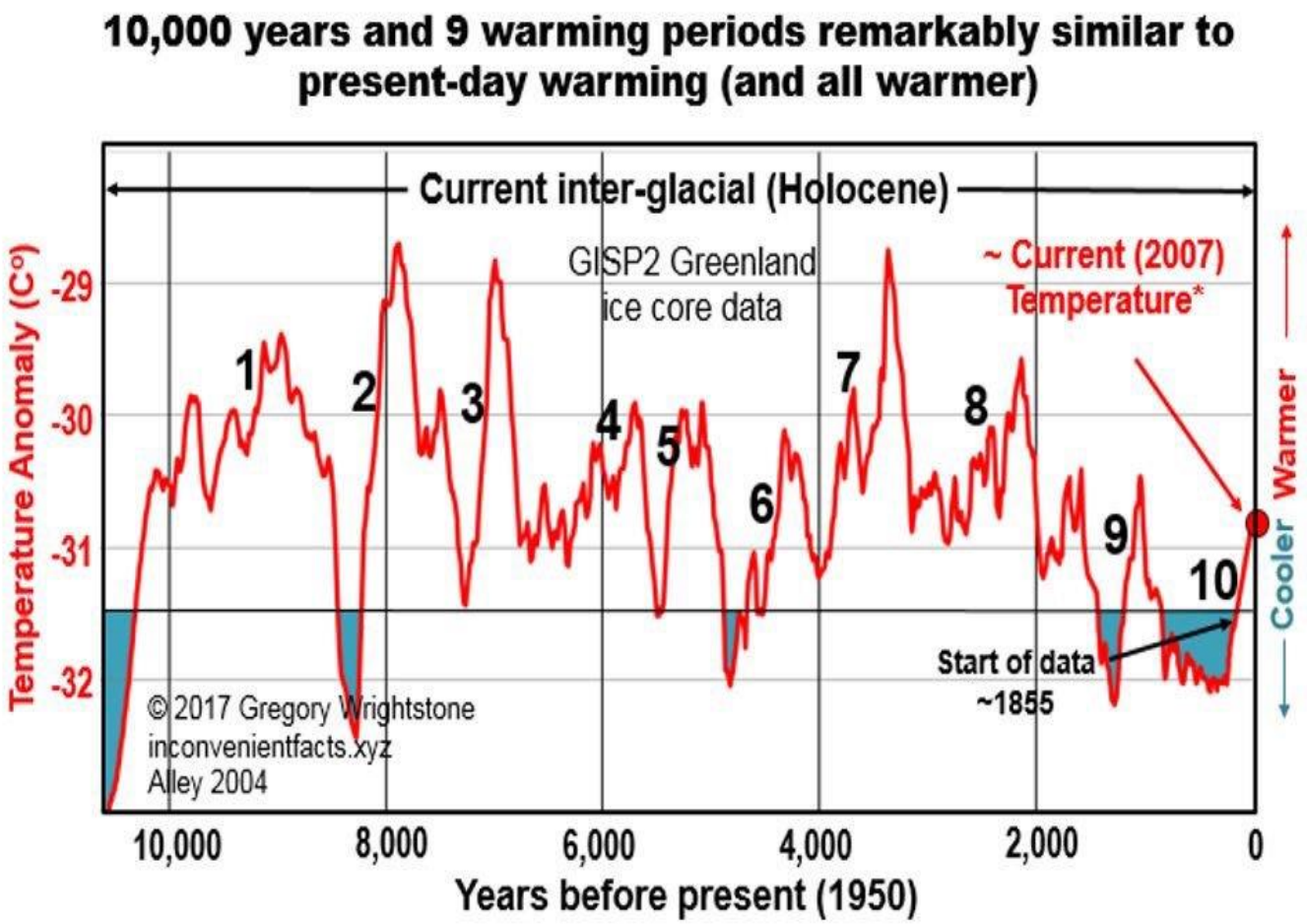
*Ljungqvist, F.C. 2010. A new reconstruction of temperature variability in the extra-tropical Northern Hemisphere during the last two millennia. Geografiska Annaler: Physical Geography, Vol. 92 A(3), pp. 339-351, September 2010. DOI: 10.1111/j.1468-0459.2010.00399.x





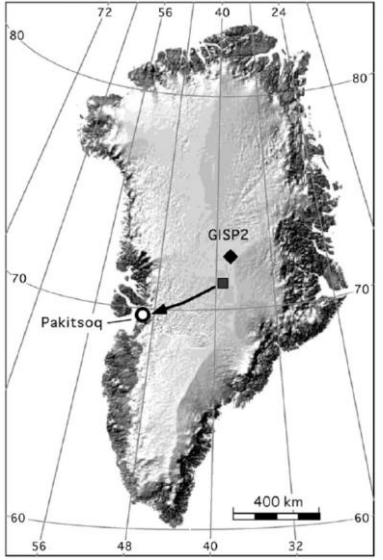
Matskovsky, V.V.; Helama, S.
Testing long-term summer temperature reconstruction based on maximum density chronologies obtained by reanalysis of tree-ring data sets from northernmost Sweden and Finland. Clim. Past **2014**, 10, 1473–1487.

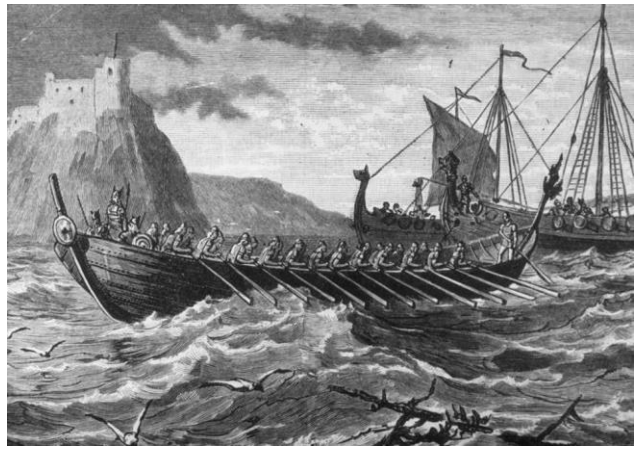
A millennial cycle in Greenland temperatures for 10,000 years.



Alley, R.B.. 2004. GISP2 Ice Core Temperature and Accumulation Data. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series #2004-013. NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.

Current Temp: Box JE, Yang L, Bromwich DH, Bai L (2009) Greenland Ice Sheet Surface Air Temperature Variability: 1840–2007. American Meteorological Society, Journal of Climate Vol 22, pp 4029 - 4049





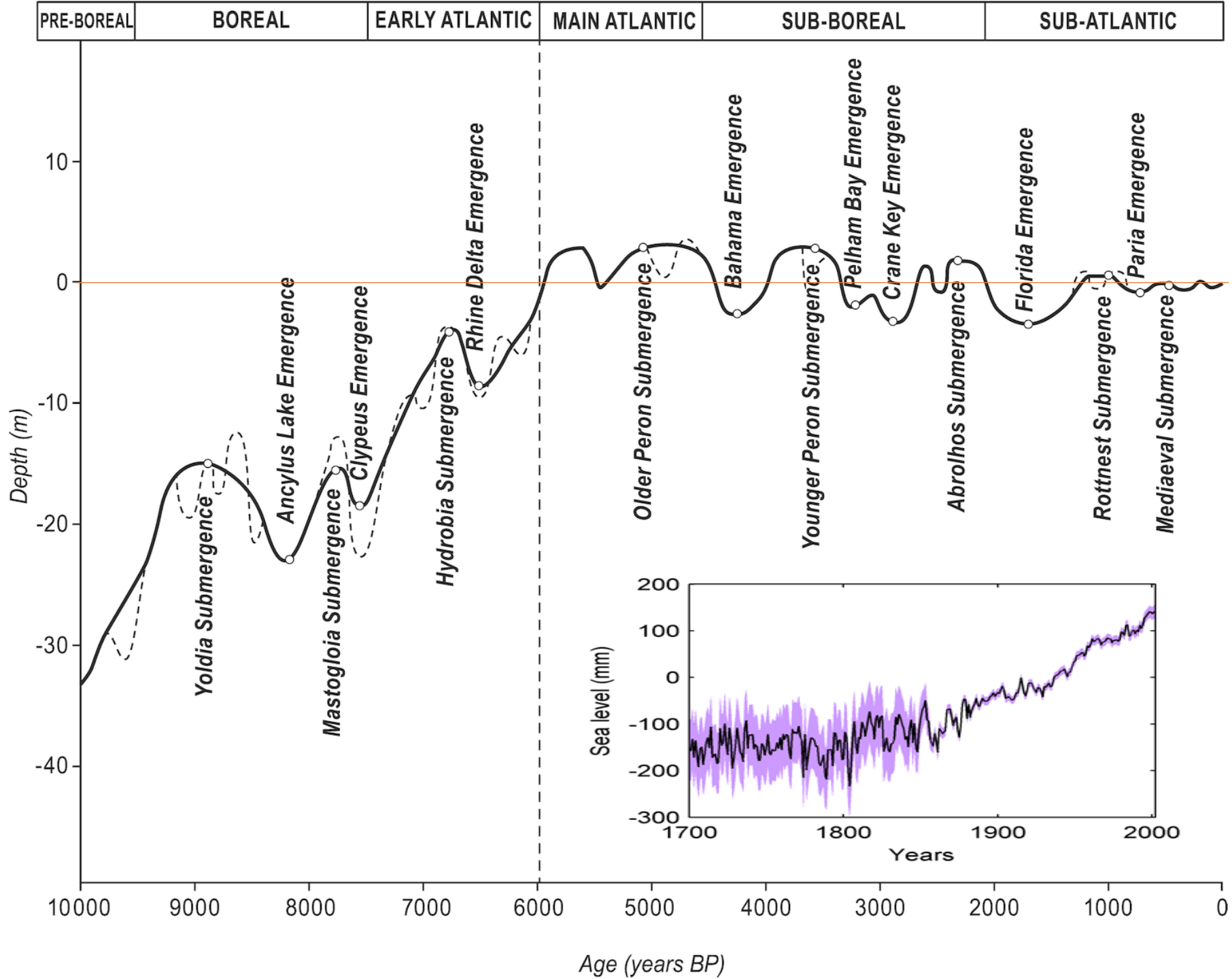
RESEARCH ARTICLE | FEBRUARY 06, 2019

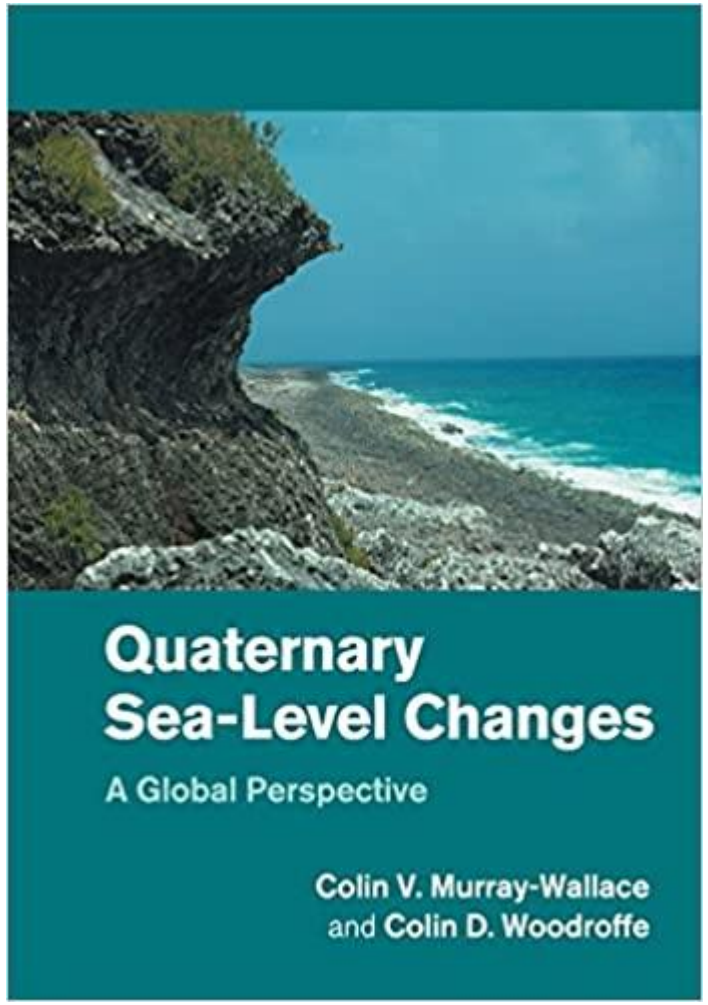
Medieval warmth confirmed at the Norse Eastern Settlement in Greenland

G. Everett Lasher; Yarrow Axford

Geology (2019) 47 (3): 267-270.

https://doi.org/10.1130/G45833.1 Article history

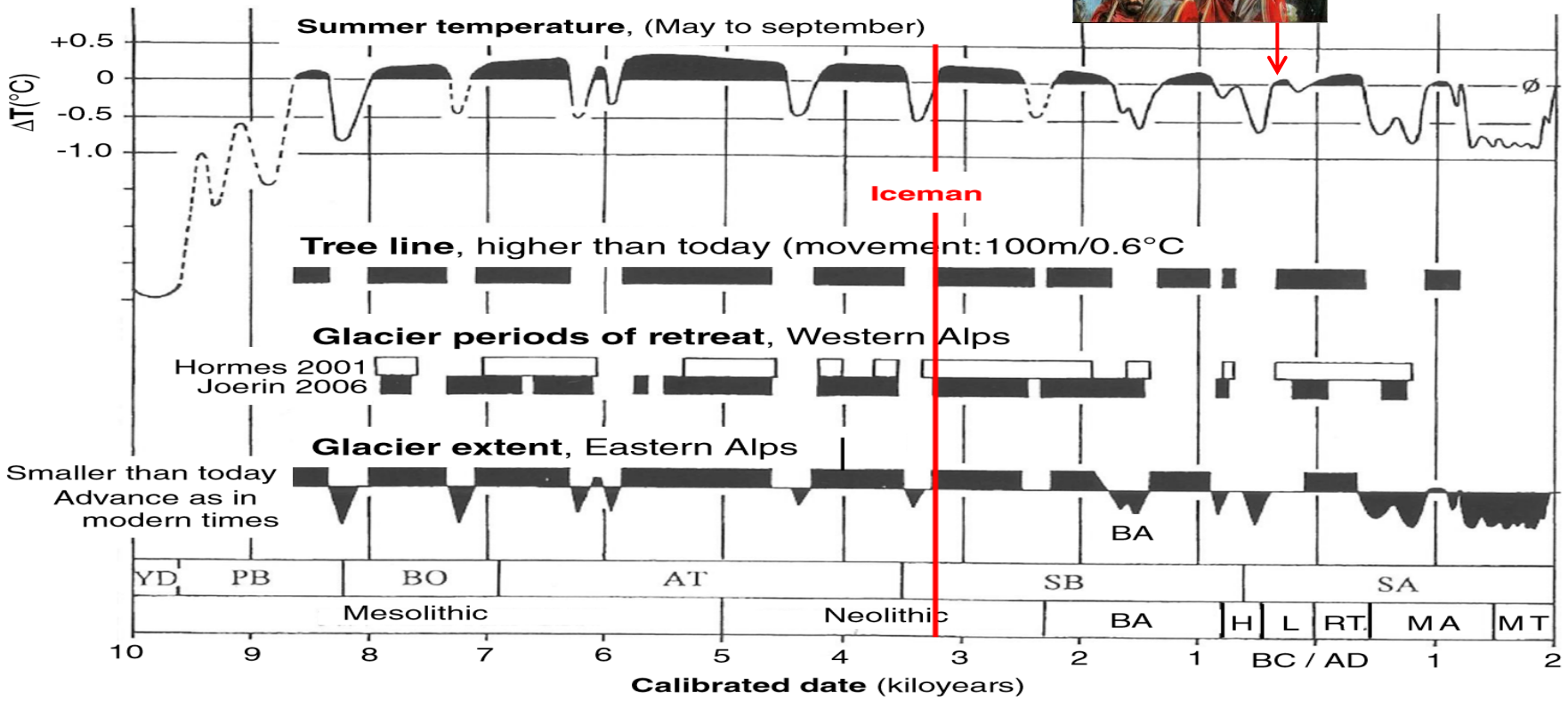




Cambridge University Press, 2014
ISBN:9781139024440

A quasi-millennial oscillation in the Summer temperatures in the European Alps throughout the Holocene

Hannibal



Kutschera, W., Patzelt, G., Steier, P., Wild, E.M.: 2017. The tyrolean iceman and his glacial environment during the holocene. Radiocarbon 59(2), pp. 395-405

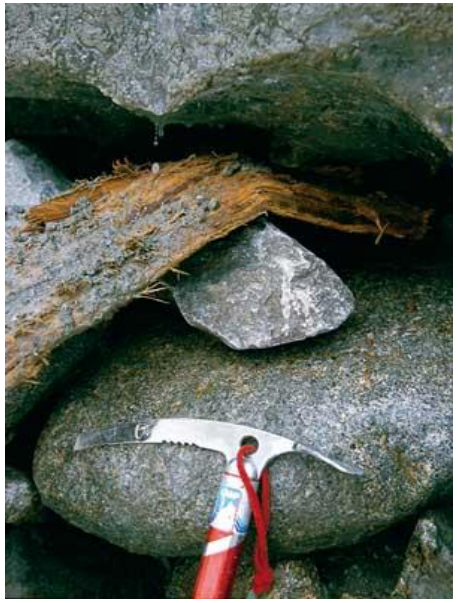
Figure 7 Schematic presentation of glacier and tree-line movements during the Holocene. The periods of smaller glaciers and higher tree lines are indicated with the box symbols. Glacial advances are indicated with filled triangles and curves. The largest advances took place during the Little Ice Age (~AD 1300 to 1850). The top curve depicts the relative summer temperature variations deduced mainly from the tree-line movement. The mean temperature between AD 1900 and 2000 is used as the zero-degree reference. The red vertical line marks the time of the Iceman (see Figure 1). At the bottom of the figure, the paleoclimatic periods (YD = Younger Dryas; PB = Preboreal; BO = Boreal; AT = Atlantic; SB = Subboreal; SA = Subatlantic) and the archaeological periods (BA = Bronze Age; H = Hallstatt period; L = La Tène period; L + H = Iron Age; RT = Roman times; MA = Middle Ages; MT = modern times) are indicated.

Trees under the glaciers

Melting glaciers in Western Canada are revealing tree stumps up to 7,000 years old where the region's rivers of ice have retreated to a historic minimum, a geologist said today.

Glacier-buried forests from ~1000 years ago uncover a warm Medieval period

Figure 2. Students learn how scientists combine living and dead trees to create millennial-length records of temperature, such as the buried forests emerging here from the wasting margin of Mendenhall Glacier (Credit: Jesse Wiles). Davi et al., 2019

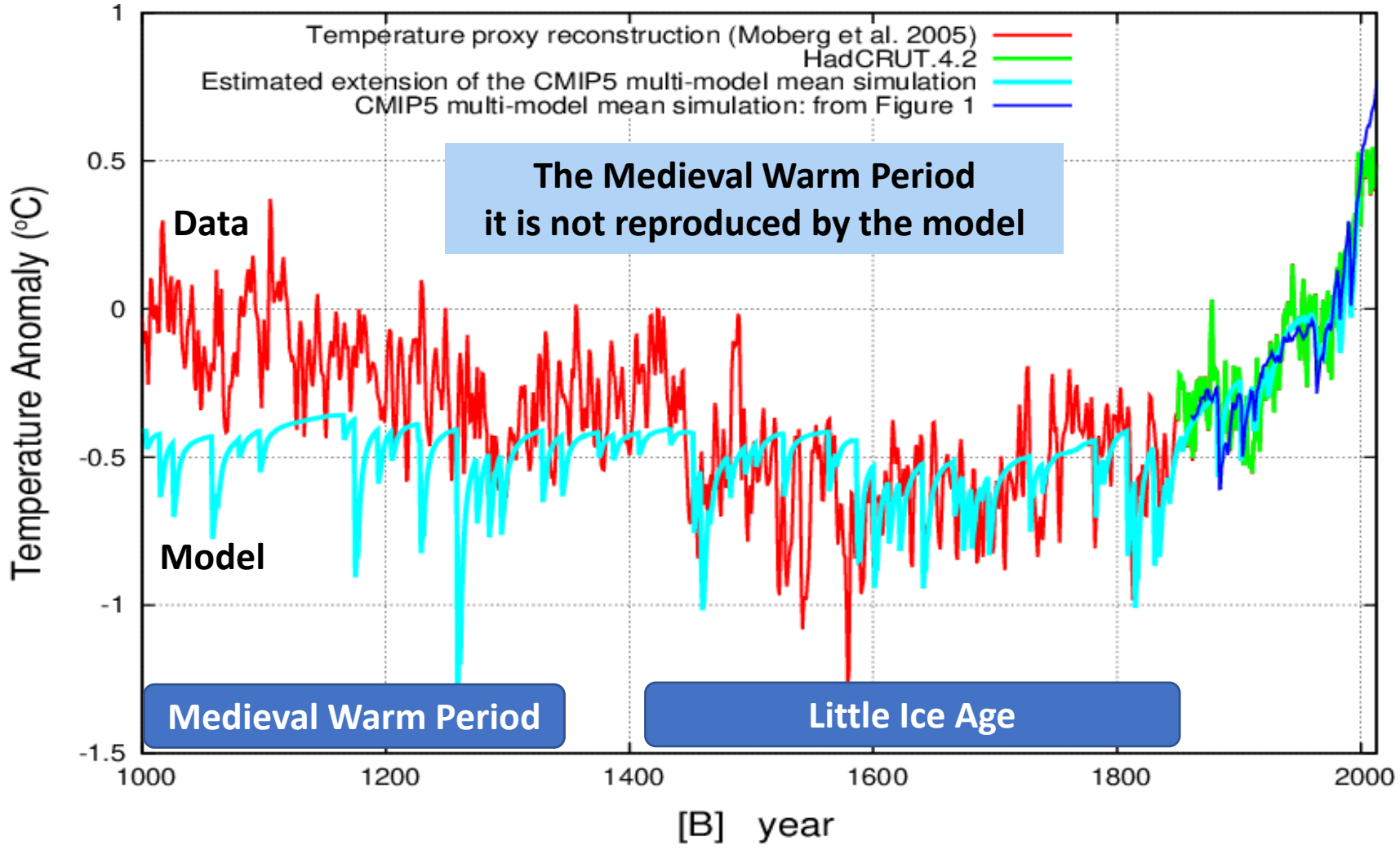


Christian Schlüchter: "Alpen ohne Gletscher? Holz- und Torffunde als Klimaindikatoren", Die Alpen, 6/2004; The Alps with little ice: evidence for eight Holocene phases of reduced glacier extent in the Central Alps, The Holocene, 2001, 11/3: 255-265

Il passo di Susten (Svizzera) come è oggi (sopra) e come probabilmente era al tempo dei Romani, 2000 anni fa verde e con diversi boschi (sotto). (Die Alpen / Atelier Thomas Richner based on a draft from Christoph Schlüchter).

Comparison between a model simulation (light blue and blue) vs the data (red and green)

Scafetta, N. Reconstruction of the Interannual to Millennial Scale Patterns of the Global Surface Temperature. Atmosphere 2021, 12, 147. https://doi.org/10.3390/atmos12020147

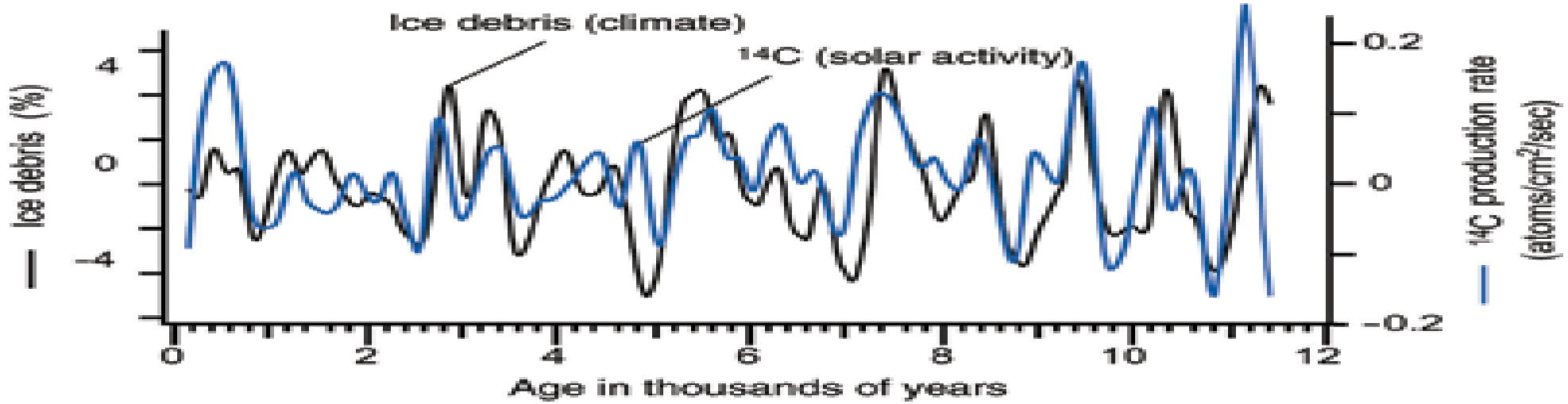


The importance of the Millennial Cycle

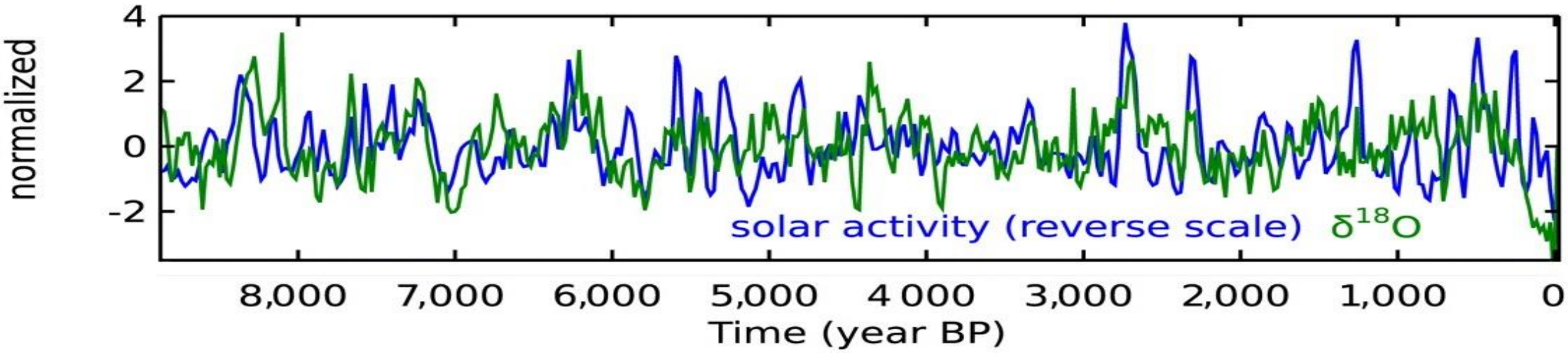
- It shows that the observed warming from the 1700s to the present was mainly induced by natural causes.

- The fact that the models do not reproduce it implies that they are physically wrong and do not use the true climatic forcings.

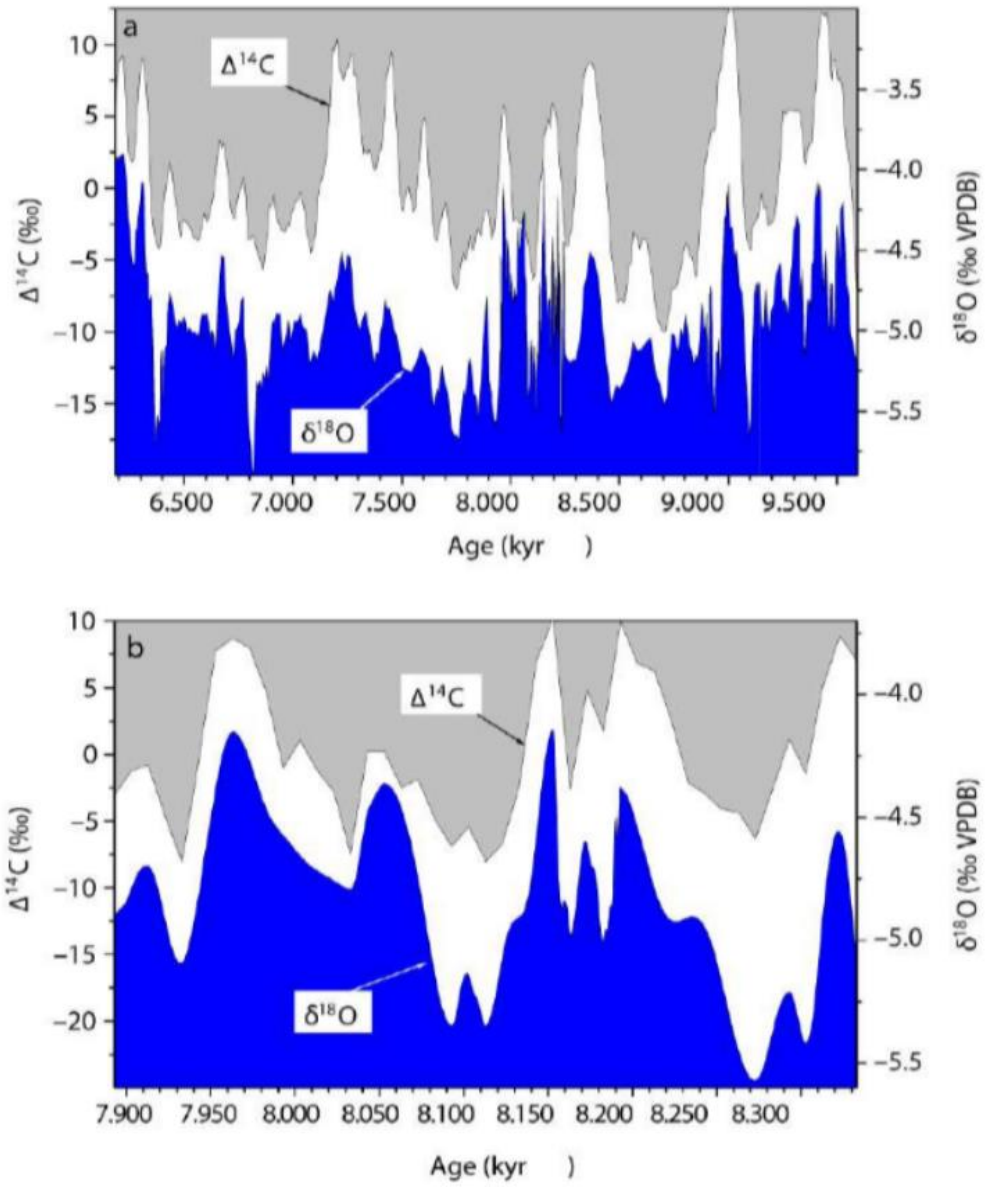
Kerr, R. A., 2001. A variable sun paces millennial climate. Science, 294, 1431-1433.



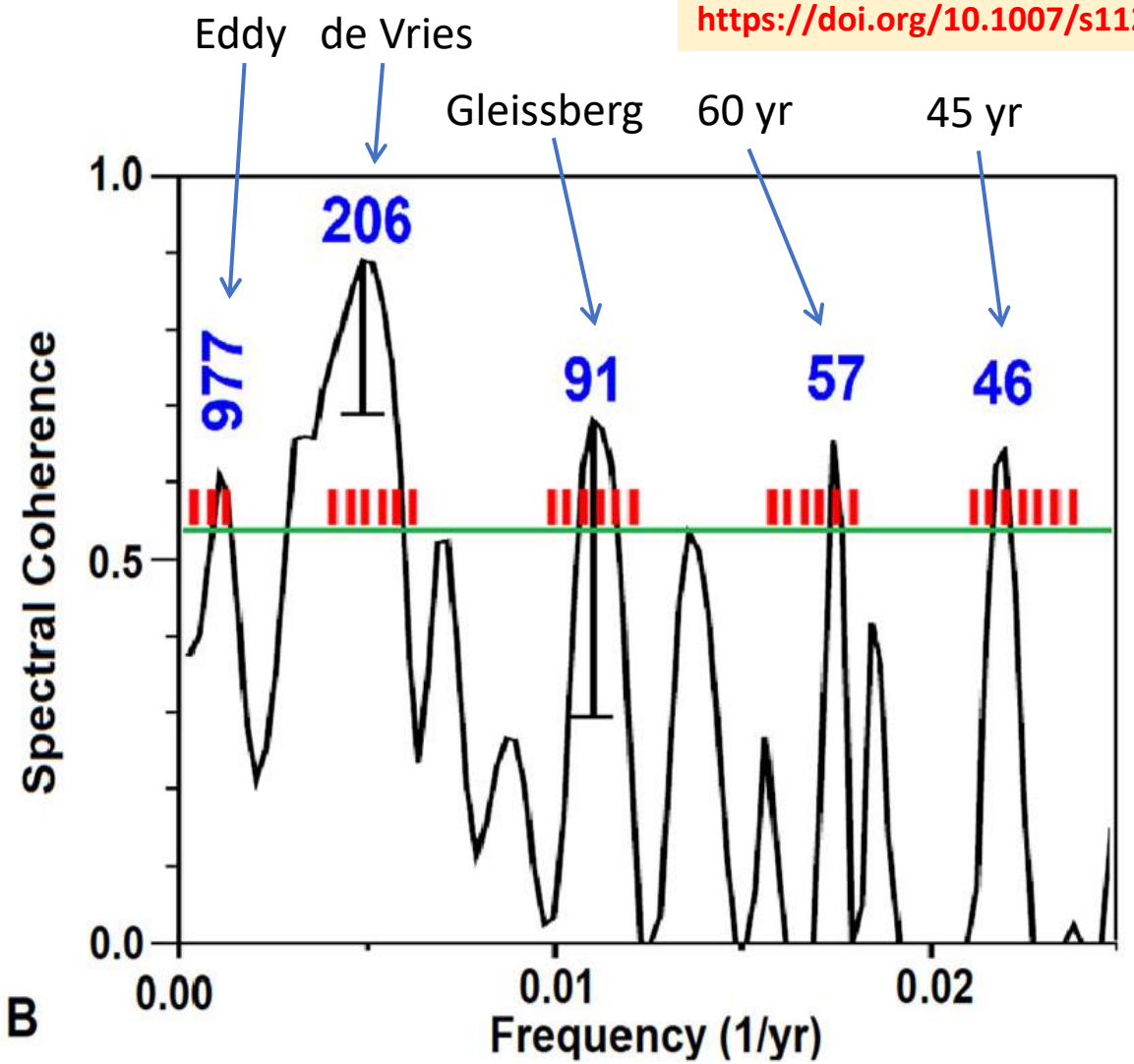
Steinhilber, F., Abreu, J. A., Beer, J., et al., 2012. 9,400 years of cosmic radiation and solar activity from ice cores and tree rings. PNAS, 109, 5967-5971, 2012.



Strong coherence between solar variability and the monsoon in Oman between 9 and 6 kyr ago



Scafetta, N.: 2020. Solar Oscillations and the Orbital Invariant Inequalities of the Solar System. Sol Phys 295, 33. https://doi.org/10.1007/s11207-020-01599-y



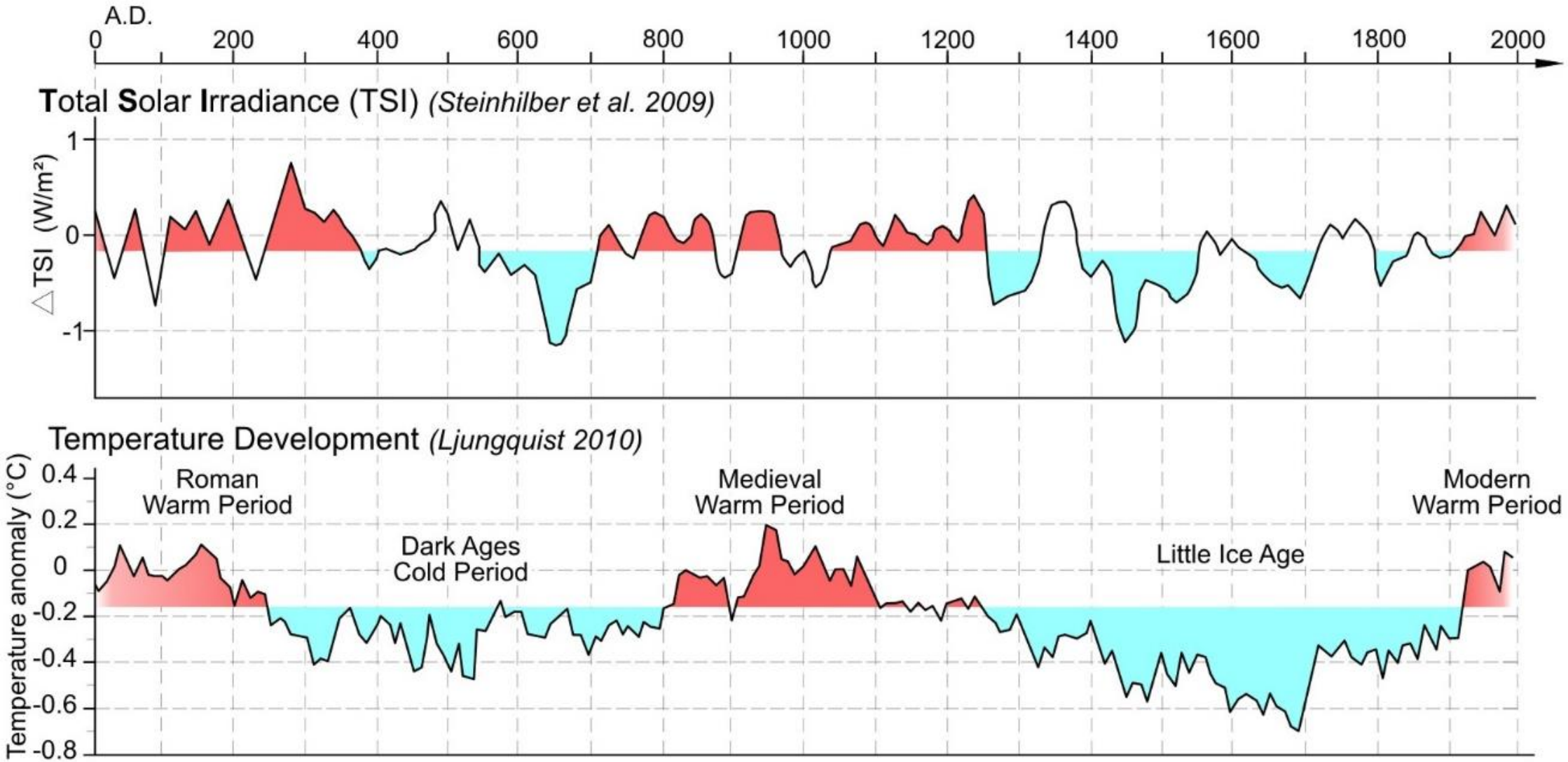
U. Neff et al., Nature 411, 290 - 293 (2001)

Le "Orbital Invariant Inequalities" sono i

95%

battimenti Gravitazionali tra Giove, Saturno Urano e Nettuno

Sun-Climate correlation: the last 2000 years



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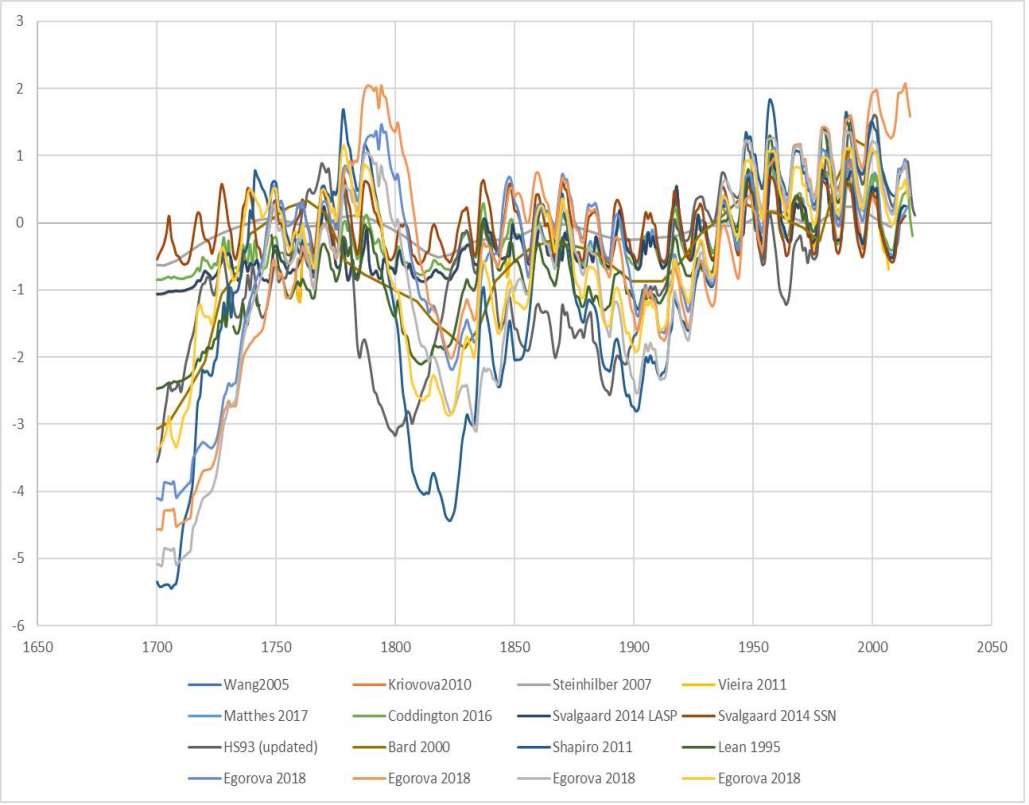
INVITED REVIEWS • FREE ARTICLE

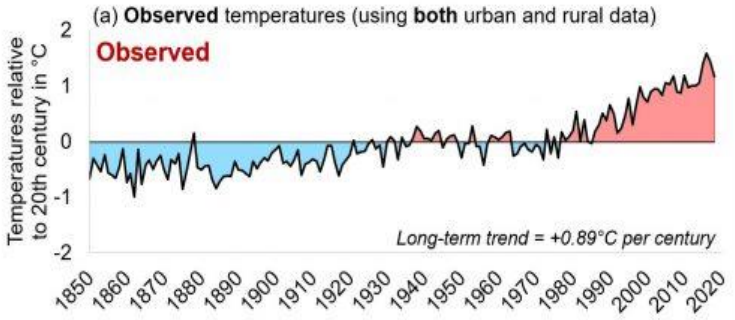
How much has the Sun influenced Northern Hemisphere temperature trends? An ongoing debate

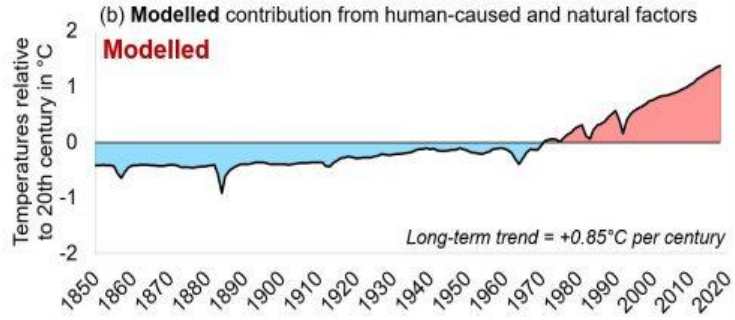
Ronan Connolly[1,2], Willie Soon[1], Michael Connolly[2], Sallie Baliunas[3], Johan Berglund[4], C. John Butler[5], Rodolfo Gustavo Cionco[6,7], Ana G. Elias[8,9], Valery M. Fedorov[10], Hermann Harde[11], Gregory W. Henry[12], Douglas V. Hoyt[13], Ole Humlum[14], David R. Legates[15], Sebastian Lüning[16], Nicola Scafetta[17], Jan-Erik Solheim[18], László Szarka[19], Harry van Loon[20], Víctor M. Velasco Herrera[21], Richard C. Willson[22], Hong Yan (艳洪)[23] and Weijia Zhang[24,25] – Hide full author list

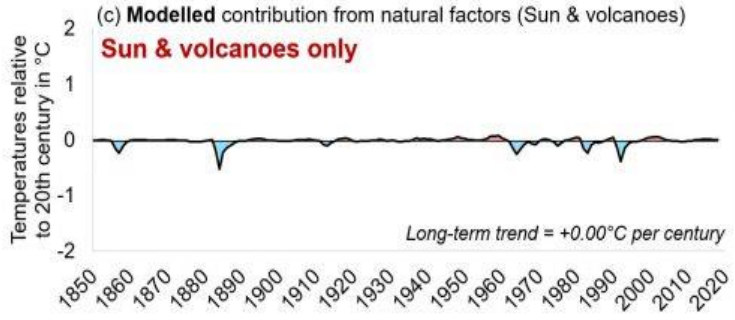


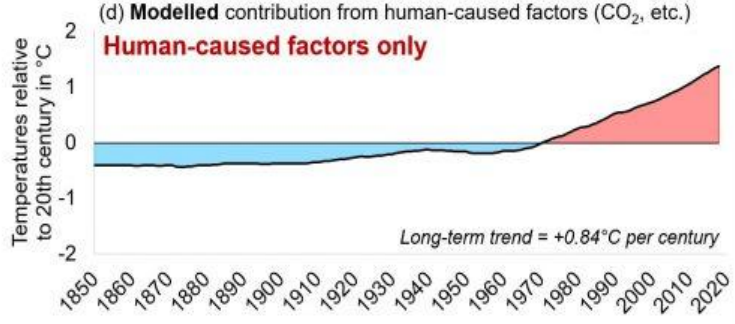
The "attribution" problem for Northern Hemisphere temperatures

Theory 1: Climate change is mostly human-caused

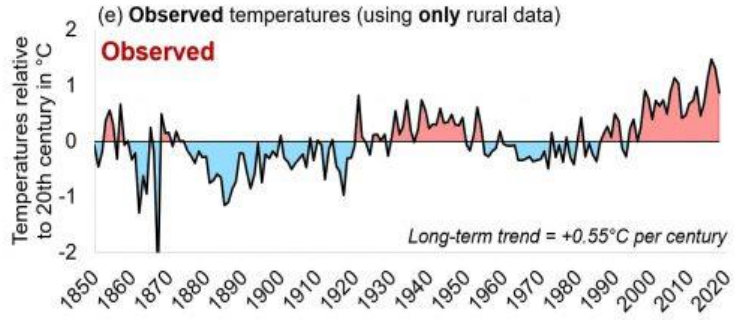


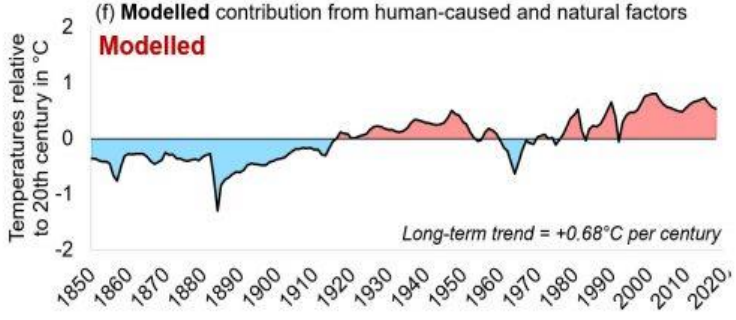


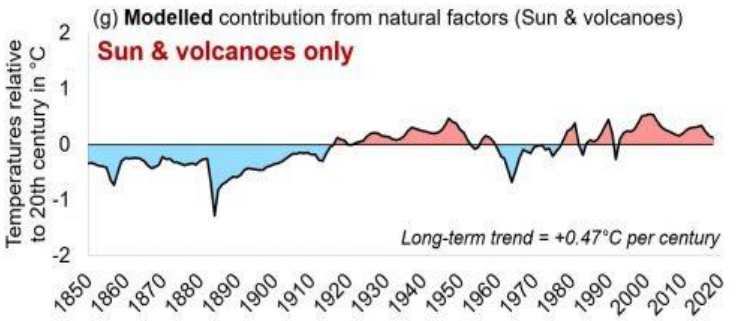


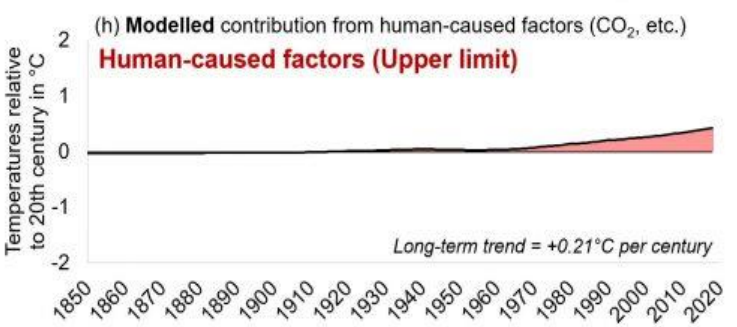


Theory 2: Climate change is mostly natural



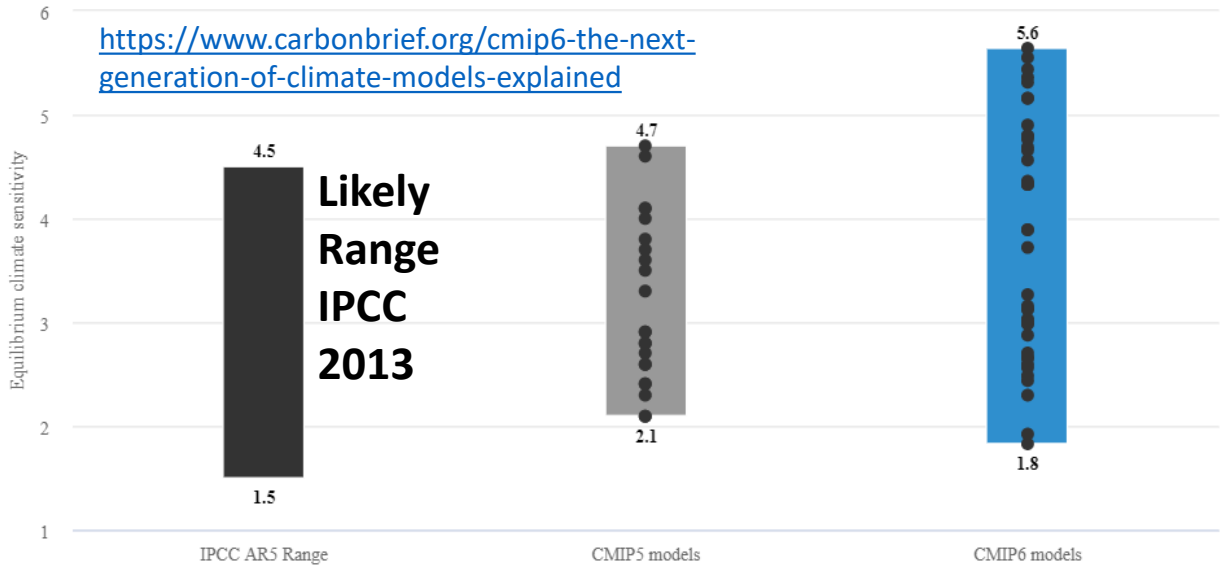


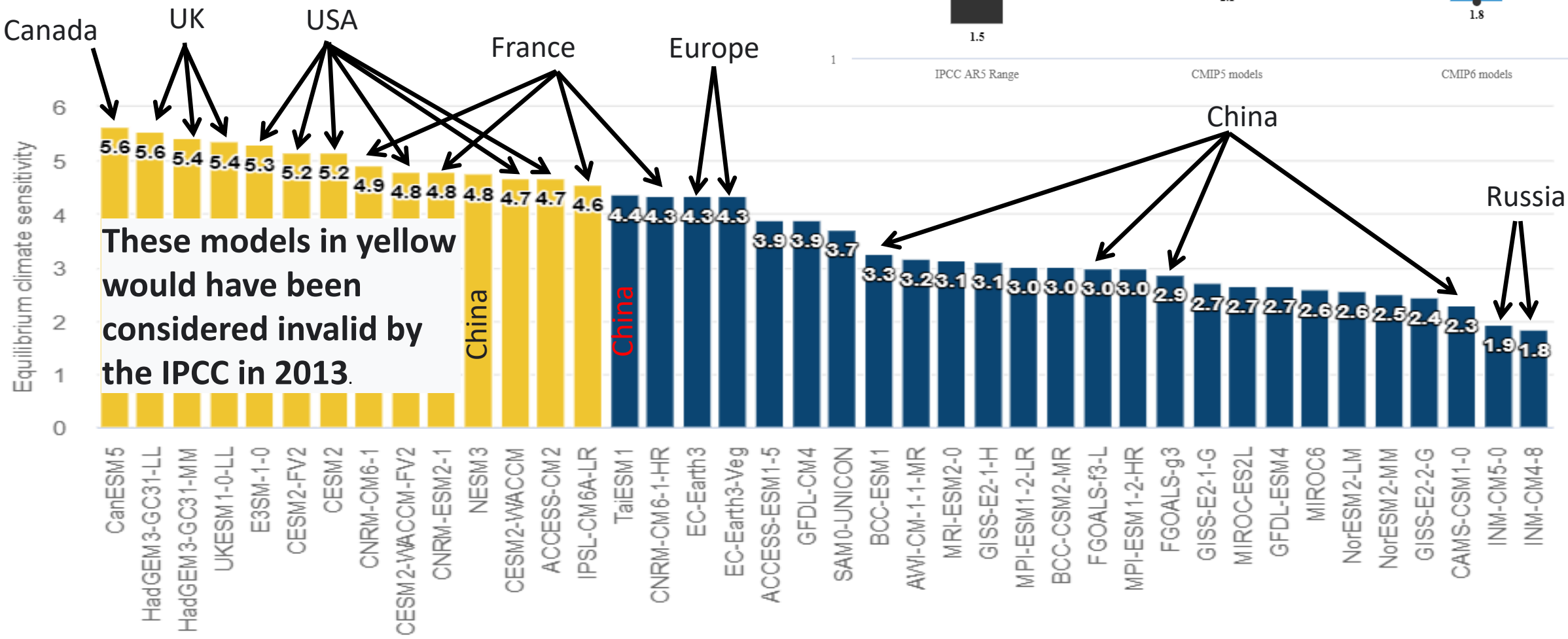




Global Climate Models (CMIP6) and the Equilibrium Climate Sensitivity (ECS)

ECS is an estimate of the steady-state **global warming** induced by CO_2 doubling.





Climate models show high ECS
Observations show low ECS

nature geoscience

Review Article | Published: 04 September 2017

Beyond equilibrium climate sensitivity

Reto Knutti ✉, Maria A. A. Rugenstein & Gabriele C. Hegerl

Nature Geoscience **10**, 727–736 (2017) | Download Citation

Abstract

Equilibrium climate sensitivity characterizes the Earth's long-term global temperature response to increased atmospheric CO_2 concentration. It has reached almost iconic status as the single number that describes how severe climate change will be. The consensus on the 'likely' range for climate sensitivity of 1.5 °C to 4.5 °C today is the same as given by Jule Charney in 1979, but now it is based on quantitative evidence from across the climate system and throughout climate history. The quest to constrain climate sensitivity has revealed

knutti2017.pdf ×

5 / 18

NATURE GEOSCIENCE DOI: 10.1038/NGEO3017

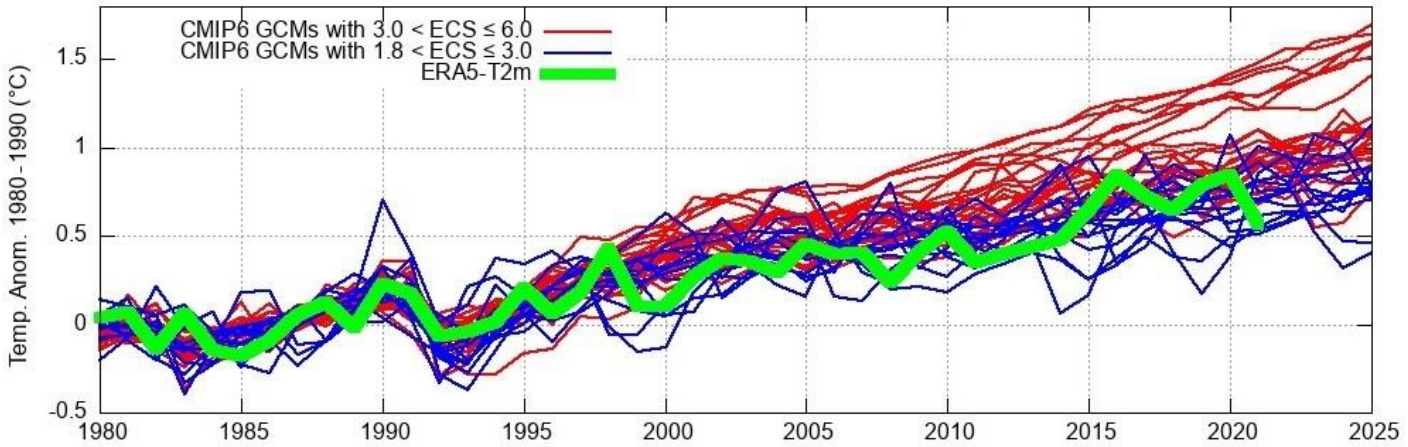
Discrepancy and lack of progress?

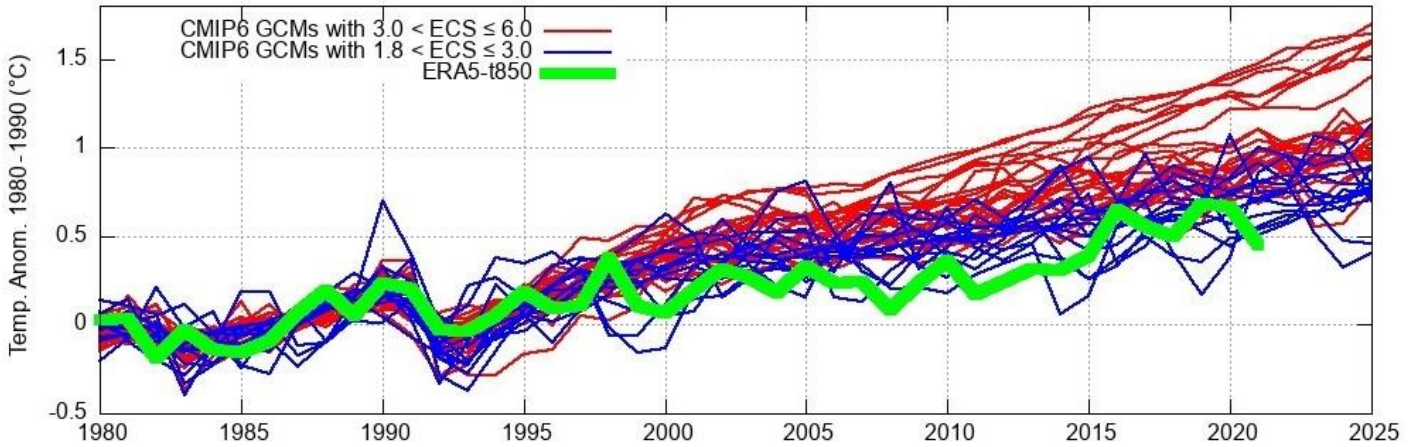
A striking feature of Figs 2 and 3 is that evidence from climate modelling favours values of ECS in the upper part of the 'likely' range, whereas many recent studies based on instrumentally recorded warming — and some from palaeoclimate — favour values in the lower part of the range. Since each line of evidence is affected by different uncertainties, their uncertainty ranges should encompass the 'true value' but the ranges do not need to be identical. It is

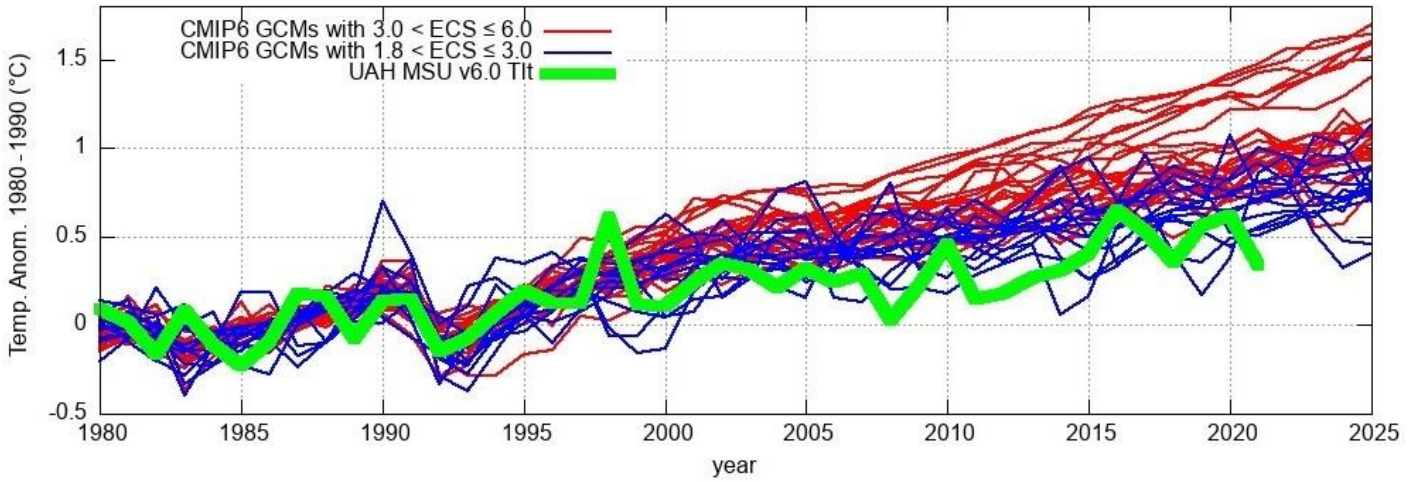
ECS = equilibrium climate sensitivity to radiative forcing such as to CO_2 infrared emissions.

CMIP6 GCMs vs. Temperature data

CMIP6 GCM surface temperature simulations
red, models with ECS > 3 °C; blue, models with ECS < 3 °C
against the temperature observations (green):
ERA5-T2m
ERA5-850mb
UAH MSU v.6.0 Tlt.

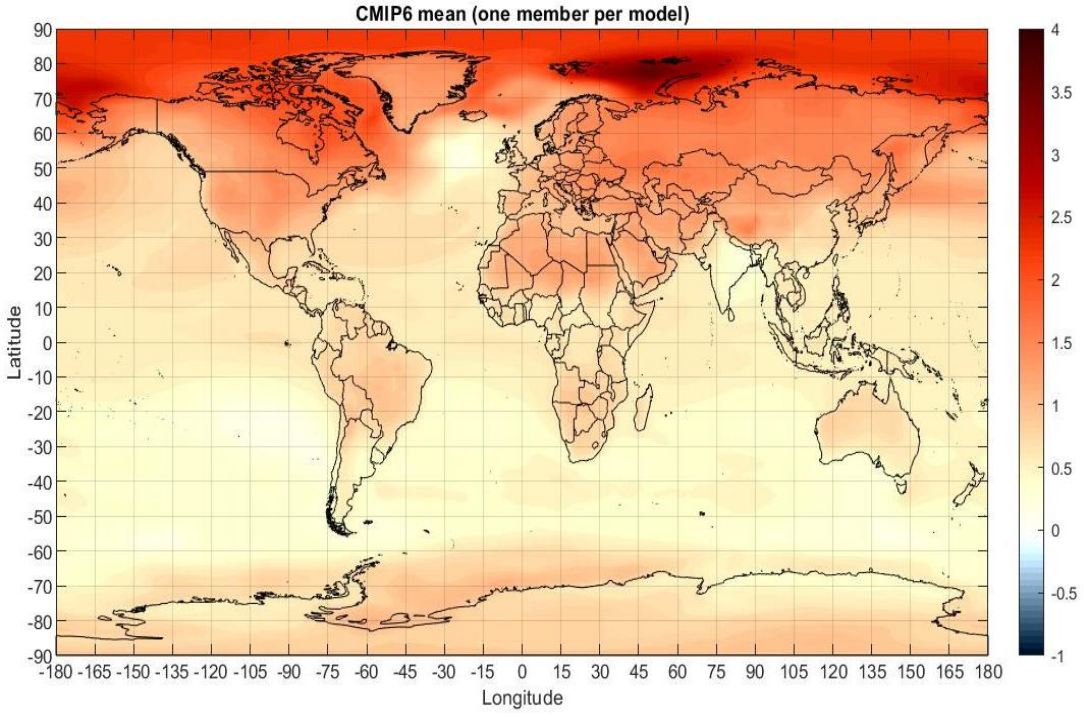


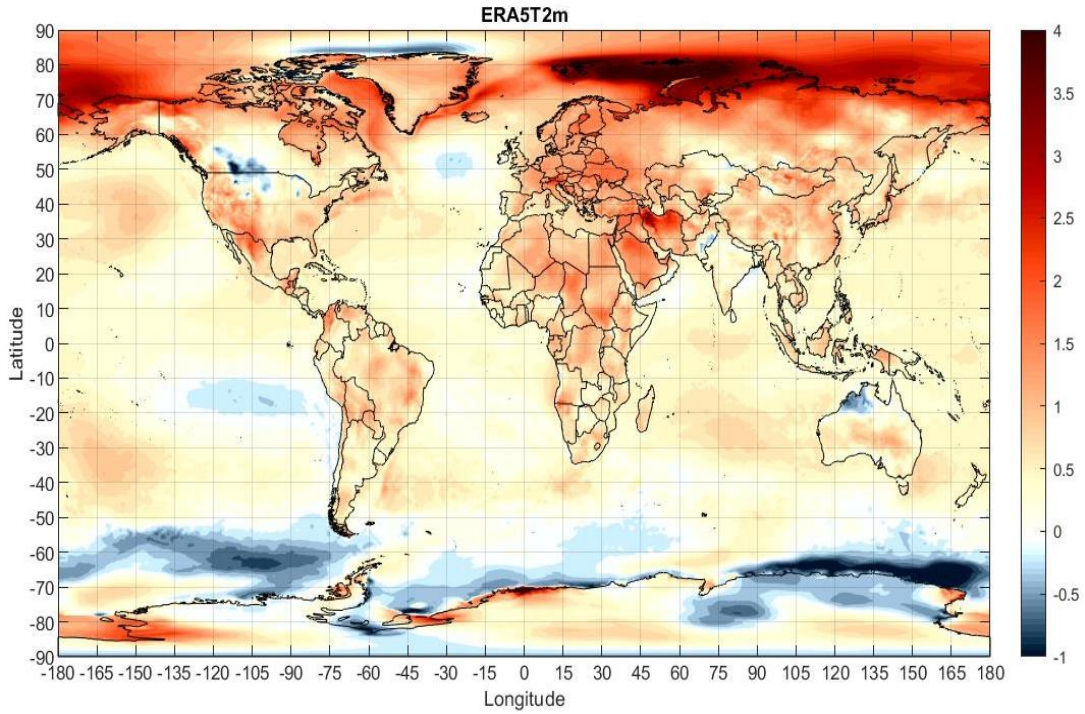


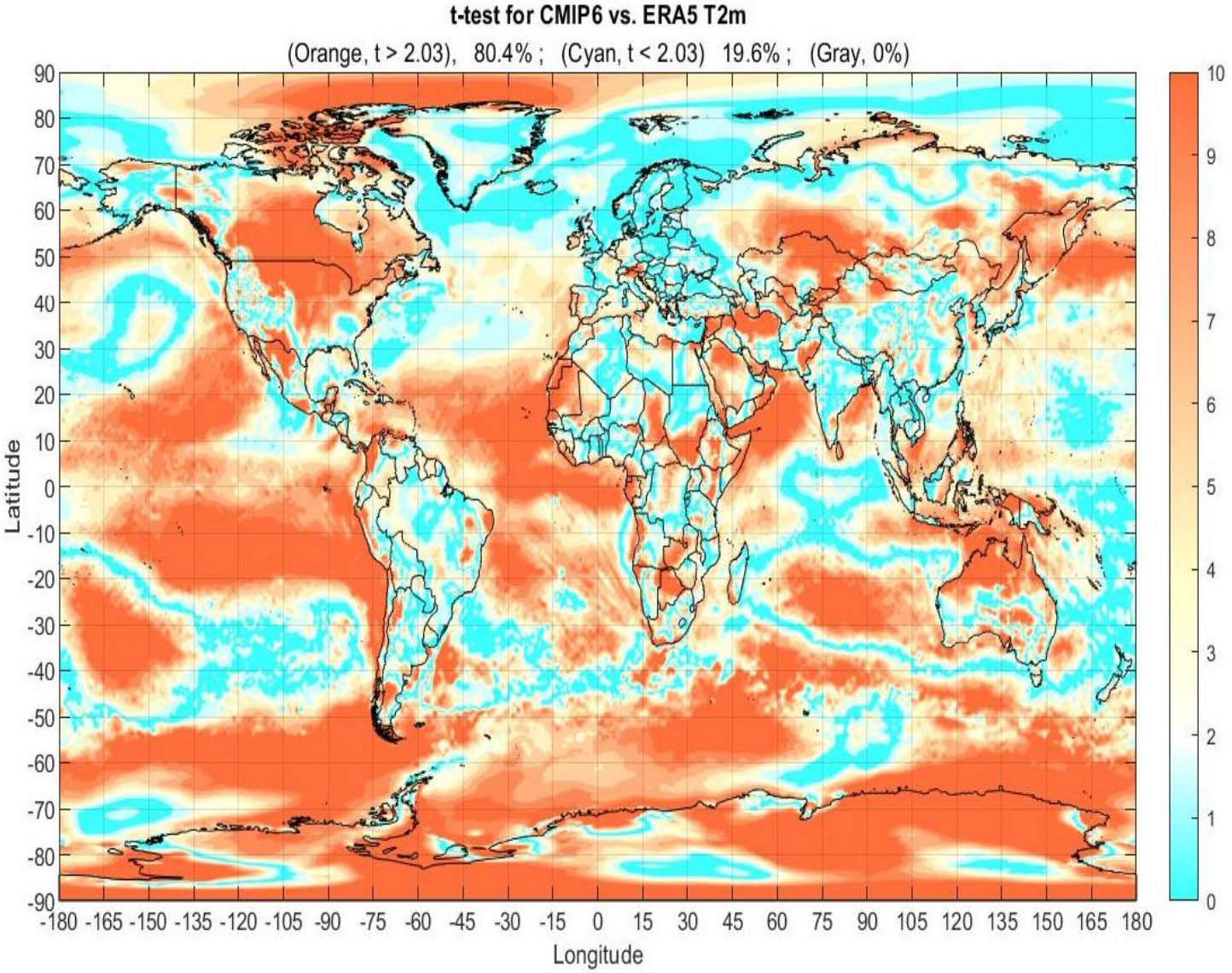


Scafetta, N. Testing the CMIP6 GCM Simulations versus Surface Temperature Records from 1980–1990 to 2011–2021: High ECS Is Not Supported. Climate 2021, 9, 161. https://doi.org/10.3390/cli9110161

The CMIP6 GCMs are incompatible with the data over more than 80% of the world surface. The model-data agreement improves with the low ECS GCMs but it is still unsatisfactory



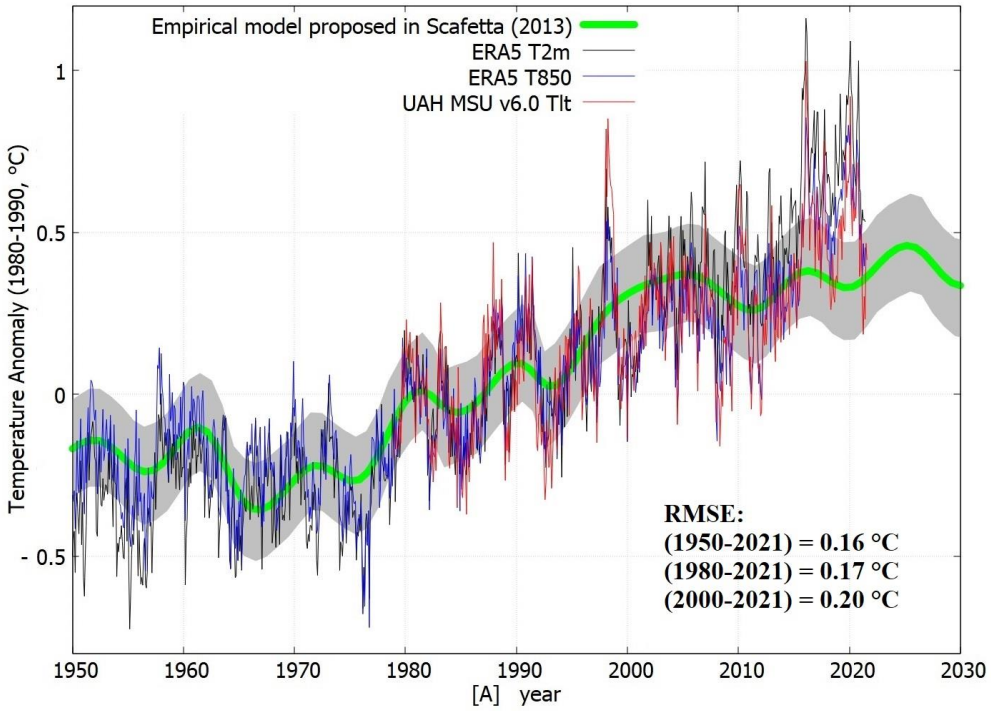


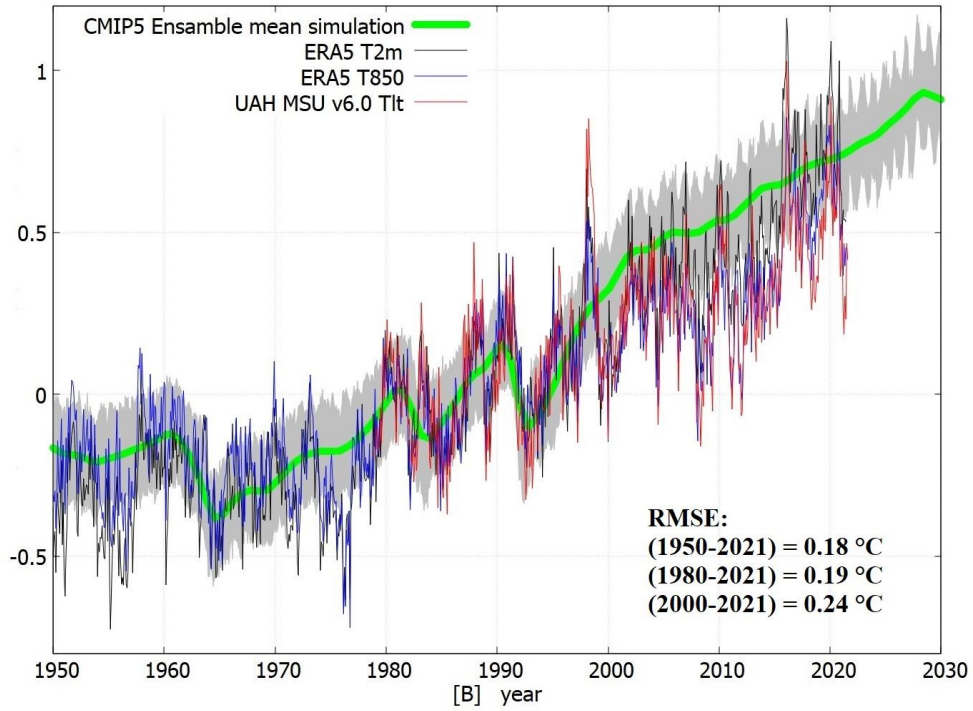


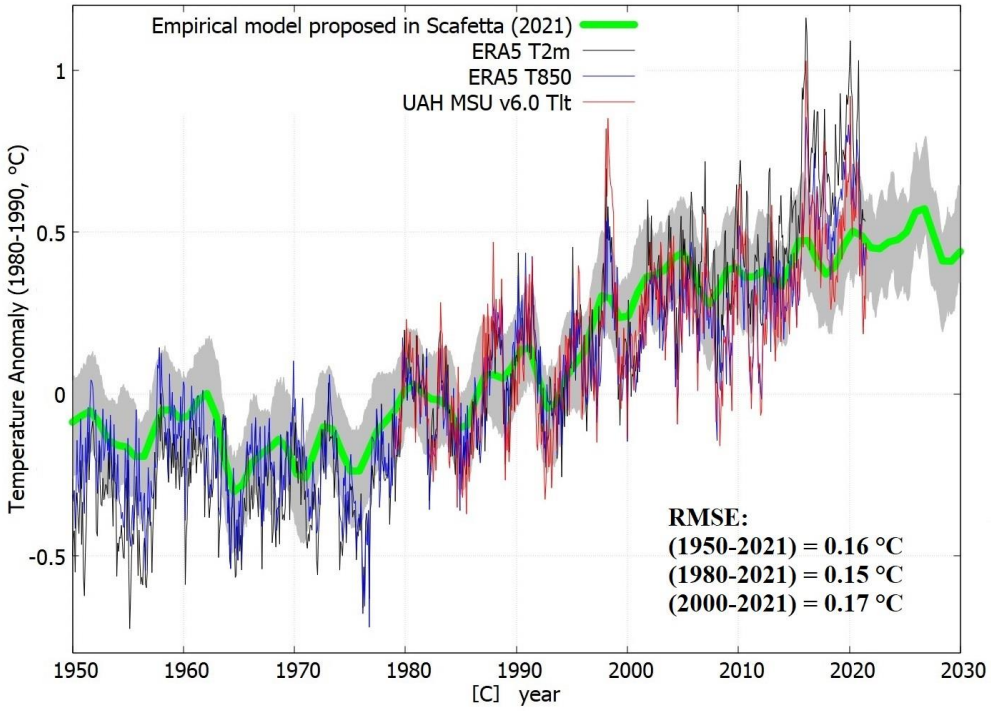
Scafetta, N. 2013. Discussion on climate oscillations: CMIP5 general circulation models versus a semi-empirical harmonic model based on astronomical cycles. Earth-Science Reviews 126, 321-357.

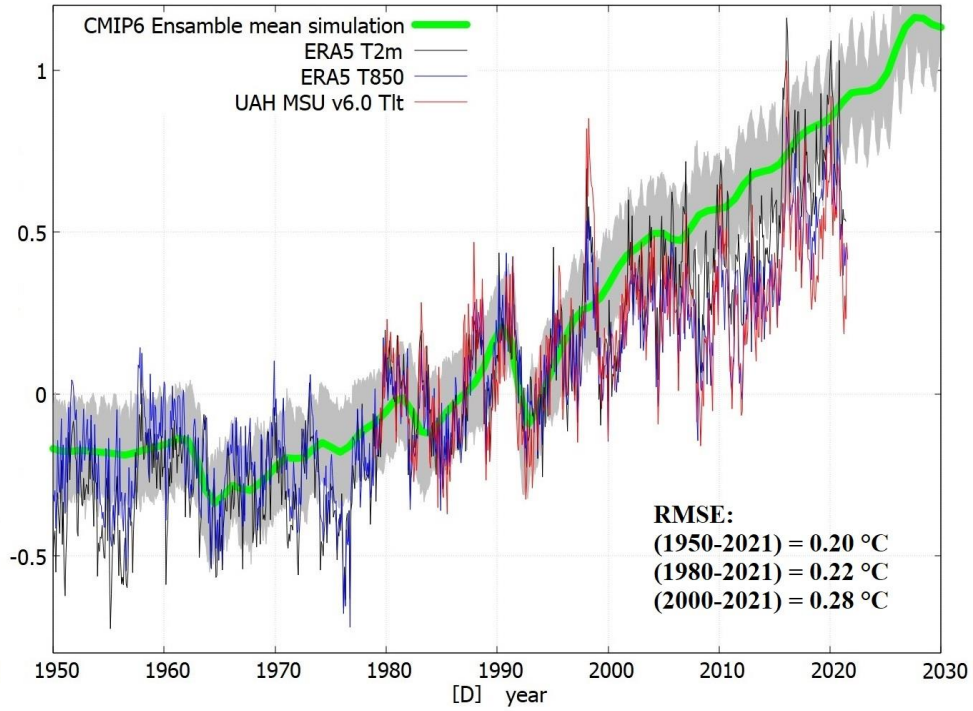
Scafetta, N. Reconstruction of the Interannual to Millennial Scale Patterns of the Global Surface Temperature. Atmosphere 2021, 12, 147. https://doi.org/10.3390/atmos12020147

Scafetta, N. Testing the CMIP6 GCM Simulations versus Surface Temperature Records from 1980–1990 to 2011–2021: High ECS Is Not Supported. Climate 2021, 9, 161. https://doi.org/10.3390/cli9110161



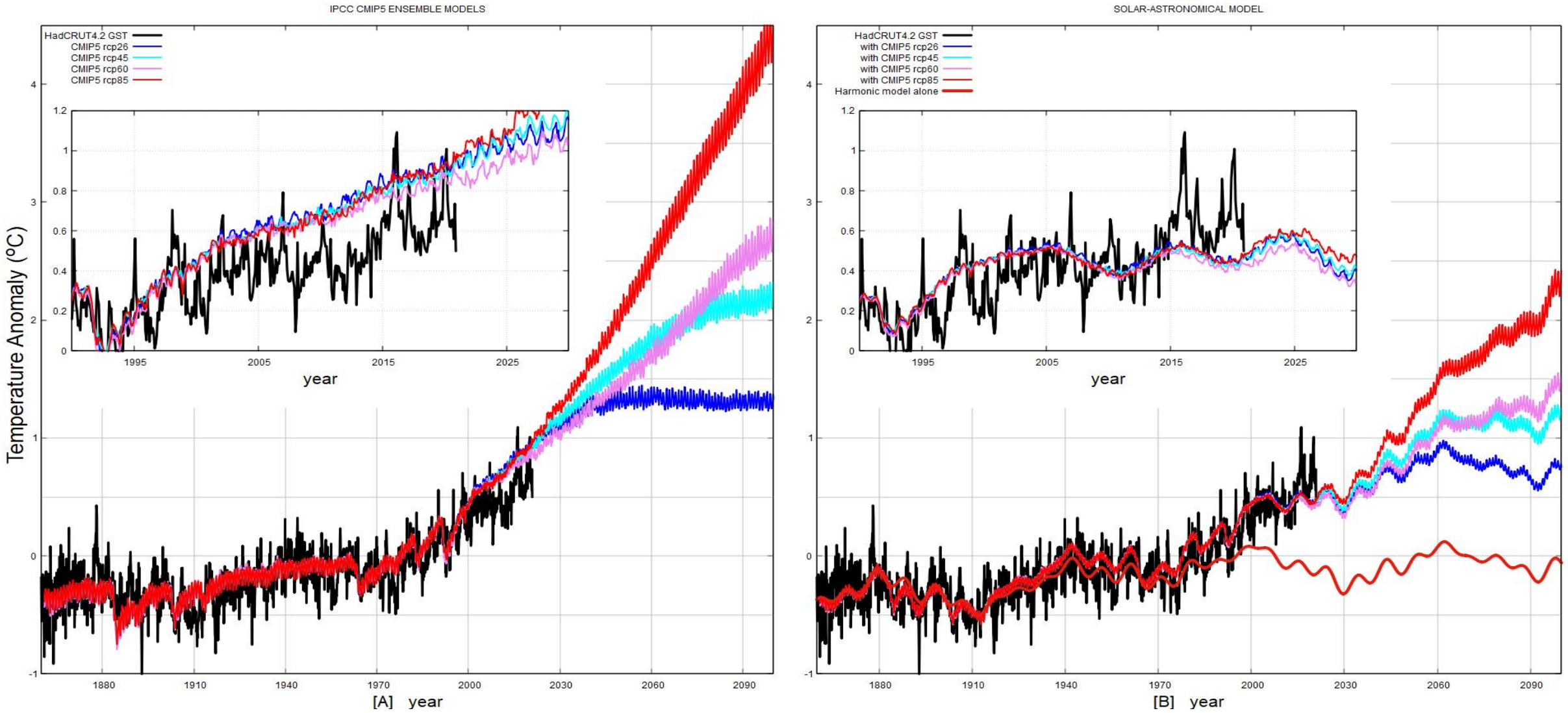






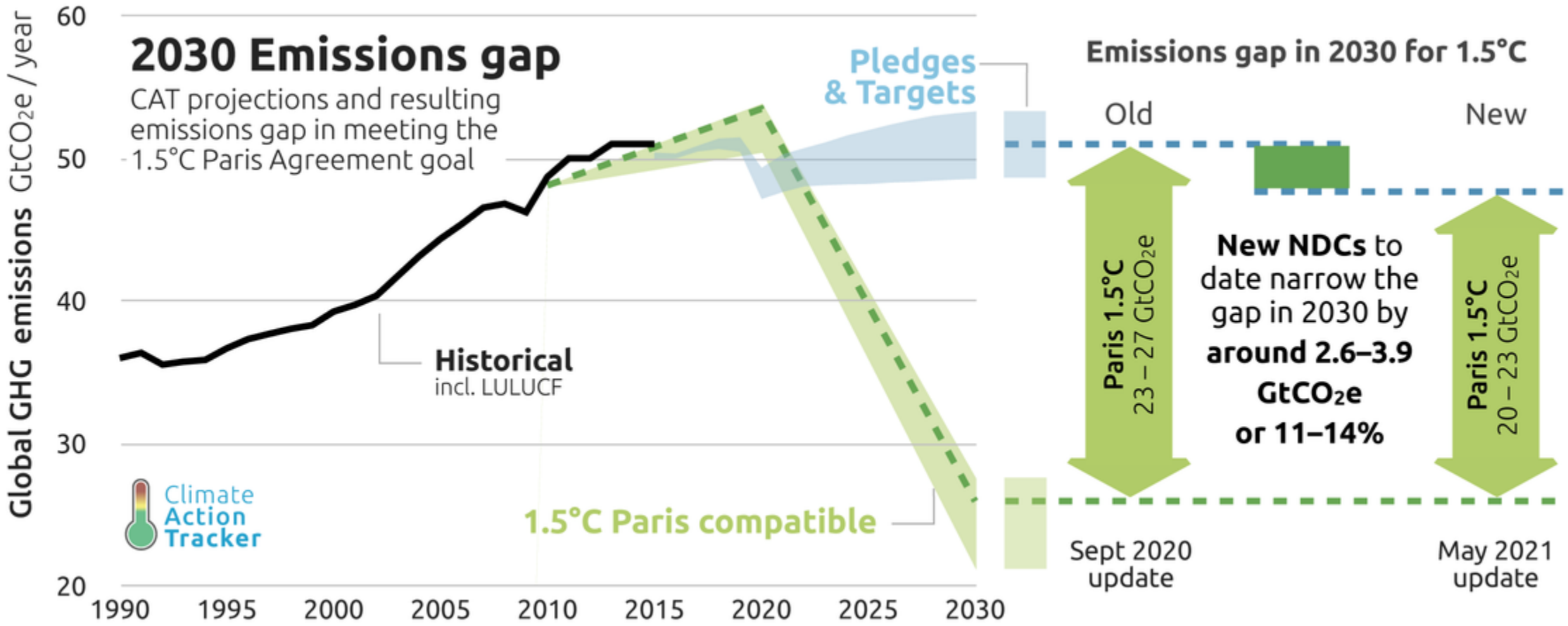
IPCC 2013
CMIP5 Models

Alternative Climate Model
Based on Natural Cycles



Scafetta, N. 2013. Discussion on climate oscillations: CMIP5 general circulation models versus a semi-empirical harmonic model based on astronomical cycles. Earth-Science Reviews 126, 321-357.

Paris 1.5 °C Agreement is not realistic



https://climateactiontracker.org/global/cat-emissions-gaps/

Crippa, M., Guizzardi, D., Muntean, M., Schaaf, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., Vignati, E., Fossil CO2 emissions of all world countries - 2020 Report, EUR 30358 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-21515-8, doi:10.2760/143674, JRC121460.

[EDGAR - The Emissions Database for Global Atmospheric Research (europa.eu)](https://edgar.jrc.ec.europa.eu/booklet/Fossil_CO2_emissions_of_all_world_countries_booklet_2020report.pdf)

	Globe 2019 vs 1990 (CO_2)	EU27+UK 2019 vs 1990 (CO_2)	EU27+UK 2019 vs 2018 (CO_2)
Power Industry	↗ + 78%	↘ - 39%	↘ - 12%
Other industrial combustion	↗ + 67%	↘ - 40%	→ - 2%
Buildings	↗ + 8%	↘ - 23%	→ + 1%
Transport	↗ + 78%	↗ + 18%	→ 0%
Other sectors	↗ + 100%	↘ - 22%	→ 0%

New coal-fired power plants under construction or planned

Global Coal Plant Tracker
PUBLISHED BY GLOBAL ENERGY MONITOR

RETURN TO ENDCOAL

Map | Table | About | Summaries | Restart

Search all data for project name, company, country

Status filtered
Tracking 1,052 coal-fired units

Basemap
Hybrid
Satellite

Coal plants: Status
select all | clear all
Mothballed
Shelved
Operating
Retired
Cancelled
Pre-permit
Announced
Construction
Permitted

Conclusion

The CMIP6 GCMs on which the "anthropogenic" theory of global warming observed from 1850-1900 is based are not scientifically validated, they contradict each other and, therefore, they cannot be considered reliable for future climate predictions according to the various emission scenarios proposed. by the IPCC.

Multiple evidences suggest that the ECS is low, and likely between 1 °C and 2 °C.

Historical and paleoclimatic evidence suggests a natural climatic variability induced by the sun and other astronomical factors that is much greater than that predicted by the IPCC models (CMIP3, CMIP5 and CMIP6).

The inclusion of natural climatic cycles and forms of non-climatic warming (e.g. UHI) has the effect of reducing the anthropogenic component from 50% to 70%.

The observed warming from 1850-1900 could be due to 50% of the sun, 30% to man and 20% is spurious because it is due to urbanization and urban heat that is not corrected in the climatic data.