CHIAREZZA SUL CLIMA,

scopriamo cosa c'è oltre le previsioni allarmistiche.

Nicola Scafetta

20 Maggio 2024

Scafetta, N.: 2024. Impacts and risks of “realistic” global warming projections for the 21st century. Geoscience Frontiers 15(2), 101774. https://doi.org/10.1016/j.gsf.2023.101774

TODAY Sezioni Attualità ACCEDI

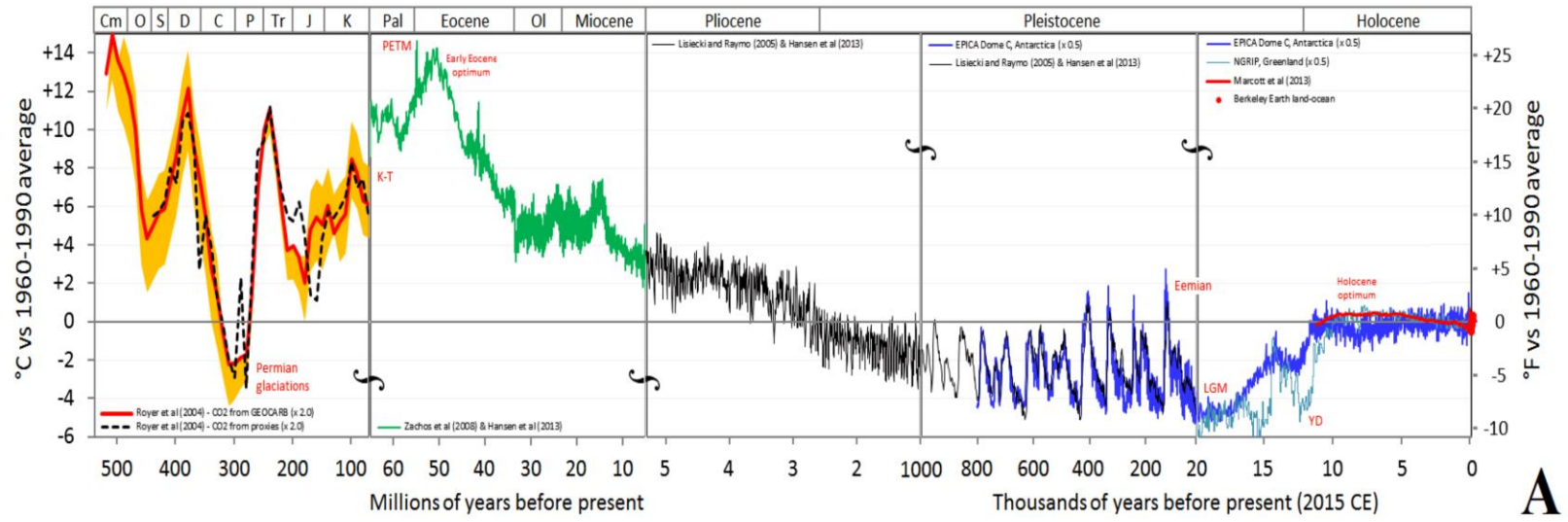
Attualità

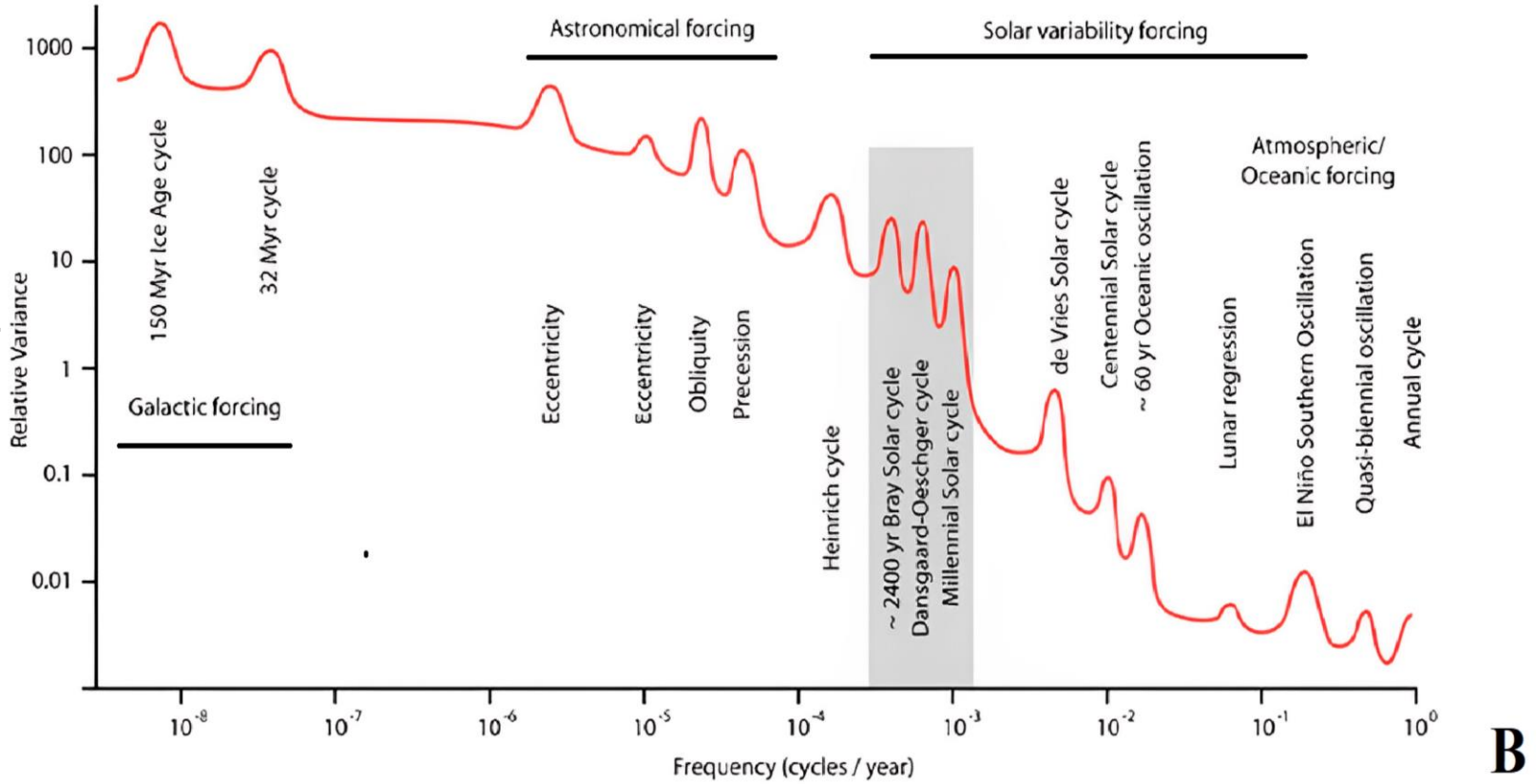
Il pianeta è in fiamme, dagli scienziati l'ultimo appello: "Sulla soglia della catastrofe"

Il rapporto dell'Ipcc non lascia scelta: dimezzare le emissioni globali di Co2 entro il 2030, altrimenti sarebbe troppo tardi. Intanto si rischiano un miliardo e mezzo di migranti climatici

Al Gore (2007) predisse: "L'intera calotta glaciale del Polo Nord potrebbe scomparire completamente entro cinque anni".

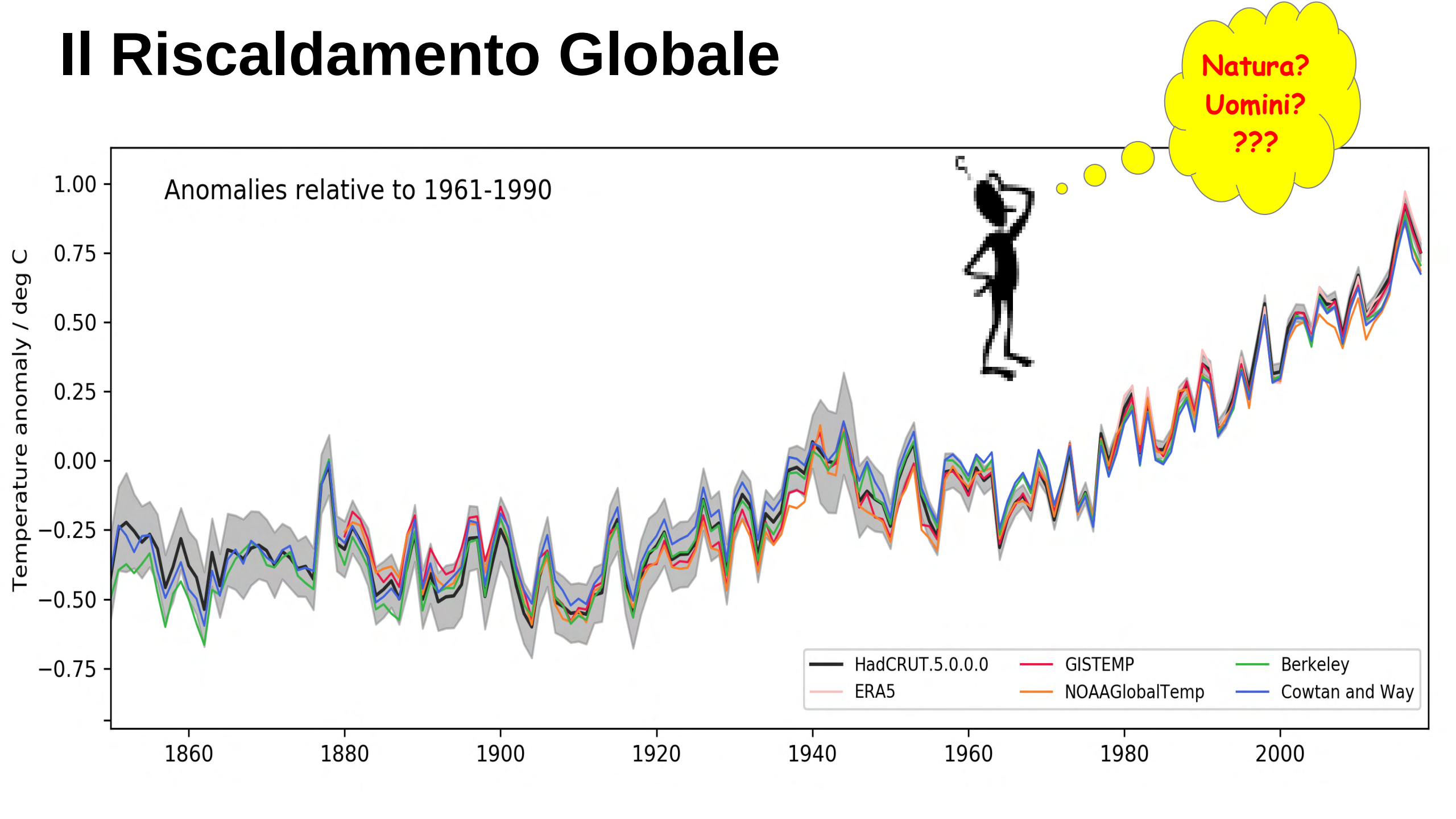
La Storia Climatica della Terra





Scafetta, N.; Bianchini, A. Overview of the Spectral Coherence between Planetary Resonances and Solar and Climate Oscillations. Climate 2023, 11, 77.

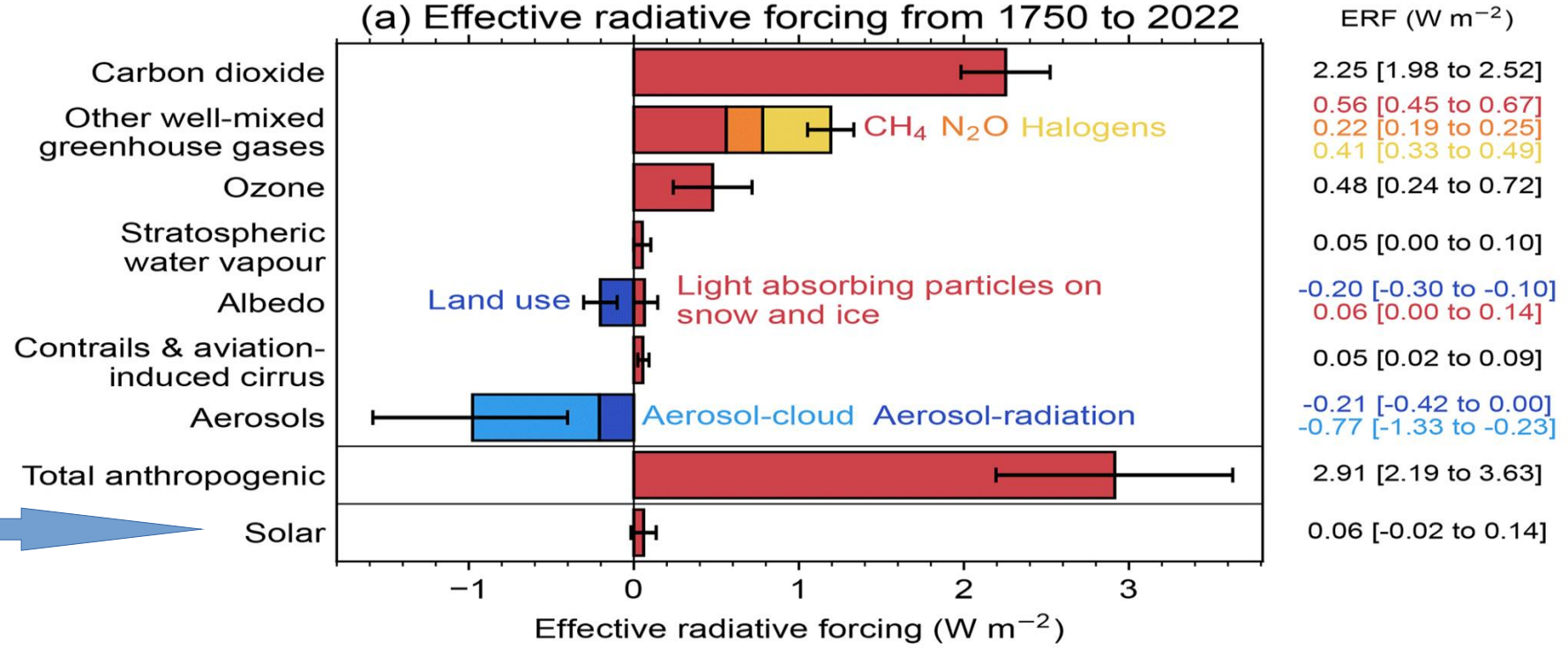
Il Riscaldamento Globale

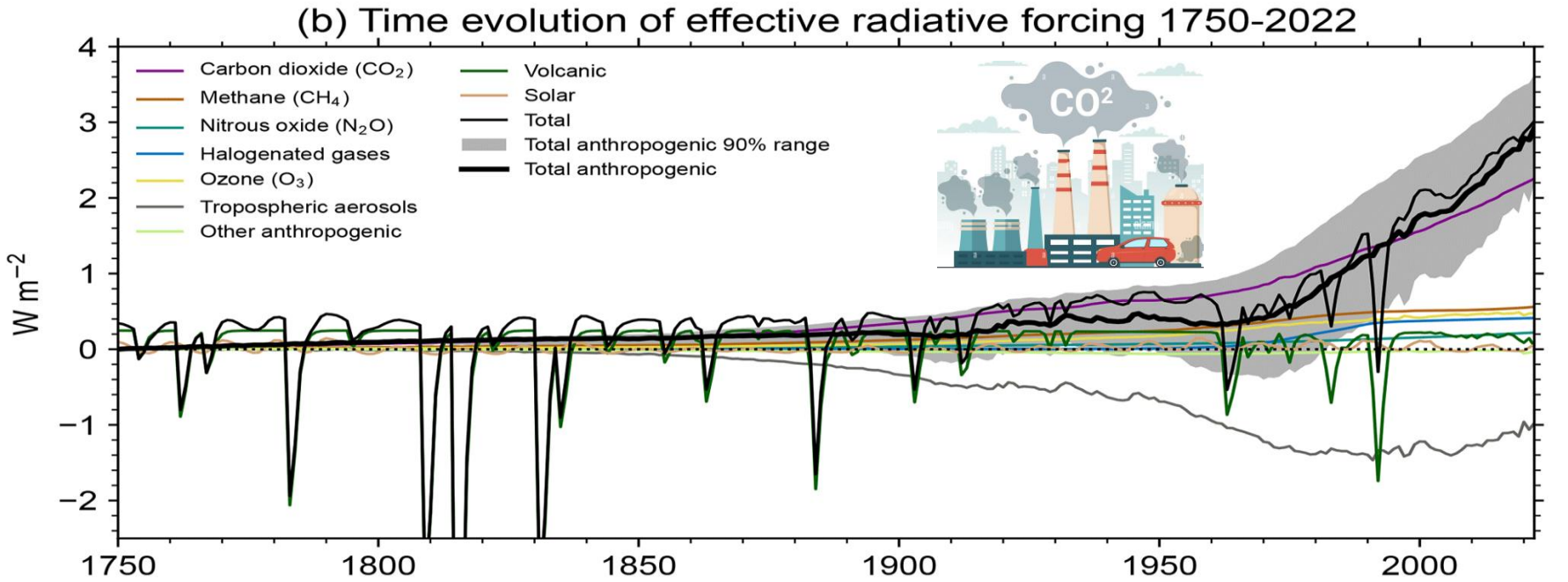


Il Contributo Solare è trascurabile

Quasi il 100% del forzante è antropico

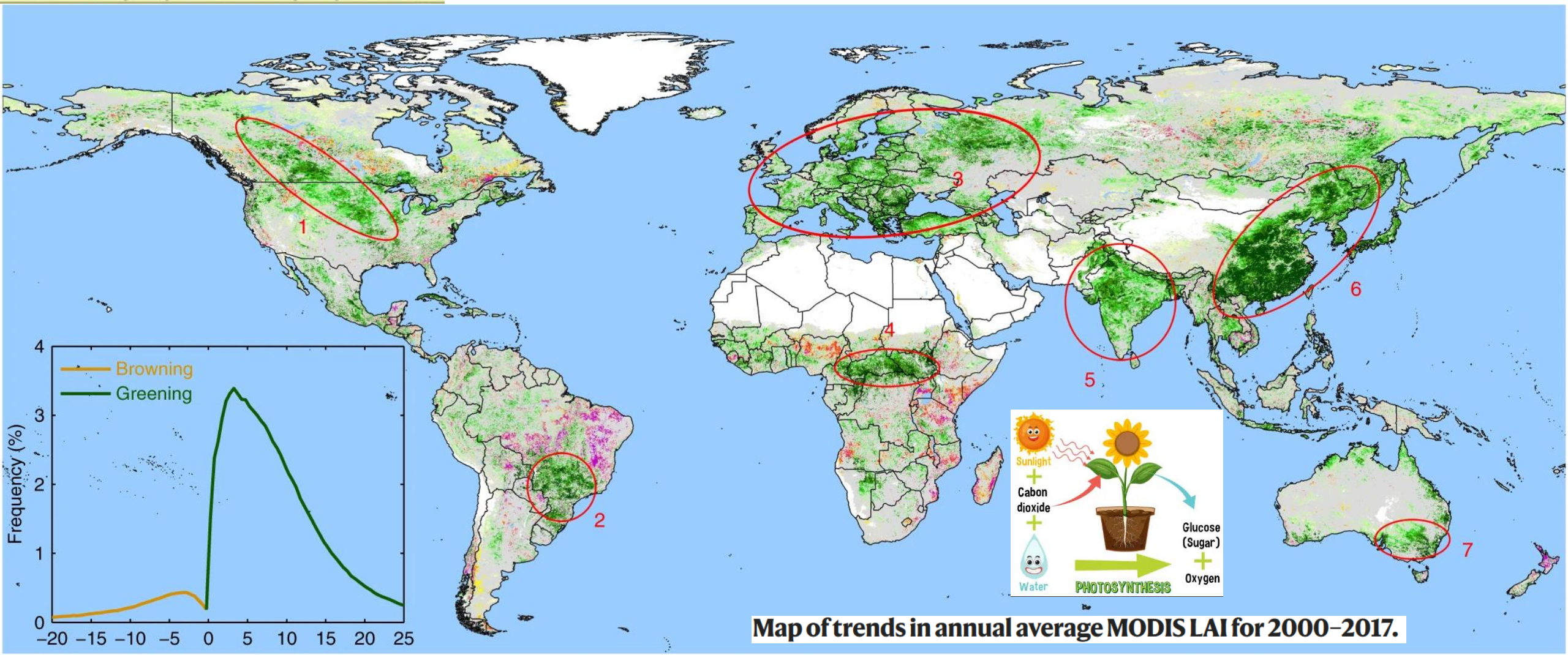
(La CO2 è un inquinante)



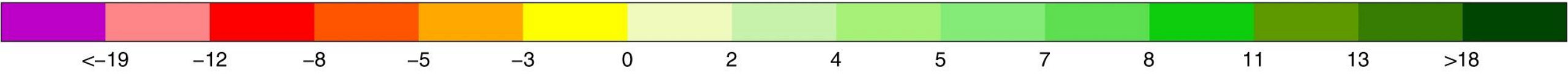


CO_2 IS PLANT FOOD

I dati satellitari mostrano un aumento della superficie fogliare della vegetazione, principalmente a causa dei cambiamenti climatici e degli effetti della fertilizzazione della CO2.



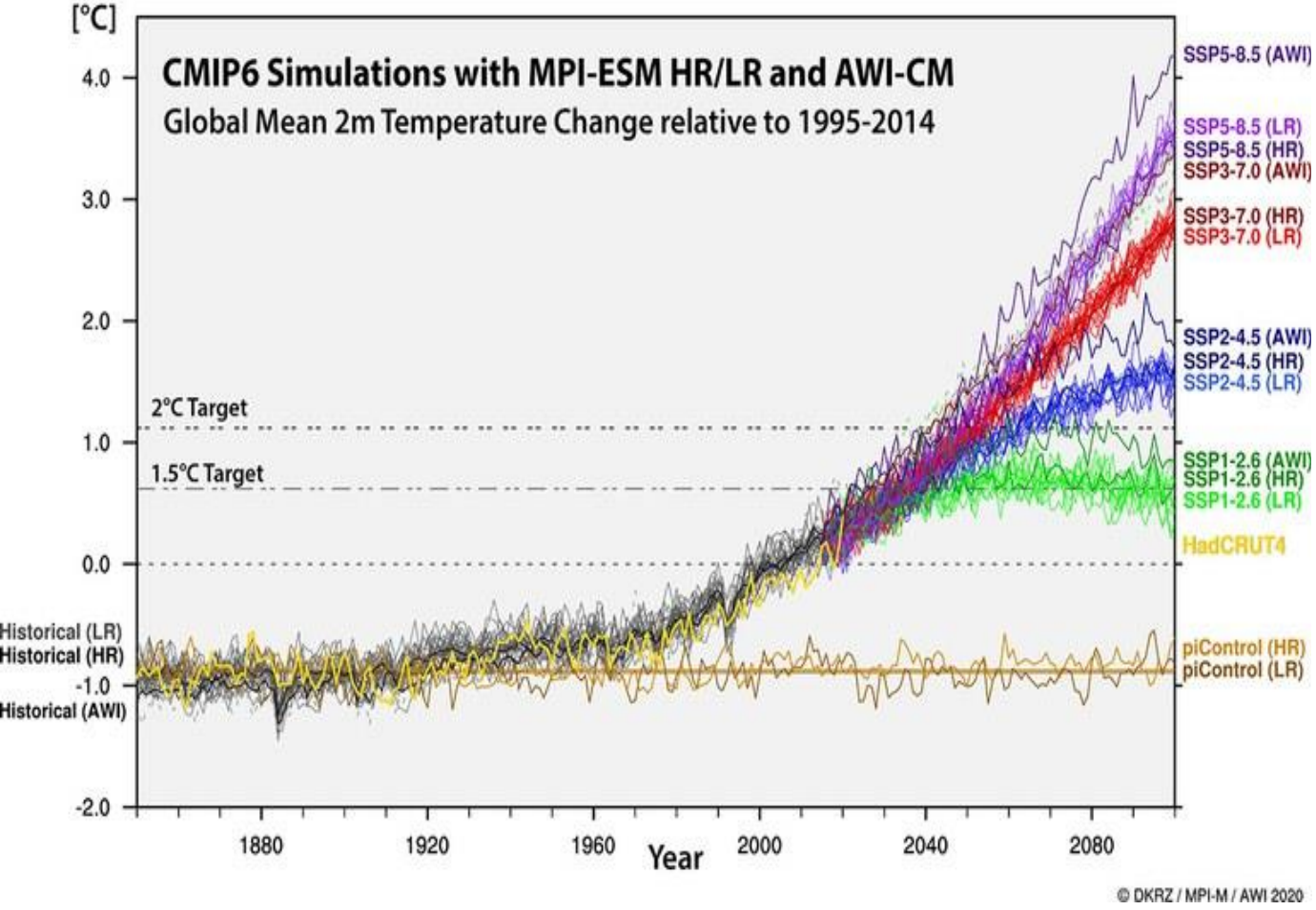
Map of trends in annual average MODIS LAI for 2000–2017.



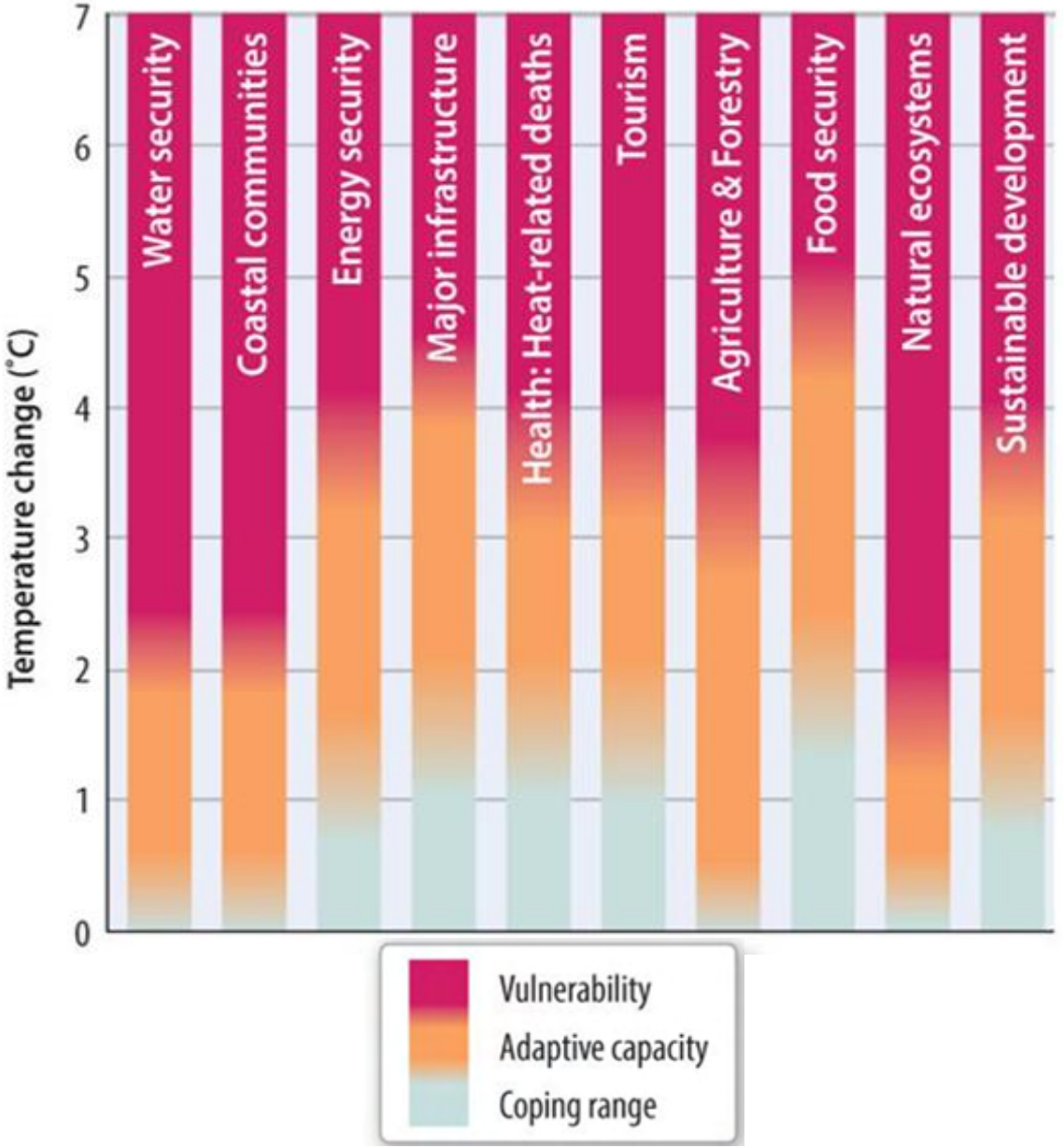
Trend in annual average LAI (10^{-2} m^2 per m^2 per decade)

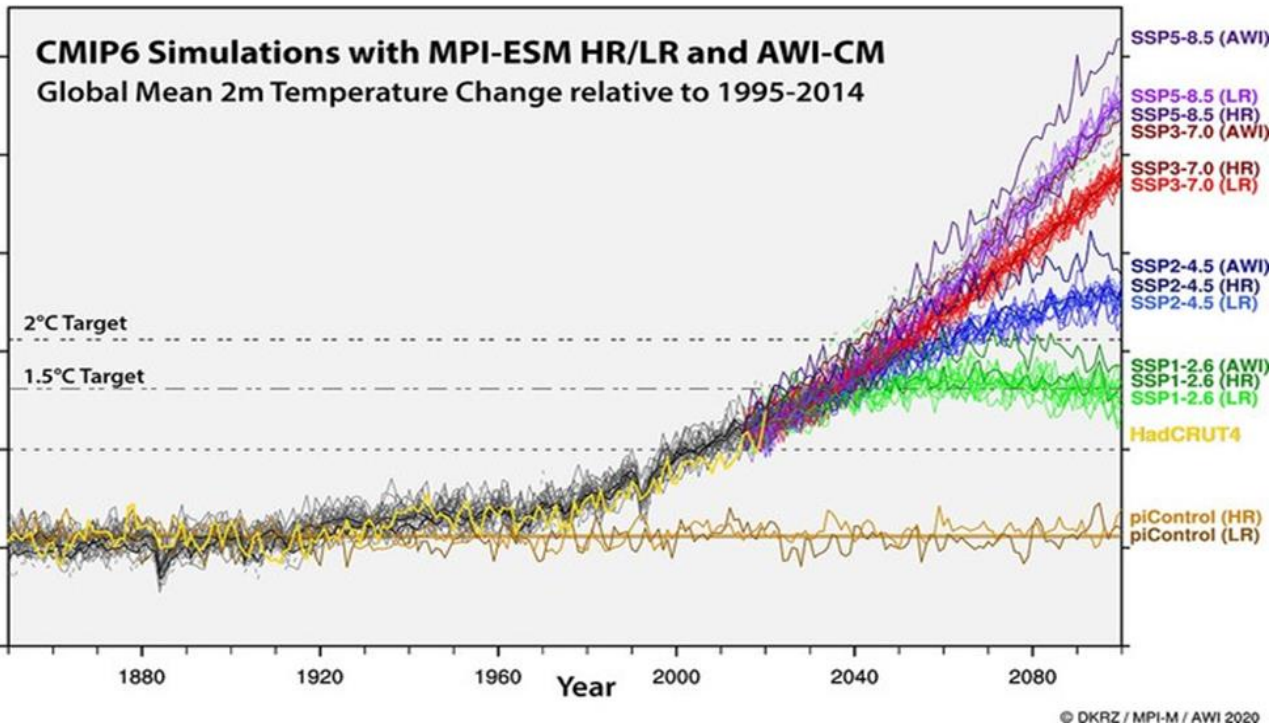
https://www.nature.com/articles/s41893-019-0220-7

Accordo di Parigi: Target di riscaldamento globale 1.5 - 2.0 °C



IPCC SR1.5 (2018)





Solo lo scenario a **zero-emissioni** SSP 1-2.6 garantisce di rimanere sotto i 2 °C e **“Salvare il Mondo”**

La strategia EU

European Commission

Energia, Cambiamento climatico, Ambiente

Azione per il clima

Casa | Chi Siamo | Cambiamento climatico | Azione dell'UE | Cittadini | Notizie e la voce

Casa > Azione dell'UE > Strategie e obiettivi climatici > Strategia a lungo termine per il 2050

Strategia a lungo termine per il 2050

L'obiettivo è quello di diventare il primo continente al mondo a impatto climatico zero entro il 2050.

CONTENUTO DELLA PAGINA

Strategie nazionali a lungo termine

Documentazione

L'UE mira a raggiungere la neutralità climatica entro il 2050, ovvero un'economia con emissioni nette di gas a effetto serra pari a zero. Questo obiettivo è al centro del Green Deal europeo ed è un obiettivo giuridicamente vincolante grazie alla legge europea sul clima.

La transizione verso una società climaticamente neutra è un'opportunità per costruire un futuro migliore per tutti, senza lasciare indietro nessuno.

Tutti i settori della società e dell'economia svolgeranno un ruolo importante, dal settore energetico all'industria, ai trasporti, all'edilizia, all'agricoltura e alla silvicoltura.

L'UE può dare l'esempio investendo in soluzioni tecnologiche, responsabilizzando i cittadini e garantendo azioni a sostegno di una transizione agevole e giusta in settori chiave quali la politica industriale, la finanza e la ricerca.

CARBON NET ZERO 2050

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Von der Leyen's flagship petrol and diesel ban isn't even backed by her own party

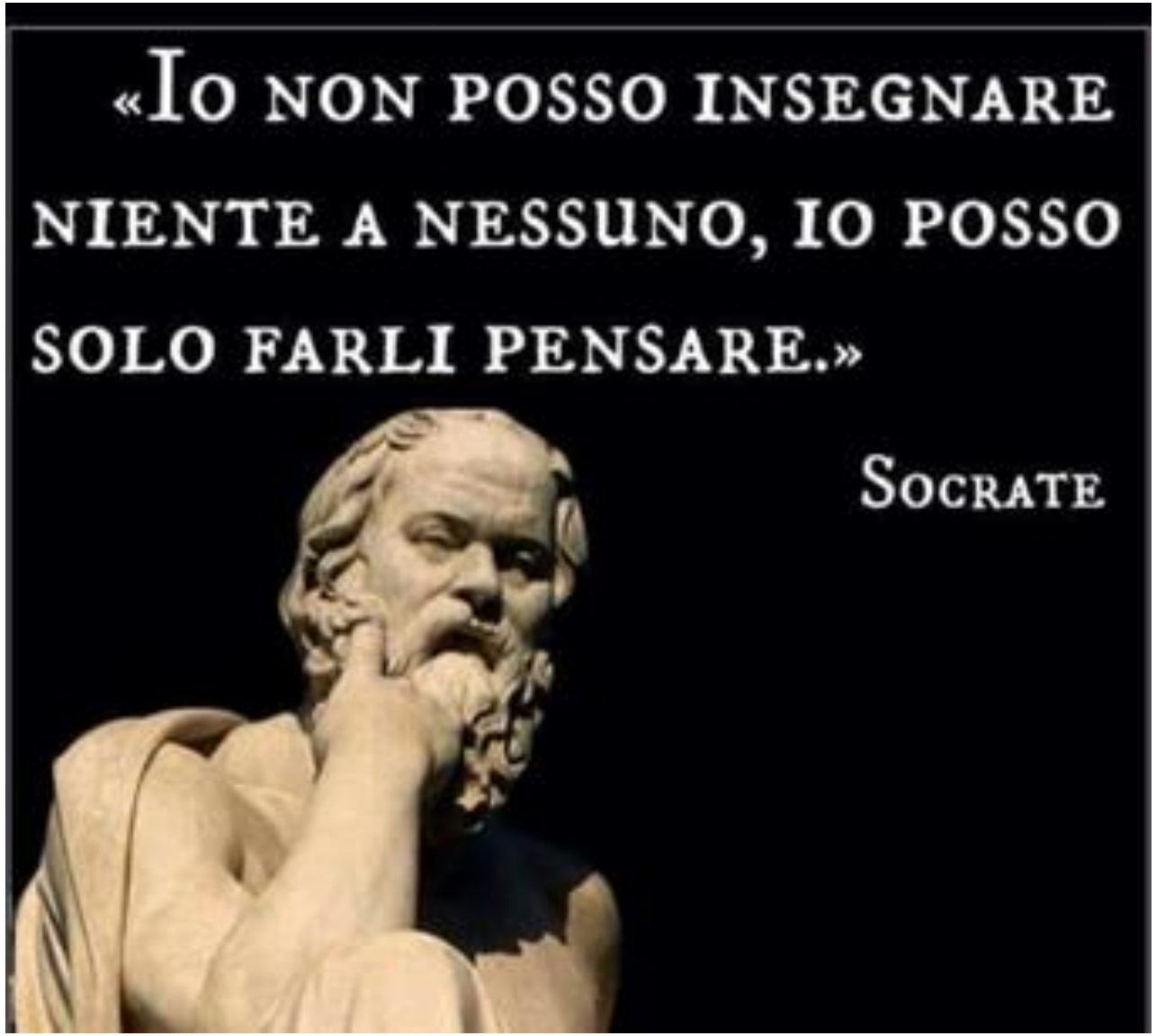
European People's Party wants to scrap the plans due to the growing cost of living crisis

James Crisp, EUROPE EDITOR
19 January 2024 • 3:18pm

Le forze conservatrici al Parlamento europeo stanno valutando la possibilità di chiedere all'UE di eliminare il divieto del 2035 sui motori a benzina e diesel.

La narrativa allarmistica è basata sulla sabbia oppure sulla roccia?

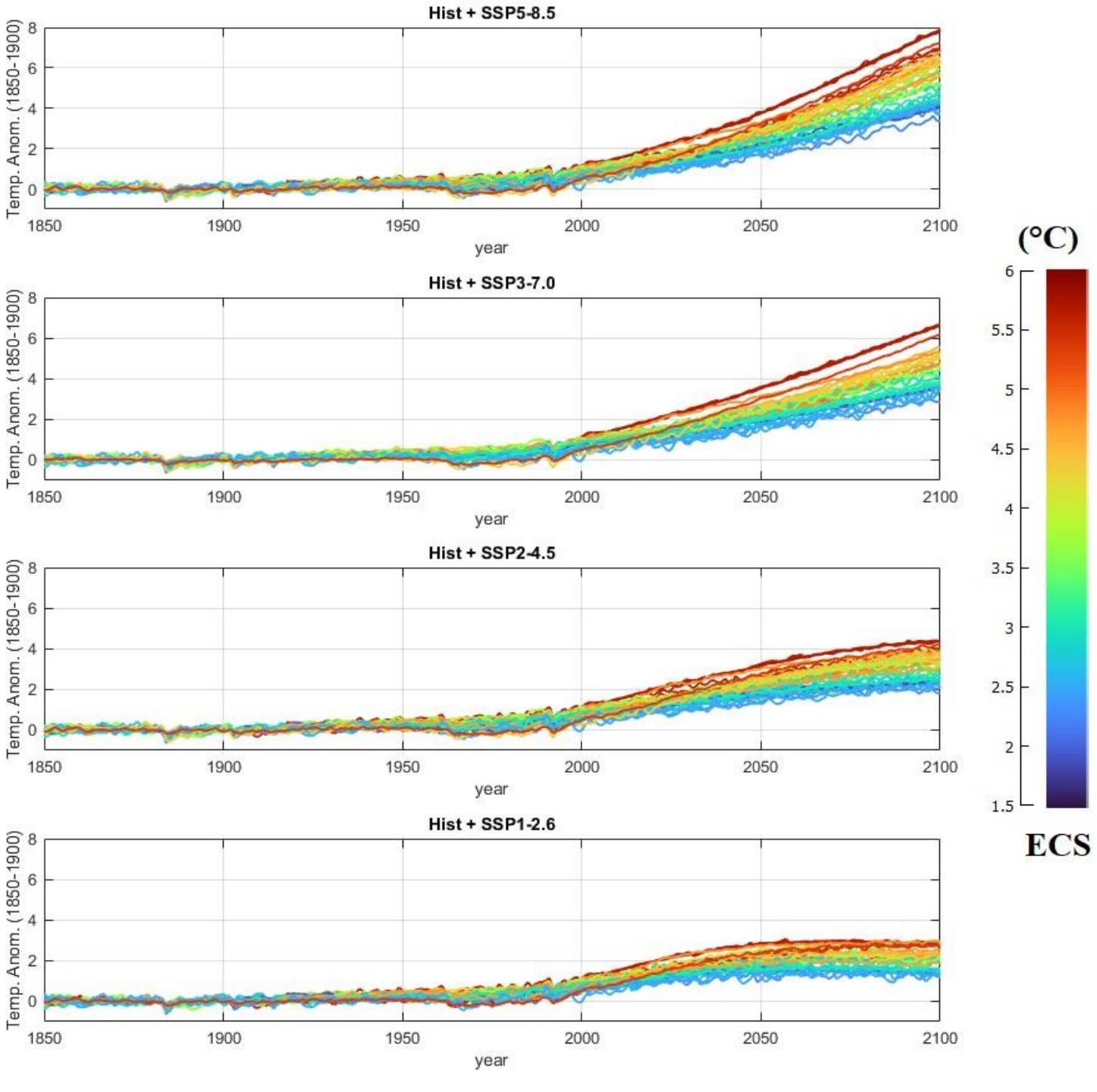
Sviluppiamo il discorso critico e scientifico….



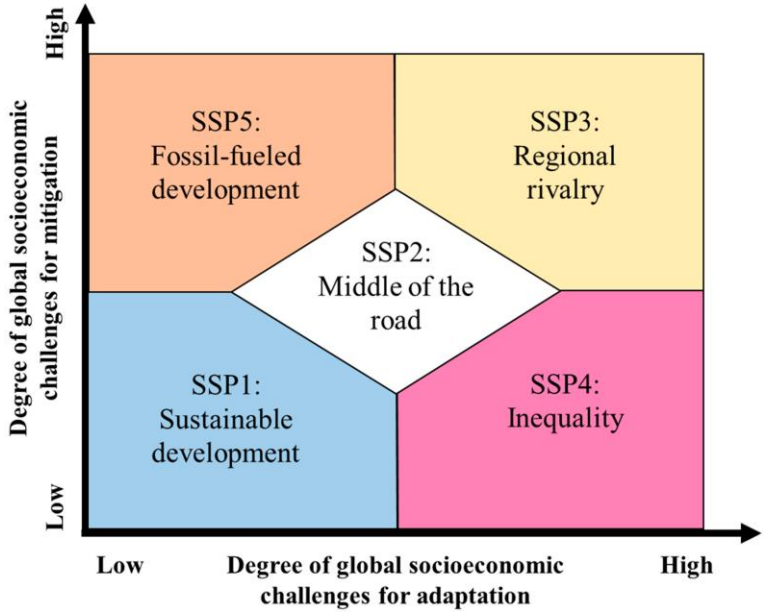
CMIP6 GCMs

Il riscaldamento previsto per il 21° secolo dipende fortemente da:

1. **i Percorsi Socioeconomici Condivisi (SSP) scelti per la simulazione;**
2. **la sensibilità climatica all'equilibrio (ECS) del modello;**
3. **l'affidabilità dei GCM nel ricostruire adeguatamente i cambiamenti climatici del passato**



Punto critico #1



Quale Percorso Socioeconomico Condiviso (SSP) è realistico?

Solo l'SSP2-4.5 è realistico

nature

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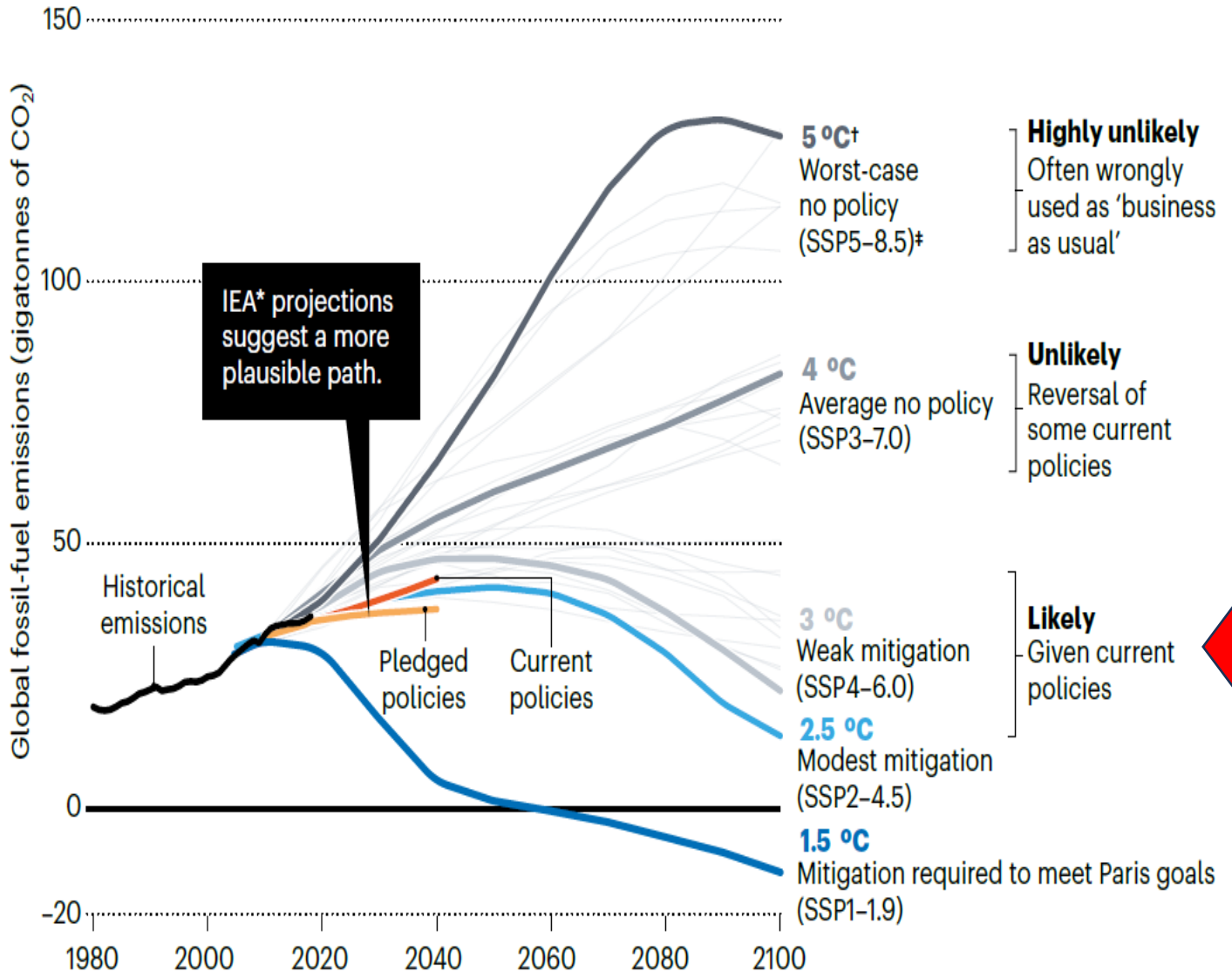
nature › comment › article

COMMENT | 29 January 2020

Emissions – the 'business as usual' story is misleading

Stop using the worst-case scenario for climate warming as the most likely outcome – more-realistic baselines make for better policy.

Zeke Hausfather & Glen P. Peters



Climatic Impact-driver Type	Climatic Impact-driver Category	Already Emerged in Historical Period	Emerging by 2050 at Least for RCP8.5/SSP5-8.5	Emerging Between 2050 and 2100 for at Least RC8.5/SSP5-8.5
Heat and Cold	Mean air temperature	1		
	Extreme heat	2	3	
	Cold spell	4	5	
	Frost			
Wet and Dry	Mean precipitation		6 7	
	River flood			
	Heavy precipitation and pluvial flood			8
	Landslide			
	Aridity			
	Hydrological drought			
	Agricultural and ecological drought			
	Fire weather			
Wind	Mean wind speed			
	Severe wind storm			
	Tropical cyclone			
	Sand and dust storm			
Snow and Ice	Snow, glacier and ice sheet		9	10
	Permafrost			
	Lake, river and sea ice	11		
	Heavy snowfall and ice storm			
	Hail			
	Snow avalanche			
Coastal	Relative sea level		12	
	Coastal flood			
	Coastal erosion			
Open Ocean	Mean ocean temperature			
	Marine heatwave			
	Ocean acidity			
	Ocean salinity	13		
	Dissolved oxygen	14		
Other	Air pollution weather			
	Atmospheric CO_2 at surface			
	Radiation at surface			

NO CHANGE

High confidence of decrease | Medium confidence of decrease | Low confidence in direction of change | Medium confidence of increase | High confidence of increase

Table 12.12 | Emergence of CIDs in different time periods. pp. 1856

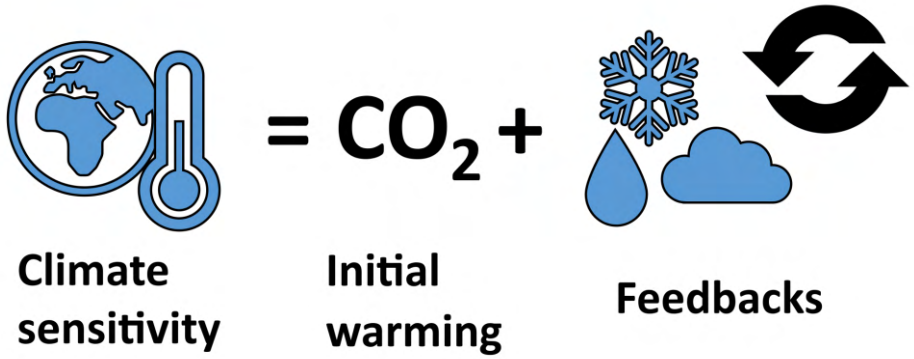
L'IPCC AR6 evidenzia principalmente lo scenario SSP5-8.5.

Tuttavia, l'IPCC AR6 riconosce anche:

"However, the likelihood of high-emissions scenarios such as RCP8.5 or SSP5-8.5 is considered low in light of recent developments in the energy sector (Hausfather and Peters, 2020a,b).

***Studies that consider possible future emissions trends in the absence of additional climate policies…. (are) approximately in line with the intermediate RCP4.5, RCP6.0 and SSP2-4.5 scenarios"* (pp. 238-239)**

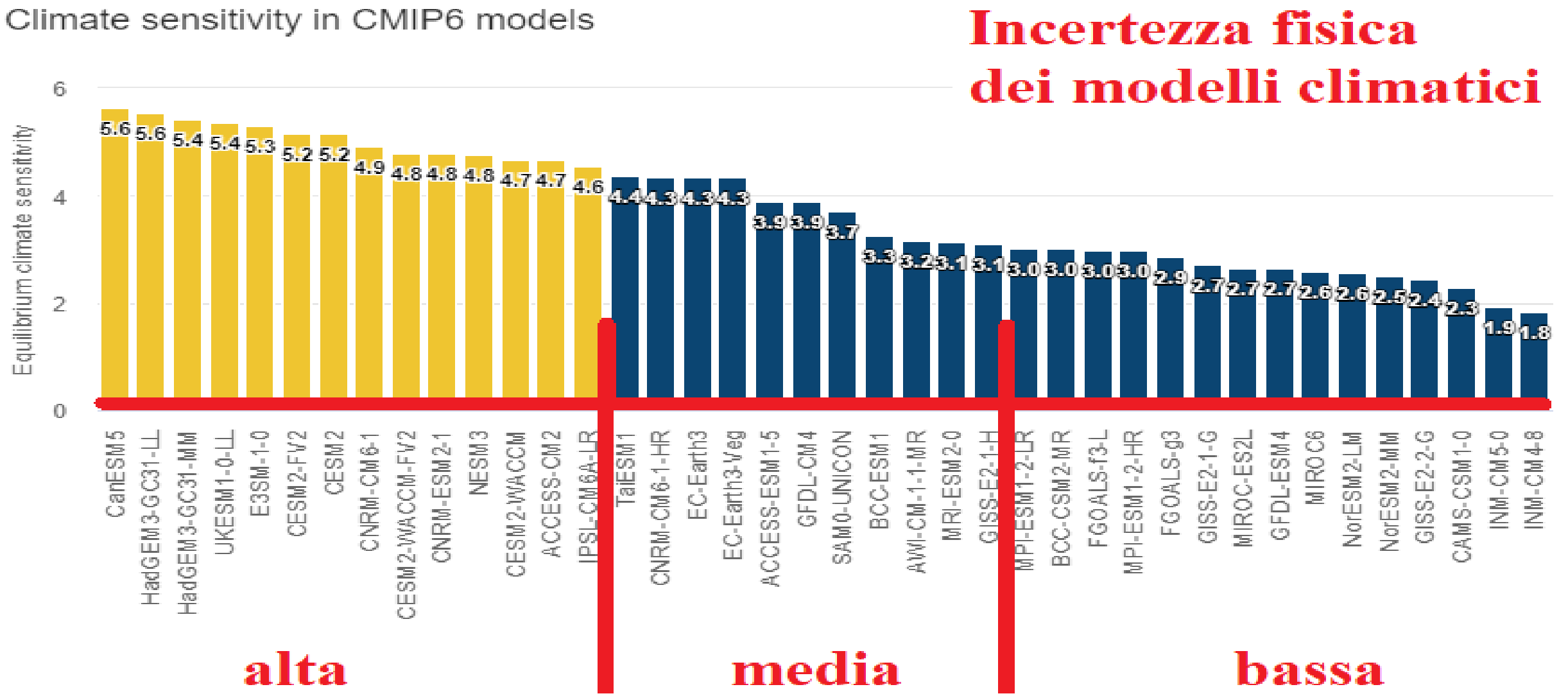
Punto critico #2



Quali modelli potrebbero essere realistici?

(Il problema della “Sensibilità climatica all’equilibrio” issue)

I modelli climatici globali (CMIP6) e l'Equilibrium Climate Sensitivity (ECS). L'ECS è una stima dell'eventuale riscaldamento globale allo stato stazionario con una CO2 doppia.



nature

COMMENT | 04 May 2022

Climate simulations: recognize the 'hot model' problem

The sixth and latest IPCC assessment weights climate models according to how well they reproduce other evidence. Now the rest of the community should do the same.

Zeke Hausfather, Kate Marvel, Gavin A. Schmidt, John W. Nielsen-Gammon & Mark Zelinka

ECS nella letteratura scientifica

1) CMIP6 GCMs: ECS = **1.8–5.8** °C

2) Sherwood et al. (Rev. Geophysics 58, e2019RG000678, 2020):
ECS = **2.6–3.9** °C (66% confidence)
ECS = 2.3–4.7 °C (95% confidence)
IPCC AR6 (2021) accepts the evaluations of Sherwood et al. (2020)

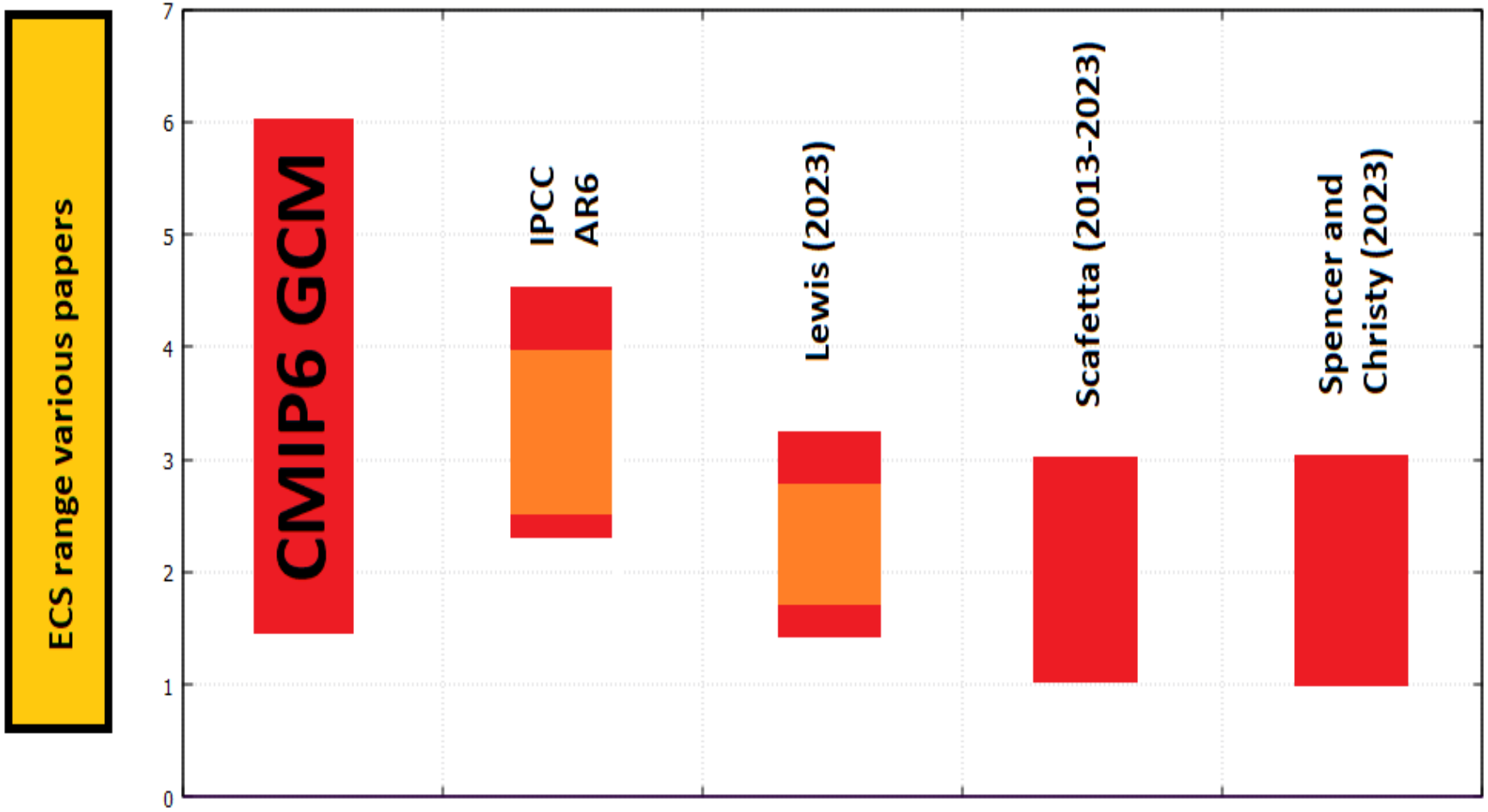
3) Lewis (Climate Dynamics 60, 3139–3165, 2023):
ECS = **1.75–2.7** °C (66% confidence)
ECS = 1.55–3.2 °C (95% confidence)

4) Scafetta (GRL, Climate Dynamics, Climate, Geoscience Front. 2021-2023):
ECS <= 3 °C, with possibility of ECS = 1-2 °C

5) Spencer and Christy (Theoretical and Applied Climatology, 2023):
confirm Lewis and Scafetta's low ECS estimates.

Studi basati sui modelli

Studi basati sulle osservazioni climatiche

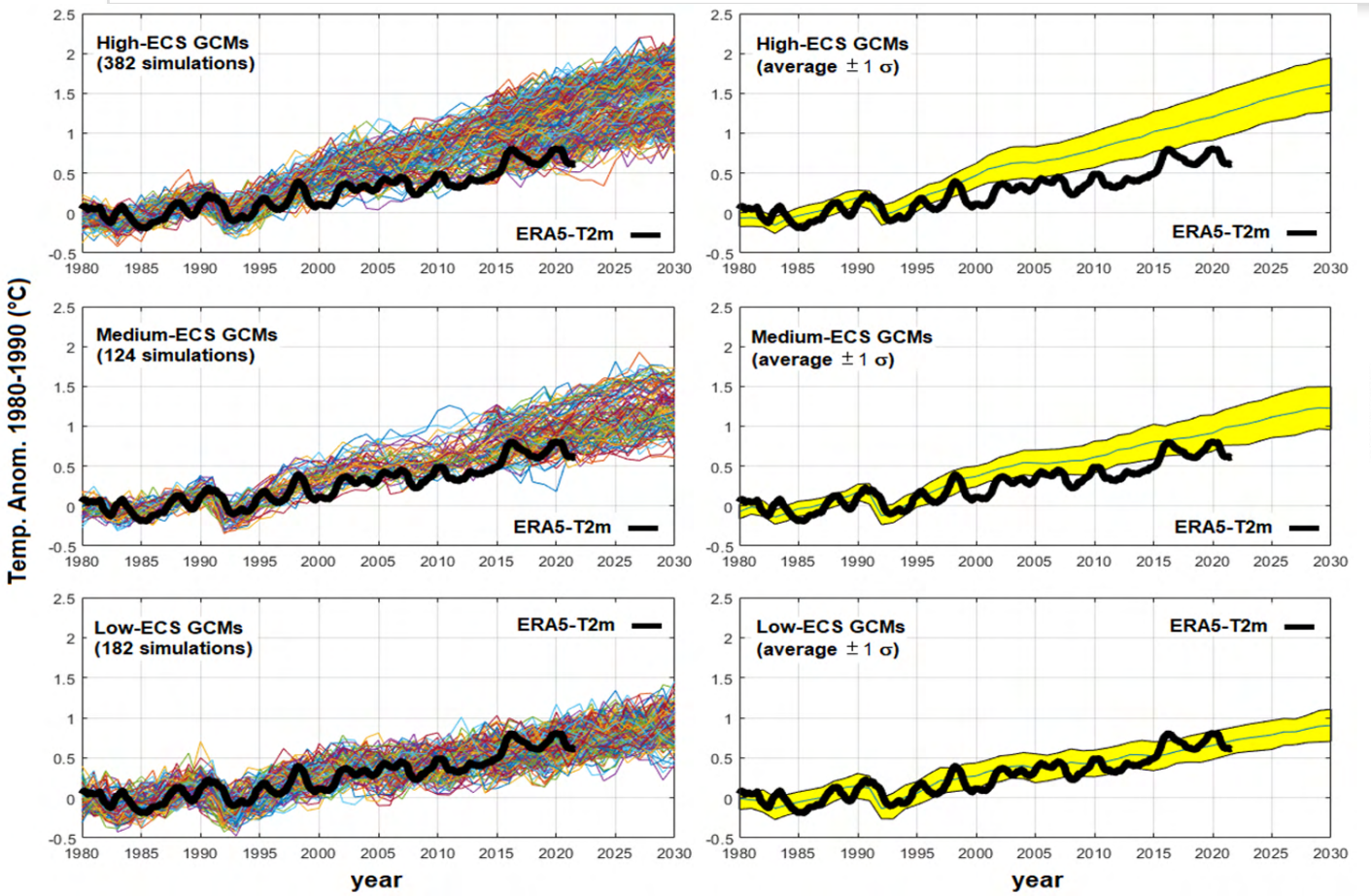


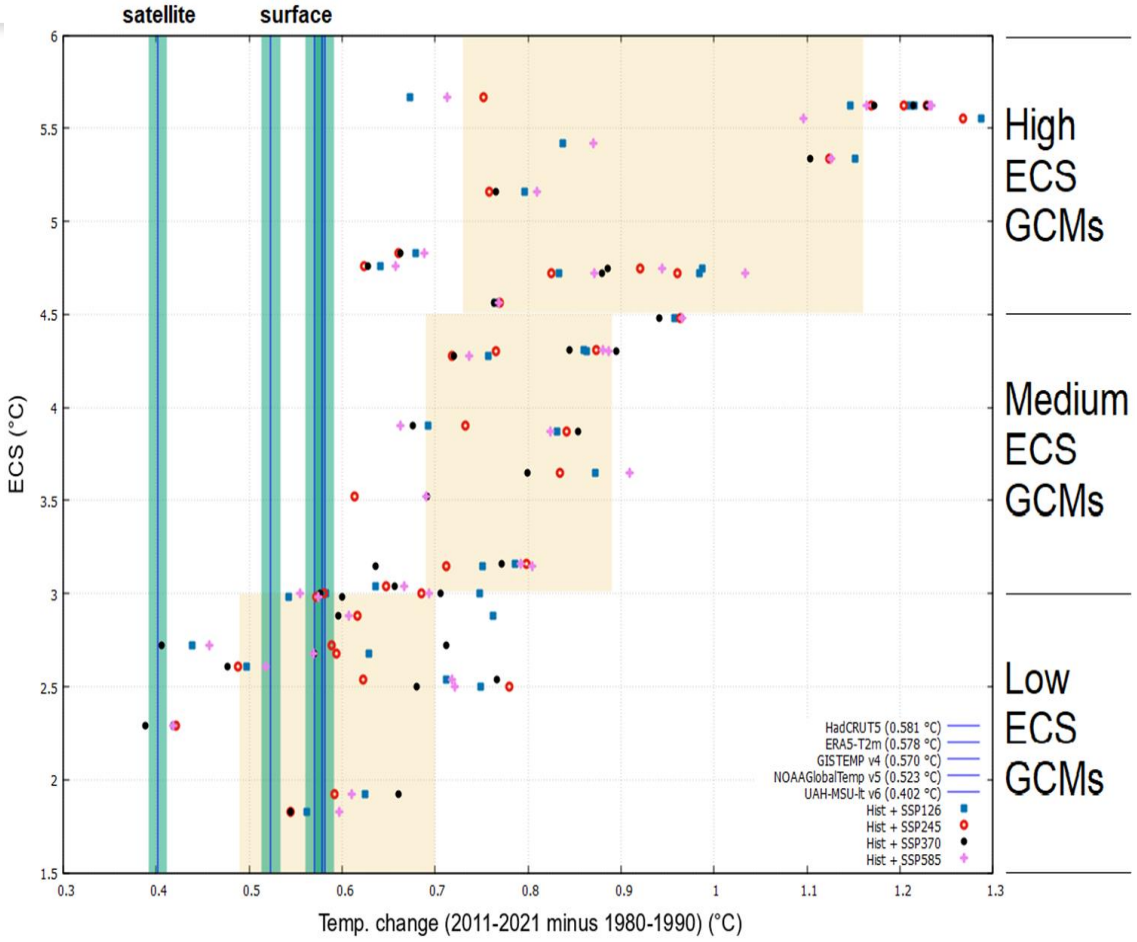
Rugenstein et al. (2023): “Early in the 2010s, a **substantial discrepancy** was noted **between estimates of climate sensitivity derived from climate models and estimates based on the observed warming record** and radiative balance ... **Estimates based on observed warming pointed to much lower values than those derived from models**”.

GCM CMIP6 rispetto ai dati di temperatura dal 1980 al 2022.

Solo i modelli GCM con una bassa sensibilità potrebbero essere realistici

- Scafetta, N. Geophys. Res. Lett. 2022, 49, e2022GL097716.
- Scafetta, N. Climate 2021, 9, 161.doi.10.3390/cli9110161
- Scafetta, N. Clim Dyn (2023). doi.10.1007/s00382-022-06493-w
- Scafetta, N. Atmosphere 2023, 14, 345. doi.10.3390/atmos14020345
- Scafetta, N. Geophys. Res. Lett. 2023, 50, e2023GL104960.





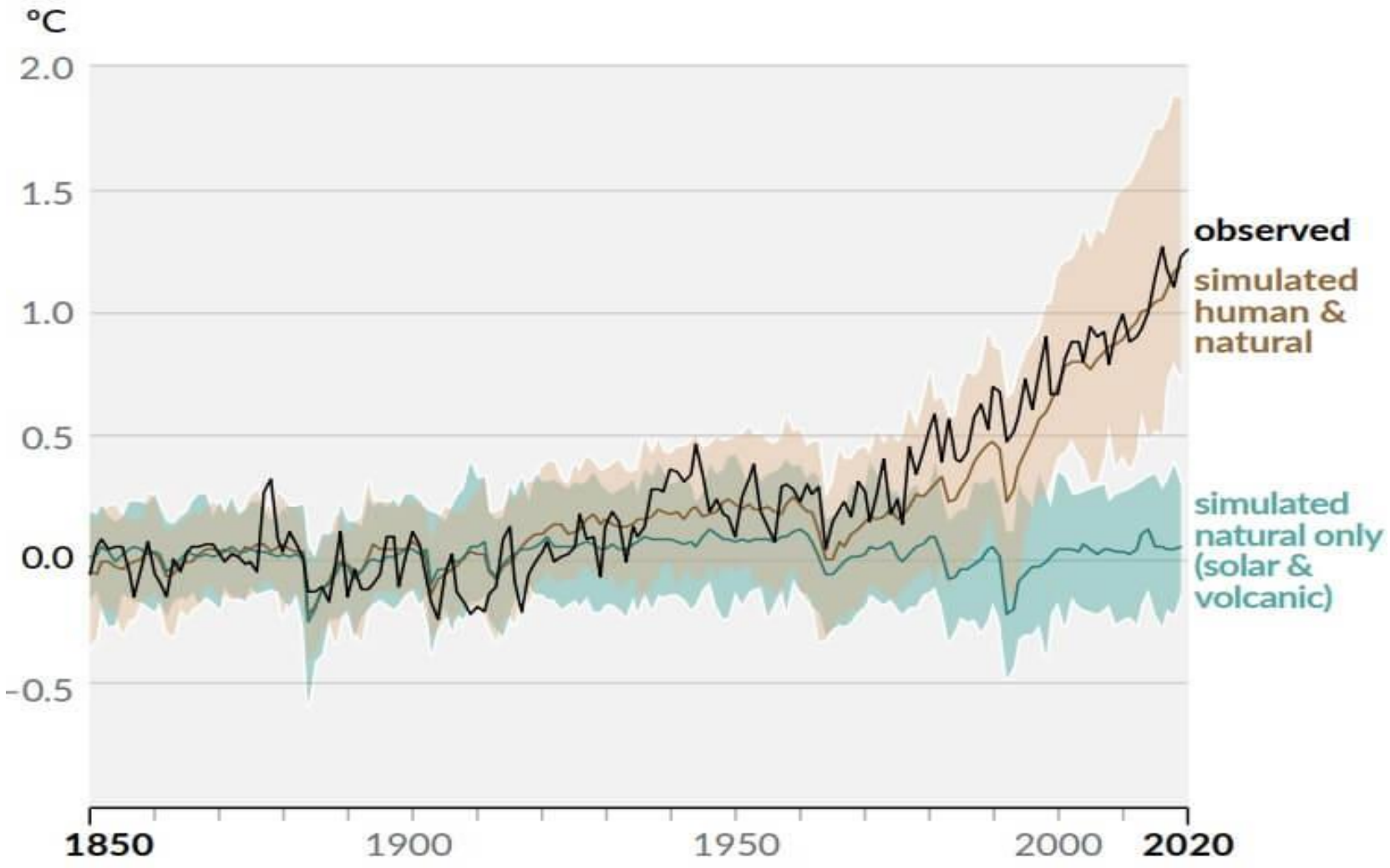
Punto critico #3

Ci sono ulteriori evidenze che i modelli possano essere fisicamente errati?

(Variabilità naturale e tendenze calde spurie)

La teoria del riscaldamento globale di origine antropica proposta dall'IPCC

"quasi il 100% del riscaldamento dal 1850 al 1900 è causato dalle emissioni umane"



Senza il contributo antropico, i modelli climatici non riproducono alcun riscaldamento dal 1850 al 1900

Con il contributo antropico, i modelli climatici riproducono il riscaldamento da 1850-1900

IPCC AR6
Figure 3.10
p. 443

I GCMS non sono in grado di riprodurre il riscaldamento della troposfera

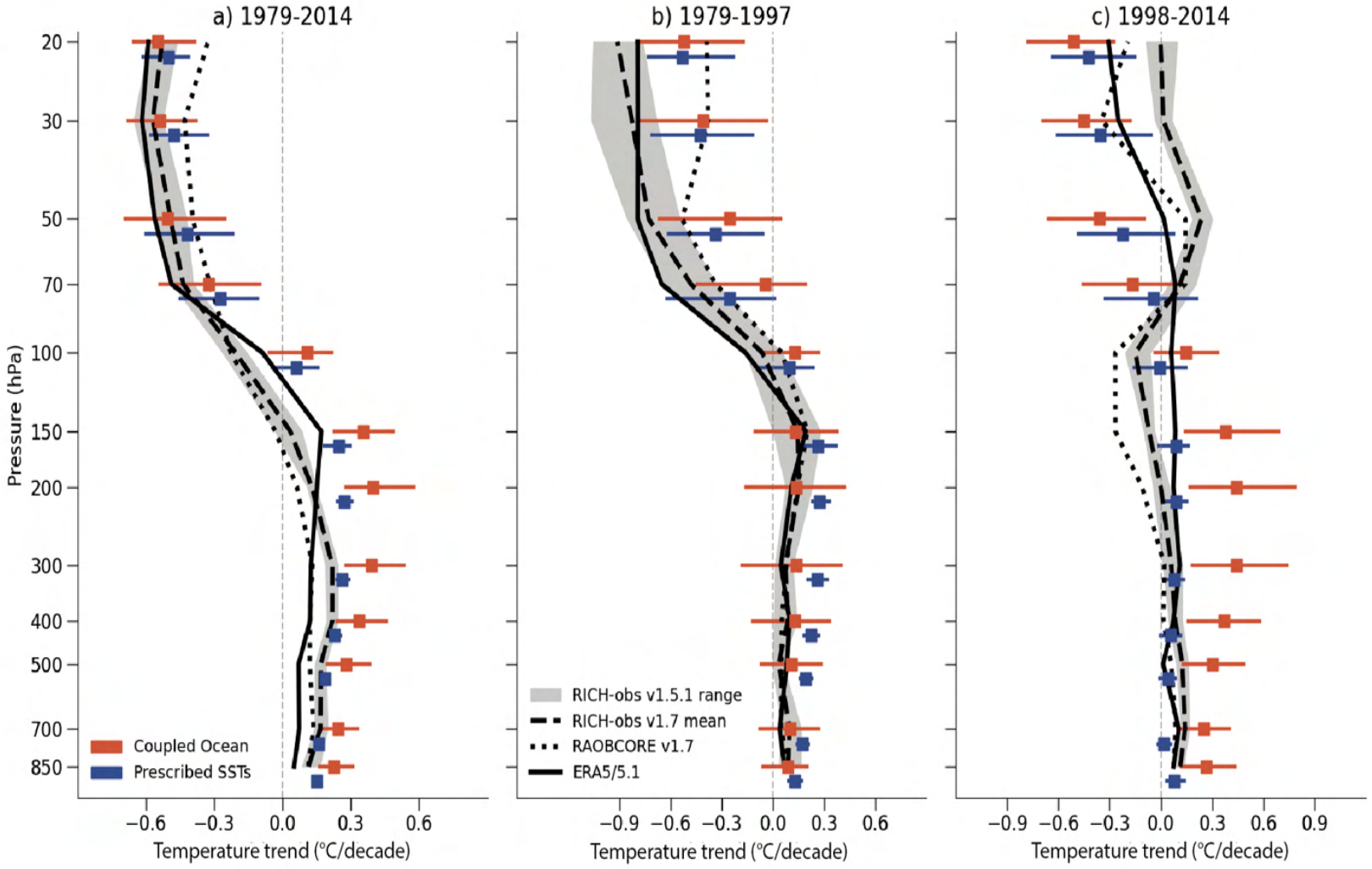
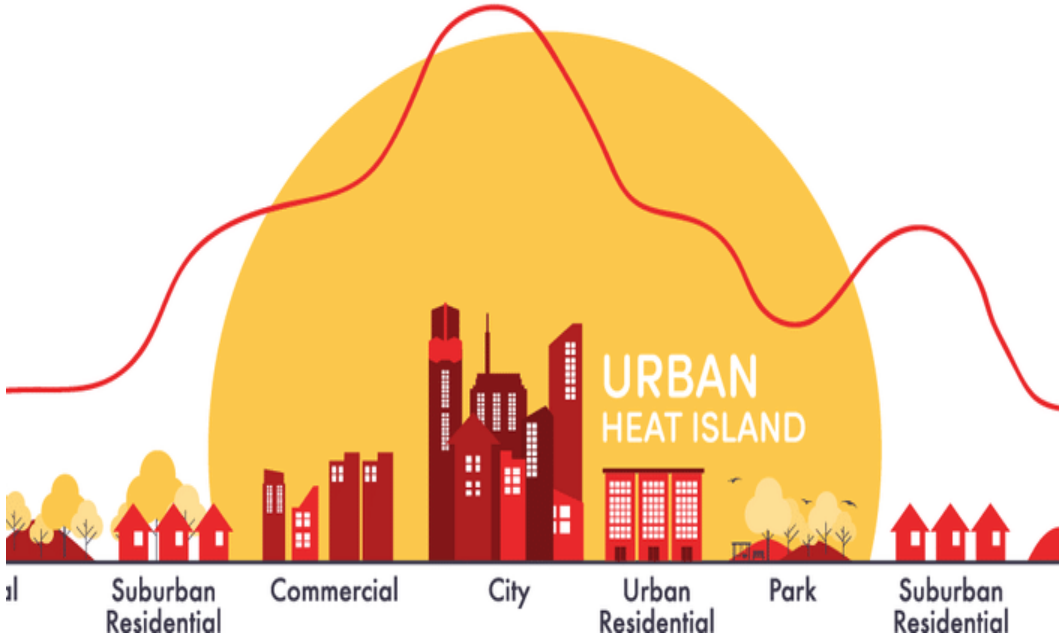
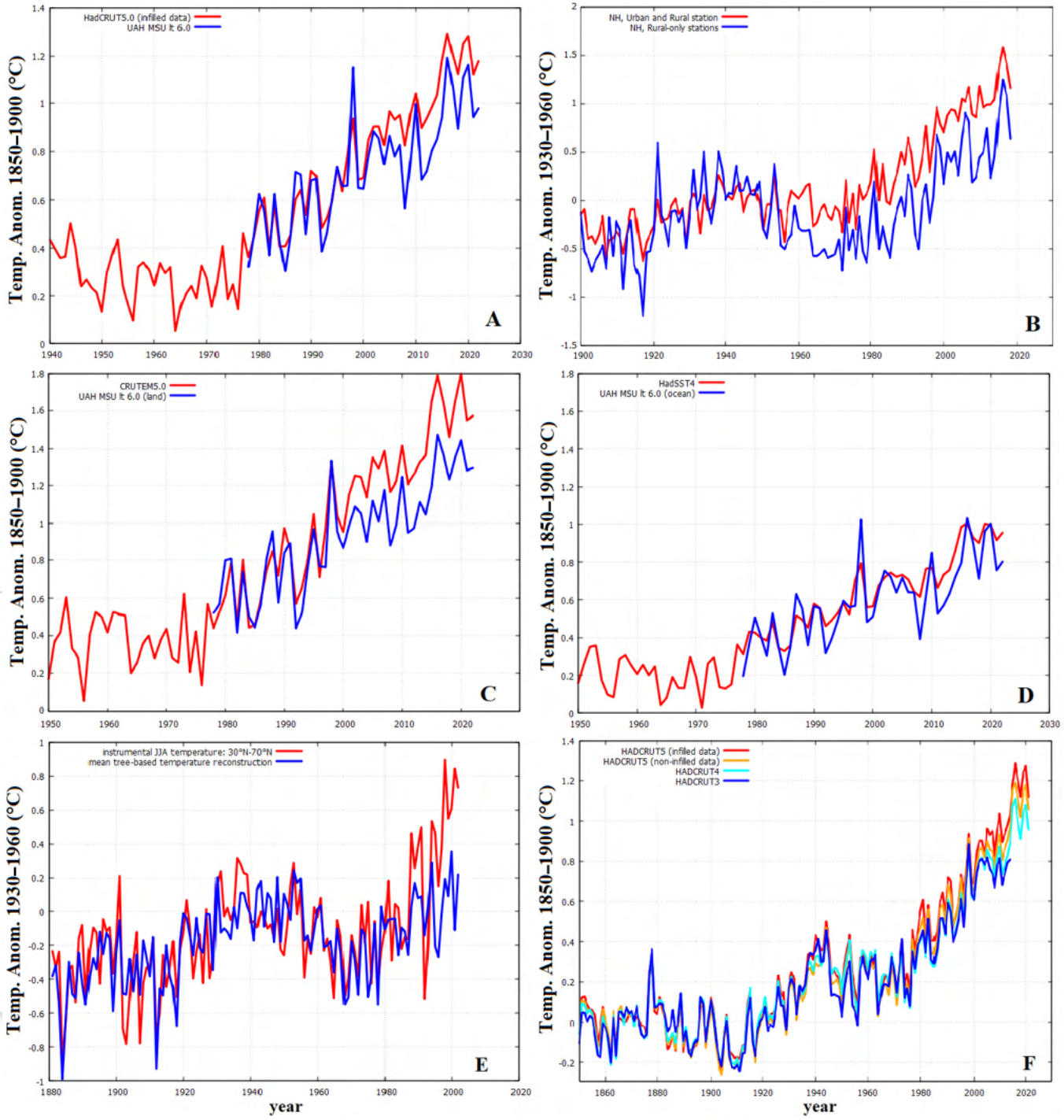


Figure 3.10 | Observed and simulated tropical mean temperature trends through the atmosphere. Vertical profiles of temperature trends in the tropics (20°S–20°N) for three periods: **(a)** 1979–2014, **(b)** 1979–1997 (ozone depletion era) and **(c)** 1998–2014 (ozone stabilization era). The black lines show trends in the Radiosonde Innovation Composite Homogenization (RICH) 1.7 (long dashed) and Radiosonde Observation Correction using Reanalysis (RAOBCORE) 1.7 (dashed) radiosonde datasets (Haimberger et al., 2012), and in the ERA5/5.1 reanalysis (solid). Grey envelopes are centred on the RICH 1.7 trends, but show the uncertainty based on 32 RICH-observations members of version 1.5.1 of the dataset, which used version 1.7.3 of the RICH software but with the parameters of version 1.5.1. ERA5 was used as reference for calculating the adjustments between 2010 and 2019, and ERA-Interim was used for the years before that. Red lines show trends in CMIP6 historical simulations from one realization of each of 60 models. Blue lines show trends in 46 CMIP6 models that used prescribed, rather than simulated, sea surface temperatures (SSTs). Figure is adapted from Mitchell et al. (2020), their Figure 1. Further details on data sources and processing are available in the chapter data table (Table 3.SM.1).



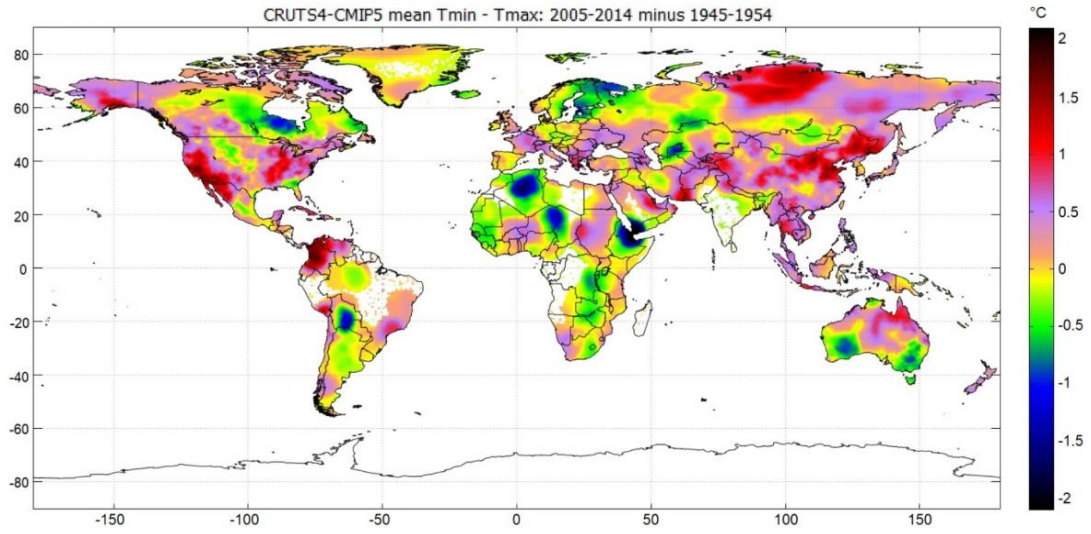
I record della temperatura superficiale sono probabilmente influenzati dal caldo urbano

- Scafetta, N. Detection of non-climatic biases in land surface temperature records by comparing climatic data and their model simulations. Clim Dyn 56, 2959–2982 (2021).

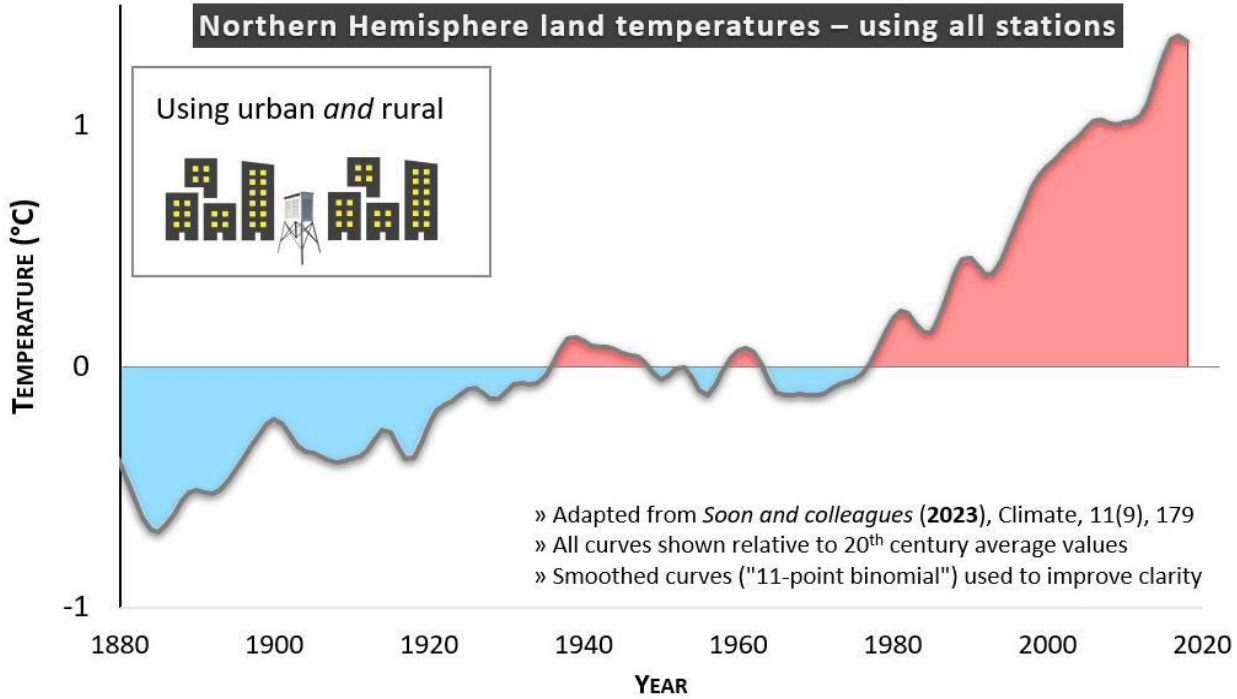


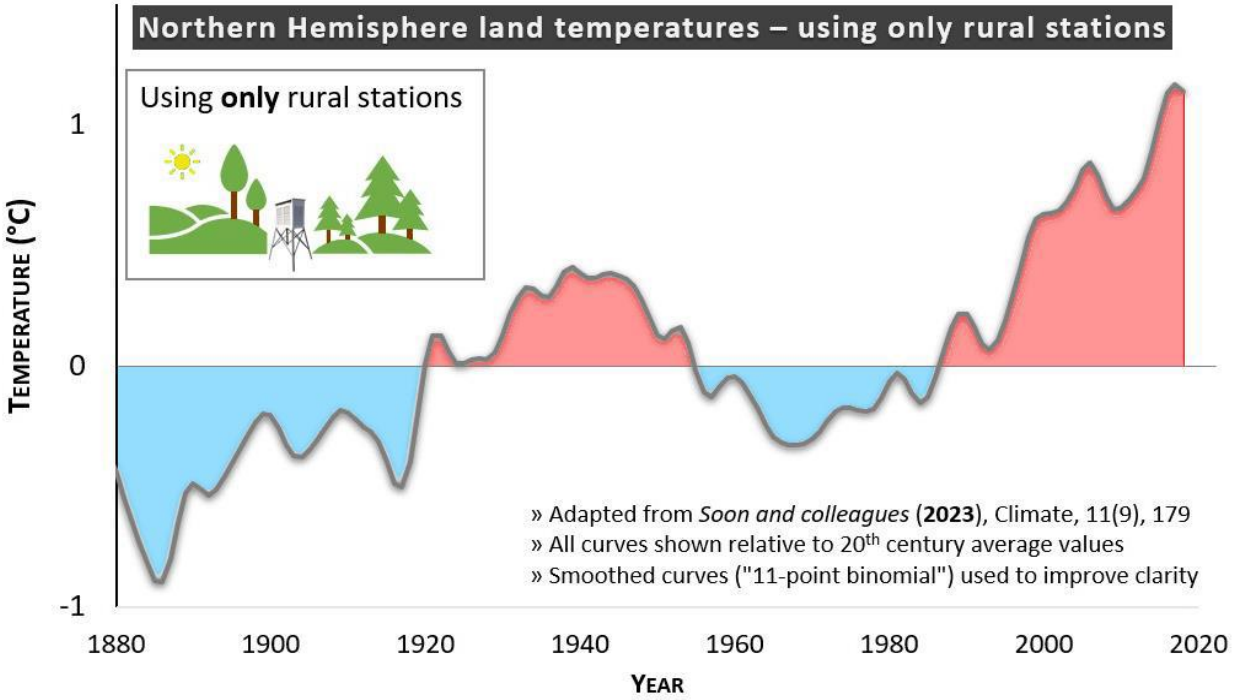
How does the rural-only temperature record compare to the urban & rural temperature record?

- Tiscaldamento iniziale fino agli anni ’40 e del raffreddamento fino agli anni ’70, che è più pronunciato nelle stazioni rurali.
- Il riscaldamento a lungo termine (0,6°C per secolo) è molto inferiore alle stime “urbane e rurali” (0,9°C per secolo)



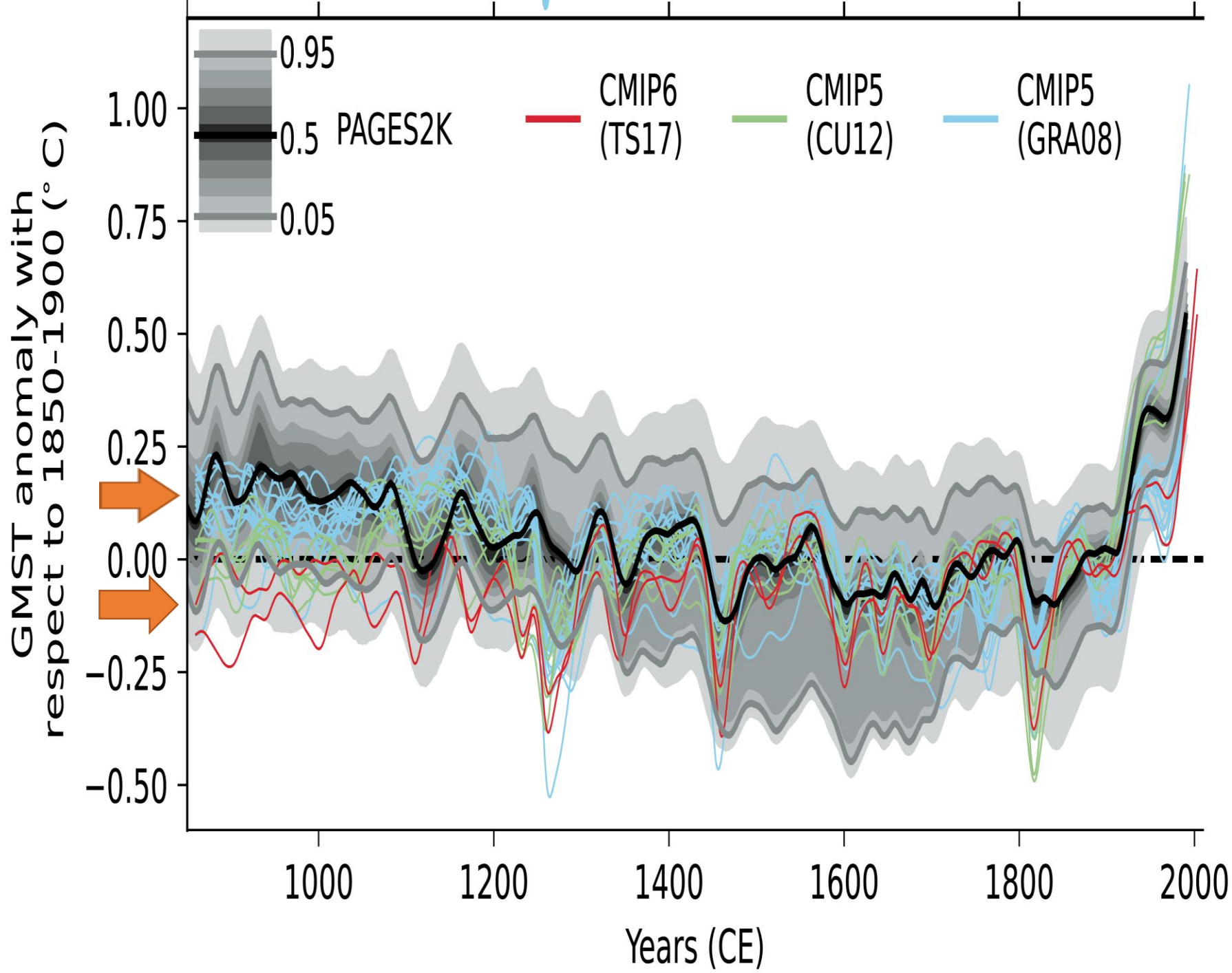
Scafetta Clim. Dyn.(2021); Soon et al. Climate (2023)





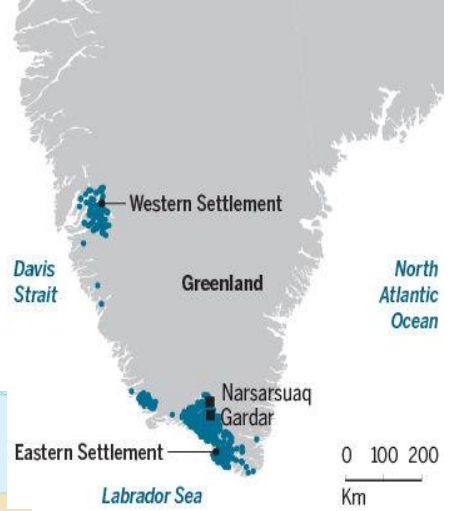
IPCC AR6 Figure 3.2, p. 432

Il periodo caldo medievale NON è riprodotto



Dall'850 al 1850 i GCM CMIP6 predicono un clima costante!

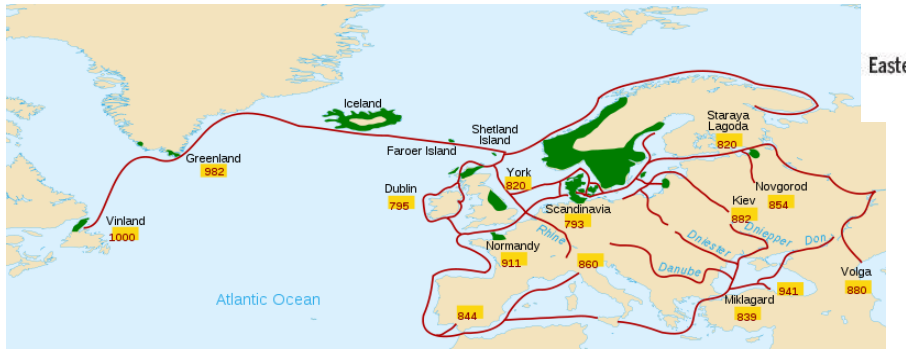
I Vichinghi in Groenlandia



https://ancientfoods.wordpress.com/2012/02/17/viking-barley-in-greenland/

Each grain of barley is only a couple of millimetres long, and the grain weighs less than 0.01 mg – yet the find is now regarded as an archaeological sensation.
Photos: Peter Steen Henriksen

Evidence suggests Vikings grew barley in south Greenland

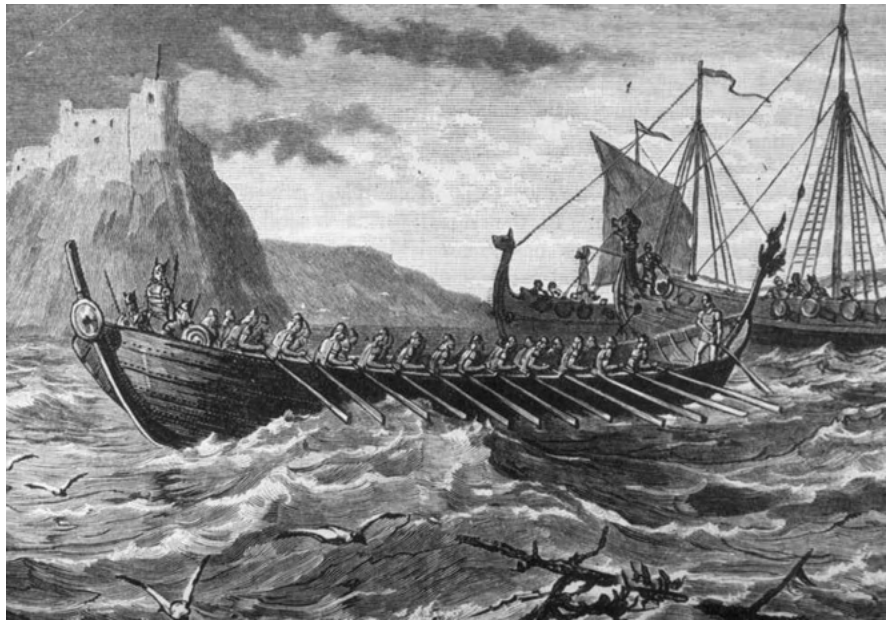


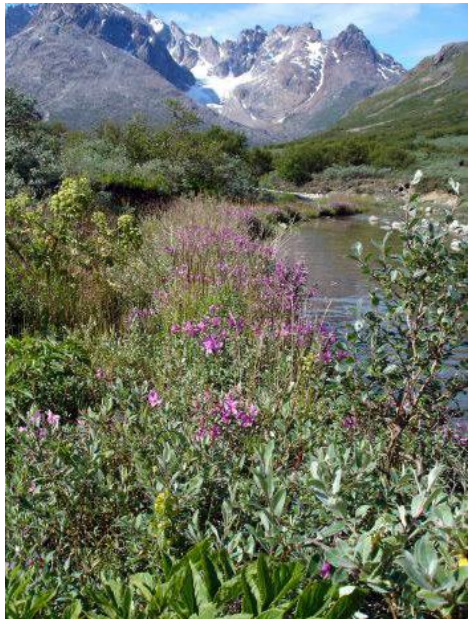
RESEARCH ARTICLE | FEBRUARY 06, 2019

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**





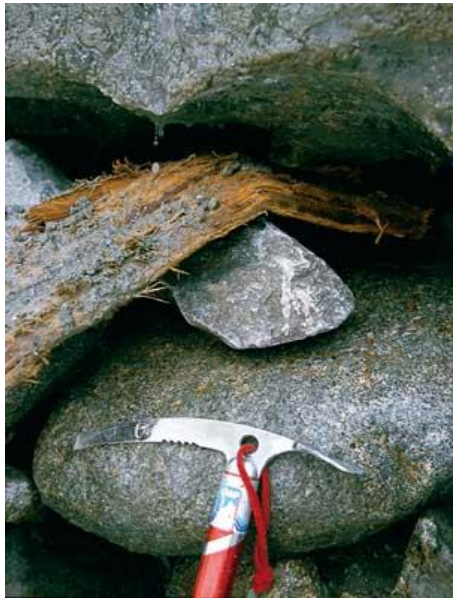
The Qinngua valley

Alberi sotto i ghiacciai

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

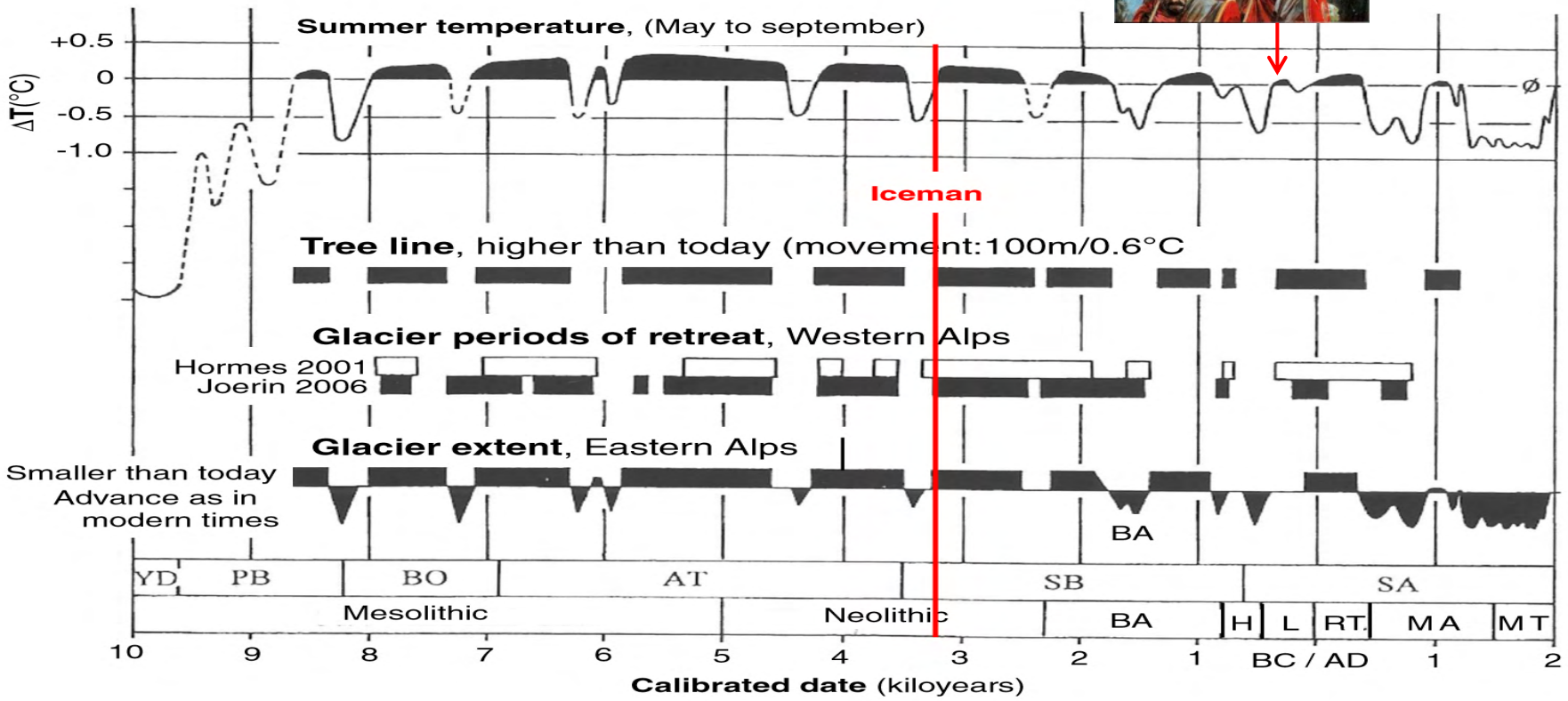


Christian Schlüchter: "Alpen ohne Gletscher? Holz- und Torffunde als Klimaindikatoren", Die Alpen, 6/2004; The Alps with little ice: evidence for eight Holocene phases of reduced glacier extent in the Central Alps, The Holocene, 2001, 11/3: 255-265

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).

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

Annibale

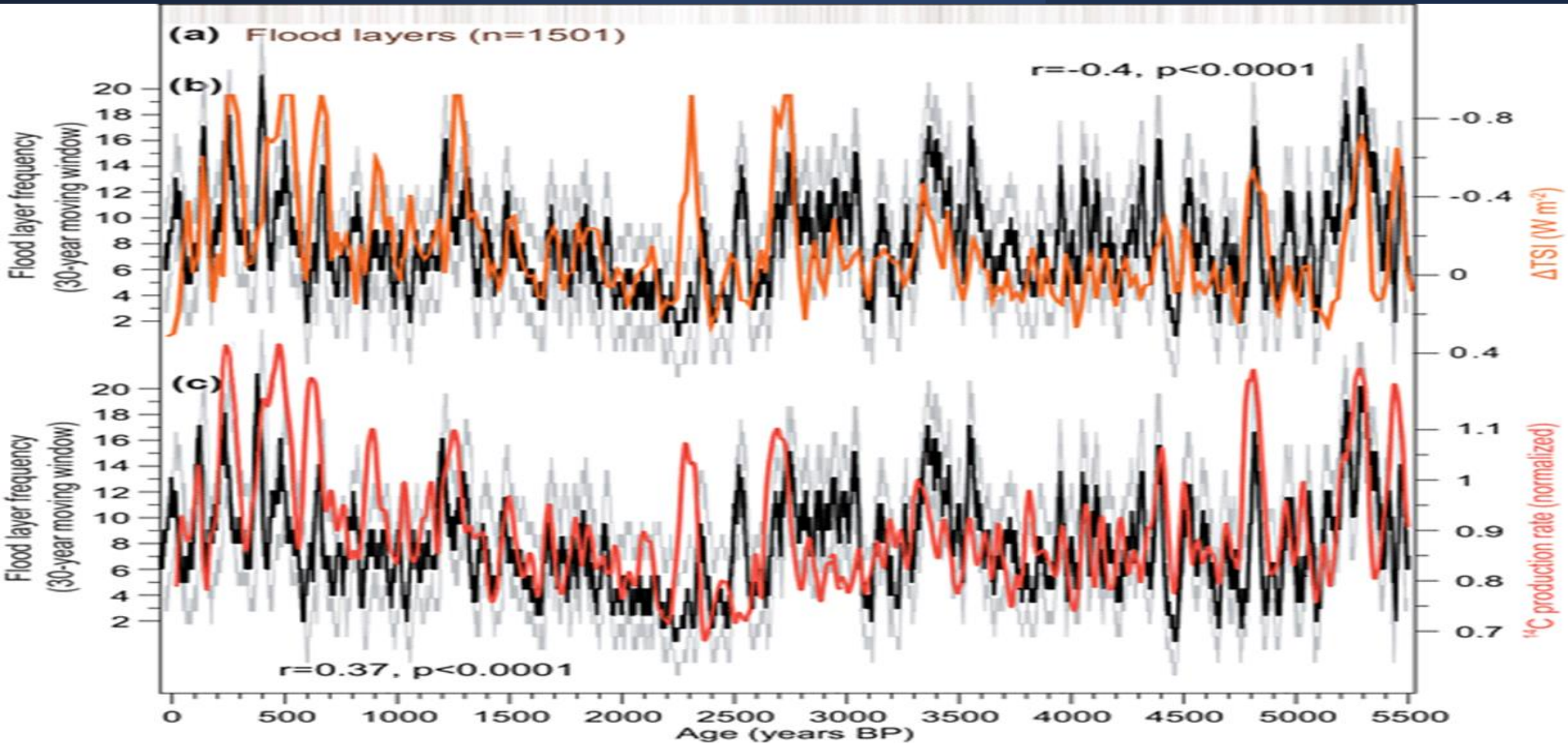


Kutschera, W., Patzelt, G., Steier, P., Wild, E.M.: 2017. The tyrolean iceman and his glacial environment during the holocene. Radiocarbon 59(2), pp. 395-405

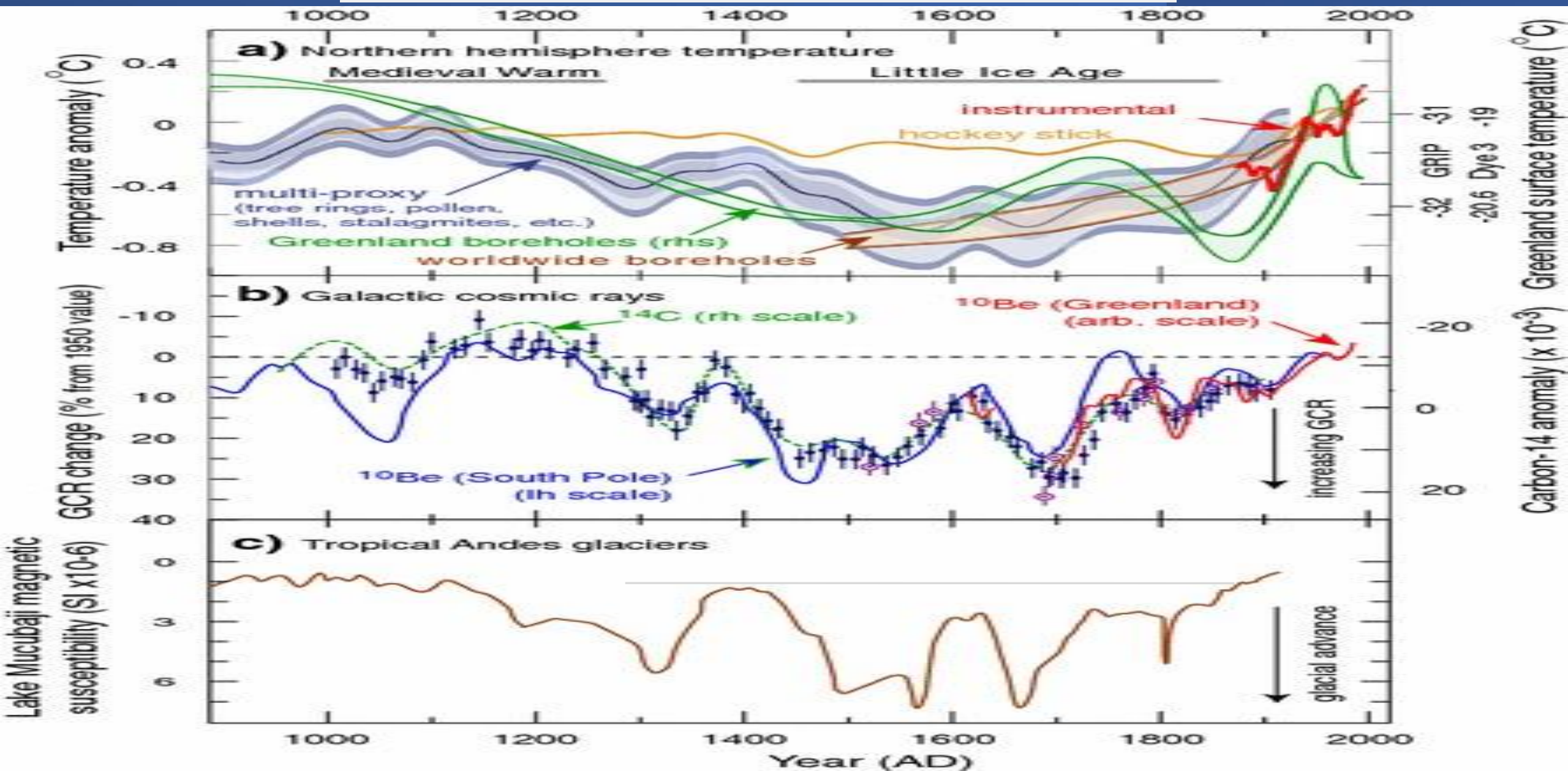
Figure 7 Schematic presentation of glacier and tree-line movements during the Holocene. The periods of smaller glaciers and higher tree lines are indicated with the box symbols. Glacial advances are indicated with filled triangles and curves. The largest advances took place during the Little Ice Age (~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.

Czymzik, M., Muscheler, R., and Brauer, A.: Solar modulation of flood frequency in central Europe during spring and summer on interannual to multi-centennial timescales, Clim. Past, 12, 799–805, 2016.

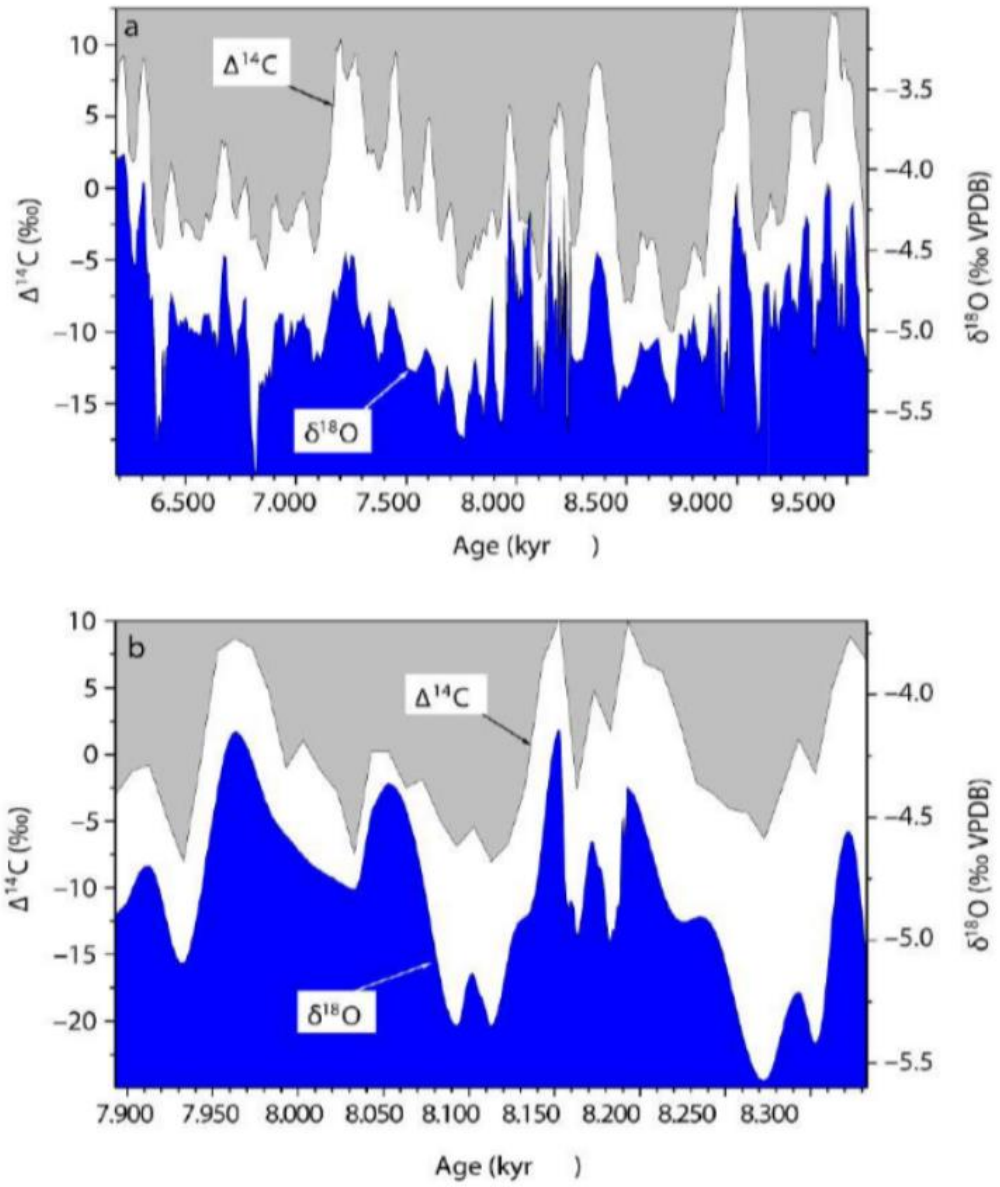
Forti correlazioni tra sole e alluvioni



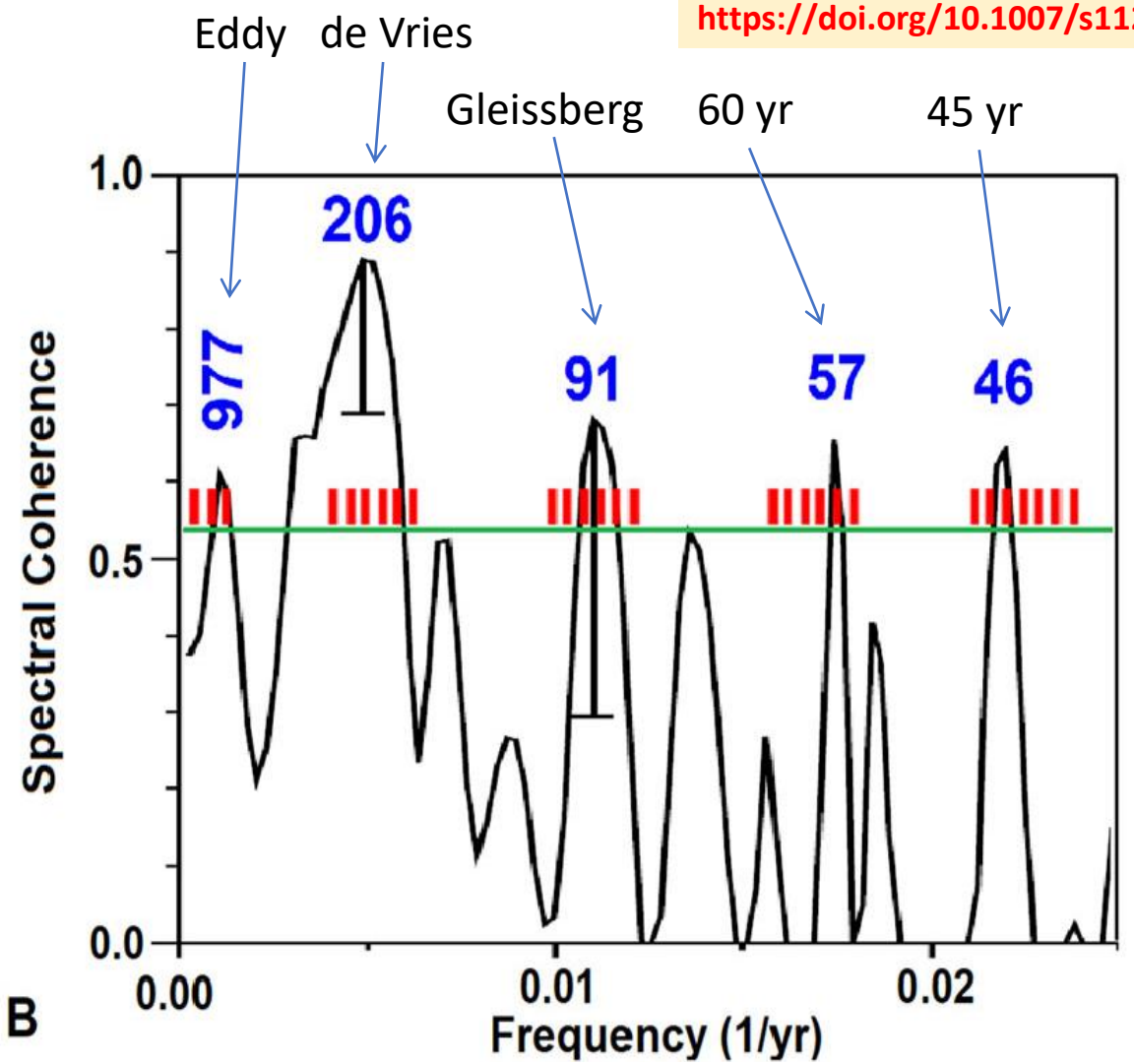
Numerose evidenze di un Periodo Caldo Medievale e di altri periodi caldi dell'Olocene indotti dal Sole



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



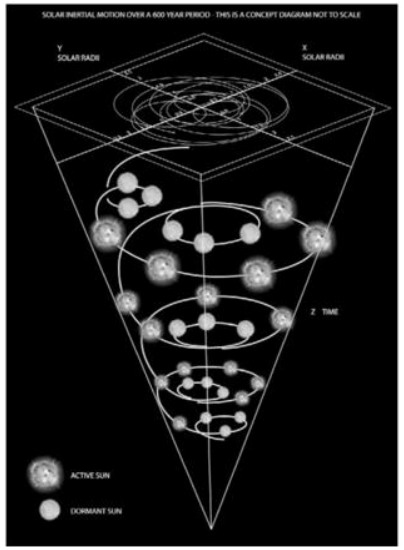
U. Neff et al., Nature 411, 290 - 293 (2001)

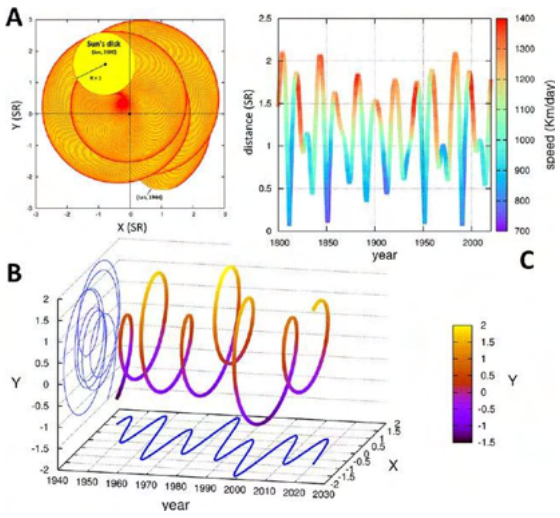
"Orbital Invariant Inequalities"

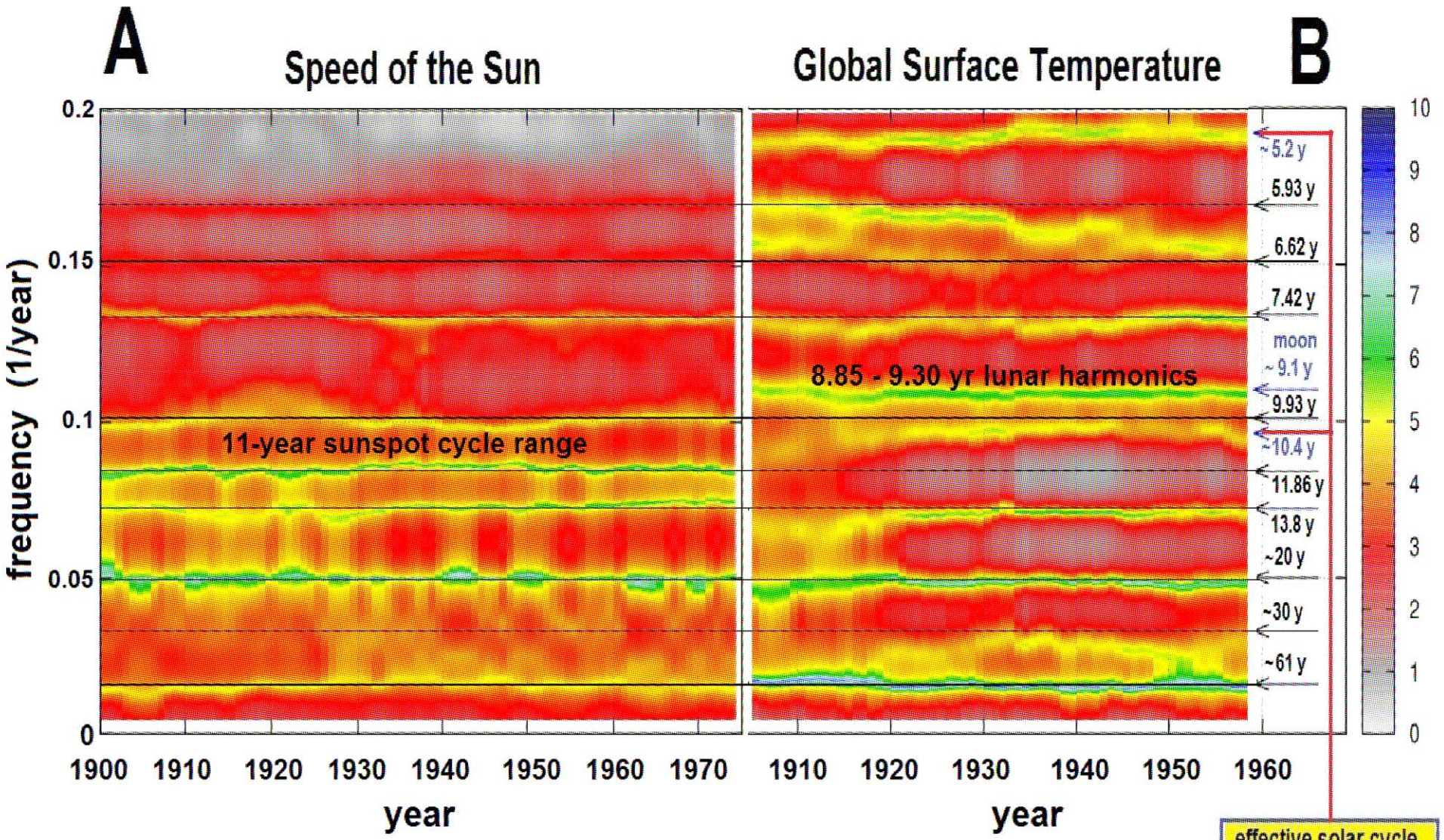
95%

Beats among Jupiter, Saturn Uranus, Neptune

Il clima della Terra presenta le stesse oscillazioni presenti nel sistema solare



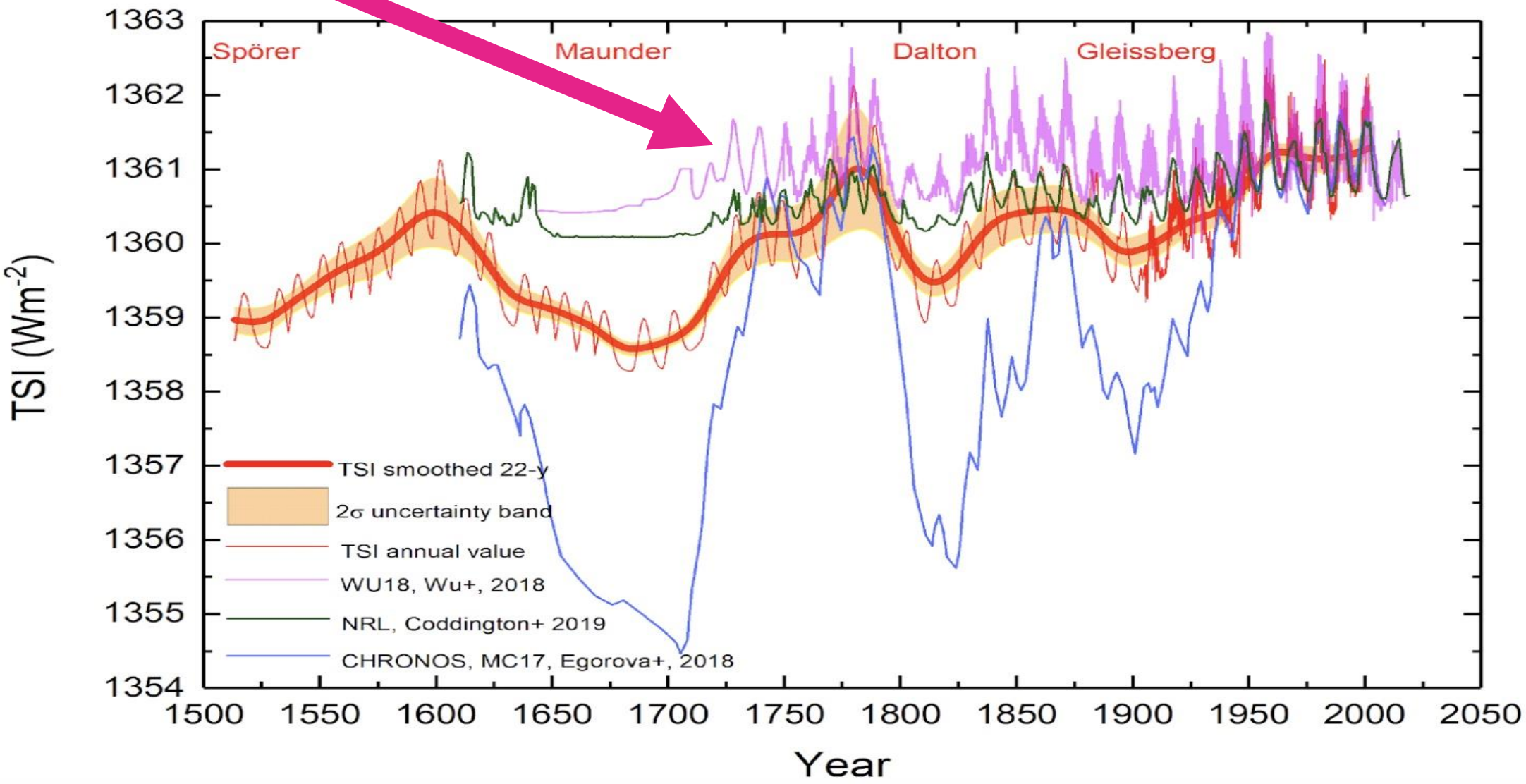




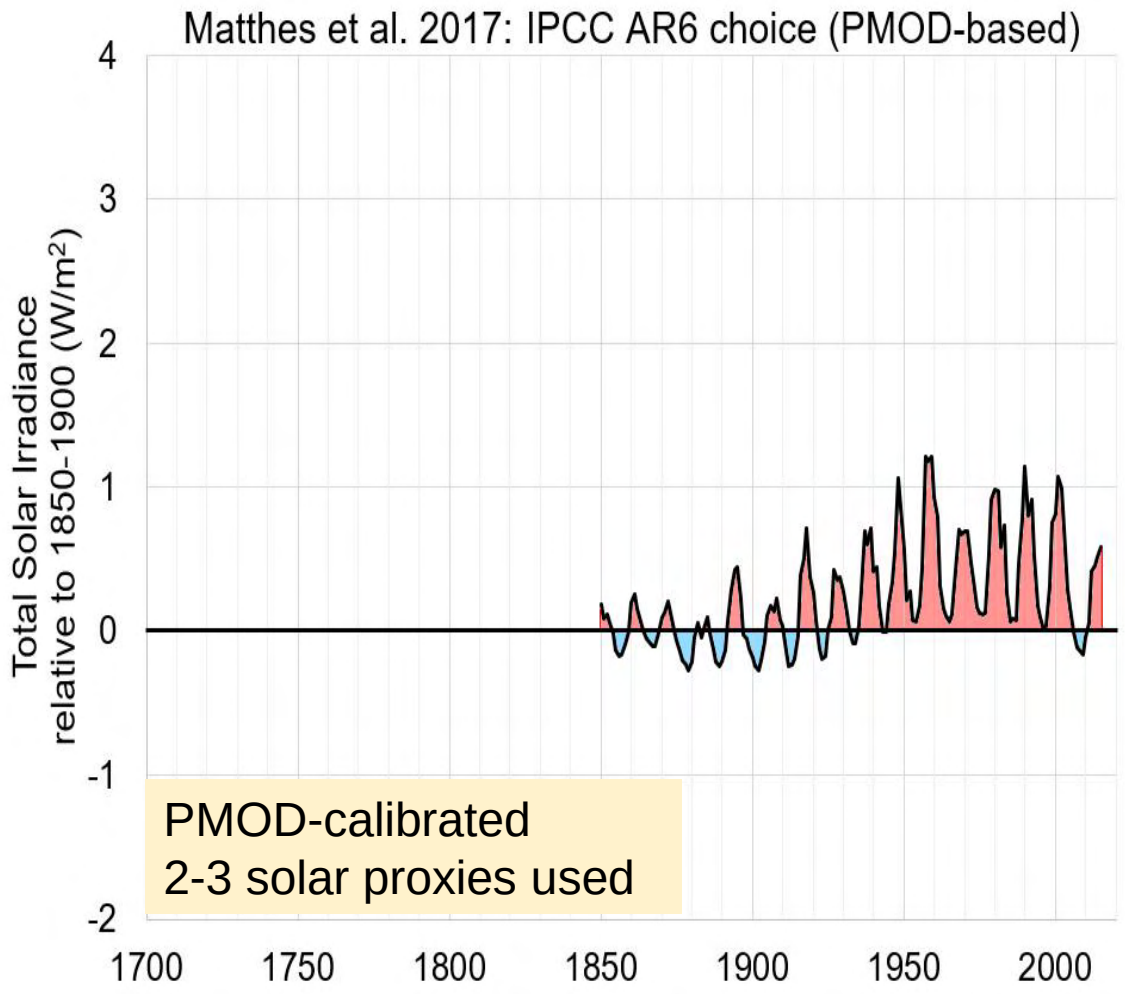
Scafetta, N., "Discussion on the spectral coherence between planetary, solar and climate oscillations: a reply to some critiques." *Astrophysics and Space Science*, vol. 354, pp. 275-299, 2014.

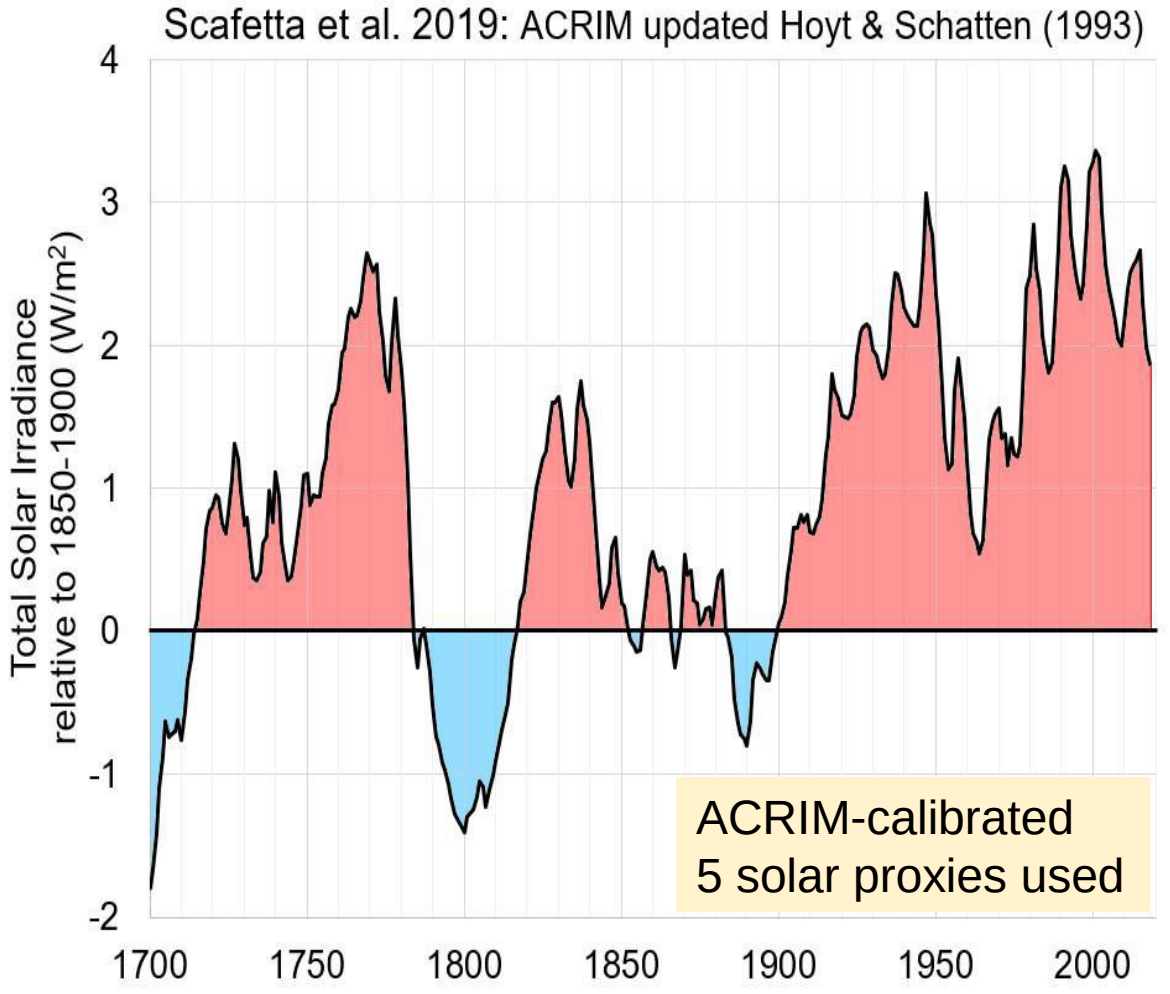
CMIP6 GCMs

- Penza, Berrilli, Bertello, Cantoresi, Criscuoli, Giobbi, Total Solar Irradiance during the Last Five Centuries, The Astrophysical Journal, 937:84, 2022



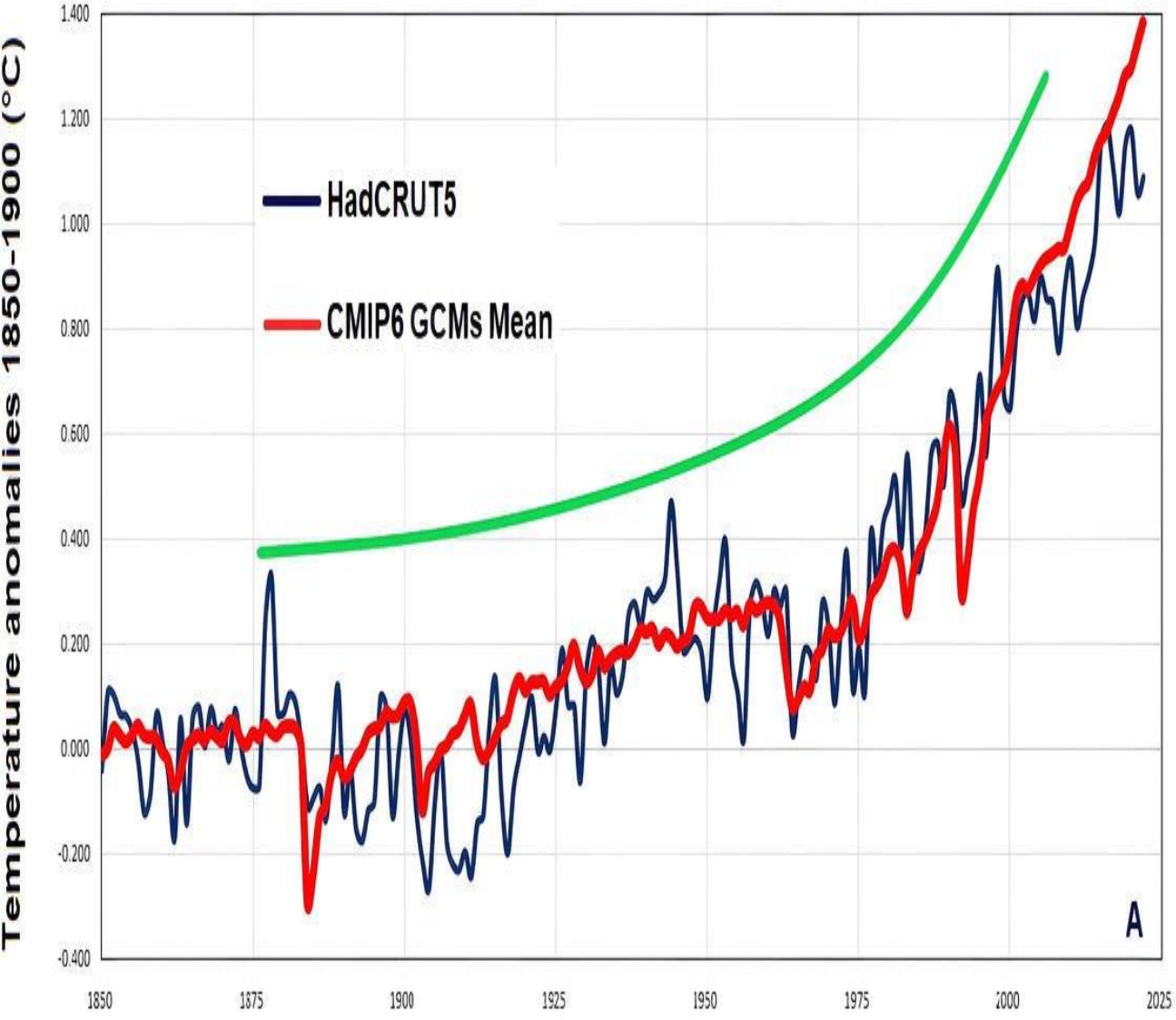
Utilizzo di compositi TSI satellitari per calibrare i proxy solari





L’80% dell’influenza solare sul clima potrebbe non essere causato esclusivamente dalla forzante dell’irradiazione solare totale, ma piuttosto da altri processi climatici solari (ad esempio i raggi cosmici).

Scafetta, N.: Empirical assessment of the role of the Sun in climate change using balanced multi-proxy solar records. Geoscience Frontiers 14(6), 101650, 2023. Pagina Web: https://doi.org/10.1016/j.gsf.2023.101650



Cosa si conclude dai fatti che:

1) L’unico scenario di sviluppo economico realistico per il XXI secolo è l’SSP2-4.5.

2) La sensibilità climatica alla CO2 è relativamente bassa.

3) Ci sono molteplici evidenze che i modelli sottostimano enormemente l’effetto solare e che il riscaldamento misurato sin dal 1900 è ragionevolmente sovrastimato dal riscaldamento urbano.

Scafetta, N.: 2024. Impacts and risks of “realistic” global warming projections for the 21st century. Geoscience Frontiers 15(2), 101774. https://doi.org/10.1016/j.gsf.2023.101774

“Impatti e rischi di proiezioni realistiche del riscaldamento globale per il ventunesimo secolo”

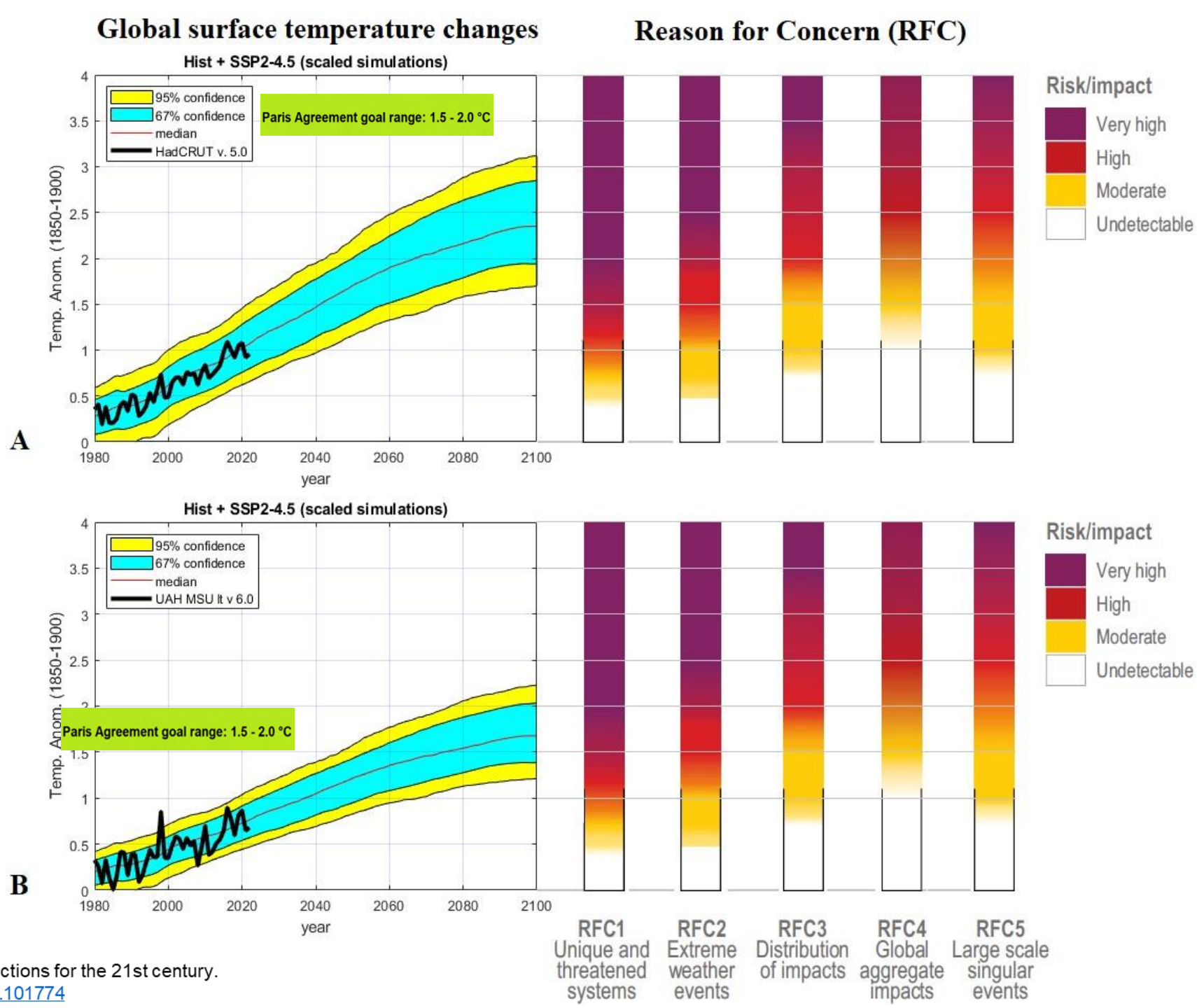
Si **usa lo scenario:**

SSP2-4.5 scenario

GCM ottimizzati:

A) Sulle temperature superficiali

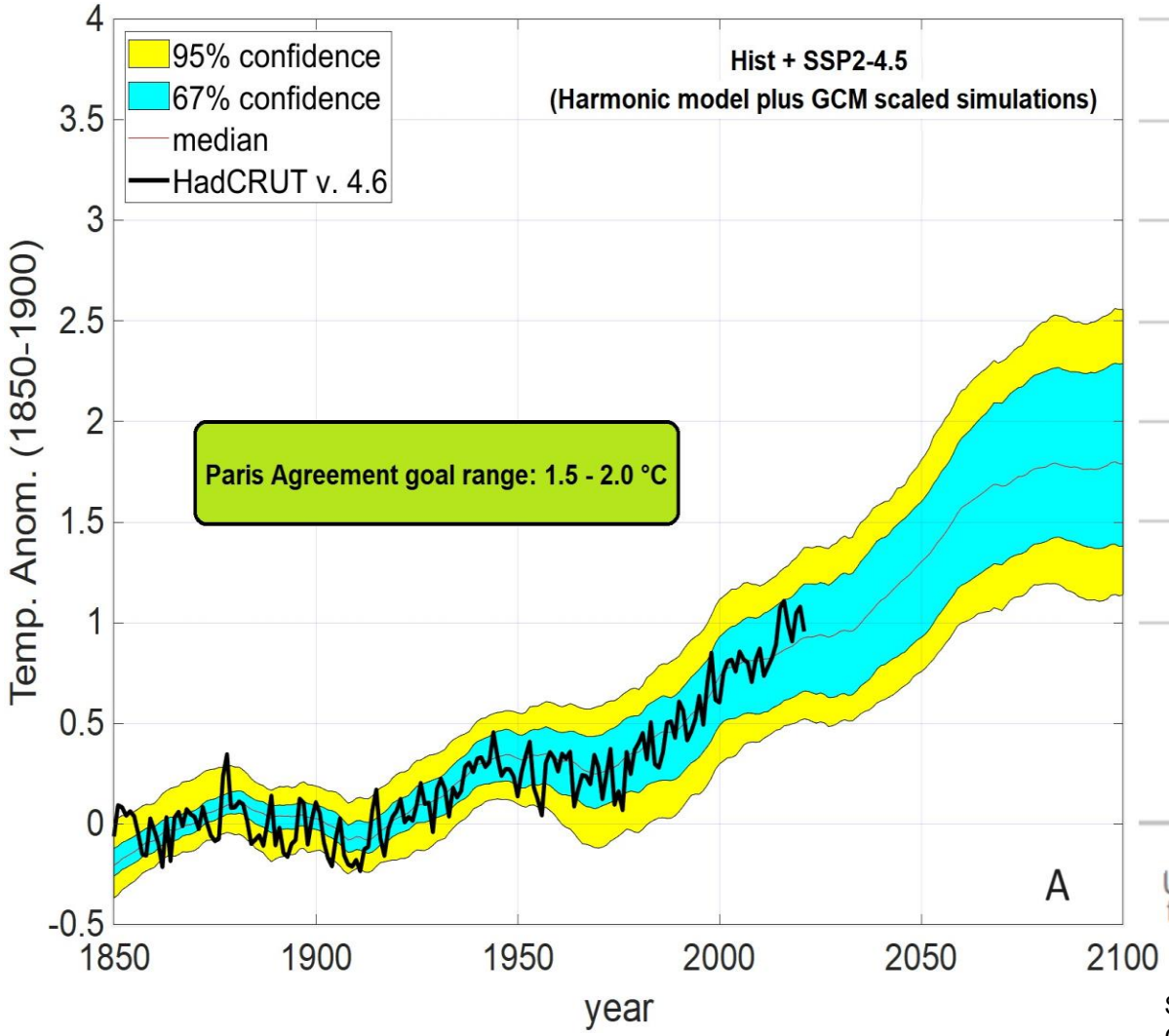
B) Sulle temperature della bassa troposfera

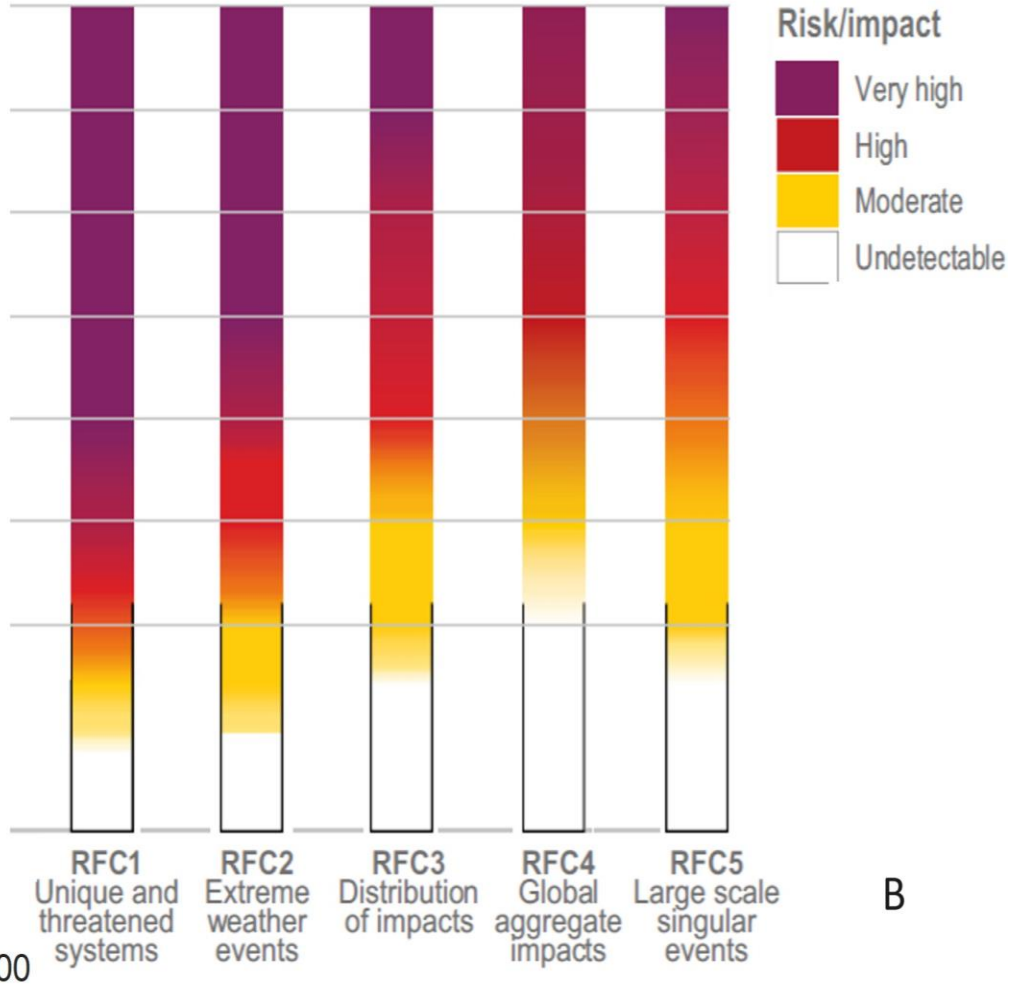


Scafetta, N.: 2024. Impacts and risks of “realistic” global warming projections for the 21st century. Geoscience Frontiers 15(2), 101774. https://doi.org/10.1016/j.gsf.2023.101774

GCM ottimizzati assumendo la variabilità naturale non riprodotta dai modelli

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.

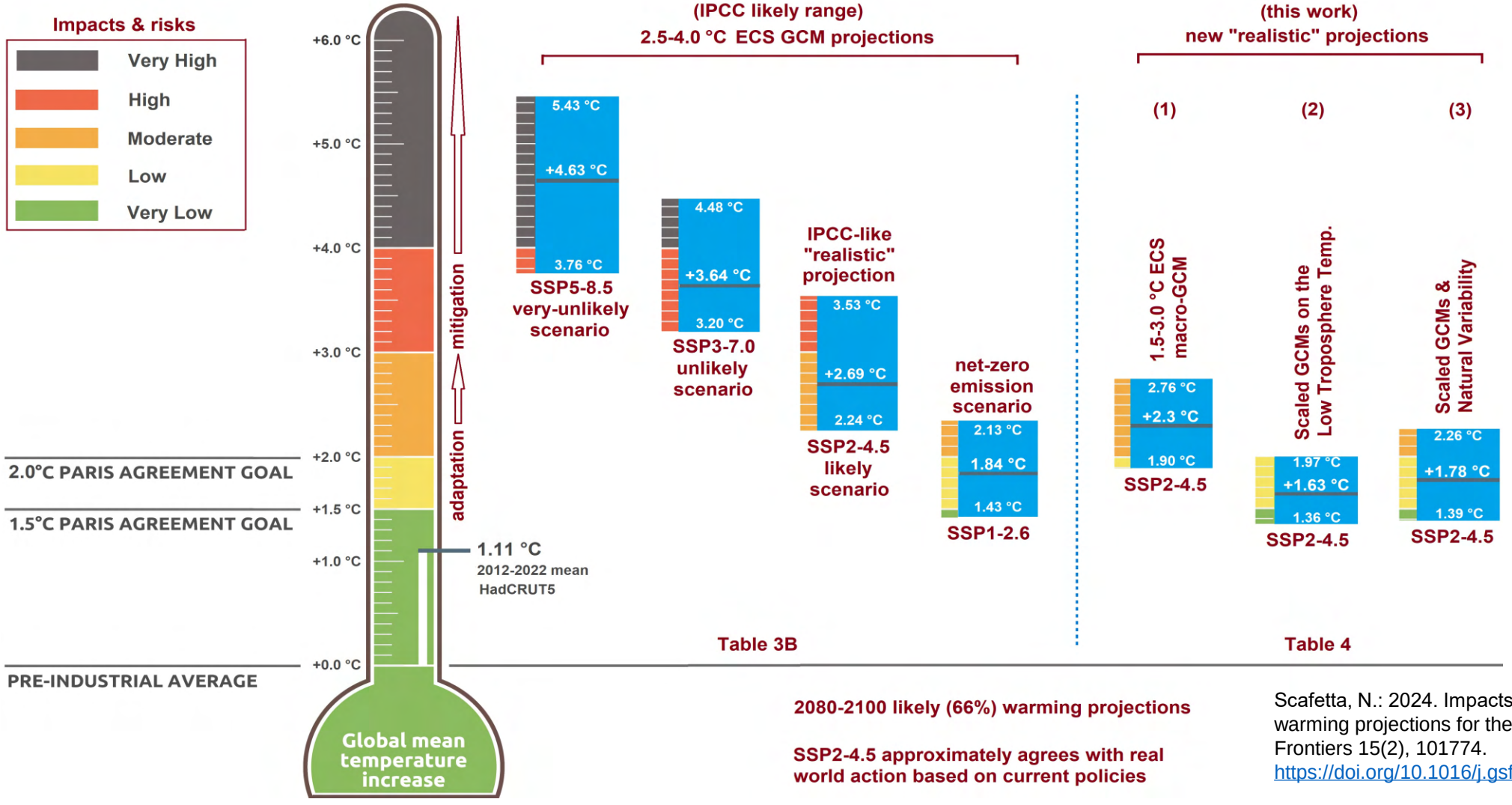




Scafetta, N.: 2024. Impacts and risks of “realistic” global warming projections for the 21st century. Geoscience Frontiers 15(2), 101774. https://doi.org/10.1016/j.gsf.2023.101774

Conclusione:
l'allarmismo climatico non è giustificato

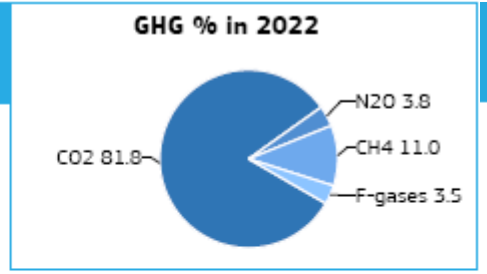
L'SSP 2-4.5 è sufficiente per soddisfare l'accordo di Parigi



Scafetta, N.: 2024. Impacts and risks of "realistic" global warming projections for the 21st century. Geoscience Frontiers 15(2), 101774.
https://doi.org/10.1016/j.gsf.2023.101774

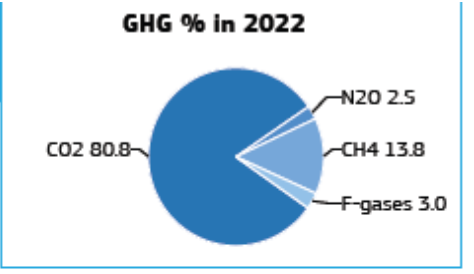
Curiosità

Italy, San Marino and the Holy See

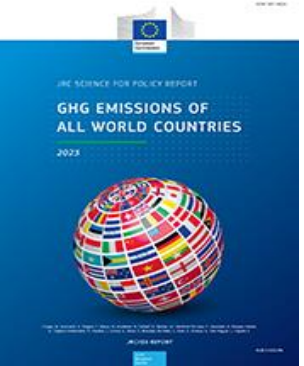


Year	GHG emissions Mt CO_2eq/yr	GHG emissions per capita t CO_2eq/cap/yr	GHG emissions per unit of GDP PPP t CO_2eq/kUSD/yr	Population
2022	394.748	6.698	0.153	58.937M
2015	430.297	7.231	0.176	59.504M
2005	580.427	9.870	0.226	58.809M
1990	513.738	8.993	0.248	57.127M

China



Year	GHG emissions Mt CO_2eq/yr	GHG emissions per capita t CO_2eq/cap/yr	GHG emissions per unit of GDP PPP t CO_2eq/kUSD/yr	Population
2022	15684.627	10.954	0.611	1.432G
2015	13479.880	9.649	0.775	1.397G
2005	8431.922	6.380	1.212	1.322G
1990	4073.563	3.474	2.520	1.172G



Country	1990	2000	2005	2015	2020	2021	2022	2022 %
unit	Mton CO_2eq	Mton CO_2eq	Mton CO_2eq	Mton CO_2eq	Mton CO_2eq	Mton CO_2eq	Mton CO_2eq	% World Tot
EU27	4915.14	4513.34	4597.10	3922.02	3427.44	3617.74	3587.80	6.67
China	4073.56	5425.51	8431.92	13479.88	14879.56	15632.89	15684.63	29.16
Italy, San Marino and the Holy See	513.74	545.78	580.43	430.30	367.41	392.96	394.75	0.73

Nuove centrali elettriche a carbone in costruzione o in progetto

https://globalenergymonitor.org/projects/global-coal-plant-tracker/tracker/

Global Energy Monitor | Global Coal Plant Tracker | MAP | DASHBOARD

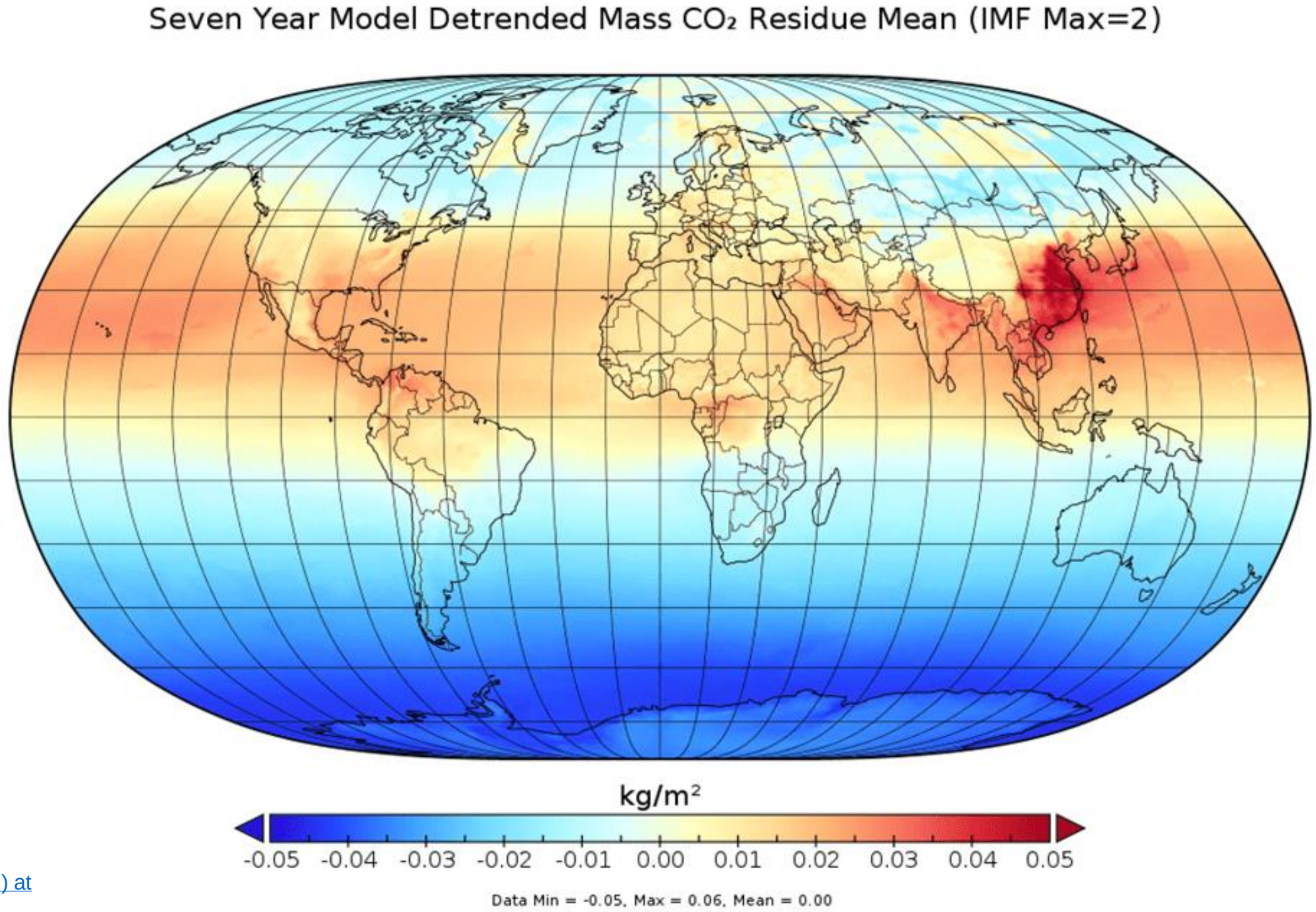
Map | Table | About | Summaries | Restart

Status filtered
Tracking 1,039 coal-fired units

Basemap
Hybrid
Satellite

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

Media della concentrazione residua di CO2 detrendizzata dal 2015 alla fine del 2019.



OCO-2 GEOS Level 3 monthly, 0.5x0.625 assimilated CO2 V10r (OCO2_GEOS_L3CO2_MONTH) at GES DISC (nasa.gov)

Climate Change Economics, Vol. 14, No. 4 (2023) 2340003 (18 pages)

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COSTS AND BENEFITS OF THE PARIS CLIMATE TARGETS

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The temperature targets in the Paris Agreement cannot be met without very rapid reduction of greenhouse gas emissions and removal of carbon dioxide from the atmosphere. The latter requires large, perhaps prohibitively large subsidies. The central estimate of the costs of climate policy, unrealistically assuming least-cost implementation, is 3.8–5.6% of GDP in 2100. The central estimate of the benefits of climate policy, unrealistically assuming high no-policy emissions and constant vulnerability, is 2.8–3.2% of GDP. The uncertainty about the benefits is larger than the uncertainty about the costs. The Paris targets do not pass the cost-benefit test unless risk aversion is high and discount rate low.

Keywords: Climate policy; net-zero; cost-benefit analysis.

JEL Code: Q54

Benefici ipotizzando il riscaldamento globale nel caso peggiore basato su SSP5-8.5

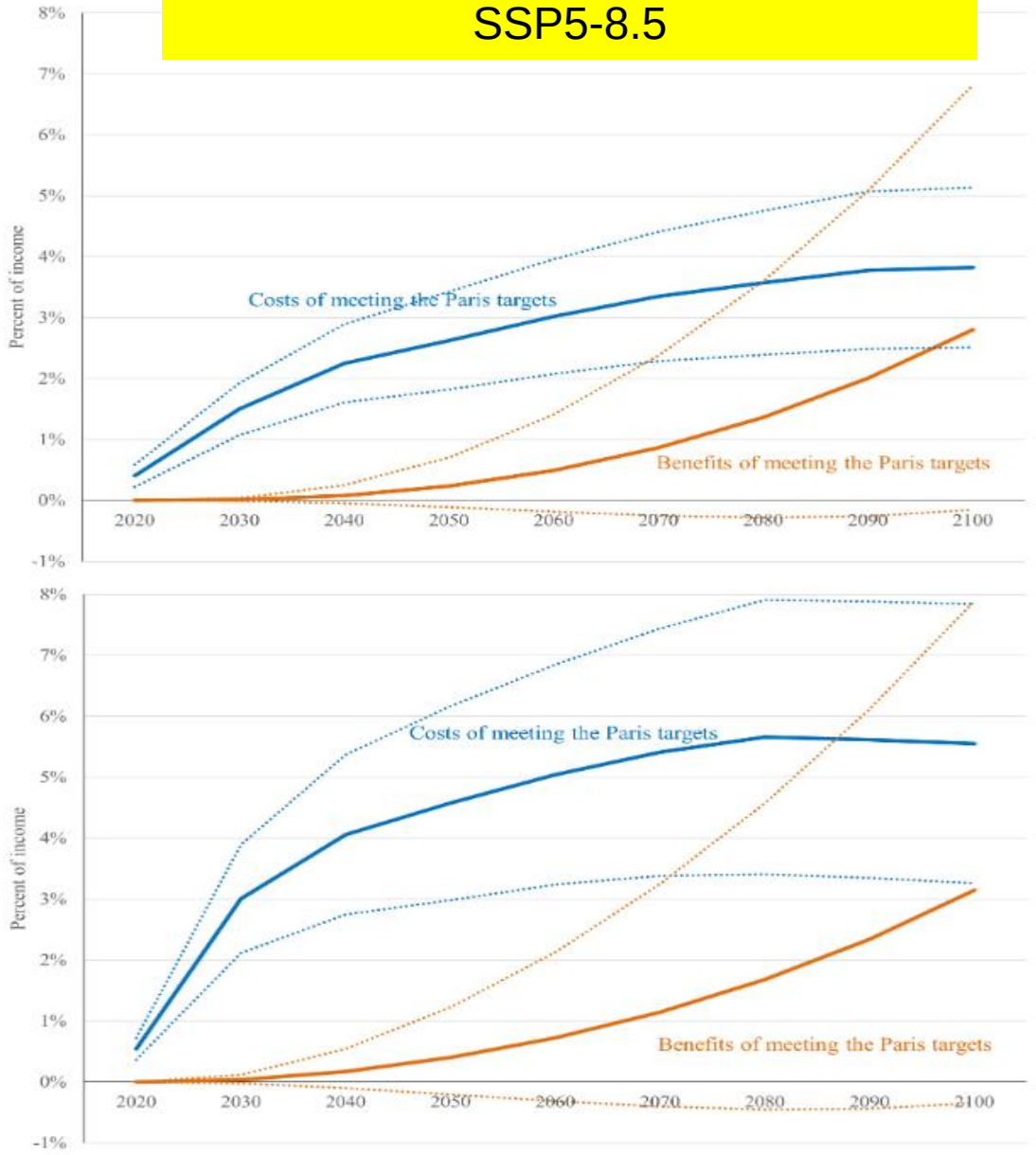

Figure 4. Costs and benefits of meeting the Paris targets of 2.0°C (top panel) and 1.5°C (bottom) global warming.

Geosystems and Geoenvironment 2 (2023) 100136

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Net zero climate remediations and potential terminal depletion of global critical metal resources: A synoptic geological perspective

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ABSTRACT

Over the past two decades, concerns about anthropogenic CO_2 emissions have led to computer-based climate models of the consequences, first on global warming and then on more general climate change. The more extremes of these models have been used to engender concerns about climate events that could be catastrophic for global populations even though natural climate change has always been incremental with only periodic large volcanic eruptions producing short-term catastrophic changes due to massive additions of aerosols to the atmosphere. Climate change accords have led to widespread acceptance of Net Zero by 2060 targets. However, indicative modelling of the nexus between clean energy and the critical metals required for low carbon solar and wind technologies and electric vehicles and their chargers indicates that many metals, particularly Co, Ni, Cu, Se, Ag, Cd, In, Te, and Pt, may be severely to terminally depleted by 2060, making further low carbon technology production impossible. Mineral exploration and currently unmined deposits with high risk factors are only likely to be able to replace these non-renewable metals at lower grades in more inaccessible or deeper mines, leading to even further increases in conventional energy for mining and metallurgy and consequent cost of the low carbon technology revolution. There is no current indication that recycling can replace the critical metal stocks. The heterogeneous global distribution of both mineral deposits containing the critical metals and production points could become a geopolitical issue if global security declines. These factors combined with the slow incremental, rather than catastrophic, changes related to climate change, suggest that a reset in Net Zero ambitions should be made to consider a more multicomponent plan for the future that involves a balanced portfolio of least polluting energy sources that do not cause serious depletion of affordable metal resources for the future.

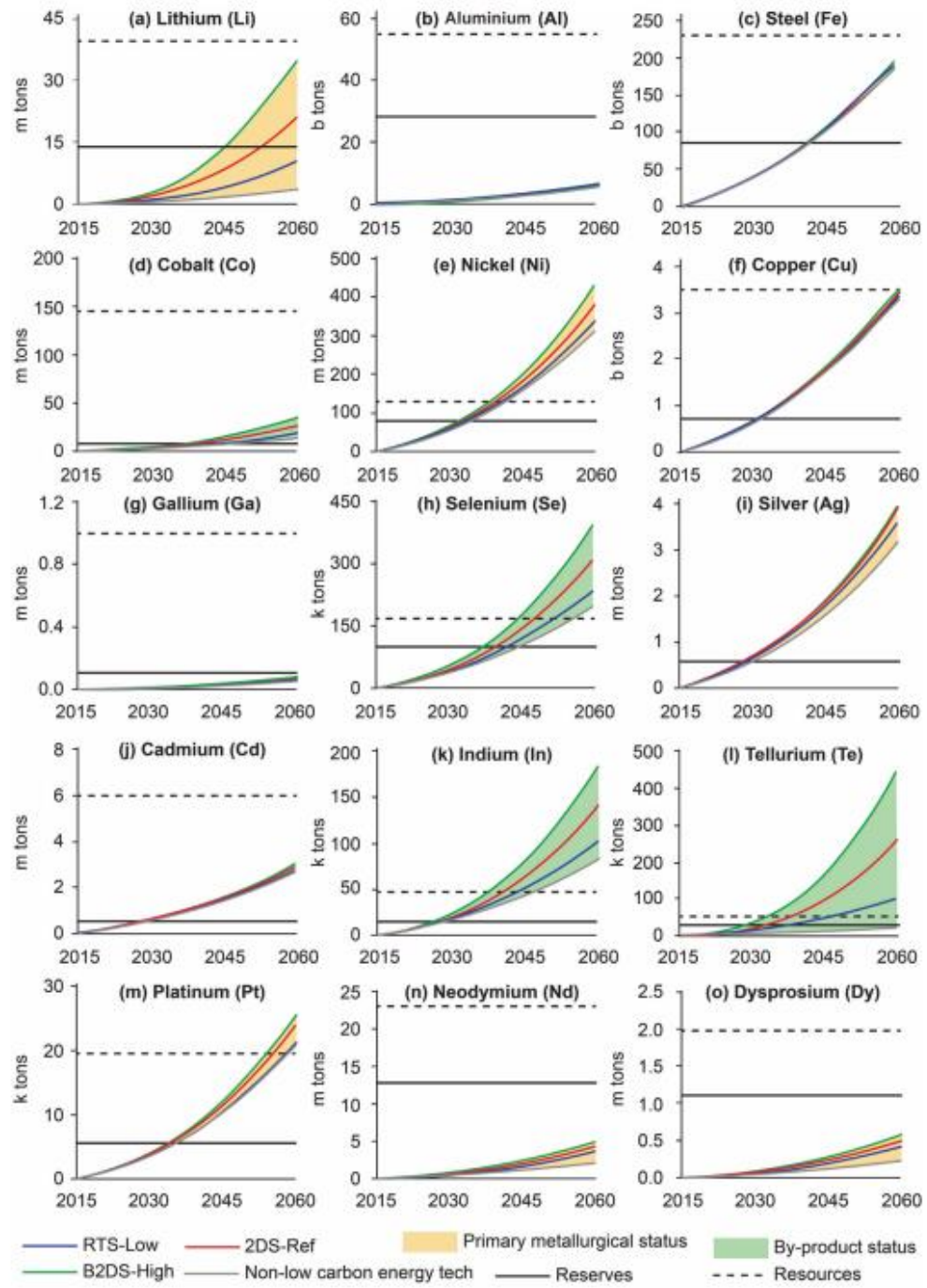

Fig. 4. Estimated cumulative demand for uses of all critical metals ordered in terms of increasing atomic number used in low carbon technologies from 2016 to 2060. Curves coloured orange to indicate primary metallurgical status of metal and green to indicate by-product status of metal. Adapted from Watari et al. (2018).

L’Europa riuscirà a salvare il mondo?

- Dal 1900 ad oggi la temperature è aumentata di circa 1.10 °C e dal 1900 ad oggi la CO2 è aumentata di circa 110 ppm, quindi abbiamo circa:
  1 ppm di CO2 = 0.01 °C (al massimo)

- Ora la CO2 sta aumentando con un velocità di circa 2.5 ppm all’anno e l’Europa (EU27) contribuisce solo l’ 6.7% di tutte le emissioni mondiali e quindi potrebbe al massimo essere responsabile di 2.5x0.067 = 0.0017 °C di riscaldamento all’anno.

- Se riduciamo le emissioni del 40% come voluto dalla EU per raggiungere il net-zero 2050, il guadagno climatico sarà di 0.0017x0.40 = 0.0007°C per anno (al massimo).

- Questo significa che ci vogliono 15 anni (di fame) per salvare 0.01 °C (al massimo, e Cina, India, ecc. permettendo)…..!

Le automobili elettriche sono il futuro? Beh, nell'Ottocento….