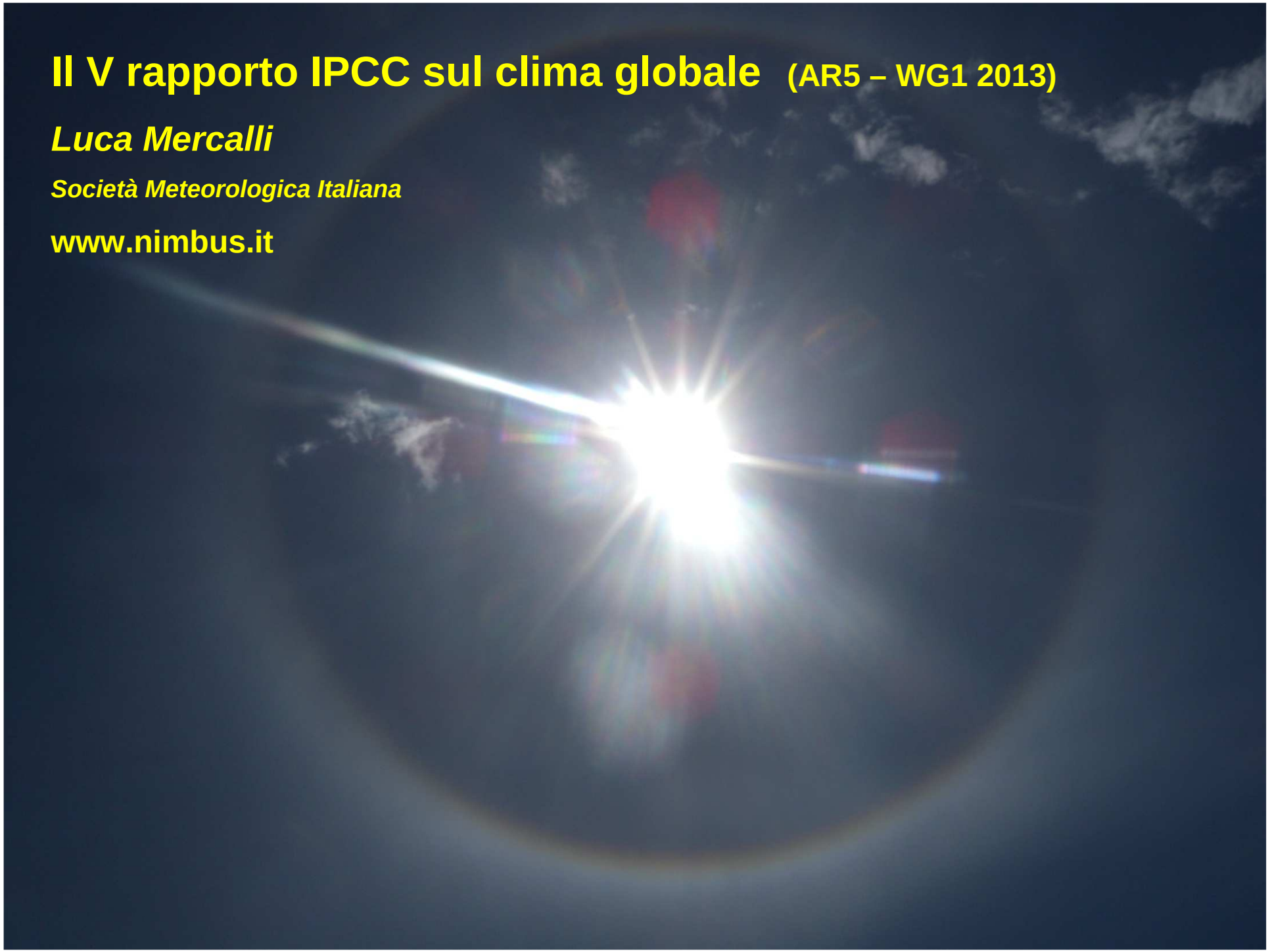


Il V rapporto IPCC sul clima globale (AR5 – WG1 2013)

Luca Mercalli

Società Meteorologica Italiana

www.nimbus.it

Aurelio Peccei

Torino 1908- Roma 1984

nature Vol 461|24 September 2009

FEATURE

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.

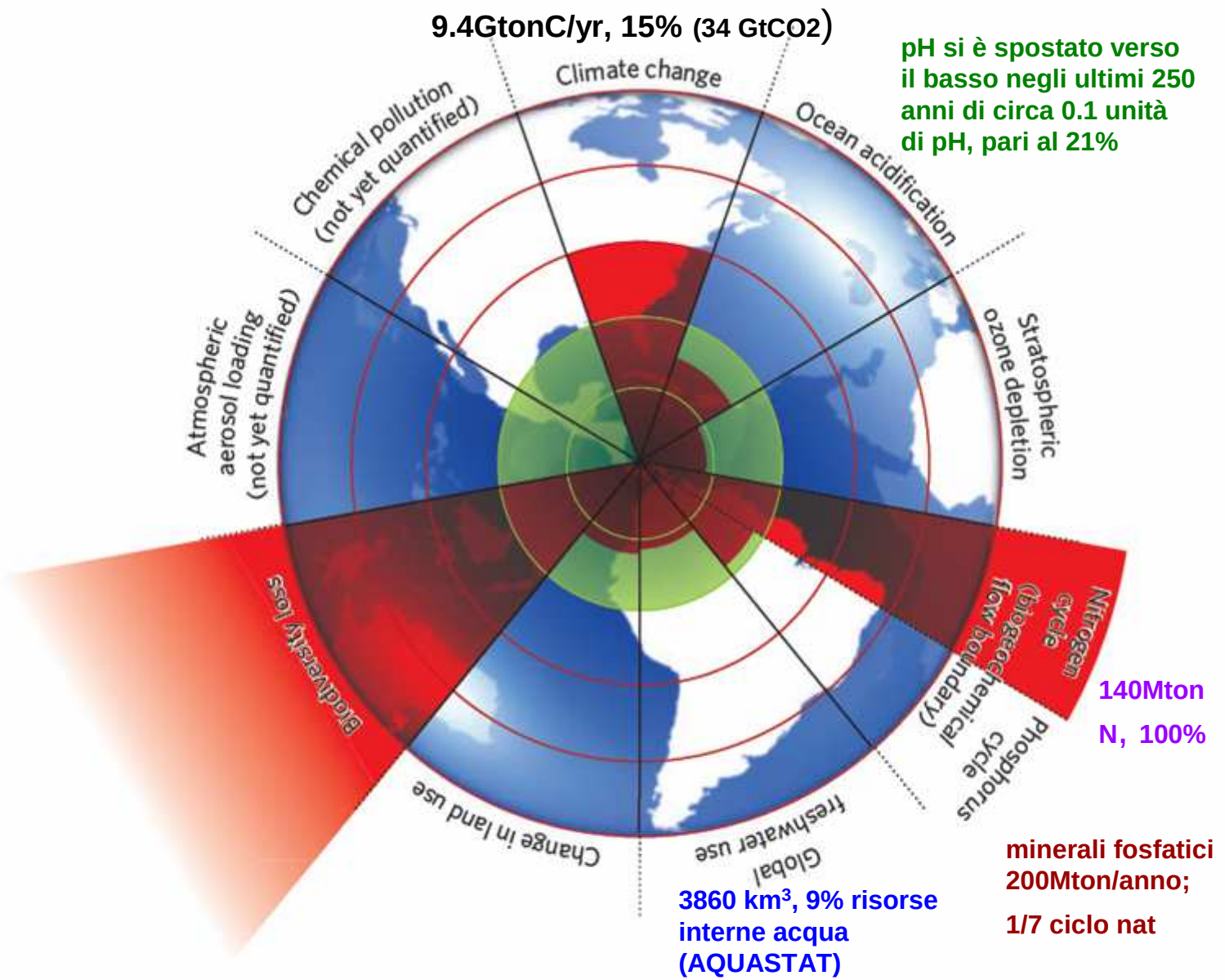


Figure 1 | Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference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

L’effetto serra: cent’anni di storia
Arrhenius 1896

Svante August Arrhenius (1859-1927) chimico svedese, prodigio matematico, premio Nobel per la Chimica 1903. Nel 1896, dopo aver studiato i lavori di Fourier e i primi spettri di radiazione infrarossa prodotti da Langley, fu il primo a sostenere che la temperatura terrestre fosse regolata dalla concentrazione atmosferica di CO_2 (*On the influence of carbonic acid in the air upon the temperature of the ground.* Philosophical Magazine). Sostenne che l’aumento di CO2 di origine antropica avrebbe evitato al mondo la prossima era glaciale e calcolò che un raddoppio di CO_2 avrebbe fatto aumentare la T di 5 C (oggi si stima tra 1,5 e 4,5 C). Al tasso di emissione del tempo, stimò che il raddoppio sarebbe avvenuto entro 3000 anni, in realtà è atteso per il 2050.

Carbon Dioxide Causes Global Warming

(Modern Mechanics, Jul, **1932**)

Carbon Dioxide Heats the Earth

DR. E. O. HULBURT, physicist of the naval research laboratory, Washington, has found conclusive mathematical evidence that the earth's temperature is being warmed by the increased amount of carbon dioxide present in the air. Smoke stacks emit huge volumes of this gas, which is also found in the breath and waste products of humans and animals.

Growing Blanket of Carbon Dioxide Raises Earth's Temperature (Popular Mechanics Aug, **1953**)

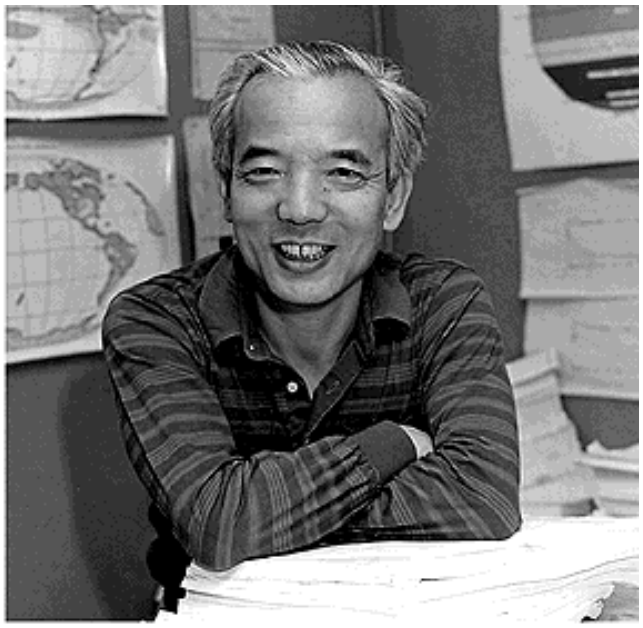
Growing Blanket of Carbon Dioxide Raises Earth's Temperature

Earth's ground temperature is rising 1½ degrees a century as a result of carbon dioxide discharged from the burning of about 2,000,000,000 tons of coal and oil yearly. According to Dr. Gilbert N. Plass of the Johns Hopkins University, this discharge augments a blanket of gas around the world which is raising the temperature in the same manner glass heats a greenhouse. By 2080, he predicts the air's carbon-dioxide content will double, resulting in an average-temperature rise of at least four percent. If most of man's industrial growth were over a period of several thousand years, instead of being crowded within the last century, oceans would have absorbed most of the excess carbon dioxide. But because of the slow circulation of the seas, they have had little effect in reducing the amount of the gas as man's smoke-making abilities have multiplied over the past hundred years.

Syukuro Manabe
Geophysical Fluid Dynamics Lab
Princeton - www.gfdl.noaa.gov

- A **1967** paper with Richard Wetherald of GFDL, published in the *Journal of Atmospheric Sciences,* predicted how increased carbon dioxide levels due to fossil fuel use could warm the earth.

- **IPCC** founded **1988**




OCTOBER 19, 1987
$1.95
TIME
SPECIAL REPORT
Fighting for Global Markets
The Heat Is On
How the Earth's Climate Is Changing
Why the Ozone Hole Is Growing


APRIL 3, 2006
SPECIAL REPORT GLOBAL WARMING
TIME
BE WORRIED. BE VERY WORRIED.
Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well
EARTH AT THE TIPPING POINT
HOW IT THREATENS YOUR HEALTH
HOW CHINA & INDIA CAN HELP SAVE THE WORLD—OR DESTROY IT
THE CLIMATE CRUSADERS

1988

www.ipcc.ch

Le indicazioni della Conferenza di Torino… del 1989!

- La conferenza internazionale organizzata dalla Fondazione San Paolo di Torino sul tema «Atmosfera, clima e uomo», tenutasi dal 16 al 18 gennaio 1989, ha elaborato alla fine dei suoi lavori una serie di raccomandazioni rivolte ai governi e agli altri organi competenti che, se osservate, possono contribuire a risolvere in parte i problemi finora esaminati…

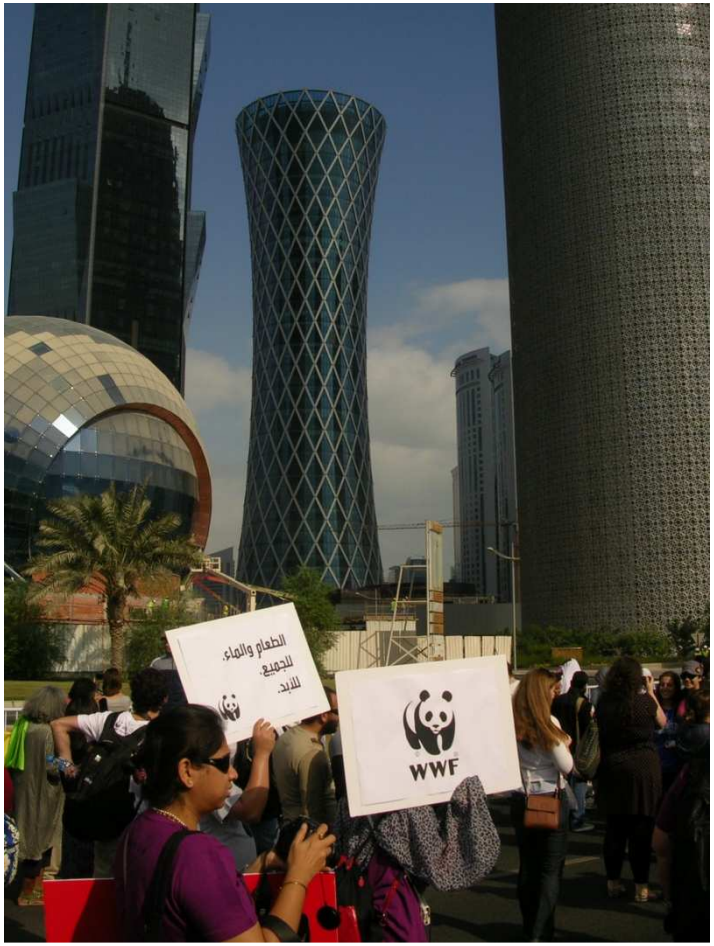
La Repubblica, 17-01-1989

- **DALLA SCIENZA UN SOS 'ORA SALVIAMO LA TERRA'**
- TORINO Torino è paralizzata da una nebbia che blocca gli aerei e rallenta le auto. Gran parte dell' Italia ha sete mentre l' acqua rimane sospesa a mezz' aria. Con ogni probabilità è solo una delle tante bizzarrie meteorologiche che da sempre hanno riempito i proverbi e le cronache. Ma che il dubbio si insinui, che i sospetti su un rapporto tra le anomalie climatiche e l' intervento dell' uomo non possa più essere respinto in maniera categorica spiega il successo del convegno organizzato al Teatro Regio dalla Fondazione San Paolo. I nomi degli scienziati arrivati a Torino da tutto il mondo per fare il punto sui problemi dell' atmosfera a cominciare dal Nobel Ilya Prigogine era già un motivo sufficiente a spiegare l' attenzione…

United Nations Framework Convention on Climate Change - 1992

Kyoto Protocol – 2005-2012

DOHA 2012
UN CLIMATE CHANGE CONFERENCE
COP18·CMP8

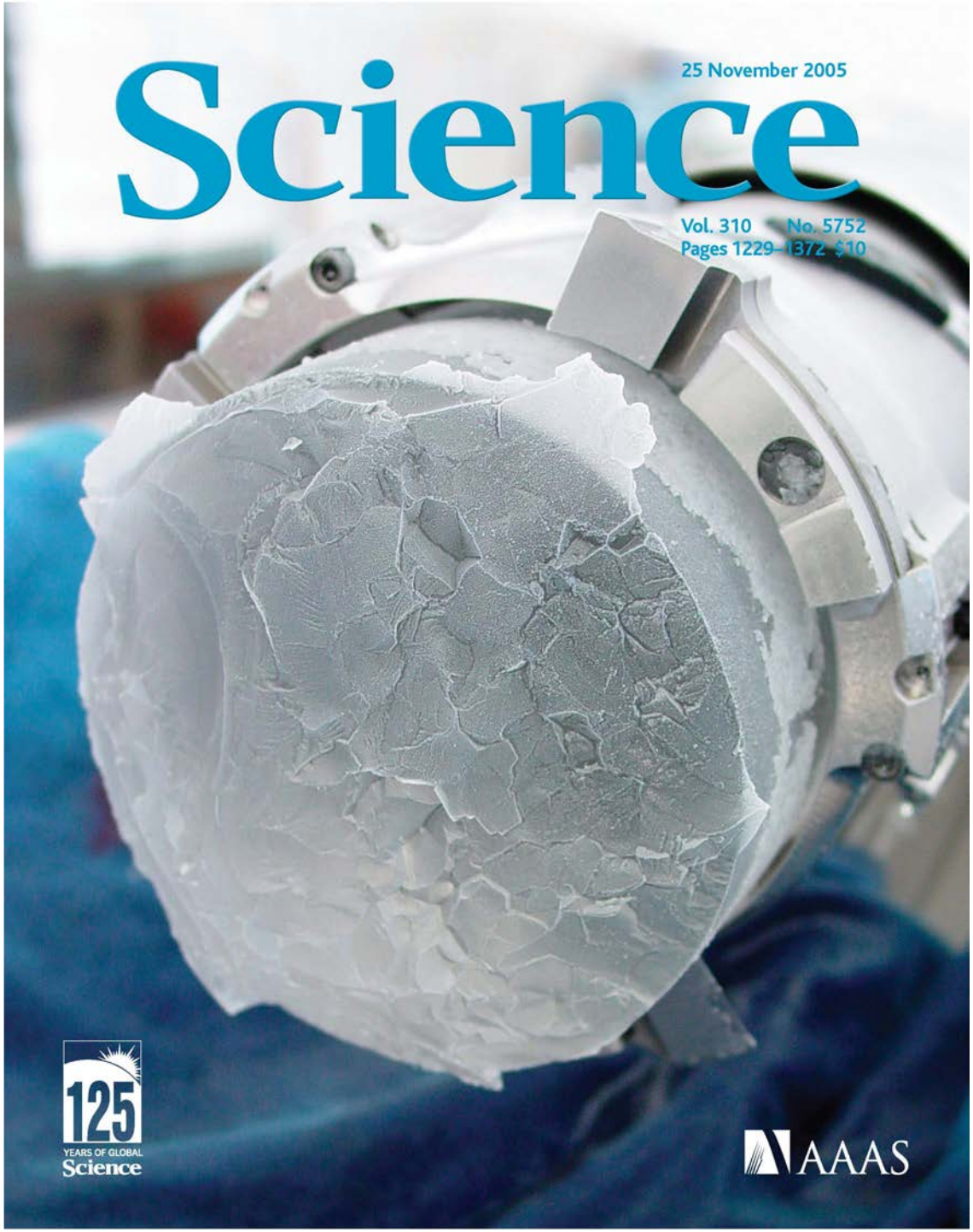


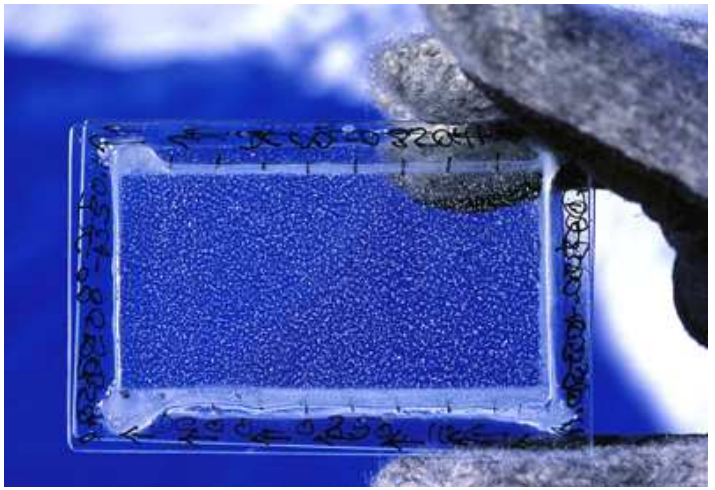
Progetto EPICA - EPICA

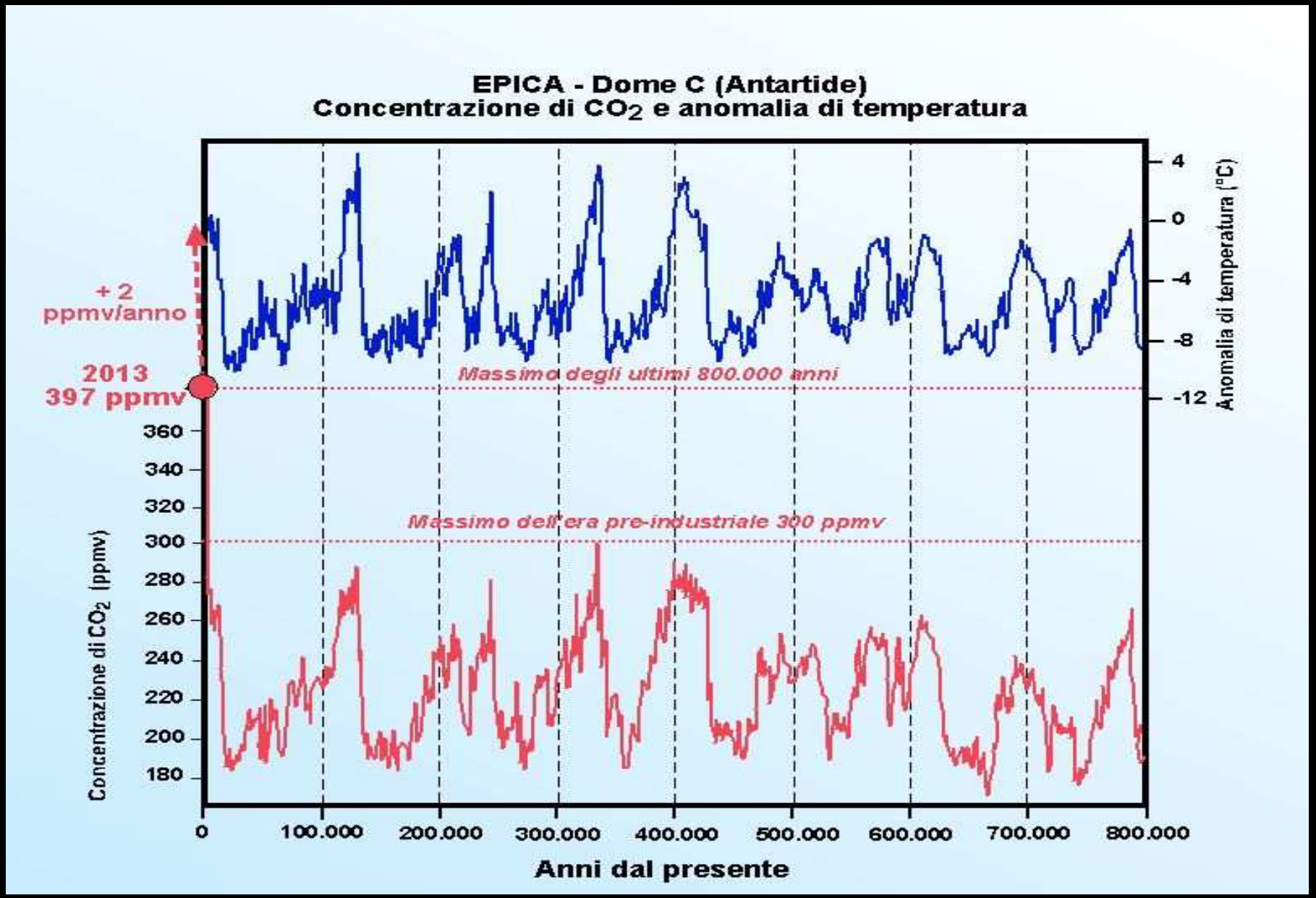
(European Project for Ice Coring in Antarctica)

Stazione italo-francese Concordia, a Dome C - Antartide


EPICA DOME
15-01-2001
3000m
EpicaDômeC
12 12 2002
30.12.2001
CA DÔME C
3270.20m 21·12·2004

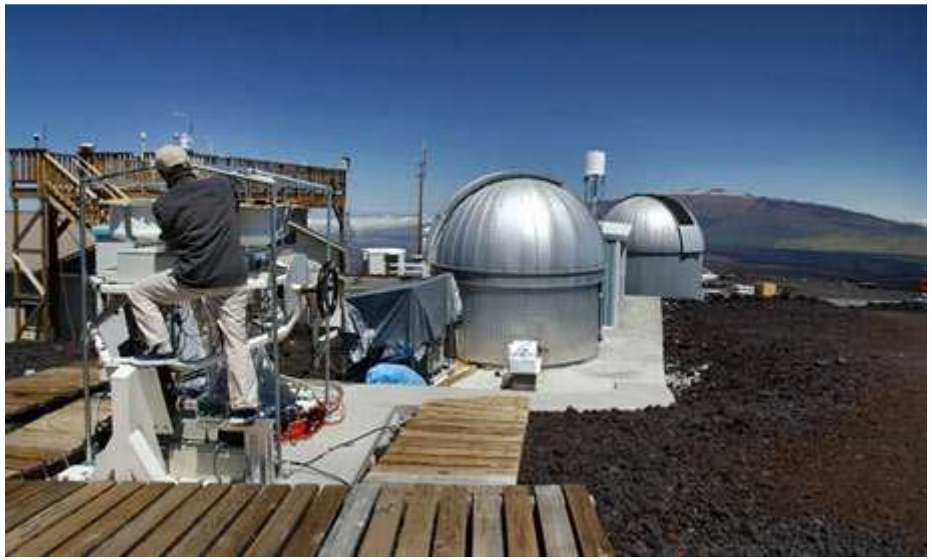

Science
25 November 2005
Vol. 310 No. 5752
Pages 1229–1372 $10
125
YEARS OF GLOBAL
Science
AAAS

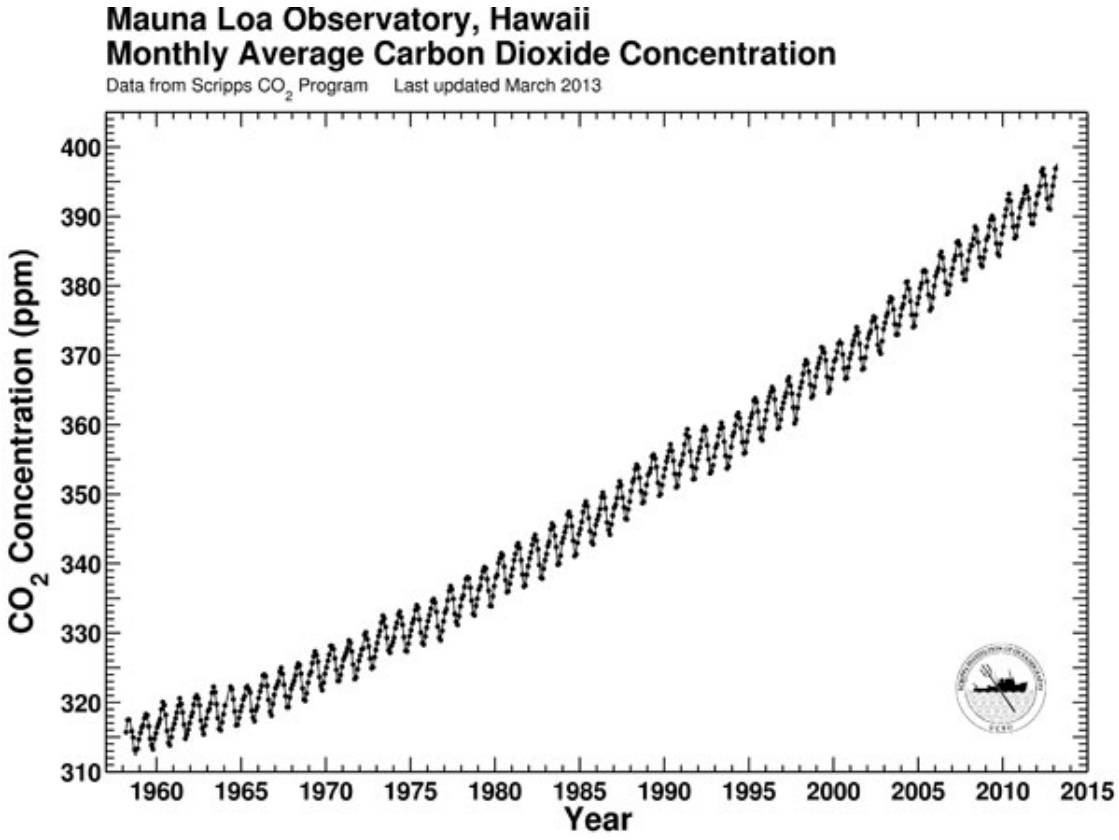




Analisi chimica delle bolle d'aria «fossile» intrappolate nel ghiaccio

CO_2 max. concentrazione 300 ppmv





CO_2 = 400 ppm

Valore massimo da 3 milioni di anni (medio Pliocene, T+3 C, SL +25 m)!

Science 8 March 2013:
Vol. 339 no. 6124 pp. 1198-1201
DOI: 10.1126/science.1228026

REPORT

A Reconstruction of Regional and Global Temperature for the Past 11,300 Years

1005x663

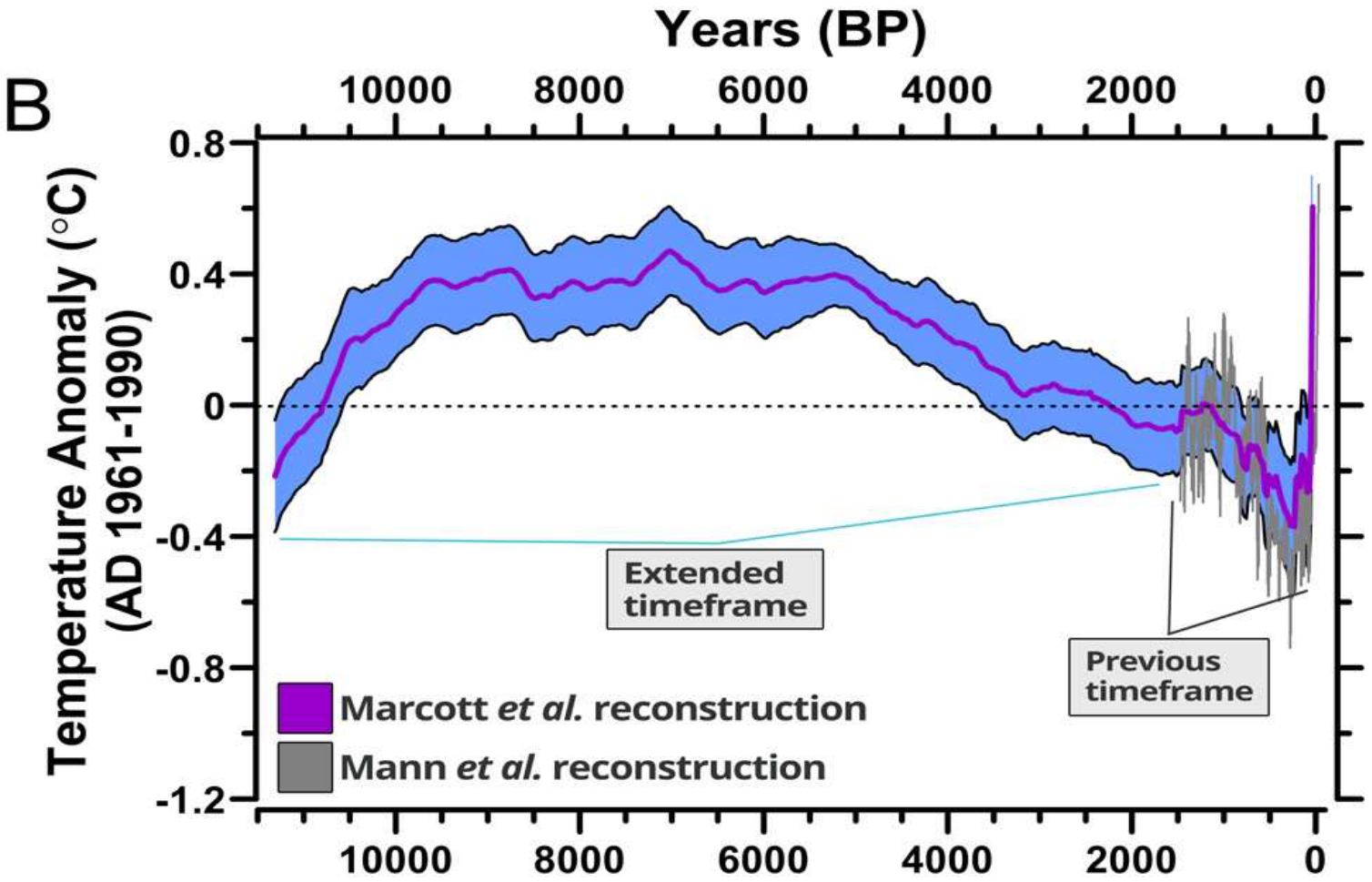
Shaun A. Marcott[1], Jeremy D. Shakun[2], Peter U. Clark[1], Alan C. Mix[1]

+ Author Affiliation

*To whom correspo

ABSTRACT

Surface temper
that time. Here
anomalies for th
ago) warmth is
in the coolest te
largely associat
have not yet exc
history. Intergov
Holocene tempe

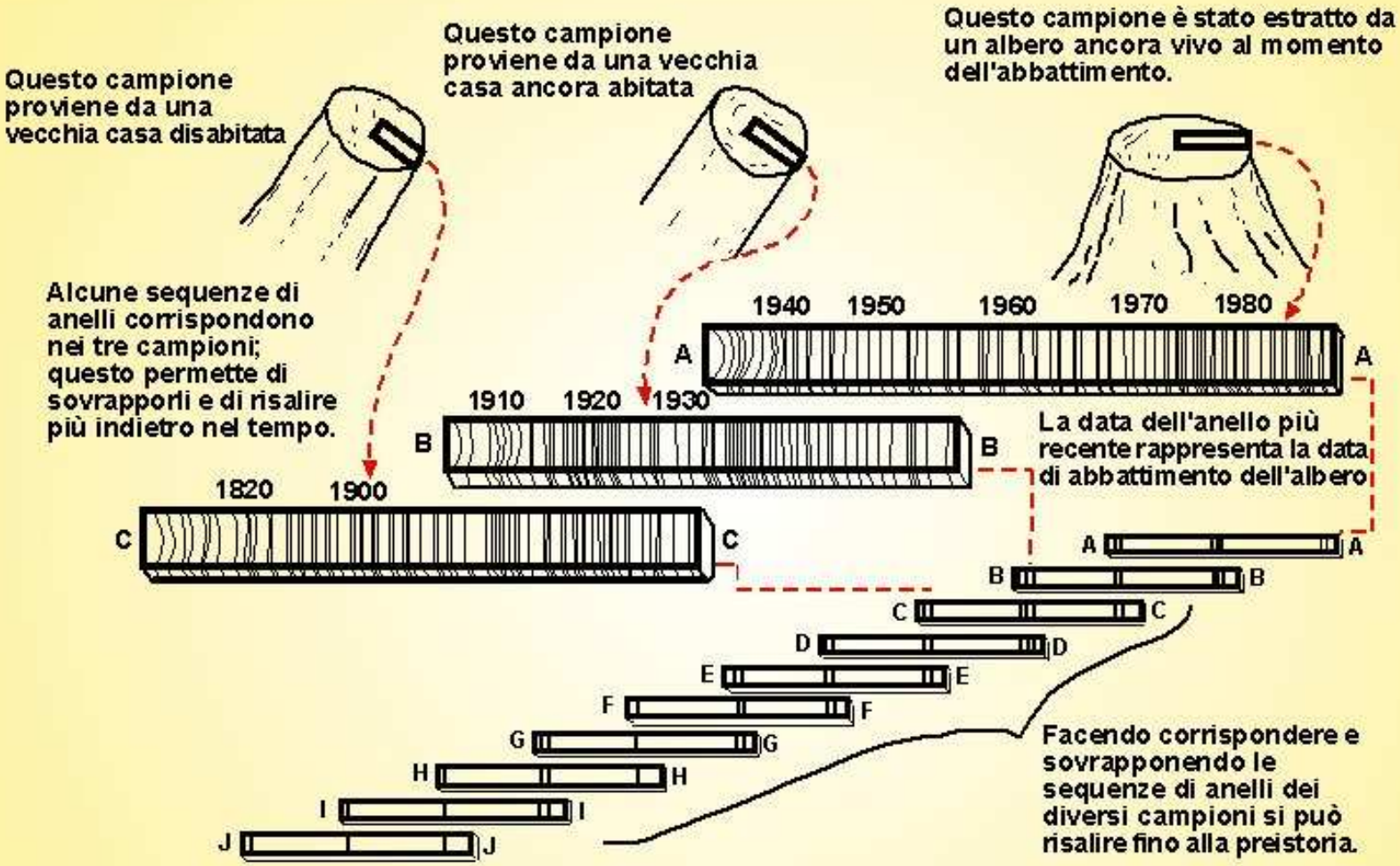


A Reconstruction of Regional and Global Temperature for the Past 11,300 Years

Shaun A. Marcott 1, Jeremy D. Shakun 2, Peter U. Clark1, Alan C. Mix1

1College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, USA.
2Department of Earth and Planetary Sciences, Harvard University, Cambridge, USA

Ricostruzioni paleoclimatiche: dendroclimatologia


Questo campione proviene da una vecchia casa disabitata
Questo campione proviene da una vecchia casa ancora abitata
Questo campione è stato estratto da un albero ancora vivo al momento dell'abbattimento.
Alcune sequenze di anelli corrispondono nei tre campioni; questo permette di sovrapporli e di risalire più indietro nel tempo.
1940 1950 1960 1970 1980
A A
1910 1920 1930
B B
1820 1900
C C
La data dell'anello più recente rappresenta la data di abbattimento dell'albero
A A
B B
C C
D D
E E
F F
G G
H H
I I
J J
Facendo corrispondere e sovrapponendo le sequenze di anelli dei diversi campioni si può risalire fino alla preistoria.

Torbiere alpine, archivi climatici (secoli/millenni)

Torbiera al Ghiacciaio del Rutor
(10.000 –> 5500 BP)

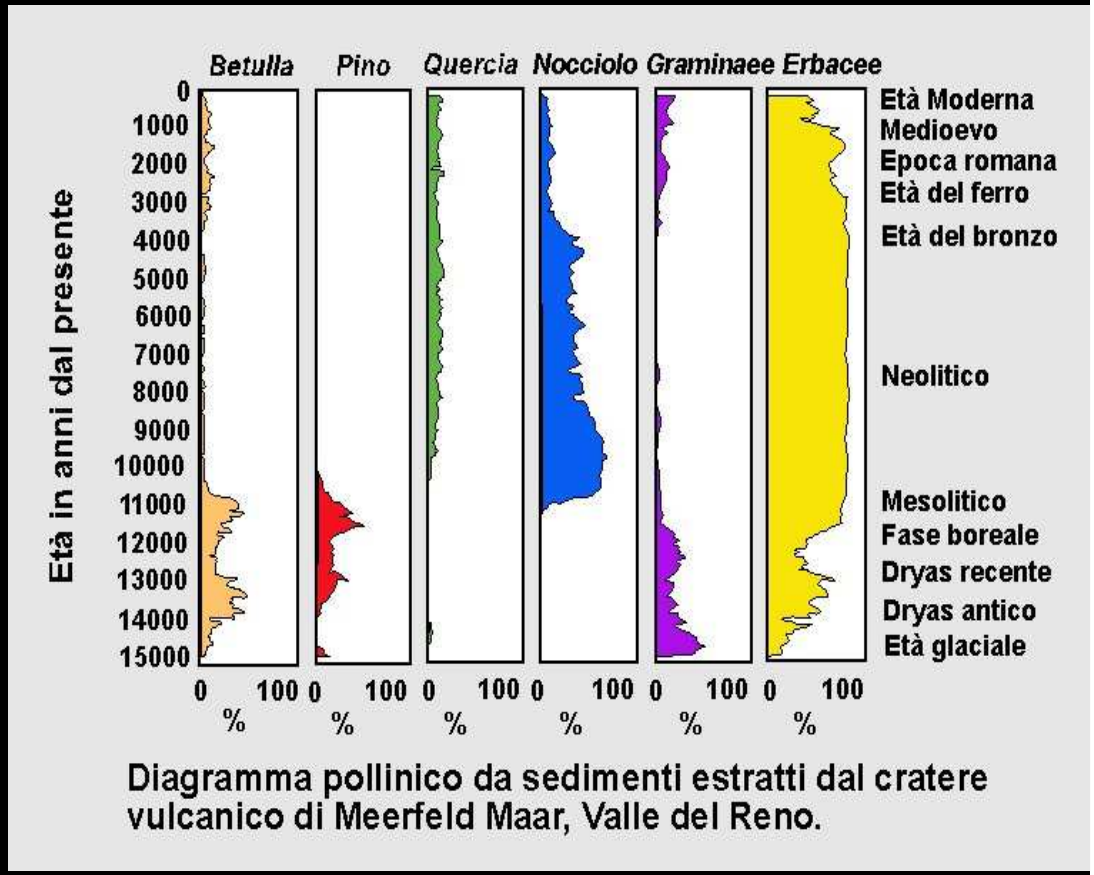
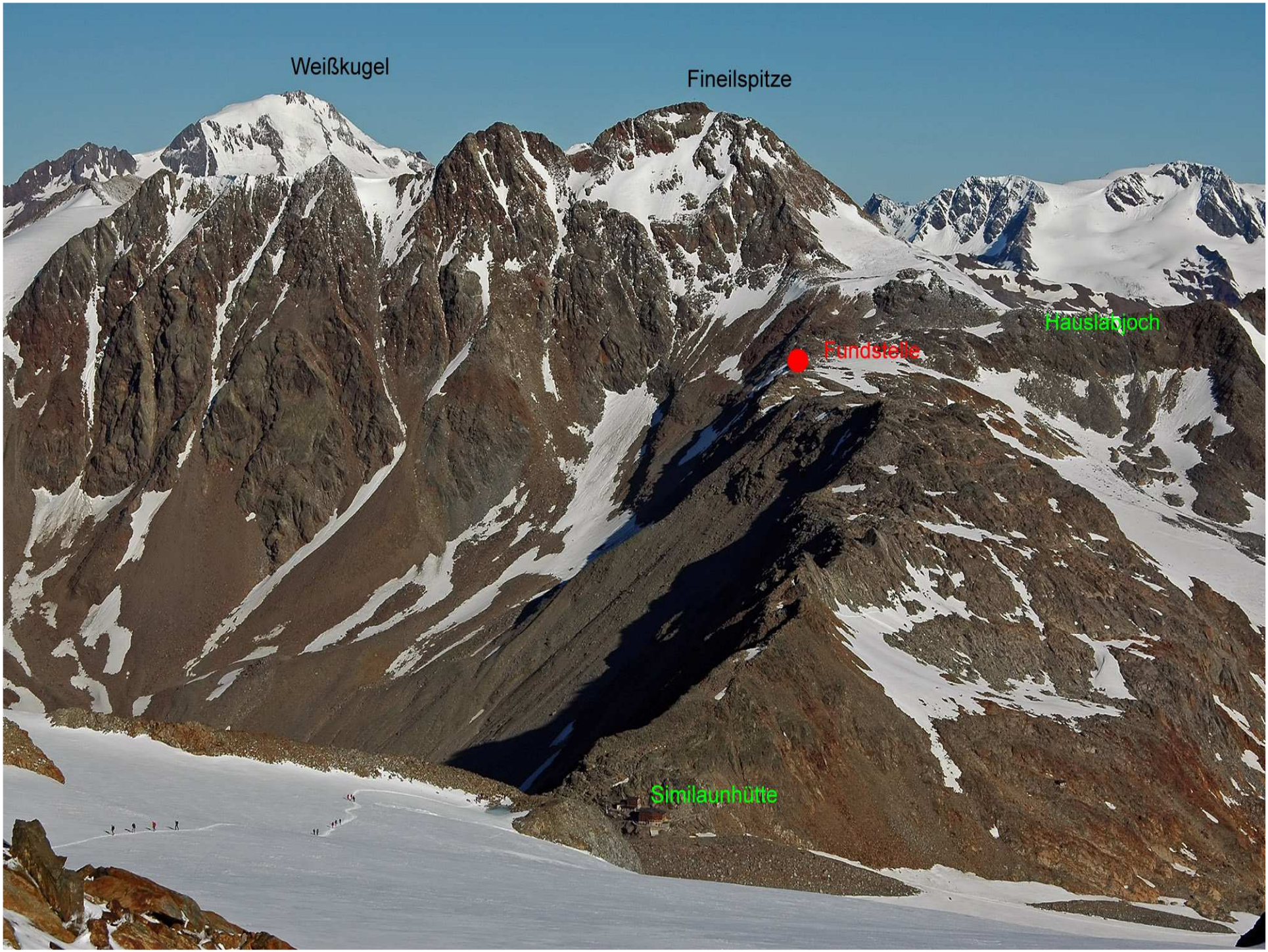


Diagramma pollinico da sedimenti estratti dal cratere vulcanico di Meerfeld Maar, Valle del Reno.

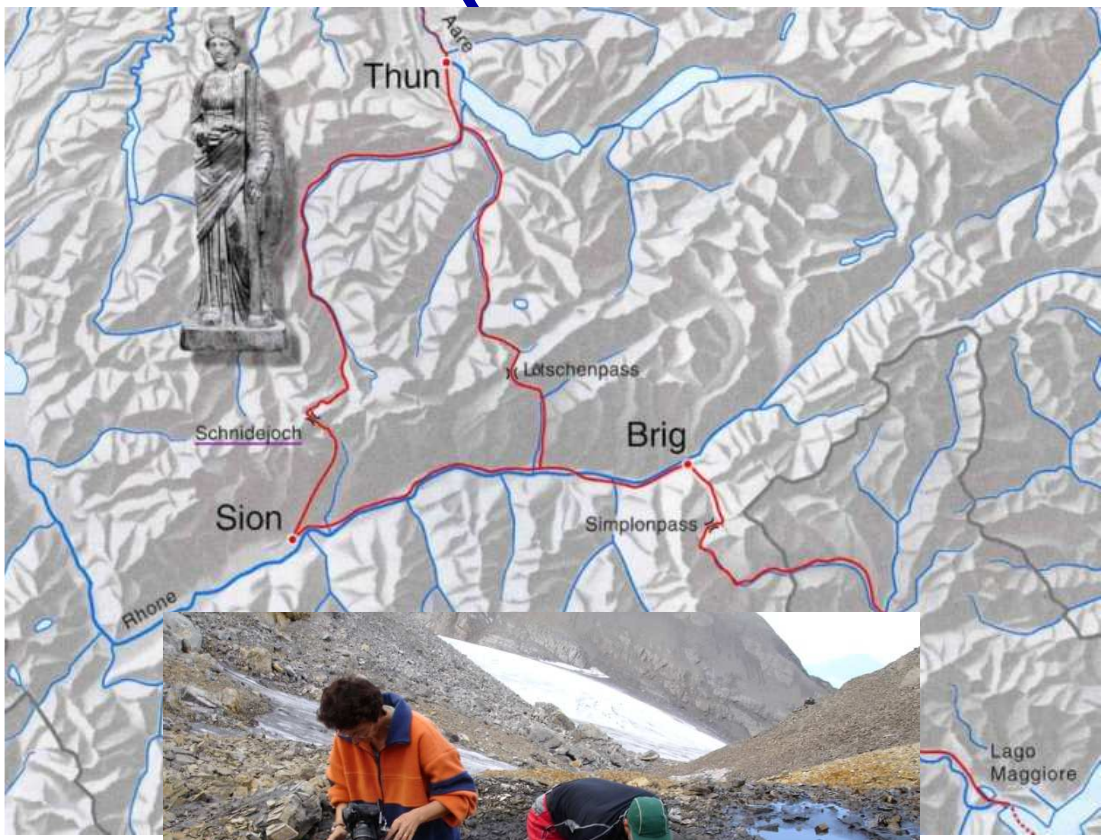
Torbiera Pessey – Mt Avic 2013

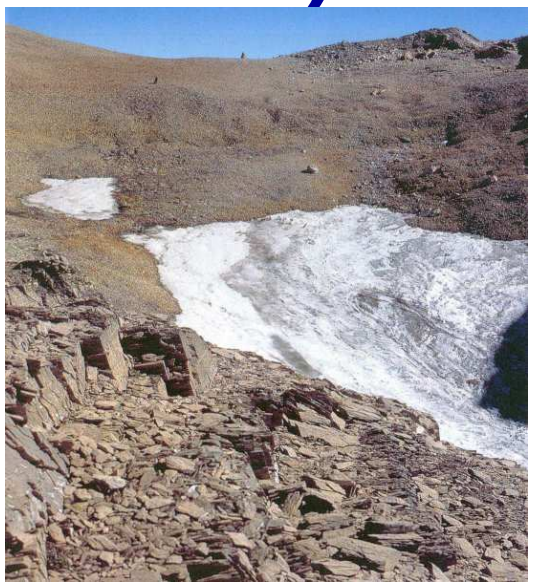

Otzi: ghiacciai alpini mai così ridotti
negli ultimi 5300 anni

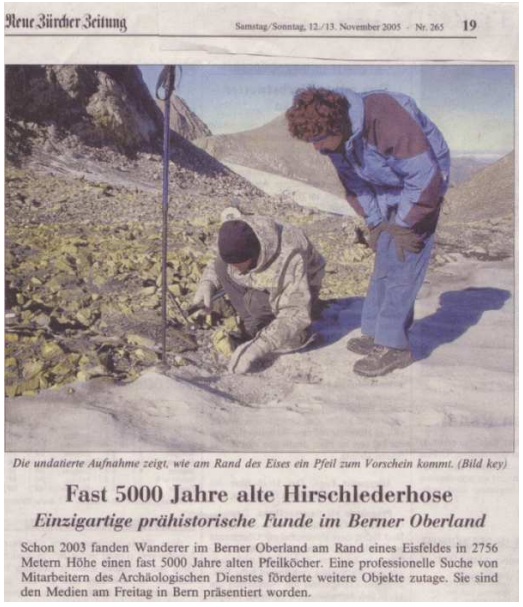

Weißkugel
Fineilspitze
Hauslabjoch
Fundstelle
Similaunhütte


Otzi the Iceman
6-foot longbow and 14 arrows
Hat made of brown bear fur
Waterproof cape (used as a blanket at night)
Axe with copper head
Stomach remains of deer meat and cereals (Otzi's last meal)
Clothes made of leather and animal fur
Animal-skin shoes stuffed with grass

Schnidejoch pass, Suisse (46 22 N / 7 23 W / 2756 m)







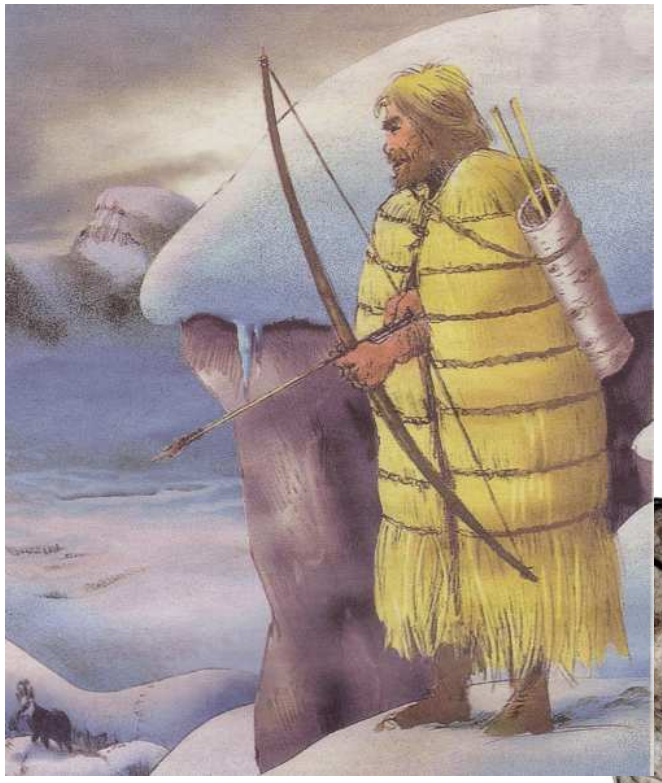
Neue Zürcher Zeitung — Samstag/Sonntag, 12./13. November 2005 – Nr. 265 — 19

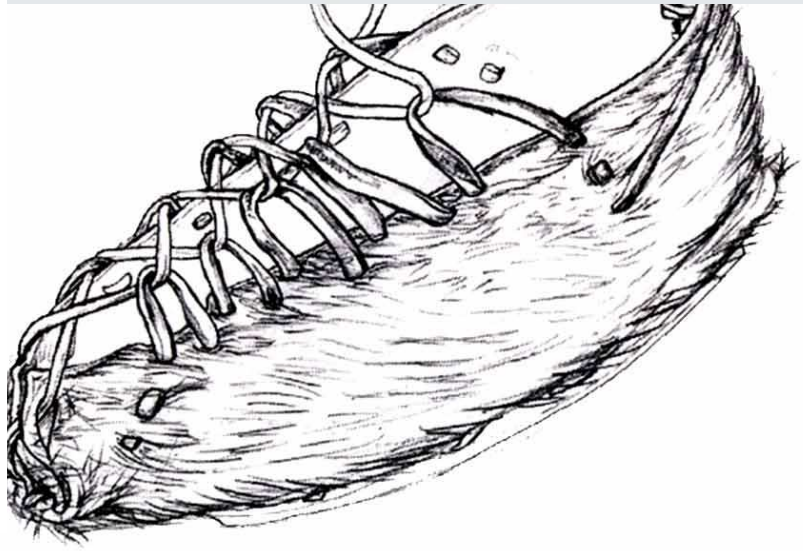
Die undatierte Aufnahme zeigt, wie am Rand des Eises ein Pfeil zum Vorschein kommt. (Bild key)

Fast 5000 Jahre alte Hirschlederhose

Einzigartige prähistorische Funde im Berner Oberland

Schon 2003 fanden Wanderer im Berner Oberland am Rand eines Eisfeldes in 2756 Metern Höhe einen fast 5000 Jahre alten Pfeilköcher. Eine professionelle Suche von Mitarbeitern des Archäologischen Dienstes förderte weitere Objekte zutage. Sie sind den Medien am Freitag in Bern präsentiert worden.





Leather requires permanent embedding in ice in order to stay preserved and, as it is observed today, deteriorates very quickly if exposed at the surface. In consequence, the finds at Schnidejoch suggest permanent ice cover at that site for the last 5000 years, more specifically from ca. 3000 BC until AD 2003. * Grosjean, 2007

Ghiacciaio Lendbreen - Norvegia:
maglione di lana dell’età del ferro, 1700 BP

Schnidejoch pass, Suisse

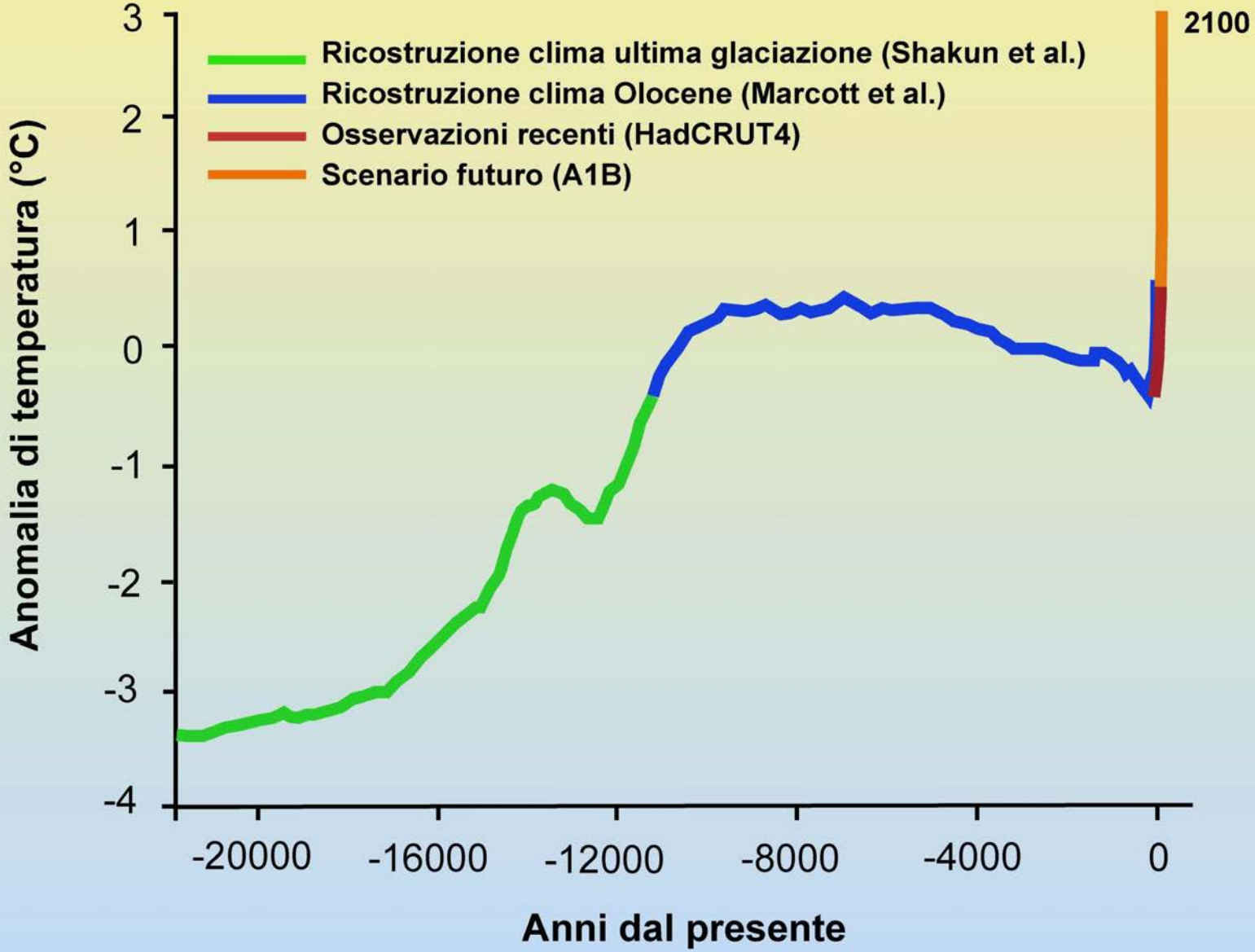
(46 22 N / 7 23 W / 2756 m)

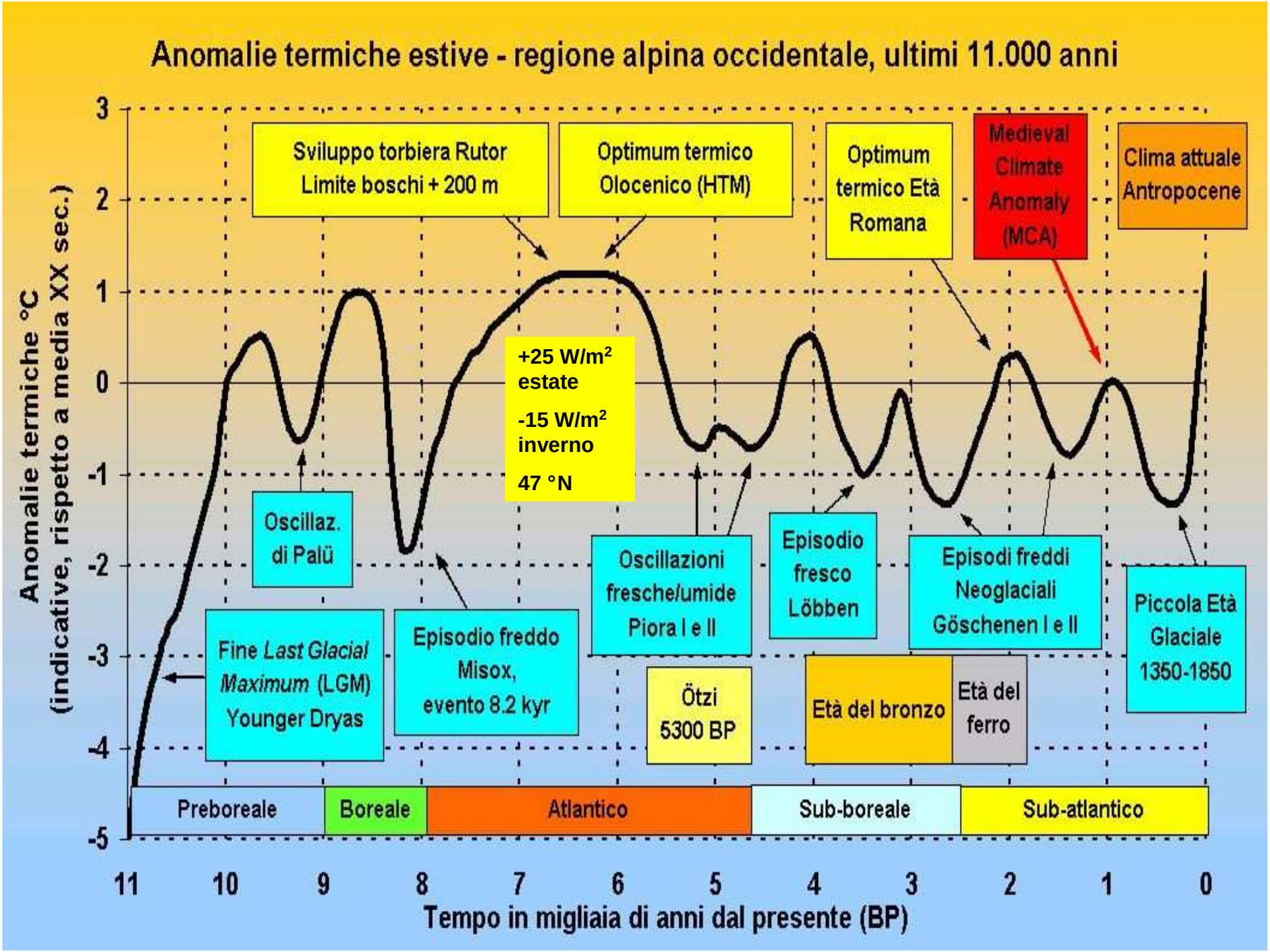
da GROSJEAN et al. 2007 - Ice-borne prehistoric finds in the Swiss Alps reflect Holocene glacier fluctuations. J. Quat. Sci.

The critical point in the context of this paper is that *leather requires permanent embedding in ice in order to stay preserved* and, as it is observed today, deteriorates very quickly if exposed at the surface. In consequence, the finds at Schnidejoch suggest permanent ice cover at that site for the last 5000 years, more specifically from ca. 3000 BC until AD 2003.

- **Schnidejoch shows that the state of the Alpine glaciers of today (year AD 2003) is very unusual and unprecedented in the light of at least the last 5000 years.**

Variazioni termiche globali dall'ultima glaciazione e scenario al 2100



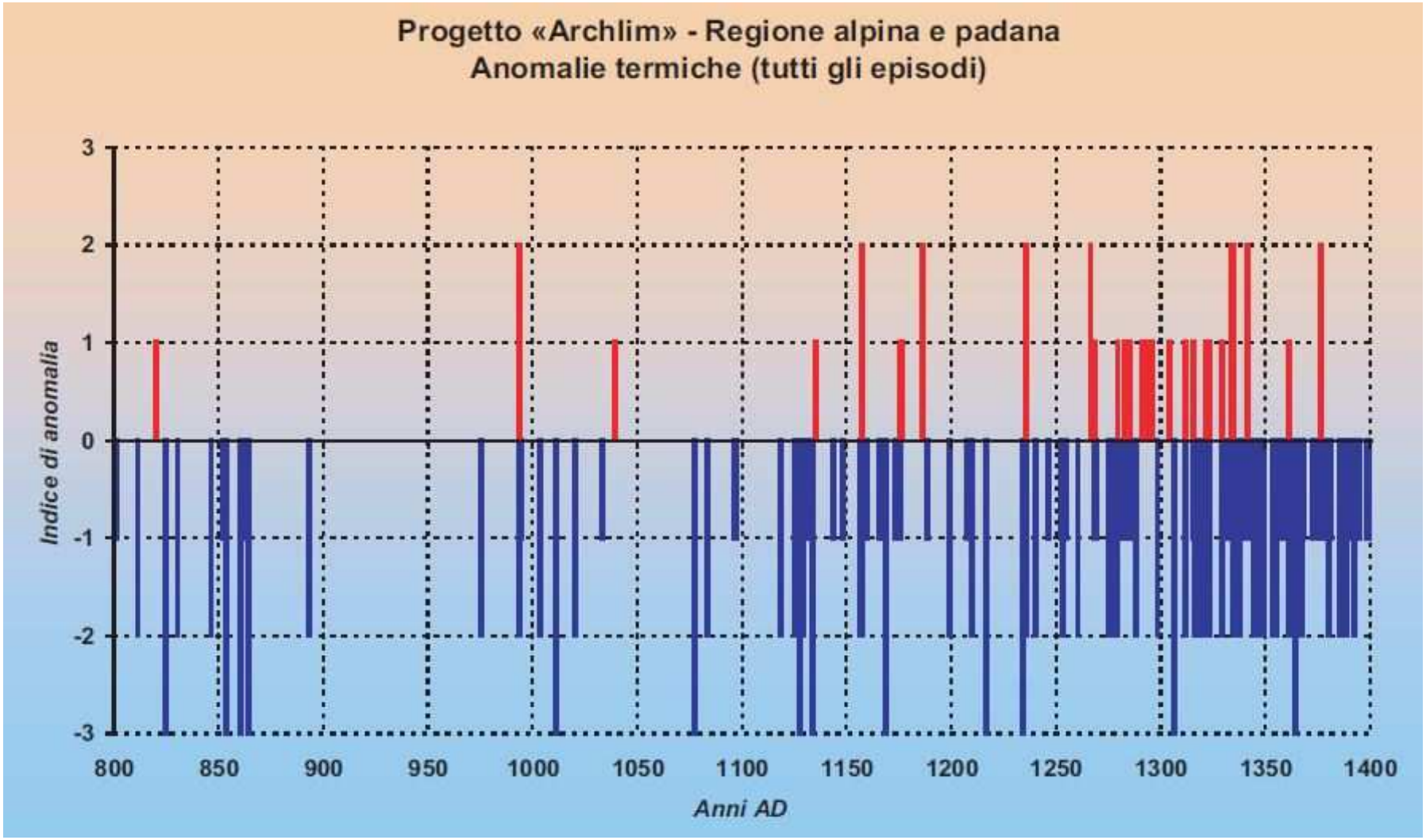

Anomalie termiche estive - regione alpina occidentale, ultimi 11.000 anni
Anomalie termiche °C
(indicative, rispetto a media XX sec.)
3
2
1
0
-1
-2
-3
-4
-5
Sviluppo torbiera Rutor
Limite boschi + 200 m
Optimum termico
Olocenico (HTM)
Optimum
termico Età
Romana
Medieval
Climate
Anomaly
(MCA)
Clima attuale
Antropocene
+25 W/m2
estate
-15 W/m2
inverno
47 °N
Oscillaz.
di Palü
Fine Last Glacial
Maximum (LGM)
Younger Dryas
Episodio freddo
Misox,
evento 8.2 kyr
Oscillazioni
fresche/umide
Piora I e II
Ötzi
5300 BP
Episodio
fresco
Löbben
Episodi freddi
Neoglaciali
Göschenen I e II
Piccola Età
Glaciale
1350-1850
Età del bronzo
Età del
ferro
Preboreale
Boreale
Atlantico
Sub-boreale
Sub-atlantico
11
10
9
8
7
6
5
4
3
2
1
0
Tempo in migliaia di anni dal presente (BP)

Dal
«Livre de laudes et devotions»
(sec. XIV)

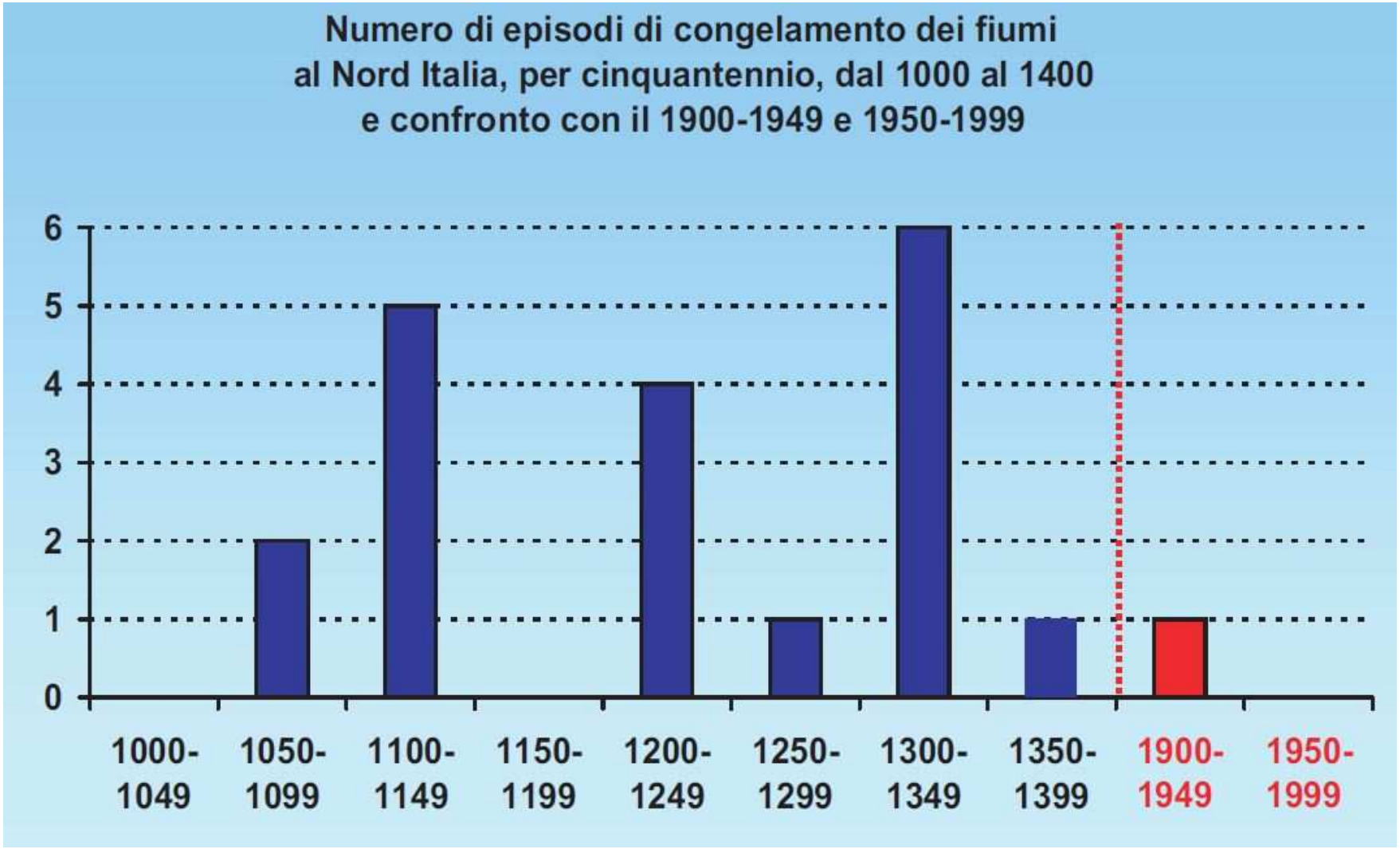
Cortesia
Archivio di Stato
di Torino

Archlim

2012

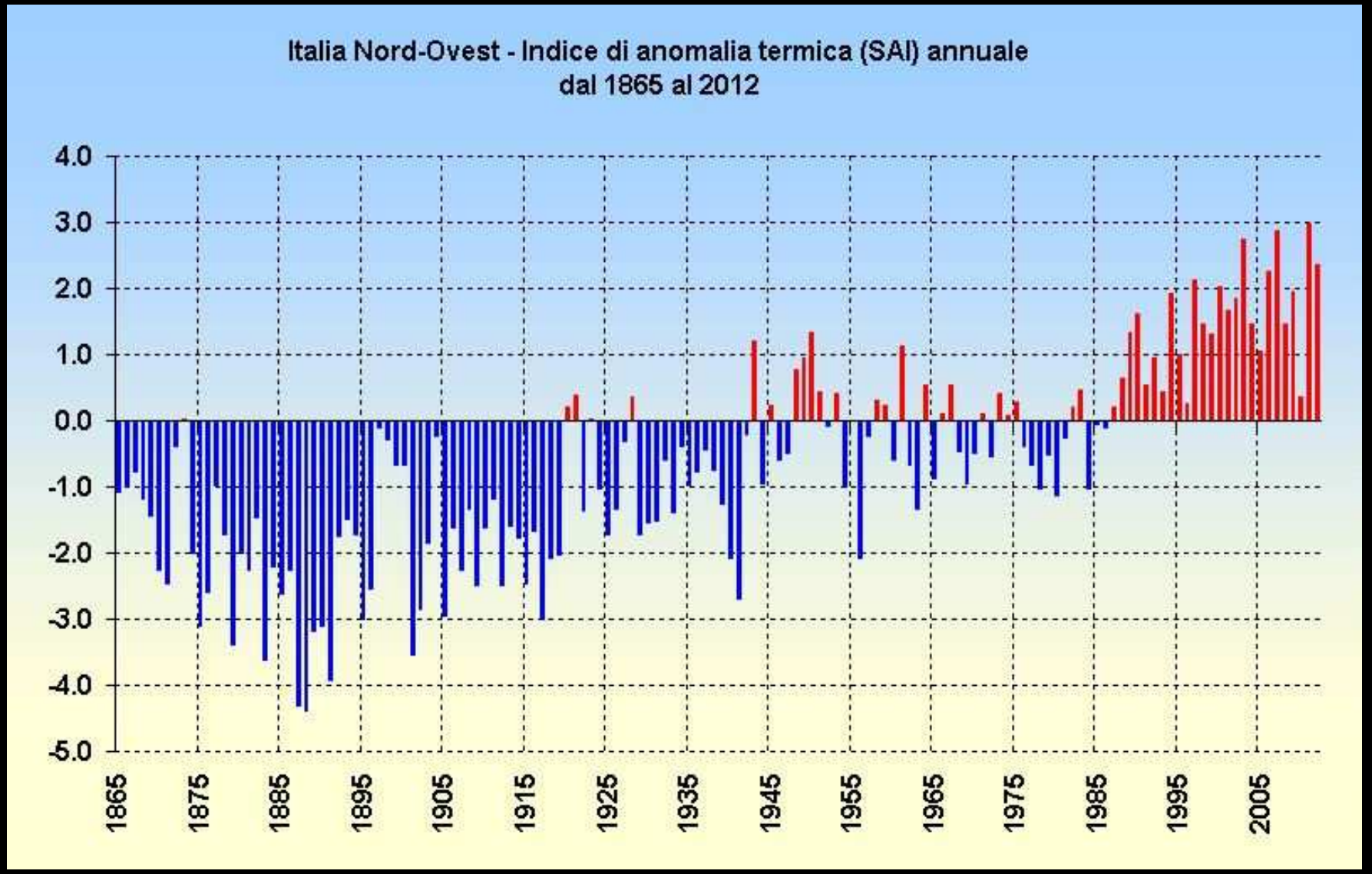


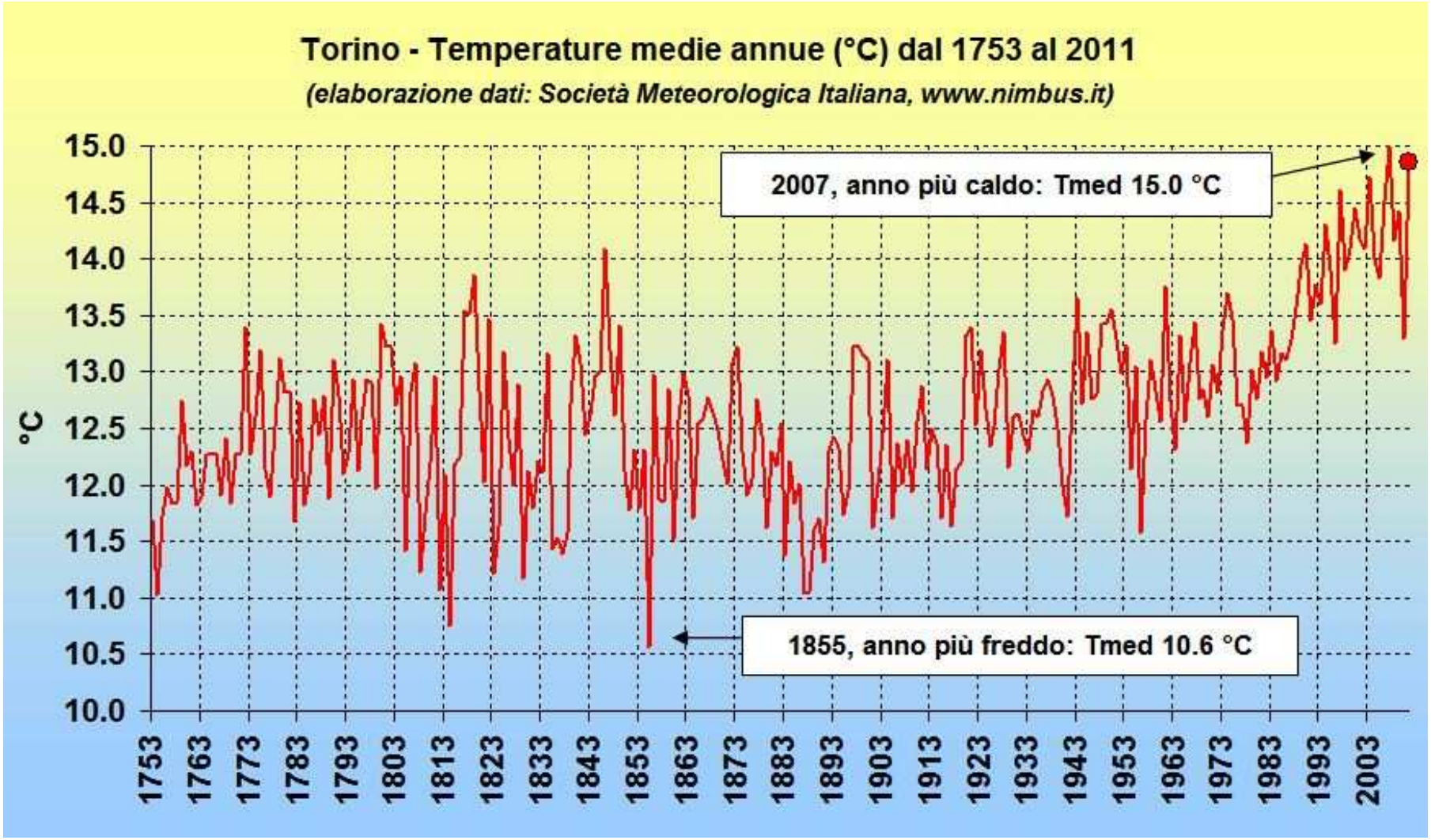
Dall’analisi degli eventi censiti
non emergono segnali probanti
di un Medioevo significativamente caldo



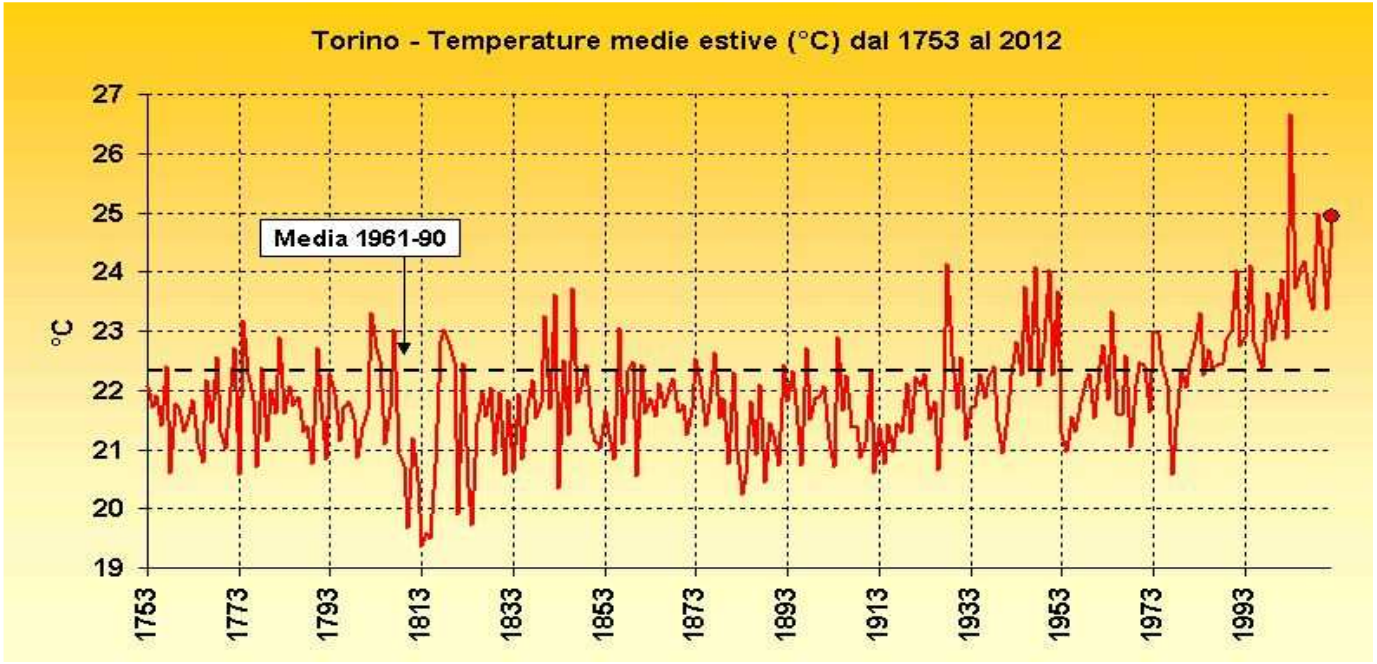
19 episodi tra il 1077 e il 1355,
in media uno ogni 15 anni
(ultimo caso recente del Po: 1929)

150 anni di misure meteorologiche sulle Alpi: la temperatura aumenta più rapidamente della media globale

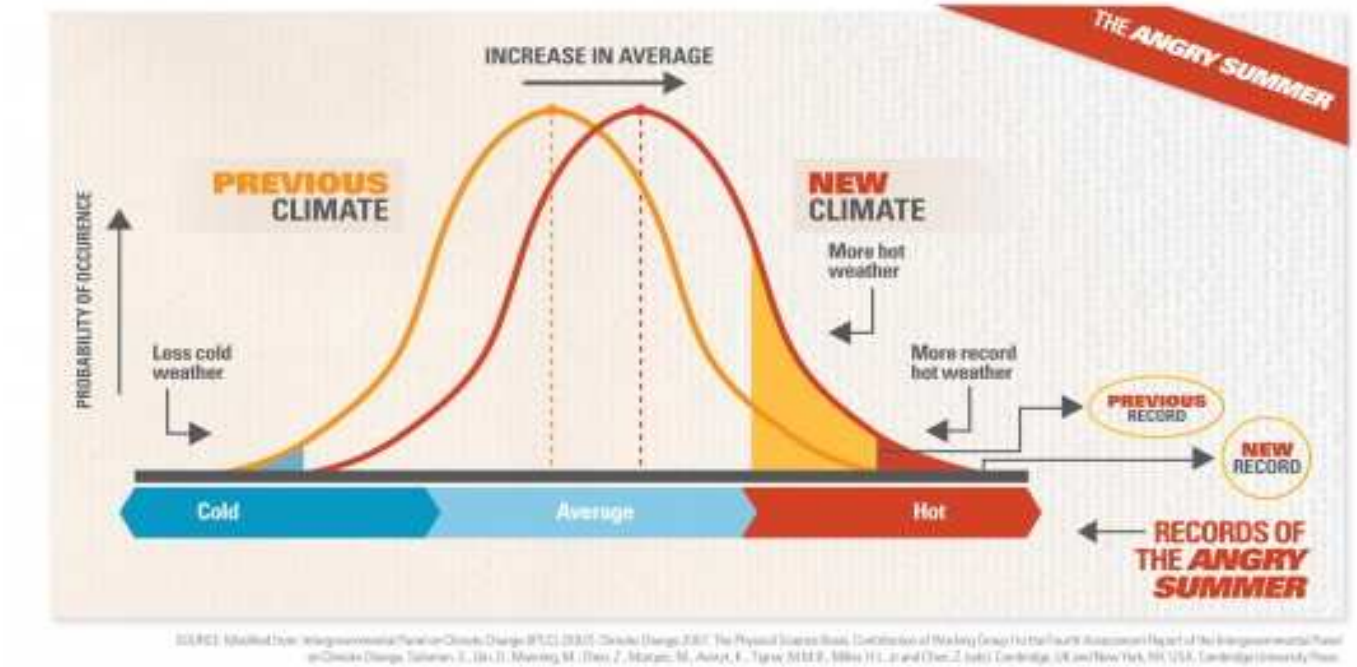




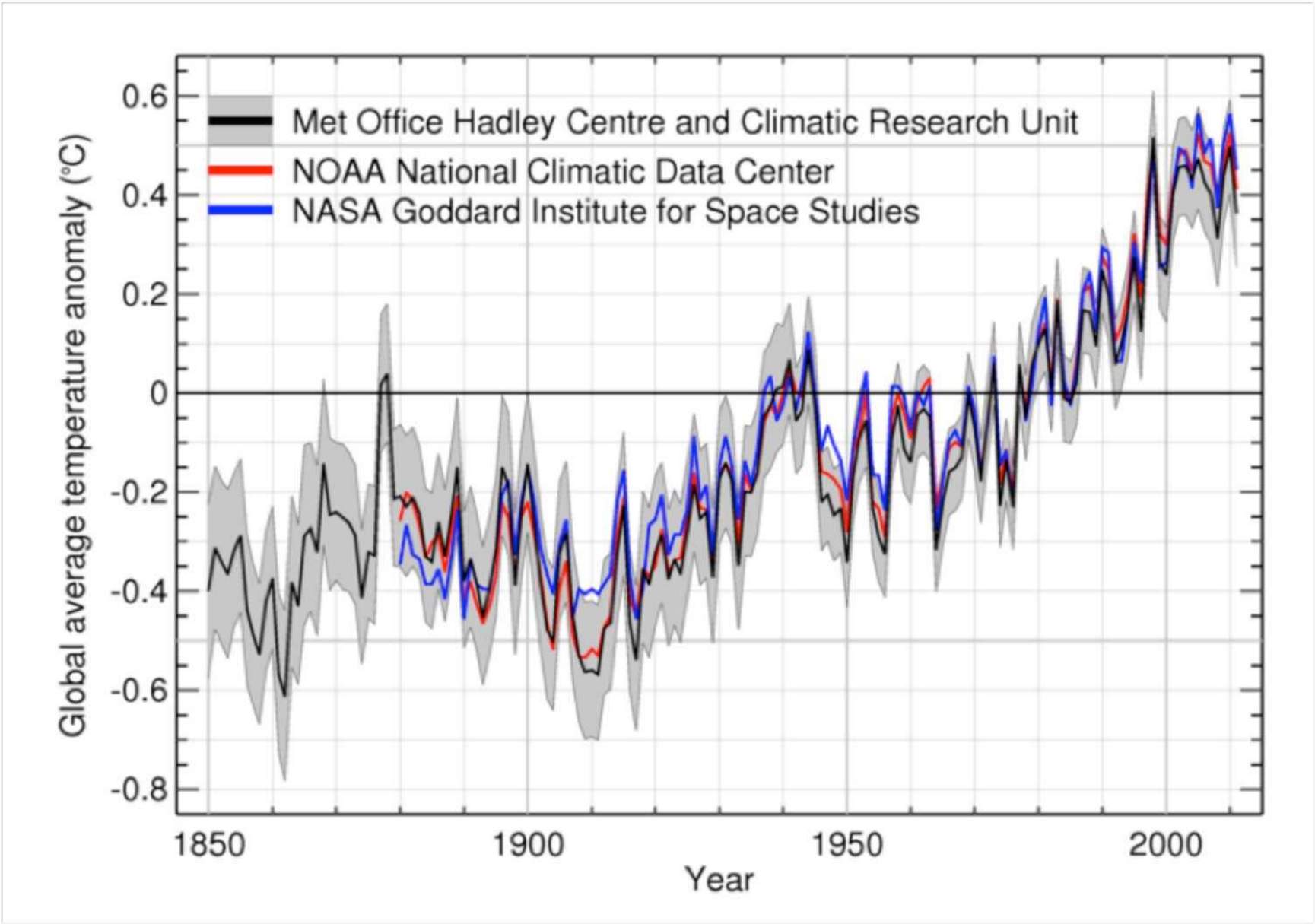
2011: secondo tra i più caldi dal 1753
(1.7 ℃ sopra media)



Nord Italia 2012: seconda estate più calda dal 1753

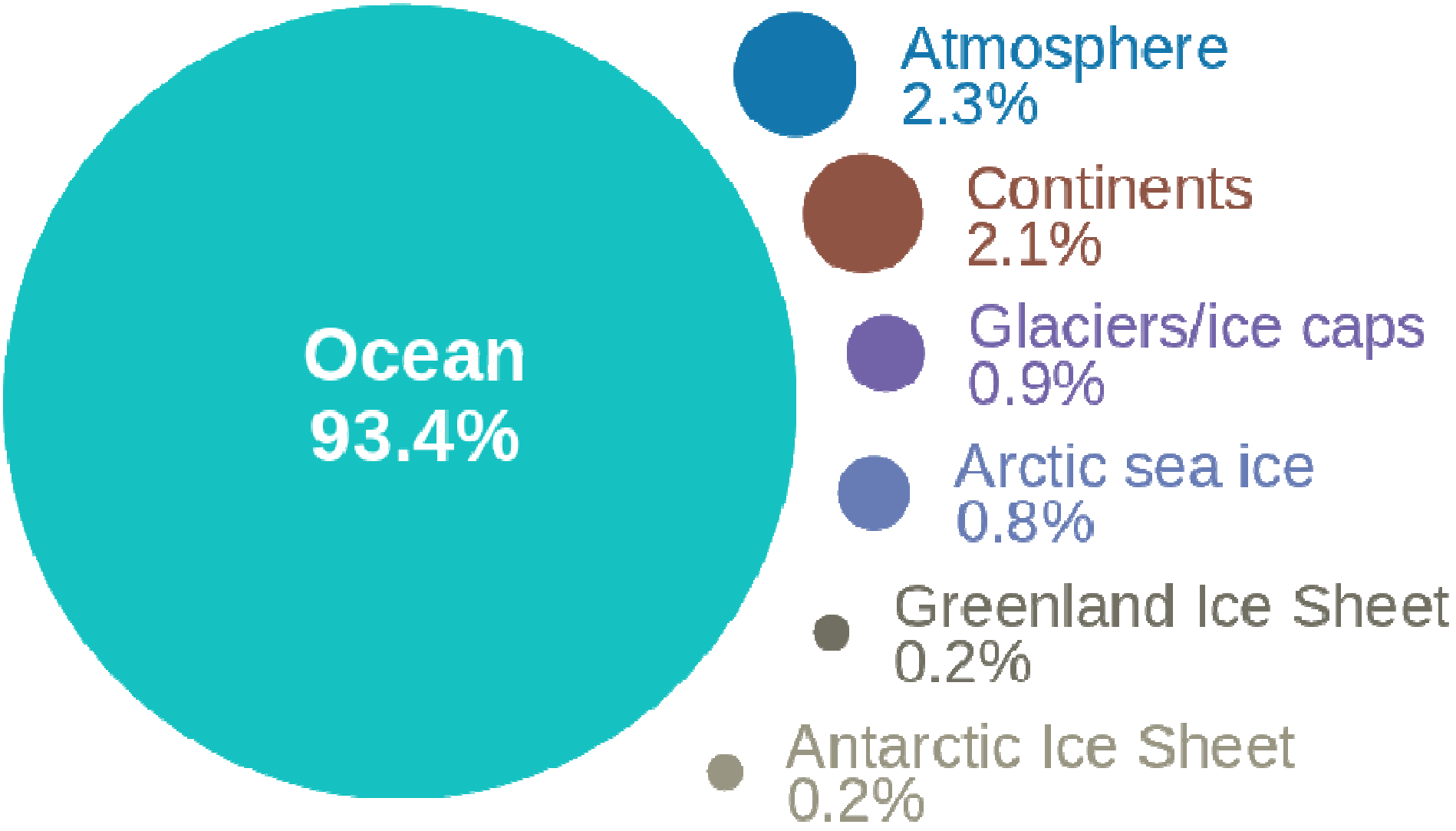


Australia 2013: l'estate più calda della serie di misure



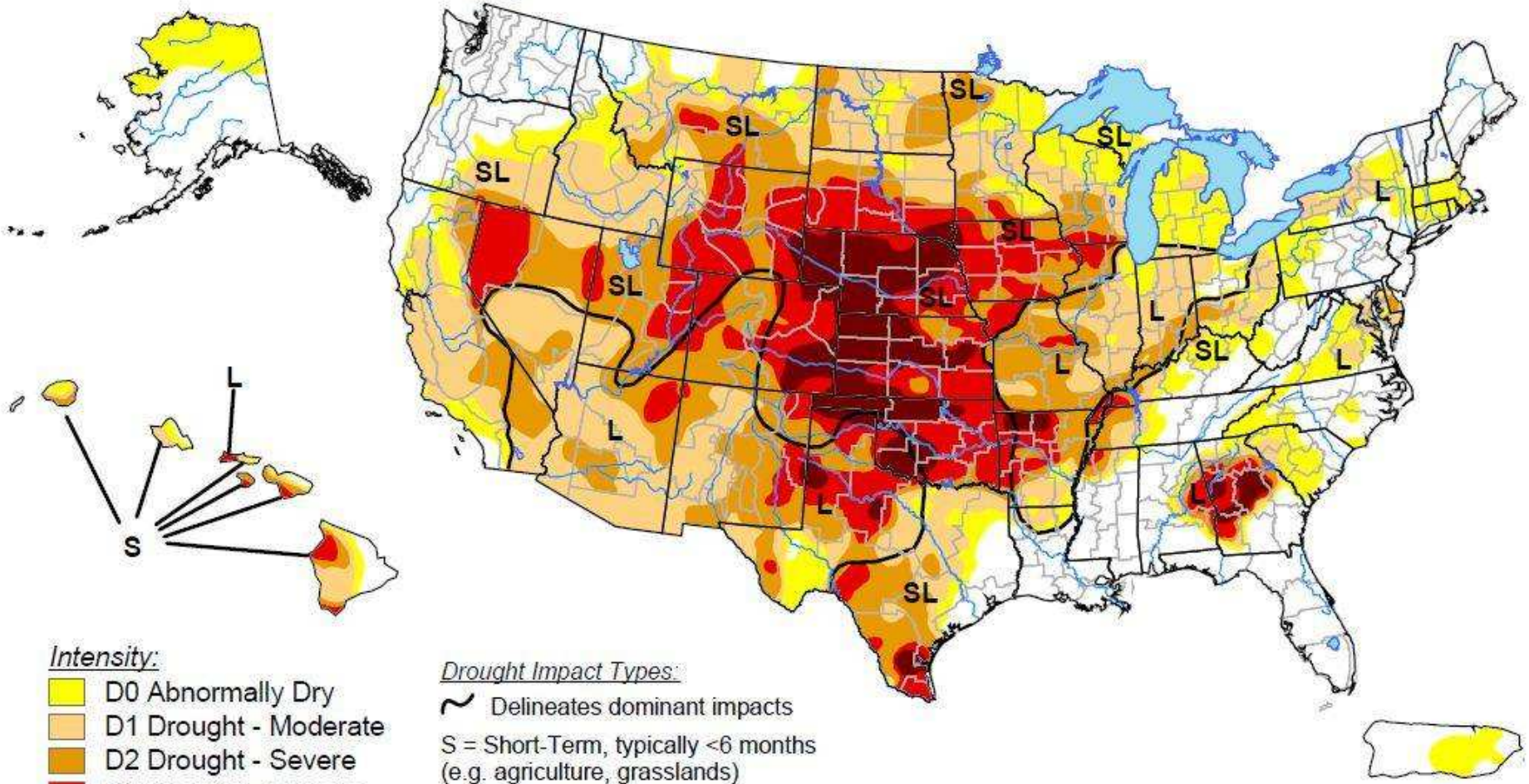
2011:decimo anno più caldo a livello globale

Where is global warming going?



U.S. Drought Monitor

September 18, 2012
Valid 7 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

~ Delineates dominant impacts

S = Short-Term, typically <6 months
(e.g. agriculture, grasslands)

L = Long-Term, typically >6 months
(e.g. hydrology, ecology)

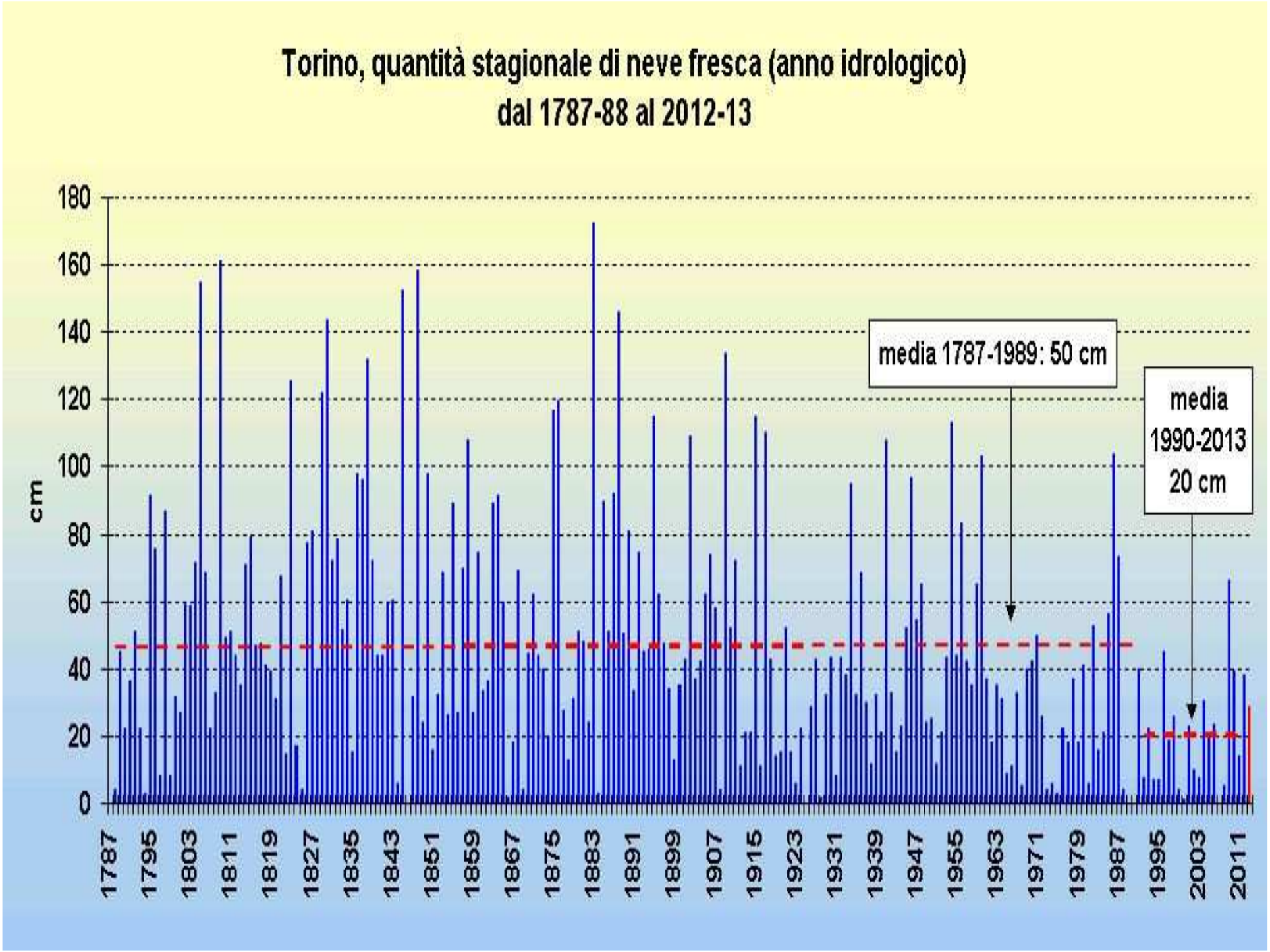
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

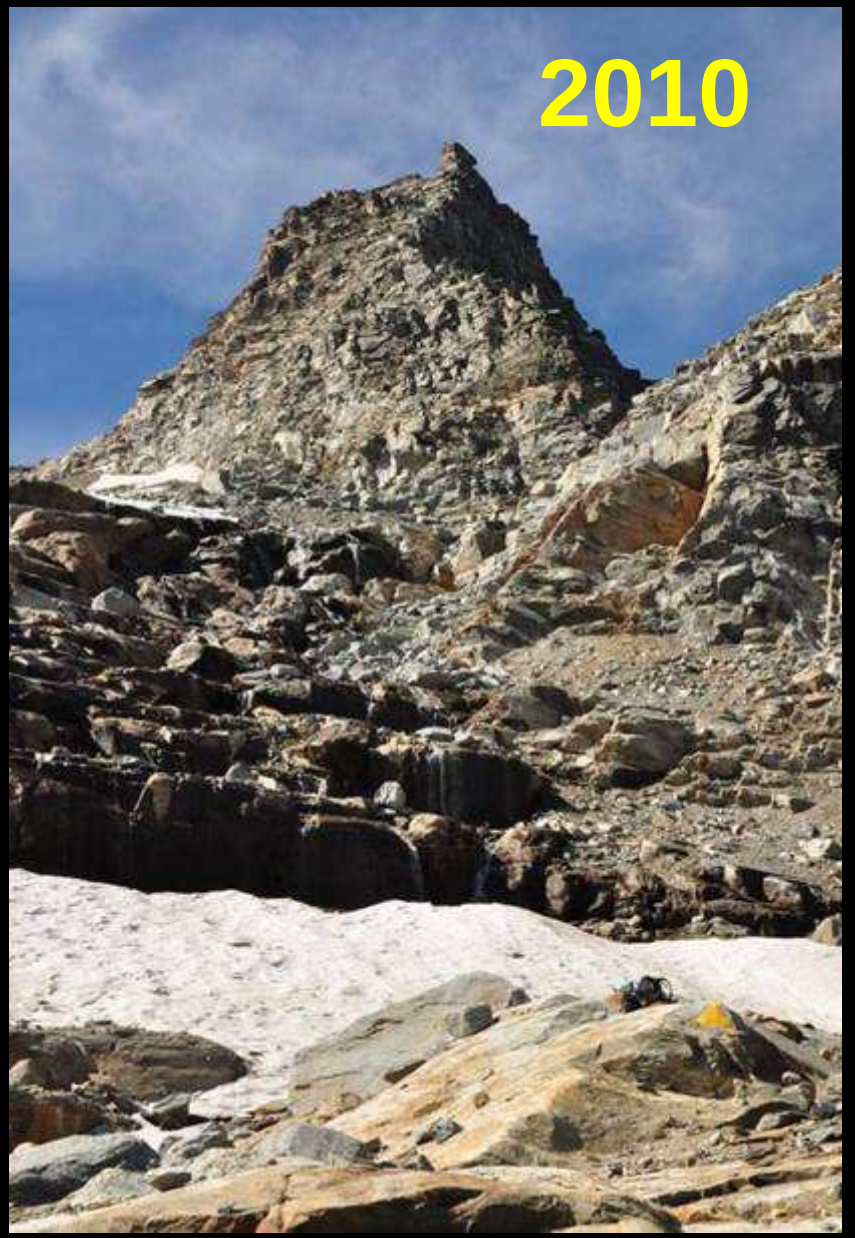
http://droughtmonitor.unl.edu/

USDA National Drought Mitigation Center

Released Thursday, September 20, 2012

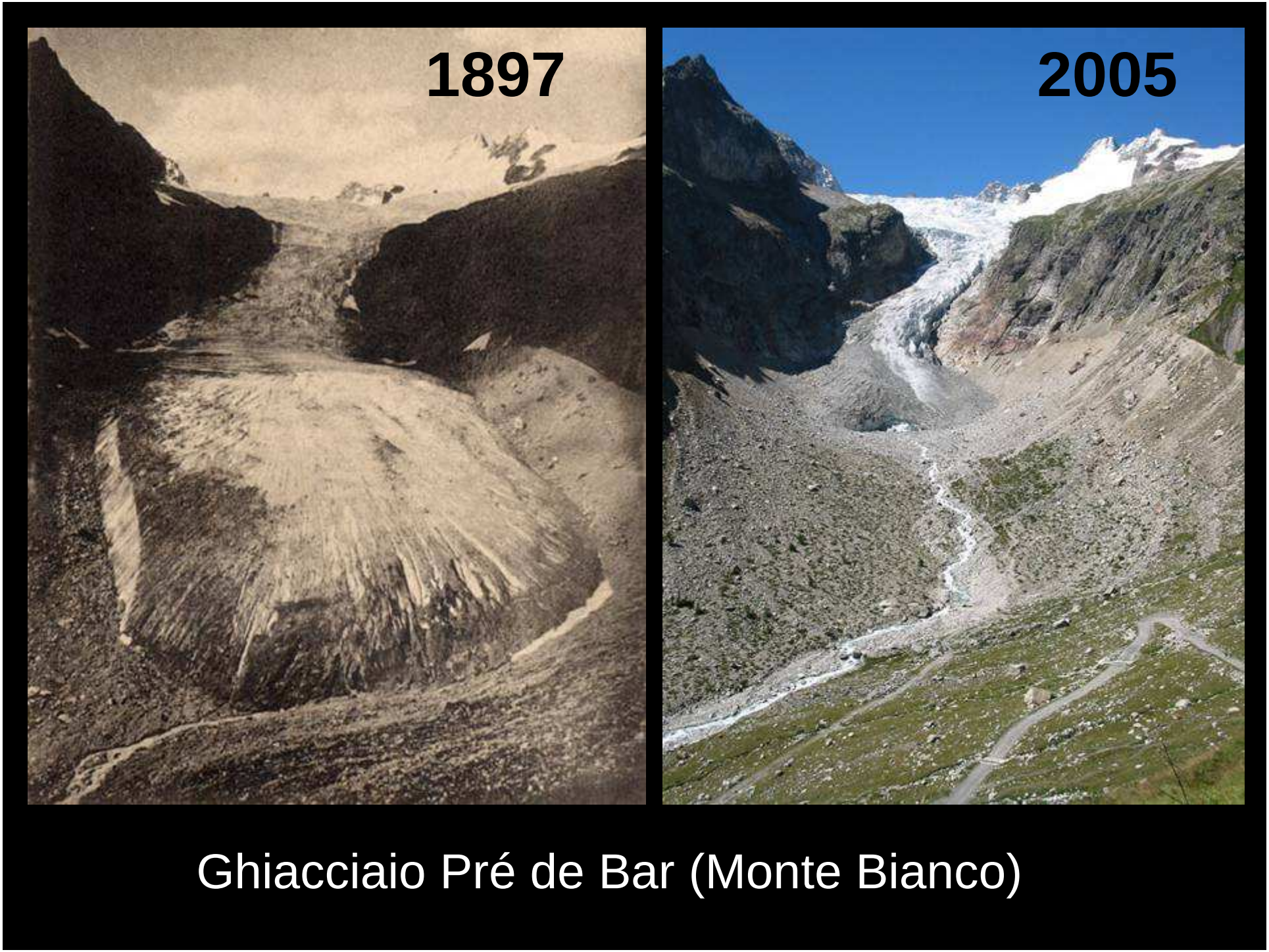
Author: David Simeral, Western Regional Climate Center


Torino, quantità stagionale di neve fresca (anno idrologico)
dal 1787-88 al 2012-13
cm
180
160
140
120
100
80
60
40
20
0
media 1787-1989: 50 cm
media
1990-2013
20 cm
1787
1795
1803
1811
1819
1827
1835
1843
1851
1859
1867
1875
1883
1891
1899
1907
1915
1923
1931
1939
1947
1955
1963
1971
1979
1987
1995
2003
2011



Il riscaldamento globale è tra noi…

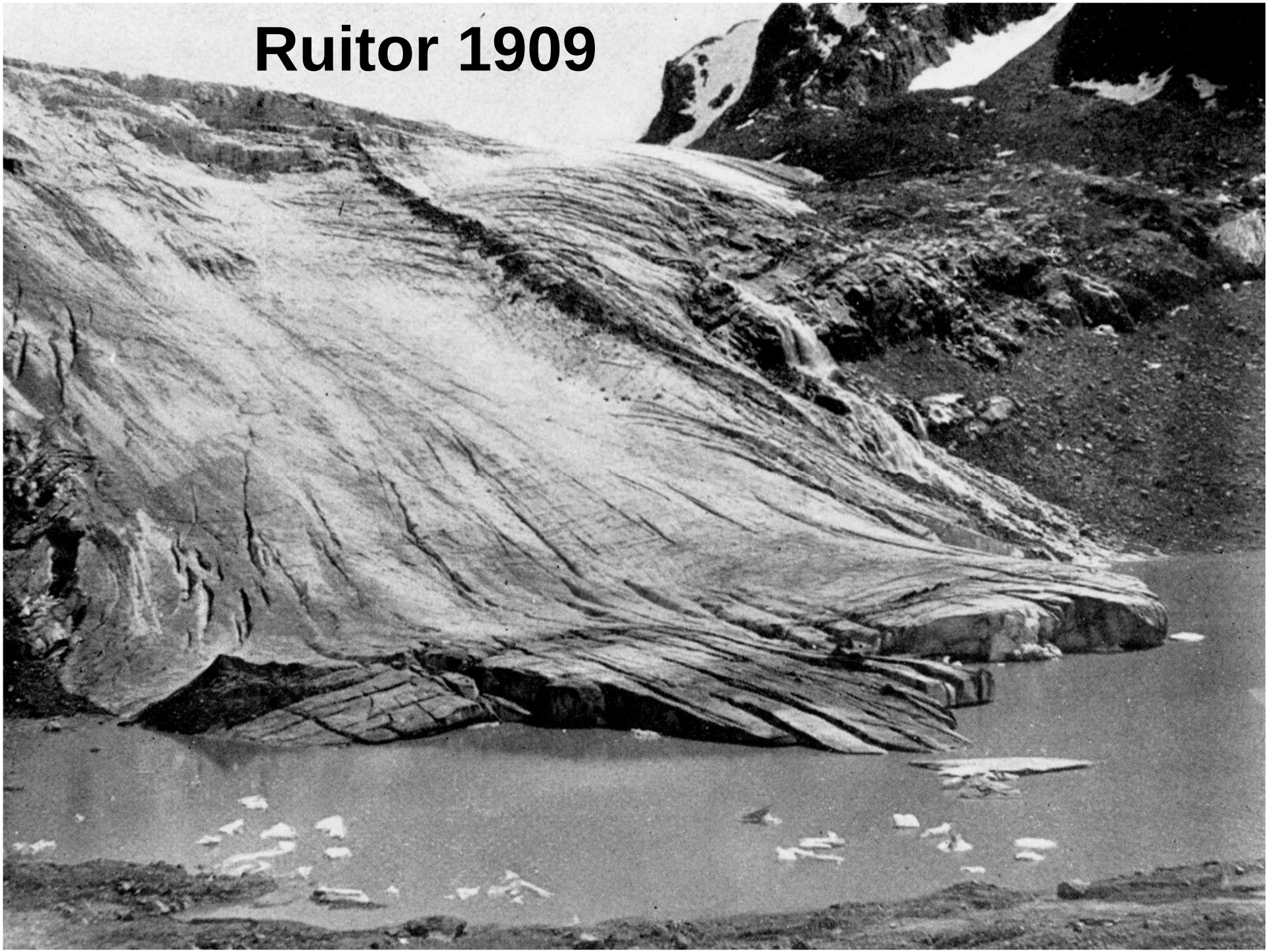
Ghiacciaio occidentale del Carro (Gran Paradiso)



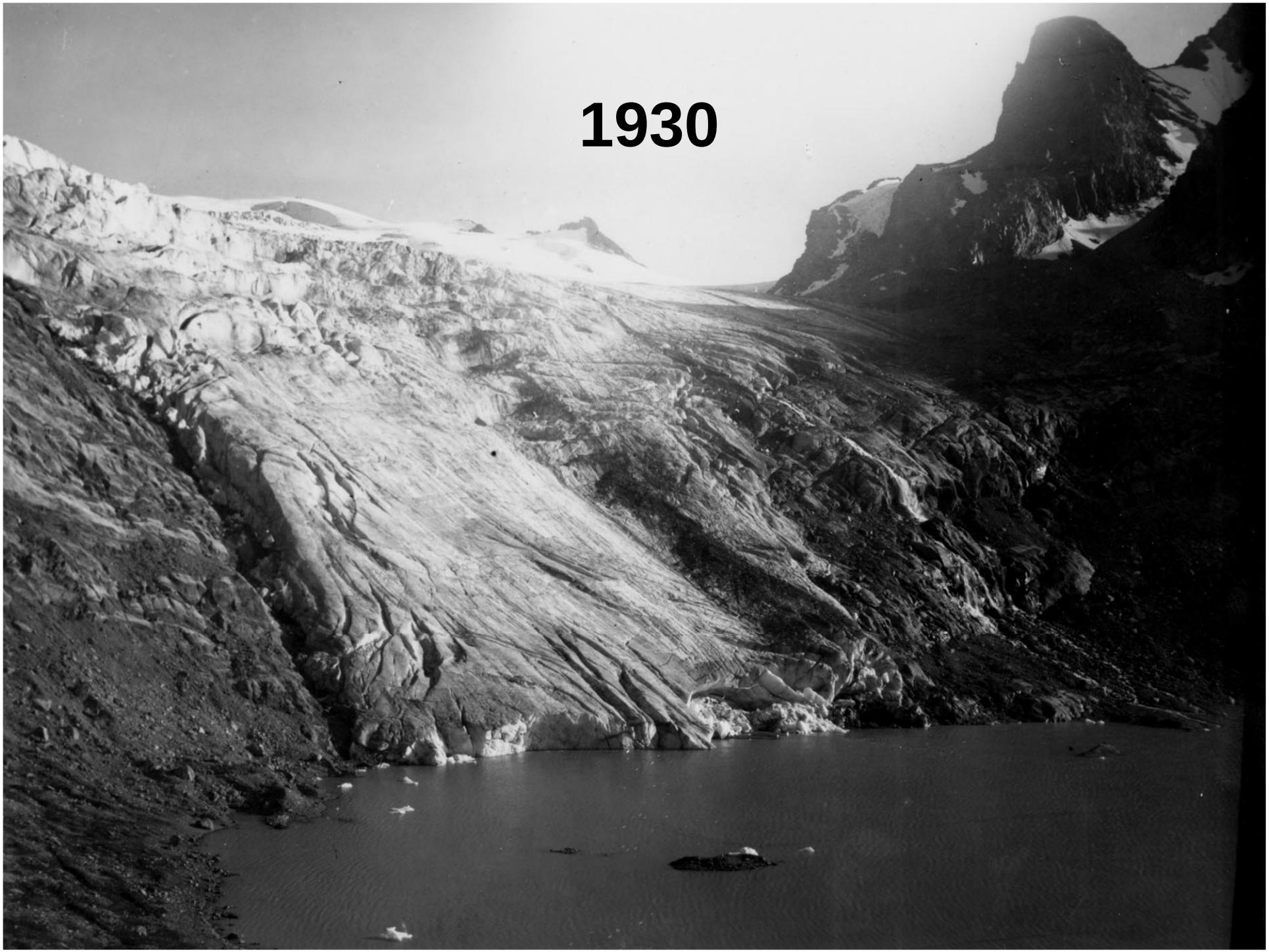
Ghiacciaio Pré de Bar (Monte Bianco)


2005

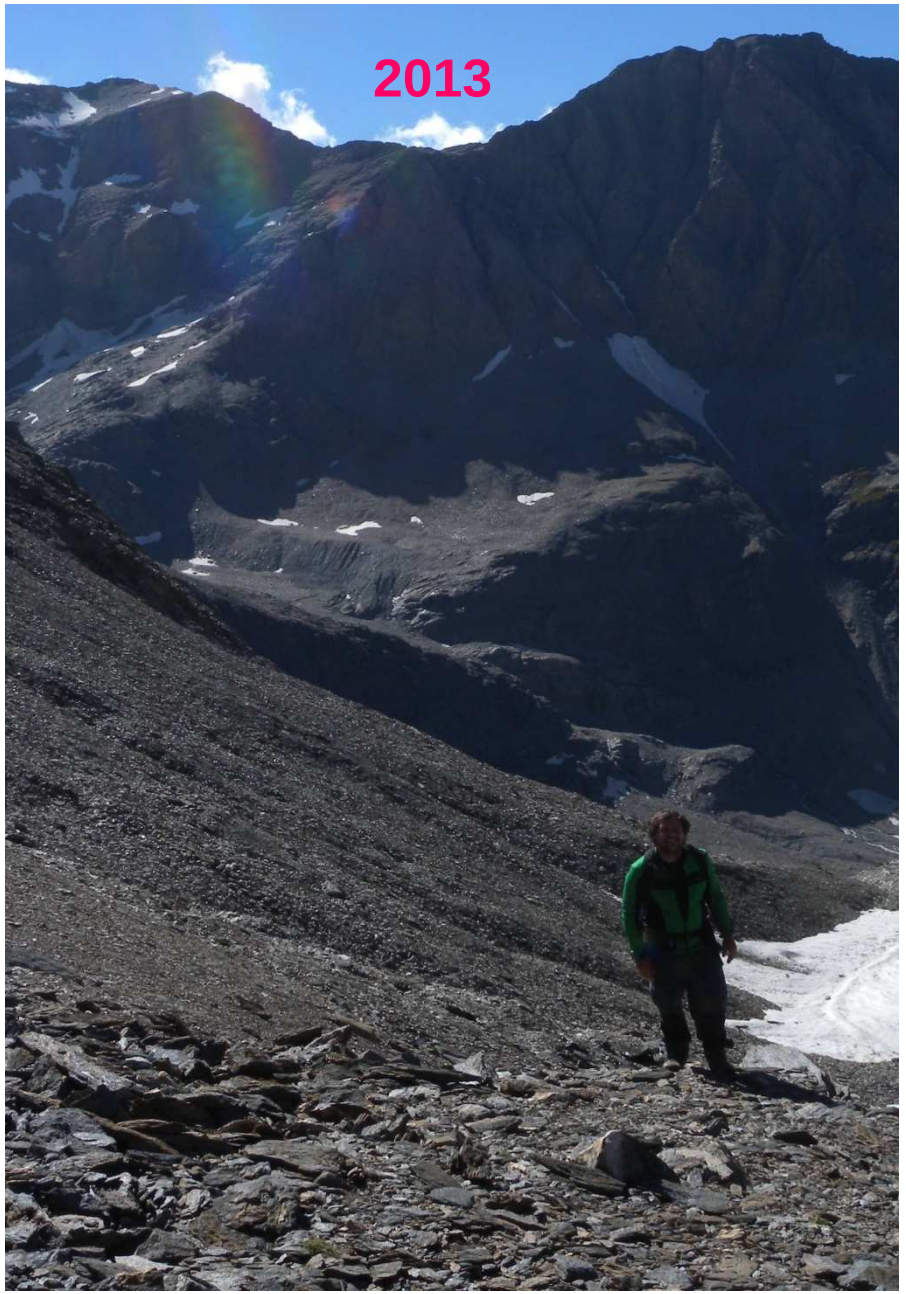

2012


Ruitor 1909

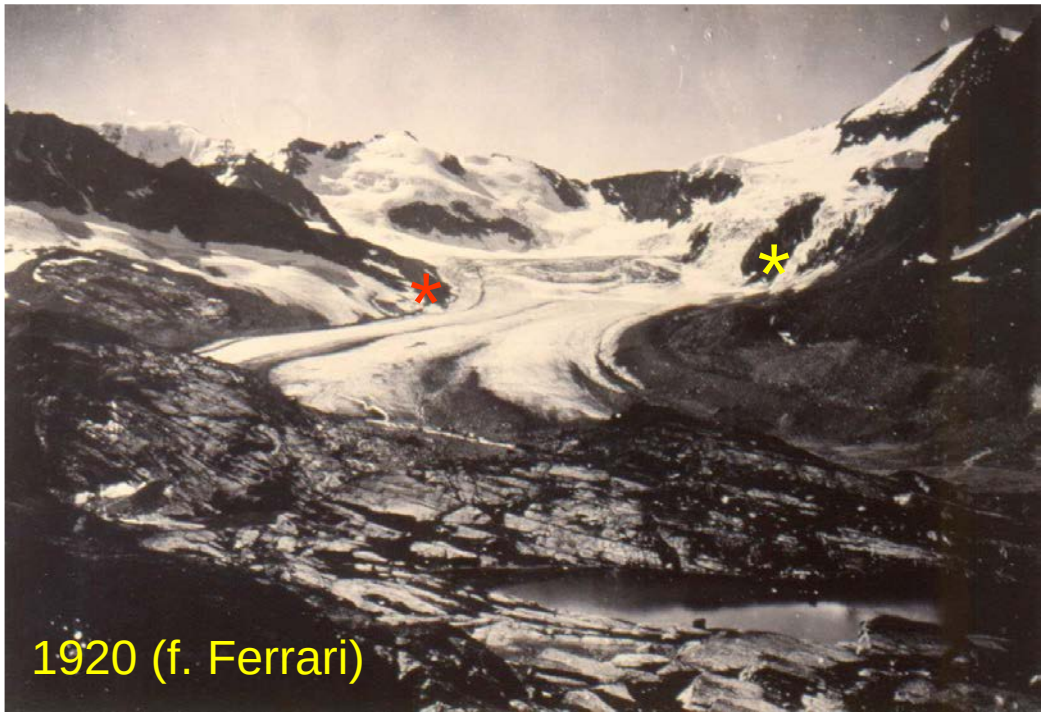

2012

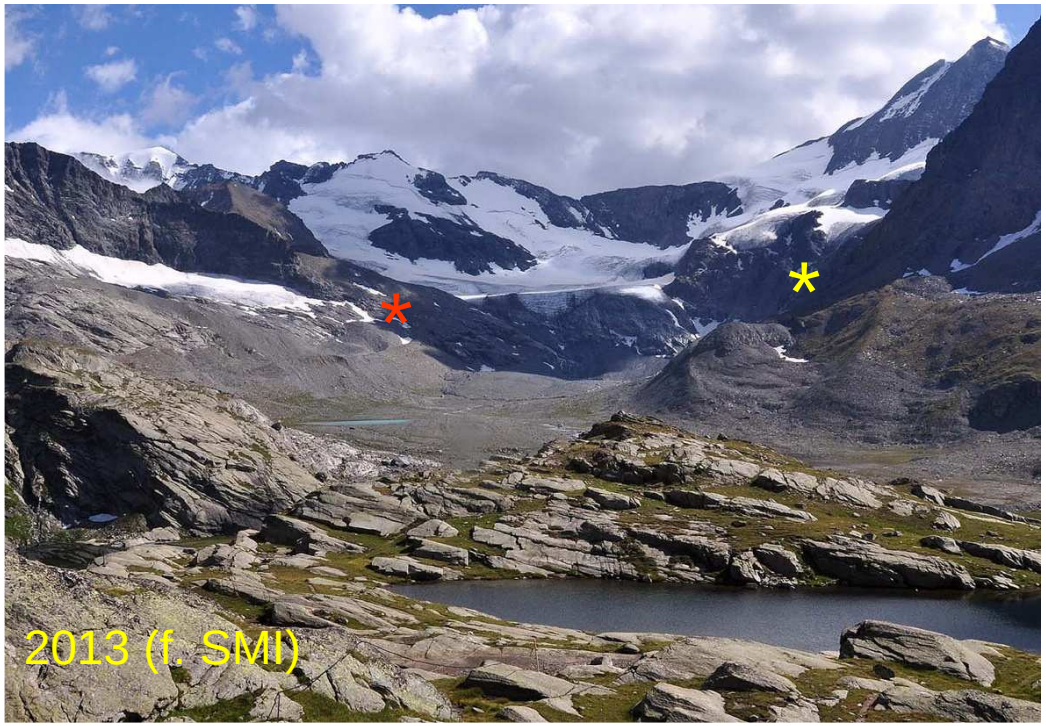

1930


2012



Glacier Derrière la Clapiére – 12 agosto 1985 e 3 settembre 2013





Glacier des Evettes

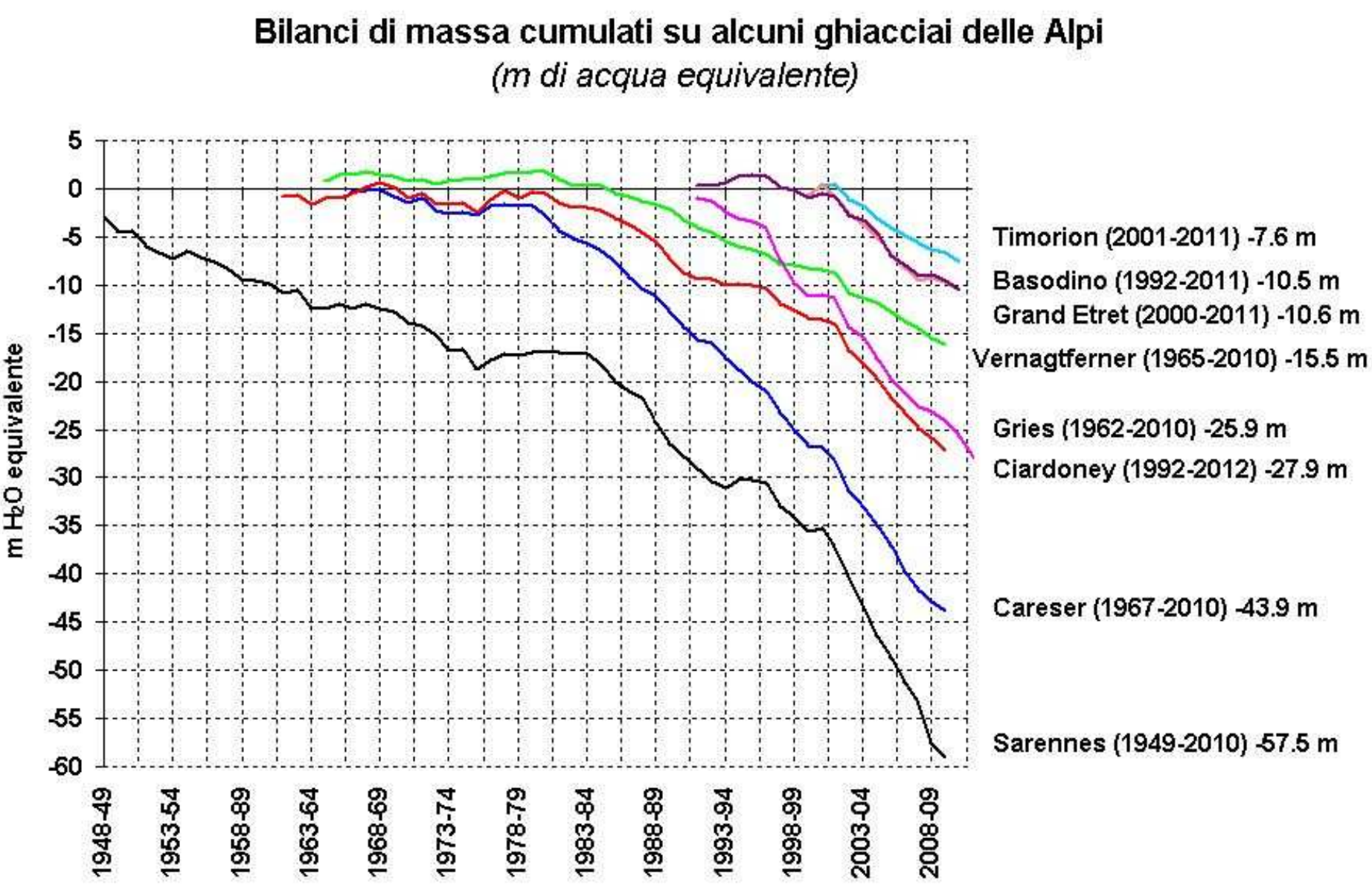
(Haute Maurienne, F)

Aree ghiacciai alpini francesi
(fonte: progetto Glariskalp):

Max PEG (1820-50): 544 km^2

2006-2009: 275 km^2

Variazione: -50%



Ingenti perdite di massa glaciale in tutte le Alpi

The Cryosphere, 6, 713–727, 2012
www.the-cryosphere.net/6/713/2012/
doi:10.5194/tc-6-713-2012

The Cryosphere

Extrapolating glacier mass balance to the mountain-range scale: the European Alps 1900–2100

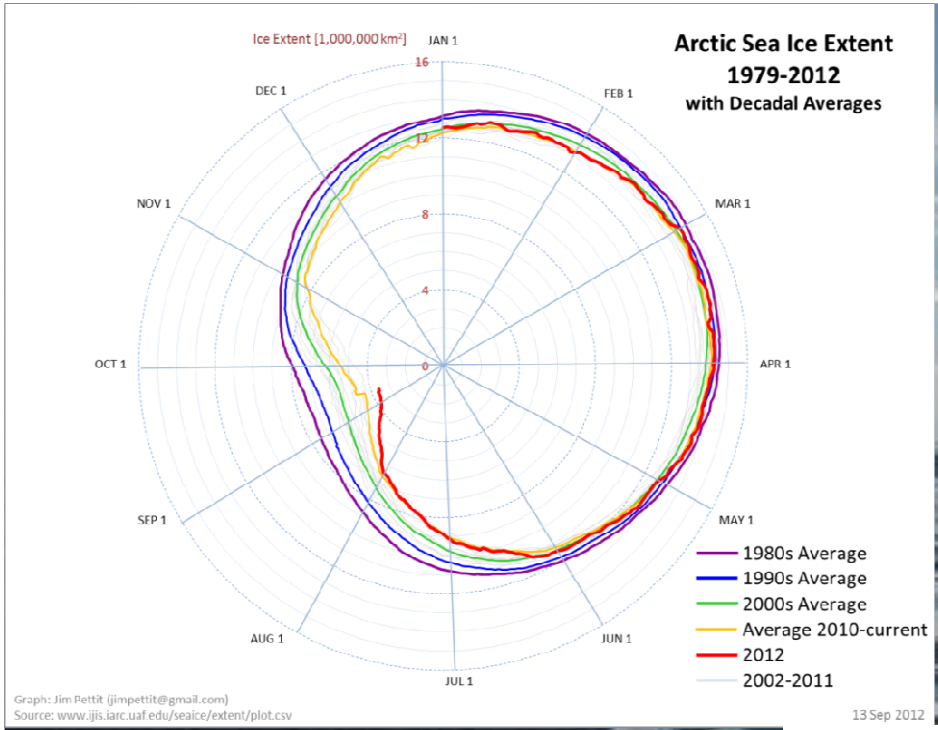
M. Huss[1,*]

[1]Department of Geosciences, University of Fribourg, 1700 Fribourg, Switzerland

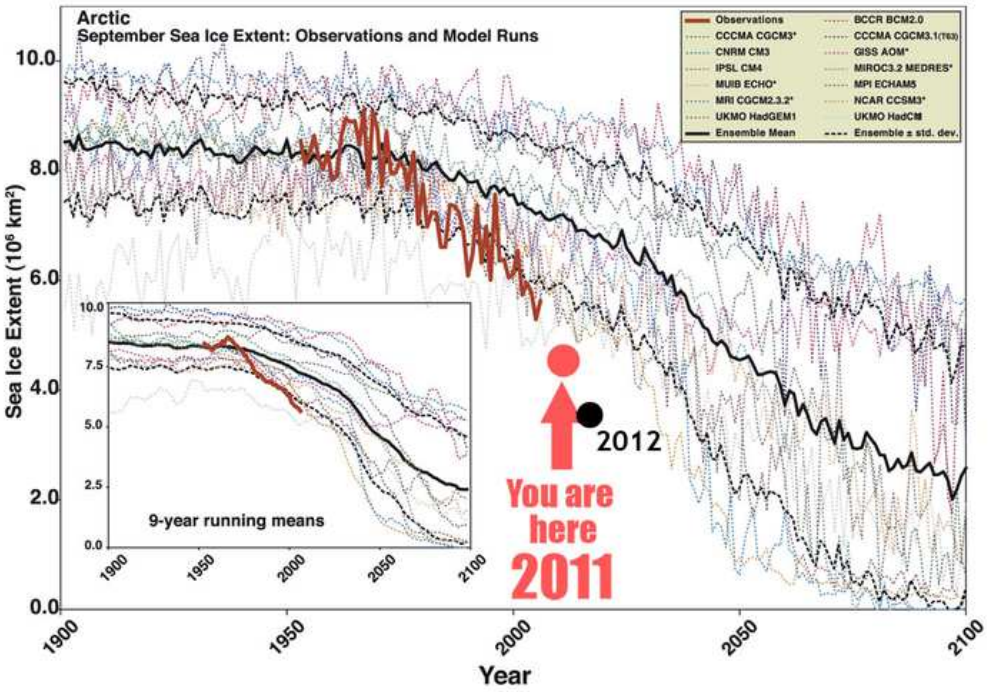
[*]*Invited contribution by M. Huss, recipient of the EGU Young Scientist Outstanding Poster Paper (YSOPP) Award 2010.*

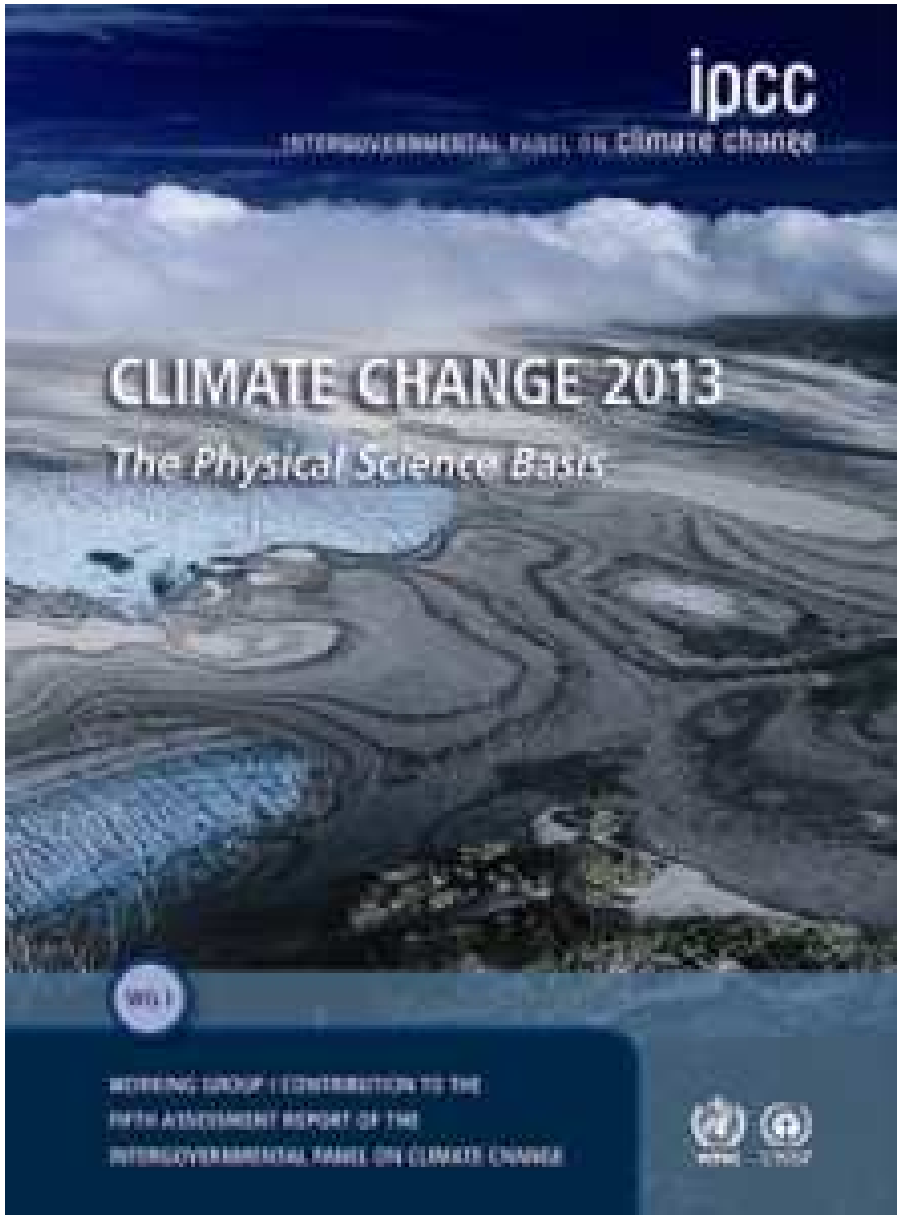
Correspondence to: M. Huss (matthias.huss@unifr.ch)

vary between $-5.9\,km^3$ (1947) and $+3.9\,km^3$ (1977). Mean mass balances are expected to be around $-1.3\,m\,w.e.\,a^{-1}$ by 2050. Model results indicate a glacier area reduction of 4–18 % relative to 2003 for the end of the 21st century.


Ice Extent [1,000,000 km²]
Arctic Sea Ice Extent
1979-2012
with Decadal Averages
JAN 1
FEB 1
MAR 1
APR 1
MAY 1
JUN 1
JUL 1
AUG 1
SEP 1
OCT 1
NOV 1
DEC 1
16
12
8
4
0
1980s Average
1990s Average
2000s Average
Average 2010-current
2012
2002-2011
Graph: Jim Pettit (jimpettit@gmail.com)
Source: www.ijis.iarc.uaf.edu/seaice/extent/plot.csv


13 Sep 2012


Arctic
September Sea Ice Extent: Observations and Model Runs
Observations
CCCMA CGCM3*
CNRM CM3
IPSL CM4
MUIB ECHO*
MRI CGCM2.3.2*
UKMO HadGEM1
Ensemble Mean
BCCR BCM2.0
CCCMA CGCM3.1(T63)
GISS AOM*
MIROC3.2 MEDRES*
MPI ECHAM5
NCAR CCSM3*
UKMO HadCM
Ensemble ± std. dev.
Sea Ice Extent (10⁶ km²)
10.0
8.0
6.0
4.0
2.0
0.0
1900
1950
2000
2050
2100
Year
9-year running means
2012
You are here
2011



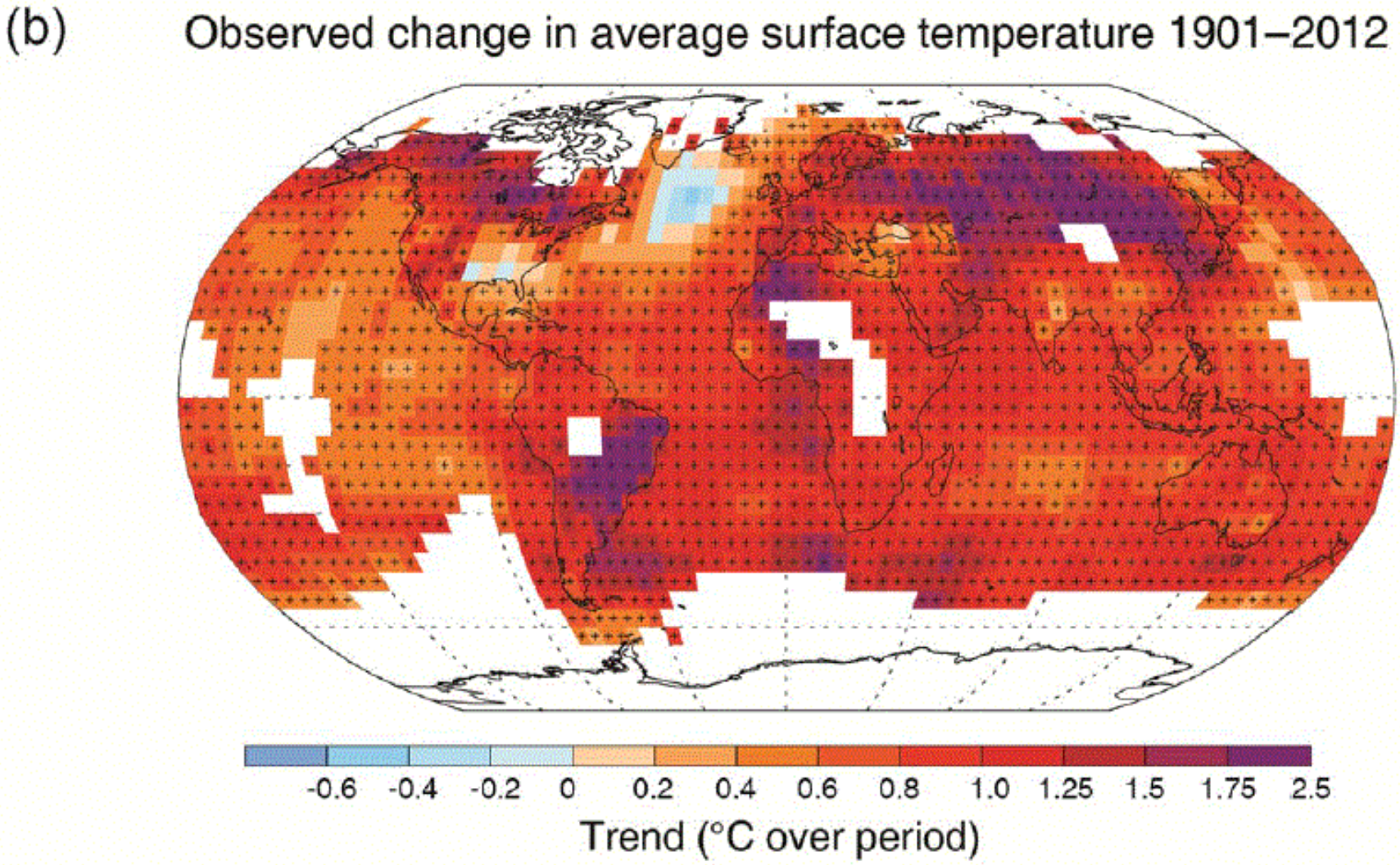
AR5 WG1
2013

ipcc
INTERGOVERNMENTAL PANEL ON
climate change

WMO UNEP

IPCC AR5 – WG1, 2013

0,85 ℃ dal 1880 al 2012



Modeling Earth's future

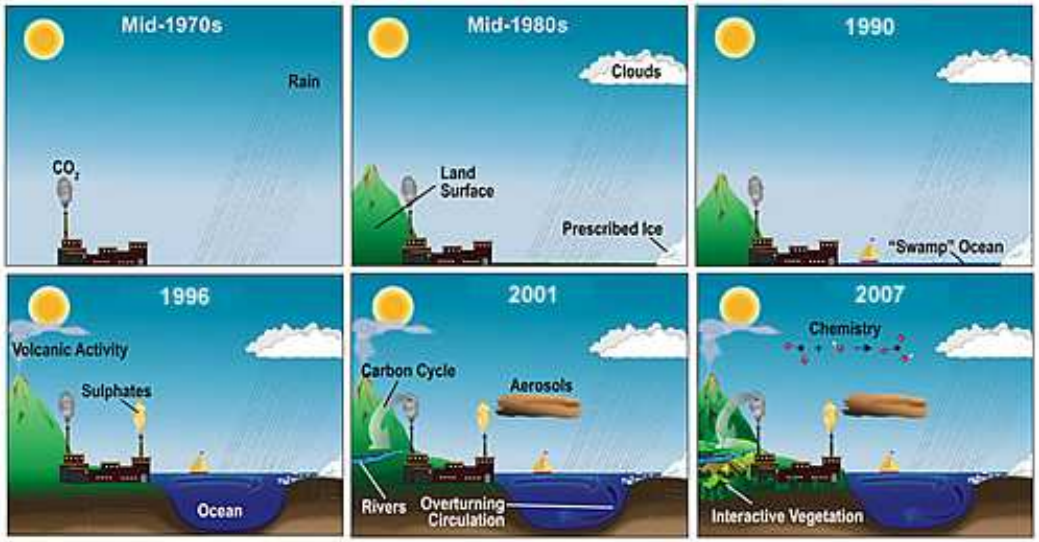
Integrated assessments of linked human-natural systems

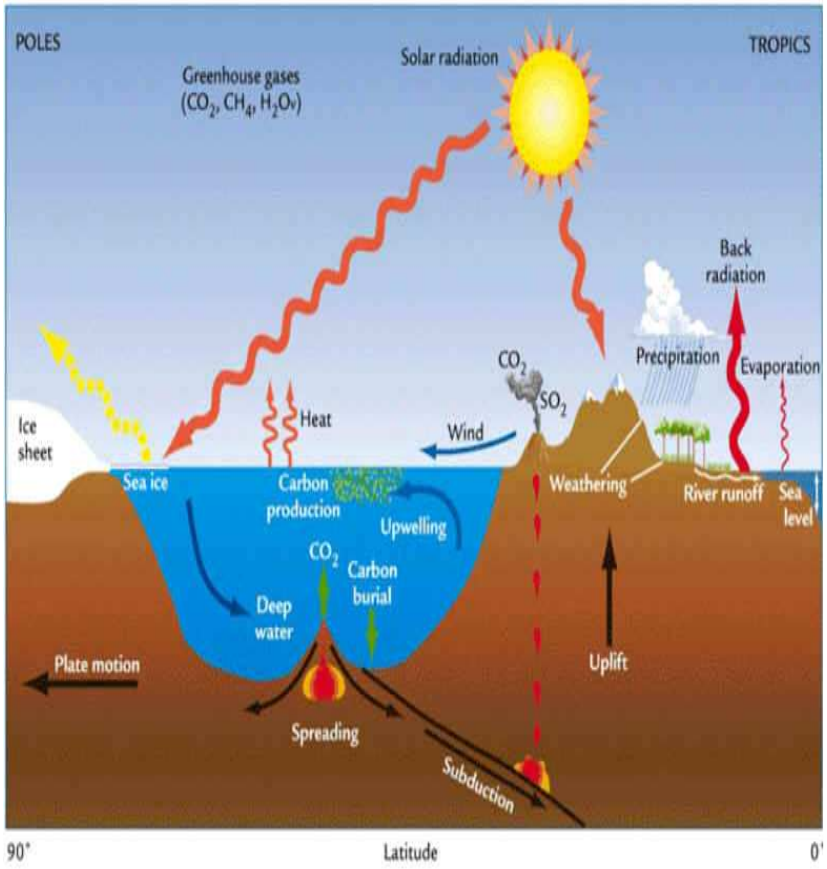
THE ROYAL SOCIETY

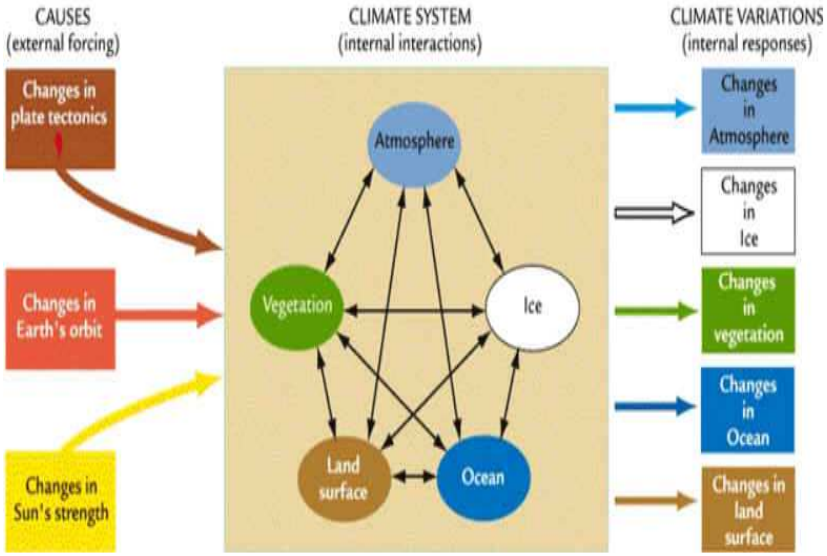
NATIONAL ACADEMY OF SCIENCES
1863–2013
Celebrating 150 Years of Service to the Nation

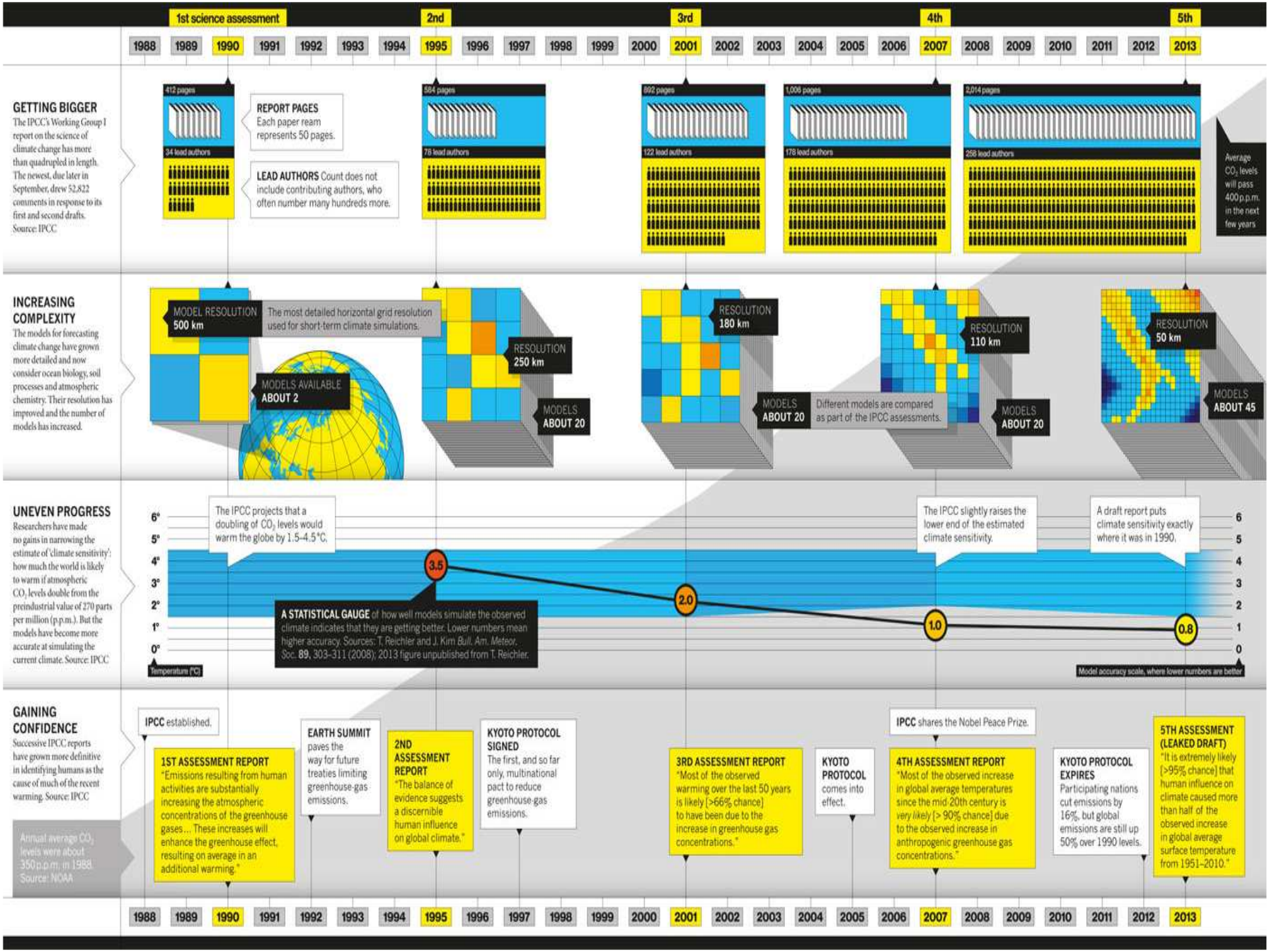
1 petaflop = 10^{15} =

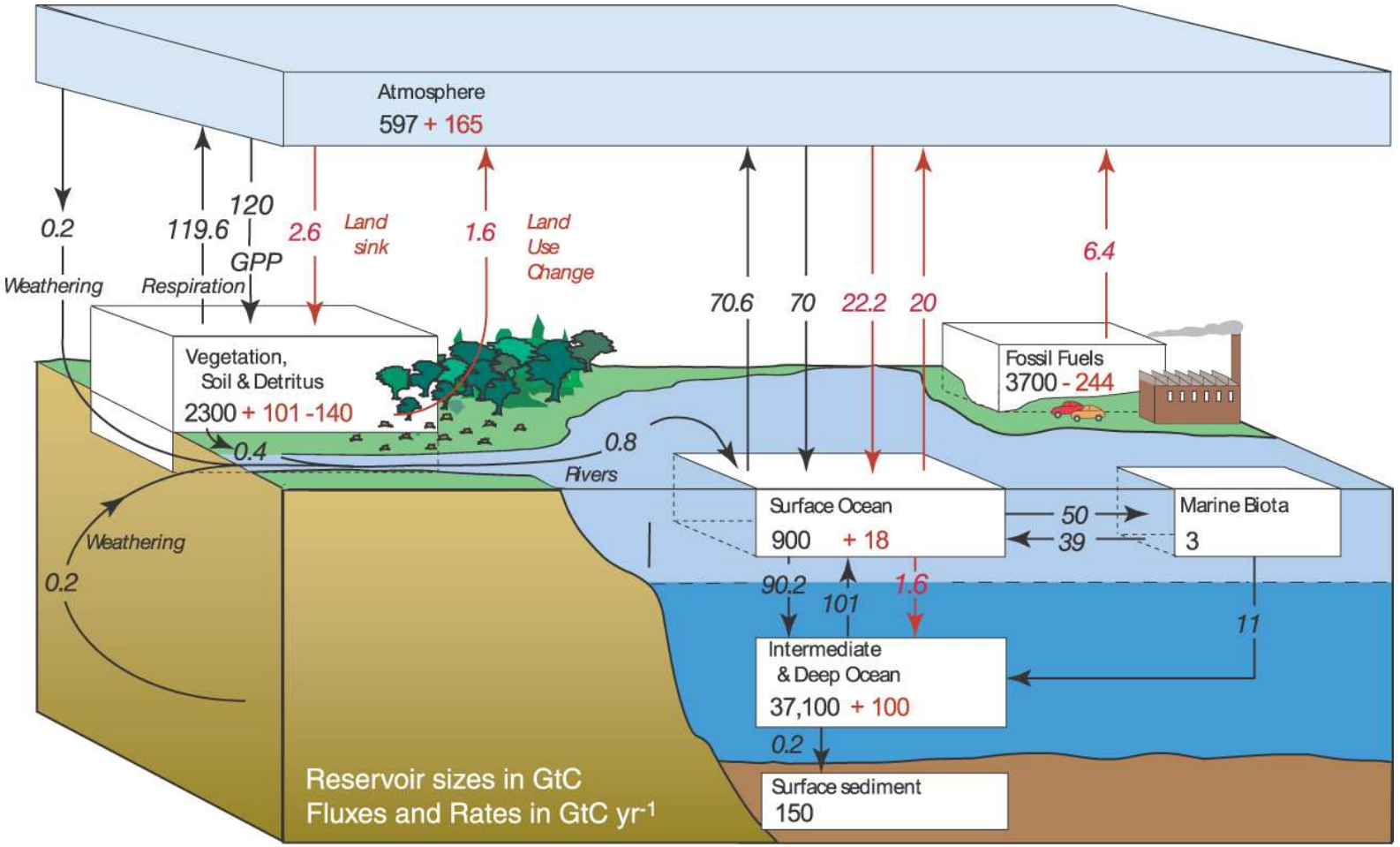
un milione di miliardi di istruzioni/operazioni al secondo

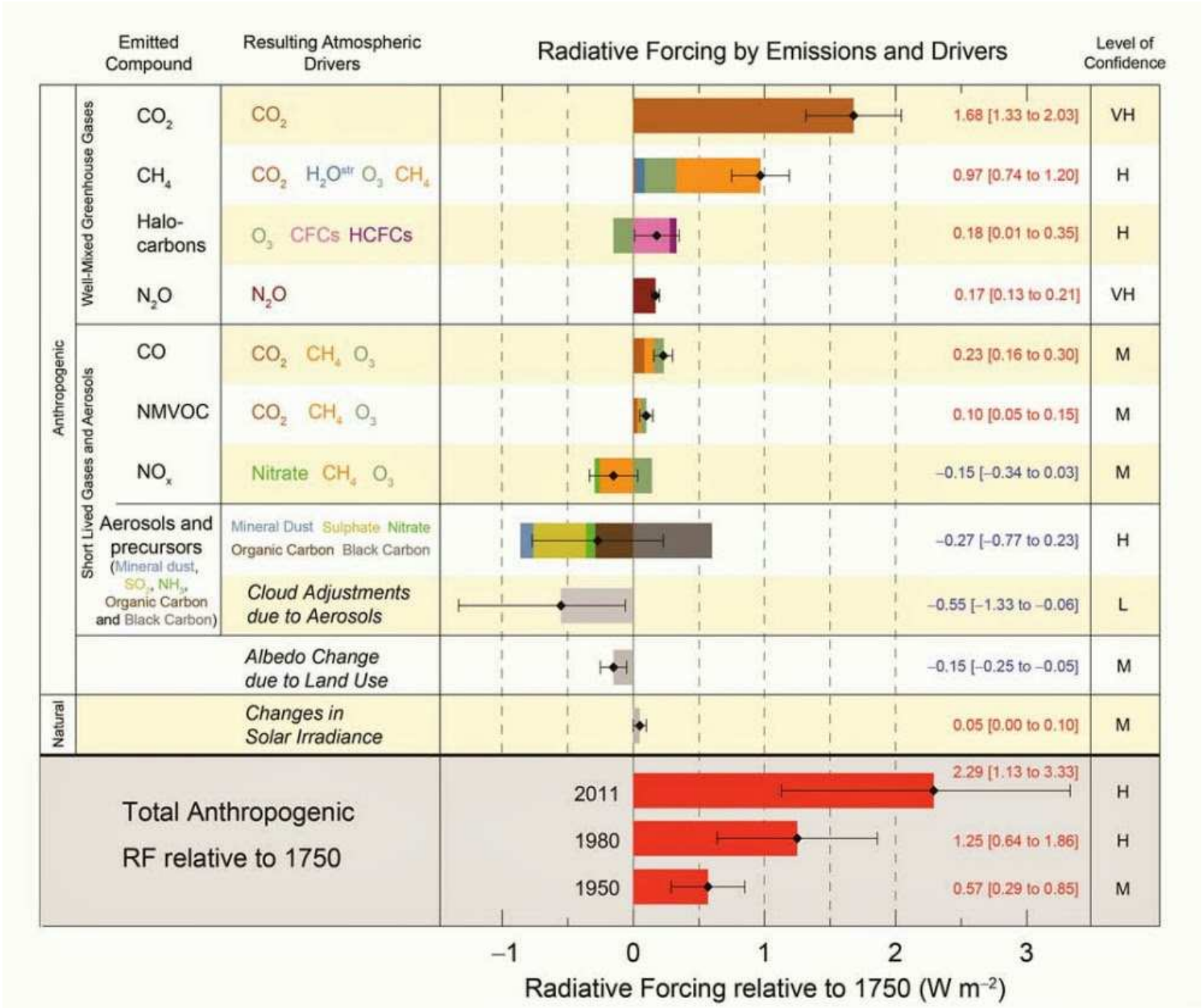

Mid-1970s
Rain
CO_2
Mid-1980s
Clouds
Land Surface
Prescribed Ice
1990
"Swamp" Ocean
1996
Volcanic Activity
Sulphates
Ocean
2001
Carbon Cycle
Aerosols
Rivers
Overturning Circulation
2007
Chemistry
Interactive Vegetation


POLES
TROPICS
Greenhouse gases (CO_2, CH_4, H_2O_v)
Solar radiation
Back radiation
Precipitation
Evaporation
CO_2
SO_2
Heat
Wind
Ice sheet
Sea ice
Carbon production
Upwelling
Weathering
River runoff
Sea level
CO_2
Carbon burial
Deep water
Plate motion
Uplift
Spreading
Subduction
90°
Latitude
0°


CAUSES
(external forcing)
CLIMATE SYSTEM
(internal interactions)
CLIMATE VARIATIONS
(internal responses)
Changes in plate tectonics
Changes in Earth's orbit
Changes in Sun's strength
Atmosphere
Vegetation
Ice
Land surface
Ocean
Changes in Atmosphere
Changes in Ice
Changes in vegetation
Changes in Ocean
Changes in land surface


1st science assessment
2nd
3rd
4th
5th
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
GETTING BIGGER
The IPCC's Working Group I report on the science of climate change has more than quadrupled in length. The newest, due later in September, drew 52,822 comments in response to its first and second drafts. Source: IPCC
412 pages
34 lead authors
REPORT PAGES Each paper ream represents 50 pages.
LEAD AUTHORS Count does not include contributing authors, who often number many hundreds more.
584 pages
78 lead authors
892 pages
122 lead authors
1,006 pages
178 lead authors
2,014 pages
256 lead authors
Average CO_2 levels will pass 400 p.p.m. in the next few years
INCREASING COMPLEXITY
The models for forecasting climate change have grown more detailed and now consider ocean biology, soil processes and atmospheric chemistry. Their resolution has improved and the number of models has increased.
MODEL RESOLUTION 500 km
The most detailed horizontal grid resolution used for short-term climate simulations.
MODELS AVAILABLE ABOUT 2
RESOLUTION 250 km
MODELS ABOUT 20
RESOLUTION 180 km
MODELS ABOUT 20
Different models are compared as part of the IPCC assessments.
RESOLUTION 110 km
MODELS ABOUT 20
RESOLUTION 50 km
MODELS ABOUT 45
UNEVEN PROGRESS
Researchers have made no gains in narrowing the estimate of 'climate sensitivity': how much the world is likely to warm if atmospheric CO_2 levels double from the preindustrial value of 270 parts per million (p.p.m.). But the models have become more accurate at simulating the current climate. Source: IPCC
The IPCC projects that a doubling of CO_2 levels would warm the globe by 1.5–4.5 °C.
The IPCC slightly raises the lower end of the estimated climate sensitivity.
A draft report puts climate sensitivity exactly where it was in 1990.
6° 5° 4° 3° 2° 1° 0°
3.5
2.0
1.0
0.8
A STATISTICAL GAUGE of how well models simulate the observed climate indicates that they are getting better. Lower numbers mean higher accuracy. Sources: T. Reichler and J. Kim *Bull. Am. Meteor. Soc.* **89**, 303–311 (2008); 2013 figure unpublished from T. Reichler.
Temperature (°C)
Model accuracy scale, where lower numbers are better
GAINING CONFIDENCE
Successive IPCC reports have grown more definitive in identifying humans as the cause of much of the recent warming. Source: IPCC
Annual average CO_2 levels were about 350 p.p.m. in 1988. Source: NOAA
IPCC established.
1ST ASSESSMENT REPORT "Emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases... These increases will enhance the greenhouse effect, resulting on average in an additional warming."
EARTH SUMMIT paves the way for future treaties limiting greenhouse-gas emissions.
2ND ASSESSMENT REPORT "The balance of evidence suggests a discernible human influence on global climate."
KYOTO PROTOCOL SIGNED The first, and so far only, multinational pact to reduce greenhouse-gas emissions.
3RD ASSESSMENT REPORT "Most of the observed warming over the last 50 years is likely [>66% chance] to have been due to the increase in greenhouse gas concentrations."
KYOTO PROTOCOL comes into effect.
IPCC shares the Nobel Peace Prize.
4TH ASSESSMENT REPORT "Most of the observed increase in global average temperatures since the mid-20th century is *very likely* [> 90% chance] due to the observed increase in anthropogenic greenhouse gas concentrations."
KYOTO PROTOCOL EXPIRES Participating nations cut emissions by 16%, but global emissions are still up 50% over 1990 levels.
5TH ASSESSMENT (LEAKED DRAFT) "It is extremely likely [>95% chance] that human influence on climate caused more than half of the observed increase in global average surface temperature from 1951–2010."


Atmosphere
597 + 165
0.2
Weathering
119.6
120
GPP
Respiration
2.6
Land
sink
1.6
Land
Use
Change
70.6
70
22.2
20
6.4
Vegetation,
Soil & Detritus
2300 + 101 -140
Fossil Fuels
3700 - 244
0.4
0.8
Rivers
Surface Ocean
900 + 18
50
39
Marine Biota
3
Weathering
0.2
90.2
101
1.6
11
Intermediate
& Deep Ocean
37,100 + 100
0.2
Surface sediment
150
Reservoir sizes in GtC
Fluxes and Rates in GtC yr-1


Emitted Compound
Resulting Atmospheric Drivers
Radiative Forcing by Emissions and Drivers
Level of Confidence
Anthropogenic
Well-Mixed Greenhouse Gases
Short Lived Gases and Aerosols
Natural
CO2
CH4
Halo-carbons
N2O
CO
NMVOC
NOx
Aerosols and precursors (Mineral dust, SO2, NH3, Organic Carbon and Black Carbon)
Mineral Dust Sulphate Nitrate Organic Carbon Black Carbon
Cloud Adjustments due to Aerosols
Albedo Change due to Land Use
Changes in Solar Irradiance
CO2
CO2 H2Ostr O3 CH4
O3 CFCs HCFCs
N2O
CO2 CH4 O3
CO2 CH4 O3
Nitrate CH4 O3
1.68 [1.33 to 2.03]
0.97 [0.74 to 1.20]
0.18 [0.01 to 0.35]
0.17 [0.13 to 0.21]
0.23 [0.16 to 0.30]
0.10 [0.05 to 0.15]
−0.15 [−0.34 to 0.03]
−0.27 [−0.77 to 0.23]
−0.55 [−1.33 to −0.06]
−0.15 [−0.25 to −0.05]
0.05 [0.00 to 0.10]
VH
H
H
VH
M
M
M
H
L
M
M
Total Anthropogenic RF relative to 1750
2011
1980
1950
2.29 [1.13 to 3.33]
1.25 [0.64 to 1.86]
0.57 [0.29 to 0.85]
H
H
M
−1
0
1
2
3
Radiative Forcing relative to 1750 (W m−2)

+2.2 W/m²

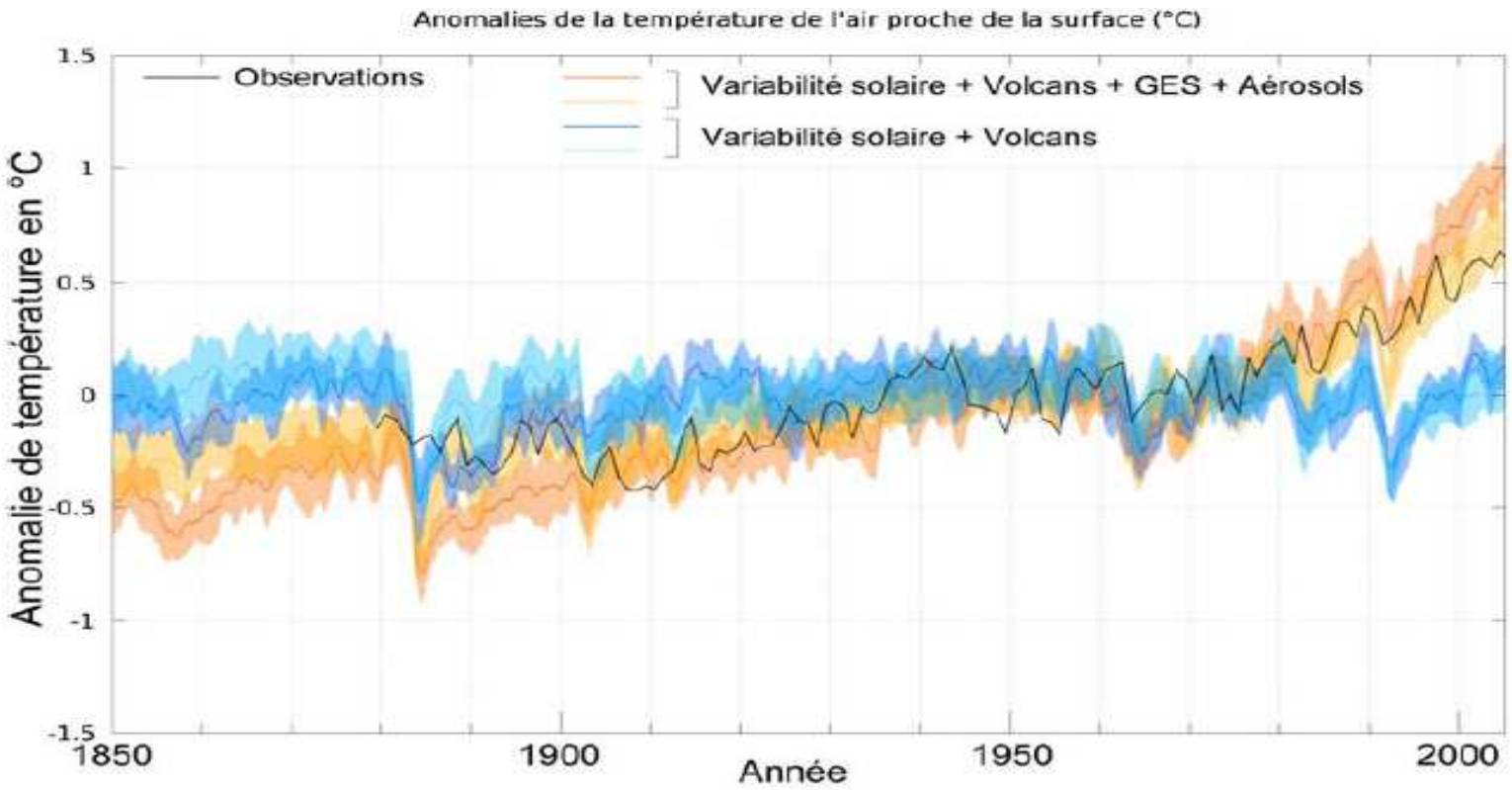
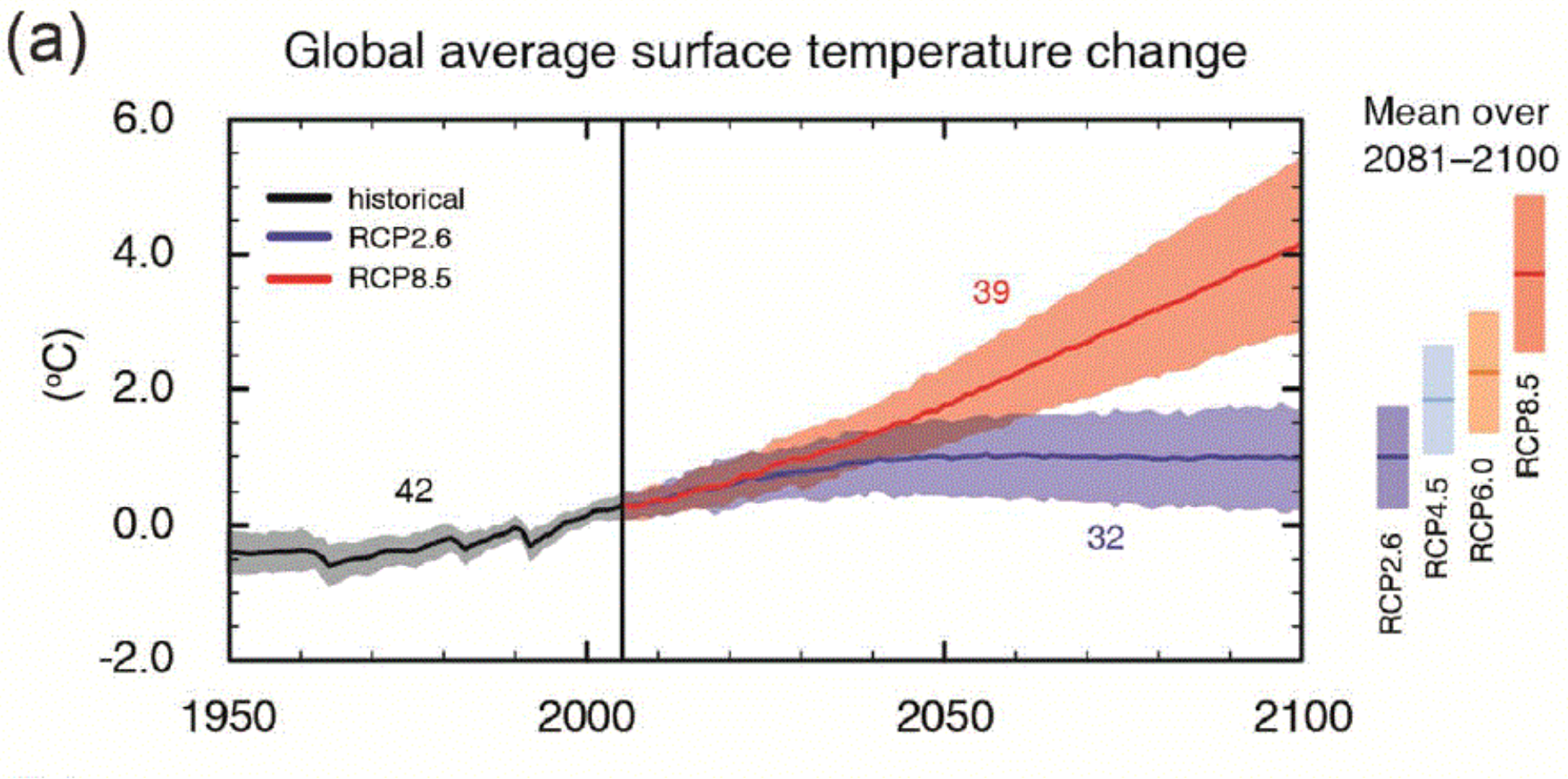


Figure 4.1 : Evolution de la température moyenne à la surface de la Terre mesurée (courbe noire) et calculée par les modèles du CNRM-CERFACS (traits pointillés) et de l'IPSL (traits pleins). Les courbes bleues ne tiennent compte que des forçages naturels (variabilité solaire et volcans) tandis que les courbes en orange tiennent compte des forçages naturels et des forçages anthropiques (gaz à effet de serre et aérosols). Pour chacune des courbes, les résultats ont été obtenus à partir d'une dizaine de simulations dont la moyenne correspond à la courbe et la variation autour de cette moyenne correspond à l'enveloppe colorée. Les différences sont calculées par rapport à la période 1901-2000 qui sert de période de référence et donc de passage par 0 pour les différentes courbes.



RCP = Representative Concentrations Pathways, W/m^2

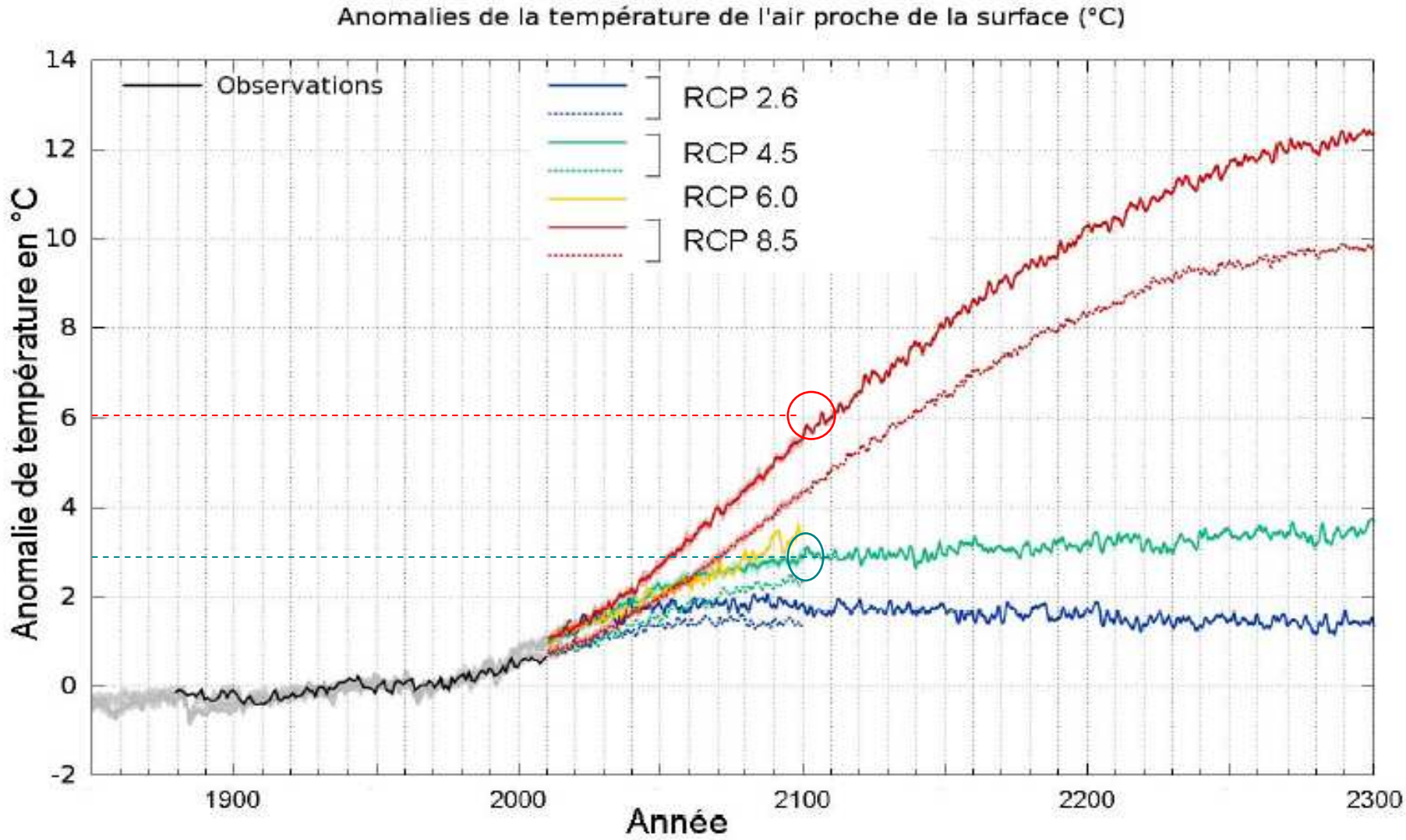
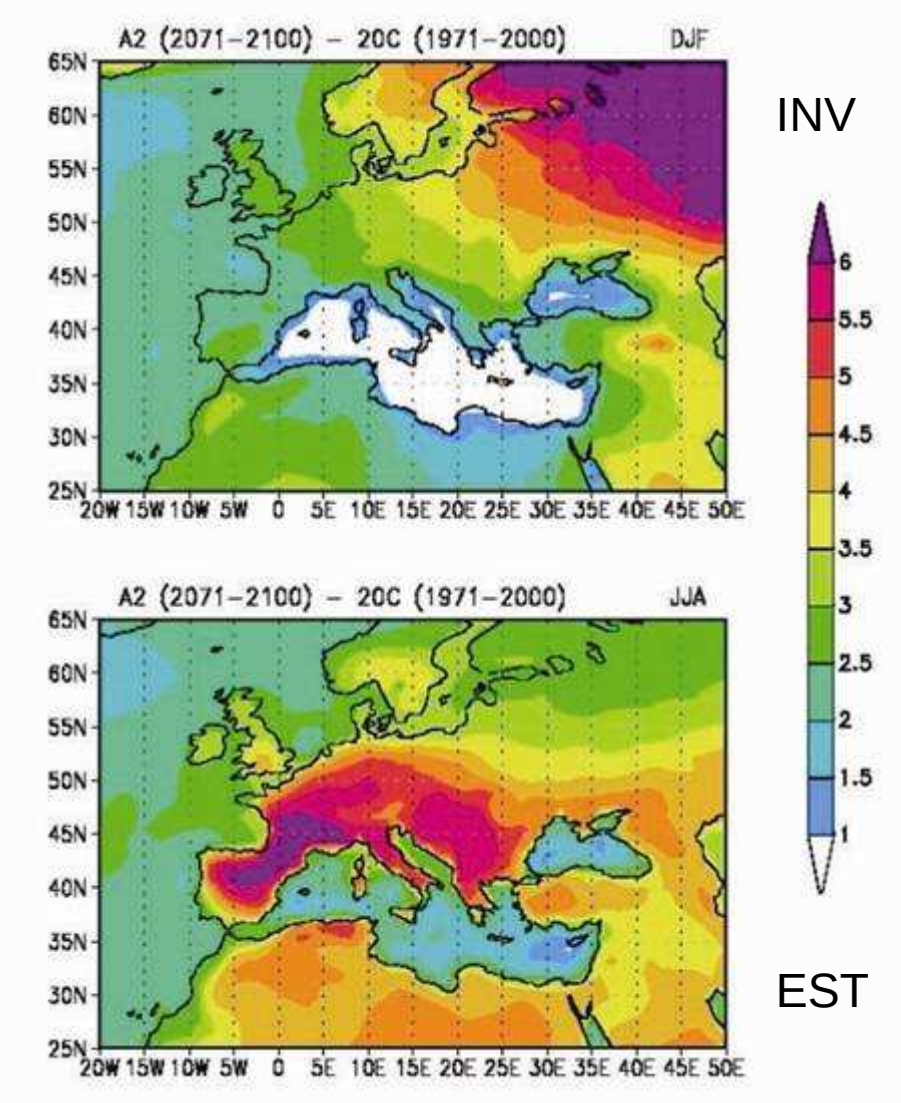


Figure 4.2 : Evolution, de 1850 à 2300, de la température moyenne (°C) à la surface de la Terre par rapport à la moyenne des années 1901-2000 mesurée (courbe noire) et calculée par les modèles du CNRM-CERFACS (traits pointillés) et de l'IPSL (traits pleins) et pour les différents scénarios RCP : RCP2.6 (le plus optimiste), RCP4.5, RCP6.0 et RCP8.5 (le plus sévère).

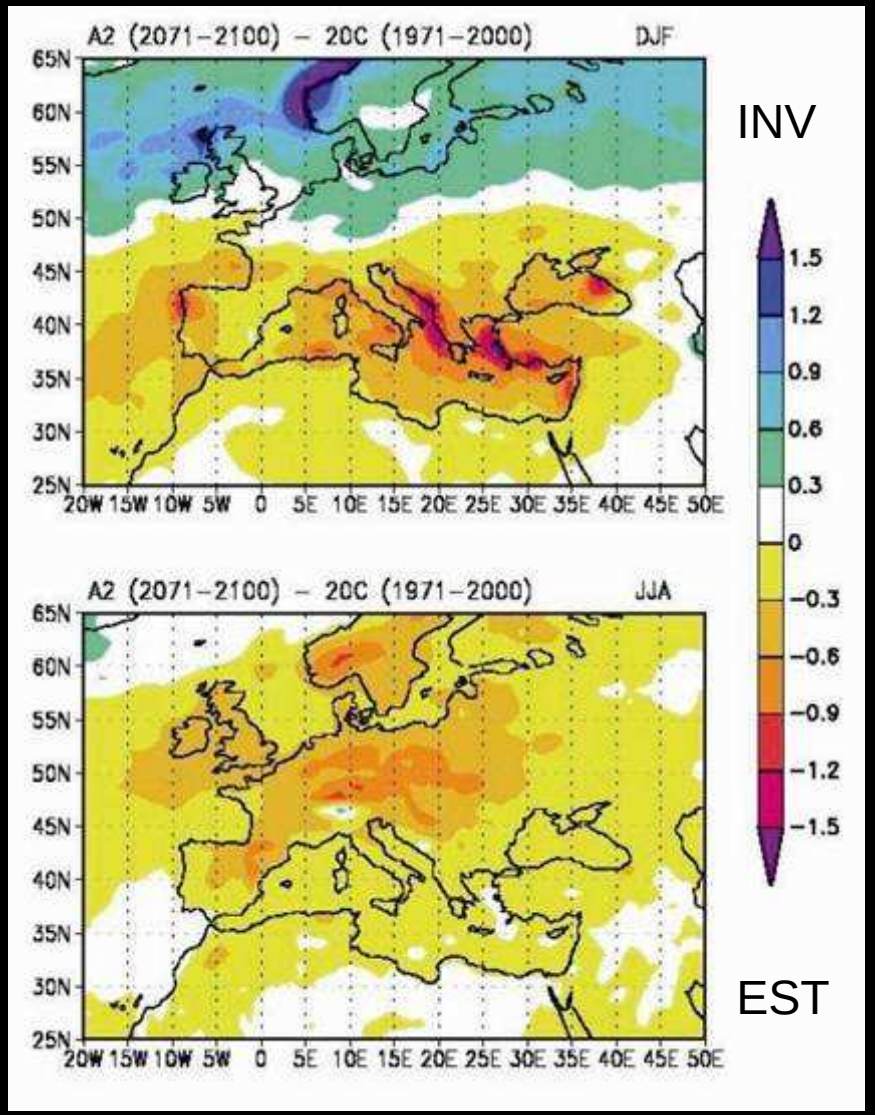
© Patrick Brockmann (LSCE/IPSL, CEA/CNRS/UVSQ)

Uno “zoom” sull’Europa

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



Temperature (℃)



Precipitazioni (mm/giorno)


GLOBAL
WARMING

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

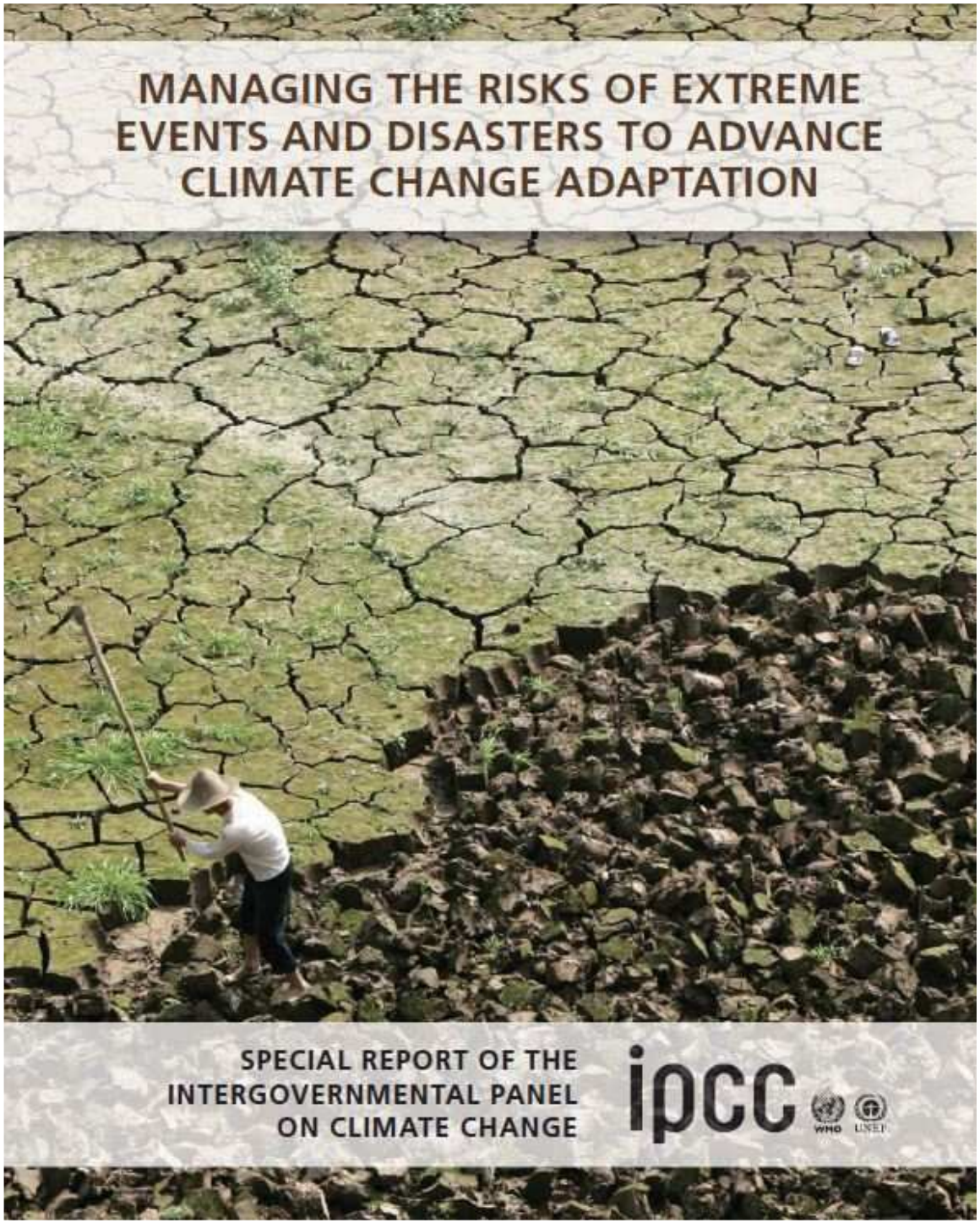
27 settembre 1992: 429 mm
8 ottobre 1970: 389 mm (ma 948 a Bolzaneto, record italiano!)

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

25 ottobre 2011, alluvione Spezzino e Lunigiana (542 mm a Brugnato, Val di Vara)

Precipitazioni straordinarie su zone poco abitate, ma interferenze drammatiche con infrastrutture in zone inondabili (F. Magra ad Aulla) e con la “tombatura” dei corsi d’acqua (T. Vernazzola a Vernazza)

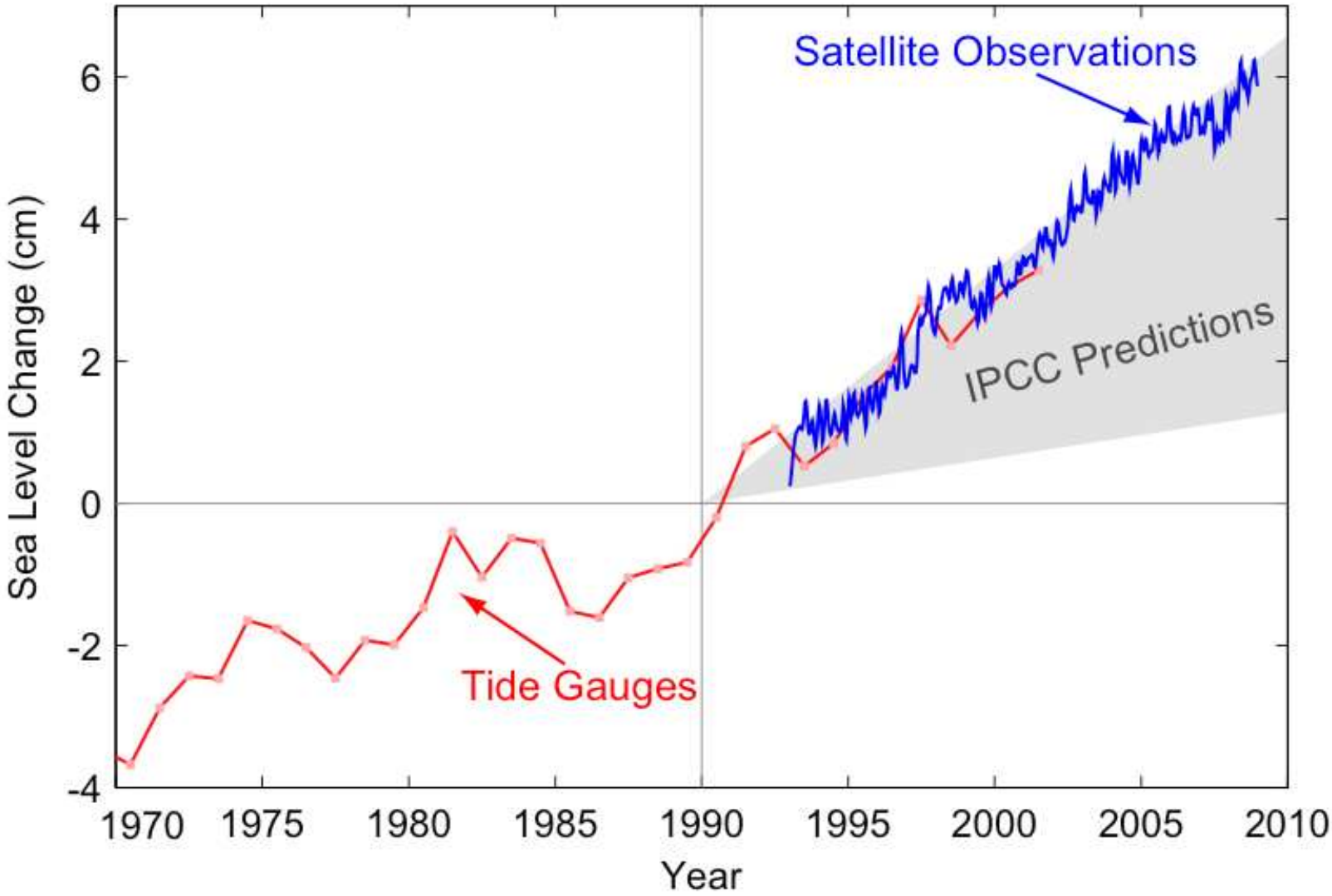
Alluvionamento poco a monte di Vernazza, depositi di detrito fino a 7 m (f. G. Staiano)



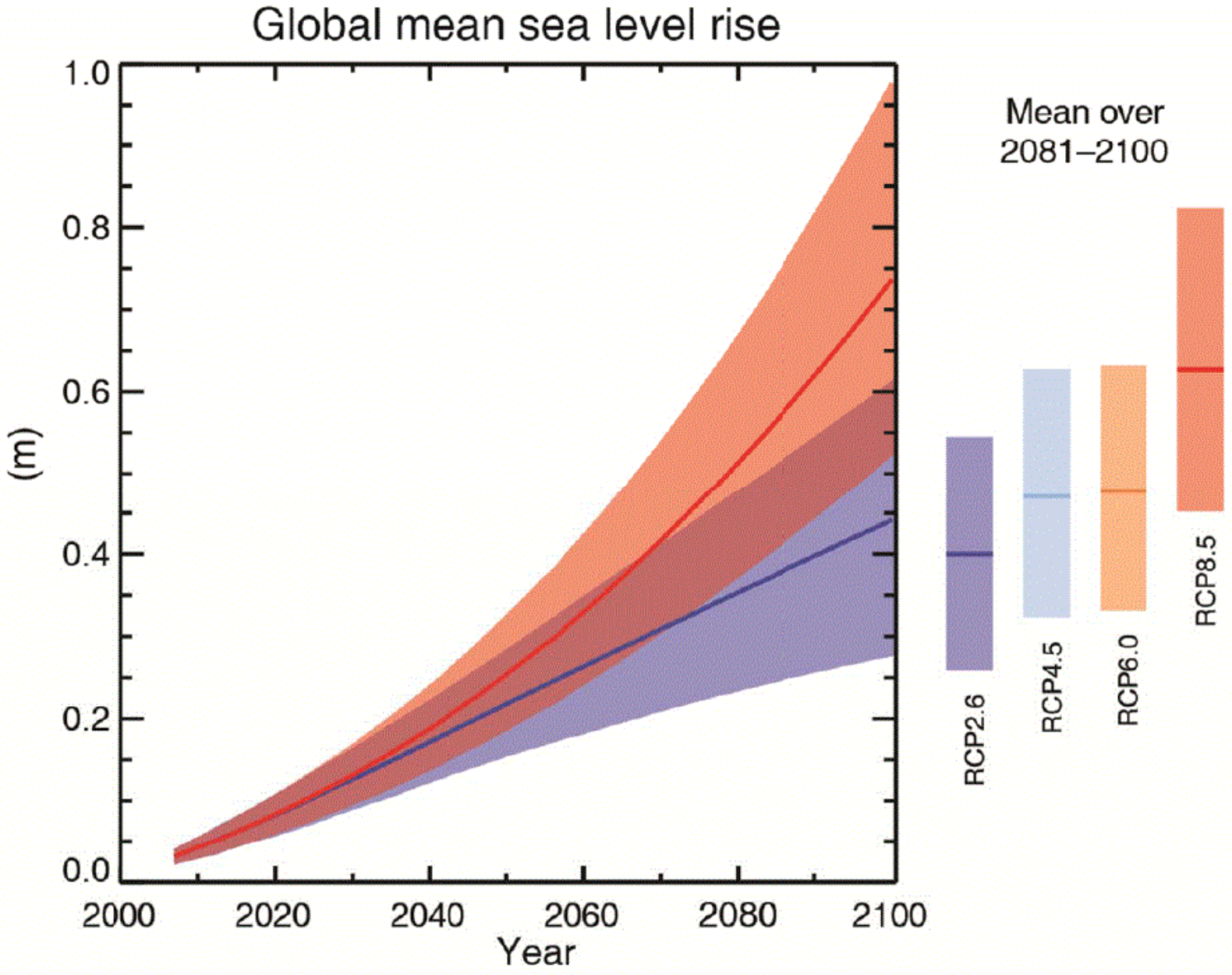
Adattarsi ai cambiamenti climatici e gestire il rischio

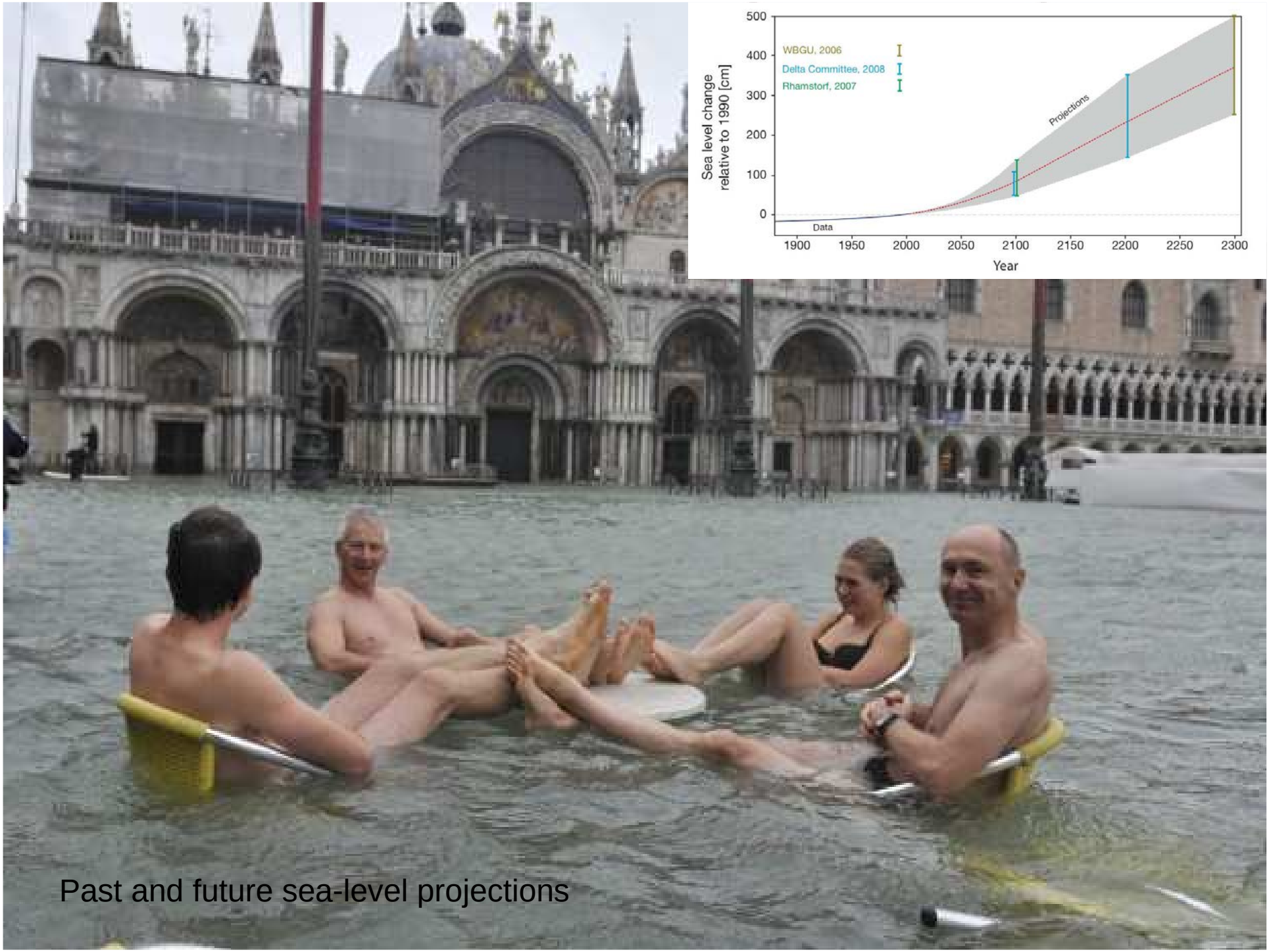
Rapporto IPCC-SREX (2012)

www.ipcc-wg2.gov/SREX



Sea-level change + **19 cm** (1901-2010),
+**3,2 mm/yr** (1993-2010).


Global mean sea level rise
1.0
0.8
0.6
0.4
0.2
0.0
(m)
2000
2020
2040
2060
2080
2100
Year
Mean over
2081–2100
RCP2.6
RCP4.5
RCP6.0
RCP8.5


Past and future sea-level projections

Sea level change relative to 1990 [cm]
500
400
300
200
100
0
WBGU, 2006
Delta Committee, 2008
Rhamstorf, 2007
Projections
Data
1900
1950
2000
2050
2100
2150
2200
2250
2300
Year

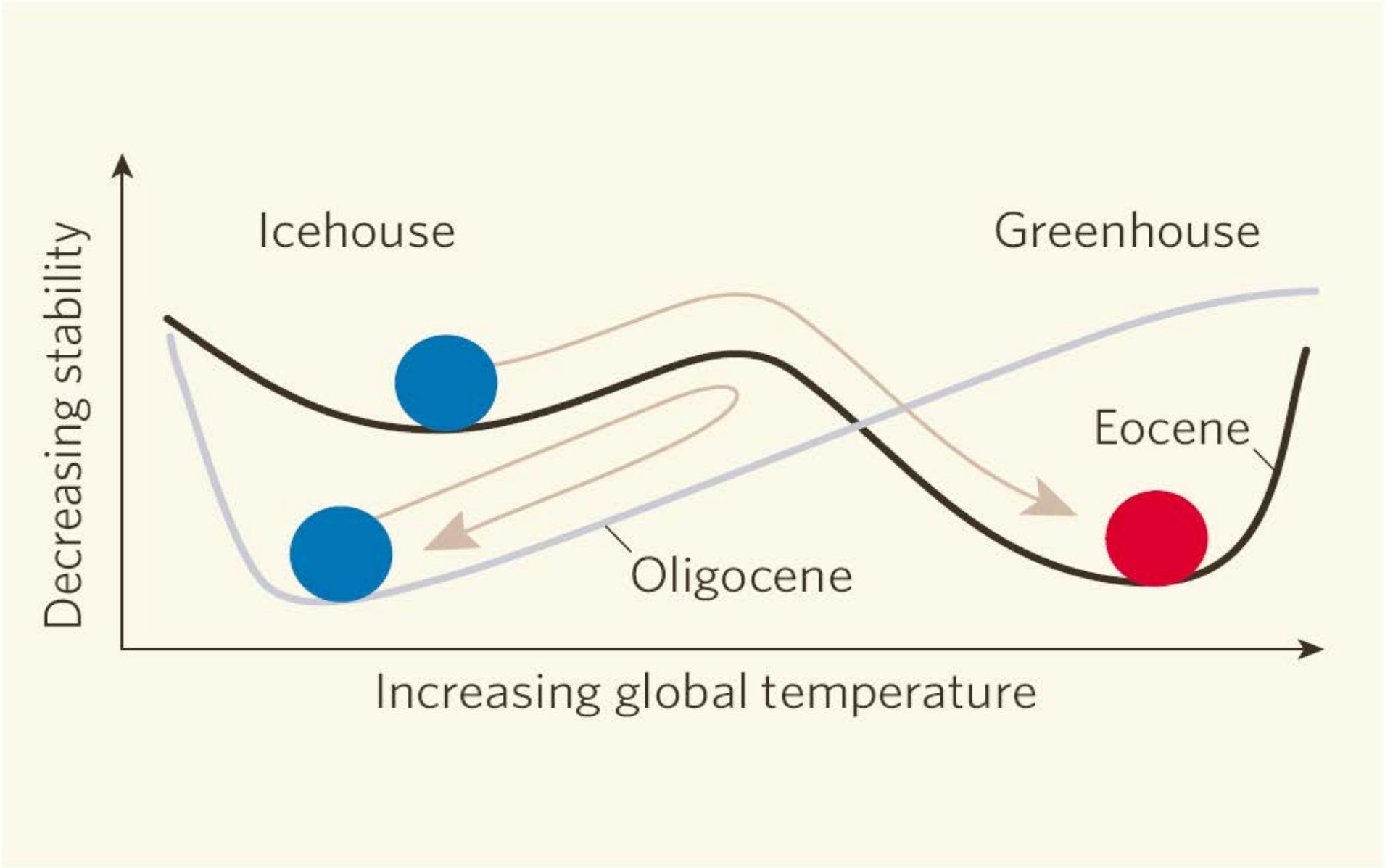


Figure 1 | Glacial stability and instability. Global temperature is indicated by the balls. The findings of

Alluvioni, tornado e incendi negli Usa Da Stoccolma l'appello di 18 Nobel

LUCA MERCALLI

L'ennesima serie di tornado si è abbattuta sugli Stati Uniti mercoledì 1° giugno, ma stavolta sul Nord-Est, dove questi fenomeni sono meno comuni rispetto ai più caldi stati meridionali: particolarmente colpito il Massachussetts, dove si sono avute quattro vittime e 48 mila edifici sono rimasti senza elettricità. Da alcune settimane il Lago Champlain, nel New England, ha raggiunto livelli record ed è straripato a seguito di piogge eccezionali che nel bimestre aprile-maggio hanno totalizzato 420 millimetri d'acqua; la Federal Emergency Management Agency (www.fema.gov) annuncia che le inondazioni potrebbero proseguire per tutto il mese di giugno. Ma la situazione è drammatica anche più a Ovest, nel bacino del Missouri, dove è in corso una piena di portata storica per la combinazione tra la rapida fusione dell'abbondante coltre nevosa presente sulle Montagne Rocciose e le piogge anomale: a Billings, nel Montana, in maggio sono caduti 242 mm di pioggia, quasi il quadruplo del normale. A Williston, North Dakota, il fiume ha sfiorato il livello record di 8,5 metri stabilito nel 1912, e ora i deflussi alluvionali si stanno propagando a valle (http://water.weather.gov/ahps). Al contrario, in conseguenza di una prolungata siccità, l'Arizona ha vissuto nei giorni scorsi uno dei più vasti incendi boschivi della sua storia, che ha percorso un'area di oltre 700 chilometri quadrati impegnando 2300 vigili del fuoco. In Europa occidentale molti temporali sono giunti nei primi giorni di giugno, localmente violenti e dannosi in Francia meridionale: domenica 5 presso Cannes sono caduti 79 millimetri d'acqua in sei ore; qua e là la siccità è stata alleviata, ma la situazione ancora non è risolta. Gli attuali problemi ambientali e sociali derivanti dal crescente impatto dell'uomo sugli ecosistemi sono stati discussi in un simposio che il 16-19 maggio ha radunato a Stoccolma una cinquantina tra i massimi esperti internazionali in sostenibilità globale: ne è emerso lo Stockholm Memorandum, documento firmato da 18 premi Nobel tra cui Carlo Rubbia, in cui si ribadisce l'urgenza per l'umanità di cambiare velocemente percorso se si vuole garantire alle future generazioni la protezione da cambiamenti climatici irreversibili e una migliore giustizia sociale (http://globalsymposium2011.org).

Cosa fanno gli altri?

In Svizzera

In Francia


Ce qu'il faut savoir
Informations
Raccourcis
1 L'essentiel sur l'effet de serre
2 Qu'est-ce que l'effet de serre ?
1. L'essentiel sur l'effet de serre
1. Caractéristiques du phénomène global
2. Effets observés à ce jour
Accords Internationaux et Accords Européens
Le protocole de Kyoto
1995 - Mandat de Berlin
En mars 1995, la première Conférence des Parties à la CCNUCC reconnaît la nécessité d'un renforcement des engagements des pays développés. Parallèlement à des objectifs quantifiés de limitations et de réduction des émissions de gaz à effet de serre (GES), elle prévoit d'élaborer des politiques et mesures.
Deuxième rapport d'évaluation du GIEC - En décembre 1995, le deuxième rapport d'évaluation du GIEC confirme la responsabilité humaine dans le changement climatique et la nécessité d'une action préventive, en vertu du principe de précaution.
1997 - Troisième session de la Conférence des Parties - Le protocole de Kyoto
Mission Interministérielle de l'Effet de Serre
English Version
Ministère de l'Ecologie et du Développement Durable
Mission Interministérielle de l'Effet de Serre


Accueil | Trouvailles | Repères | Ressources
Vivre les changements climatiques
L'effet de serre expliqué
Repères
Le livre
L'effet de serre, c'est quoi?
Causes et responsables
Risques et conséquences
Actions à faire
Calculez vos émissions de gaz à effet de serre
Mettez vos connaissances à l'épreuve
ÉDITIONS MULTIMONDES
www.multim.com
Claude Villeneuve
François Richard
Vivre les changements climatiques
QUOI DE NEUF ?


Réseau Action Climat France

ECONOMIES D'ENERGIE FAISONS VITE ÇA CHAUFFE

ADEME

Agence de l'Environnement
et de la Maîtrise de l'Energie

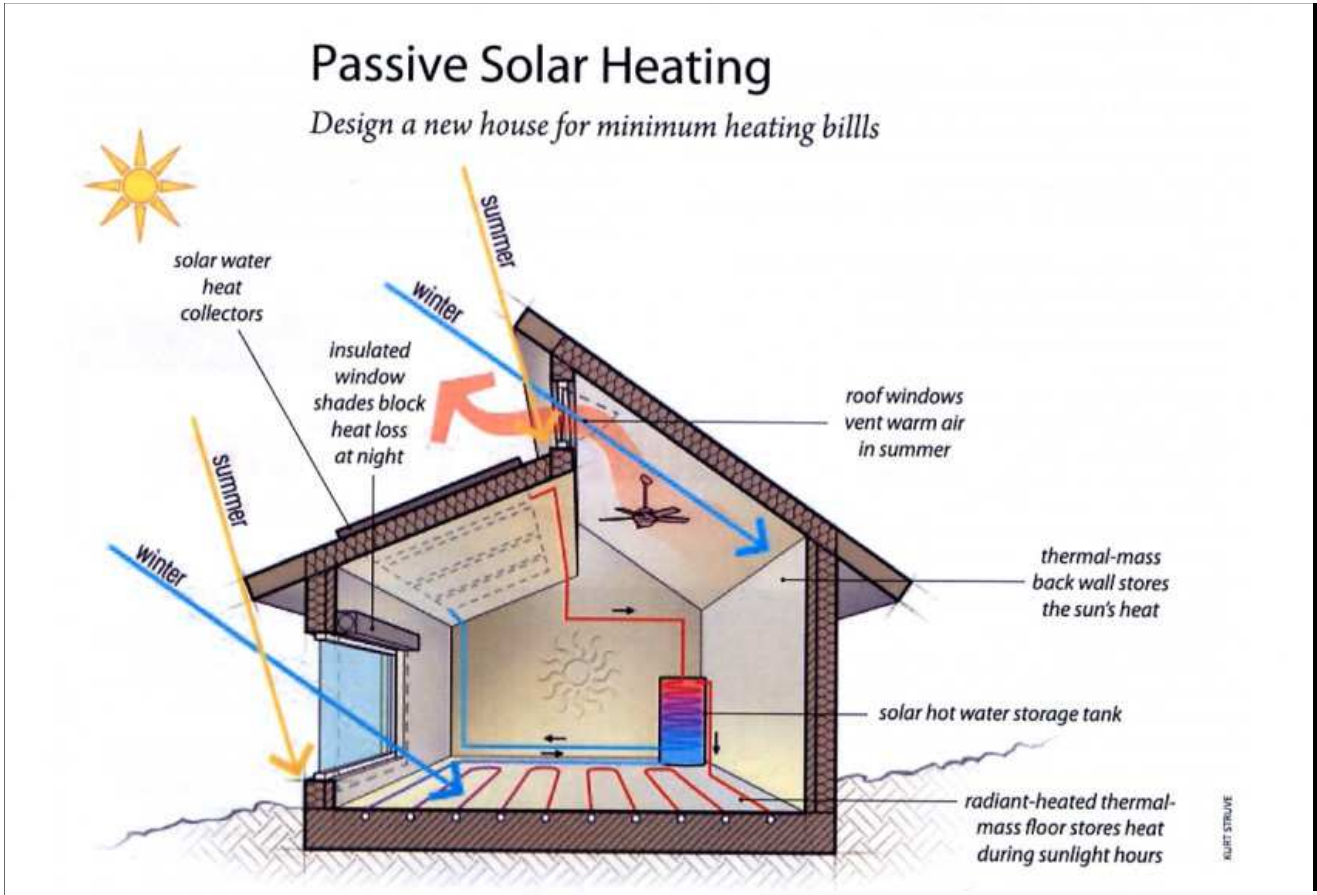
Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTÈRE
DE L'ECOLOGIE ET
DU DÉVELOPPEMENT
DURABLE

MINISTÈRE DÉLÉGUÉ
À L'INDUSTRIE

MINISTÈRE DÉLÉGUÉ
À LA RECHERCHE


Mappa
Satellite
Ibrida
Consumo irreversibile di suolo!
Via Primo Levi
Via della Cortassa
Via Druento
Via Cassagna
Via Cesare Pavese
Via San Paolo
Via Maiolo
Via Asti
Via Novara
Via Biella
Via Maiolo
Antonio Gramsci
Via Giacomo Puccini
SS24
Via Aosta
Via dei Prati
Via Dora Riparia
Via Ivrea
Via Arauda
Via Vercelli
Via Piave
Tangenziale Nord
A55
Via Torino Pianezza
Via Torino
SS24
Via Torino
SS24
A55
Via Collegno
Viale dei Partigiani
Via Pianezza
A55
Via Sergio Allegri
Via Collegno
Via Archa
Cascina Merli
A55
Collegno



Efficienza energetica e fonti rinnovabili

REUSE
REDUCE
RECYCLE

Being wise with waste: the EU's approach to waste management

EUROPEAN COMMISSION

environment

Produrre meno rifiuti!

514 kg/pc anno

Fare il compost!

www.cec-zev.eu/fileadmin/user_upload/eu-consommateurs/PDFs/publications/etudes_et_rapports/Etude-Obsolescence.pdf

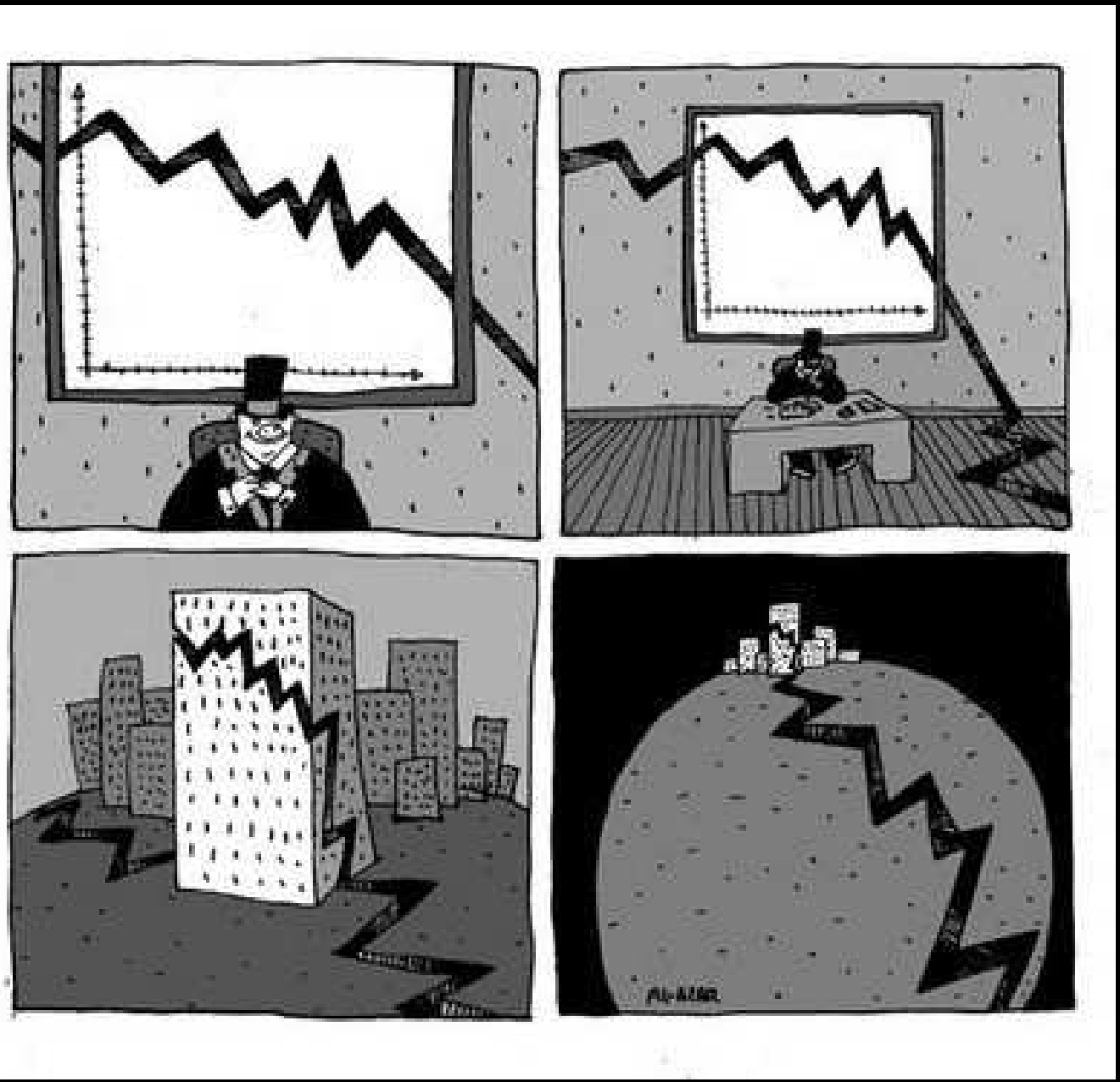

La mia centrale termo-elettrica sul tetto…

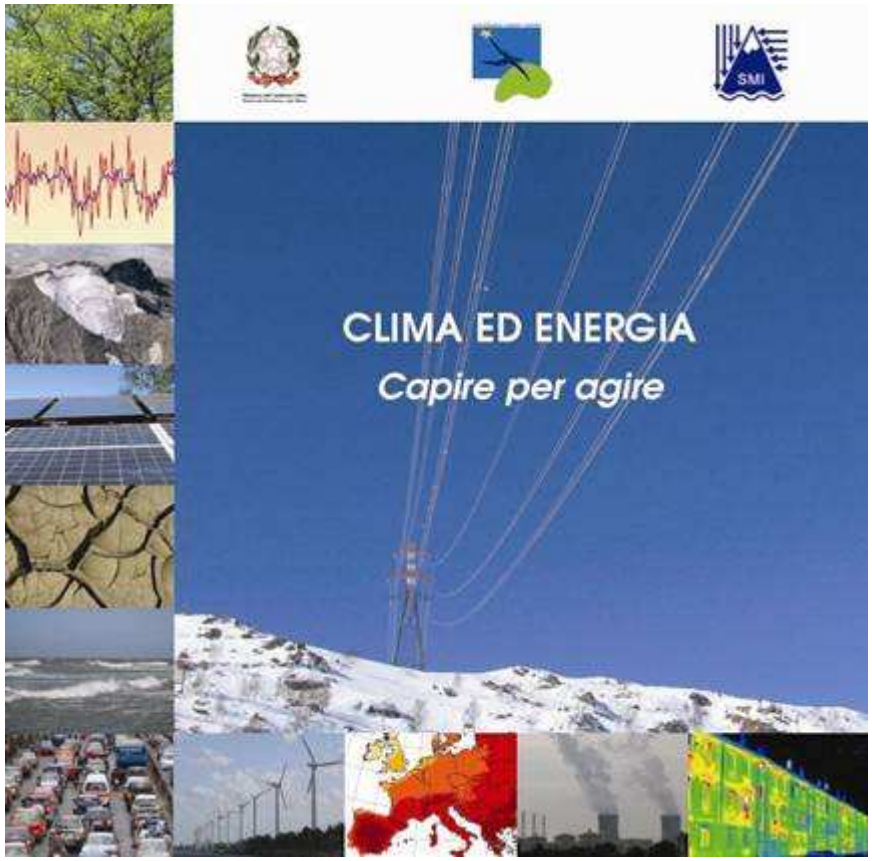
Potenza fotovoltaico 17-18.11.2011

Vegetables production in home gardens:
0 km,
less CO_2,
less waste,
less energy dependency,
more quality!

Incidente Aereo di Kegworth, 8 gennaio 1989, Boeing 737–400 da Londra, 126 passeggeri, 47 vittime

Impatto su autostrada M1 presso East Midlands Airport.





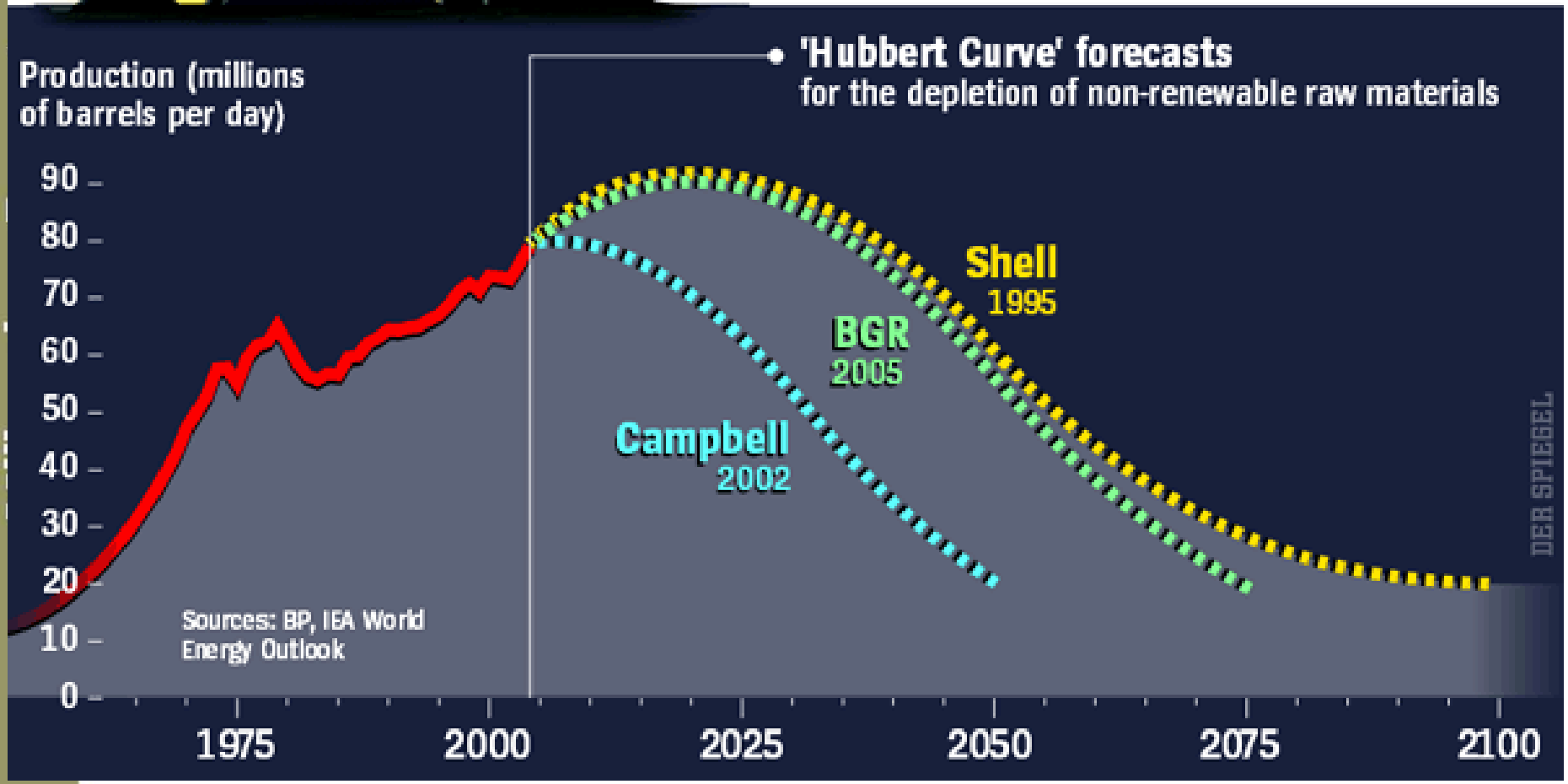
www.campagnaseeitalia.it/pubblicazioni/clima-ed-energia-capire-per-agire/

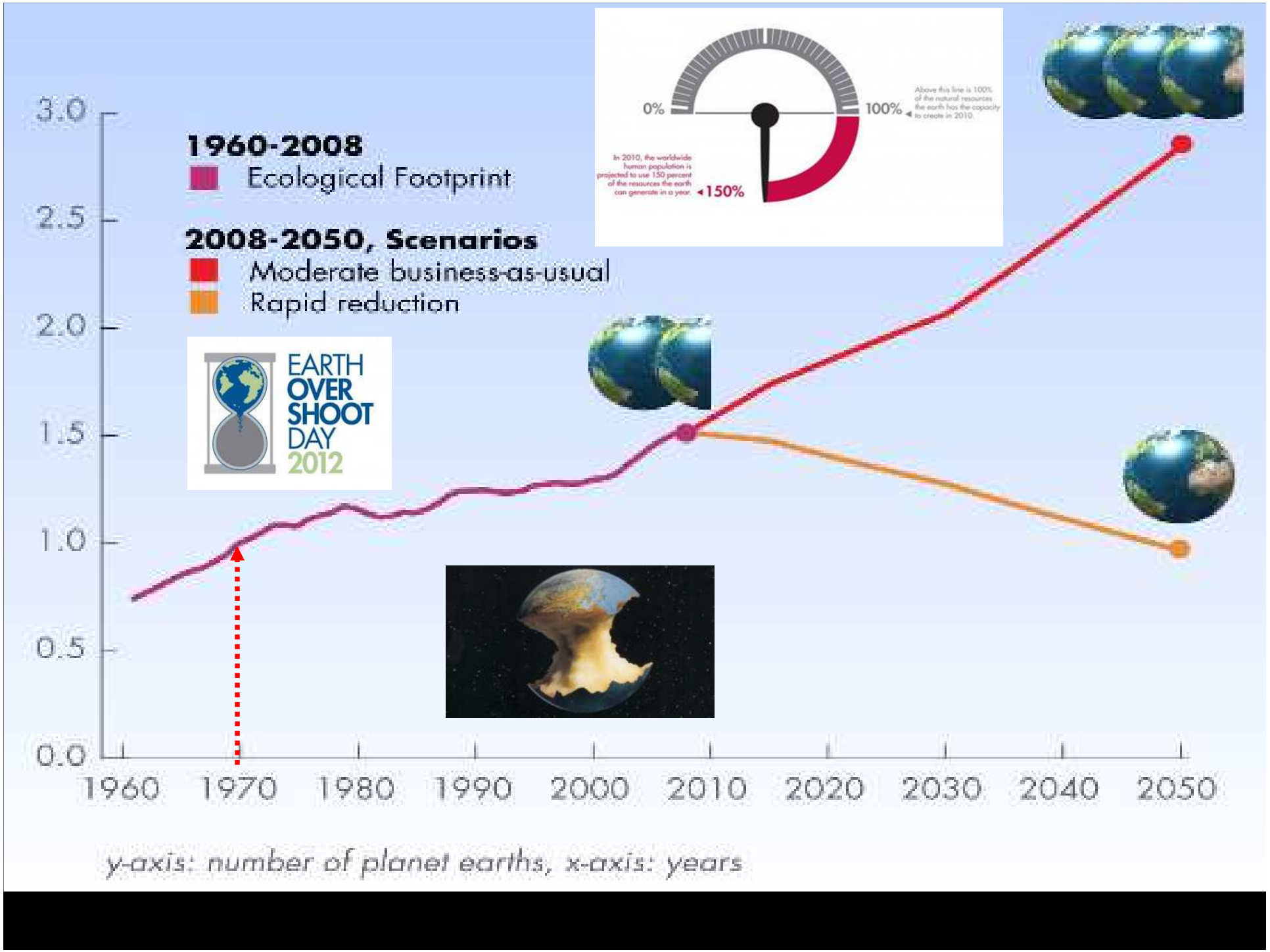

www.midwayfilm.com

Consumi di energia primaria: 12 miliardi di ton di petrolio equivalente

The End of Fossil Fuels

Crude oil production – history and future developments




0%
100%
Above this line is 100% of the natural resources the earth has the capacity to create in 2010.
In 2010, the worldwide human population is projected to use 150 percent of the resources the earth can generate in a year.
150%
1960-2008
Ecological Footprint
2008-2050, Scenarios
Moderate business-as-usual
Rapid reduction
EARTH OVER SHOOT DAY 2012
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
y-axis: number of planet earths, x-axis: years