Climate Change: tra evidenze scientifiche e percezione mediatica

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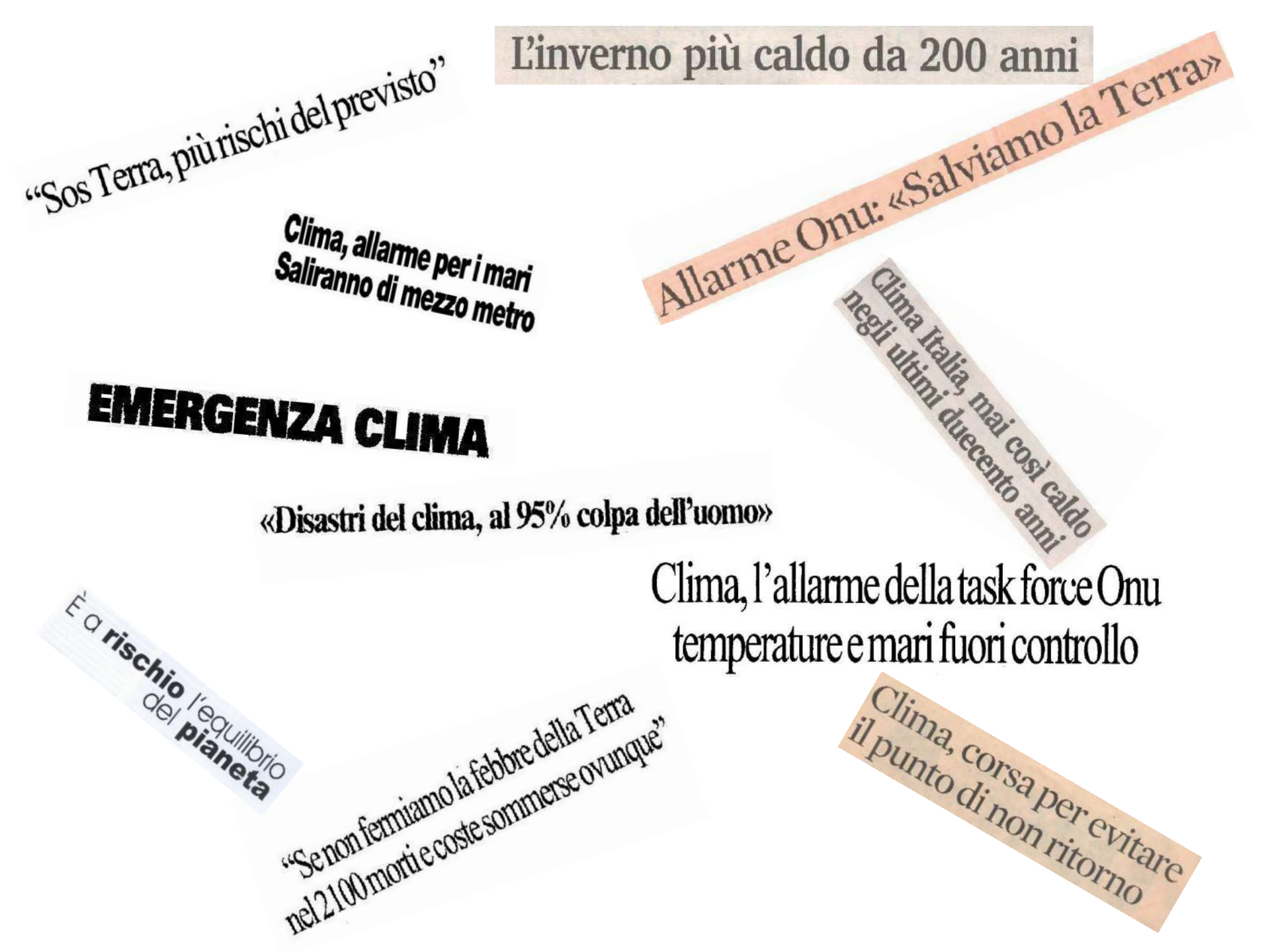
cmcc


Rasmus Tonboe @RasmusTonboe · 14 giu
@SteffenMalskaer got the difficult task of retrieving our oceanographic moorings and weather station on sea ice in North West Greenland this year. Rapid melt and sea ice


L'inverno più caldo da 200 anni
"Sos Terra, più rischi del previsto"
Allarme Onu: «Salviamo la Terra»
Clima, allarme per i mari
Saliranno di mezzo metro
Clima Italia, mai così caldo
negli ultimi duecento anni
EMERGENZA CLIMA
«Disastri del clima, al 95% colpa dell'uomo»
Clima, l'allarme della task force Onu
temperature e mari fuori controllo
È a rischio l'equilibrio del pianeta
"Se non fermiamo la febbre della Terra
nel 2100 morti e coste sommerse ovunque"
Clima, corsa per evitare
il punto di non ritorno

"Spesso allarmistiche e fittizie le ipotesi sui cambiamenti climatici"

Diverso parere

Attenzione agli eccessi catastrofisti

di **Emilio Gerelli**

L'organo dell'Onu che indaga sul riscaldamento globale, l'Intergovernmental panel on climate change (Ipcc), ha presentato ieri 21 pagine di Sintesi per i politici, in attesa di un più robusto Rapporto, promesso, ma rinviato. Ciò impedirà agli scienziati di vagliare le affermazioni della Sintesi, mancando i dettagli. Di più, contrariamente alla pretesa del Panel di rappresentare la comunità scientifica, la Sintesi è stata sottoposta, come sempre, al controllo politico dei Governi partecipanti al Panel.

Addio, dunque, all'indipendenza della scienza, come è provato da passate proteste di studiosi sul fatto che le Sintesi non rappresentavano correttamente le conclusioni dei Rapporti approfonditi. Peraltro, anche gli esperti del Panel sono di nomina governativa. Non vengono, quindi, scelti dagli studiosi competenti: situazione analoga a quella in cui i professori universitari non vengono liberamente scelti dai loro pari competenti, ma da un ministro. Risultato: la ricerca va a rotoli.

La Sintesi prevede notevoli aumenti del livello del mare e della temperatura a fine secolo. Quanto alla solidità di queste previsioni, si tace sul fatto che esse poggiano principalmente su simulazioni da calcolatori, che dovrebbero replicare il complicatissimo sistema climatico: un compito da molti ritenuto impossibile. Anche

CHI È DISPOSTO A PAGARE

Nel documento mancano dettagli importanti per la valutazione scientifica
Grandi inquinatori fuori dal protocollo di Kyoto

Kyoto e i "misfatti" dell'uomo

L'effetto serra: tante bufale bene inventate

Se nell'Artico i ghiacci si sciolgono, nell'Antartide la temperatura si abbassa. È la legge della Natura

CLIMA

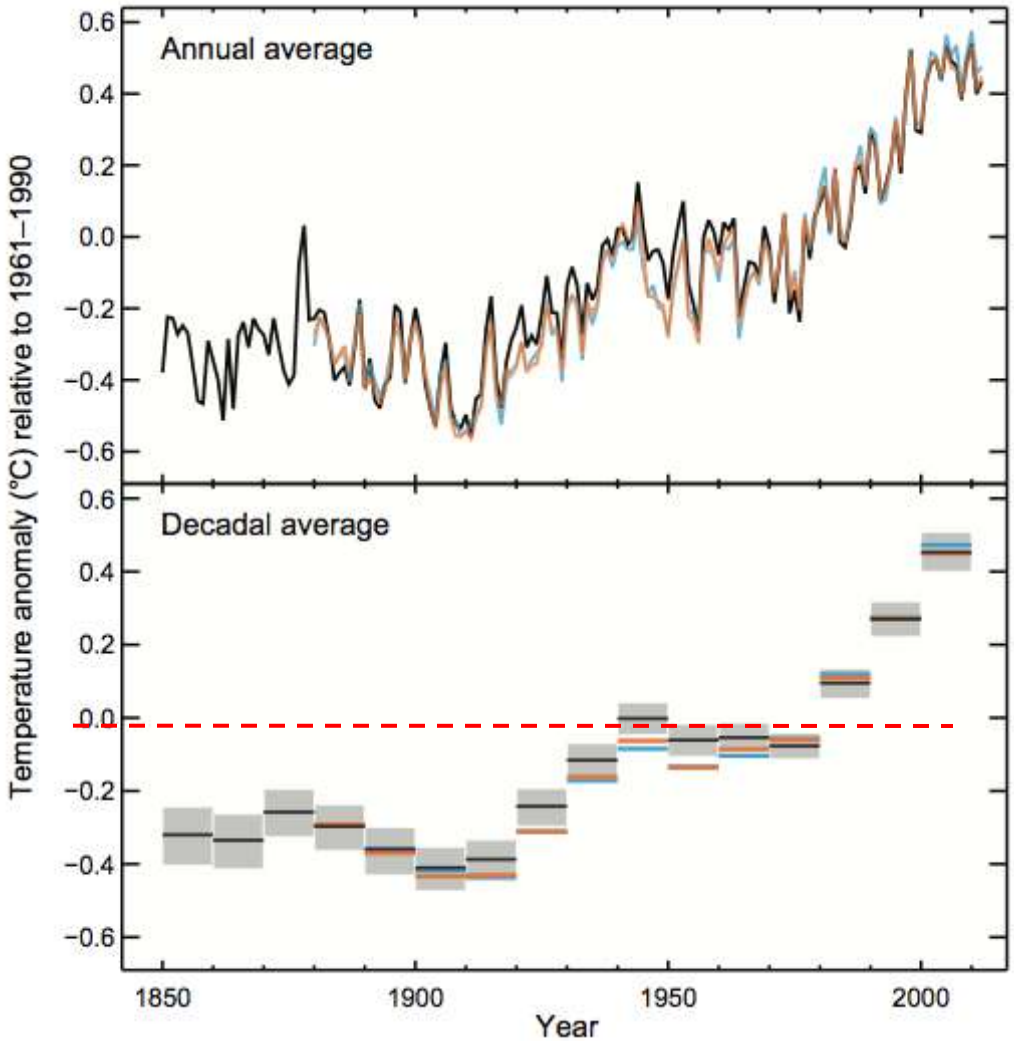
Ma davvero il mondo si sta scaldando troppo?

Il nuovo romanzo dello scrittore è dedicato al clima: "Occupiamoci di cose più serie, come l'Aids"

La favola della Terra più calda

Fenomenologia del Climate Change: misure strumentali [1850-presente]

Temperatura Media Globale Superficiale



Aumento della T_{mgs} :

- *- trend lineare –*

  0,85° C nel periodo 1880–2012
- **Ultimi tre decenni sono stati i più caldi dal 1850**
- **L'ultimo decennio è stato il più caldo.**

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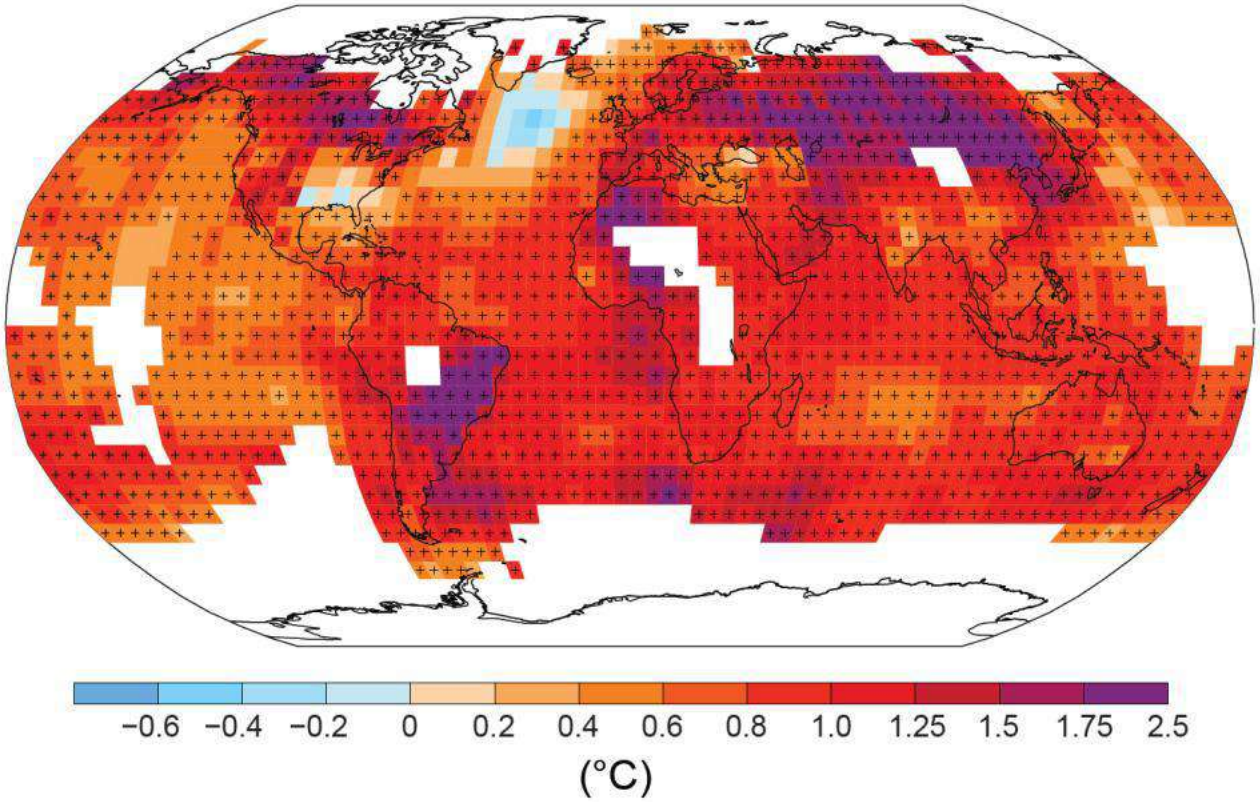
1901 – 2012: Variazioni osservate delle temperature superficiali



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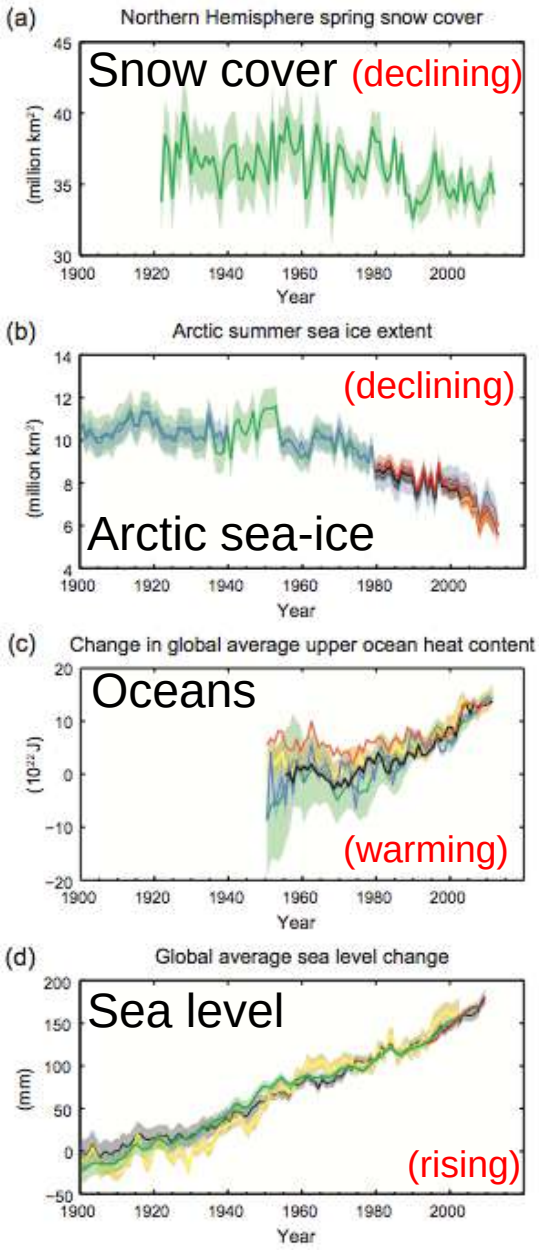
Altri indicatori del CC



- Since the 1950s, many of the observed changes are unprecedented over decades to millennia.

- The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.

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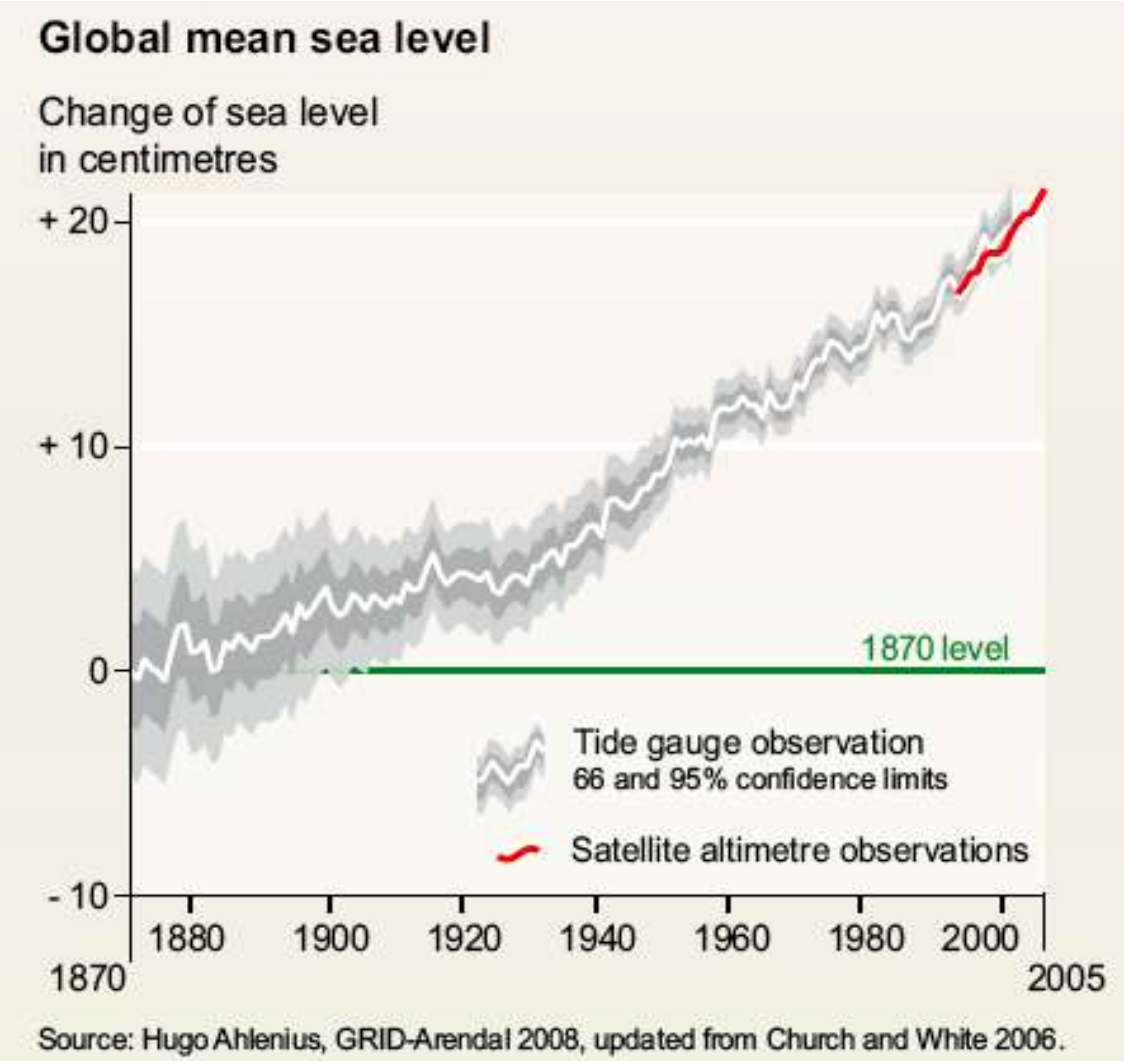
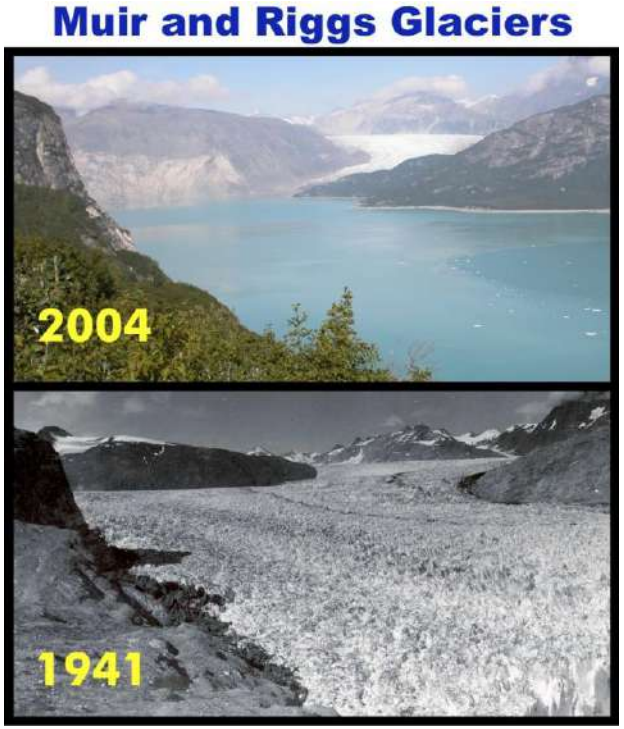
Variazioni dell’altezza del livello del mare

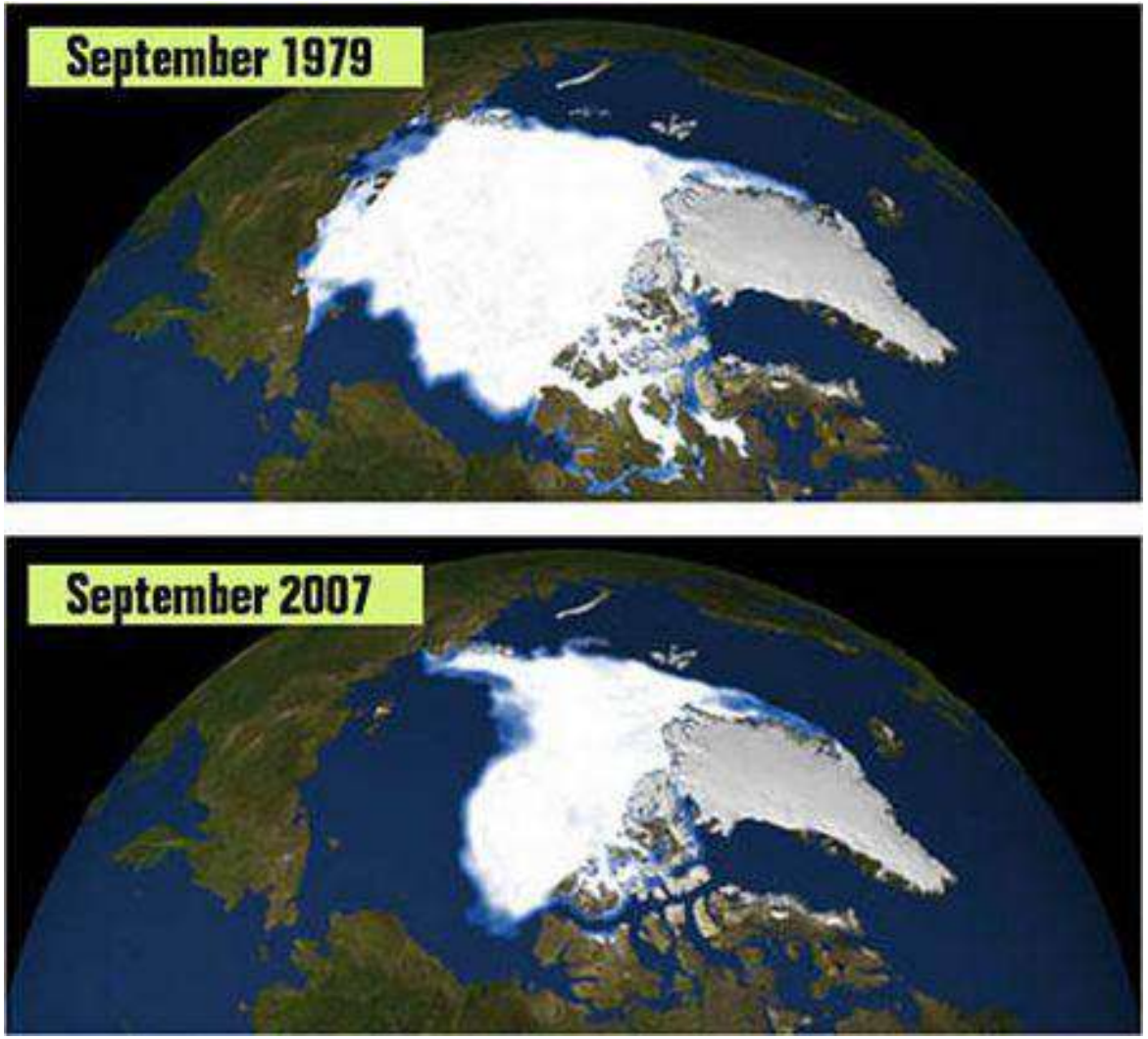


Variazioni nell’estensione dei ghiacciai

Ghiacciaio della Vedretta di Vallelunga

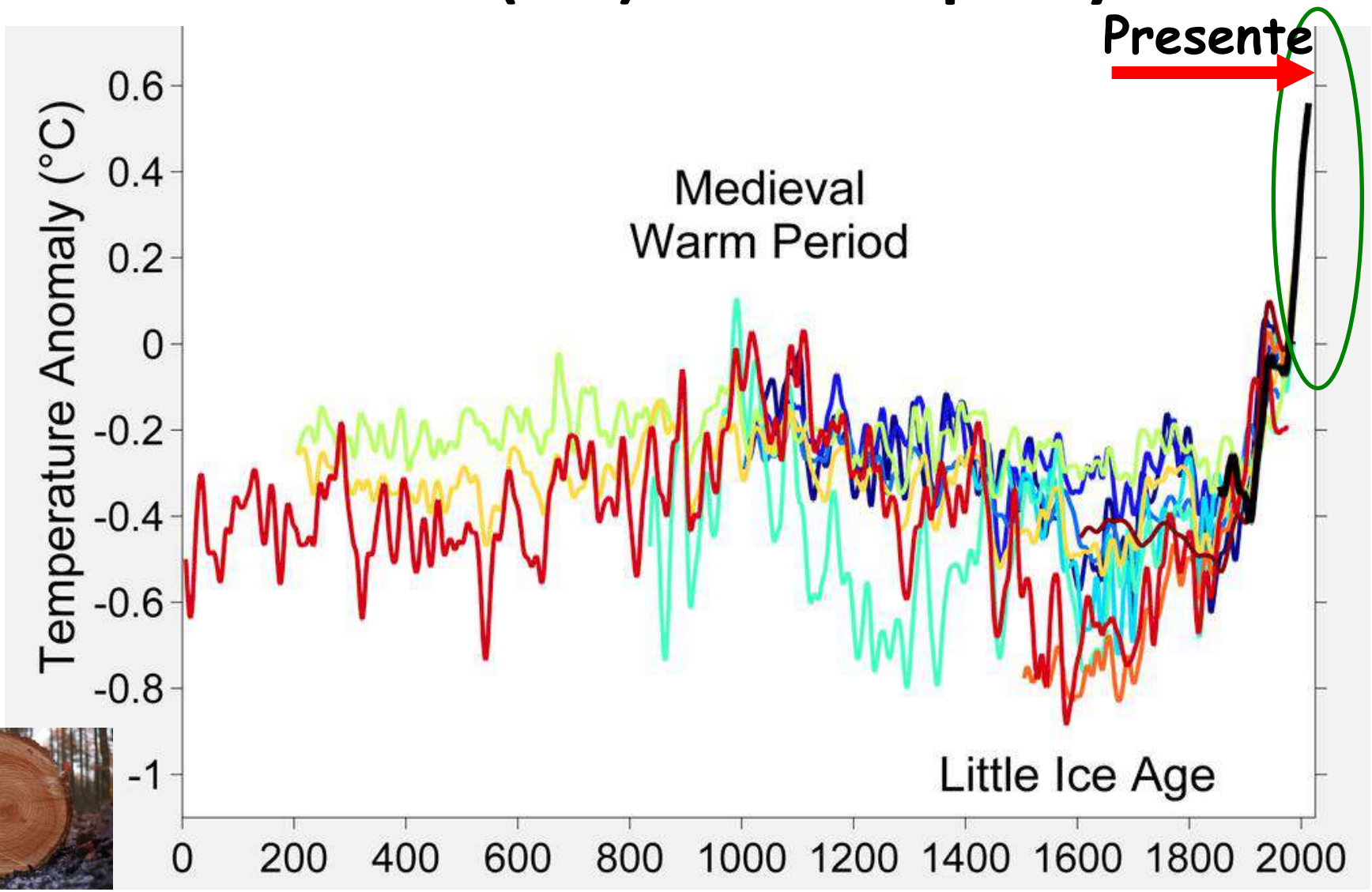


Variazioni nell’estensione del ghiaccio Artico

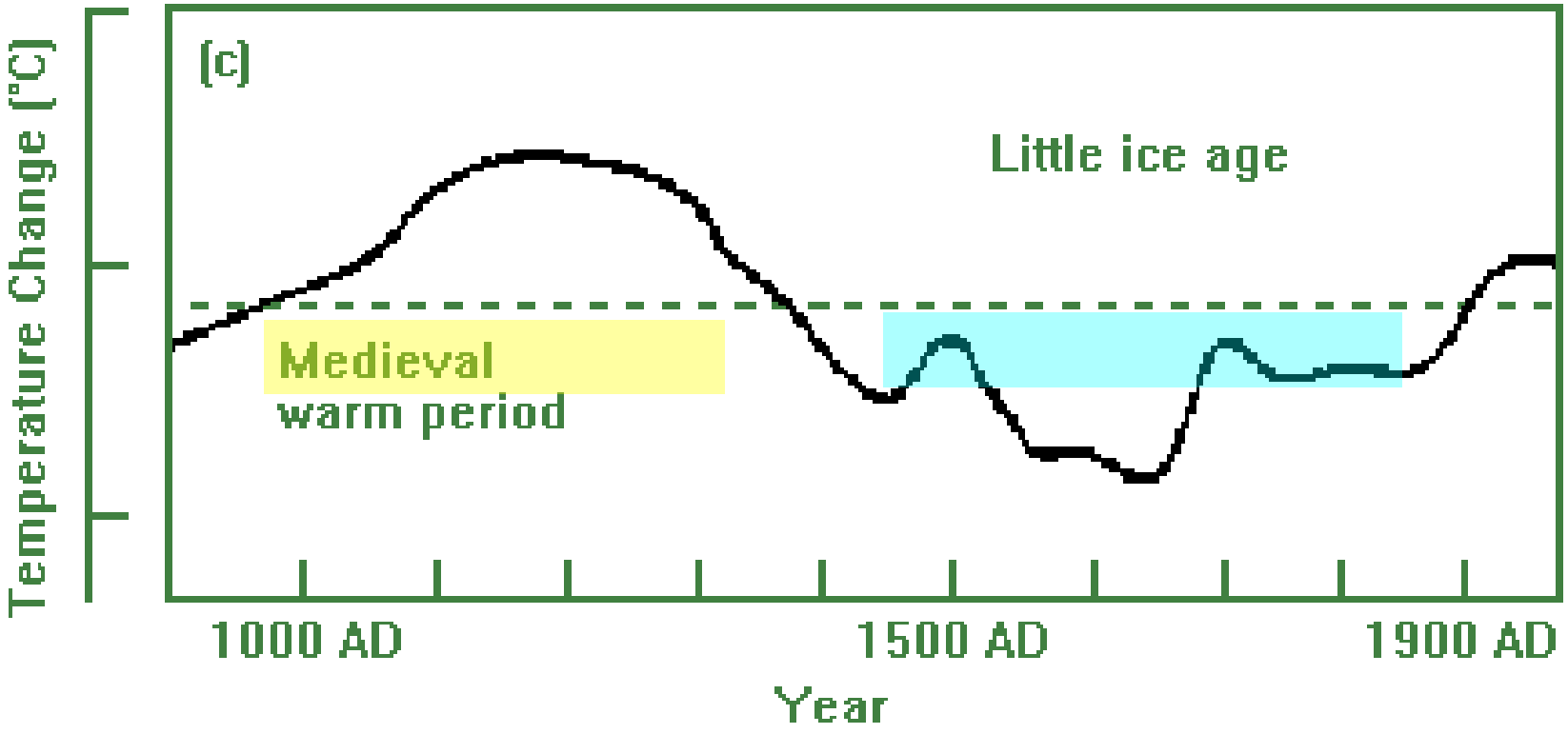


Passato Prossimo
[2000 years BP]

Ricostruzioni della temperatura superficiale dell'emisfero nord (NH) tramite "proxy"

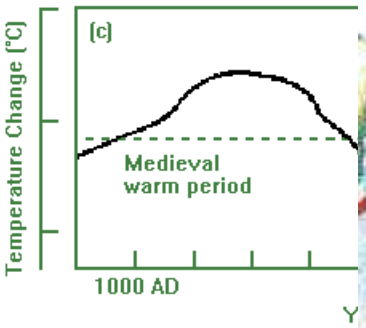


Cambiamenti avvenuti in periodi relativamente recenti



L'Optimum Climatico Medievale

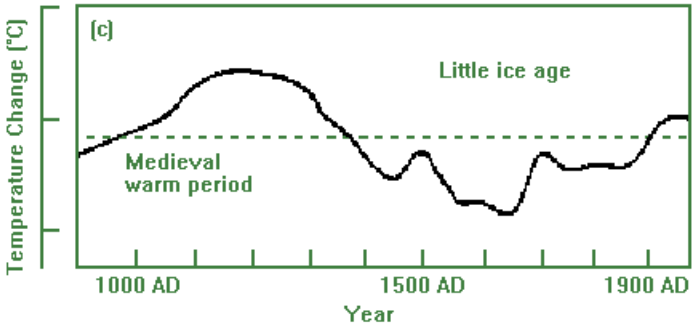
I Vichinghi,
sfruttando l'optimum climatico medioevale riescono ad esplorare tutto l'Atlantico Settentrionale.



Erik il Rosso,viaggia e fonda colonie in Groenlandia
Nord America (Vineland)

La Piccola Era Glaciale

Dopo il 1450, le cose cambiano. Sul settore EuroAtlantico le temperature volgono al freddo: e' arrivata la Piccola Era Glaciale.

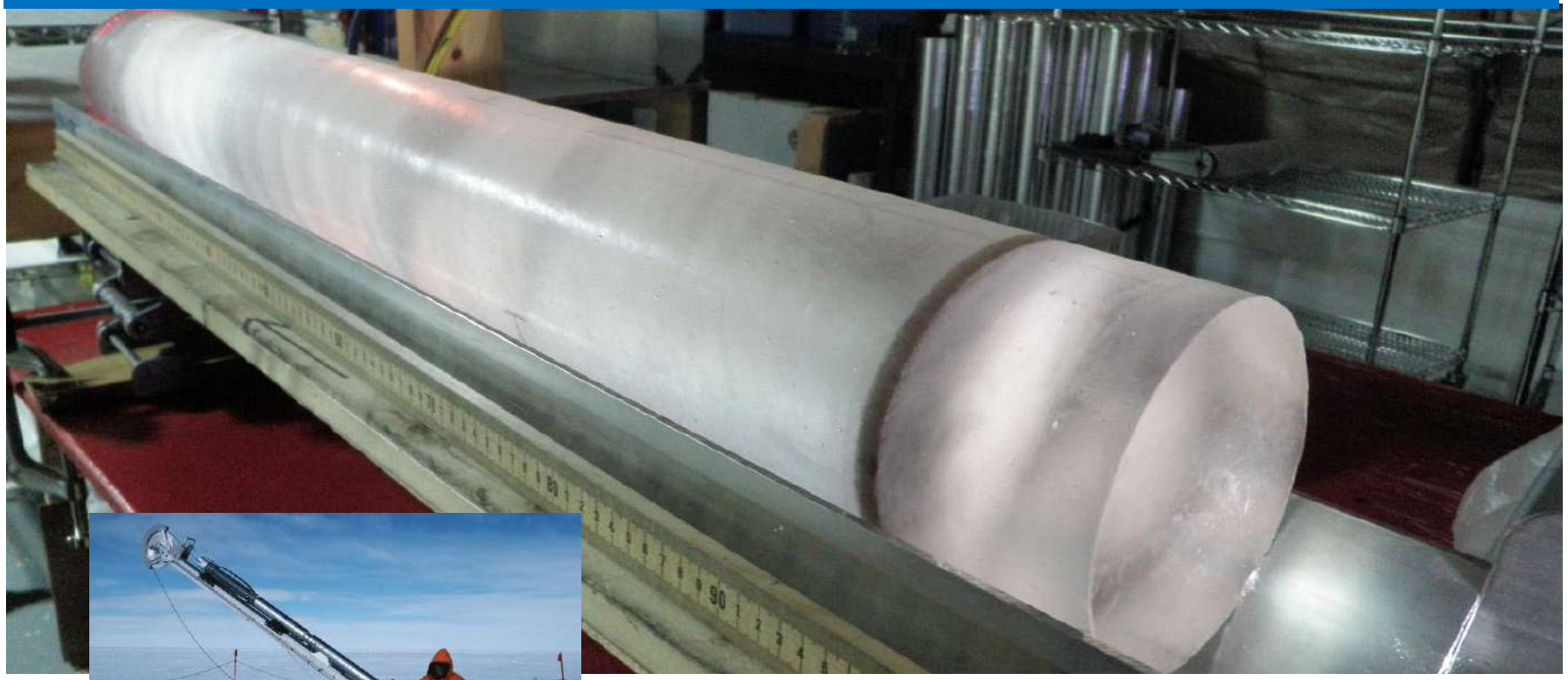


Le fiere del ghiaccio sul Tamigi (sec. XVI-XIX)

Passato Remoto
[650K years BP]

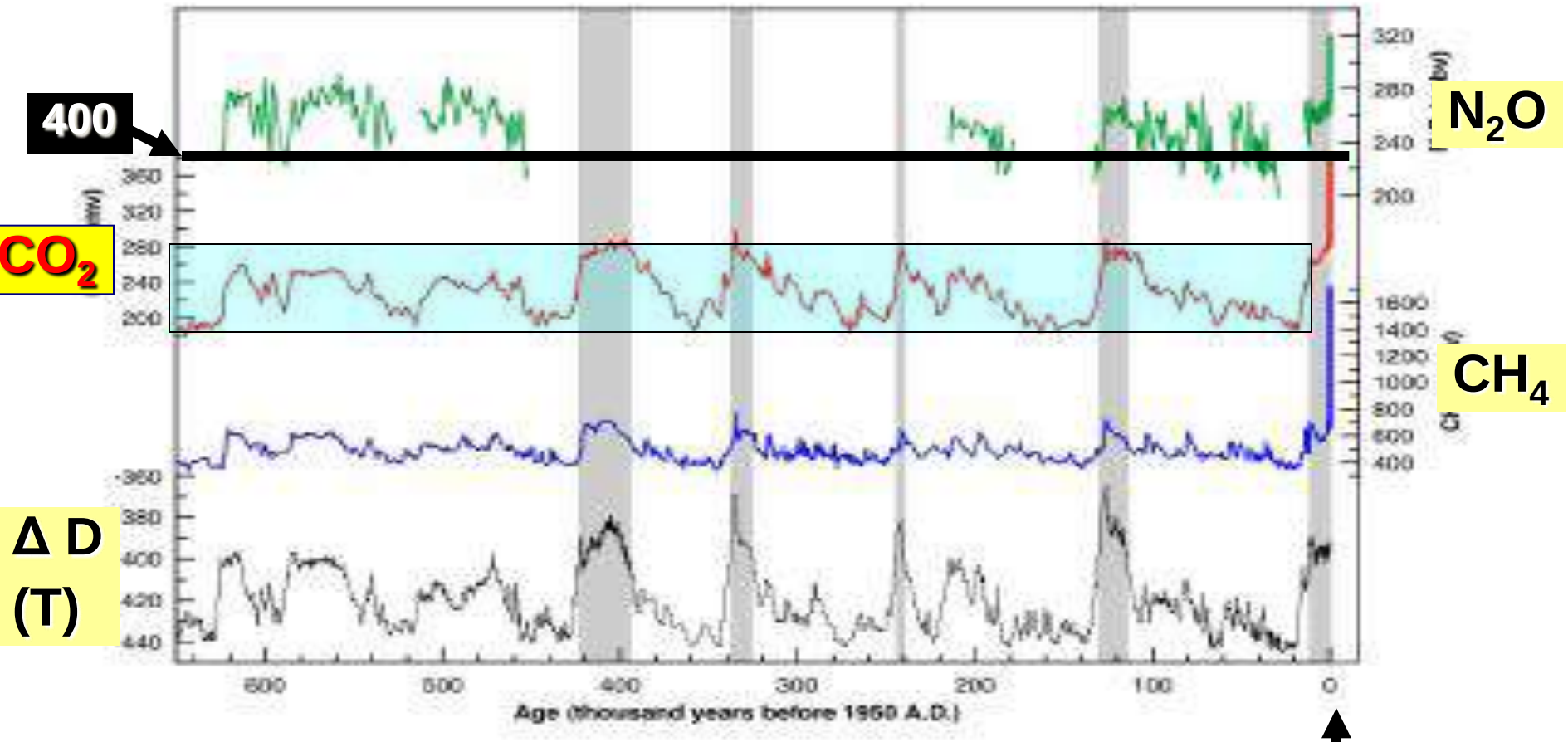
La memoria del ghiaccio:

il contributo della paleoclimatologia allo studio del clima

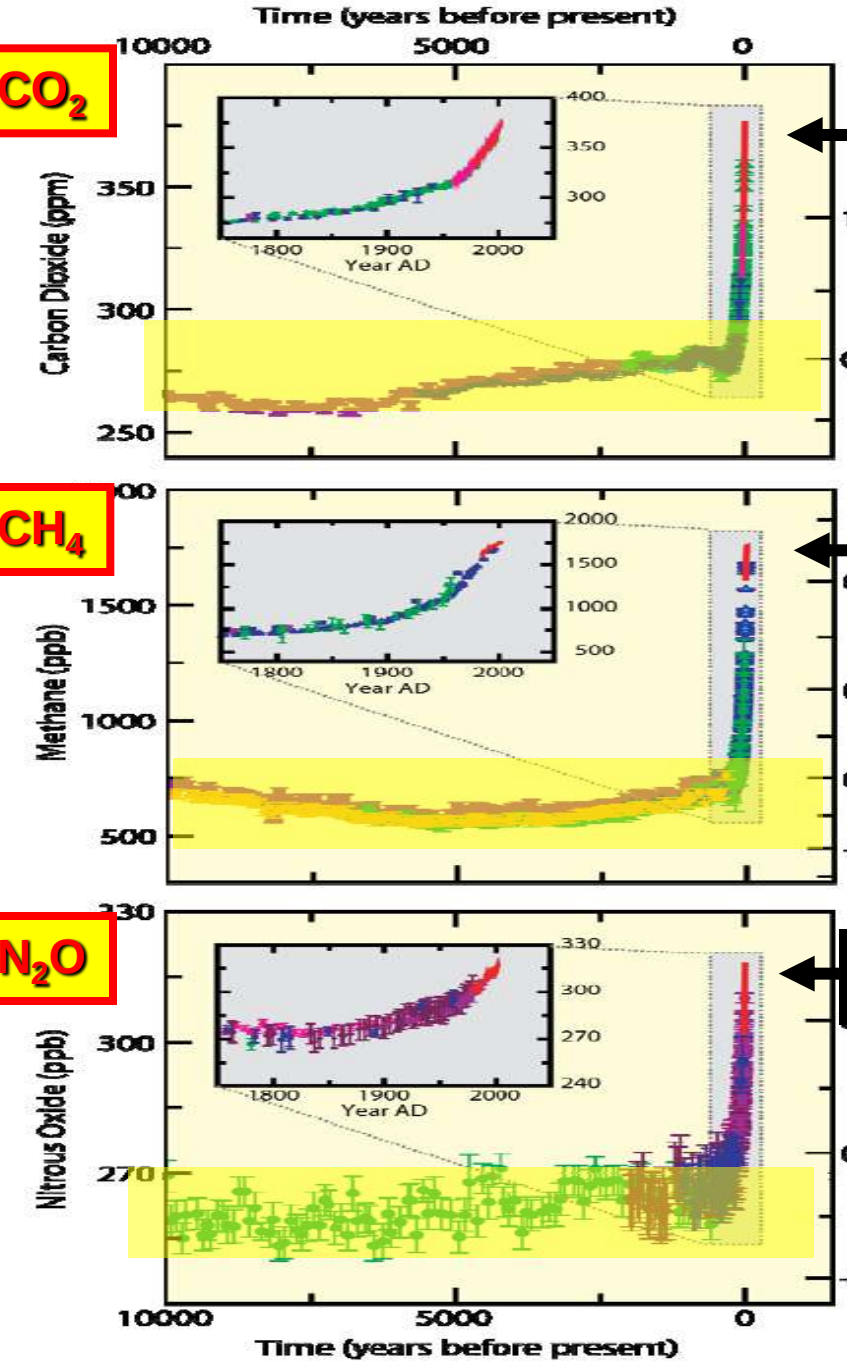


650000 anni fa - Presente:

Concentrazioni dei gas serra e "proxy" della temperatura



Fonte: *IPCC AR4 TS, da pubblicazioni di: Petit et al. (1999); Indermühle et al. (2000); EPICA community Members (2004); Spahni et al. (2005); Siegenthaler et al. (2005a,b).*



CO_2

2015: 400 ppm

7500 AC –1750:
260 - 280 ppm

CH_4

2015: 1823 ppb

7500 AC -1750:
715 ppb

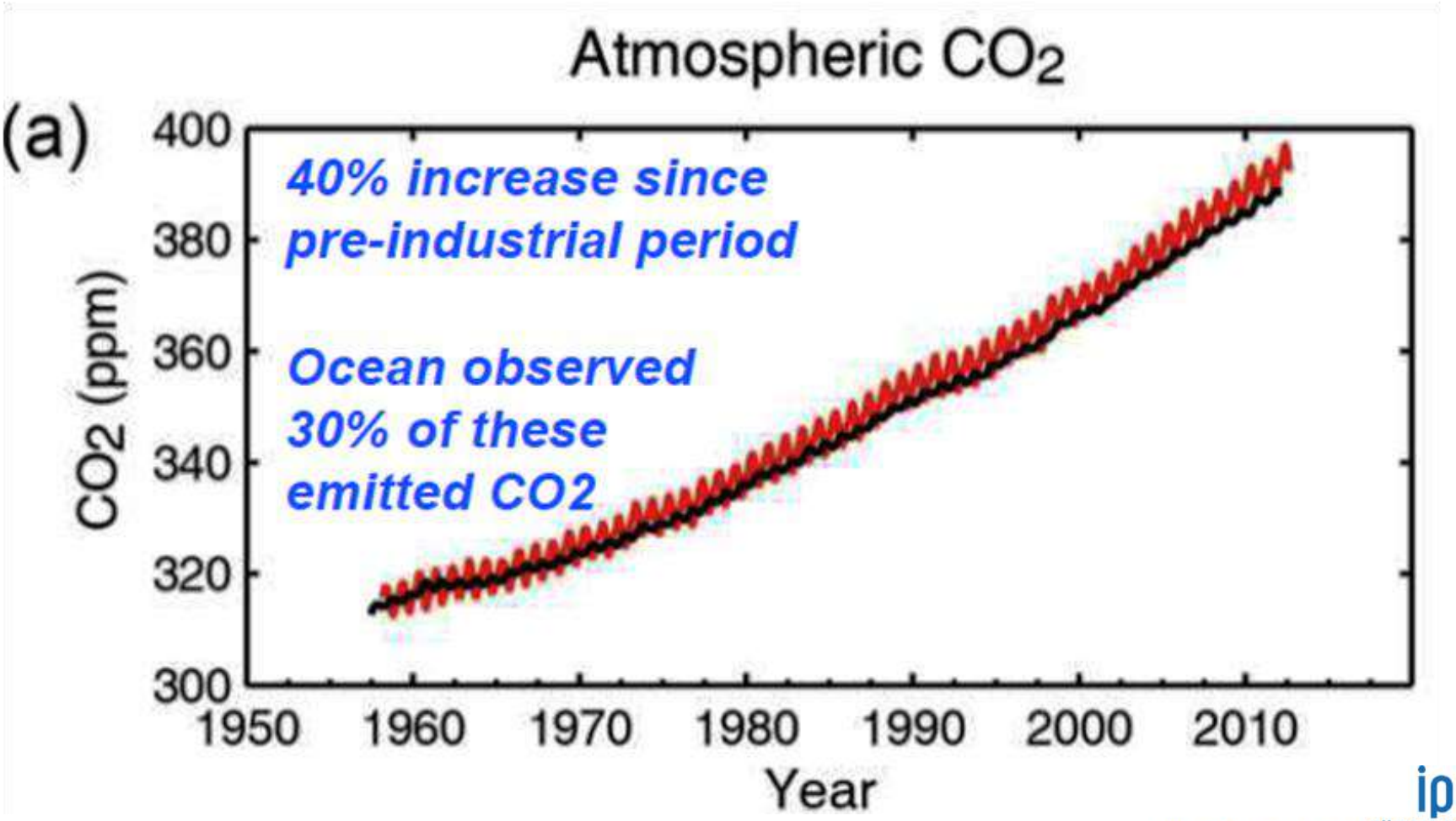
Variazione delle concentrazioni di GHG e del Forzante Radiativo: egli ultimi 10000 anni 750-2006

N_2O

2015: 327 ppb

7500 AC - 1750:
circa 270 ppb

The atmospheric concentrations of CO2, methane and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.



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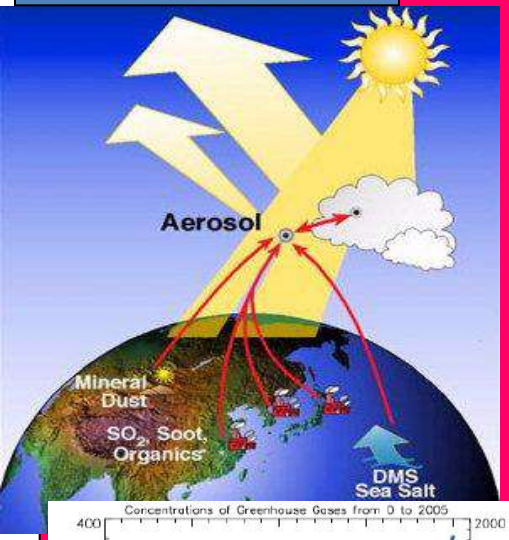
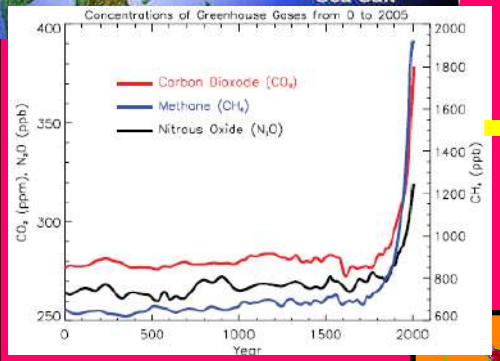
Understanding the causes

(Beyond detection)

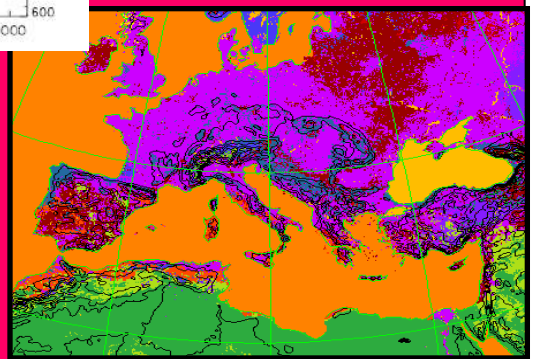
Fattori umani



Aerosol atmosferico



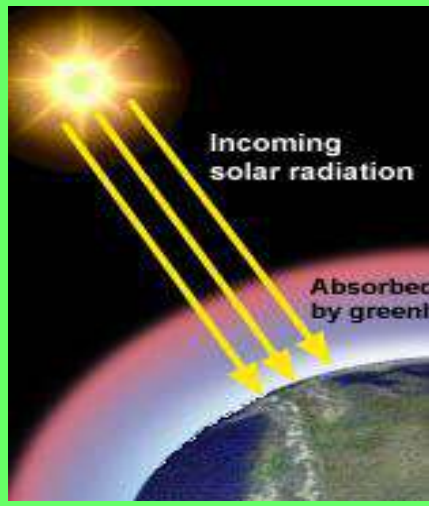
Uso del territorio



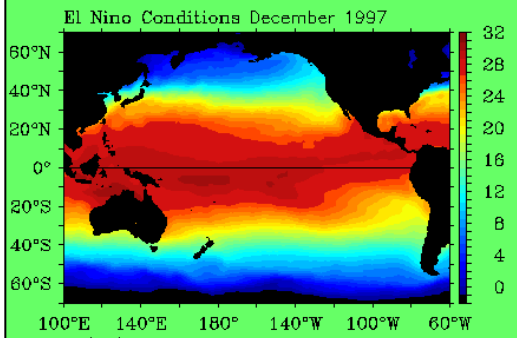
Attività vulcanica

Fattori naturali

Variazione della radiazione solare



Effetto Serra Rinforzato

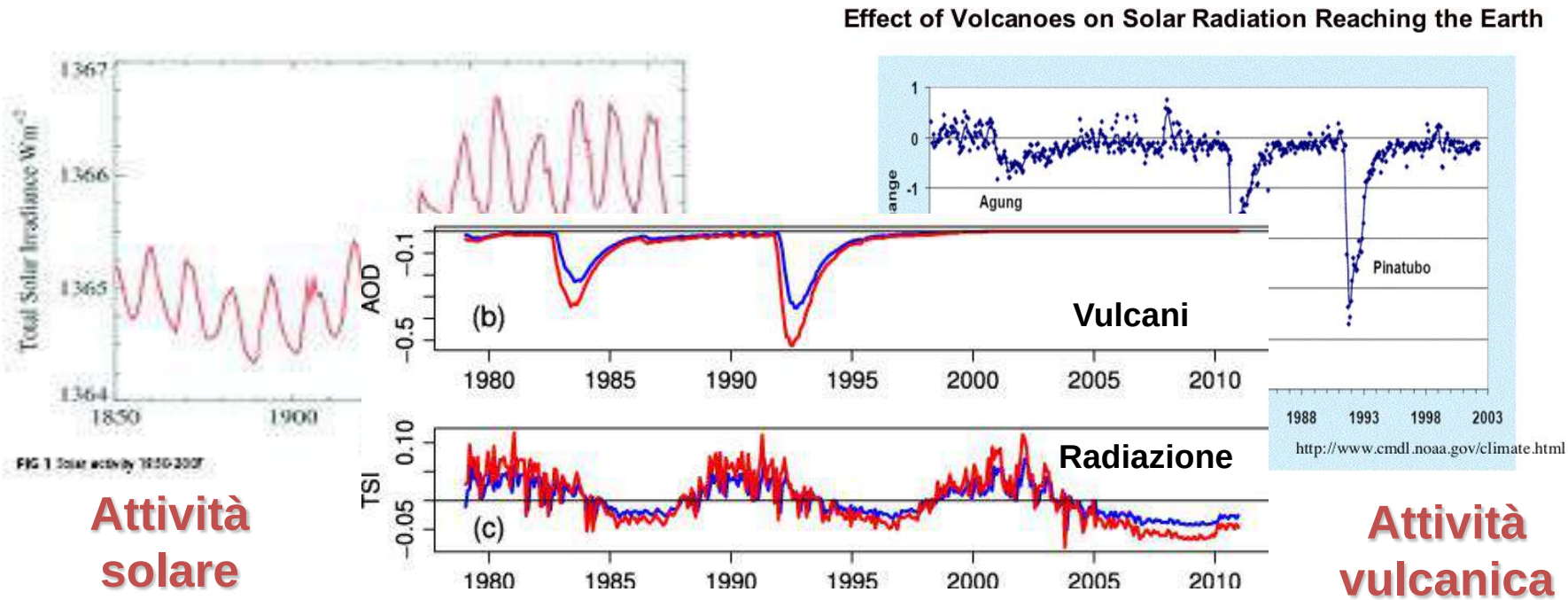


Variabilità naturale (ENSO, NAO)

Global Warming: e' dovuto alla naturale variabillità climatica?

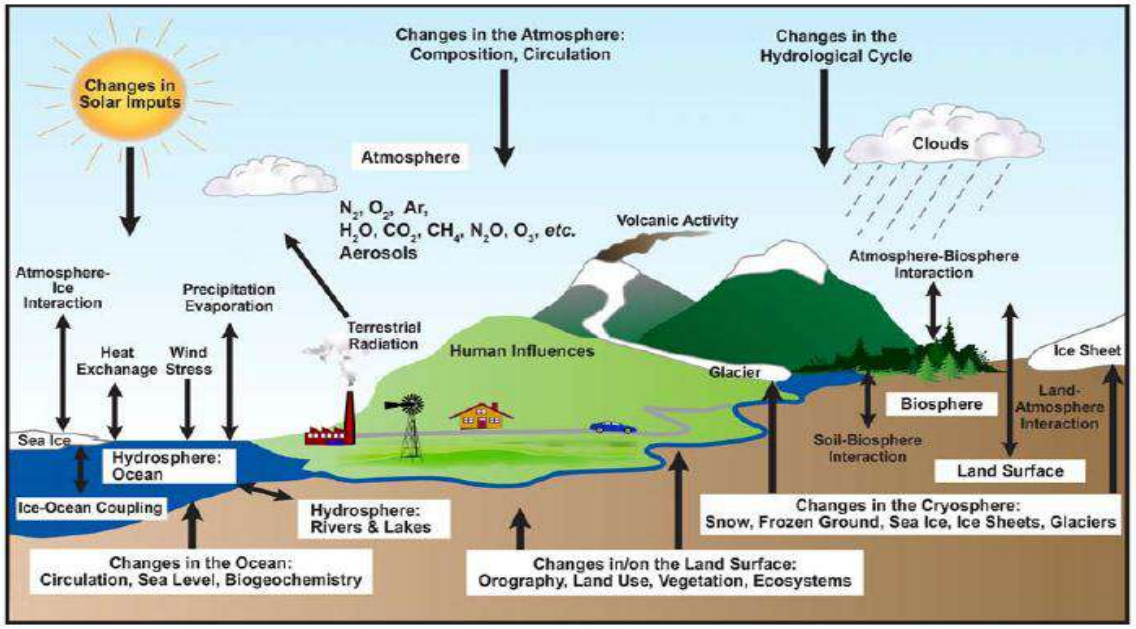
L'andamento dei cicli solari potrebbe spiegare il riscaldamento di inizio secolo, ma le misurazioni satellitari mostrano un'attivita' costante negli ultimi 35 anni

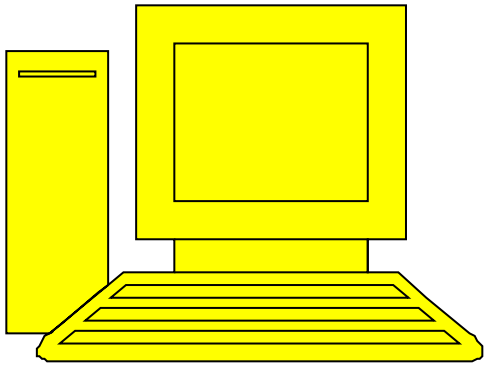
Le eruzioni vulcaniche, inizialmente imputate come possibile causa di riscaldamento, schermano la radiazione solare incidente, contribuendo a un temporaneo raffreddamento



MODELLI NUMERICI DEL CLIMA

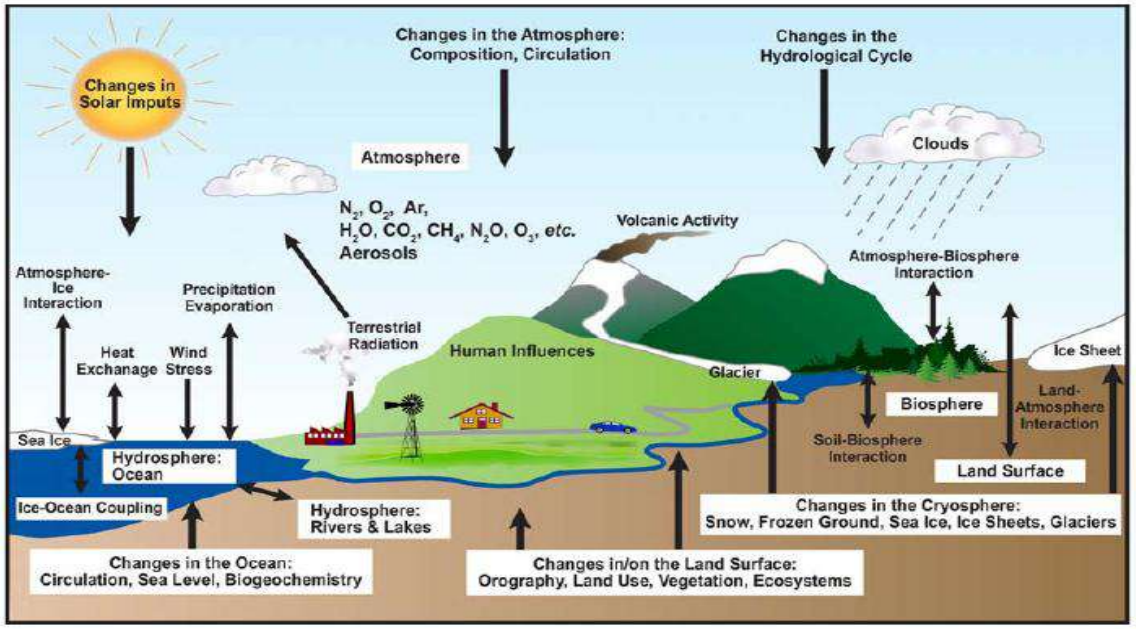
Il sistema clima

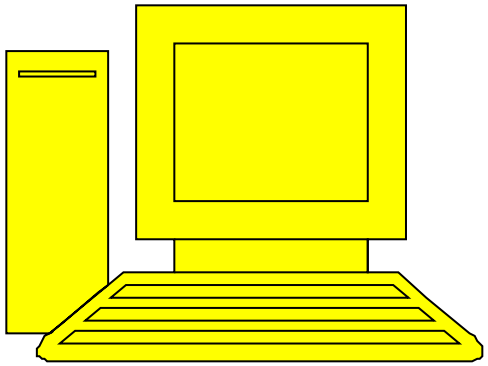




MODELLI NUMERICI DEL CLIMA

Il sistema clima





$$\frac{\partial u}{\partial t}+\vec{v}\cdot\nabla u-2\Omega\sin\theta v-\frac{uv\tan\theta}{a}+\frac{uw}{a}=-\frac{1}{\rho a\cos\theta}\frac{\partial p}{\partial\lambda}+F_\lambda$$

$$\frac{\partial v}{\partial t}+\vec{v}\cdot\nabla v+2\Omega\sin\theta u-\frac{u^2\tan\theta}{a}+\frac{vw}{a}=-\frac{1}{\rho a}\frac{\partial p}{\partial\theta}+F_\theta$$

$$\frac{\partial w}{\partial t}+\vec{v}\cdot\nabla w-\frac{u^2+v^2}{a}=-\frac{1}{\rho}\frac{\partial p}{\partial z}-g+F_z$$

$$\frac{\partial T}{\partial t}+\vec{v}\cdot\nabla T=\frac{1}{C_p\rho}\frac{dp}{dt}-Q$$

$$\frac{\partial\rho}{\partial t}+\vec{v}\cdot\nabla\rho+\frac{\rho}{a\cos\theta}\left[\frac{\partial u}{\partial\lambda}+\frac{\partial}{\partial\theta}(v\cos\theta)\right]=-\rho\frac{\partial w}{\partial z}$$

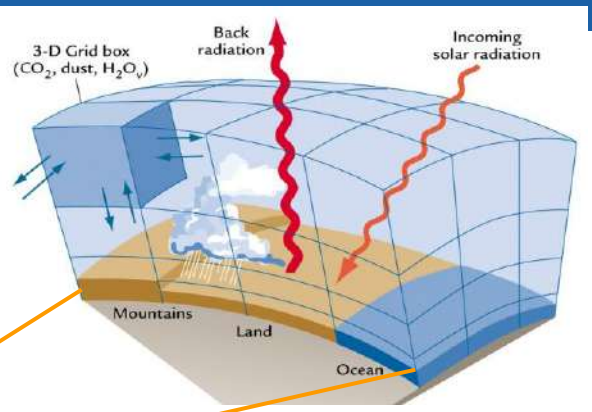
$$p=\rho Rt$$

CMCC High Performance Computing System

NEC SX9
Vector Machine

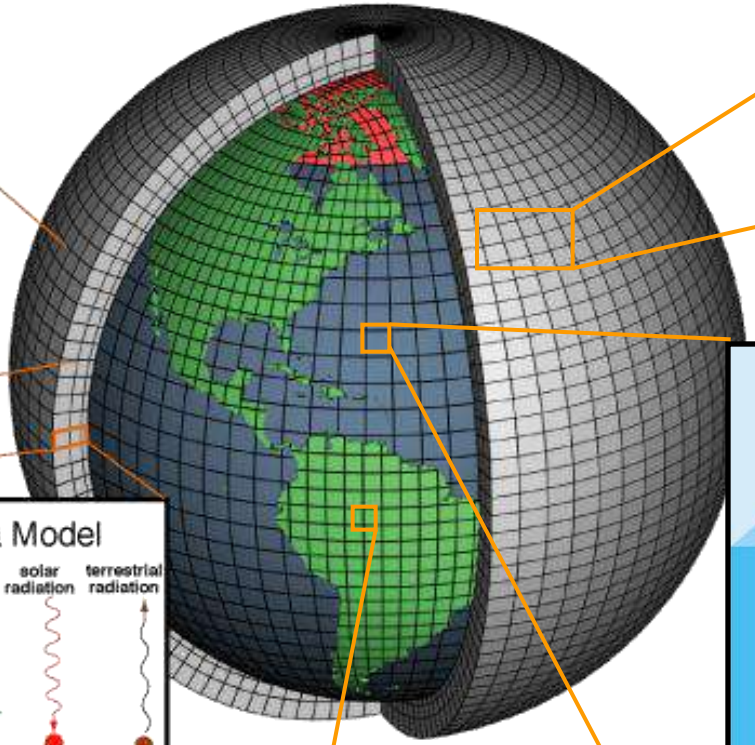
IBM Power 6
Cluster

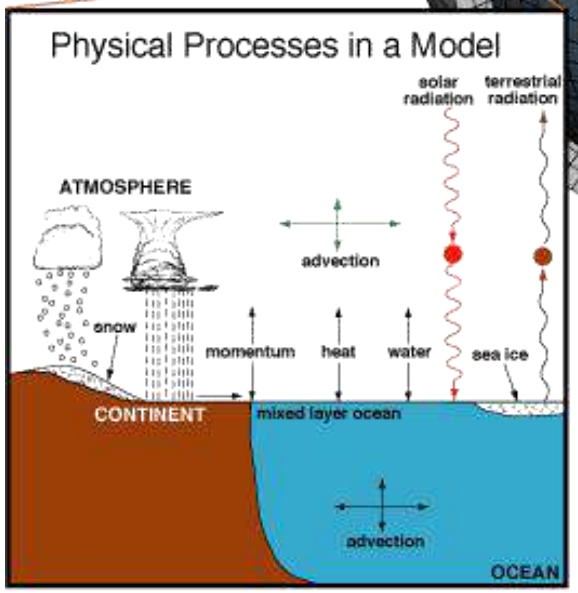
Il modello numerico di simulazione del Sistema Terra



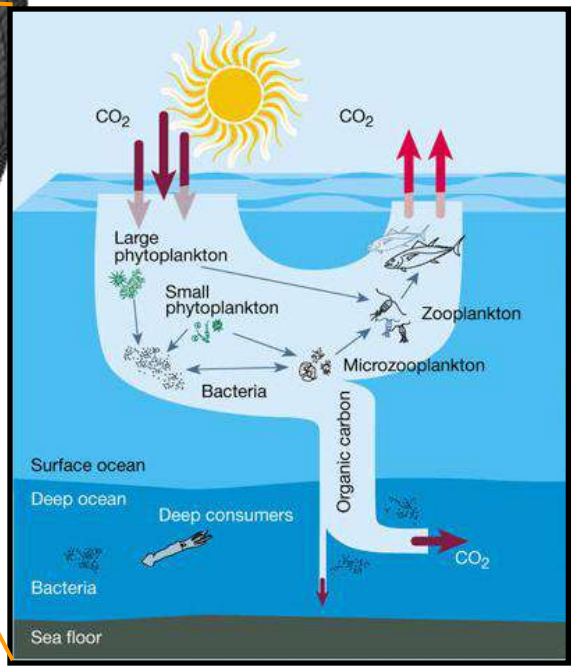
Horizontal Grid
(Latitude-Longitude)

Vertical Grid
(Height or Pressure)



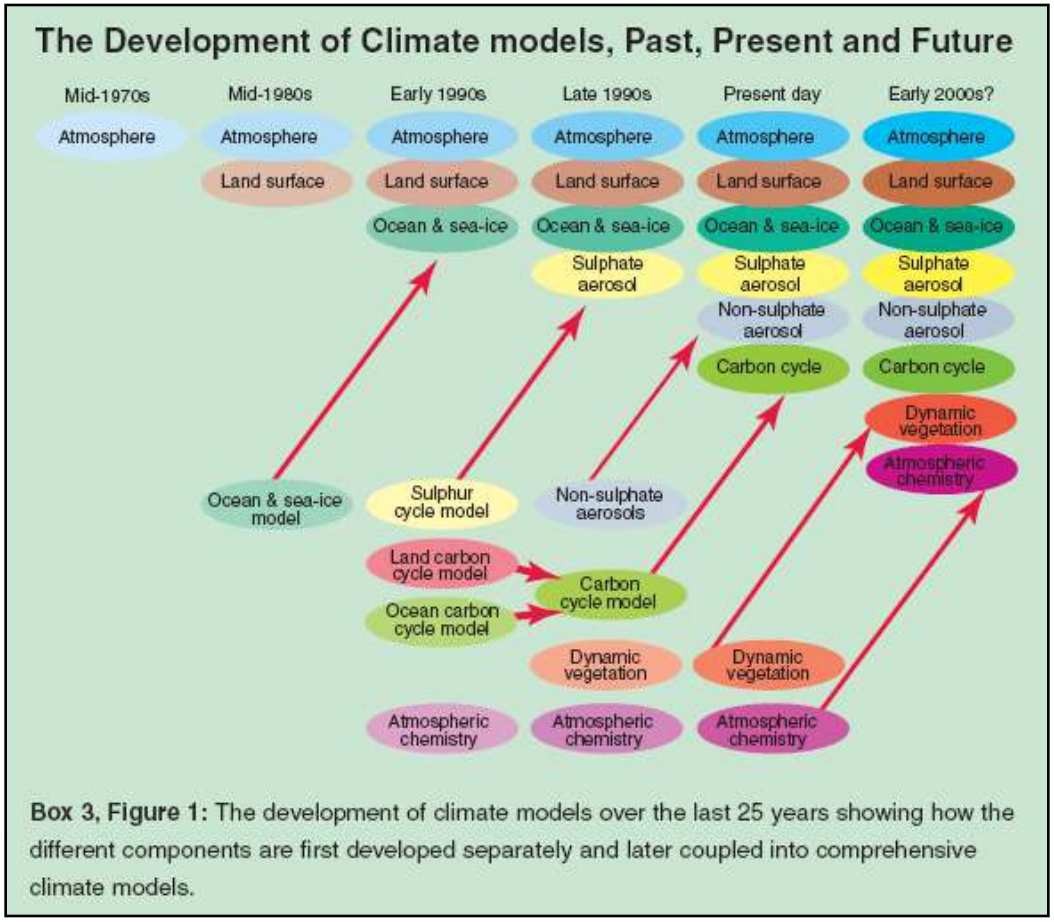


Ocean biogeochemical processes

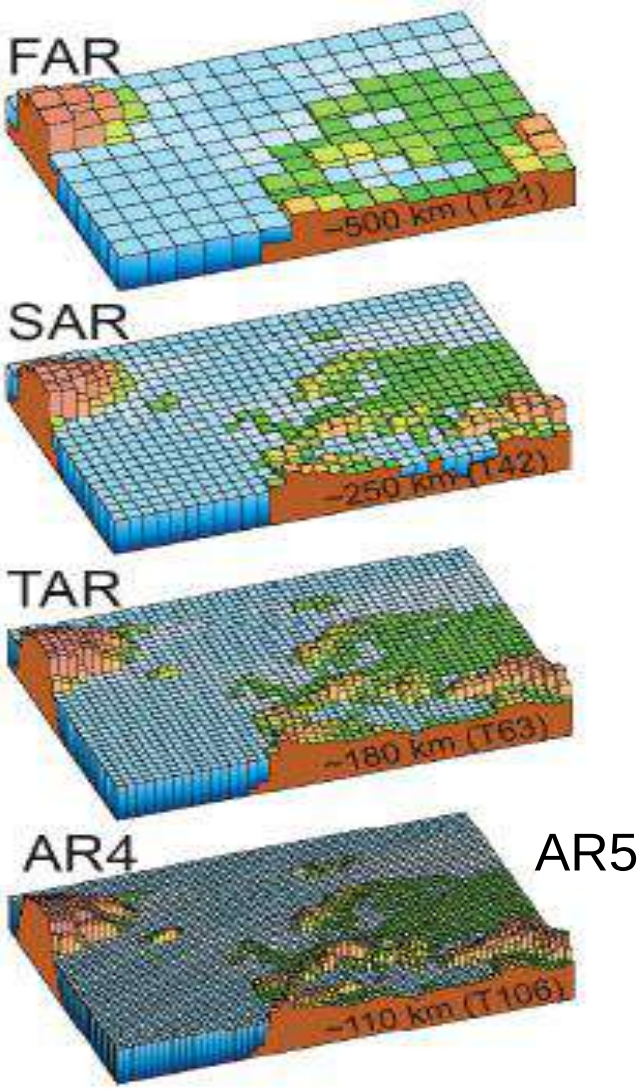


Land biogeochemical processes

EVOLUZIONE DEI MODELLI CLIMATICI



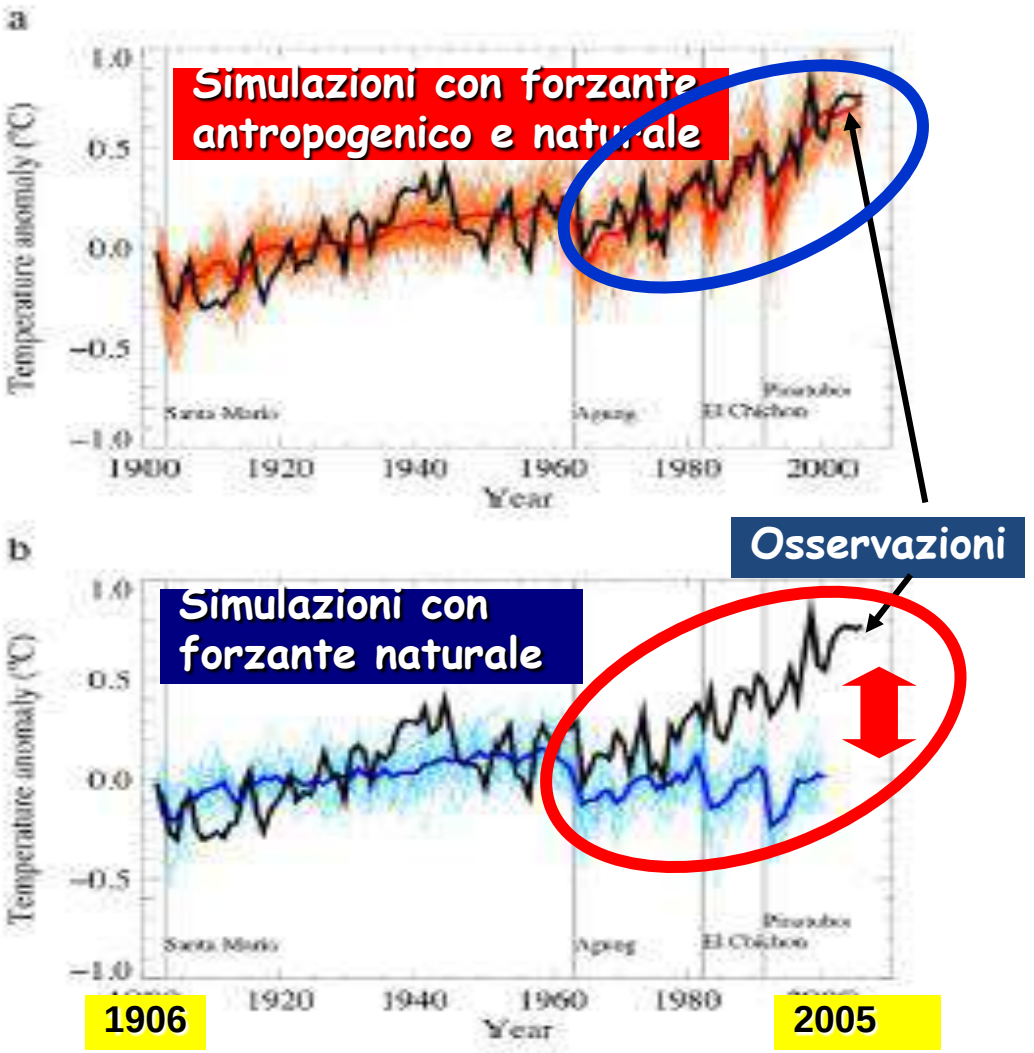
Box 3, Figure 1: The development of climate models over the last 25 years showing how the different components are first developed separately and later coupled into comprehensive climate models.



1906 – 2005:
Anomalie di T_{surf} globale relative a (1901-1950)

(58 Simulazioni con 14 *AOGCM*)

WGI – AR4 – IPCC (2007)



Solo utilizzando forzanti antropogenici e naturali i risultati dei modelli si riconciliano con le osservazioni.

Il futuro

Che cosa accadrà?

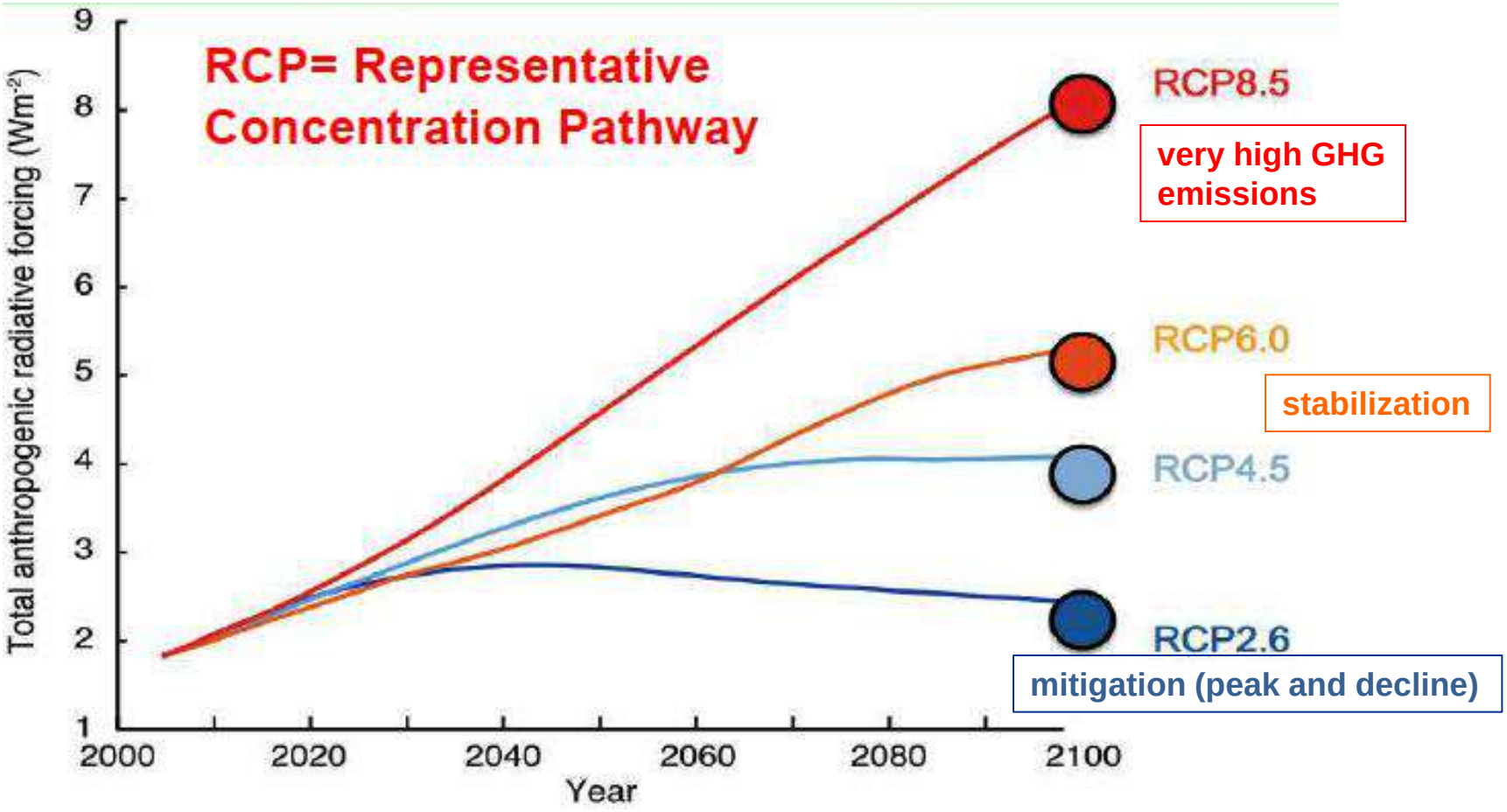
Possiamo usare dei **MODELLI CLIMATICI** per fare **SCENARI**.

Uno **SCENARIO** è una descrizione plausibile di cosa potrebbe accadere nel Sistema Terra come lo conosciamo, basato su un insieme coerente ed internamente consistente di assunzioni sulle forze che lo guidano (soprattutto economiche, tassi di sviluppo tecnologico, andamento dei mercati, etc.).

Gli SCENARI non sono previsioni

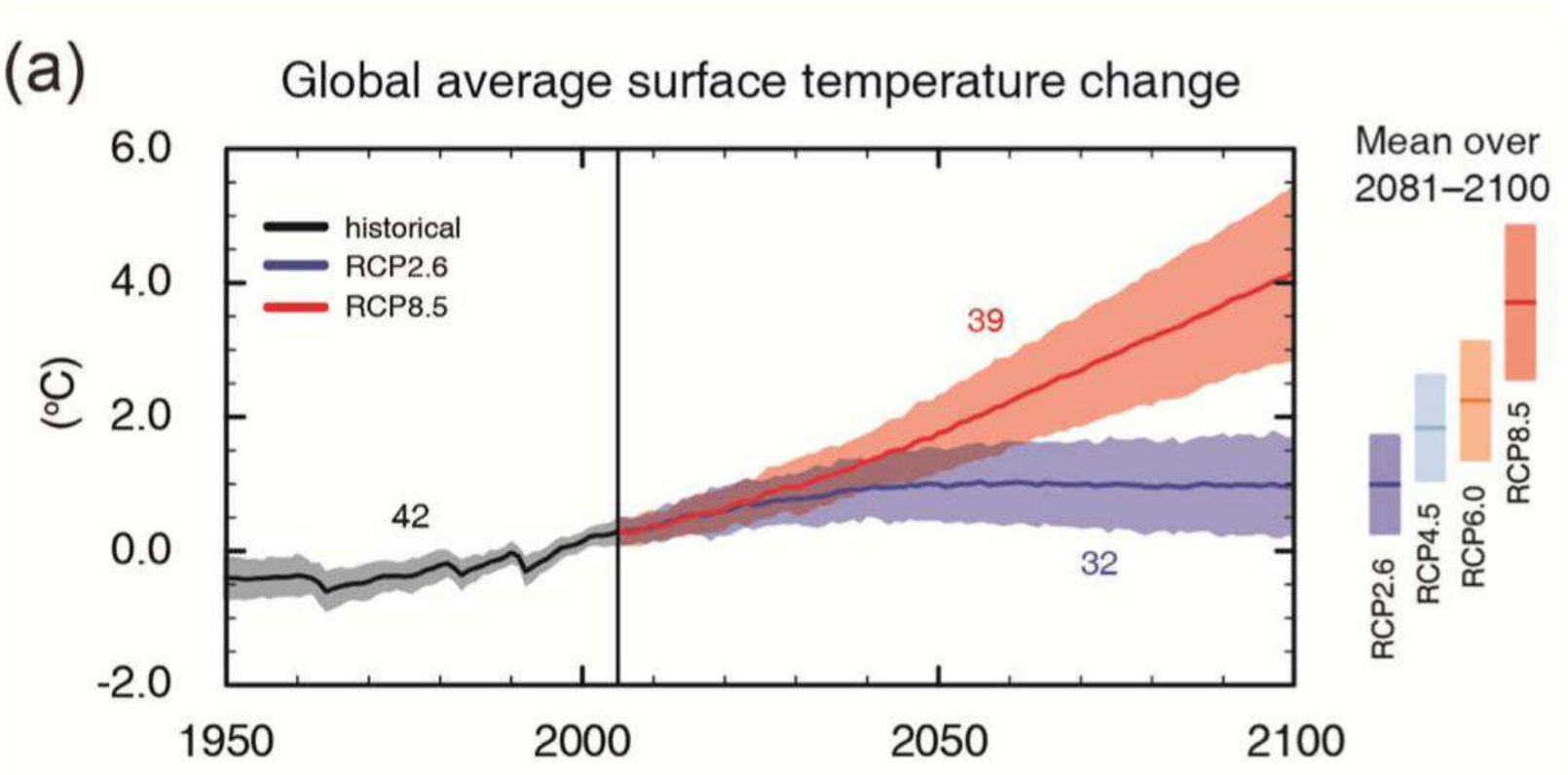
Proiezioni di clima futuro

For future climate projections, climate models requires **Emission Scenarios**. Models in AR5 use ***Representative Concentration Pathway (RCP)***



RCPs represent a range of 21st Century climate policy scenarios

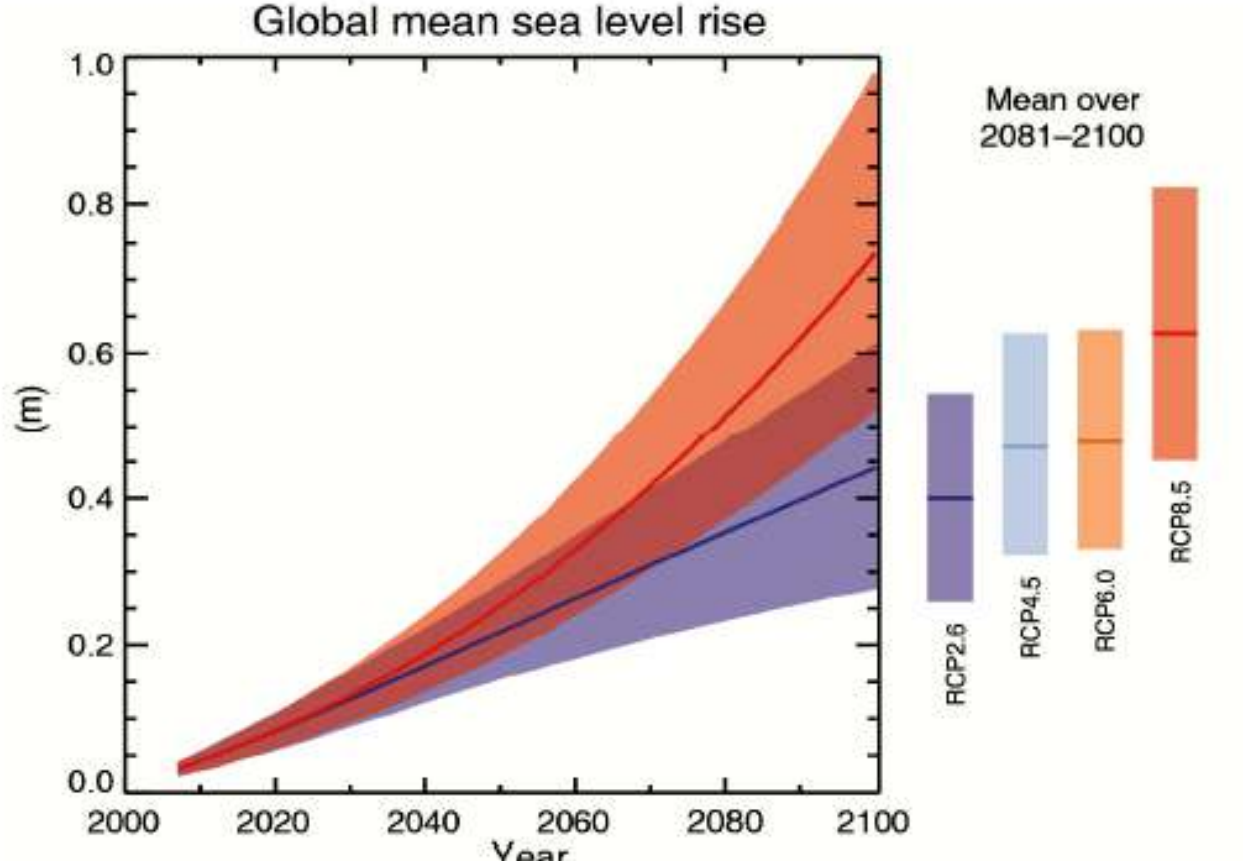
Proiezioni di temperatura media globale superficiale



The temperature increase during the last 100 years was only about **0.8°C**.

Global surface temperature change for the end of the 21st century is *likely to exceed* 1.5° C relative to 1850–1900 for all scenarios except RCP2.6.

Il livello del mare continuera' ad aumentare nel corso del 21mo secolo



RCP2.6 (2081-2100): *likely range:* **26 to 55 cm**

RCP8.5 (2081-2100): *likely range:* **45 to 82 cm**

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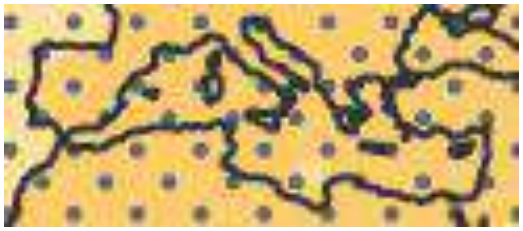
2100: temperatura superficiale

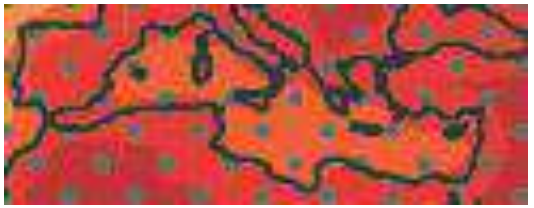
(2 scenari)

1 – 1,5 °C Increase



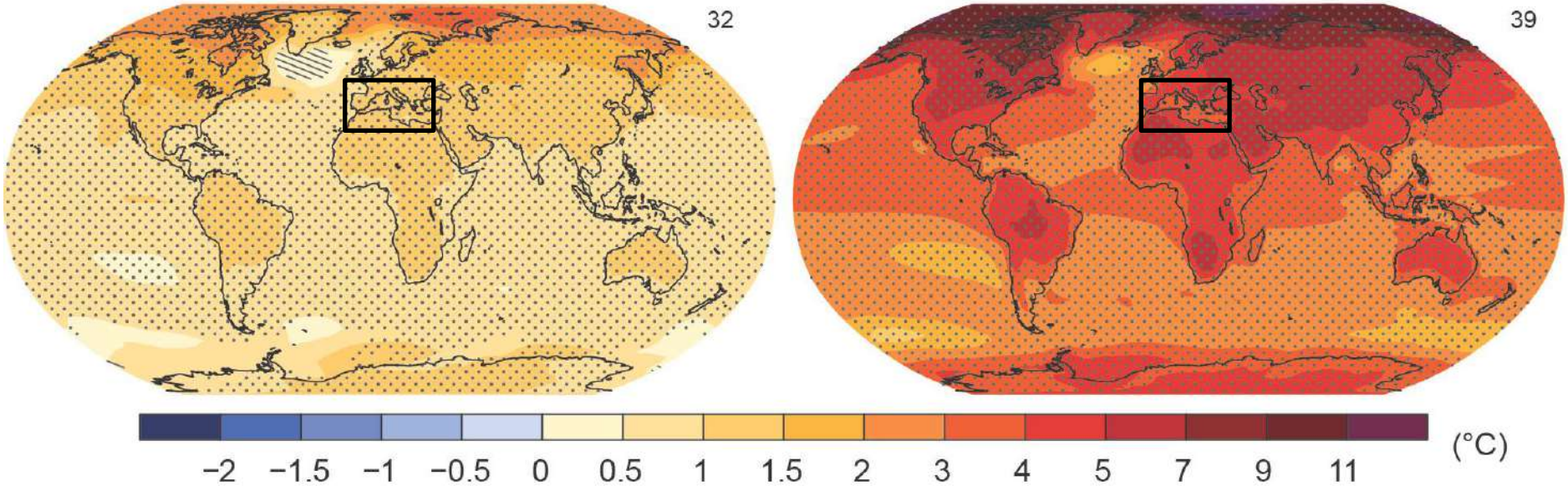
RCP 2.6

4 – 7 °C Increase



RCP 8.5

(a) Change in average surface temperature (1986–2005 to 2081–2100)



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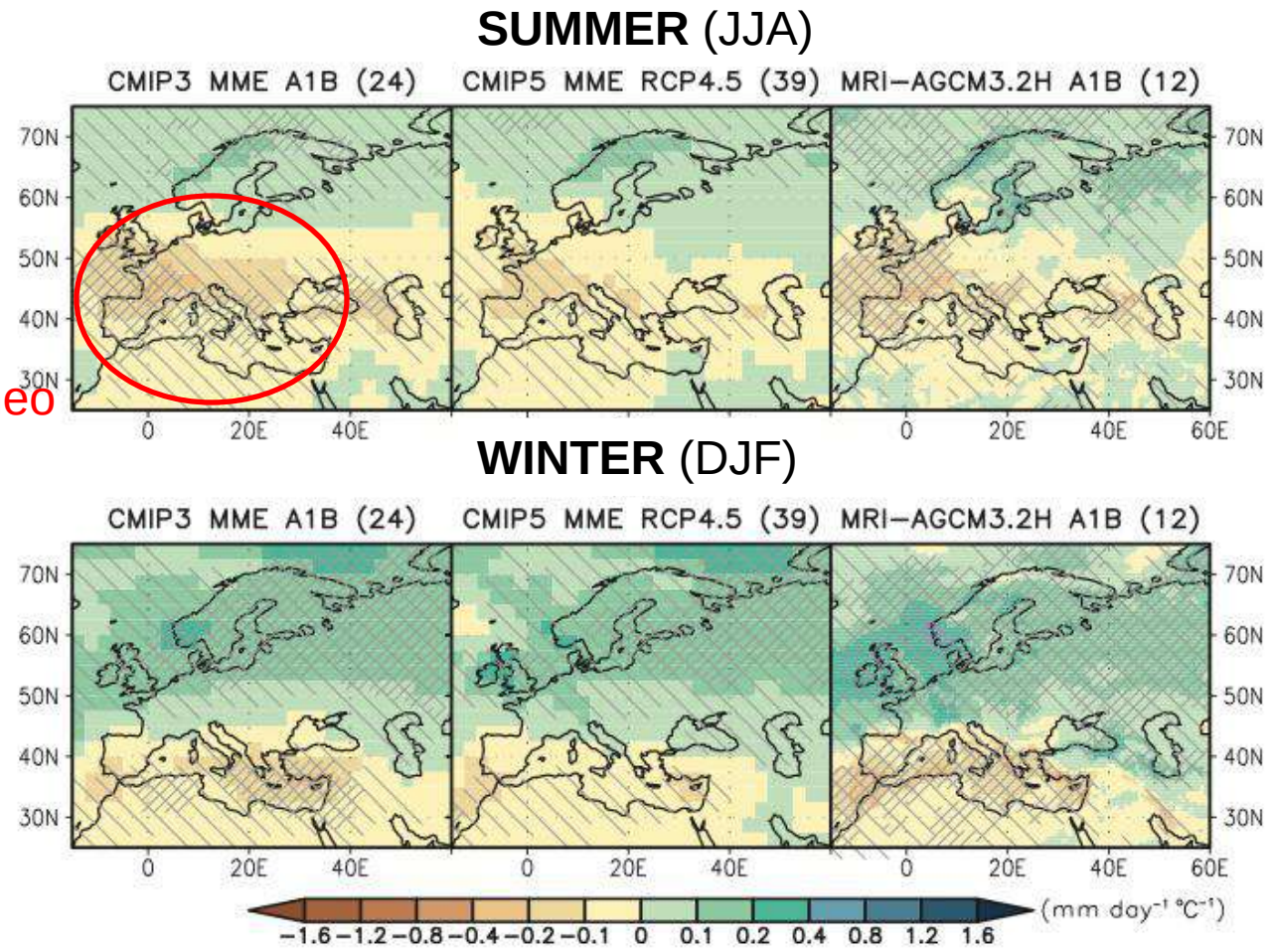
INTERGOVERNMENTAL PANEL ON climate change

Cambiamenti attesi per la precipitazione sulla regione Euro-Med (2080-2100 vs 1986-2005)

clima
estivo secco
sulla regione
del Mediterraneo

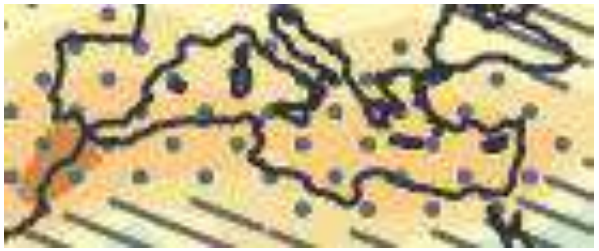


Small changes are expected over the Central and Northern Europe but a **notable reduction (dry conditions) over the Mediterranean region**

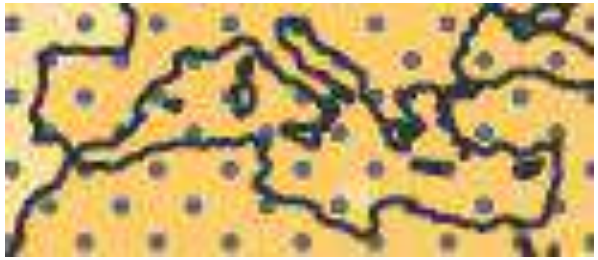
2100: verso un clima piu' caldo e piu' secco

10% Decrease

10-20% Decrease



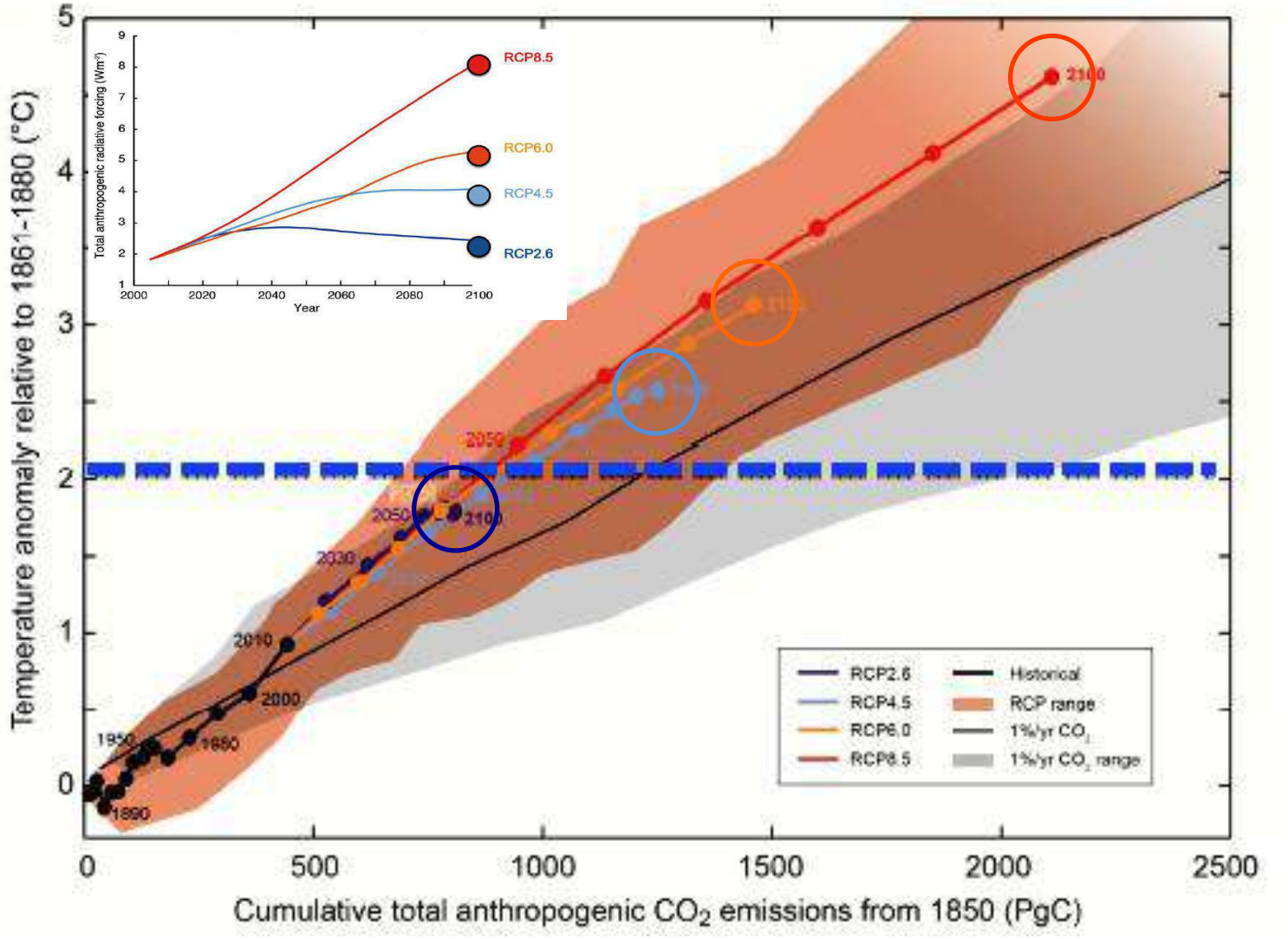
1 – 1,5 °C Increase



RCP 2.6

4 – 7 °C Increase

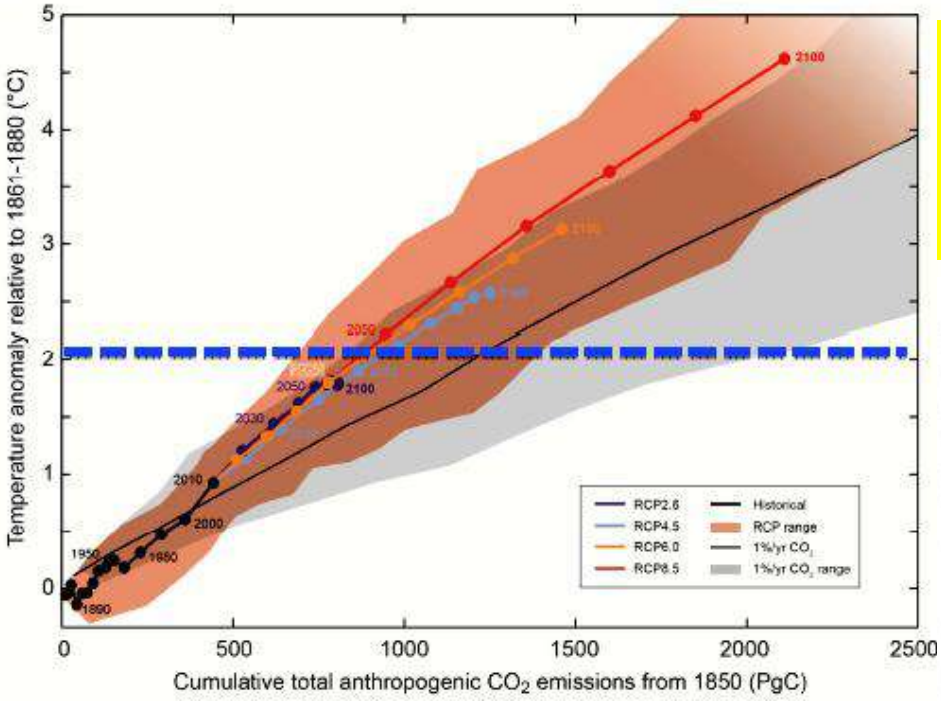
RCP 8.5


Temperature anomaly relative to 1861-1880 (°C)
Cumulative total anthropogenic CO_2 emissions from 1850 (PgC)
Total anthropogenic radiative forcing (Wm^{-2})
Year
RCP8.5
RCP6.0
RCP4.5
RCP2.6
2100
2050
2030
2010
2000
1950
1890
RCP2.6
RCP4.5
RCP6.0
RCP8.5
Historical
RCP range
1%/yr CO_2
1%/yr CO_2 range

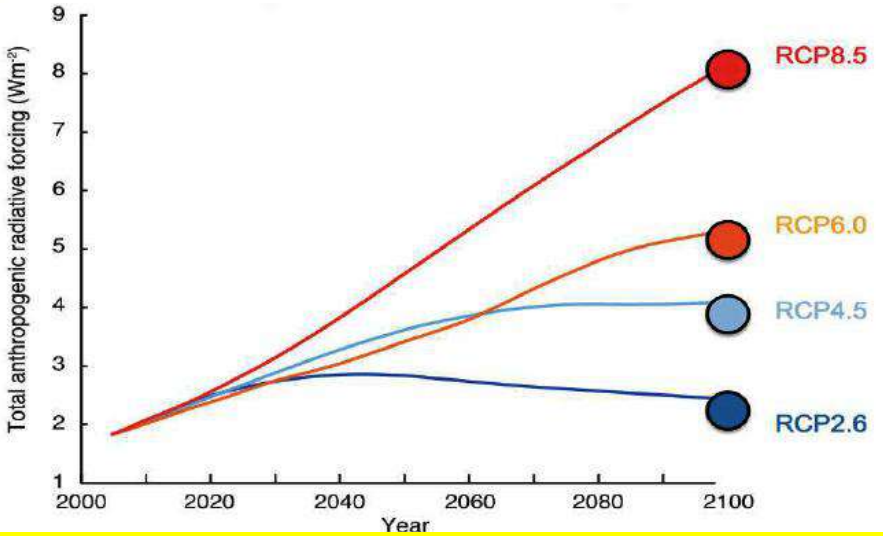
MITIGAZIONE:

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Limiting climate change will require substantial and sustained reductions of GHG emissions



RCP2.6 would be the Emission Scenario to follow if we were to cap warming at **2°C**



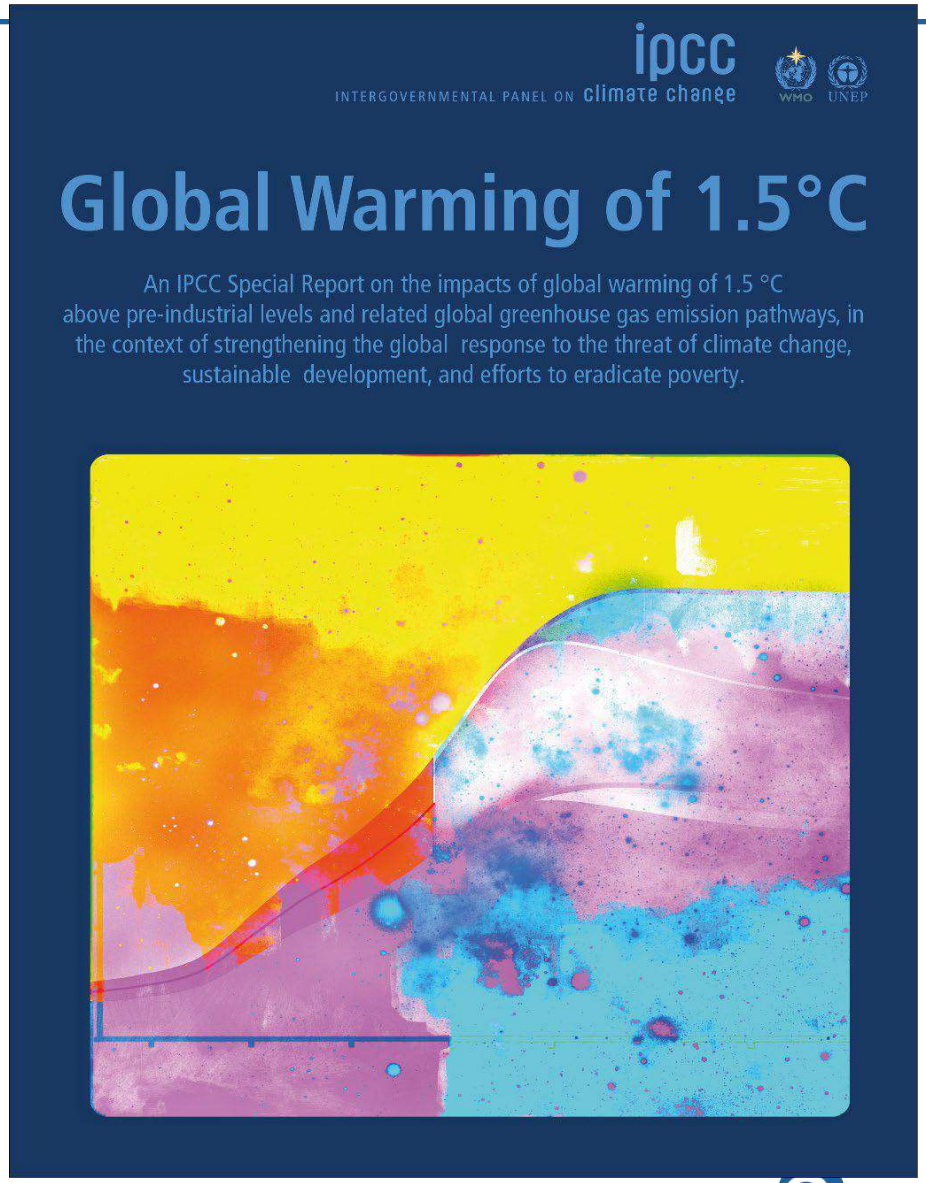
To limit warming to ***likely less than 2°C*** as in **RCP2.6**, requires total emissions since preindustrial to be limited to less than about **790 PgC**.

515 PgC were emitted by 2011.

The 1.5°C Report (2018)

This Report responds to the invitation for IPCC *"... to provide a Special Report in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways"* contained in the Decision of the 21st COP (Paris)

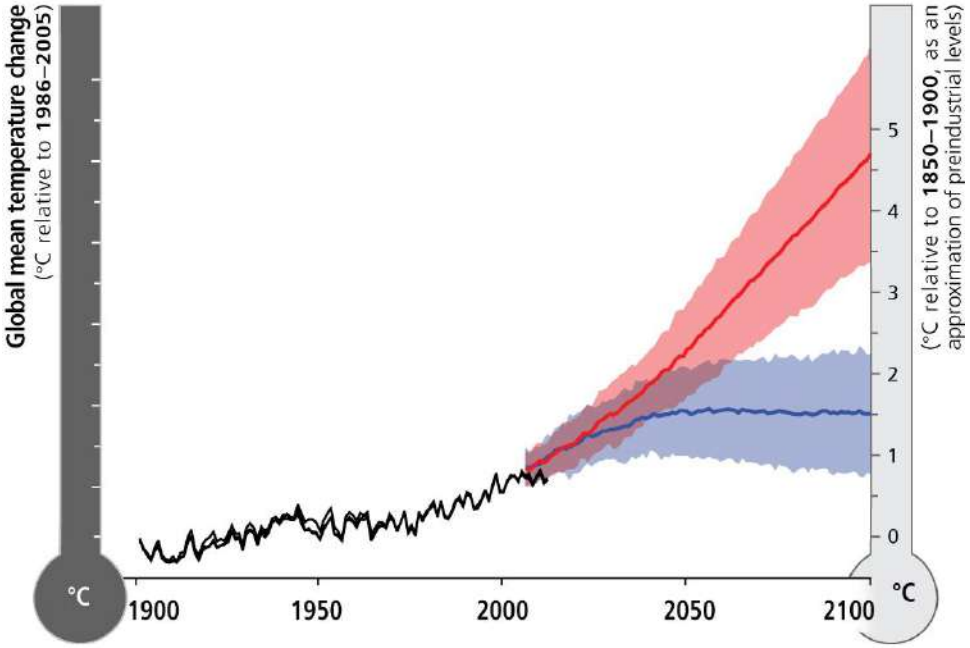
The IPCC accepted the invitation, adding that the Special Report would look at these issues in the context *of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*.

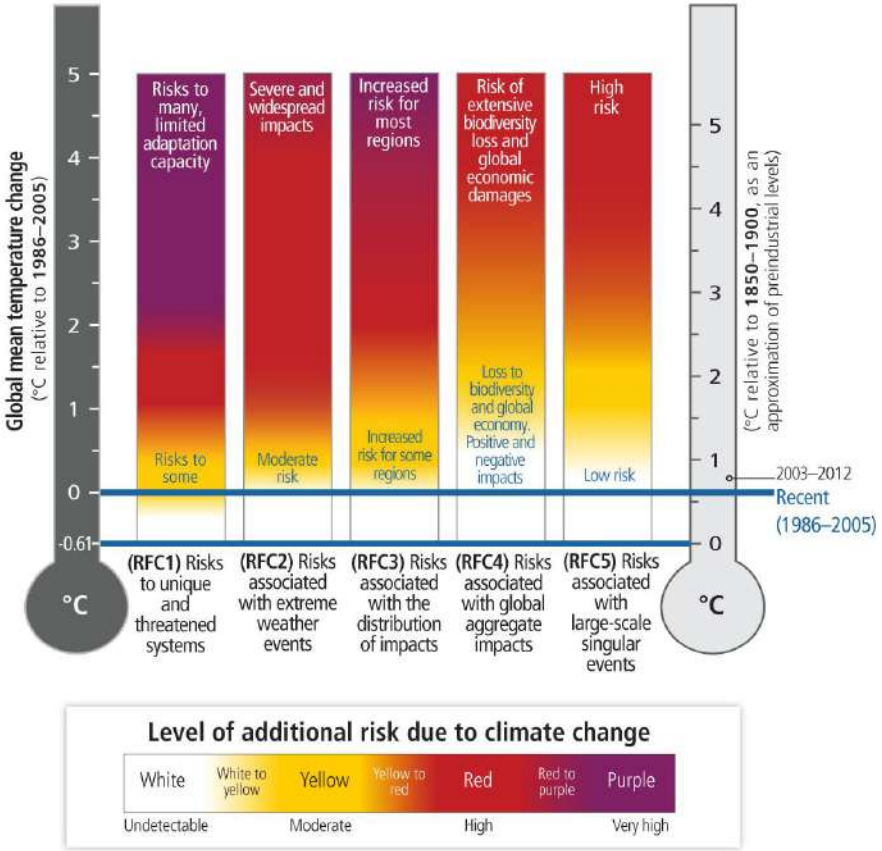


The 1.5°C Report (2018)

A global perspective on climate-related risks

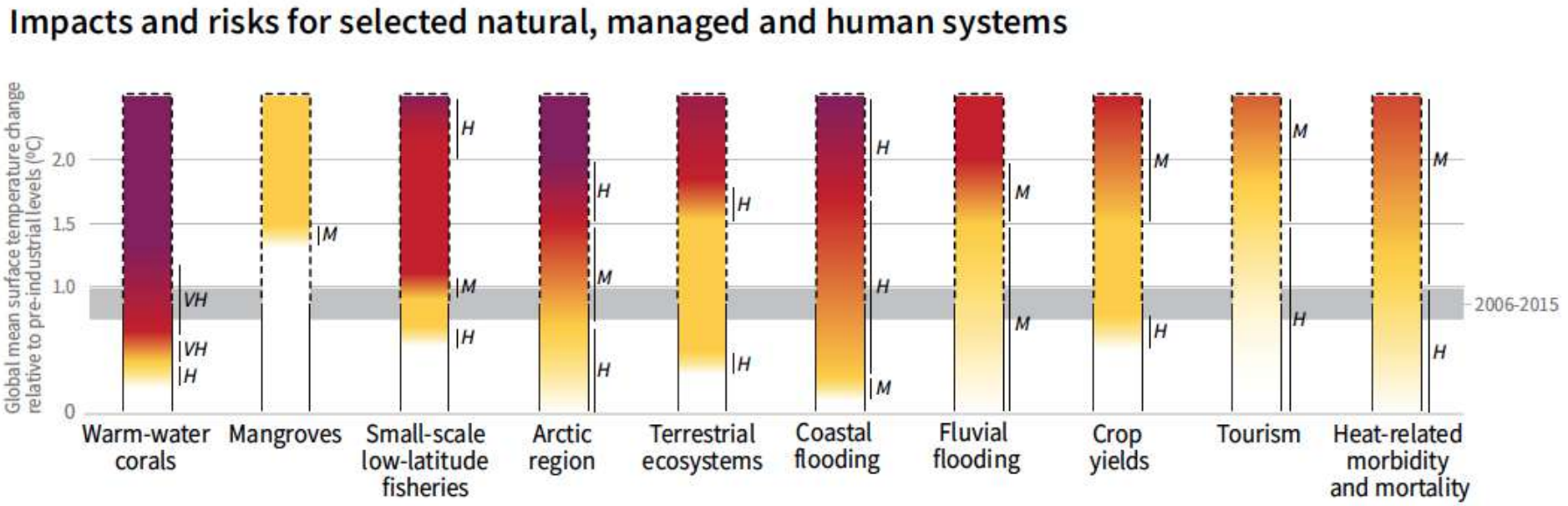
Risks associated with reasons for concern for increasing level of climate change





IPCC-AR5, WGII, Box TS.5

The 1.5°C Report (2018)



The 1.5°C Report (2018)

How close are we to 1.5 °C?

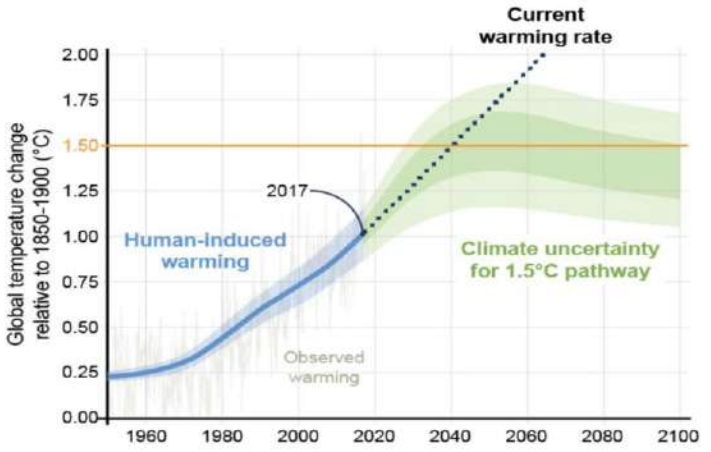
- Human–induced **warming has already reached about 1° C above pre-industrial levels** (high confidence).

- **If the current warming rate continues** (+0.2 ° C per decade), the world would reach human–induced **global warming of 1.5° C around 2040** (high confidence).

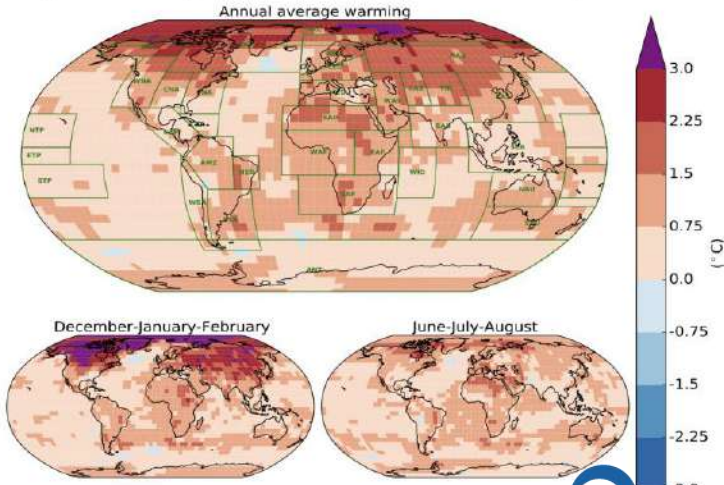
- **Warming in many regions has already exceeded 1.5° C above pre-industrial levels** (high confidence).

- **Over a fifth of the global population live in regions that have already experienced warming in at least one season that is greater than 1.5° C** above pre-industrial levels (high confidence)

Human-induced warming reached approximately 1°C above pre-industrial levels in 2017



Regional warming in the decade 2006-2015 relative to preindustrial



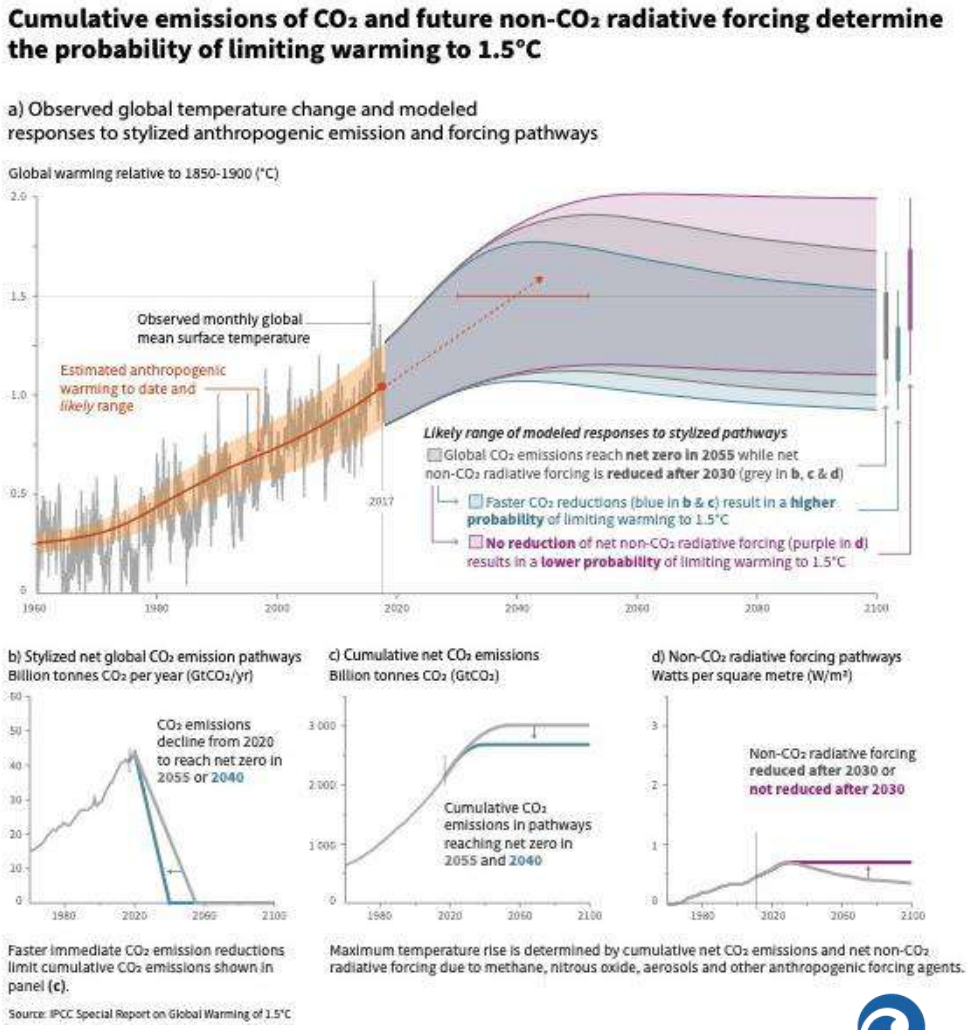
FAQ1.2, Figure 1 IPCC SR.15, Ch.1, Fig. 1.3

adapted from M. Bindi, SISC Annual Conference, 2

The 1.5°C Report (2018)

What kind of pathways limit warming to 1.5° C and are we on track?

- **Countries' pledges agreed in Paris** to reduce their **emissions are currently not in line with limiting global warming to 1.5° C**.

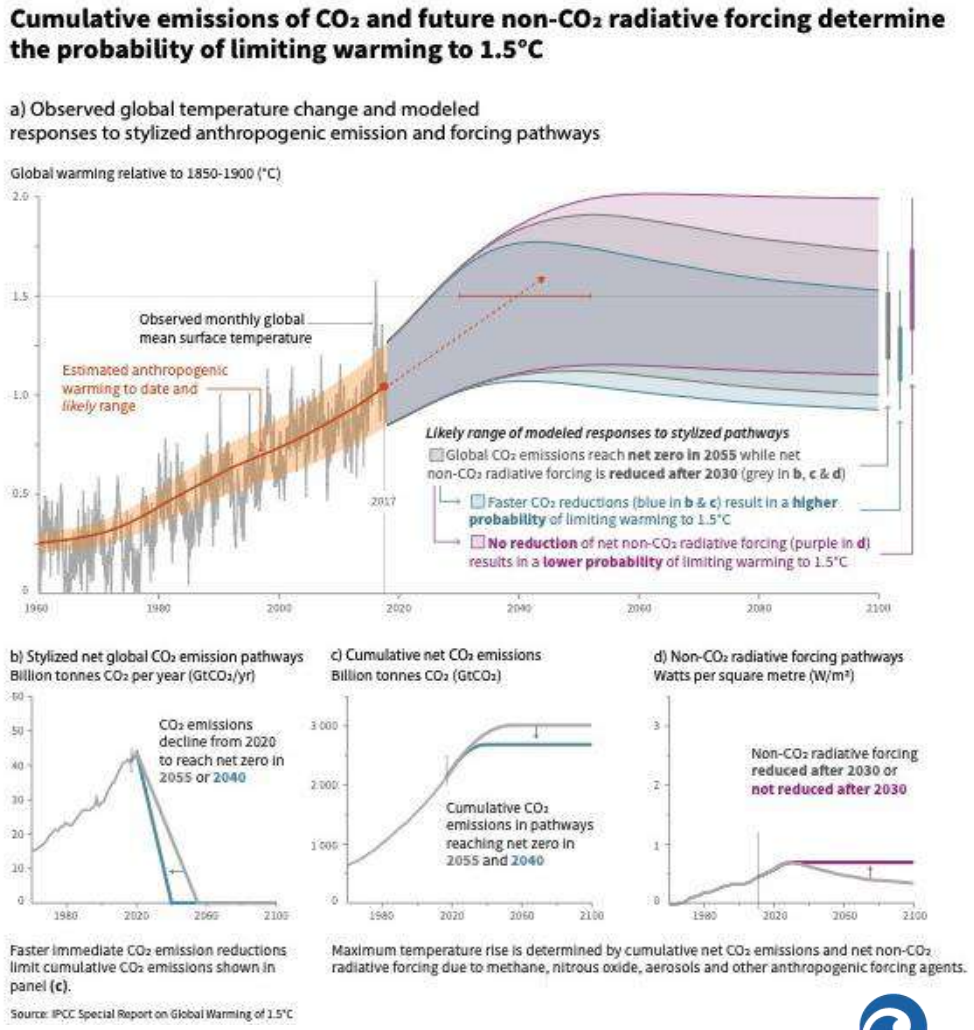


adapted from M. Bindi, SISC Annual Conference, 2018

The 1.5°C Report (2018)

What kind of pathways limit warming to 1.5° C and are we on track?

• A world that is consistent with holding warming to 1.5° C would see **greenhouse gas emissions rapidly decline in the coming decade** (e.g. global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 **reaching net zero around 2050**).



adapted from M. Bindi, SISC Annual Conference, 2018

“What’s the use of having developed a science well enough to make predictions if, in the end, all we’re willing to do is stand around and wait for them to come true?”

Sherwood Rowland

(*) Premio Nobel per la chimica (1995) per gli studi sugli effetti dei CFC sullo ozono in atmosfera.