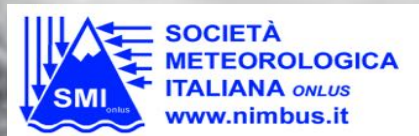


# Antropocene e clima globale: quali scenari per il futuro?

*Luca Mercalli*

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

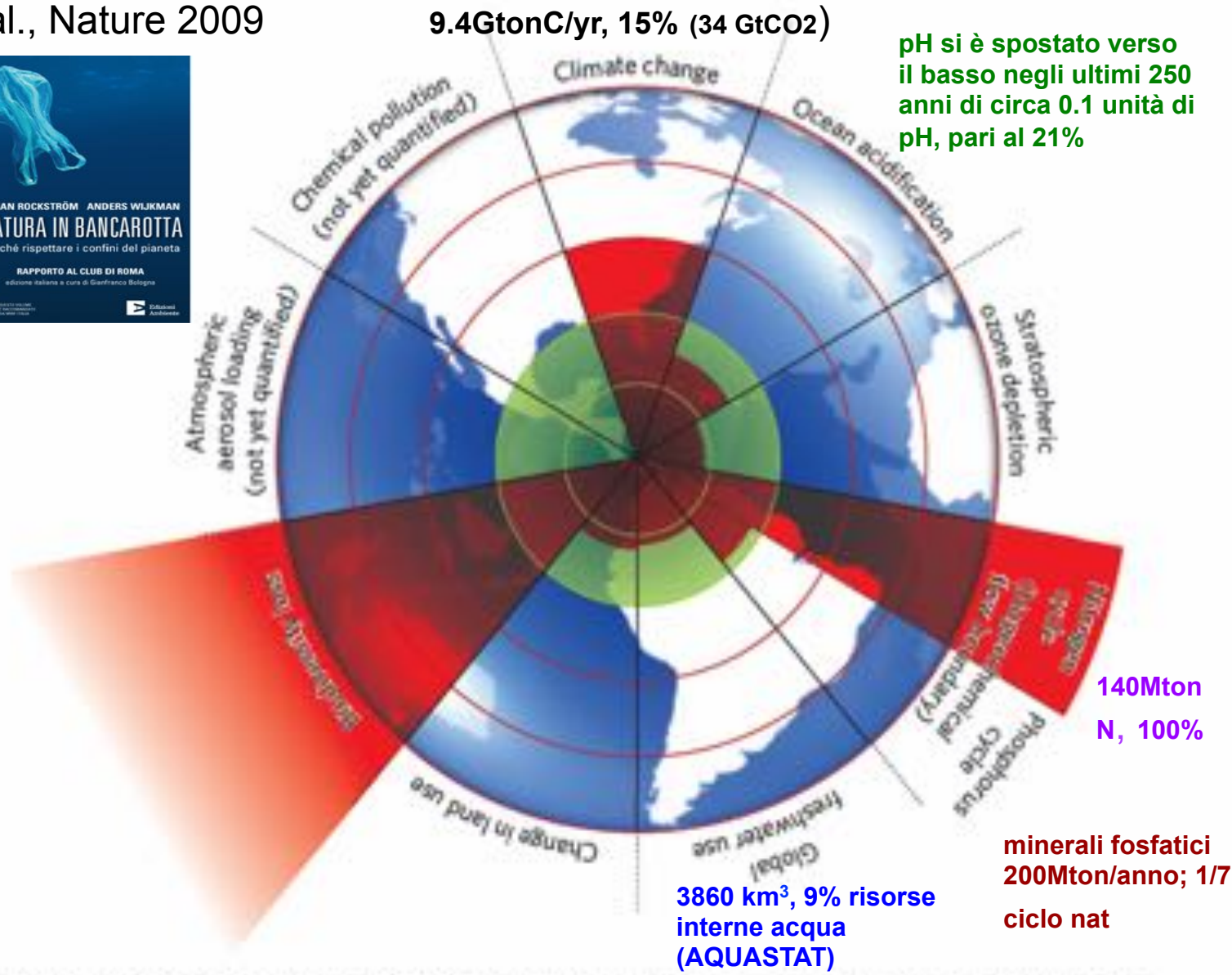


Uragano Faxai, 22 dicembre 2001

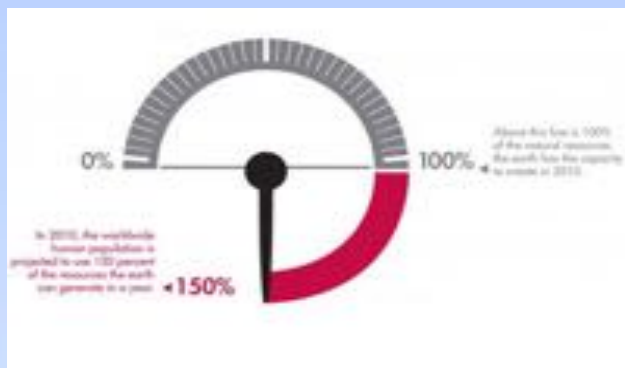
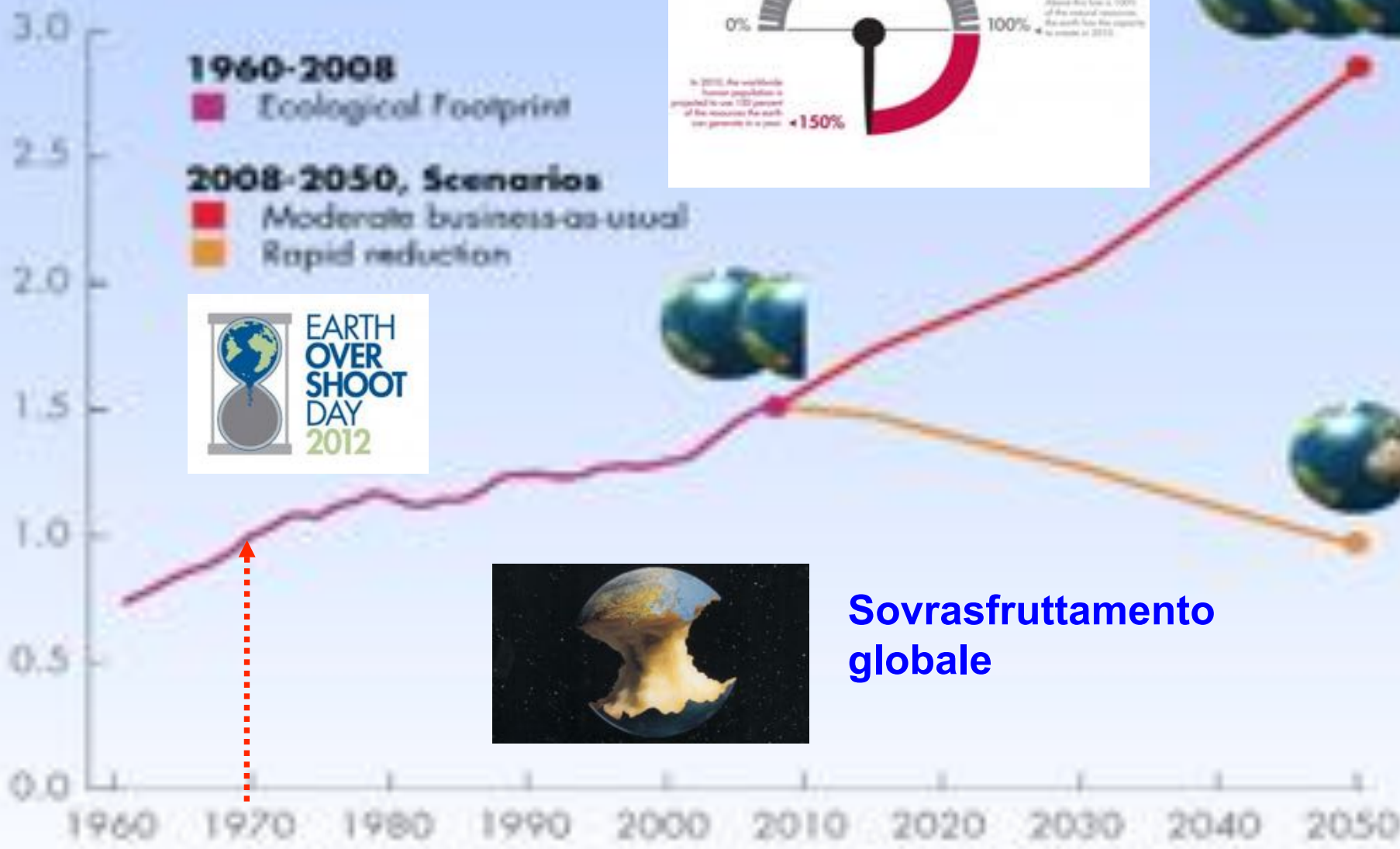
pH si è spostato verso il basso negli ultimi 250 anni di circa 0.1 unità di pH, pari al 21%

# A safe operating space for humanity

Identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue **Johan Rockström** and colleagues.



**Figure 1 | Beyond the boundary.** The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.



**Sovrasfruttamento globale**

y-axis: number of planet earths, x-axis: years

# A first in human history

Carbon dioxide levels have crossed 400 ppm. This means the impacts of climate change will be even more pronounced—droughts, floods and sea level rise, for instance. If the world does not act to limit carbon dioxide emissions, climate change will cause devastation worldwide, and more so in South Asia. The poor will end up with a raw deal

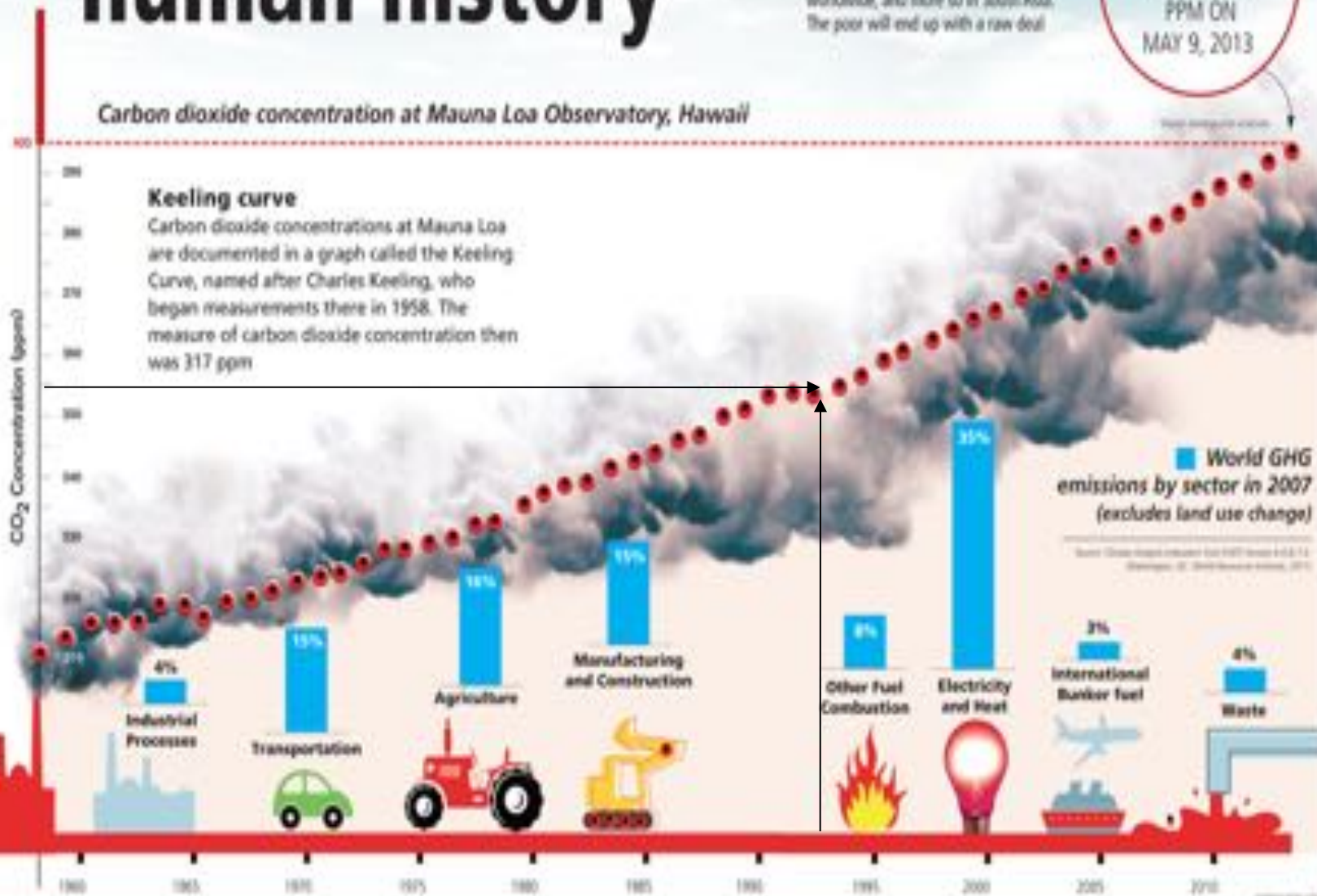
CO<sub>2</sub>

BREACHES  
**400**  
PPM ON  
MAY 9, 2013

Carbon dioxide concentration at Mauna Loa Observatory, Hawaii

## Keeling curve

Carbon dioxide concentrations at Mauna Loa are documented in a graph called the Keeling Curve, named after Charles Keeling, who began measurements there in 1958. The measure of carbon dioxide concentration then was 317 ppm



For the past several years, CO<sub>2</sub> concentrations have hovered close to 390 ppm. The 400 ppm daily average is a first in human history

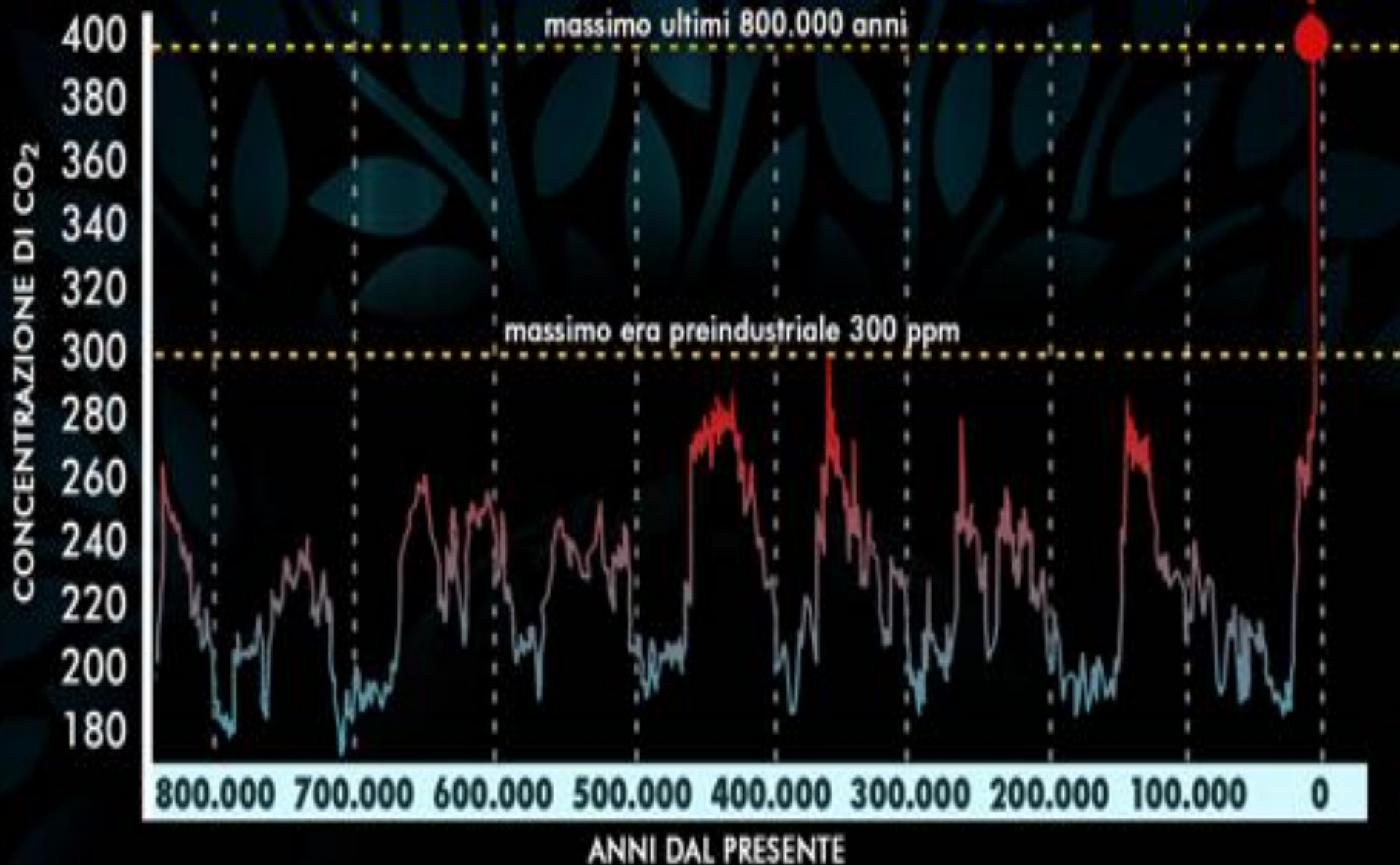
In the last 50 ppm increase, the Arctic melted. Imagine what another 50 ppm increase will do

Diversity of even common species found in most parts of the world will be badly hit. Animal species in particular may decline more as a result of loss of food from plants

Some environmentalists are of the view that to return to the 350 ppm level, use of conventional energy sources has to be re-examined. But this is easier said than done. Any alternative measure will require finance and technological assistance from industrialised countries to developing countries. Even though institutions for financial transfer exist under UNFCCC, there is no money and the industrialised world has not provided exclusive climate finance to developing countries yet

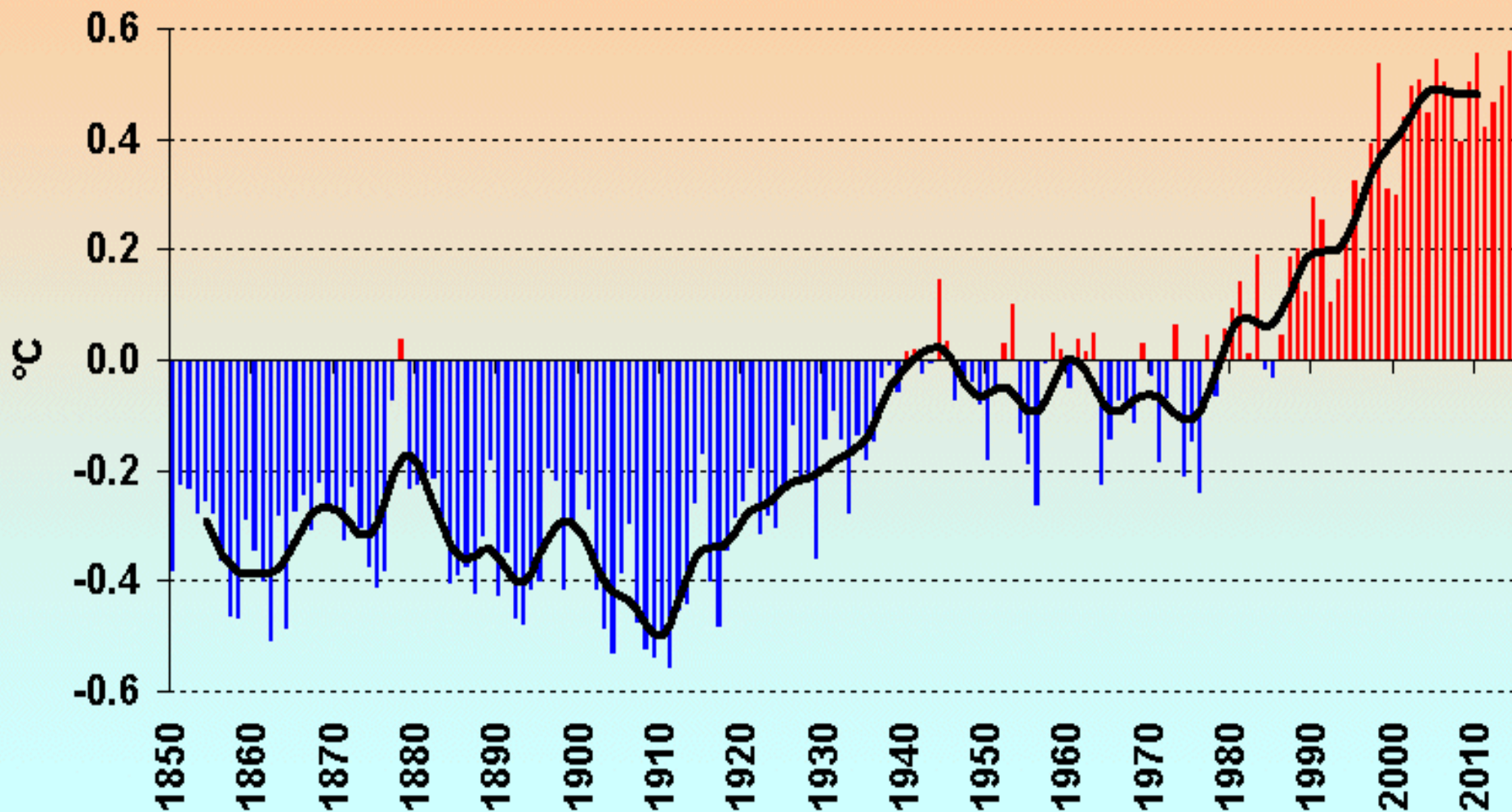
fonte: progetto EPICA

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

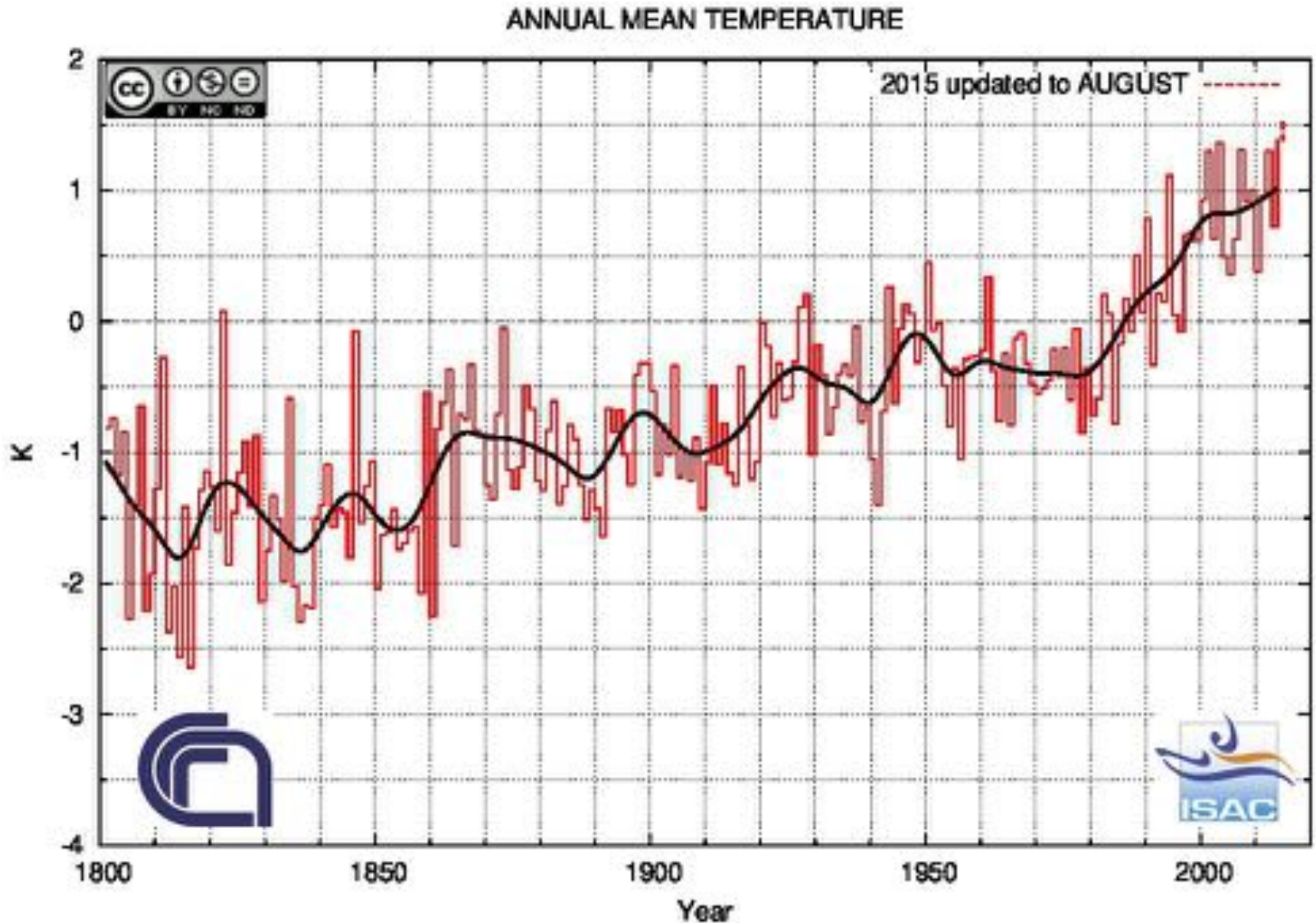


# Riscaldamento globale in atto: circa +1°C nell'ultimo secolo

Anomalie termiche globali 1850-2014  
(da trentennio 1961-90)  
*serie MetOffice - Hadley Center*

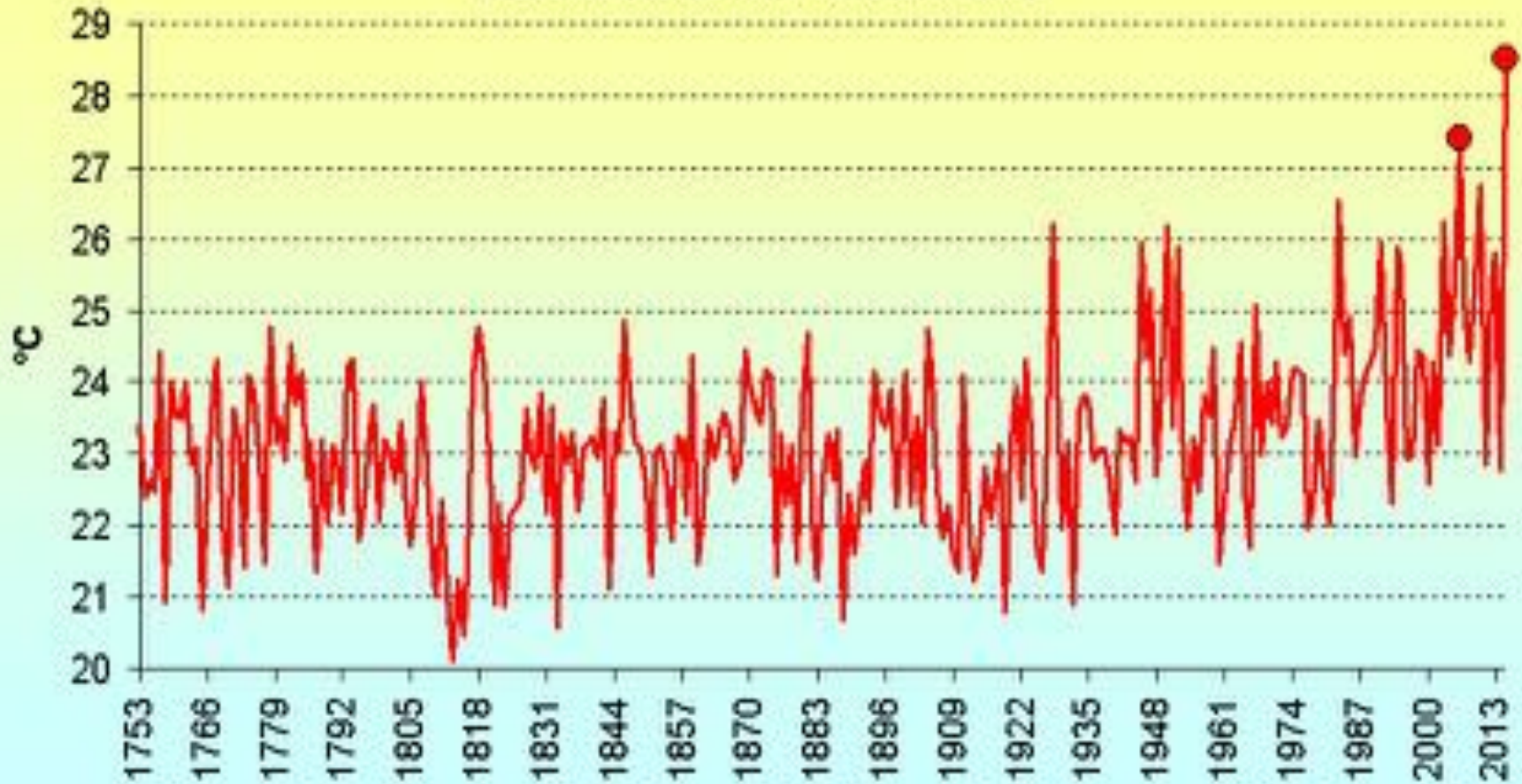


# Anomalie termiche a lungo termine - serie nazionale italiana



## Torino - Temperature medie di luglio dal 1753 al 2015 (°C)

Elaborazione dati: SMI - [www.nimbus.it](http://www.nimbus.it)

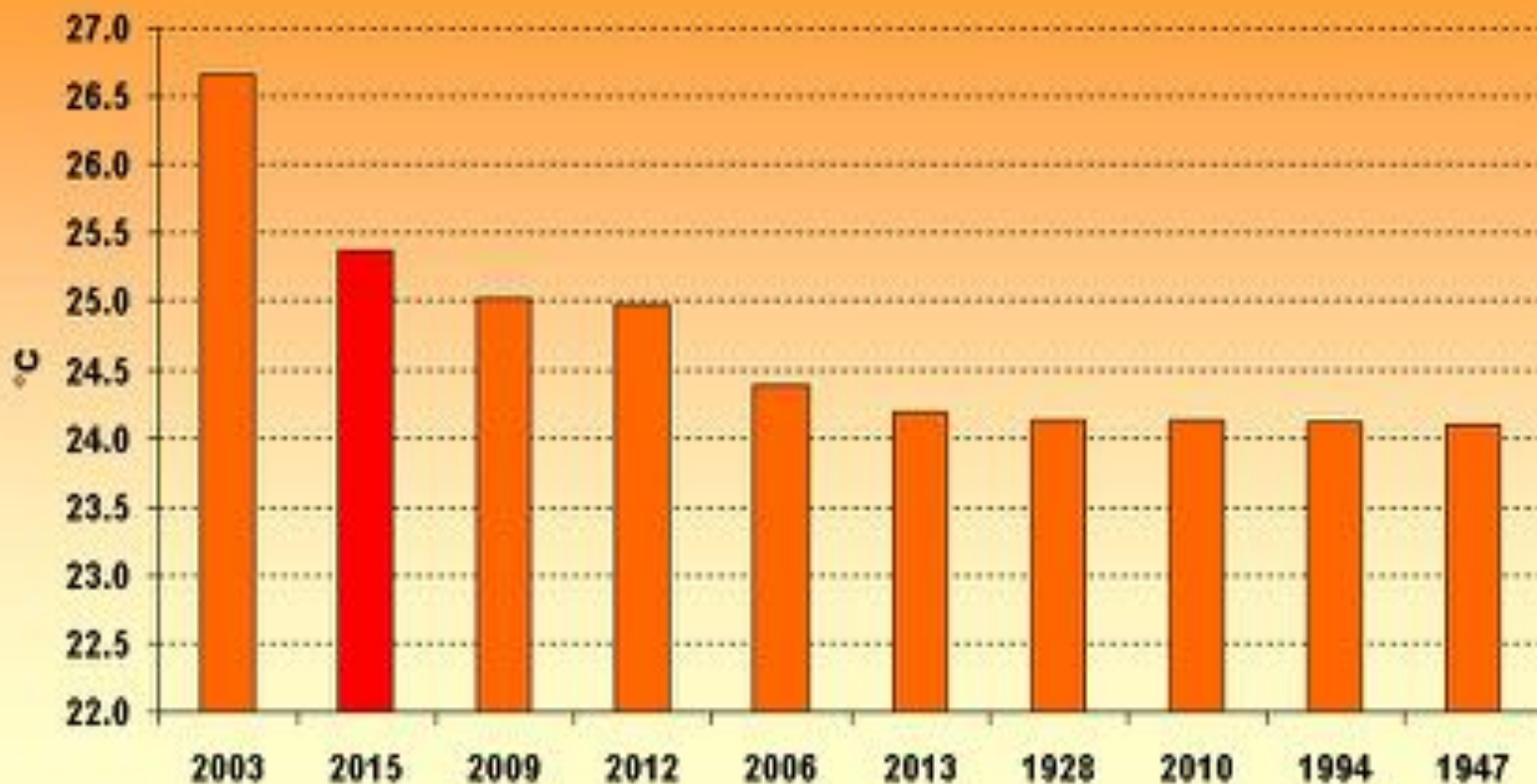


July 2015: warmest month in records for Northern Italy and W EU



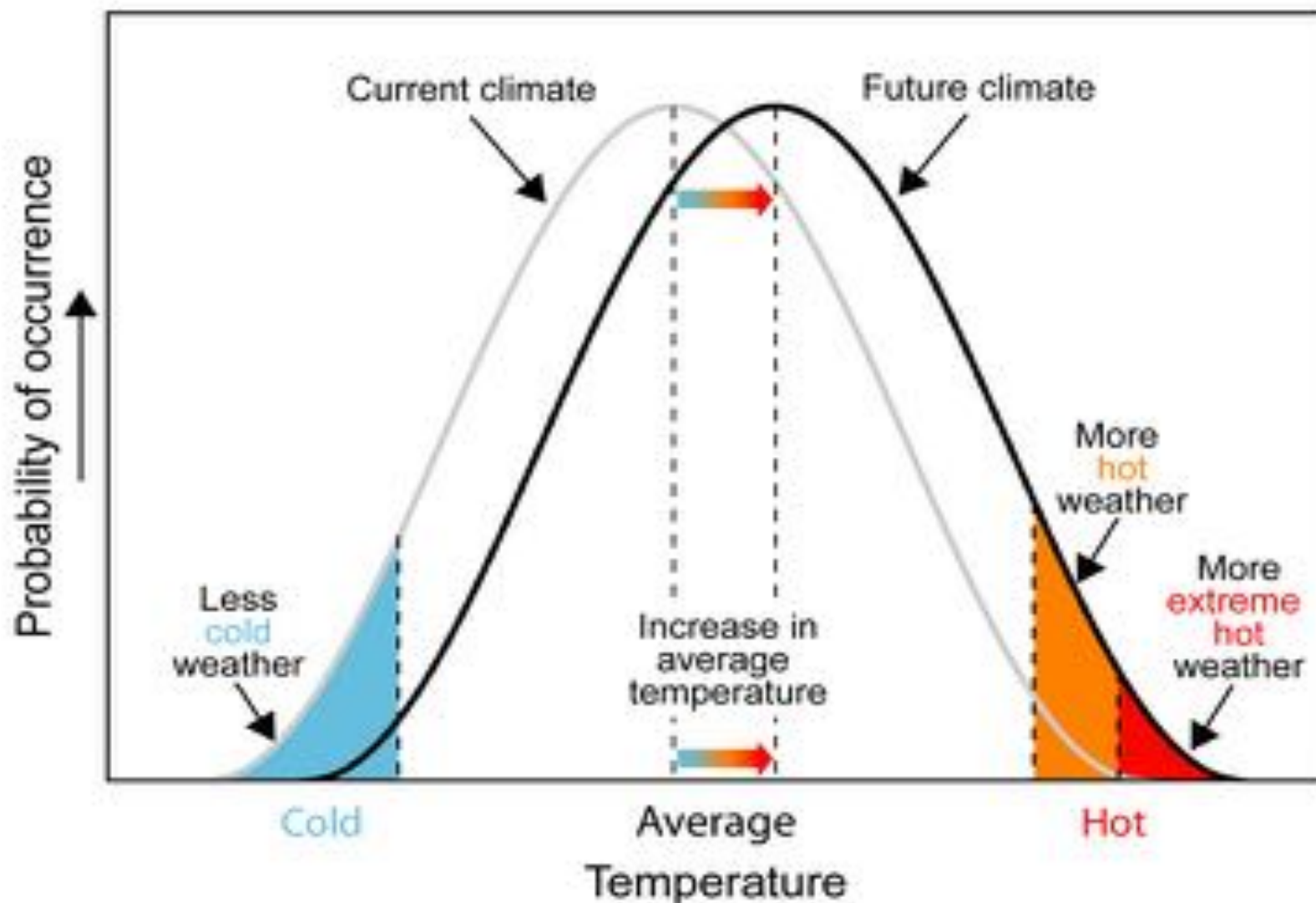
## Le 10 estati più calde dal 1753 a Torino

(elaborazione dati: SMI - [www.nimbus.it](http://www.nimbus.it))



Italia Nord, 2015: seconda estate più calda  
in 250 anni

# Future Climate Shift





**1897**  
(f. Druetti)



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



**2012**  
(f. L. Mercalli)

***Ghiacciaio Pré de Bar (Monte Bianco)***

**Il ritiro dei ghiacciai: un robusto indicatore del riscaldamento globale facilmente percepibile da chiunque**

**1987**

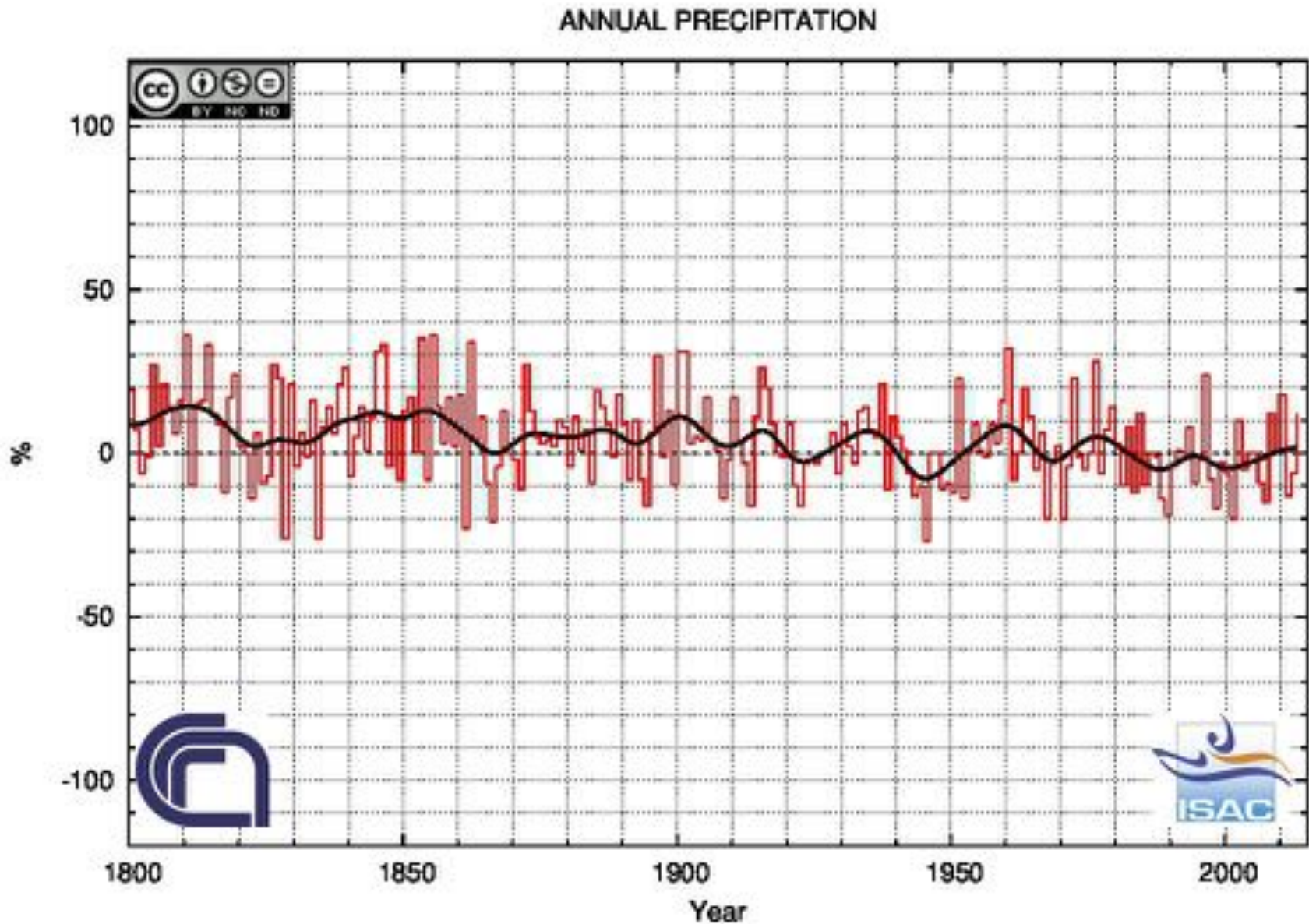


**2010**

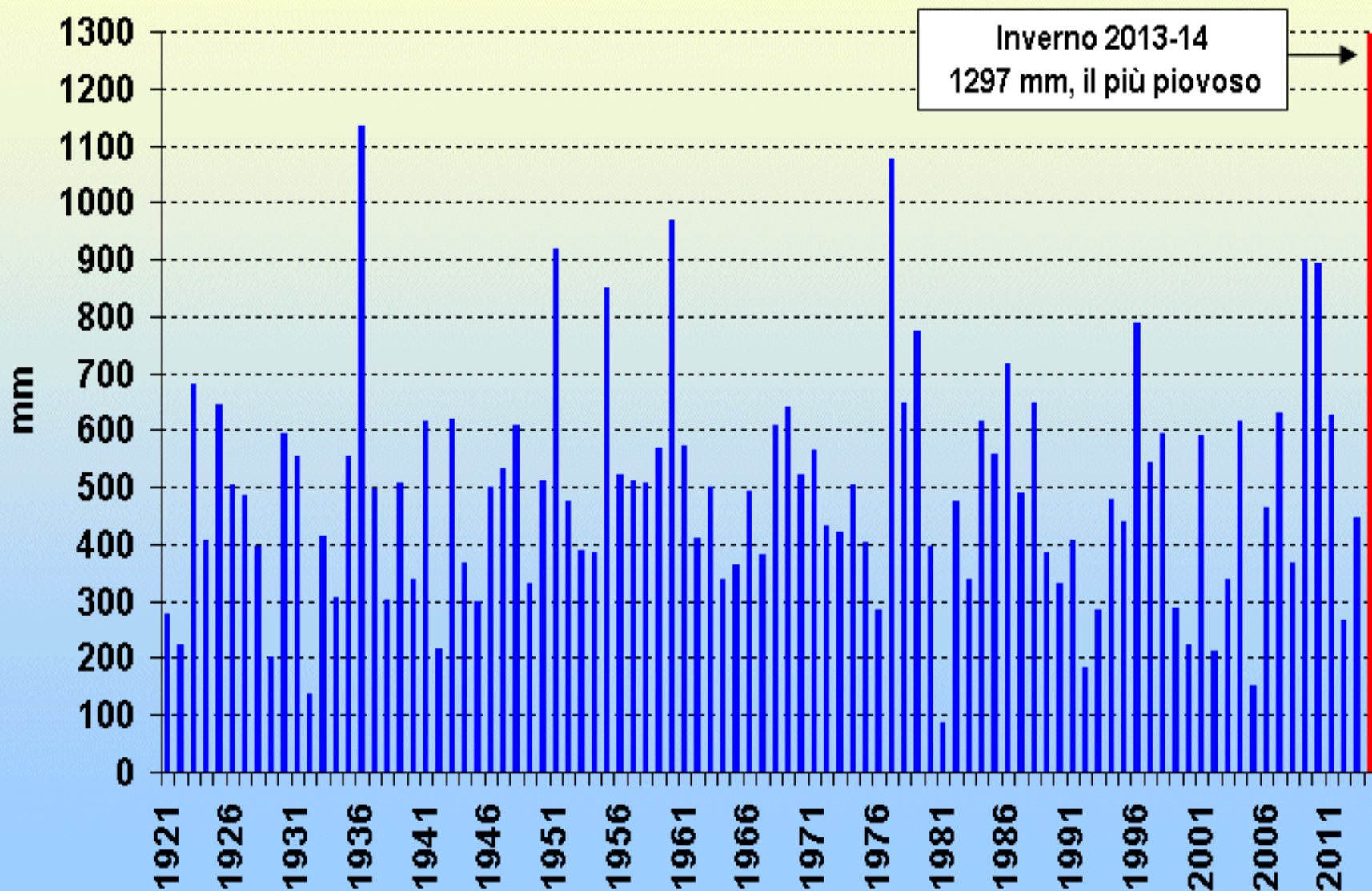


*Ghiacciaio occidentale del Carro (Gran Paradiso)*

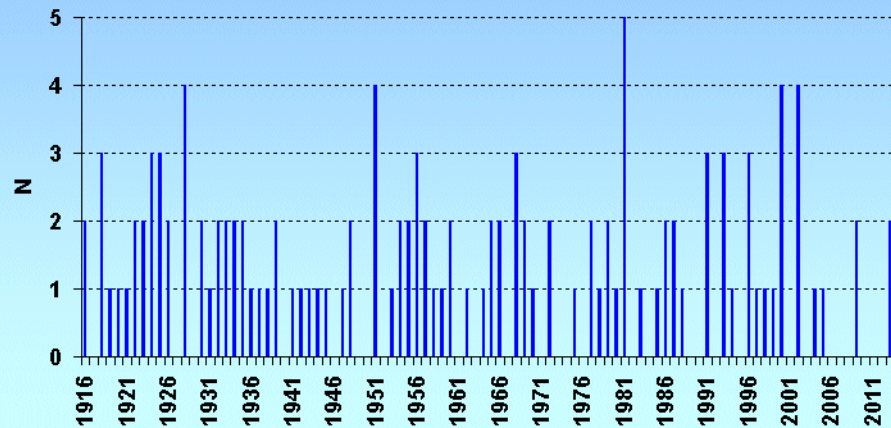
# Italia – serie precipitazioni



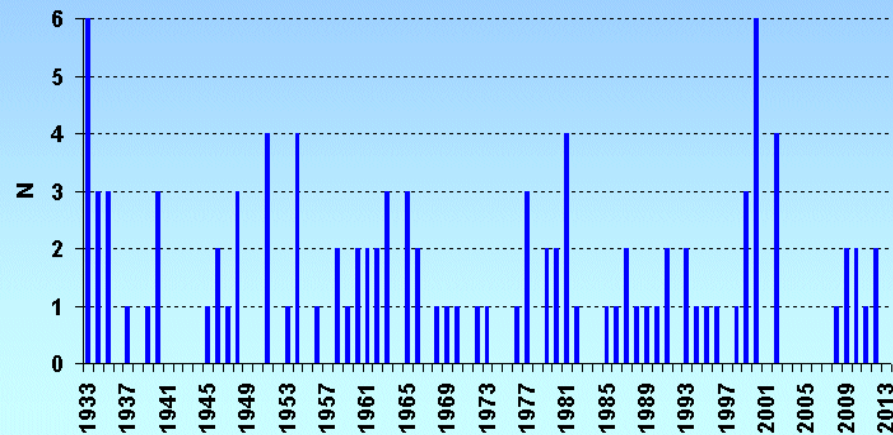
# Pontremoli (MS) - Precipitazioni trimestre dicembre-febbraio dal 1920-21 al 2013-14 (mm pioggia e neve fusa)



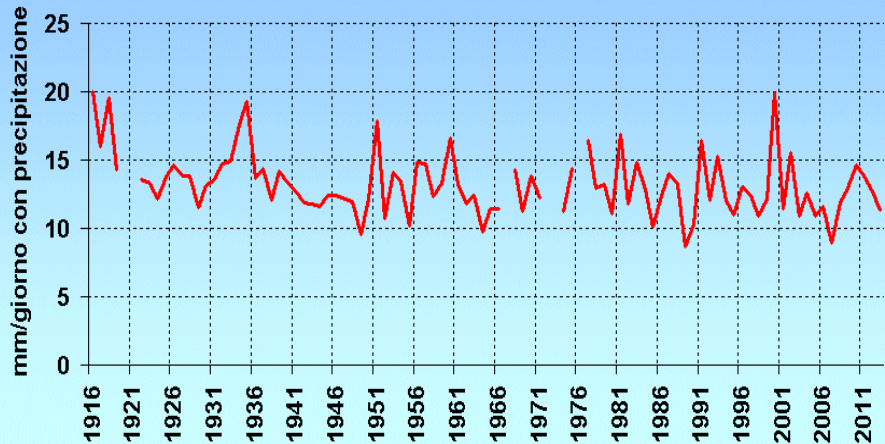
Alpe Devero - Numero annuo di giorni con precipitazione superiore al 99° percentile (61 mm)



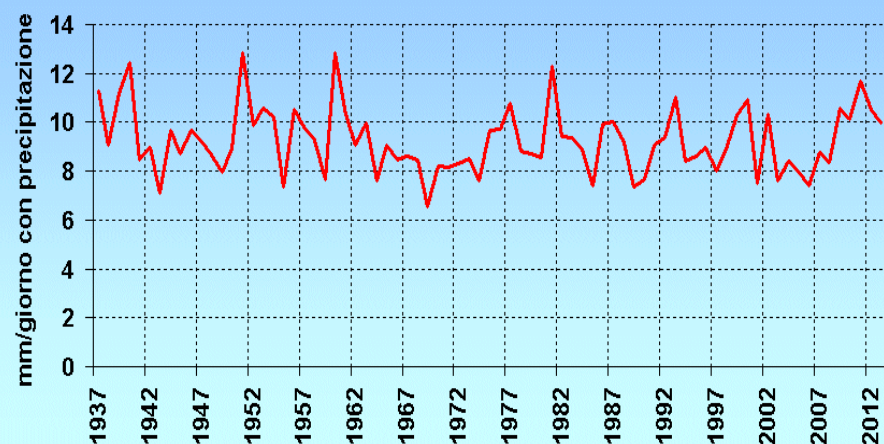
Lago Toggia - Numero annuo di giorni con precipitazione superiore al 99° percentile (87 mm)



Alpe Devero - Intensità pluviometrica media (mm/giorno con precipitazioni, 1916-2013)



Lago Toggia - Intensità pluviometrica media (mm/giorno con precipitazioni, 1937-2013)



Caso studio Ossola: le precipitazioni giornaliere intense non sono in aumento (per ora)

# Inondations et protection civile: Cote d'Azur 3 octobre 2015 retour d'expérience

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EN DIRECT

## Déluge sur la Côte d'Azur : 20 morts



### LA QUESTION DU JOUR

Intempéries : a-t-on  
trop "bétonné" la  
Côte d'Azur ?

Oui - 92 %

Non - 8 %

Total des votes : 608





**Huit morts à Mandelieu-la-Napoule**, piégés dans des parkings souterrains

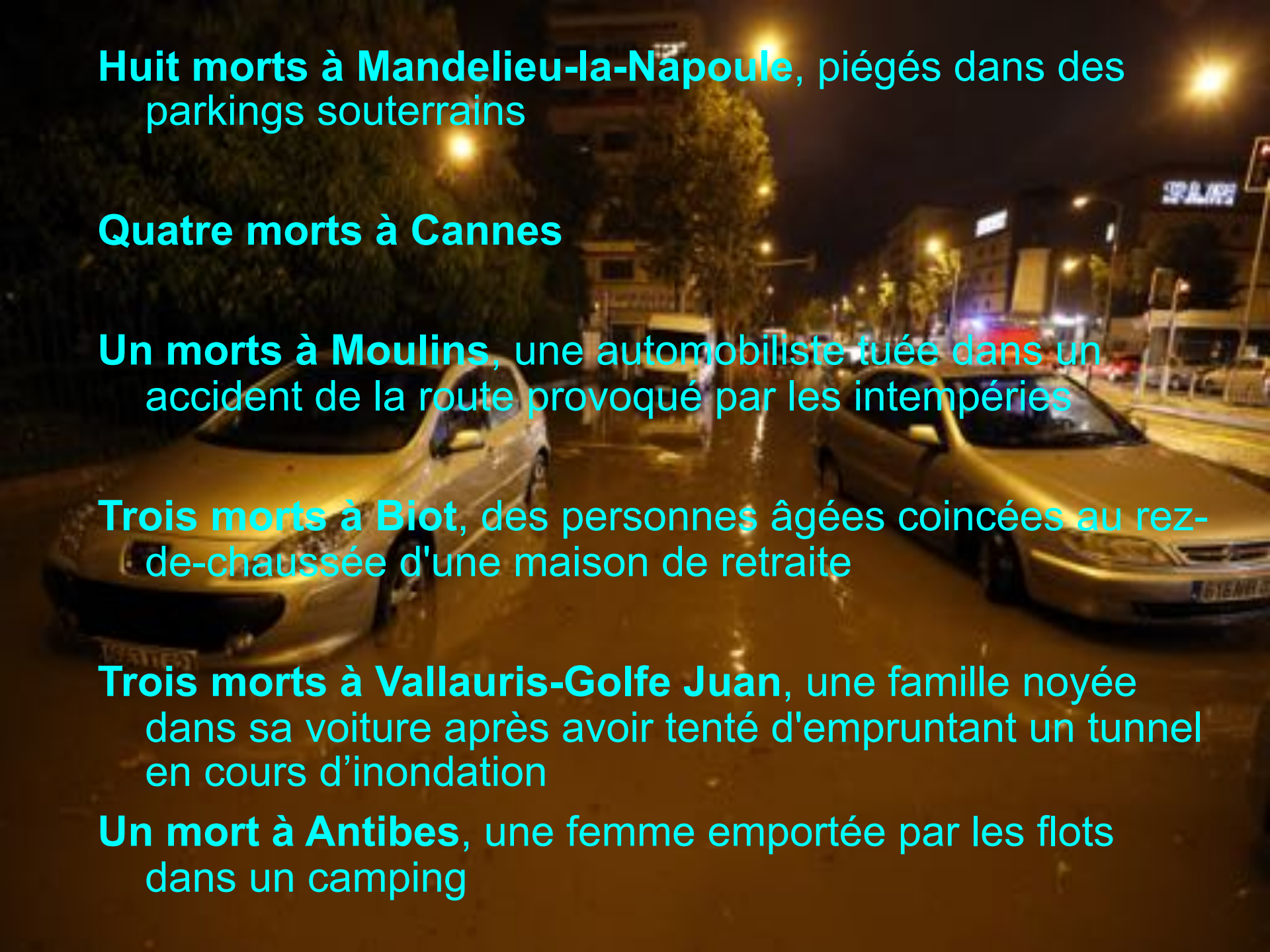
**Quatre morts à Cannes**

**Un mort à Moulins**, une automobiliste tuée dans un accident de la route provoqué par les intempéries

**Trois morts à Biot**, des personnes âgées coincées au rez-de-chaussée d'une maison de retraite

**Trois morts à Vallauris-Golfe Juan**, une famille noyée dans sa voiture après avoir tenté d'emprunter un tunnel en cours d'inondation

**Un mort à Antibes**, une femme emportée par les flots dans un camping



# Eventi pluviometrici estremi: un quadro statisticamente incerto in evoluzione verso l'incremento



Genova, 4 novembre 2011: 395 mm (274 in 4 ore)

10 ottobre 2014: 395 mm in 24 h

27 settembre 1992: 429 mm

8 ottobre 1970: 389 mm (ma 948 a Bolzaneto, record italiano!)

*Effetti disastrosi quasi inevitabili, con tali apporti, e tale morfologia  
necessità di maggiore educazione al rischio e autoprotezione*

# Maltempo Sardegna, 16 morti e 2700 sfollati. Letta: "Lo Stato c'è e fa il massimo"

di Redazione Il Fatto Quotidiano | 19 novembre 2013

Commenti (1336)

Olbia nov. 2013

Bomporto (MO) gen. 2014



# Modeling Earth's future

Integrated assessments of linked  
human-natural systems



THE  
ROYAL  
SOCIETY

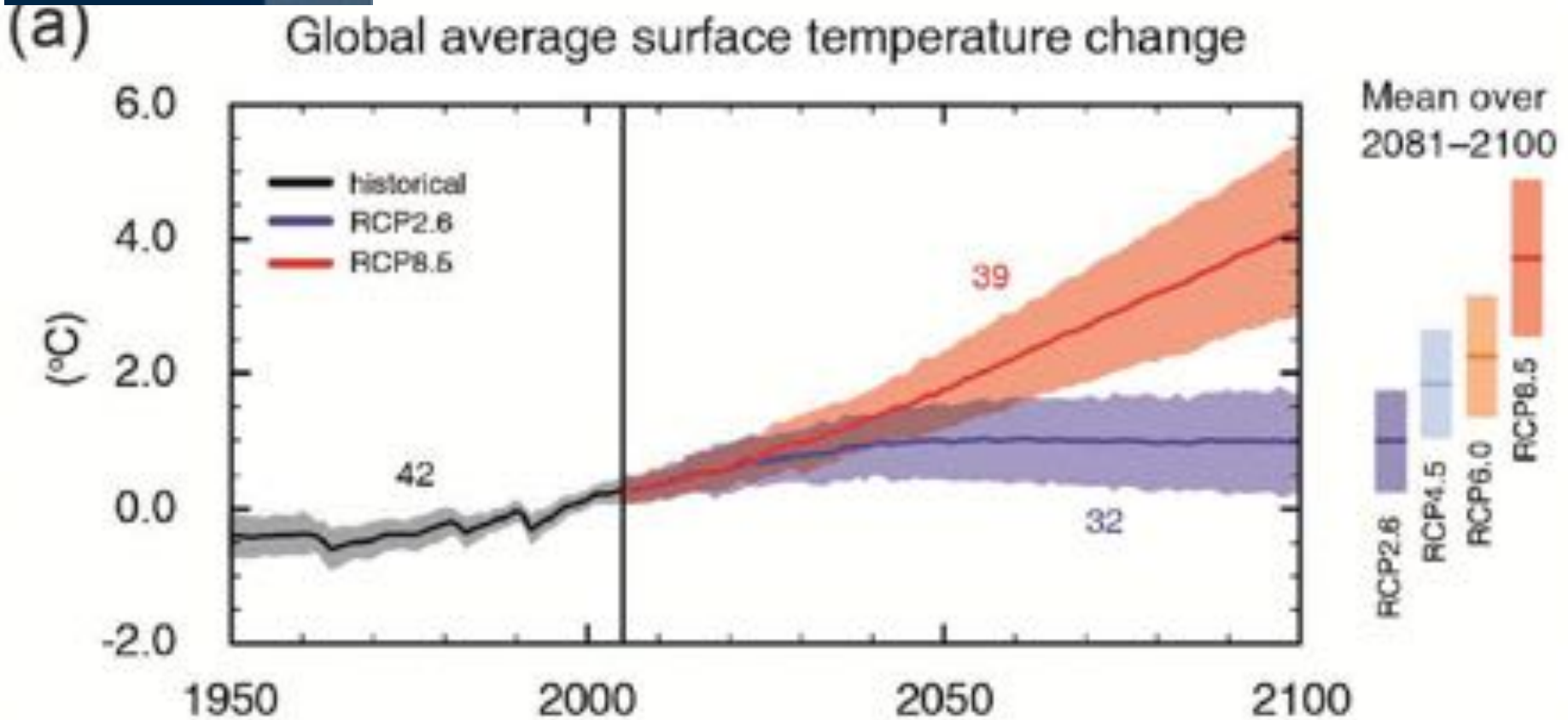
NATIONAL ACADEMY  
OF SCIENCES  
1863-2013  
Celebrating 150 Years  
of Service to the Nation

1 petaflop =  $10^{15}$  =

un milione di miliardi di istruzioni/operazioni al secondo

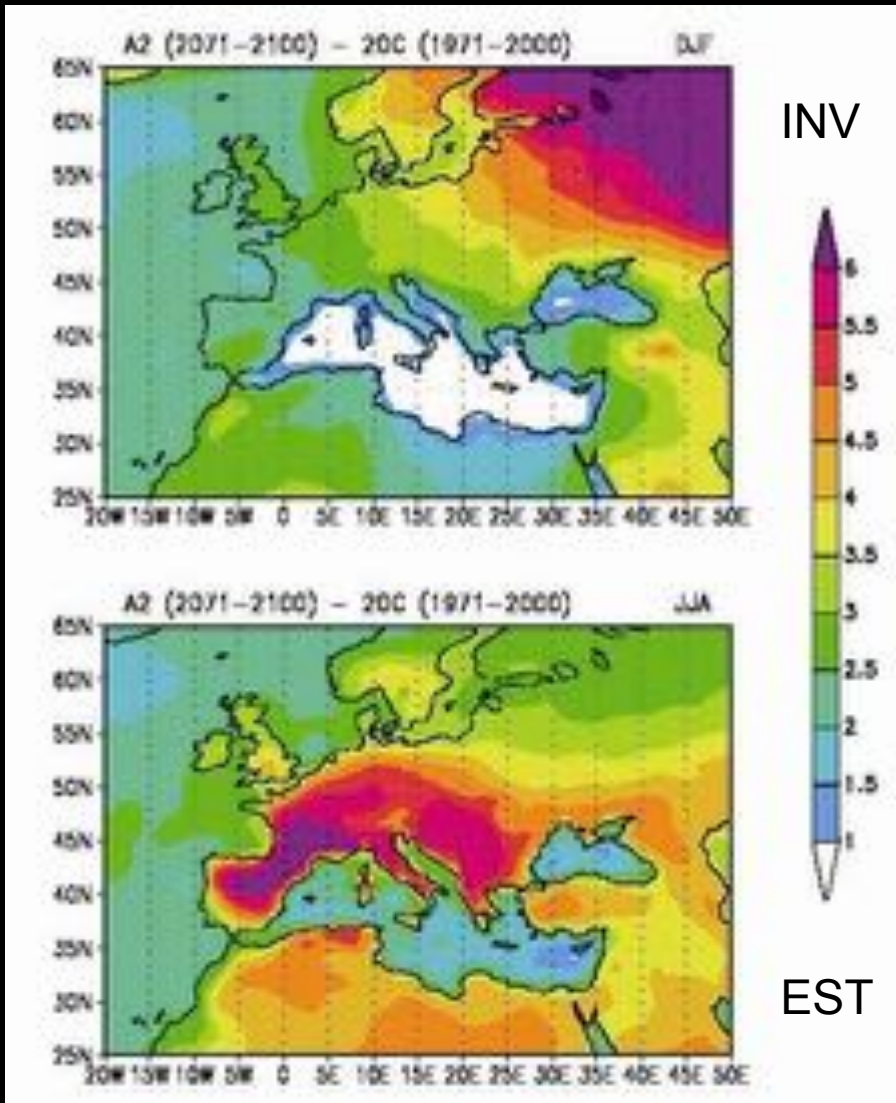


# Il futuro della temperatura globale secondo IPCC AR5

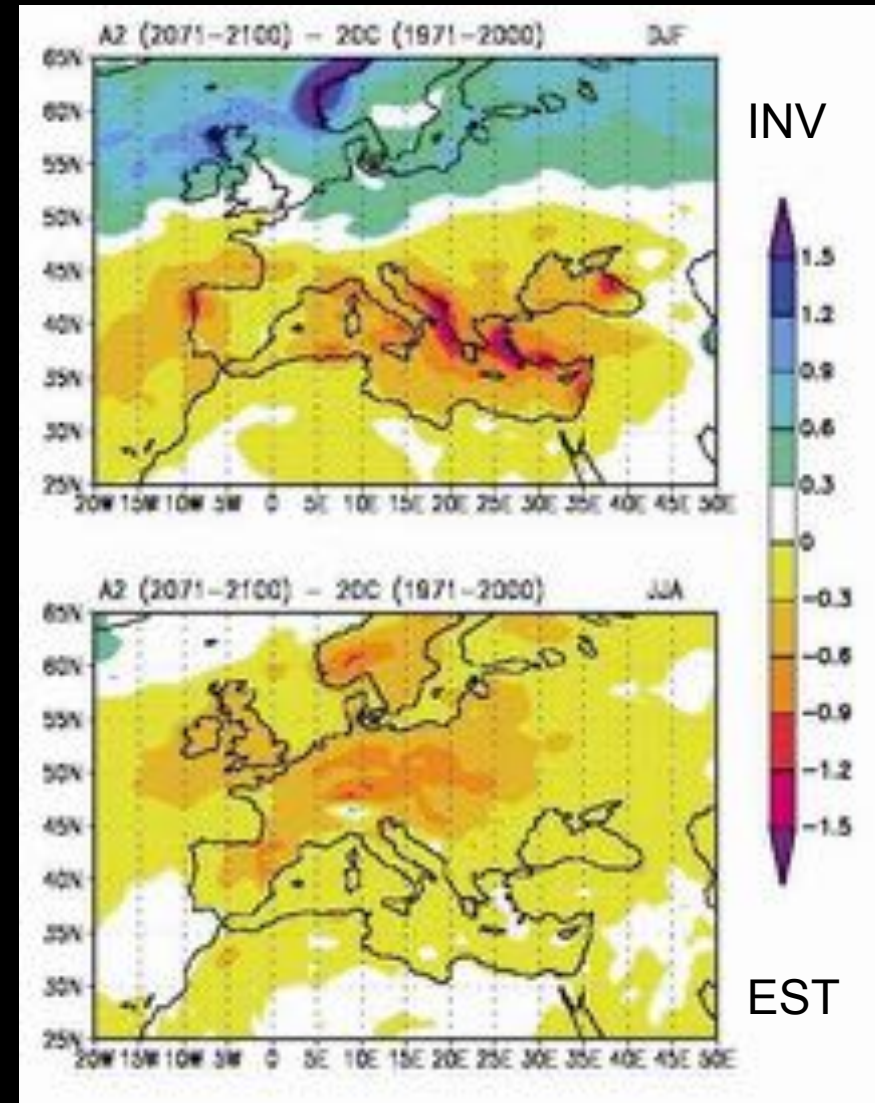


# Uno "zoom" sull'Europa

(fonte: Centro Euro-Mediterraneo per i Cambiamenti Climatici)



Temperature (°C)

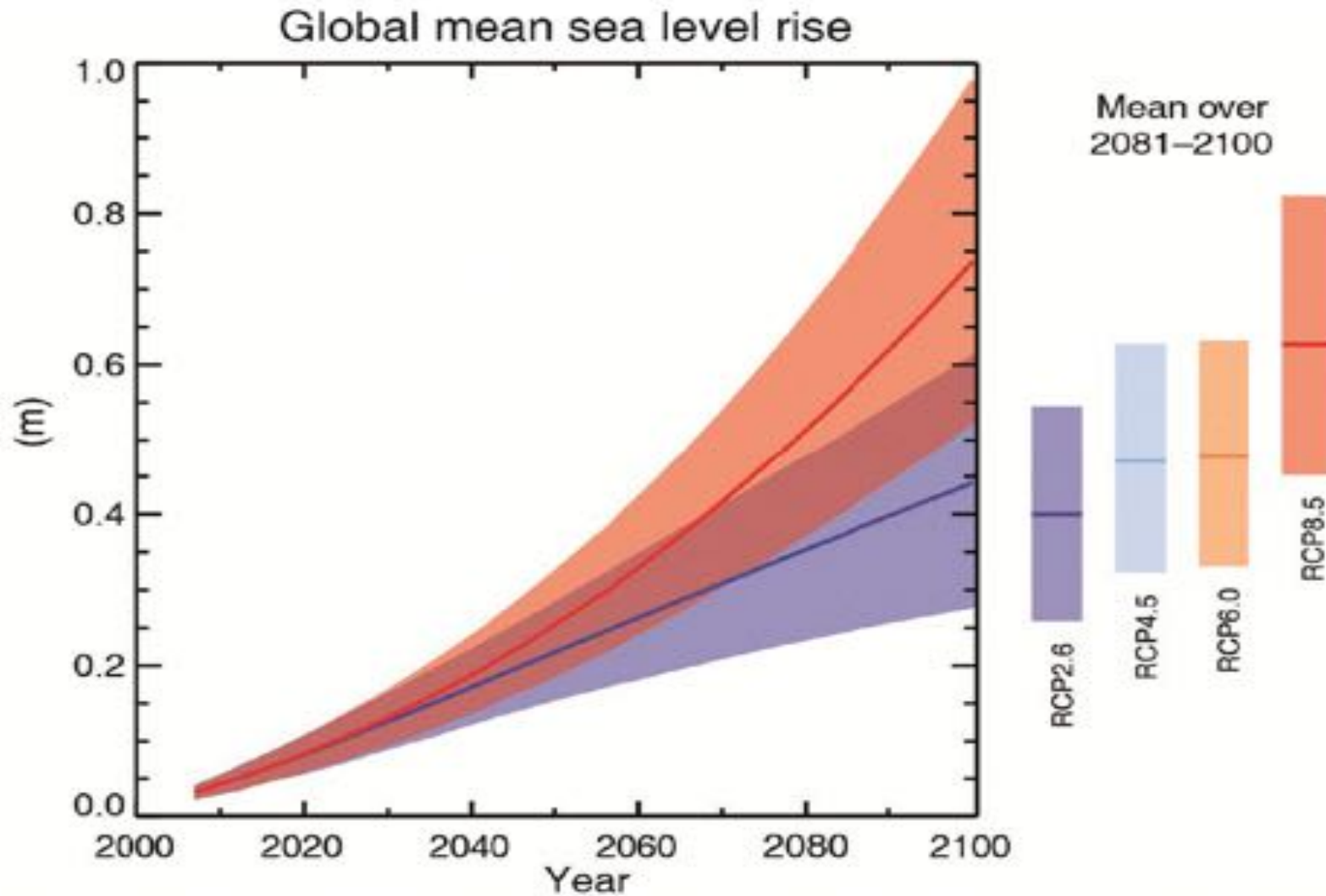


Precipitazioni (mm/giorno)



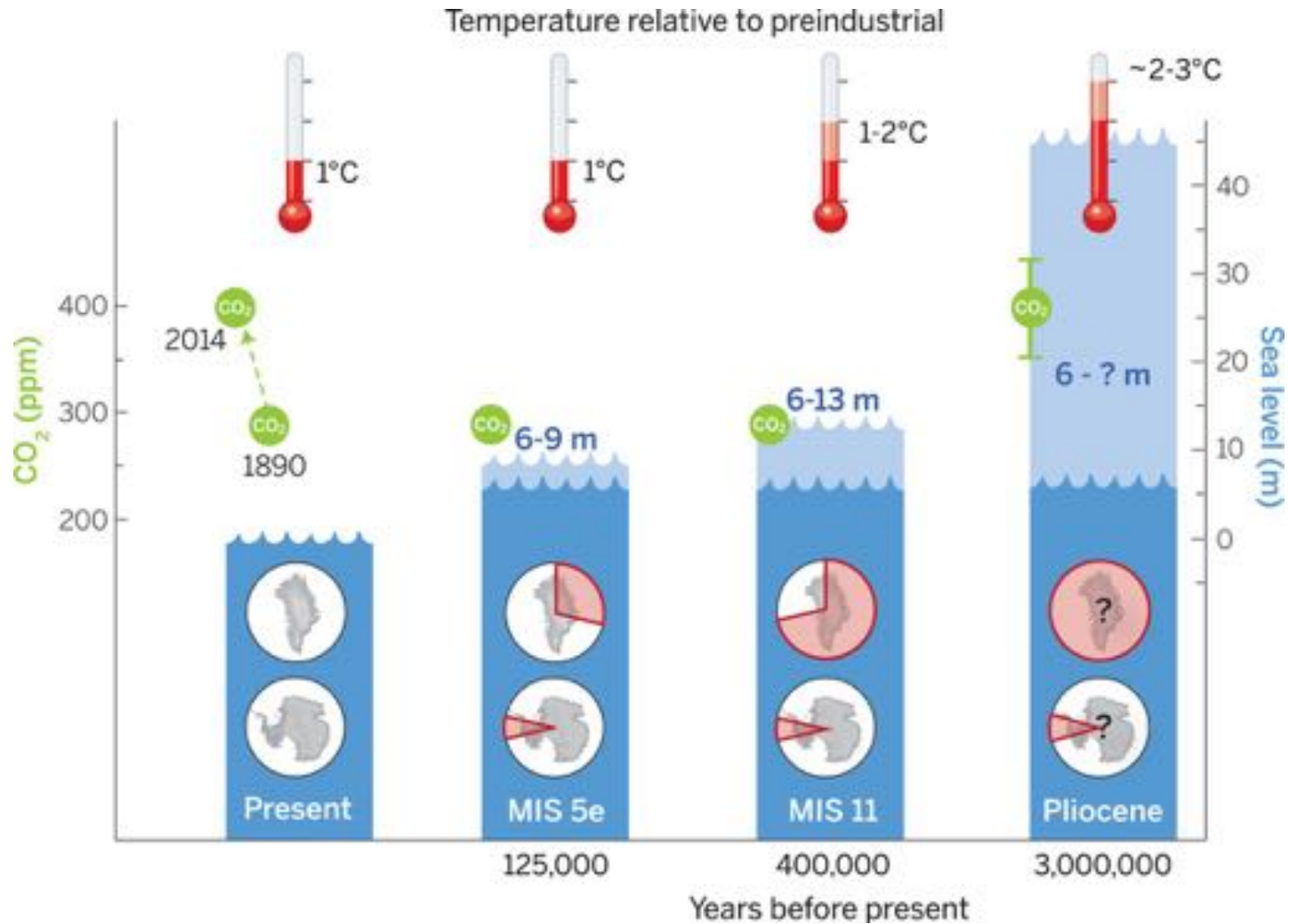
**Aumento livello marino: lento ma implacabile**

# L'aumento di livello marino secondo IPCC AR5





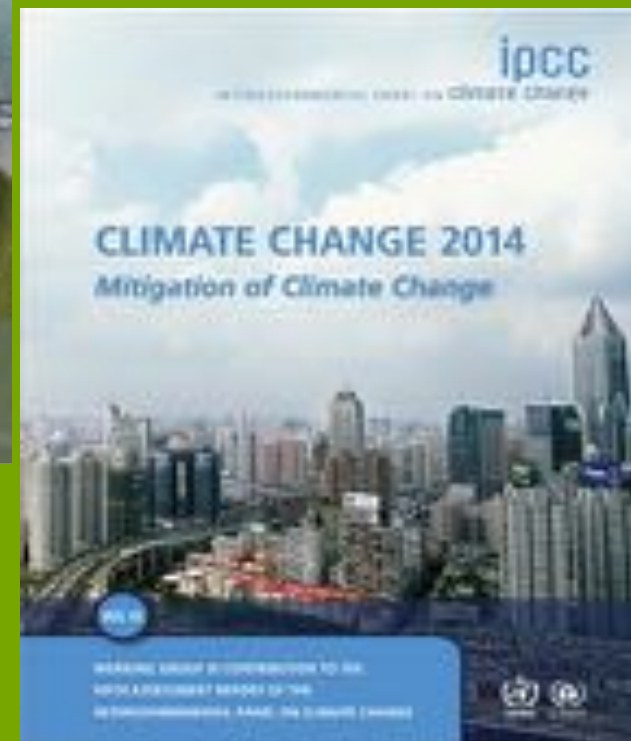
# Peak global mean temperature, atmospheric CO<sub>2</sub>, maximum global mean sea level (GMSL), and source(s) of meltwater.



A. Dutton et al. Science 2015;349:aaa4019

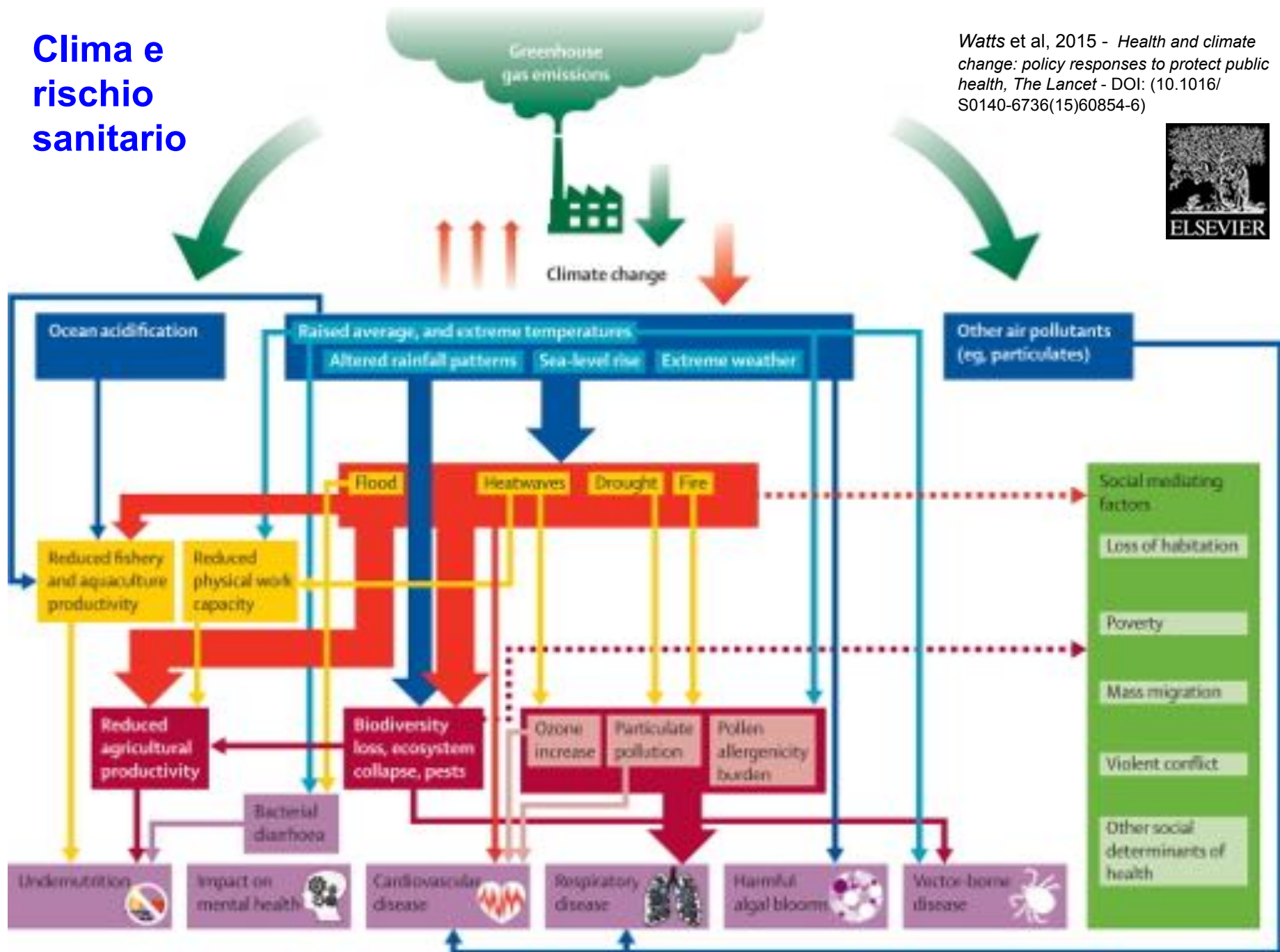


# V rapporto IPCC 2013-14



# Clima e rischio sanitario

Watts et al, 2015 - *Health and climate change: policy responses to protect public health*, *The Lancet* - DOI: (10.1016/S0140-6736(15)60854-6)



# Decarbonizzazione economia, energie rinnovabili ed efficienza energetica, economia circolare, resilienza e prevenzione

