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INSEGNARE GEOGRAFIA

# Rischio climatico e transizione

Relatore: Luca Mercalli

Società Meteorologica Italiana  
[www.nimbus.it](http://www.nimbus.it)





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# Clima, biodiversità, inquinamento: trappole globali da evitare

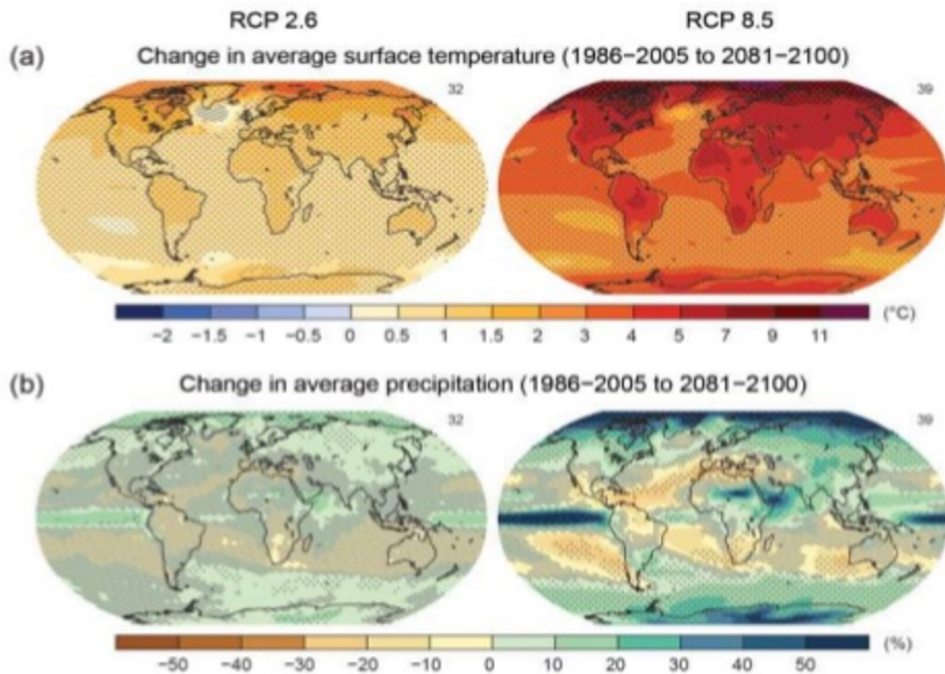
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## Figure SPM.8a,b

Maps of CMIP5 multi-model mean results

All Figures © IPCC 2013



IPCC AR5 Working Group I  
Climate Change 2013: The Physical Science Basis

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change





“

Today's IPCC Working Group 1 Report is a code red for humanity.”

9 AUGUST 2021



Sixth Assessment Report  
SYNTHESIS REPORT

ipcc  
INTERGOVERNMENTAL PANEL ON climate change  
WHO UNEP

Today's IPCC report is a how-to guide to defuse the climate time-bomb

#IPCC

#ClimateReport

U.S. Mission Photo by Eric Bridgers

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EMBARGOED - Do not publish, quote or distribute before 10 a.m. Central European Summer Time (08:00 UTC/GMT, 4 a.m. EDT) on Monday 9 August 2021

ipcc  
INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2021  
The Physical Science Basis  
Summary for Policymakers



This Summary for Policymakers was formally approved at the 14th Session of Working Group I of the IPCC and accepted by the 56th Session of the IPCC, Virtual Meeting, 6 August 2021  
SUBJECT TO COP26/101

WGI

Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change



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# Greenhouse Effect Normal CO<sub>2</sub>

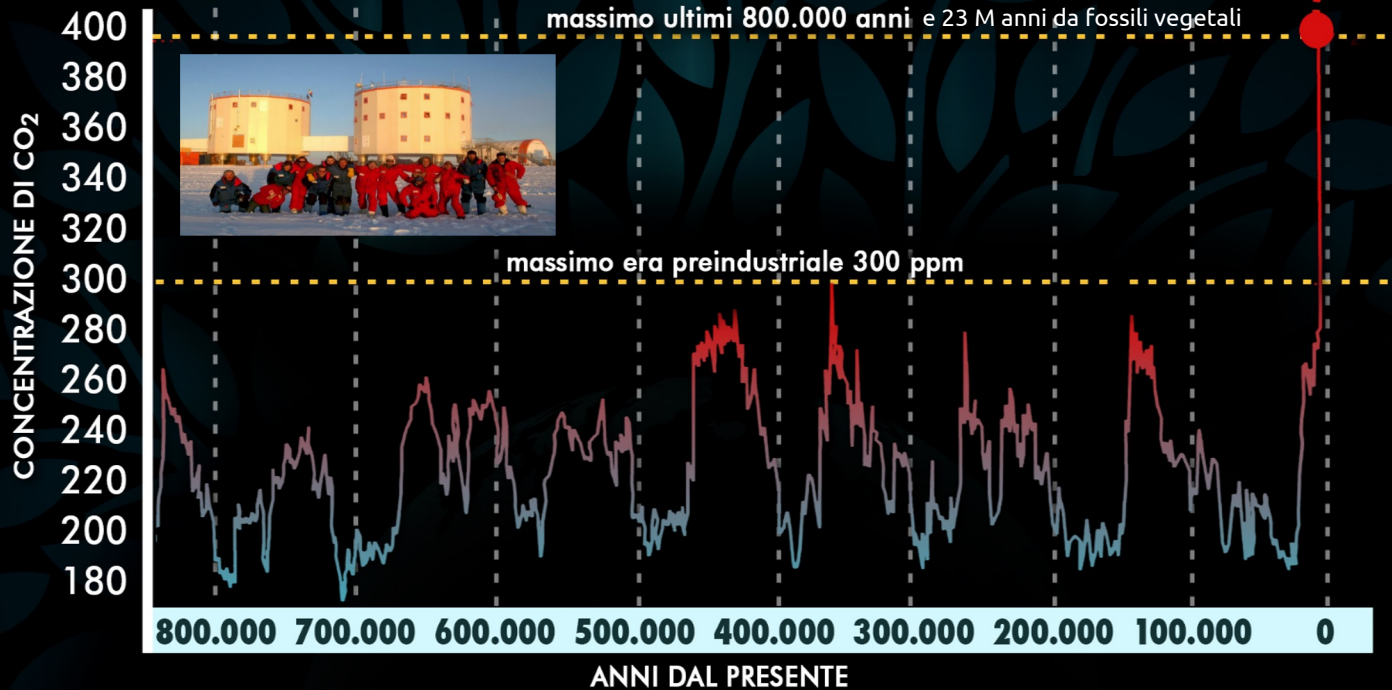
# Greenhouse Effect: Rampant CO<sub>2</sub>



423 ppm

fonte: progetto EPICA

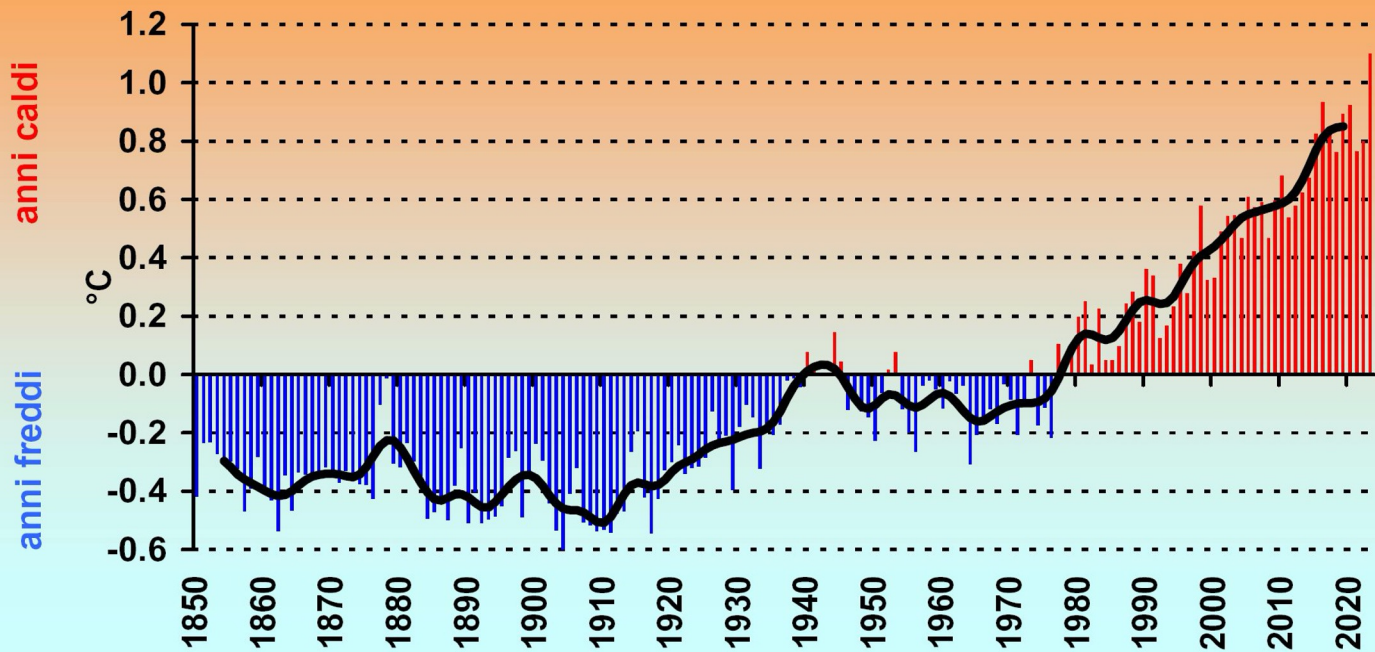
## LIVELLO CO<sub>2</sub> NEL TEMPO



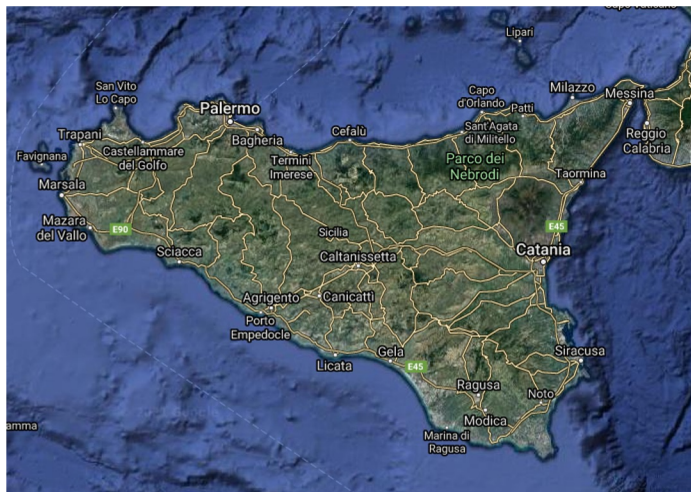
A 23 m.y. record of low atmospheric CO<sub>2</sub> - Ying Cui; Brian A. Schubert; A. Hope Jahren *Geology* (2020)  
<https://doi.org/10.1130/G47681.1>



# Anomalie termiche globali 1850-2023 (rispetto a media trentennio 1961-90) *serie MetOffice - Hadley Center*



**11 agosto 2021**

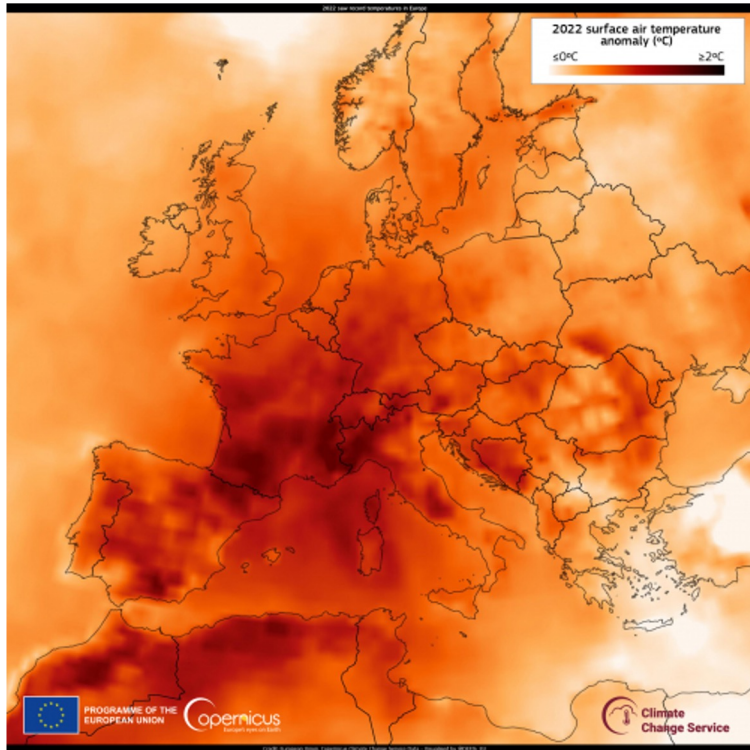


**48,8 °C a Florida,  
Siracusa**  
Temperatura  
massima record in  
Italia e in Europa  
in circa 200 anni  
di osservazioni

Stazione meteo rete SIAS

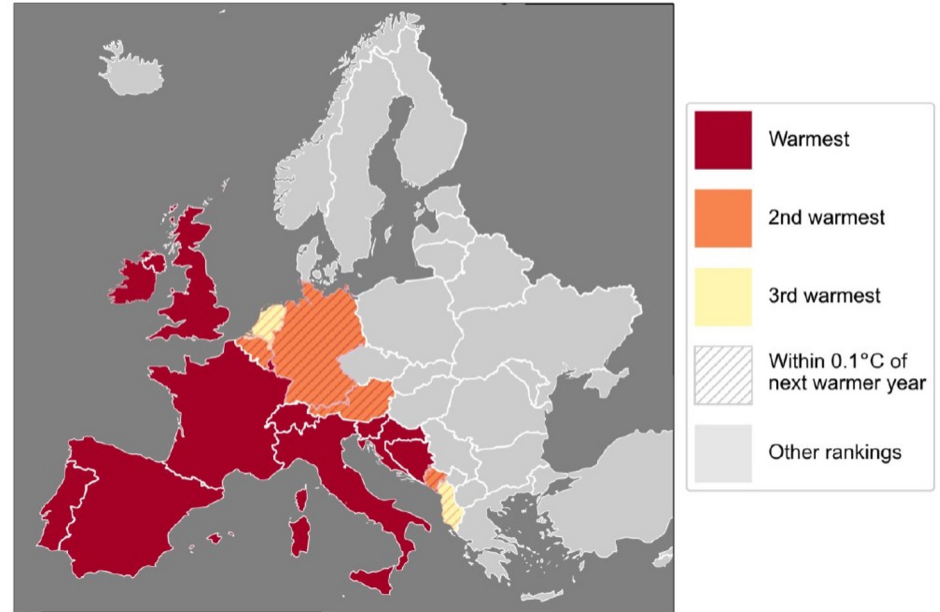


# 2022: l'anno più caldo in Europa W



## Ranking of 2022 annual mean temperature by country

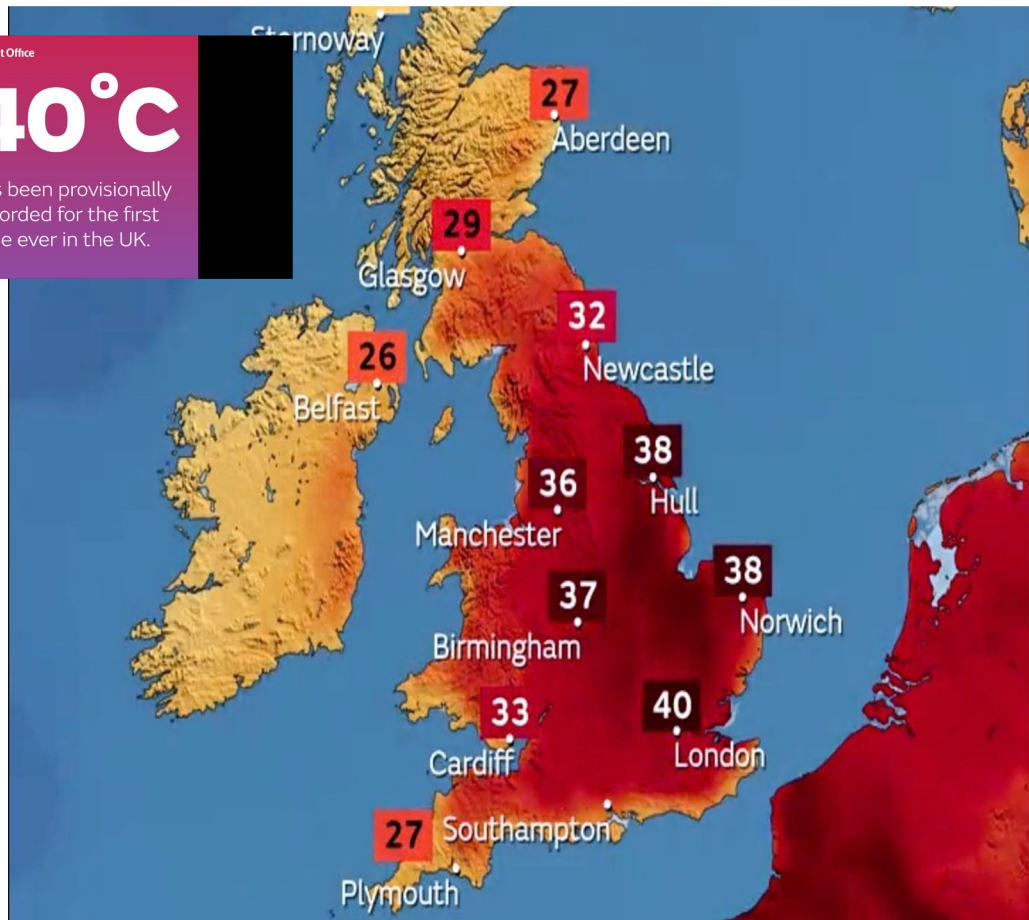
Rankings based on ERA5 data for 1950-2022 • Credit: C3S/ECMWF



Met Office

# 40°C

has been provisionally recorded for the first time ever in the UK.

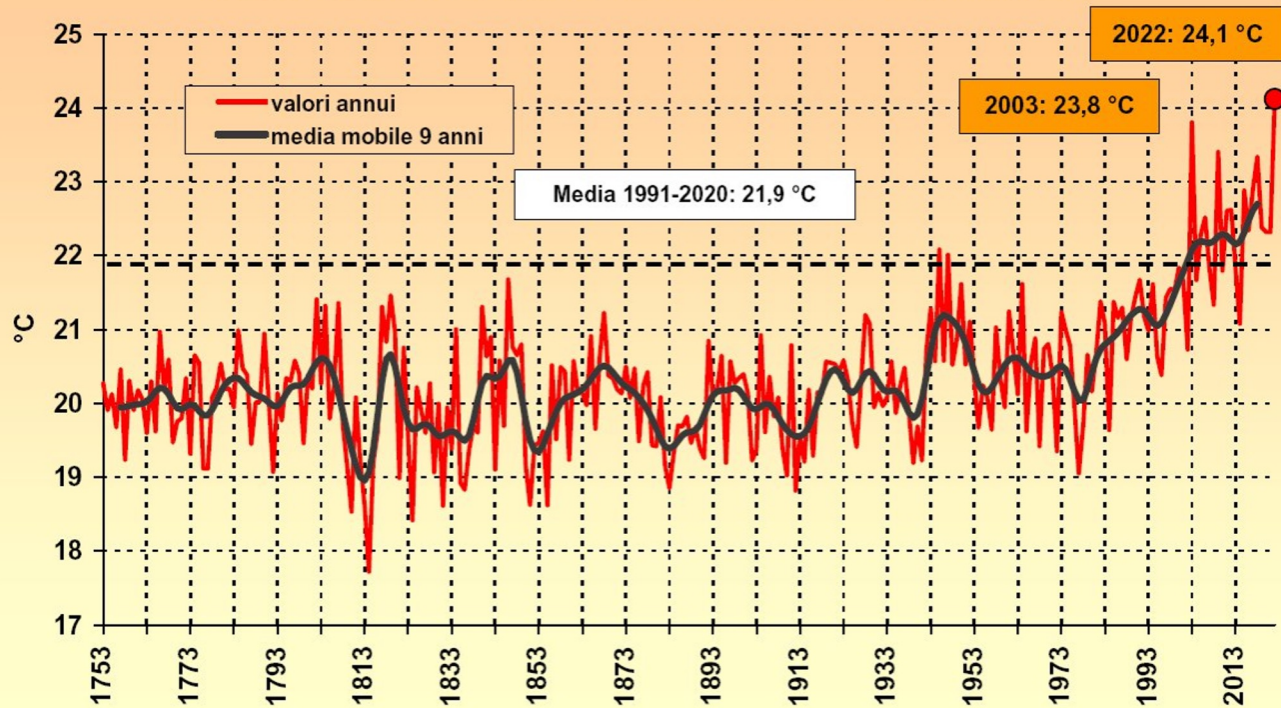


## State of the Climate in Europe 2022

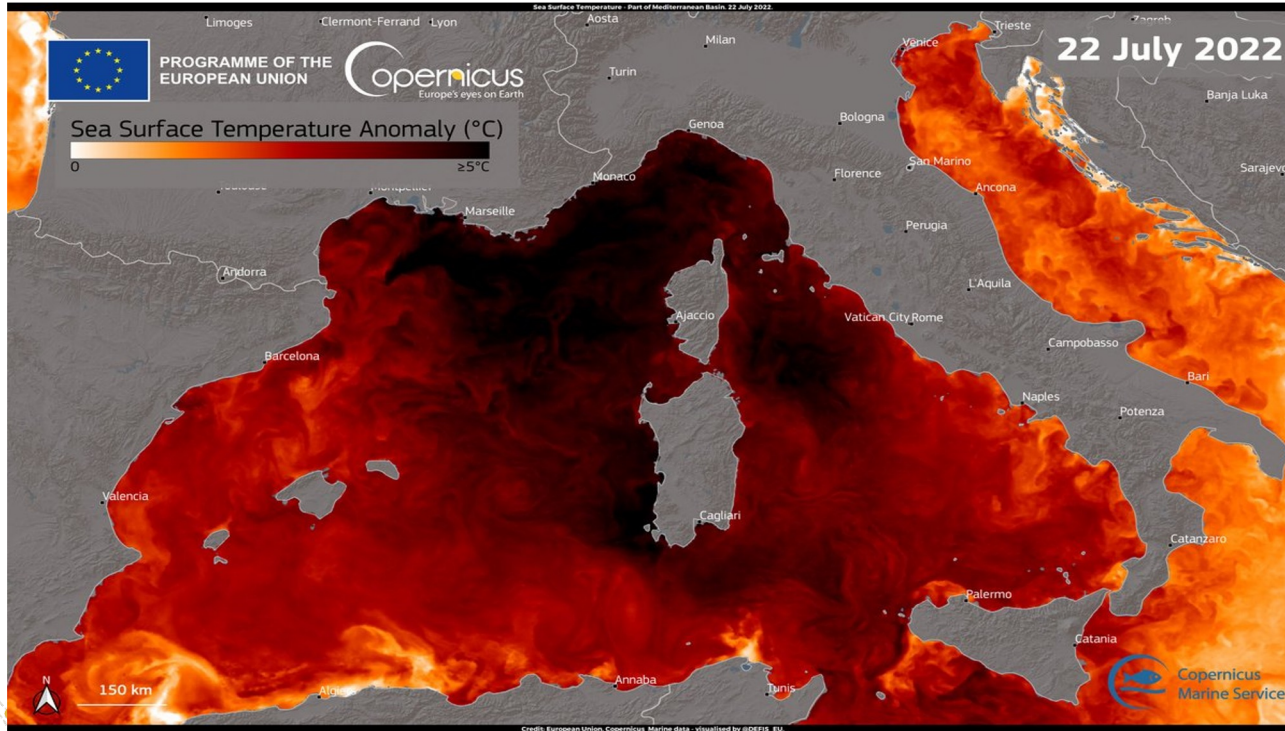


## Torino centro - Temperature medie maggio-settembre (°C), 1753 - 2022

(dati attuali ARPA Piemonte; elaborazione dati storici: SMI - [www.nimbus.it](http://www.nimbus.it))

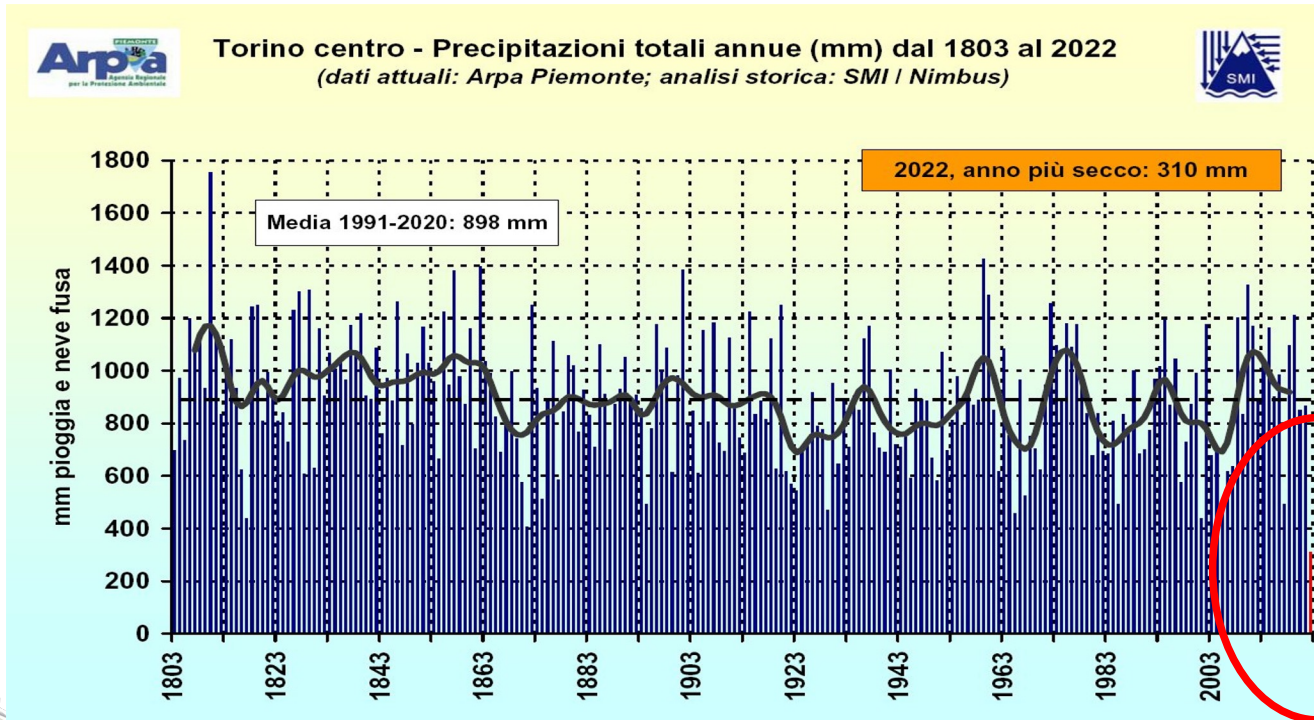


# 2022, straordinaria ondata di calore "marina" nel Mediterraneo, fino a 5° sopra media!



Credit: European Union, Copernicus Sentinel-3 imagery

# 2022: anno più asciutto in oltre due secoli a Torino

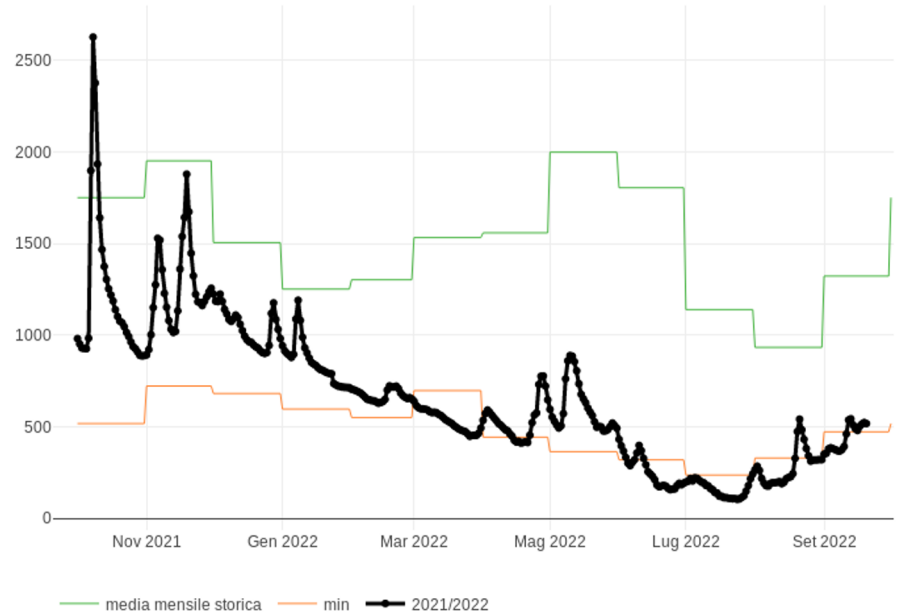


# 2022: portata media del Po ai minimi storici, 22 luglio = 108 m<sup>3</sup>/s

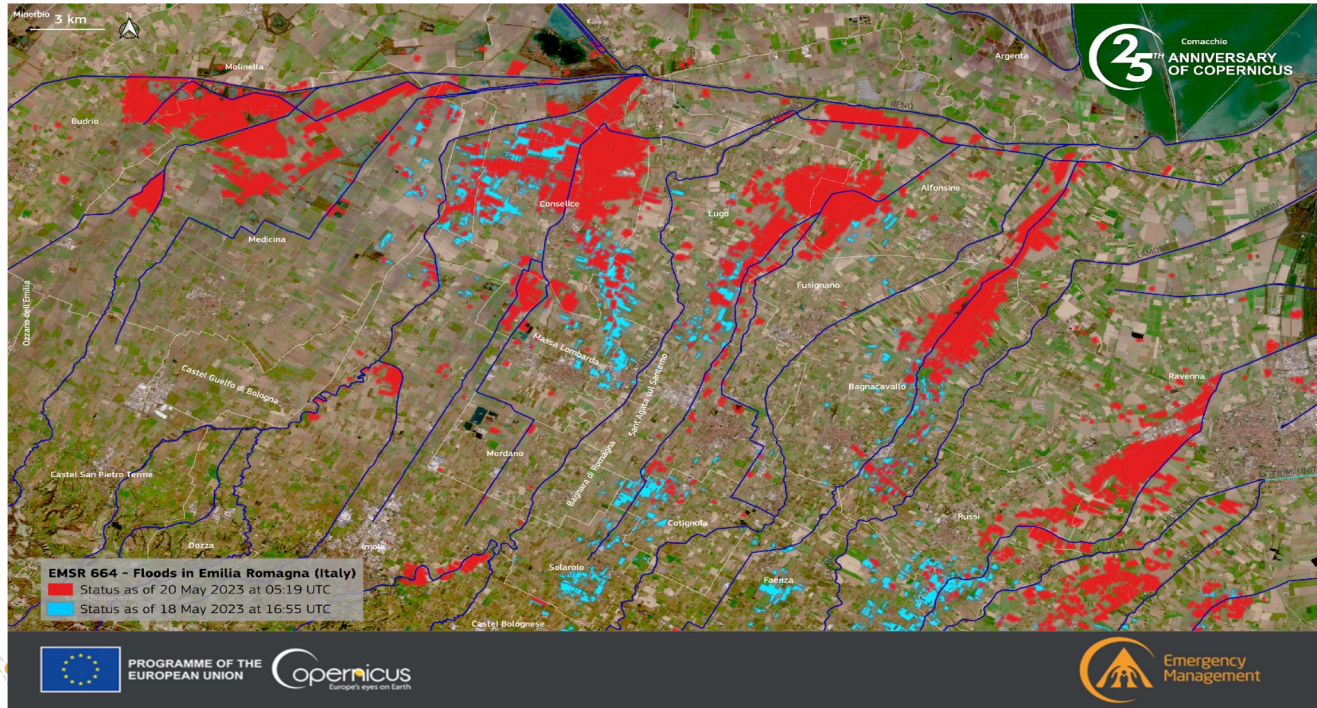


T. Orco in magra primaverile  
straordinaria nel Torinese (9 aprile 2022)

### Portata del fiume Po a Pontelagoscuro



# Maggio 2023, improvvisa fine della siccità al Nord Italia, gravi alluvioni in Romagna



Due eventi ravvicinati da 150-250mm (simili solo al caso del maggio 1939), effetti aggravati dall'interferenza con le crescenti infrastrutture umane.



# Alluvioni



Germania-Belgio luglio 2021: 243 vittime;  
Marche 15 Settembre 2022, 13 vittime;  
Ischia, 26 novembre 2022, 12 vittime



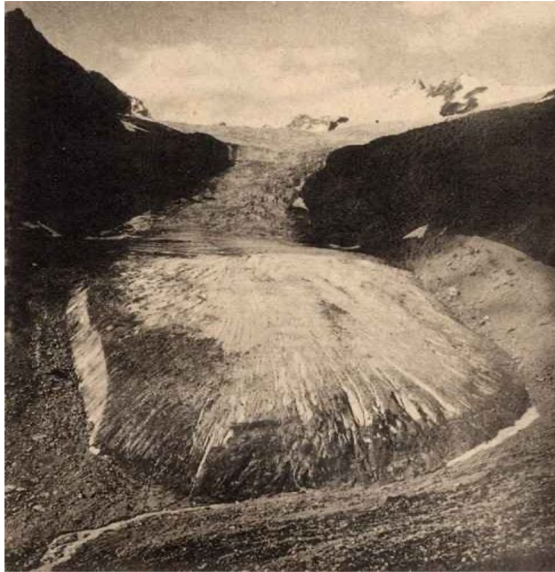


Estate 2021 e 2022:  
incendi in  
California, Grecia,  
Turchia, Algeria,  
Siberia, Francia...

Estate 2023: 6000  
incendi in Canada,  
170.000 km<sup>2</sup>  
bruciati



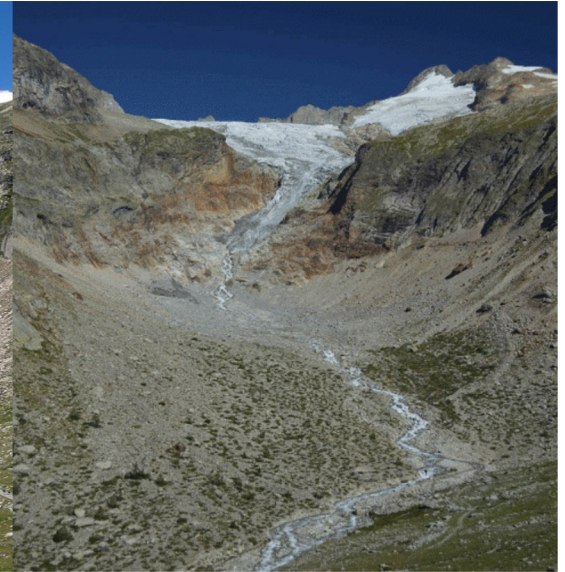
***Ghiacciaio Pré de Bar (Monte Bianco):  
ritiro della fronte di oltre 800 m dal 1897 al 2015  
I ghiacciai alpini si sono ridotti di oltre il 60% in un secolo***



**1897**  
(f. Druetti)



**2005**  
(f. L. Mercalli)



**2015**  
(f. S. Jobard)



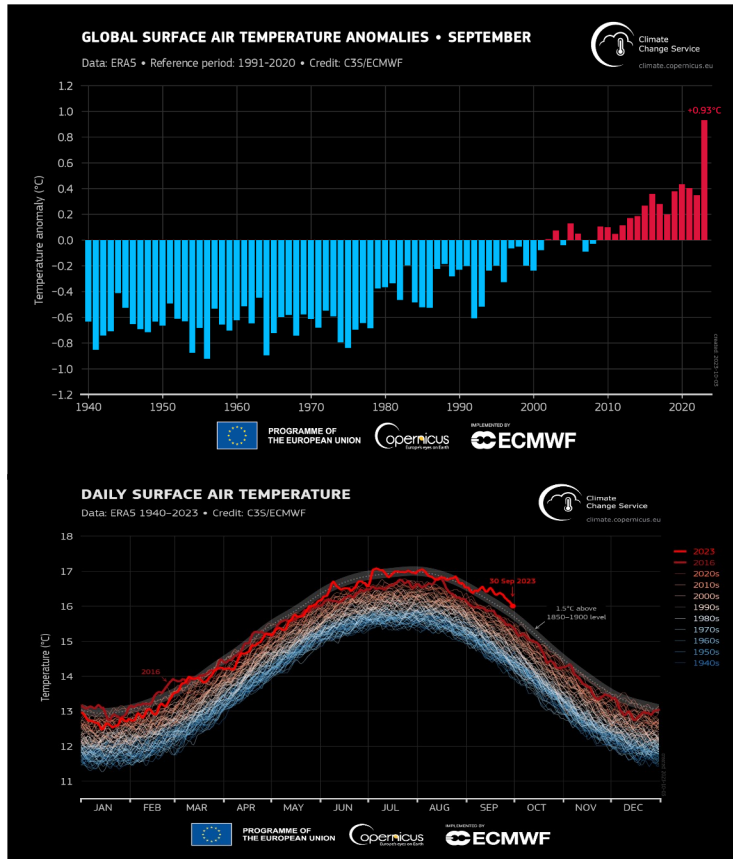
***3 luglio 2022: ghiacciaio Marmolada, collasso glaciale  
causato da massiccio e anomalo afflusso di acqua di  
fusione all'interno del ghiacciaio, 11 vittime***



Foto CNSAS

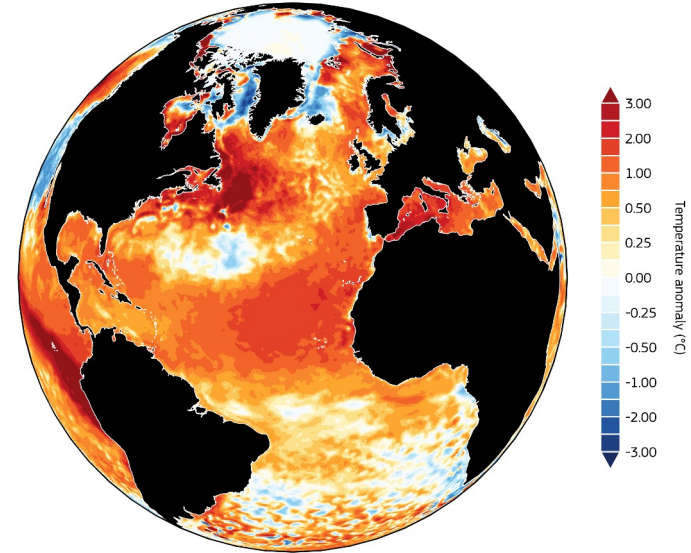


# 2023: i giorni più caldi del mondo

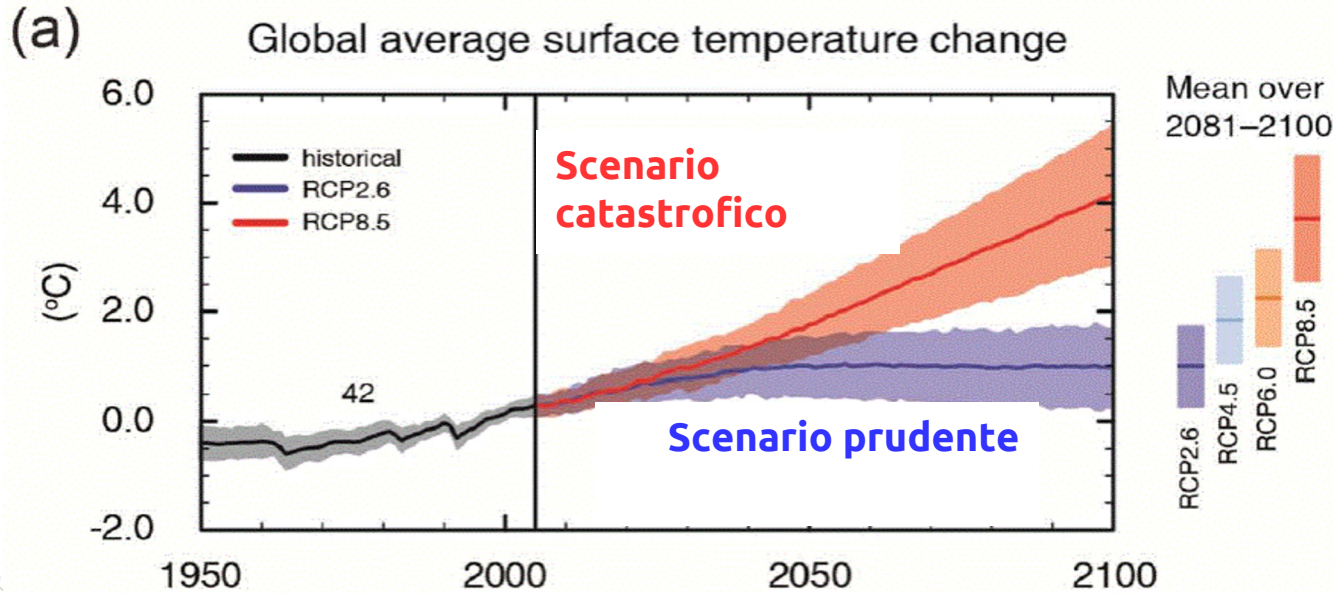
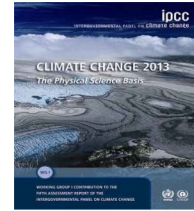


## SEA SURFACE TEMPERATURE ANOMALY • JULY 2023

Reference period: 1991-2020 • Data: ERA5 • Credit C3S/ECMWF



# Scenari 5° rapporto IPCC (AR5 2013):

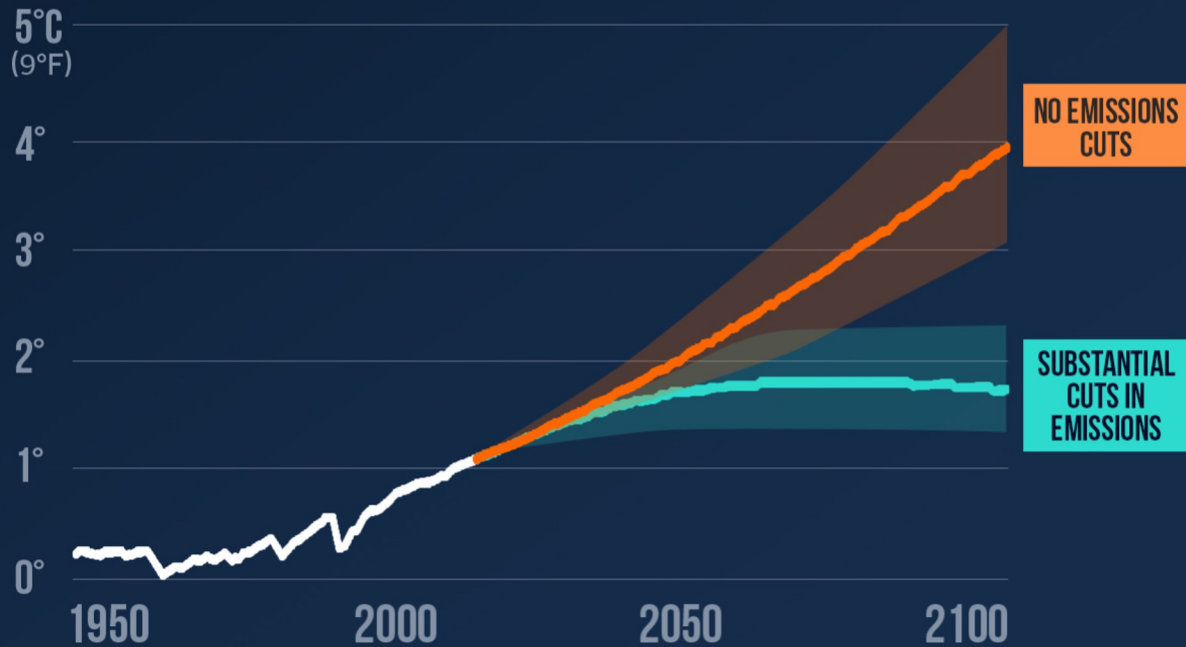


**+2°C** al 2100 se si applica **Accordo Parigi 2015** (linea azzurra), o fino a **+5°C** in più con business-as-usual (linea rossa)



# FUTURE TEMPERATURES

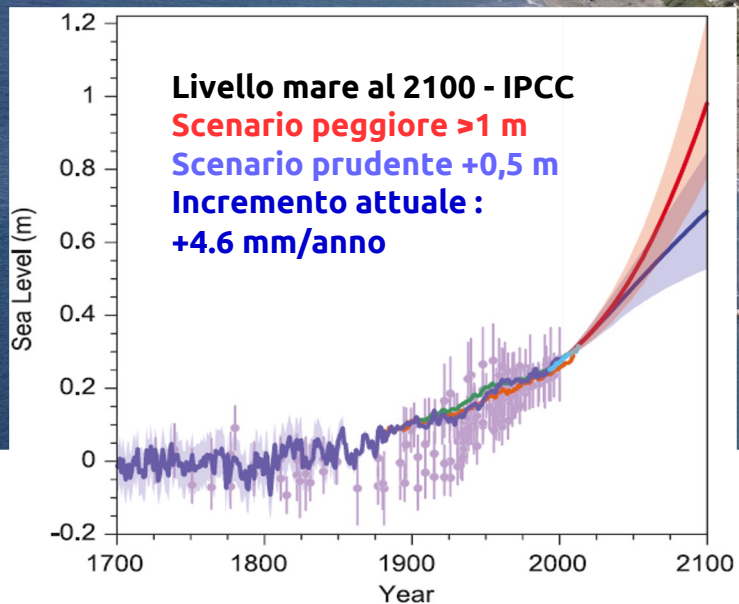
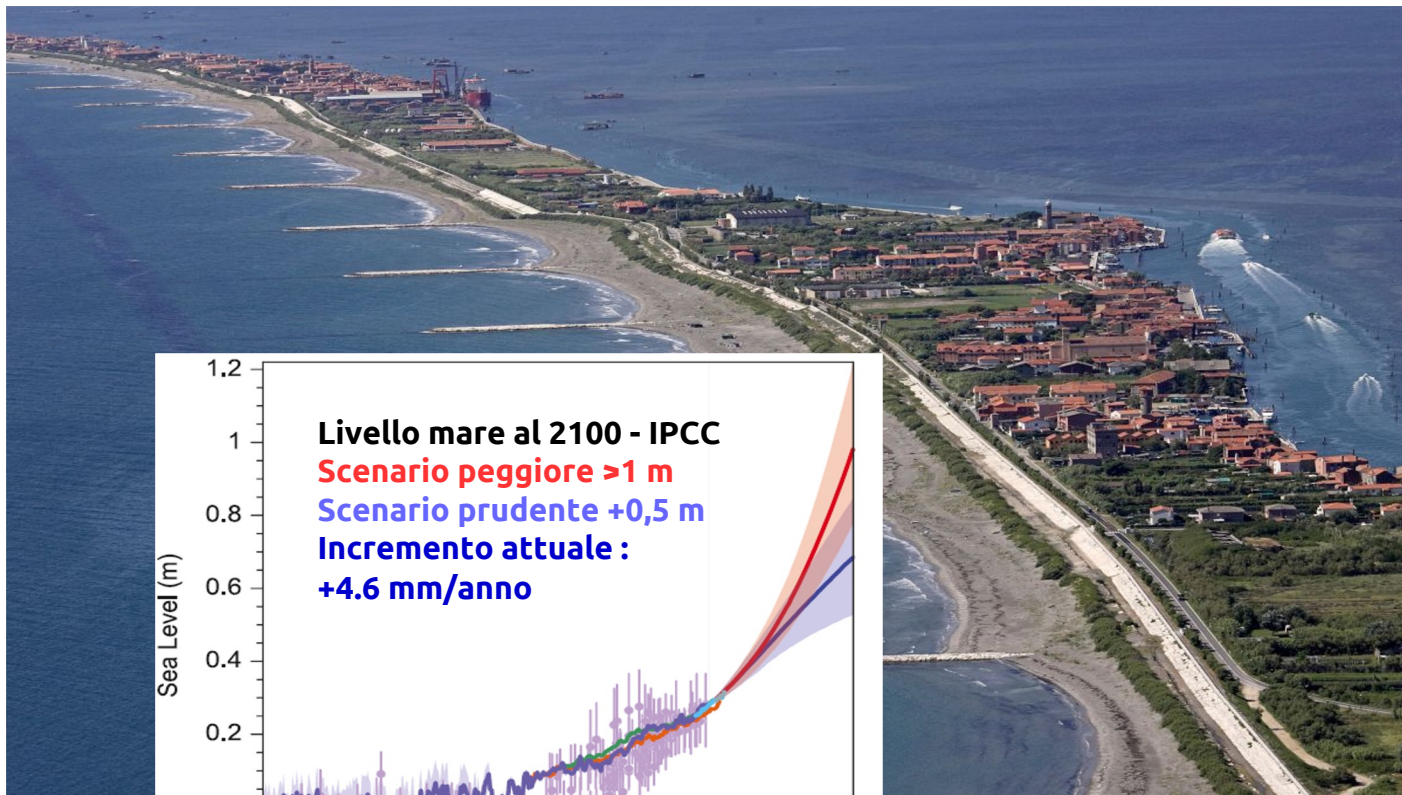
WARMING DEPENDS ON CHOICES TODAY



Global surface temperature (°C) anomaly relative to 1850-1900  
High warming scenario: SSP3-7, Low warming scenario from SSP1-2.6.  
Source: IPCC AR6 WG1

CLIMATE CENTRAL

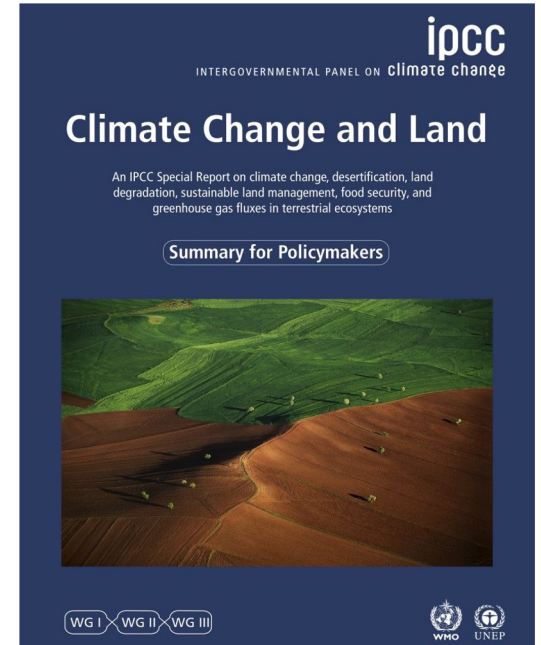




Le zone costiere risentiranno dell'aumento del livello marino, e dovranno essere adeguatamente protette (es. Venezia, delta del Po).



# Cambiamento clima e perdita biodiversità





L'inquinamento di  
aria, acqua e suolo  
minaccia la nostra  
salute e quella  
delle generazioni  
future POP  
Persistent Organic  
Pollutants + Heavy  
Metals Toxicity.

[https://commons.wikimedia.org/wiki/File:Pollution\\_plastique\\_2.jpg](https://commons.wikimedia.org/wiki/File:Pollution_plastique_2.jpg)



# Top 10 Global Risks by Severity

Over the next 10 years



■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological

Source: World Economic Forum Global Risks Report 2022

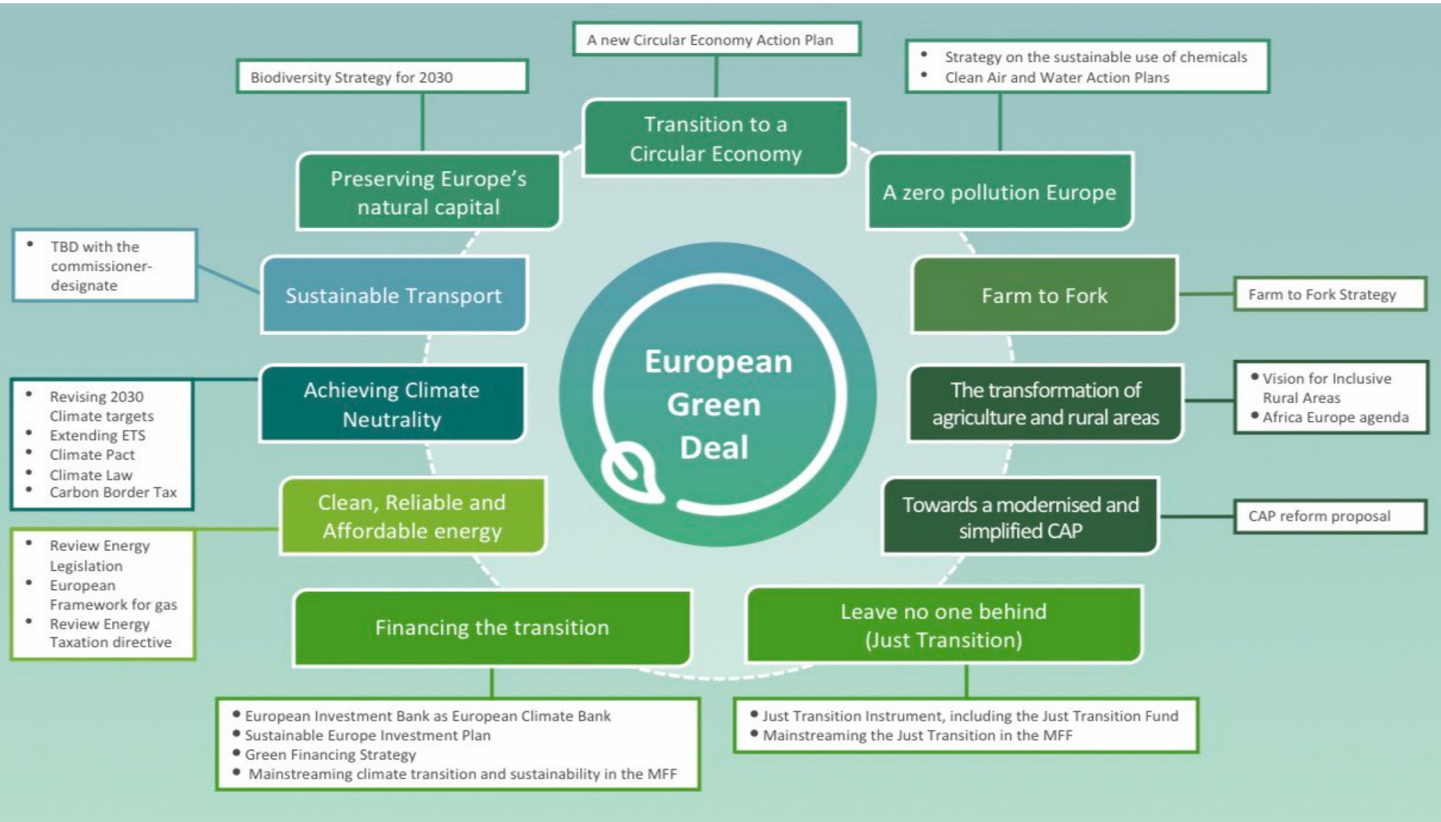


I primi tre rischi globali più importanti secondo il World Economic Forum 2022 sono :

- cambiamenti climatici
- eventi meteorologici estremi
- perdita di biodiversità.

Possiamo ancora agire per evitare di peggiorarli, **ma dobbiamo farlo subito!**  
**Non c'è più tempo...**







INSEGNARE GEOGRAFIA

## ***Favorire la mobilità elettrica***



A condizione  
che sia  
alimentata da  
elettricità  
rinnovabile e  
che sia  
obbligatorio il  
riciclo delle  
batterie.





Telework can save ...



time



money



environment



# Allevamento



Vale 15% delle emissioni globali (metano)  
Ridurre la quota di carne rossa nella dieta e sostenere agricoltura biologica e a filiera corta locale.



# Fermare la cementificazione, il suolo non è infinito!

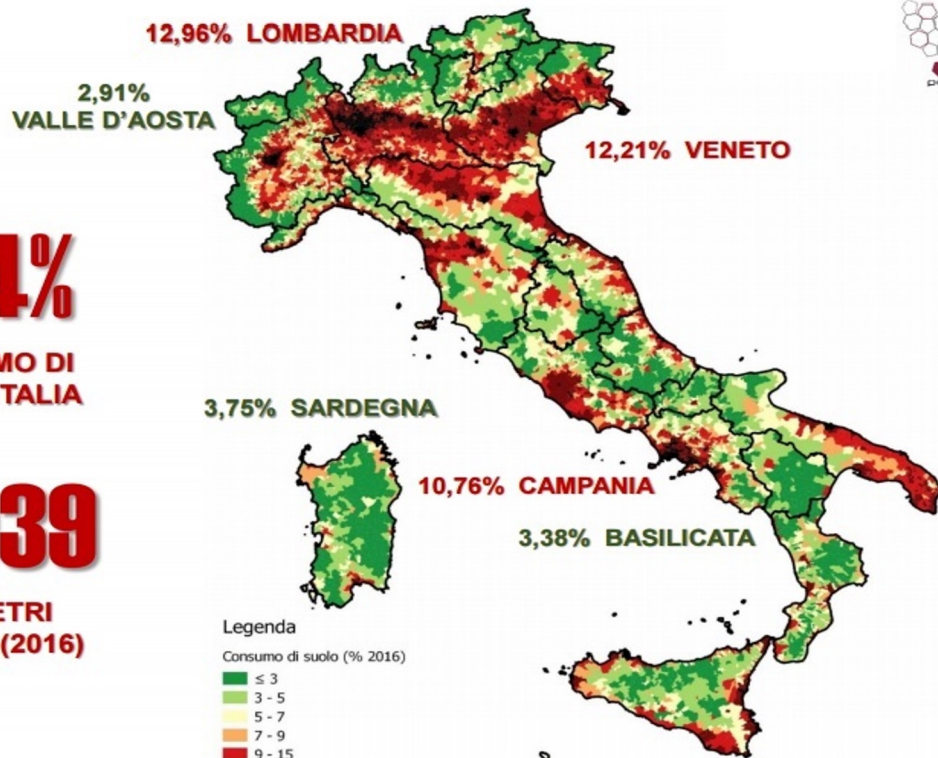


## 7,64%

IL CONSUMO DI  
SUOLO IN ITALIA

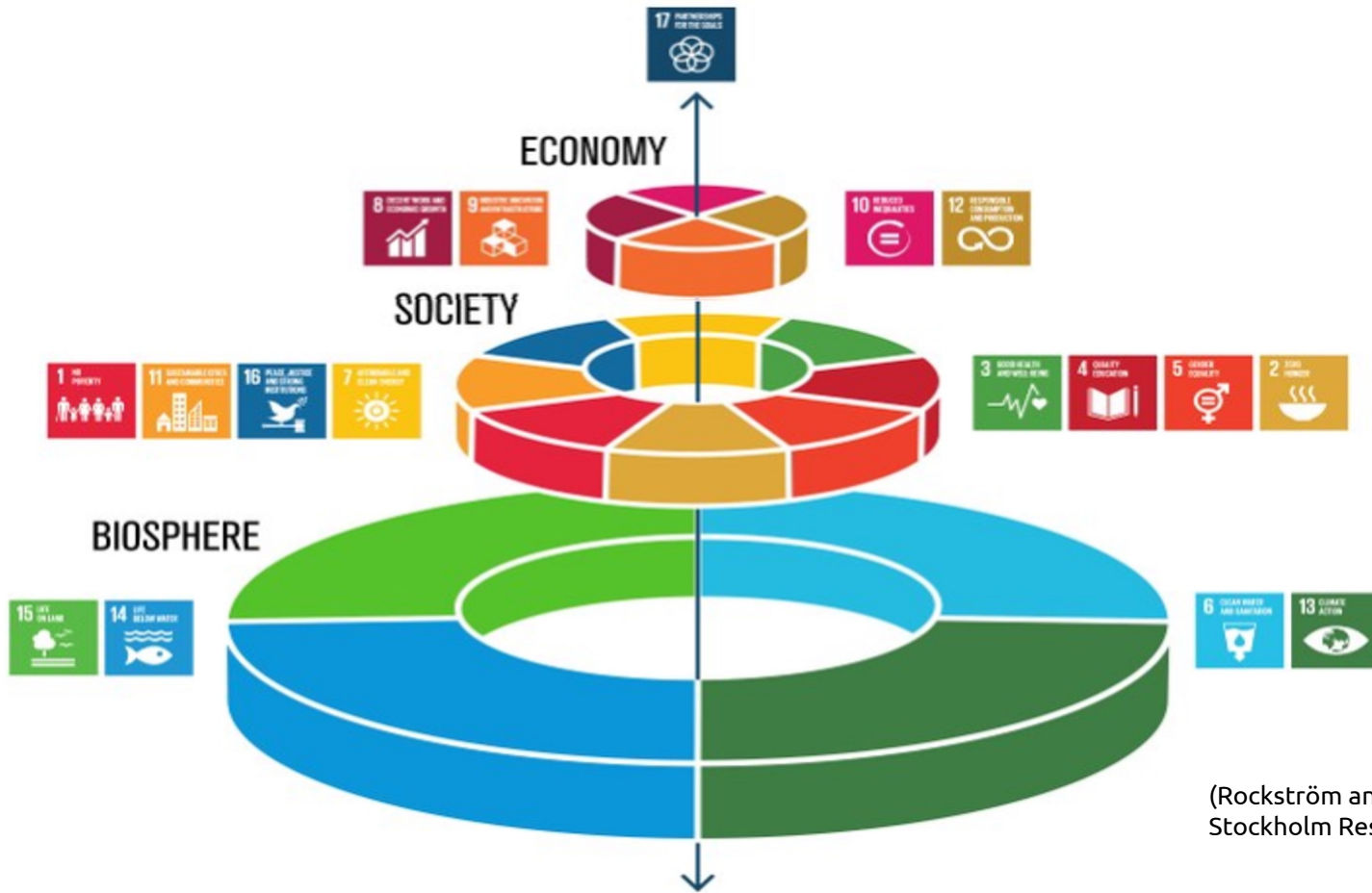
## 23.039

CHILOMETRI  
QUADRATI (2016)



# Al lavoro! Gli obiettivi UN dell'Agenda 2030





(Rockström and Sukhdev 2016, Stockholm Resilience Centre)



# Earth beyond six of nine planetary boundaries

KATHERINE RICHARDSON · WILL STEFFEN · WOLFGANG LUCHT · JØRGEN BENDTSEN · SARAH E. CORNELL · JONATHAN F. DONGES · MARI INGO FETZER · GOVINDASAMY BALA · [...] AND JOHAN ROCKSTRÖM · +19 authors [Authors Info & Affiliations](#)

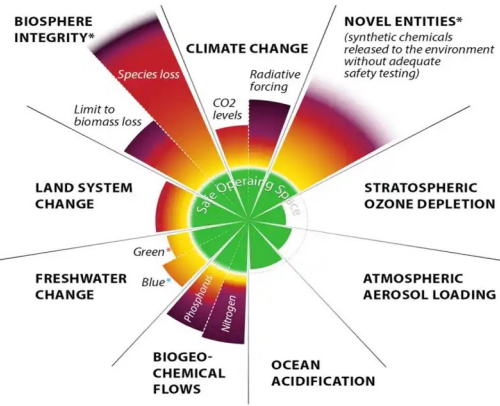
SCIENCE ADVANCES · 13 Sep 2023 · Vol 9, Issue 37 · DOI: 10.1126/sciadv.adb2458

234,323

## Abstract

This planetary boundaries framework update finds that six of the nine boundaries are transgressed, suggesting that Earth is now well outside of the safe operating space for humanity. Ocean acidification is close to being breached, while aerosol loading regionally exceeds the boundary. Stratospheric ozone levels have slightly recovered. The transgression level has increased for all boundaries earlier identified as overstepped. As primary production drives Earth system biosphere functions, human appropriation of net primary production is proposed as a control variable for functional biosphere integrity. This boundary is also transgressed. Earth system modeling of different levels of the transgression of the climate and land system change boundaries illustrates that these anthropogenic impacts on Earth system must be considered in a systemic context.

## SIX OUT OF NINE PLANETARY BOUNDARIES BREACHED

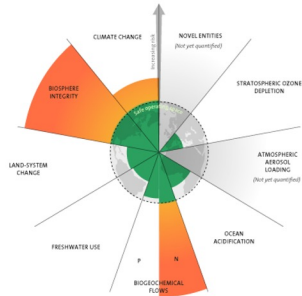


\*Blurred upper edges because either the increasing risk has not yet been quantitatively defined or the current value is uncertain  
 \*Blue water is found in lakes, rivers, and reservoirs  
 \*Green water is available in the soil for plants and soil microorganisms

Boundary transgressed

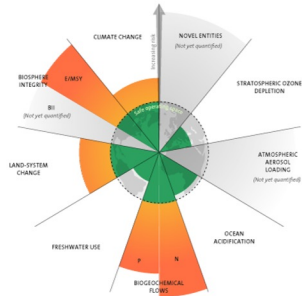
Safe operating space    Zone of increasing risk    High risk zone

2009



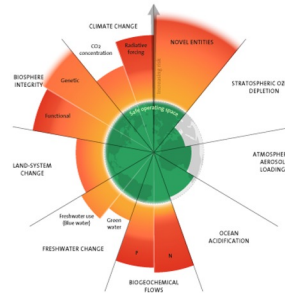
3 boundaries crossed

2015



4 boundaries crossed


2023



6 boundaries crossed



# The 2023 state of the climate report: Entering uncharted territory

William J. Ripple, Christopher Wolf , Jillian W. Gregg, Johan Rockström, Thomas M. Newsome, Beverly E. Law, Luiz Marques, Timothy M. Lenton, Chi Xu, Saleemul Huq, Leon Simons and Sir David Anthony King

William J. Ripple ([bill.ripple@oregonstate.edu](mailto:bill.ripple@oregonstate.edu)) is affiliated with the Department of Forest Ecosystems and Society at Oregon State University (OSU), in Corvallis, Oregon, in the United States and the Conservation Biology Institute (CBI), in Corvallis, Oregon, in the United States. Christopher Wolf ([christopher.wolf@oregonstate.edu](mailto:christopher.wolf@oregonstate.edu)) and Jillian W. Gregg are affiliated with Terrestrial Ecosystems Research Associates, in Corvallis, Oregon, in the United States. Johan Rockström is affiliated with the Potsdam Institute for Climate Impact Research, in Potsdam, Germany. Thomas M. Newsome is affiliated with the School of Life and Environmental Sciences at The University of Sydney, in Sydney, New South Wales, Australia. Beverly E. Law is affiliated with the Department of Forest Ecosystems and Society at OSU and the CBI. Luiz Marques is affiliated with the State University of Campinas—Unicamp and with the Center for Research in Energy and Materials, in Campinas, in the state of São Paulo, in Brazil. Timothy M. Lenton is affiliated with the Global Systems Institute at the University of Exeter, in Exeter, England, in the United Kingdom. Chi Xu is affiliated with the School of Life Sciences at Nanjing University, in Nanjing, China. Saleemul Huq is affiliated with the International Centre for Climate Change and Development at the Independent University Bangladesh, in Dhaka, Bangladesh. Leon Simons is affiliated with the Club of Rome Netherlands, in 's-Hertogenbosch, in The Netherlands. Sir David Anthony King is affiliated with the Department of Chemistry at Downing College, at the University of Cambridge, in Cambridge, England, in the United Kingdom. Co-lead authors William J. Ripple and Christopher Wolf contributed equally to the work.

Life on planet Earth is under siege. We are now in an uncharted territory. For several decades, scientists have consistently warned of a future marked by extreme climatic conditions because of escalating global temperatures caused by ongoing human activities that release harmful greenhouse gasses into the atmosphere. Unfortunately, time is up. We are seeing the manifestation of those predictions as an alarming and unprecedented succession of climate records are broken, causing profoundly distressing scenes of suffering to unfold. We are entering an unfamiliar domain regarding our climate crisis, a situation no one has ever witnessed firsthand in the history of humanity.

exceptional heat waves have swept across the world, leading to record high temperatures. The oceans have been historically warm, with global and North Atlantic sea surface temperatures both breaking records and unprecedented low levels of sea ice surrounding Antarctica (figure 1a–1d). In addition, June through August of this year was the warmest period ever recorded, and in early July, we witnessed Earth's highest global daily average surface temperature ever measured, possibly the warmest temperature on Earth over the past 100,000 years (figure 1e). It is a sign that we are pushing our planetary systems into dangerous instability.





# APOSTOLIC EXHORTATION LAUDATE DEUM

Of the Holy Father Francis  
To all people of good will on the climate crisis

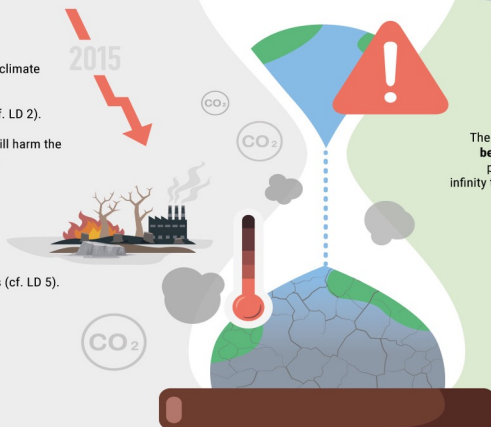
October 4, 2023

## SINCE THE PUBLICATION OF LAUDATO SI' IN 2015...

- We have not reacted strongly enough to the climate crisis (cf. LD 2).
- The world that welcomes us is crumbling (cf. LD 2).
- We see how the impact of climate change will harm the lives and families of many people (cf. LD 2).

## THE SIGNS OF CLIMATE CHANGE ARE:

- Extreme phenomena, unusual heat, droughts (cf. LD 5).
- Heavy rainfall, floods (cf. LD 5).
- Unusual acceleration of warming (cf. LD 6).
- Acceleration of the increase of greenhouse gases (cf. LD 11).



## HOW DID WE GET TO THIS POINT?



Neither the **human causes** of climate change (cf. LD 11) nor its position in the **technocratic paradigm** can be doubted.



The **human being believes himself to be limitless**, "whose capacities and possibilities could be expanded to infinity thanks to technology" (cf. LD 21).



We believe that the world around us is an object of exploitation, of unbridled use, of **unlimited ambition** (cf. LD 25).



**LACK OF EFFICIENCY, OPPORTUNITIES, AND LASTING PROGRESS IN MULTILATERAL AGREEMENTS BETWEEN STATES** (cf. LD 34).

There are no organizations with real authority to ensure non-renounceable objectives (cf. LD 35).

Previous effective decision-making procedures were not sufficient (cf. LD 43).

Prior Climate Conferences have had a low level of implementation (personal interests are privileged over the common good) (cf. LD 52).

What is the point of preserving a power that will be remembered for its inability to intervene (cf. LD 60)?



POPE FRANCIS

“ ”  
The whole of the universe shows the inexhaustible richness of God (cf. LD 63). Let us join this path of reconciliation with the world that shelters us (cf. LD 69). "There are no cultural changes without changes in people" (cf. LD 70). "Praise God": a human being who pretends to take his place becomes the worst danger to himself (cf. LD 73).



COP28  
UAE

UN Dubai COP28  
NOV 30, 2023 - DEC 12, 2023

- It should be a turning point to react and show that what has been done was worthwhile (cf. LD 54).
- It should help us to make a better energy transition (cf. LD 59).
- It should help us to get out of the logic of patchwork solutions in order to seek the common good and ensure the future of coming generations (cf. LD 58, 60).

DICASTERY FOR PROMOTING  
INTEGRAL  
HUMAN  
DEVELOPMENT

Contact the Laudato Si' Movement and the  
Laudato Si' Action Platform at  
[www.LaudateDeum.org](http://www.LaudateDeum.org)  
[info@humandevlopment.va](mailto:info@humandevlopment.va)



NOW  
THIS

“

**We have a choice. Collective  
action or collective suicide.  
It is in our hands.**

UN SECRETARY-GENERAL ANTÓNIO GUTERRES  
JULY 18, 2022

“ The Guardian • Pacific Press / LightRocket via Getty Images



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**SPAZIO ALLE  
DOMANDE**



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<https://deascuola.it/rete-commerciale/>



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