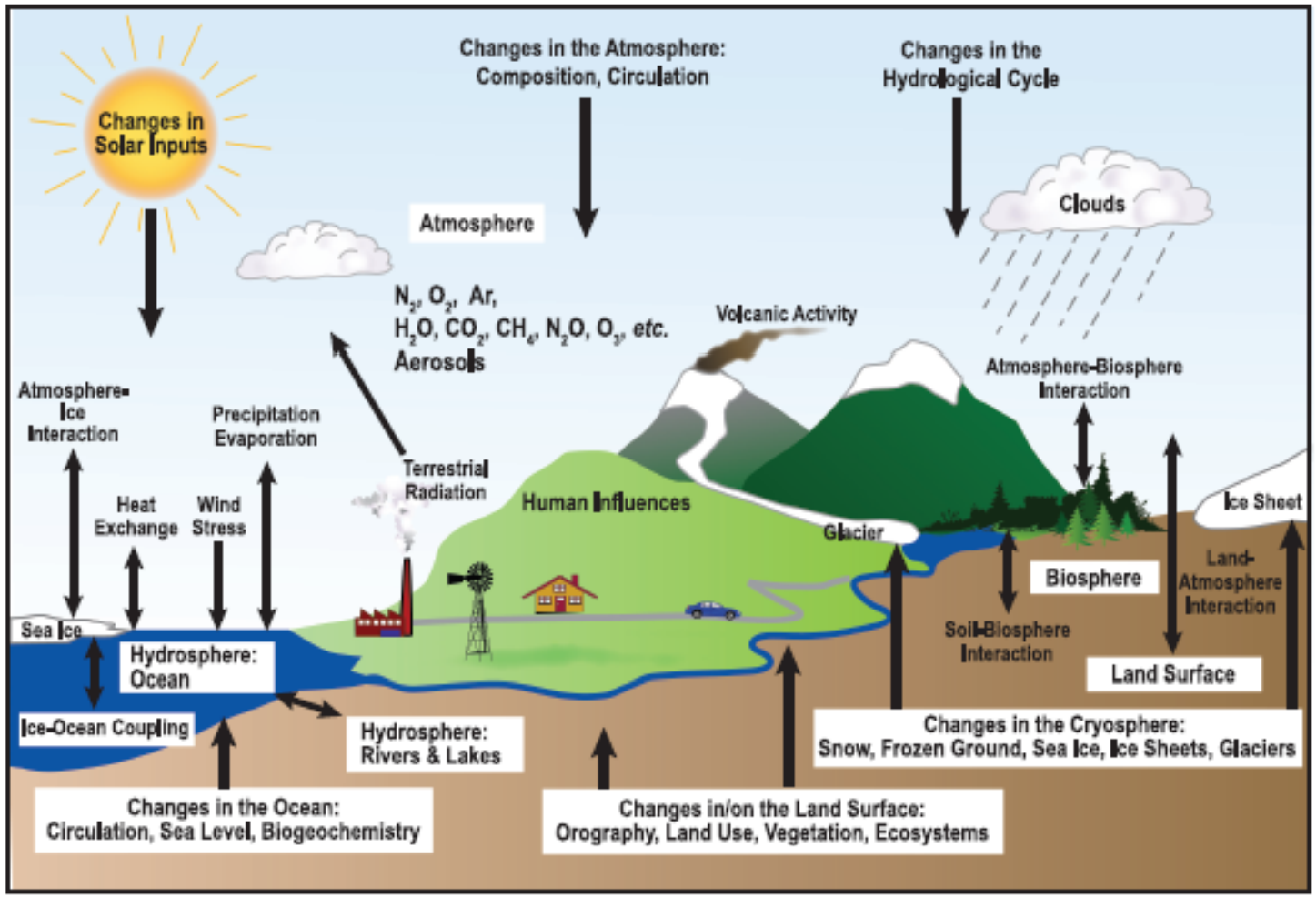
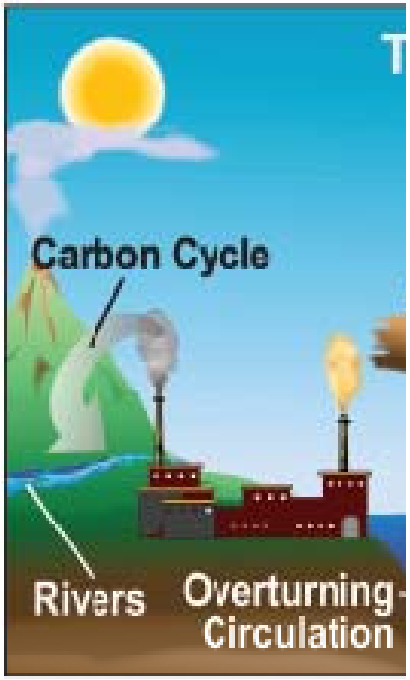
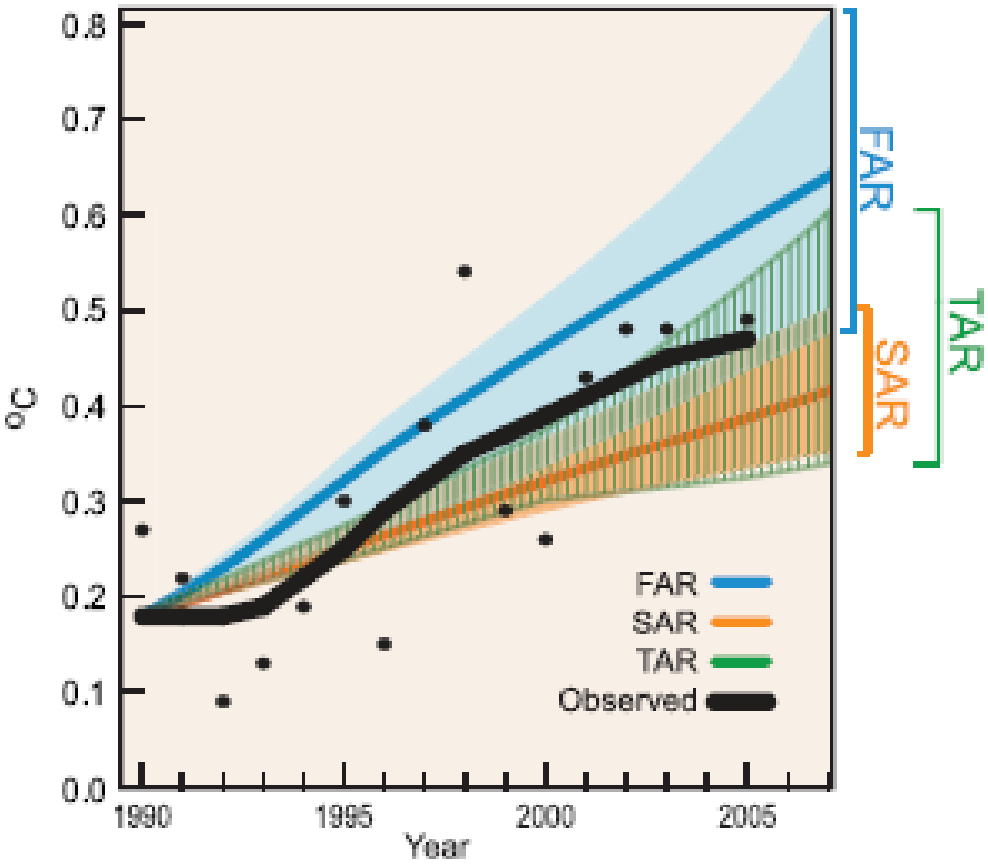
Histórico da Variabilidade e Mudança Climática da Terra

What is the Relationship between Climate Change and Weather??



FAQ 1.2, Figure 1. *Schematic view of the components of the climate system, their processes and interactions.*





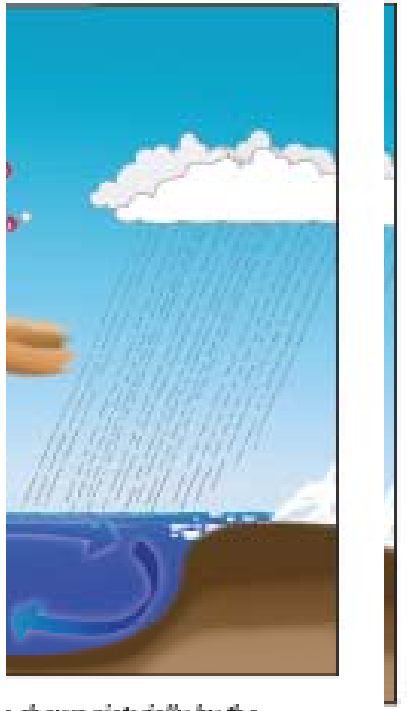
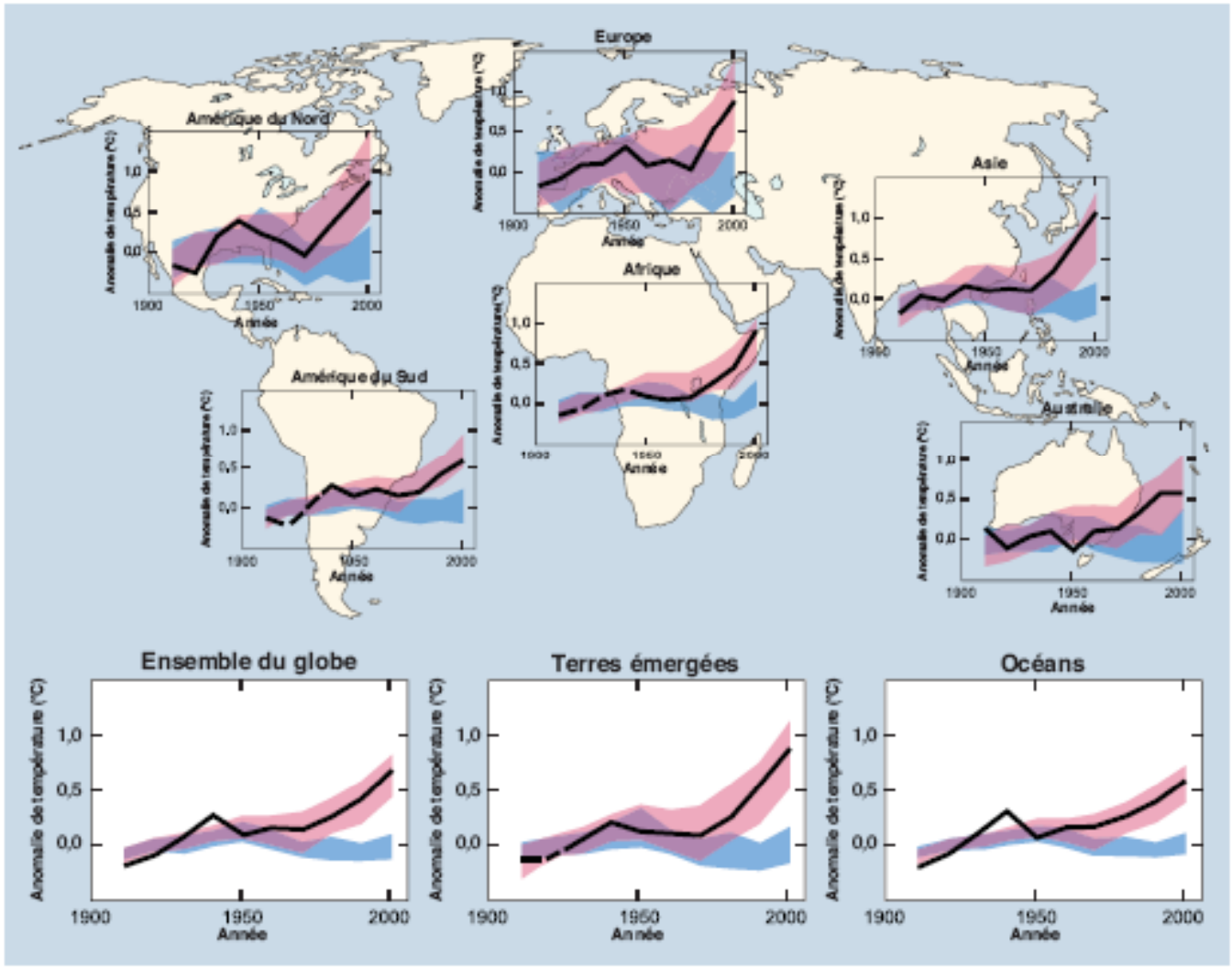


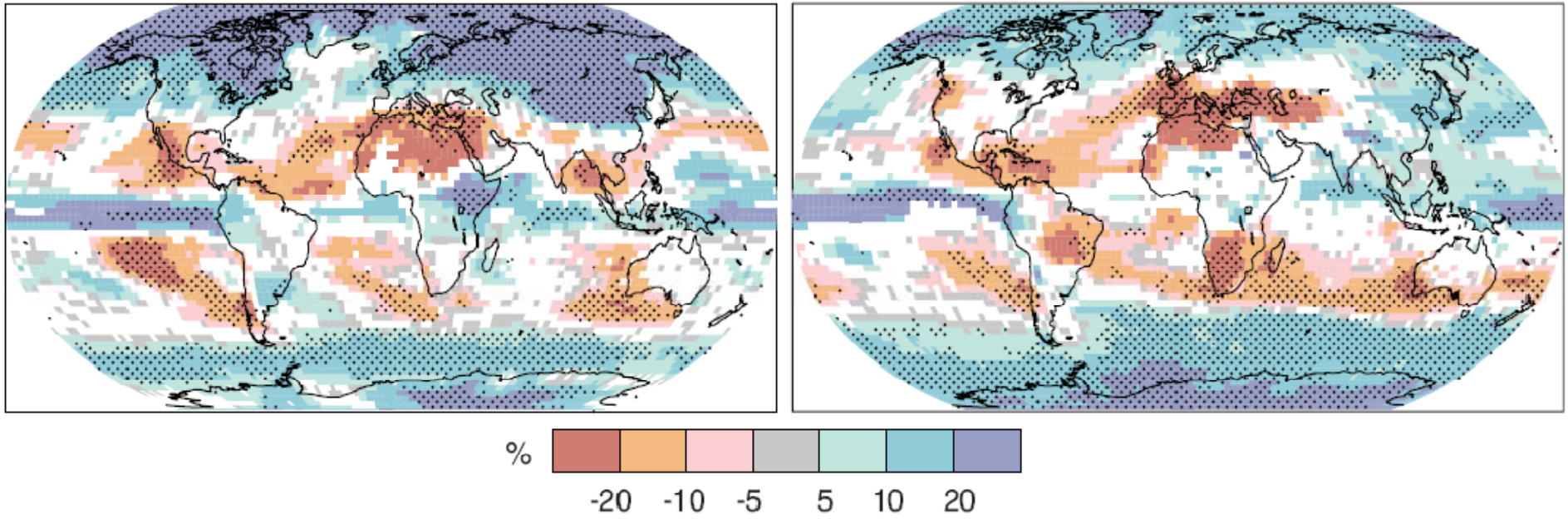
Figure 1.2. *The complexity of climate different features of the modelled world.*

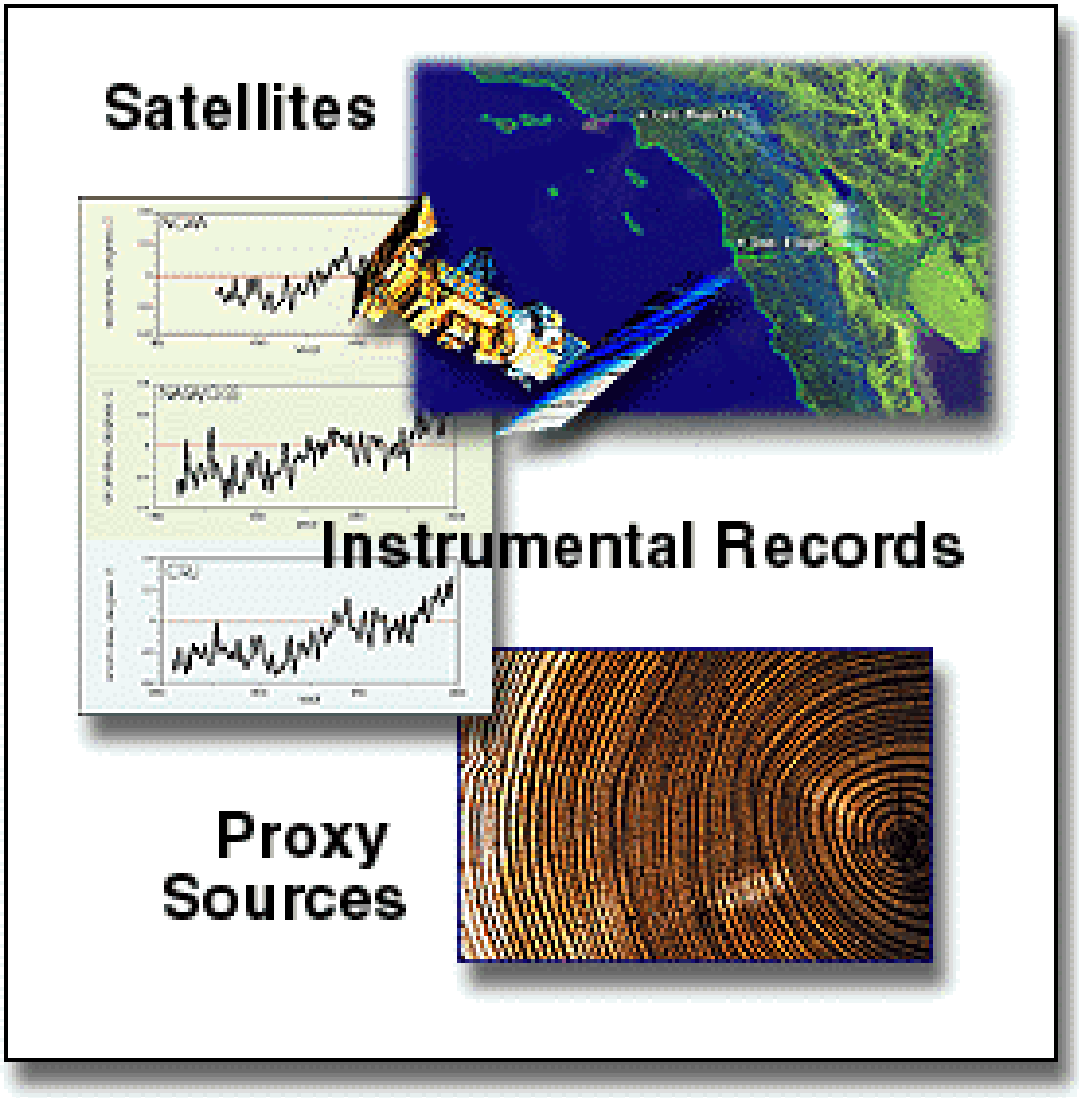
shown pictorially by the

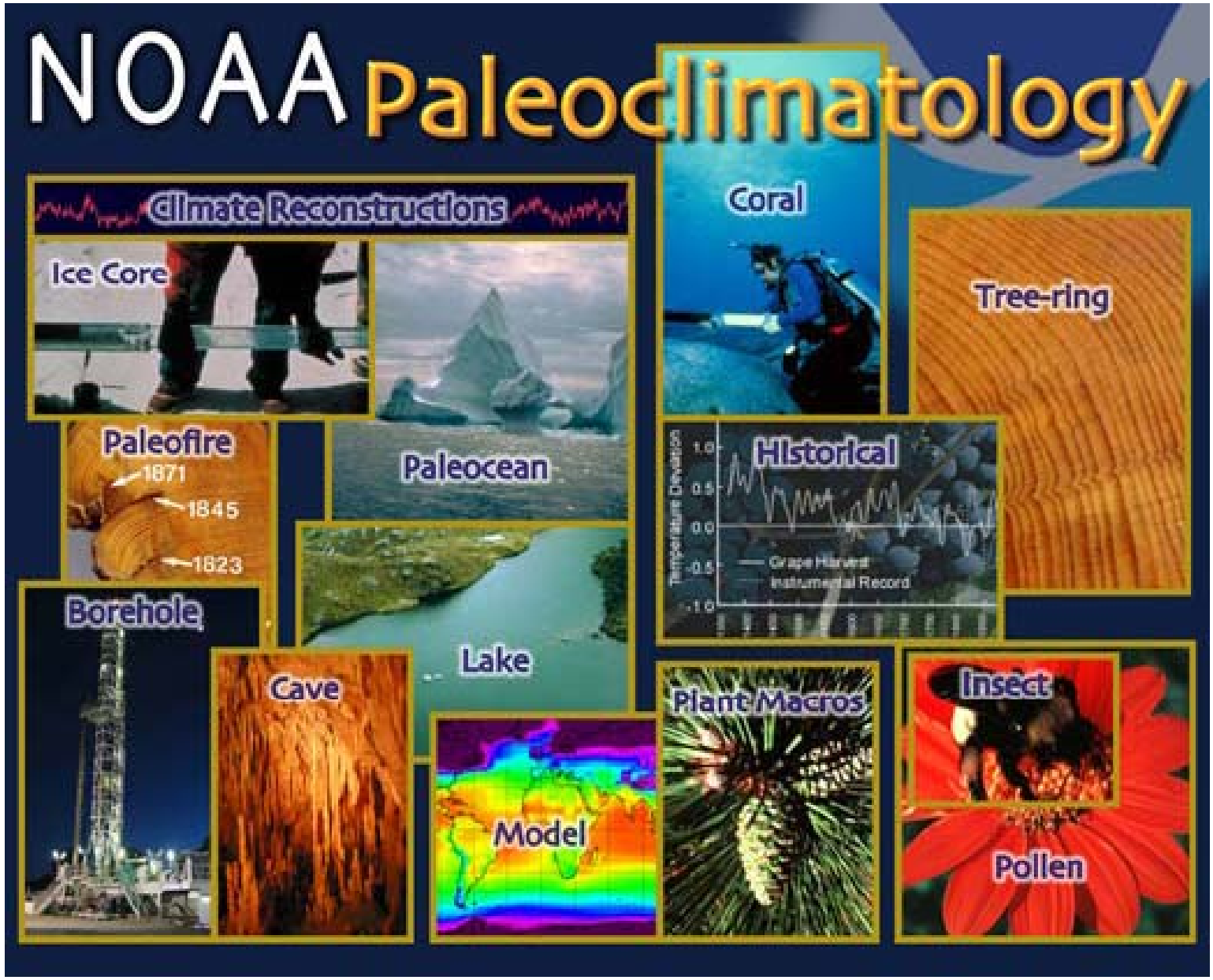
Variation des températures à l'échelle du globe et des continents

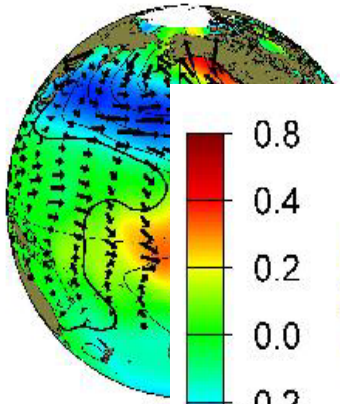


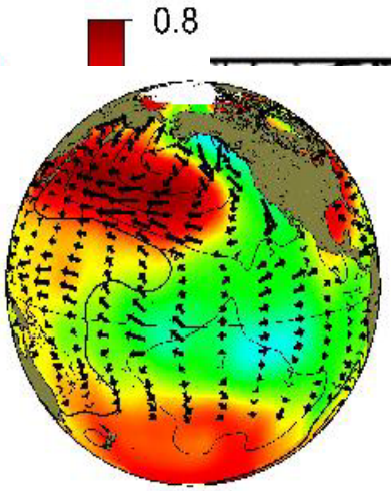
Projections multimodèles des variations du régime des précipitations

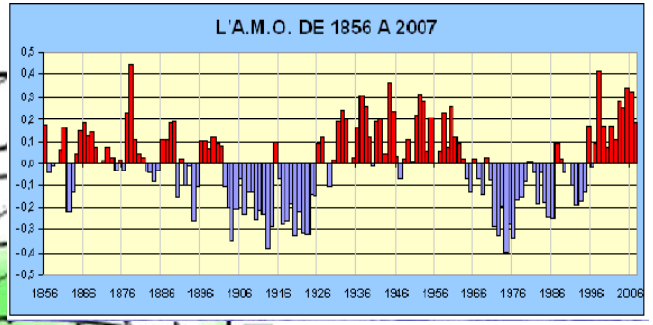


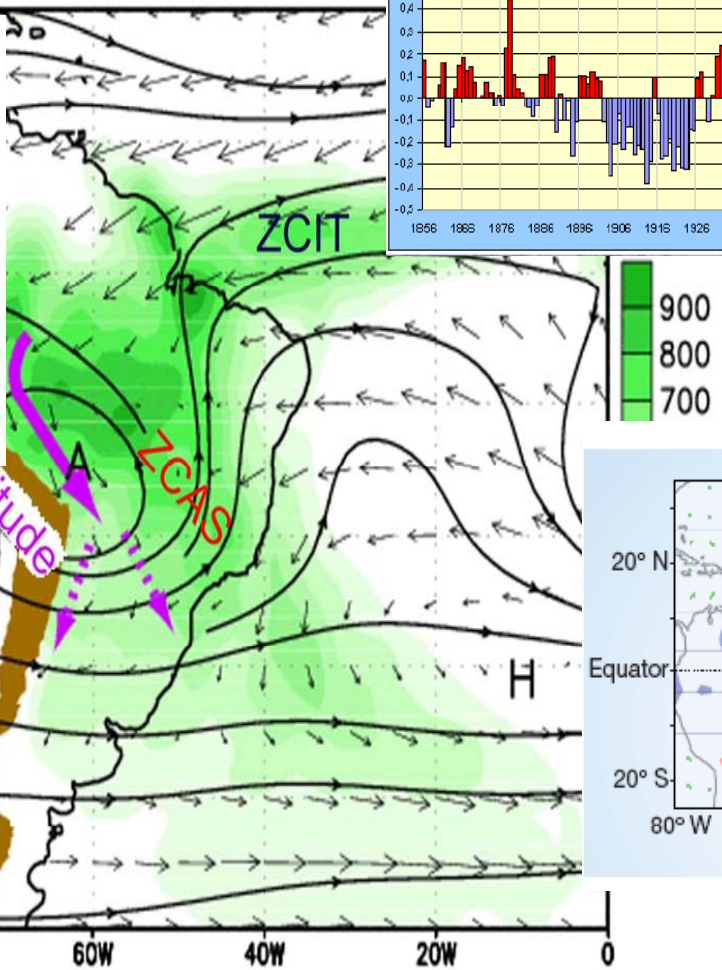

Satellites
Instrumental Records
Proxy Sources

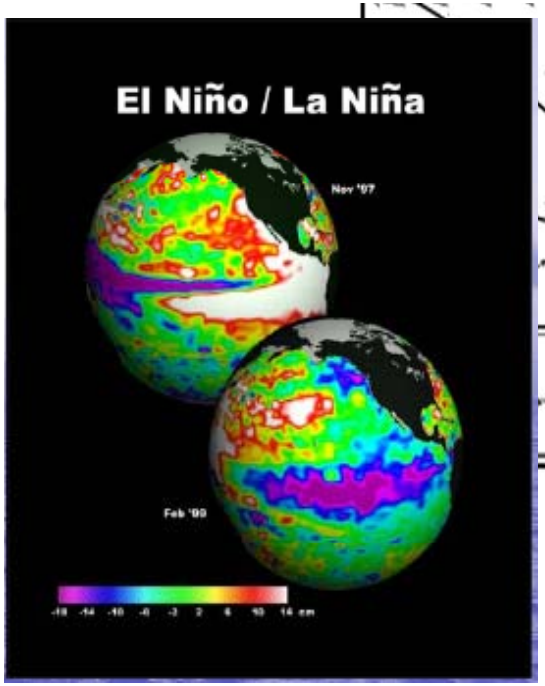

NOAA Paleoclimatology
Climate Reconstructions
Ice Core
Coral
Tree-ring
Paleofire
1871
1845
1823
Paleocean
Historical
Temperature Deviation
1.0
0.5
0.0
-0.5
-1.0
Grape Harvest
Instrumental Record
Borehole
Lake
Cave
Model
Plant Macros
Insect
Pollen

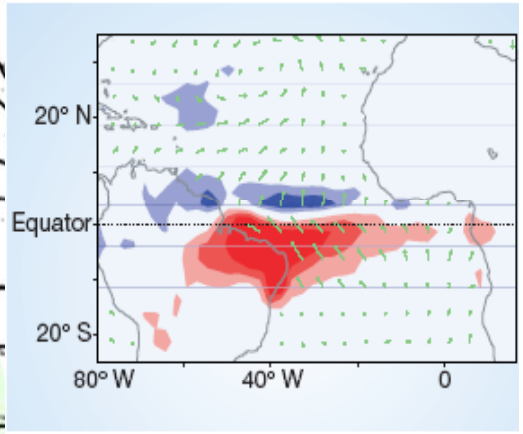

0.8
0.4
0.2
0.0
-0.2
-0.6


0.8


L'A.M.O. DE 1856 A 2007


ZCIT
900
800
700
A
ZCAS
H
80W
60W
40W
20W
0
10


El Niño / La Niña
Nov '97
Feb '99


20° N
Equator
20° S
80° W
40° W
0

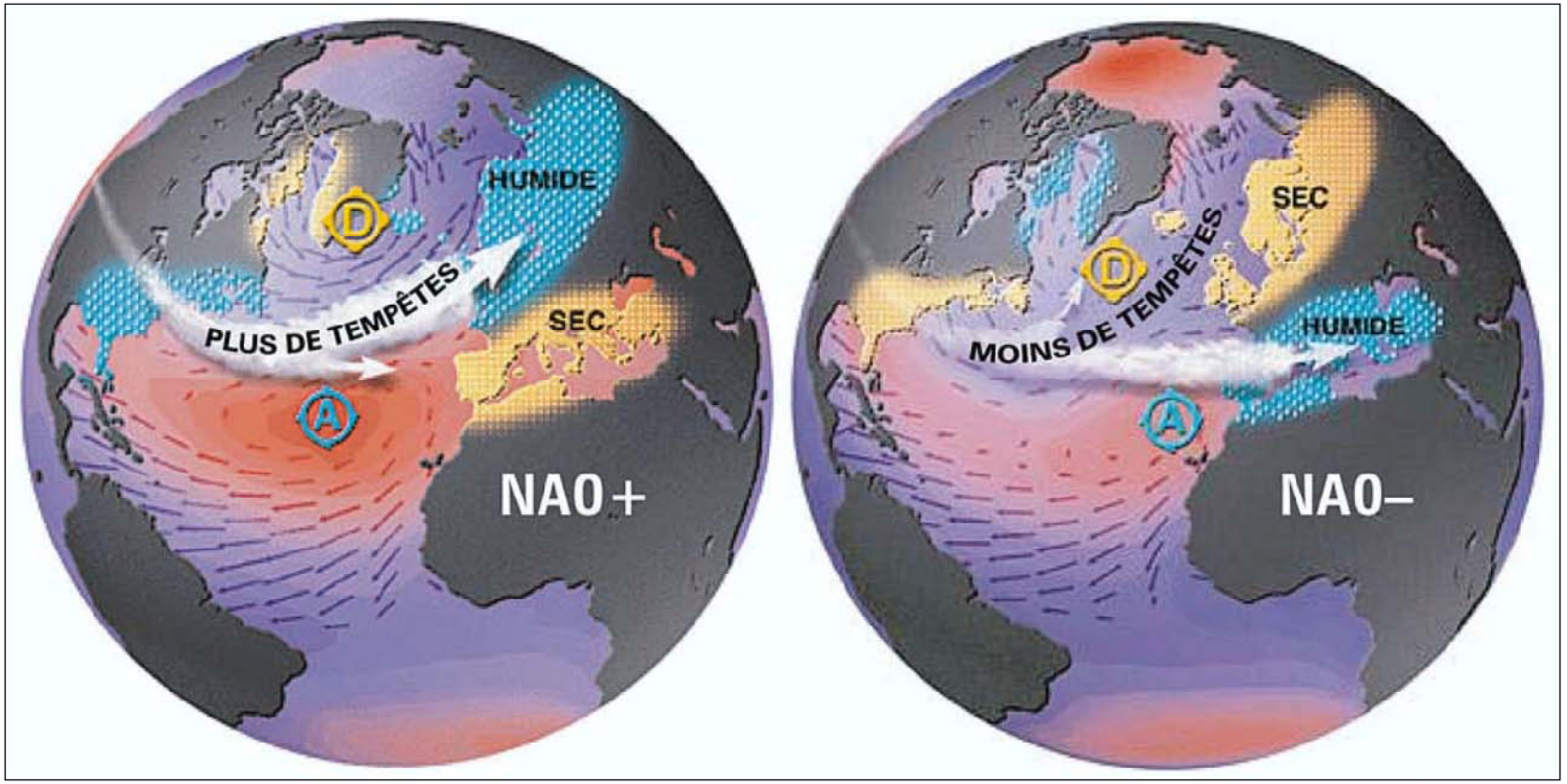


Figure 2 - Schéma récapitulatif des impacts associés aux deux phases de l'oscillation nord-atlantique (NAO). [Figure reproduite des pages descriptives Internet du Lamont-Doherty Earth Observatory, Martin Visbeck].

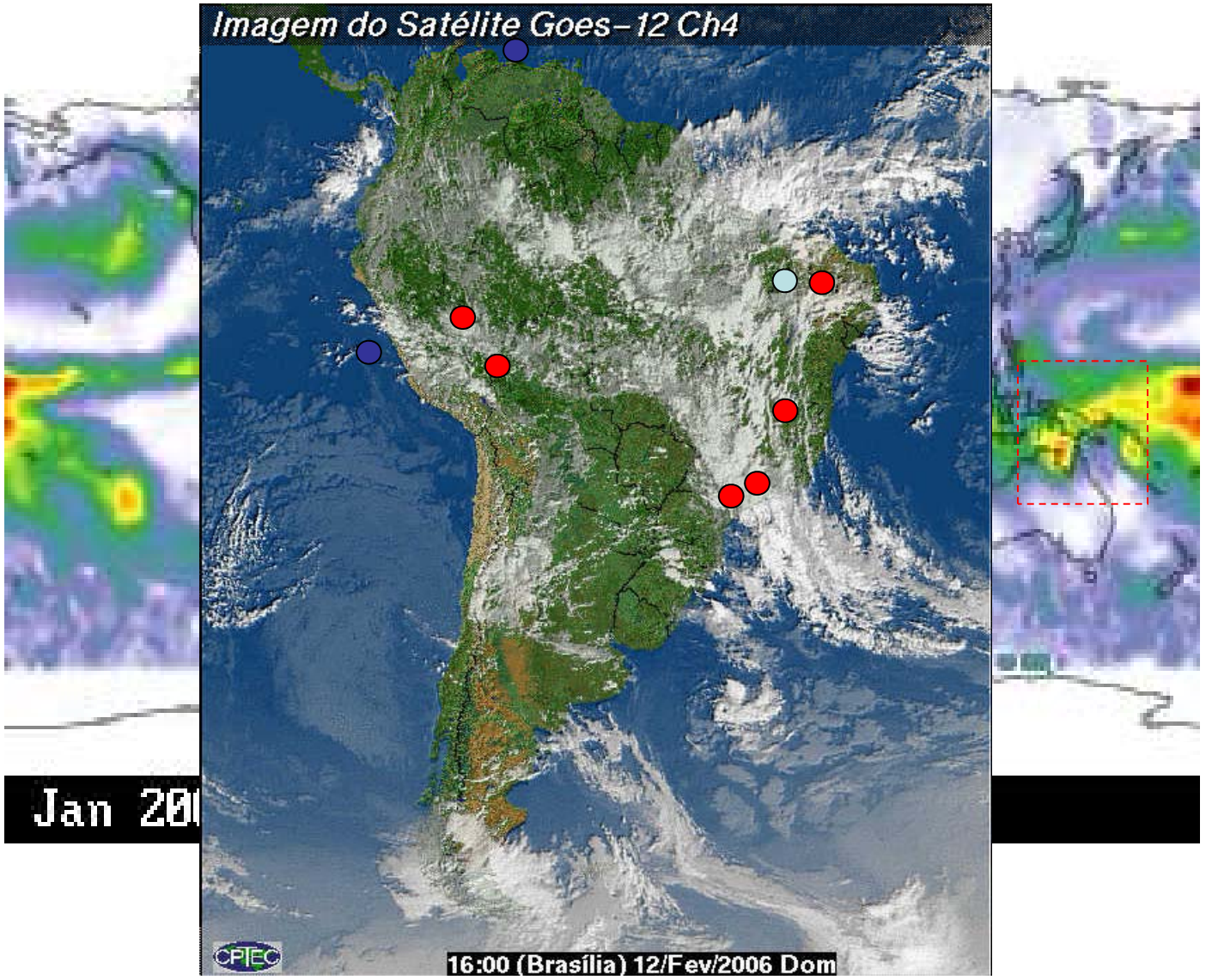
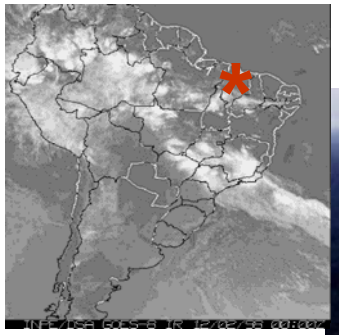
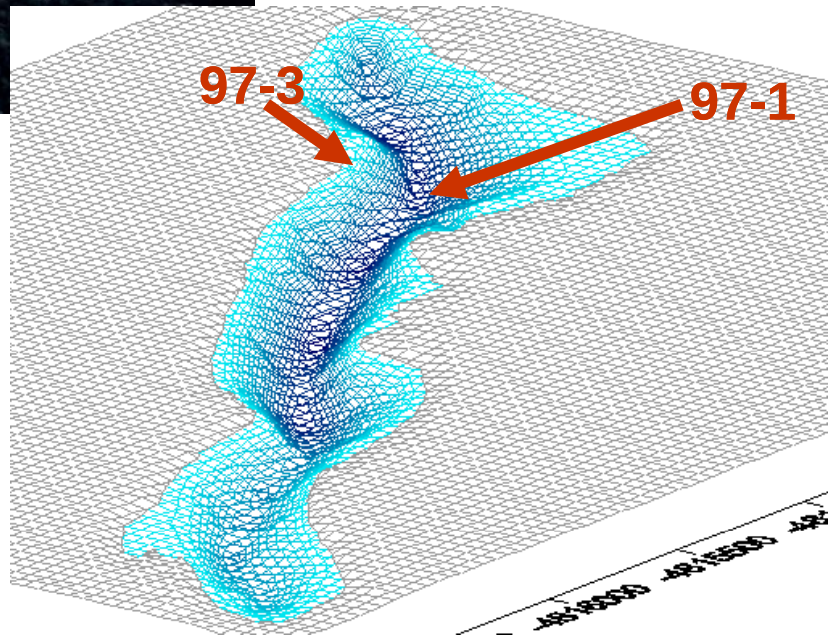


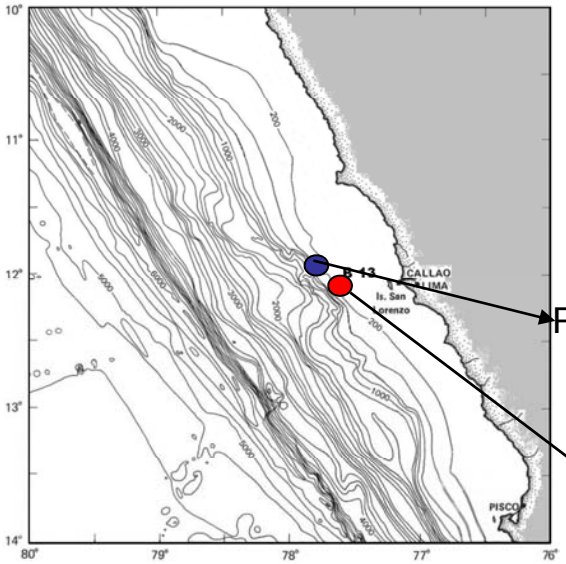
Imagem do Satélite Goes–12 Ch4
Jan 20
CPTEC
16:00 (Brasília) 12/Fev/2006 Dom



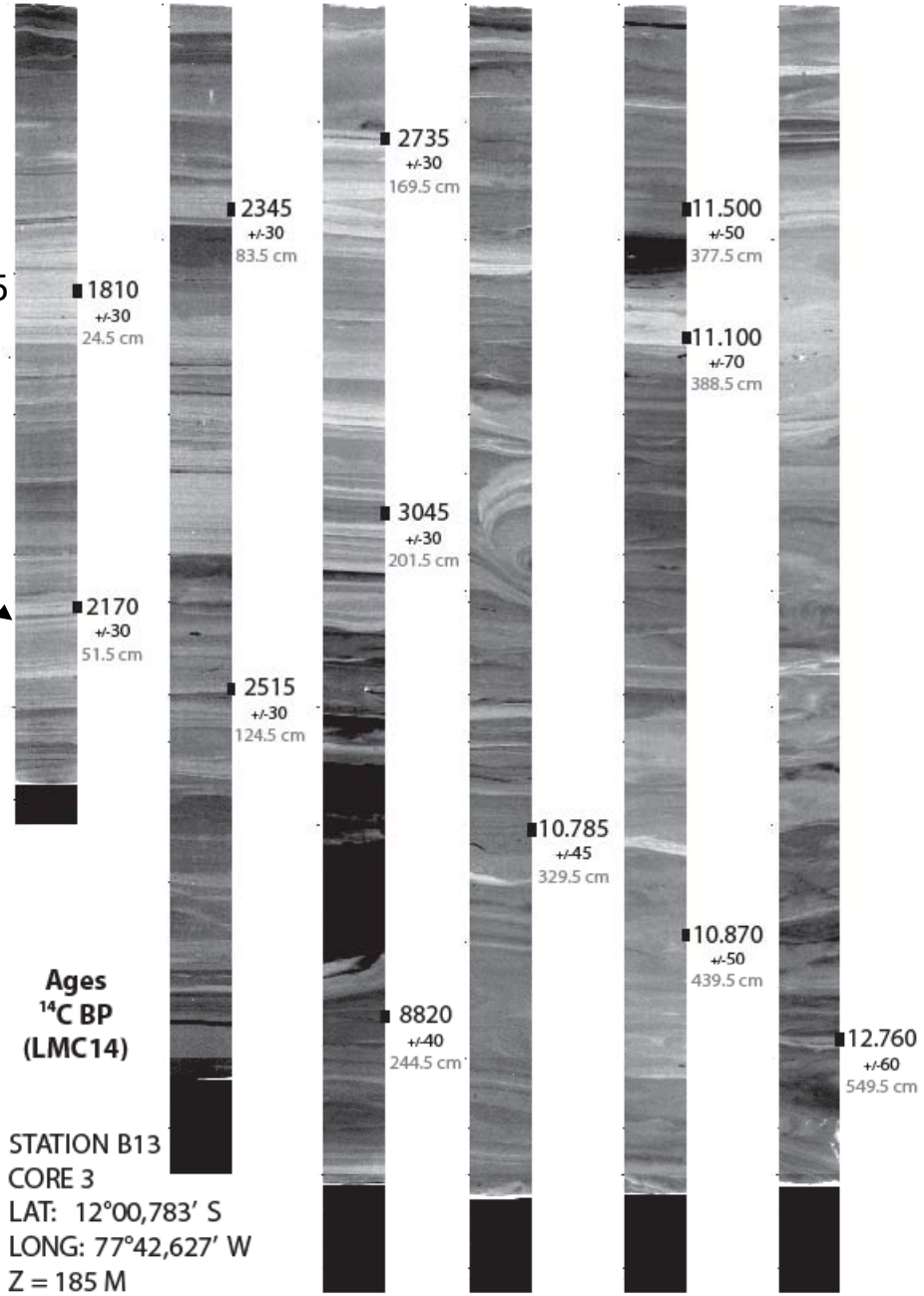
Caço (MA-Brasil)



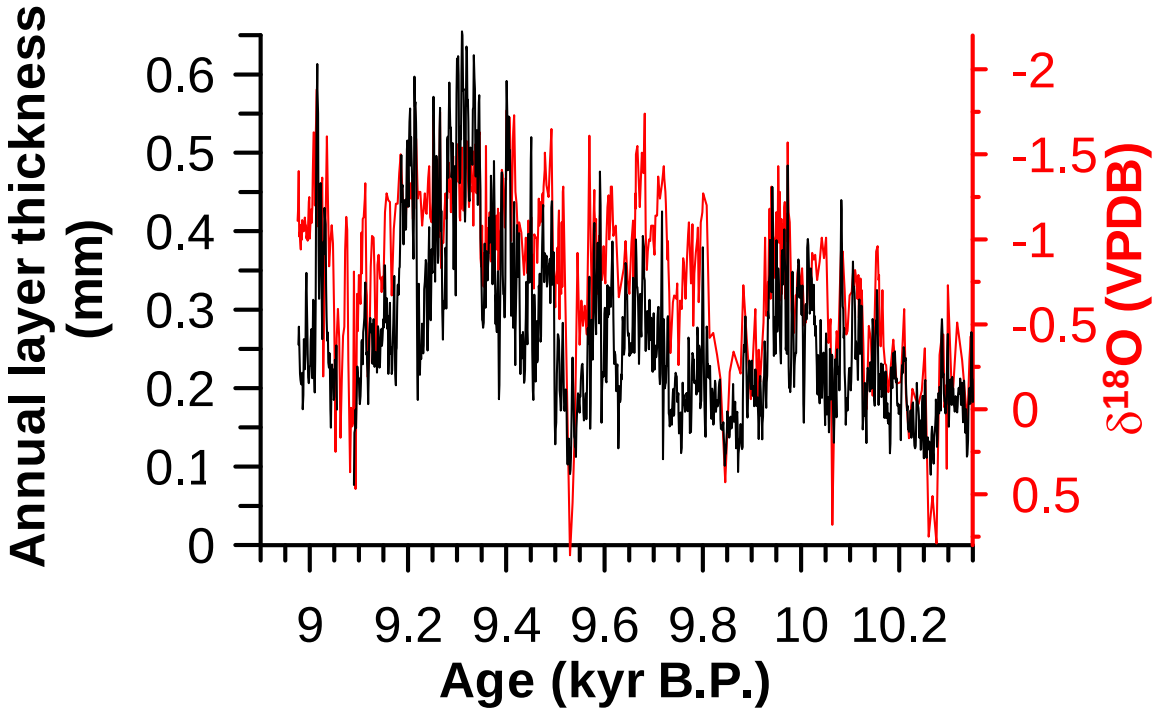
B13 Core collected during the MPI cruse (April 2005)



Rein et al., 2005

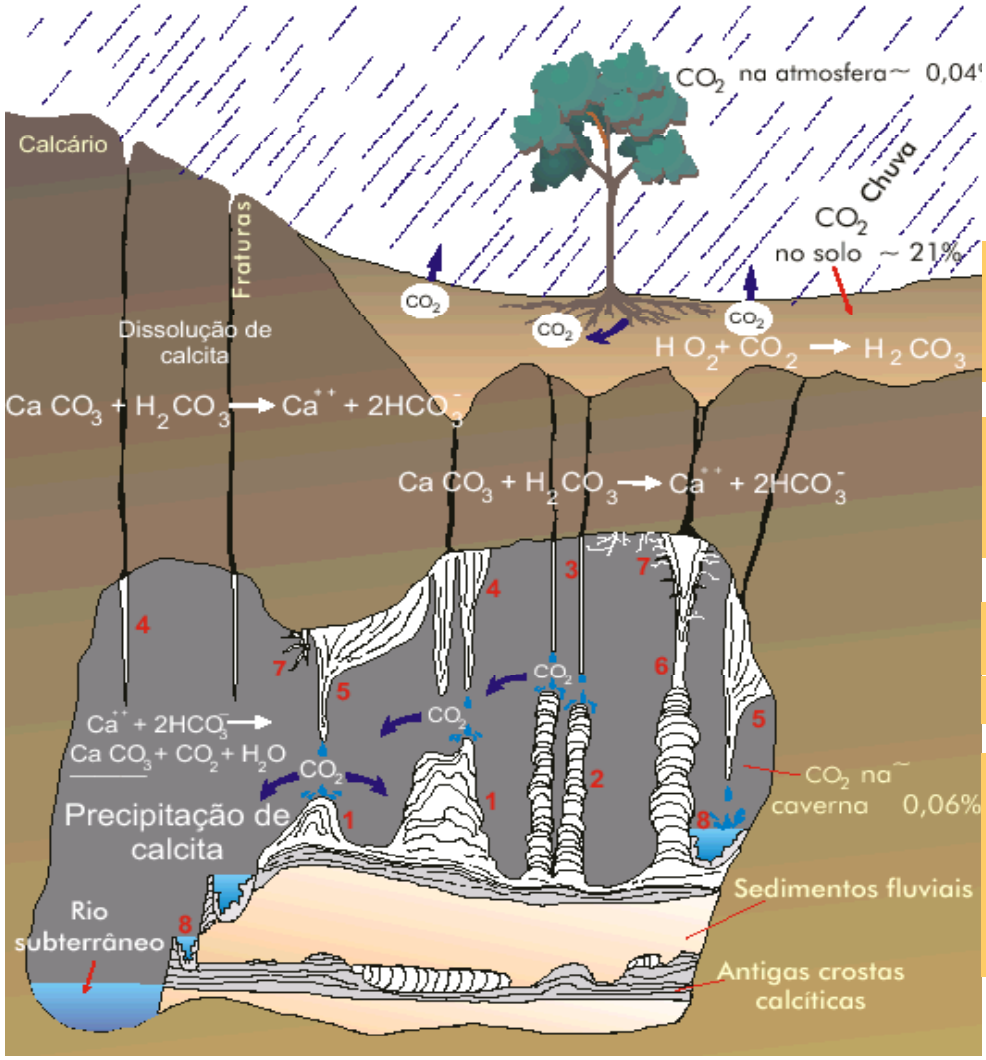



2005 1 19



Registros de alta resolução temporal

Fleitmann et al.,
2003, Science



Datação U/Th

$$\delta^{18}O = (^{18}O/^{16}O)_{sample} - {}^{18}O/^{16}O)_{VPD}$$
$$(^{18}O/^{16}O)_{VPDB}$$

$$\delta^{13}C = (^{13}C/^{12}C)_{amostra} - {}^{13}C/^{12}C)_{VPDB}$$
$$(^{18}O/^{16}O)_{VPDB}$$

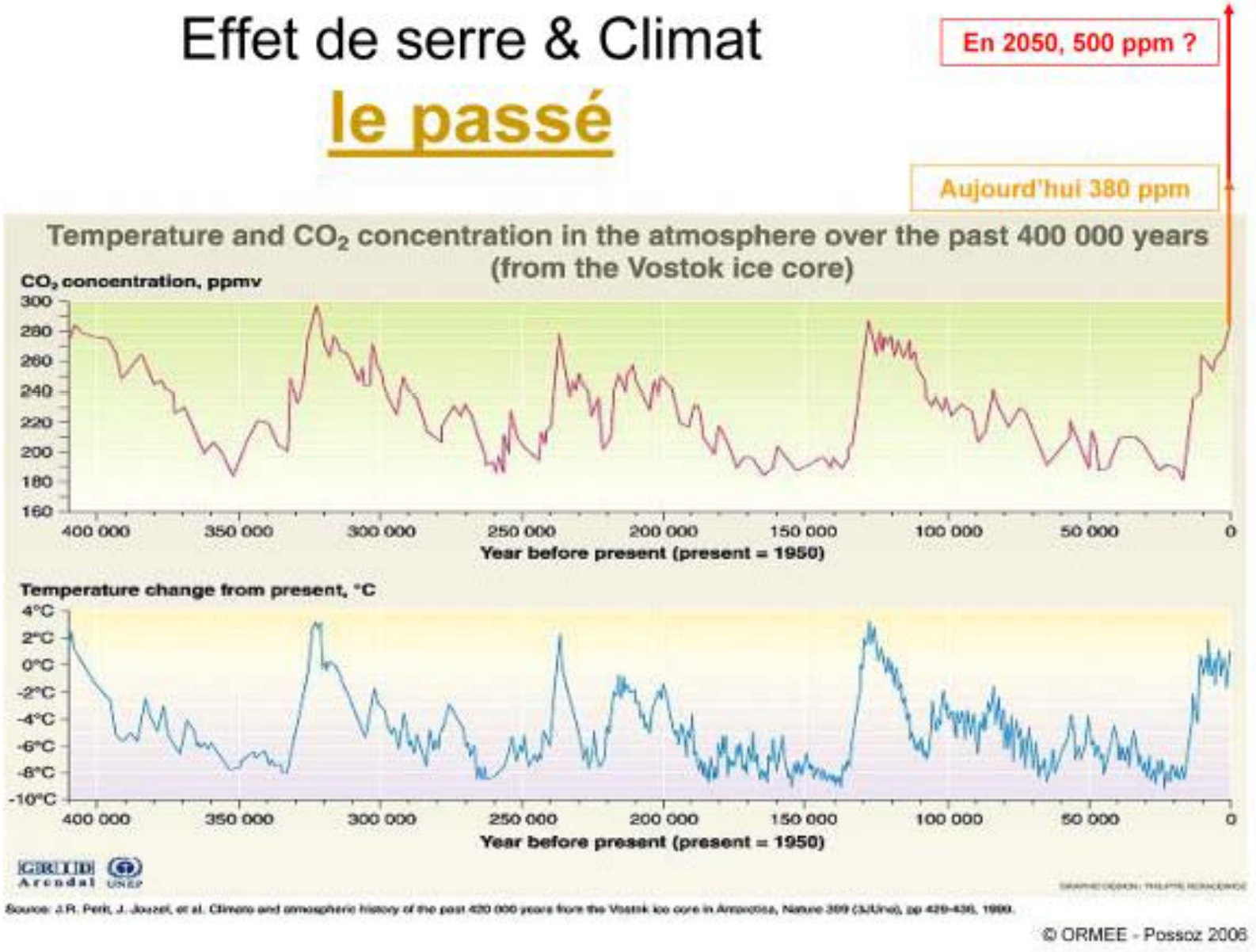
Taxa de crescimento

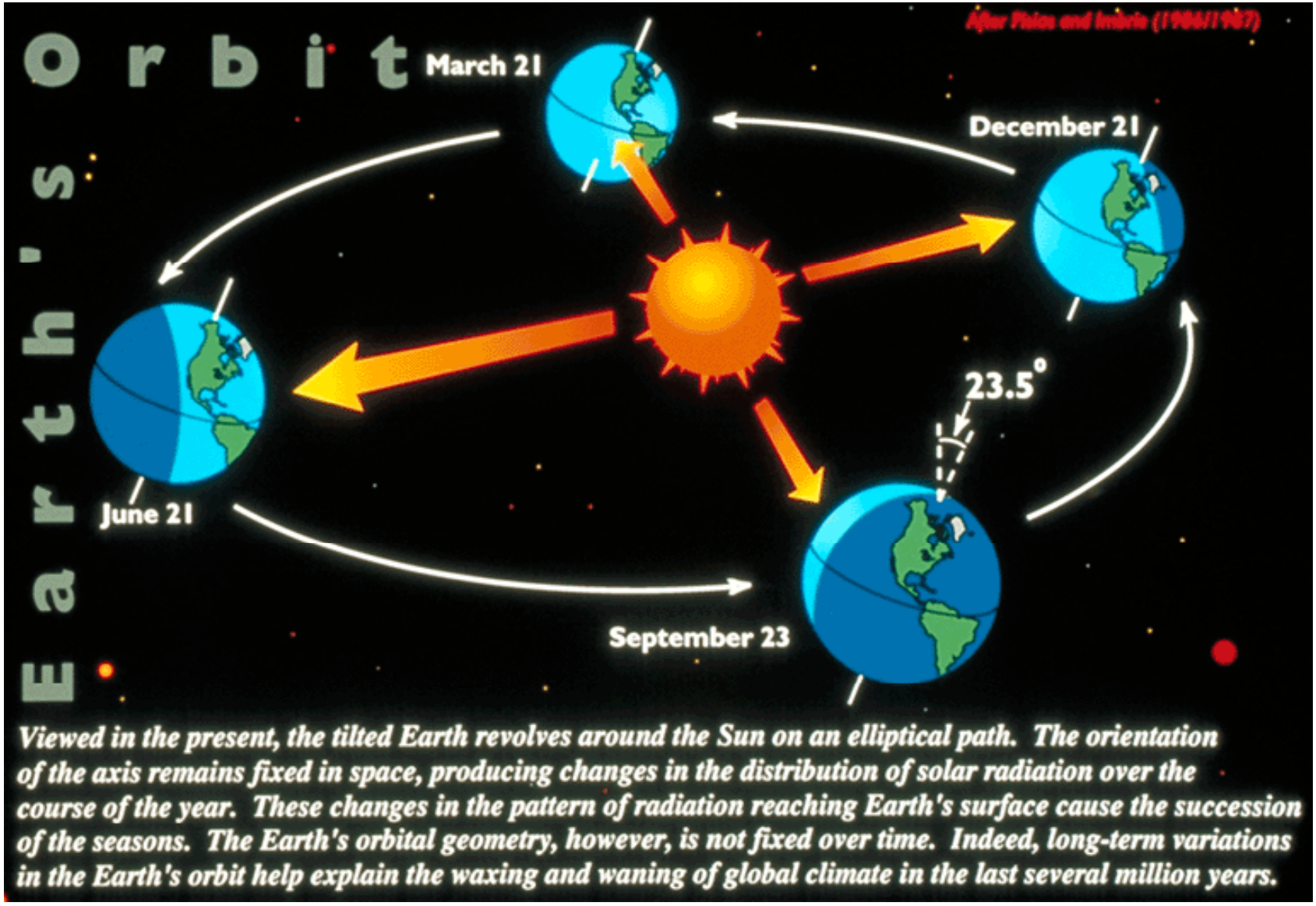
Elementos traços: Mg, Sr, Ba, U, P

Fonte: Decifrando a terra/Teixeira et al. 2000

Effet de serre & Climat

le passé

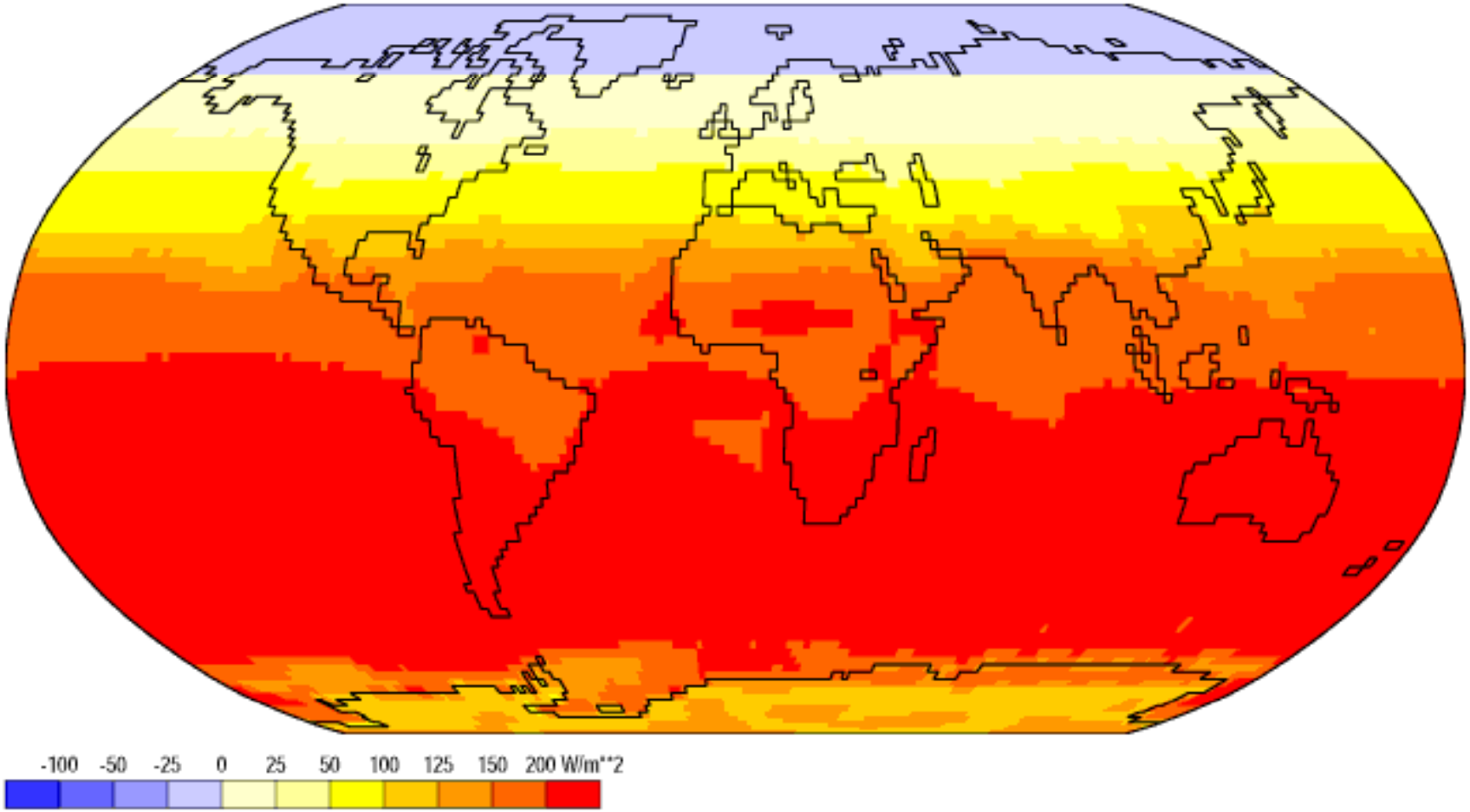




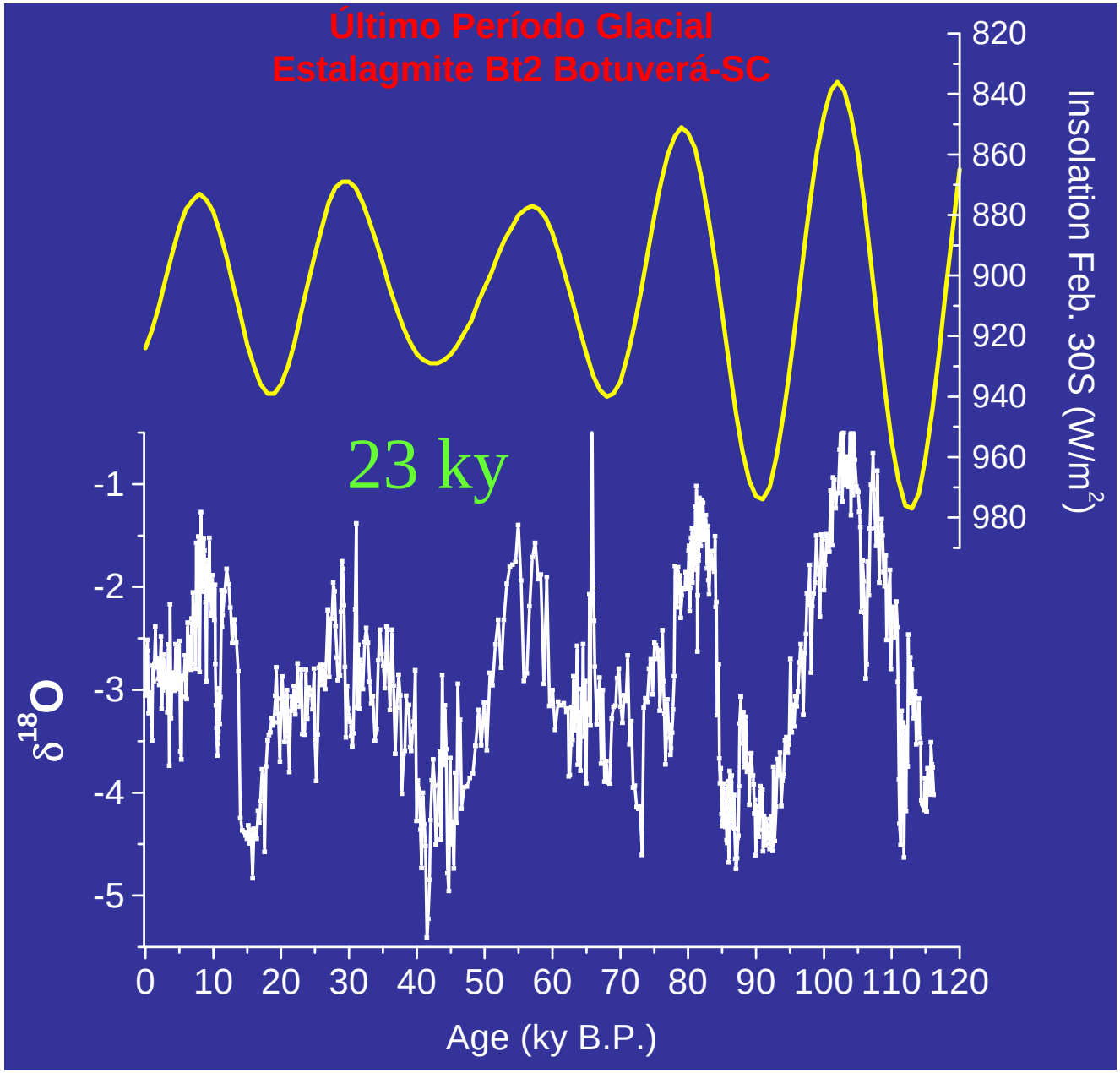
Viewed in the present, the tilted Earth revolves around the Sun on an elliptical path. The orientation of the axis remains fixed in space, producing changes in the distribution of solar radiation over the course of the year. These changes in the pattern of radiation reaching Earth's surface cause the succession of the seasons. The Earth's orbital geometry, however, is not fixed over time. Indeed, long-term variations in the Earth's orbit help explain the waxing and waning of global climate in the last several million years.

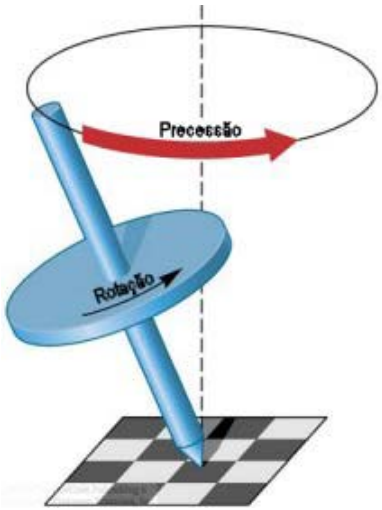
Net Short-Wave Radiation

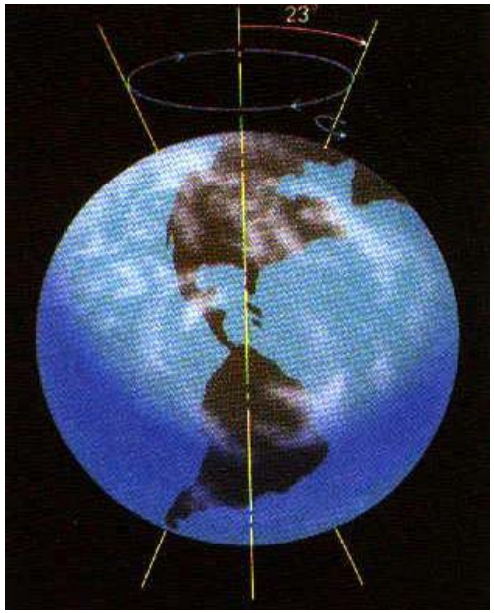
Dec



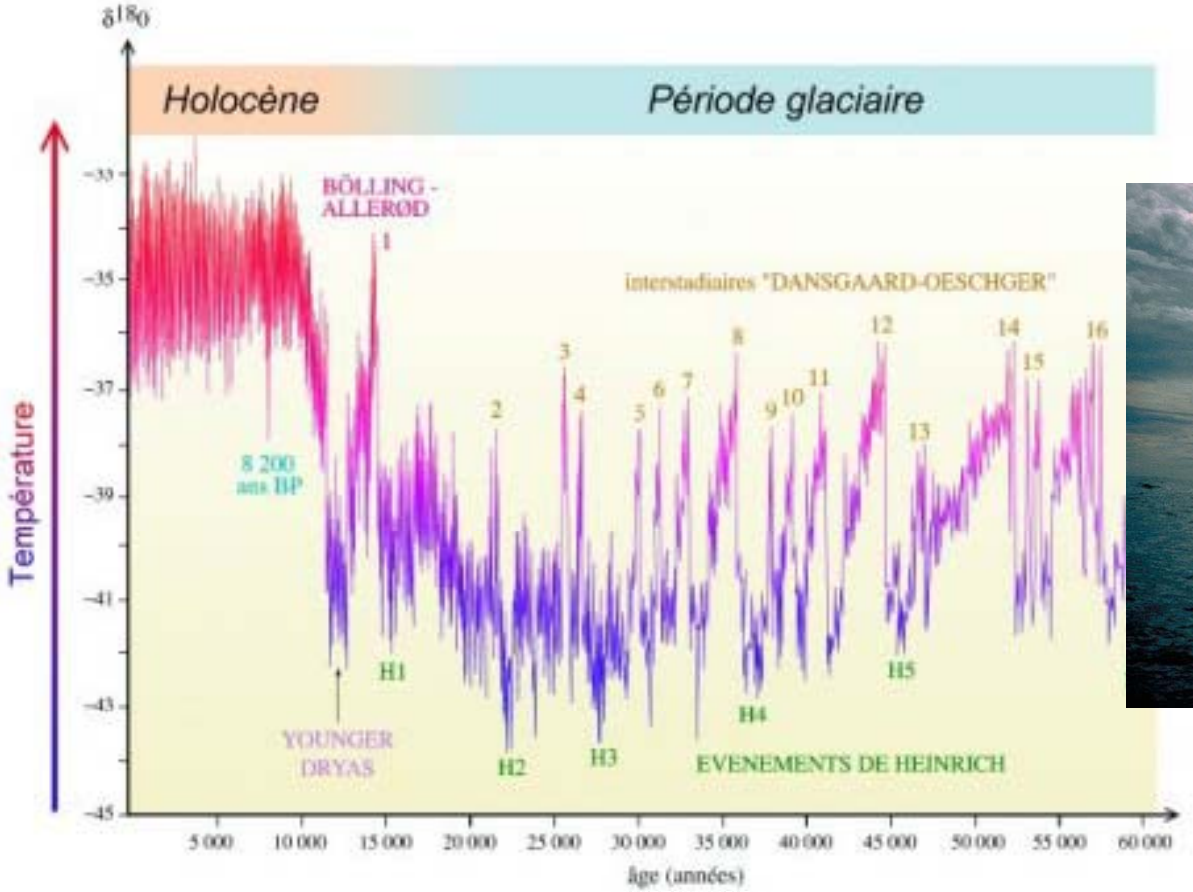
Data: NCEP/NCAR Reanalysis Project, 1959-1997 Climatologies
Animation: Department of Geography, University of Oregon, March 2000

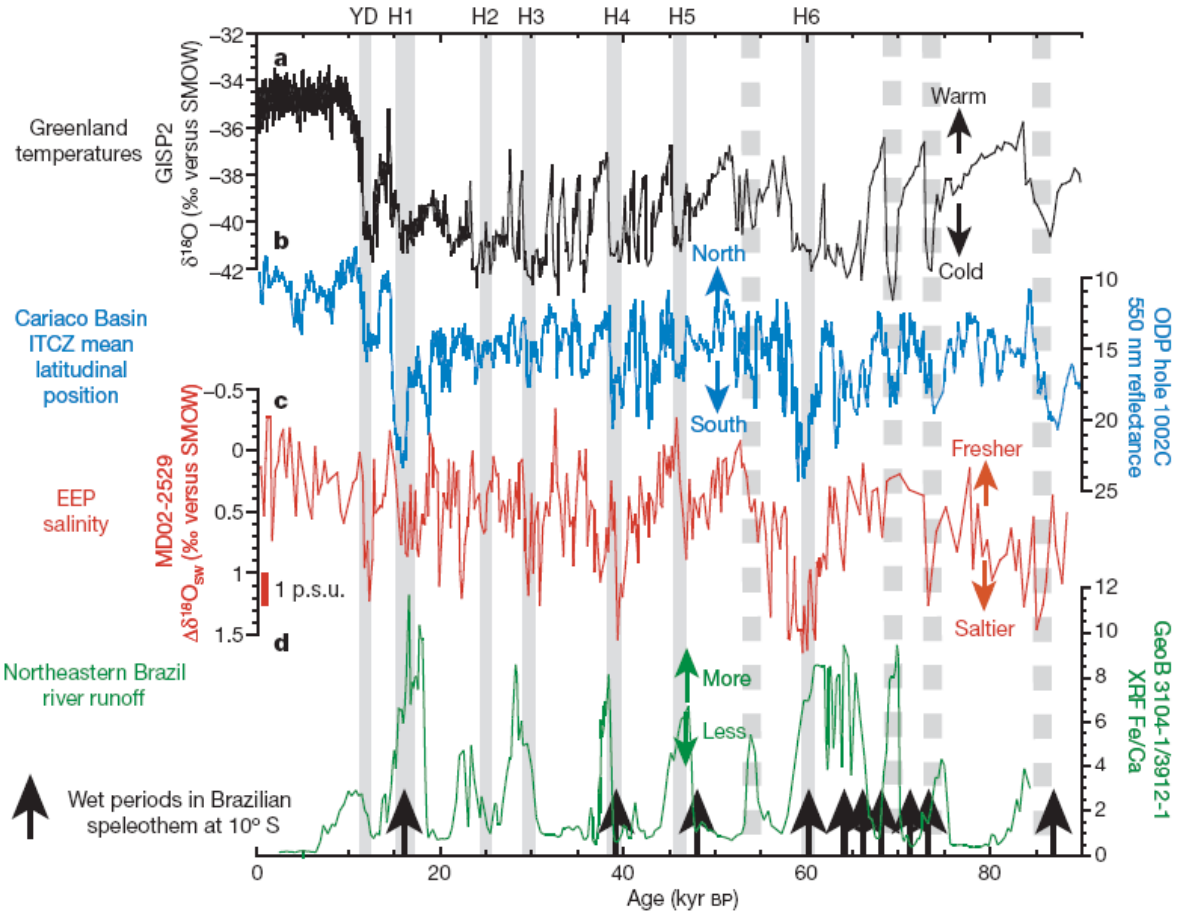


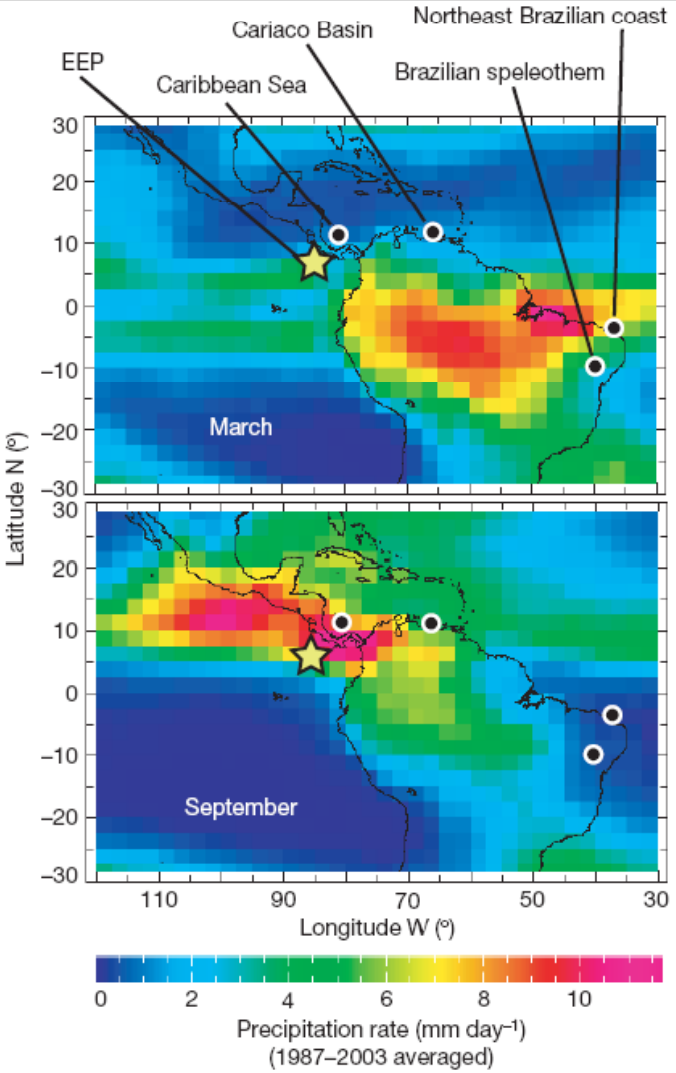




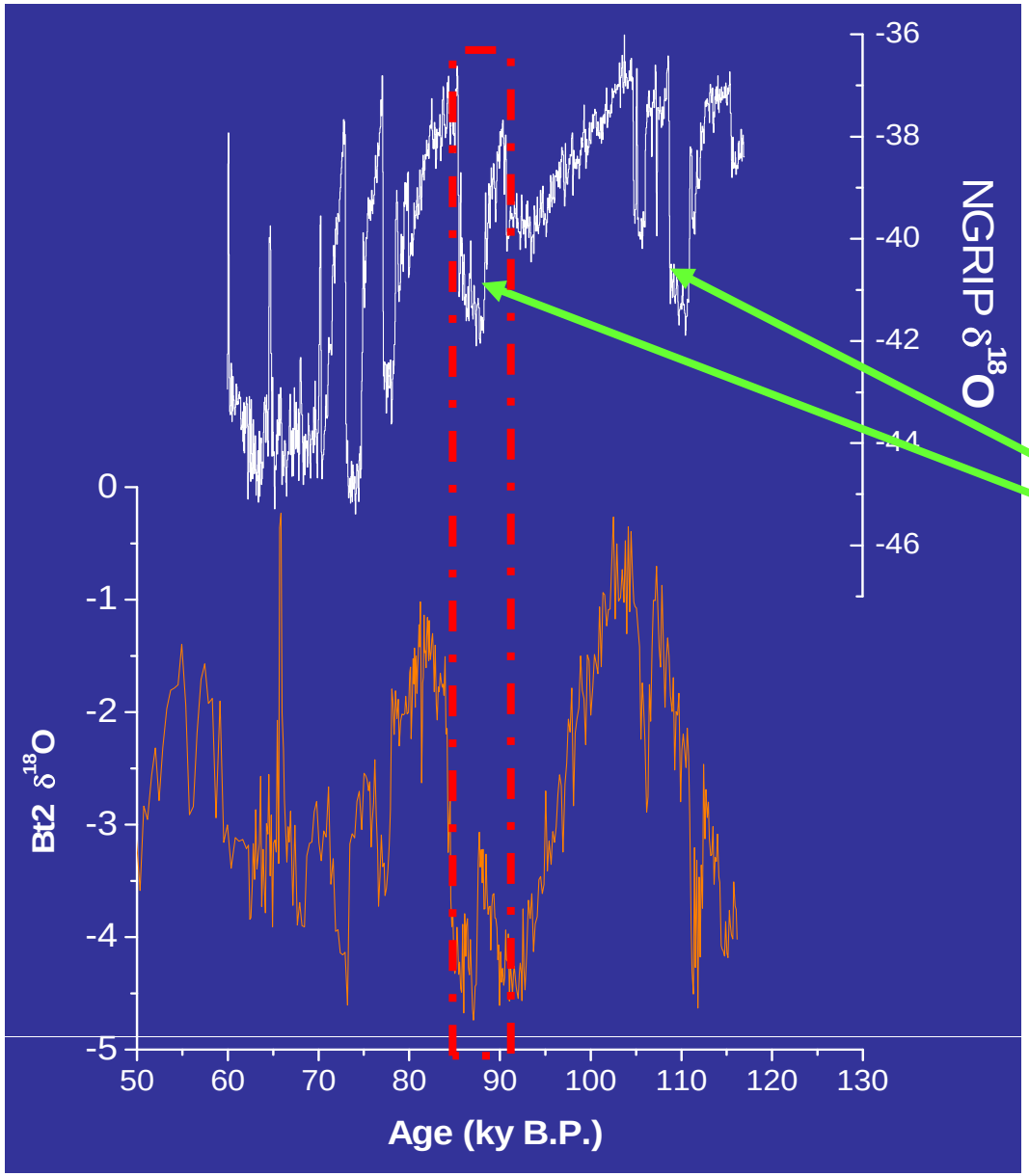
Cruz et al., Nature, 2005


δ18O
Holocène
Période glaciaire
BÖLLING - ALLERØD
interstadiaires "DANSGAARD-OESCHGER"
8 200 ans BP
YOUNGER DRYAS
H1
H2
H3
H4
H5
EVENEMENTS DE HEINRICH
Température
âge (années)





Leduc et al.,Nature. 2007



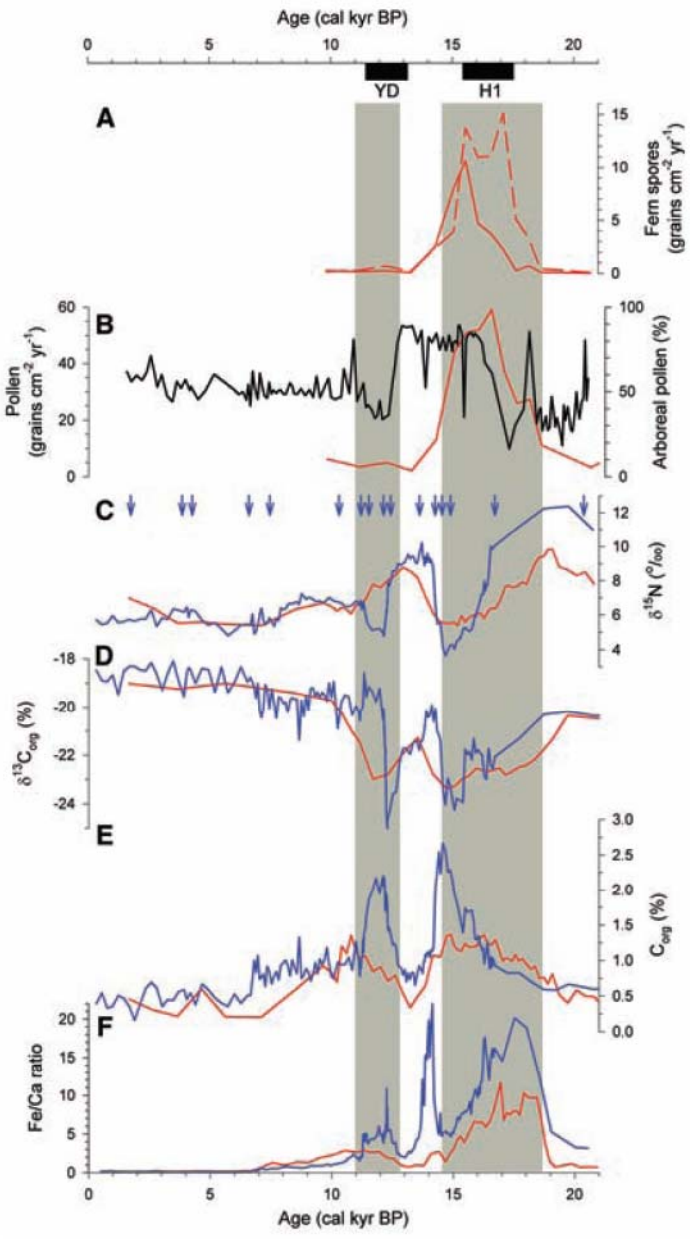
Heinrich events

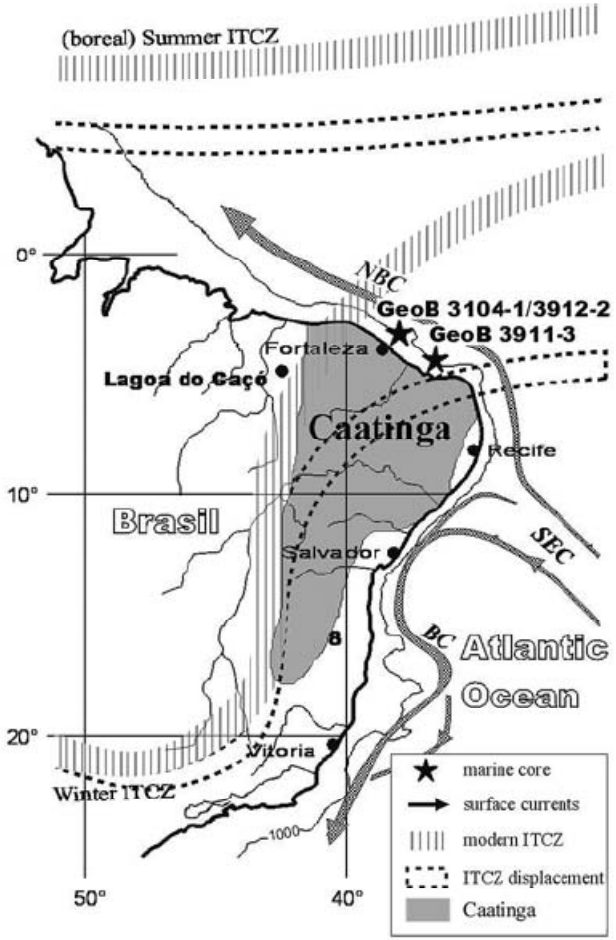
Frio Hemisfério Norte

Intensificação

das monções de verão

Cruz et al., QSR, 2006

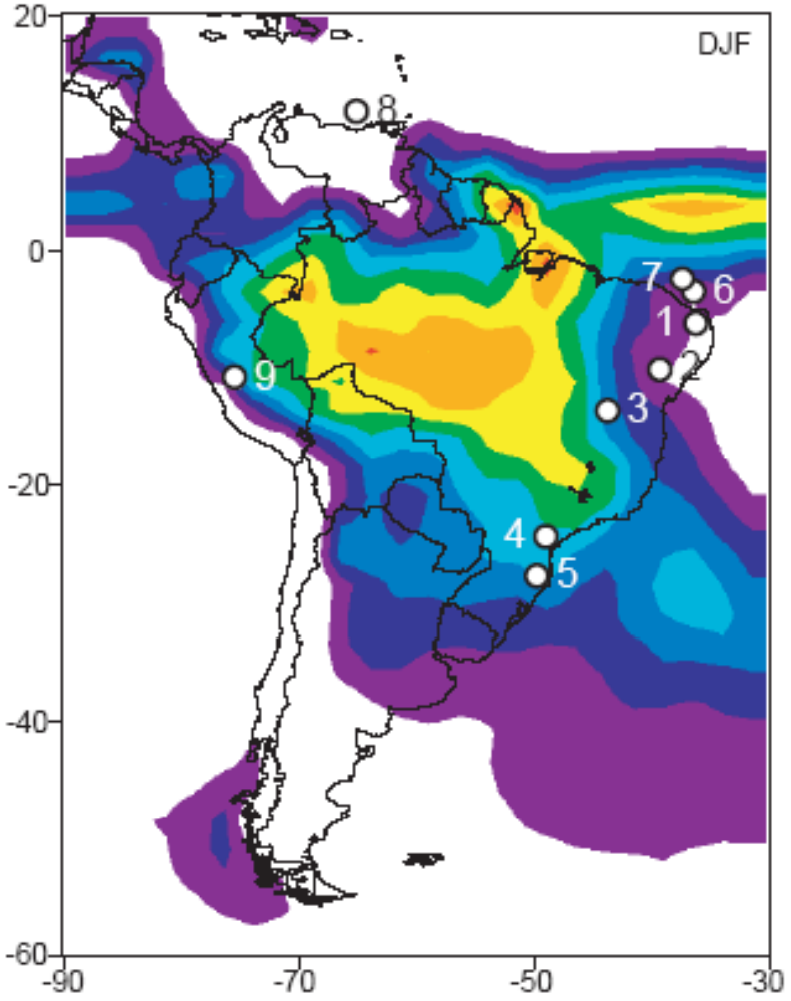




Asynchronous Terrestrial and Marine Signals of Climate Change During Heinrich Events

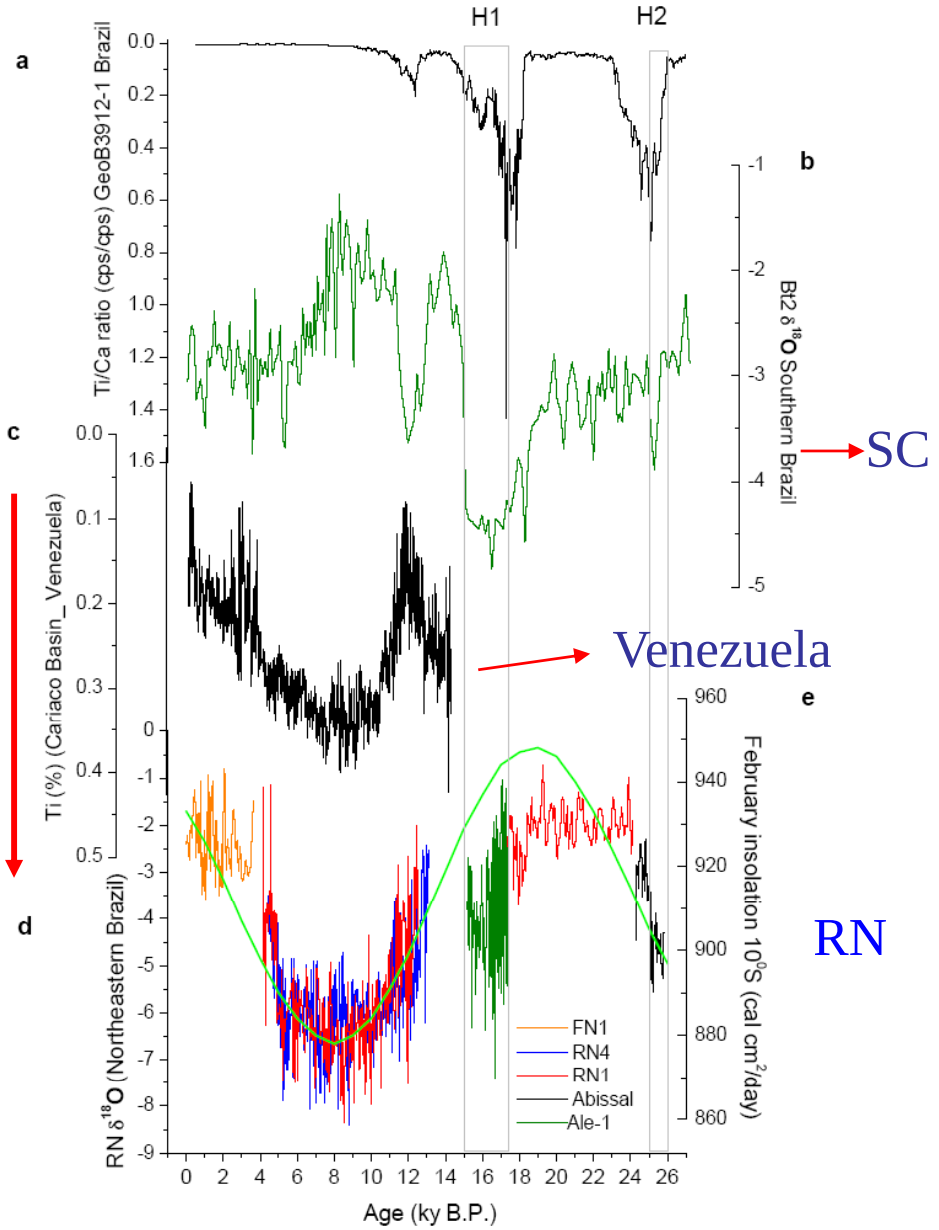
Tim C. Jennerjahn,[1]* Venugopalan Ittekkot,[1] Helge W. Arz,[2] Hermann Behling,[3] Jürgen Pätzold,[3] Gerold Wefer[3]

24 DECEMBER 2004 VOL 306 SCIENCE www.sciencemag.org



Cruz et al., *Nature Geoscience*, 2009

Precipitação



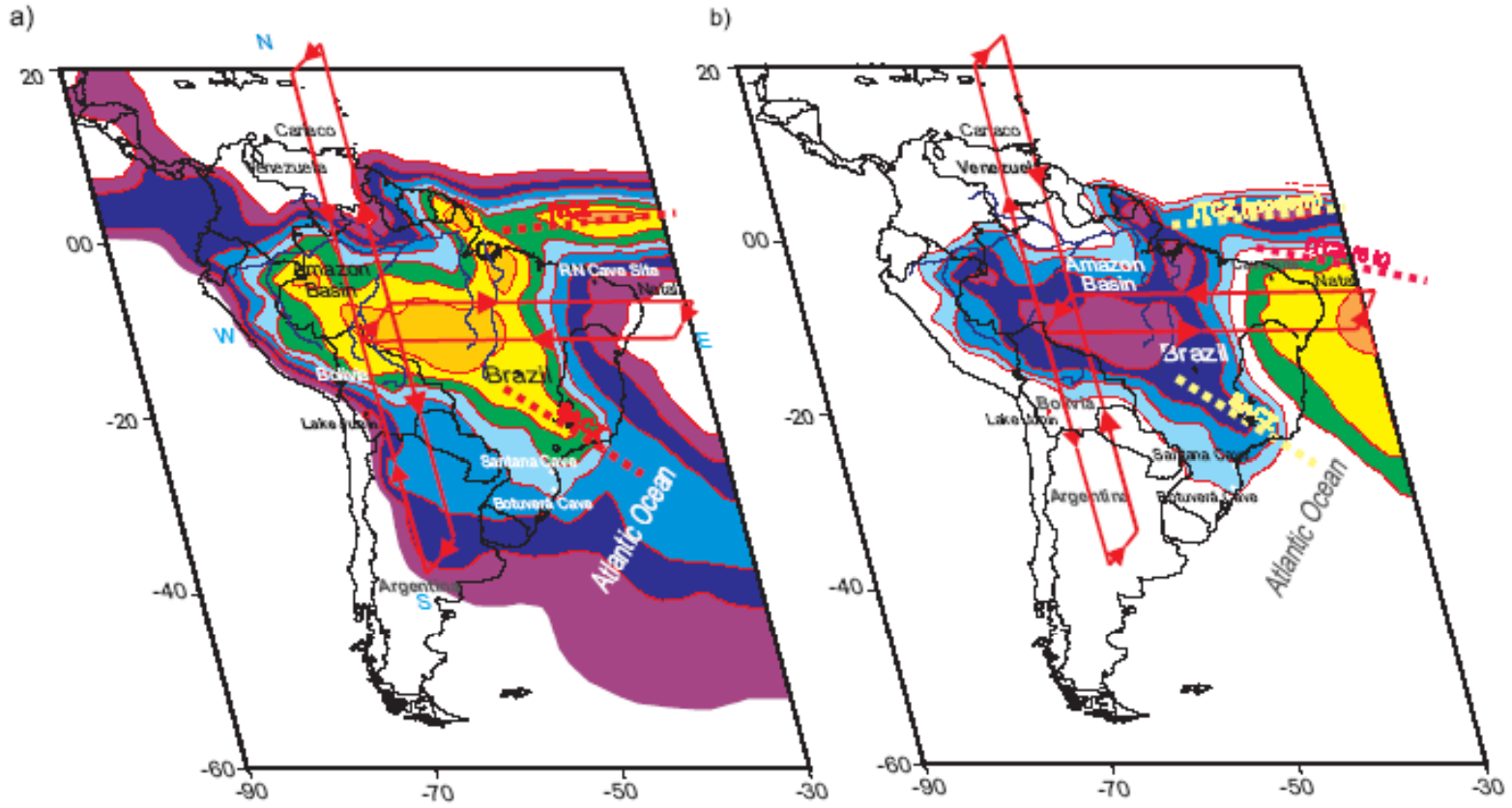
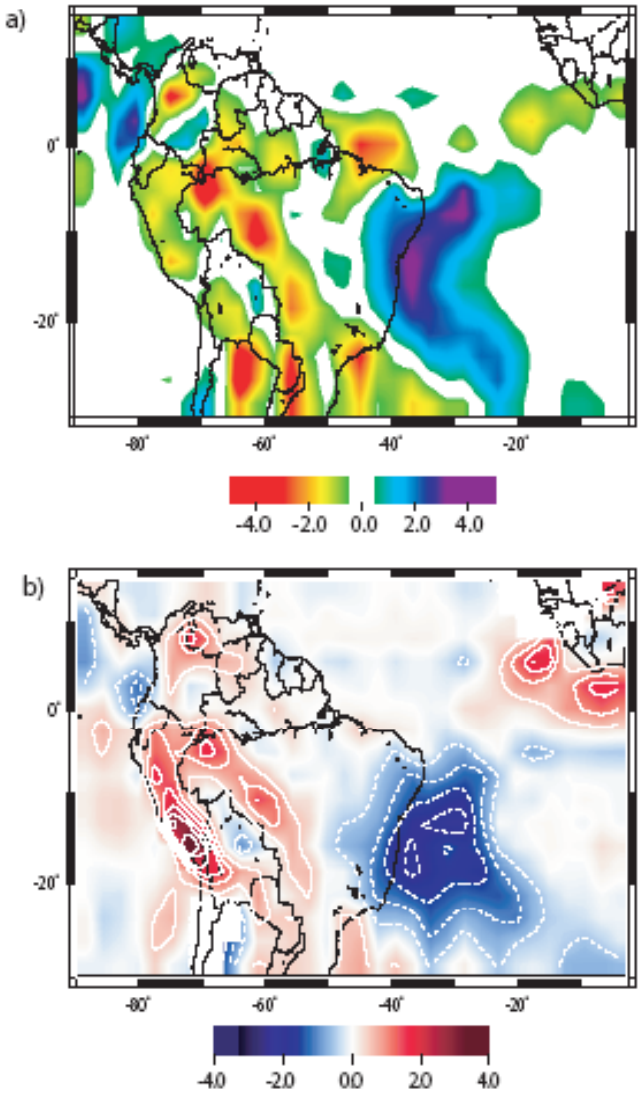


Figure S3: Schematic diagram showing austral summer (DJF) precipitation anomalies (green and yellow colors indicating wet anomalies, blue and purple indicating dry anomalies) in South America and related changes in the anomalous Walker and Hadley circulation for a) high summer insolation in the southern hemisphere during the last 4,000 years (late Holocene), and b) low summer insolation in the southern hemisphere between 9,000 and 6,000 years (early and mid-Holocene).

Cruz et al., *Nature Geoscience*, 2009

Simulações através do ECHAN-4



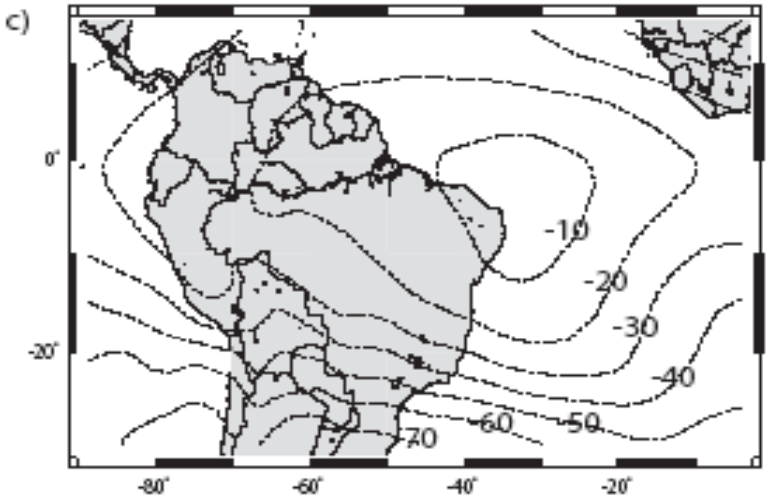
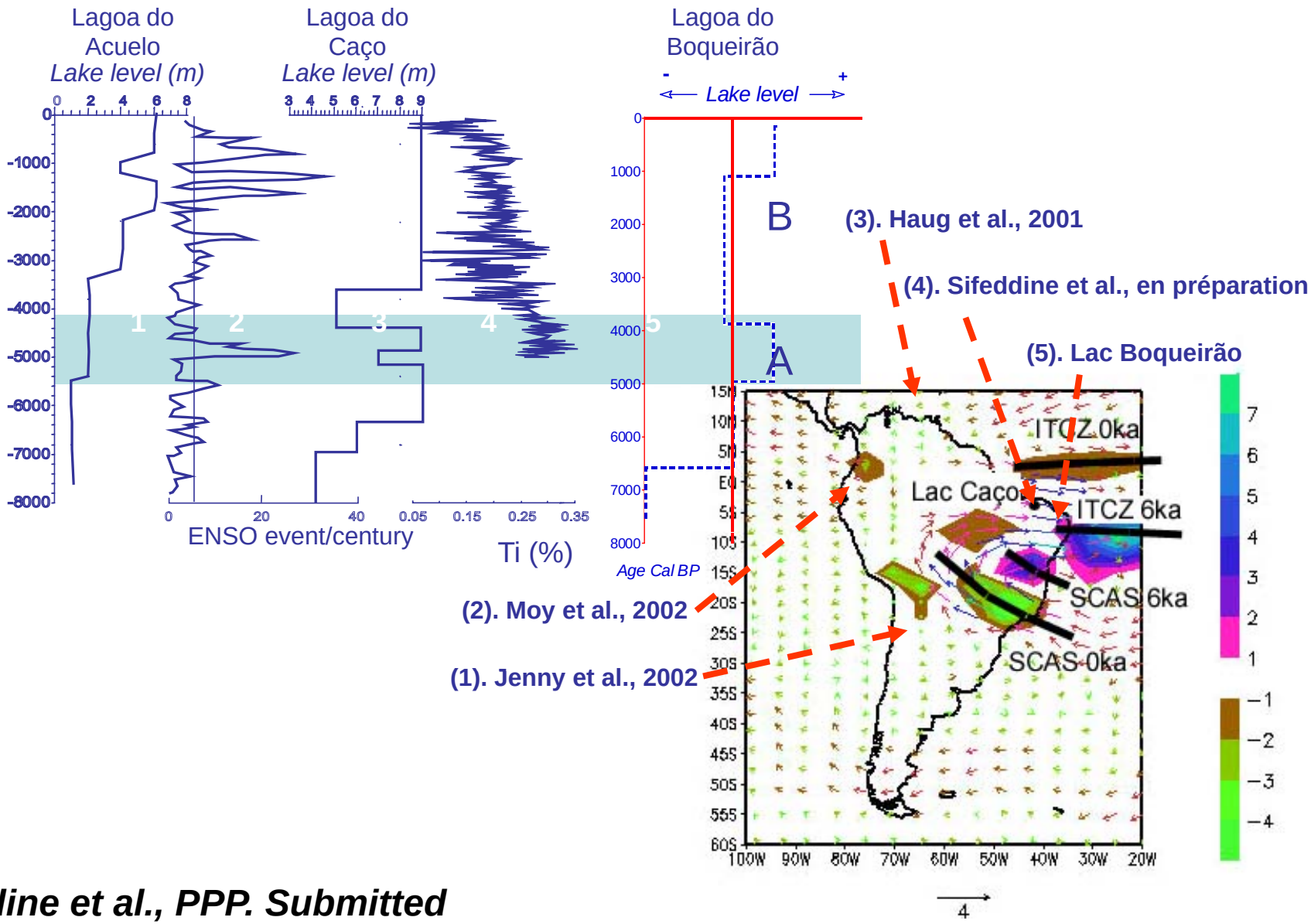
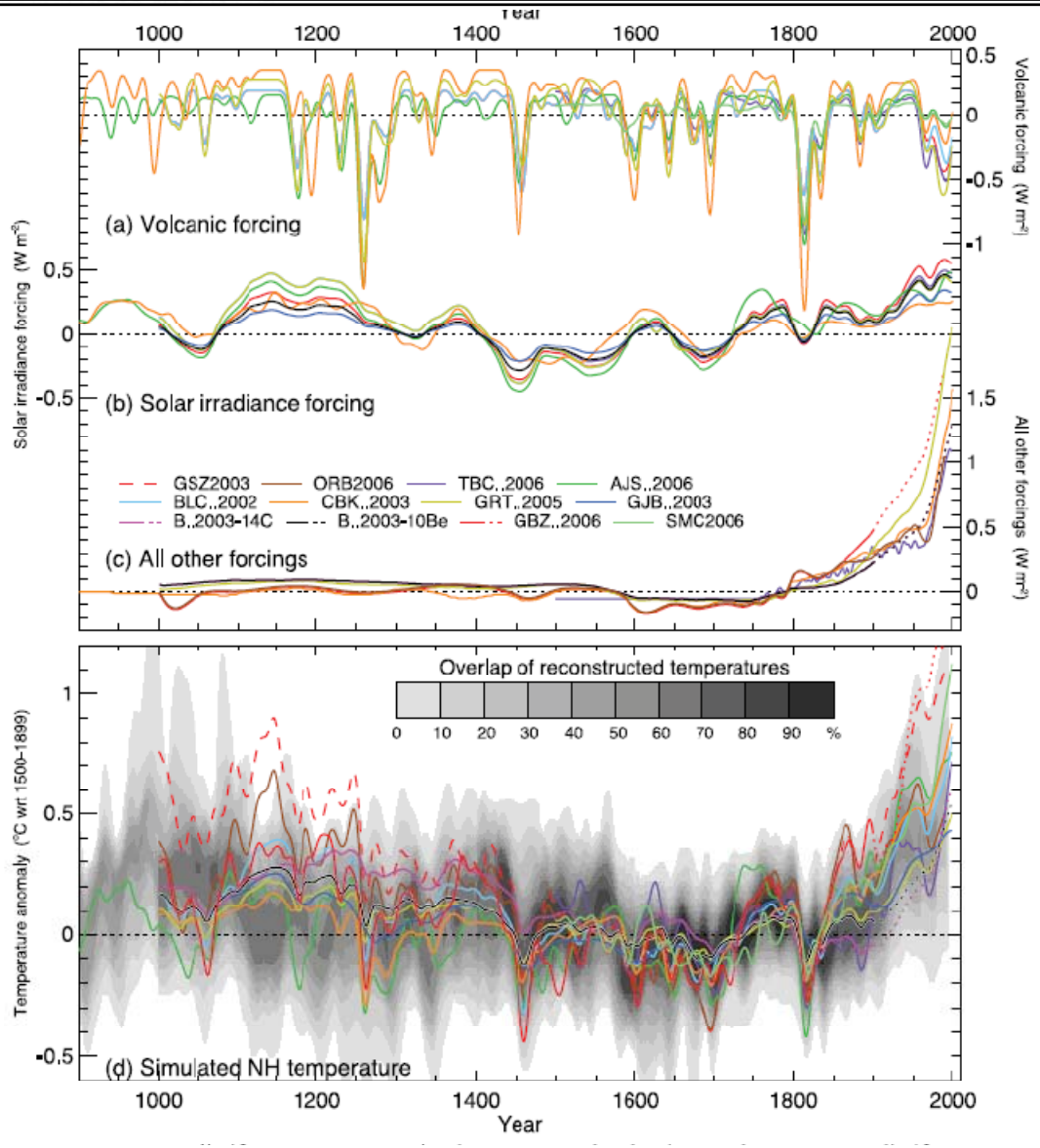


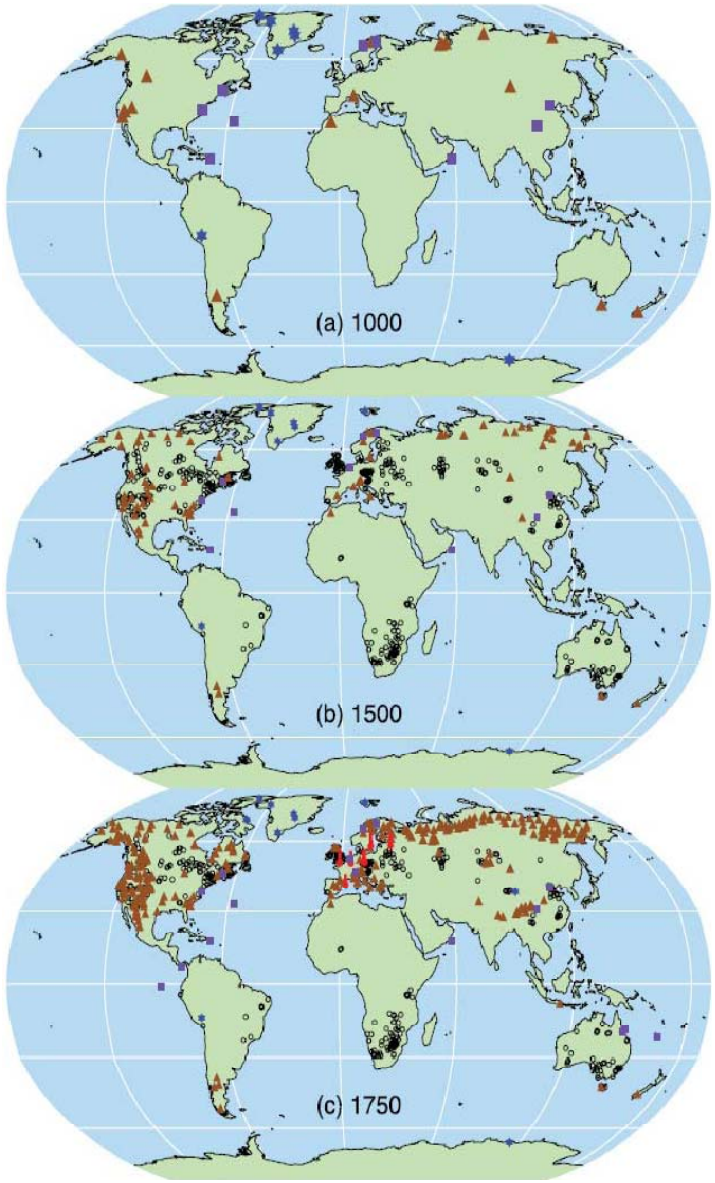
Figure S1: a) Difference in austral summer and fall (DJFMAM) precipitation (in mm/day) betw
B.P. and present as simulated with ECHAM-4 (Hoffmann et al., 1998). The control run is based
year integration forced with modern SSTs and greenhouse gases; the mid-Holocene simulation
integration based on orbital configuration at 6 ky B.P. and preindustrial greenhouse gas levels,
modern vegetation and SST. b) as in a) but for $\delta^{18}O$ (in permil). Contour interval is 0.5 permil,
omitted and negative contours are dashed. c) as in a) but for 250 hPa geopotential height with c
interval of 10 m and negative contours dashed.

Cruz et al., *Nature Geoscience*, 2009



Sifeddine et al., PPP. Submitted


Year
1000
1200
1400
1600
1800
2000
(a) Volcanic forcing
(b) Solar irradiance forcing
(c) All other forcings
Solar irradiance forcing (W m⁻²)
Volcanic forcing (W m⁻²)
All other forcings (W m⁻²)
GSZ2003
ORB2006
TBC.,2006
AJS.,2006
BLC.,2002
CBK.,2003
GRT.,2005
GJB.,2003
B.,2003-14C
B.,2003-10Be
GBZ.,2006
SMC2006
Overlap of reconstructed temperatures
0 10 20 30 40 50 60 70 80 90 %
Temperature anomaly (°C wrt 1500-1899)
(d) Simulated NH temperature
Year


(a) 1000
(b) 1500
(c) 1750

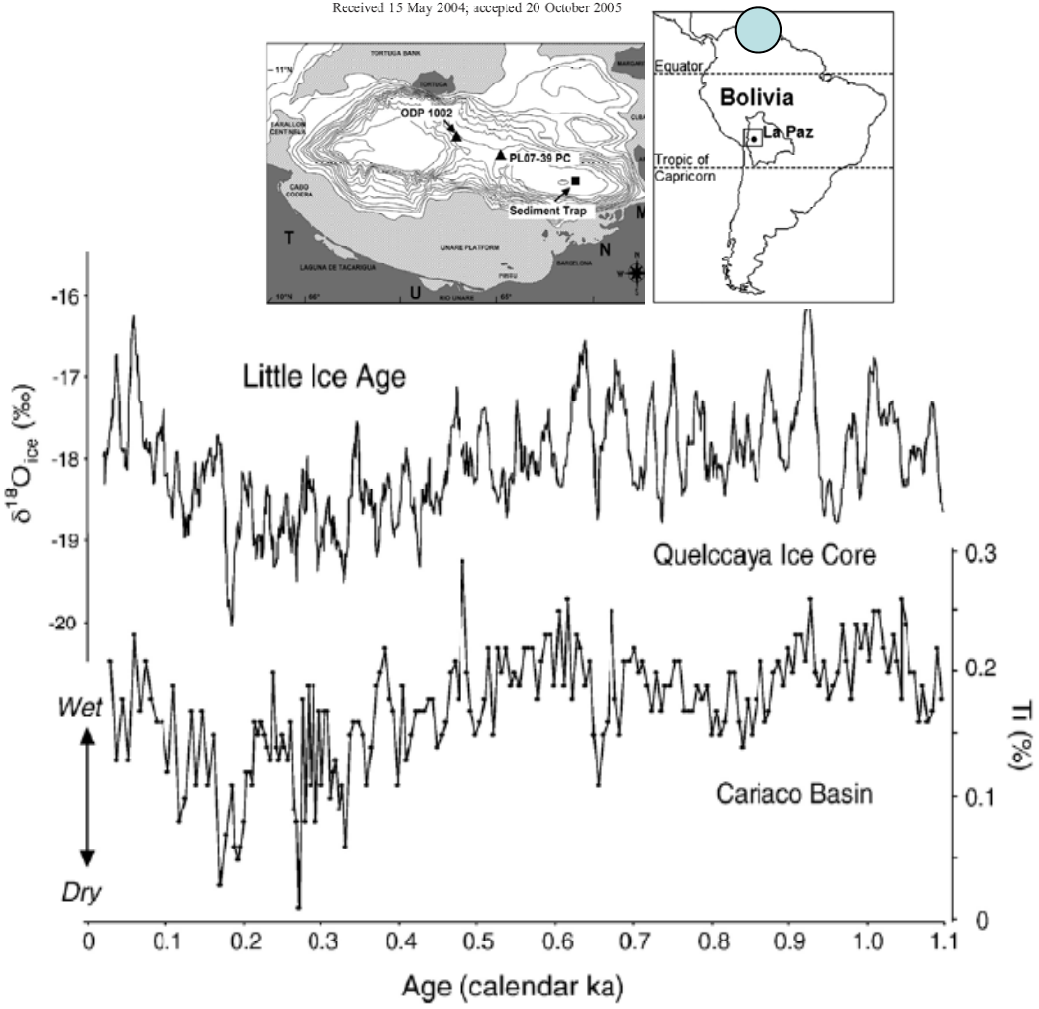
IPCC 2007

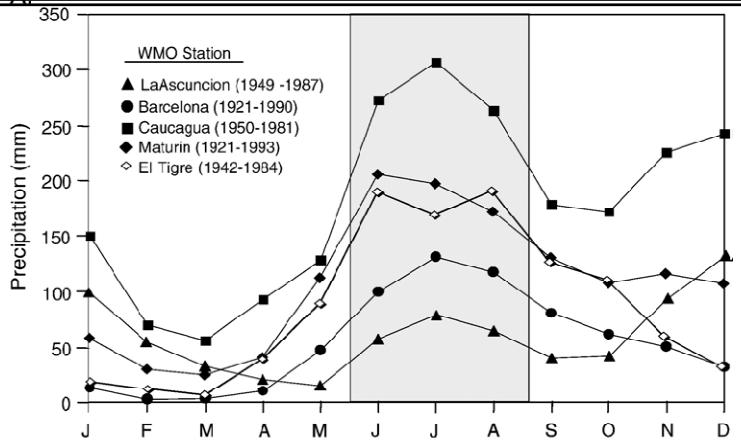
Variability in the mean latitude of the Atlantic Intertropical Convergence Zone as recorded by riverine input of sediments to the Cariaco Basin (Venezuela)

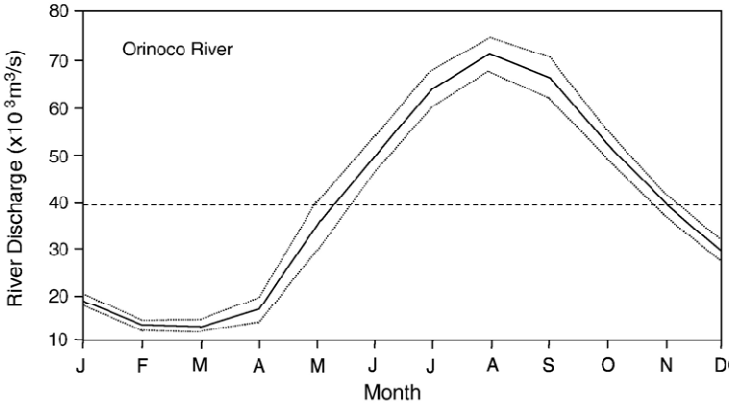
Larry C. Peterson [a,*], Gerald H. Haug [b]

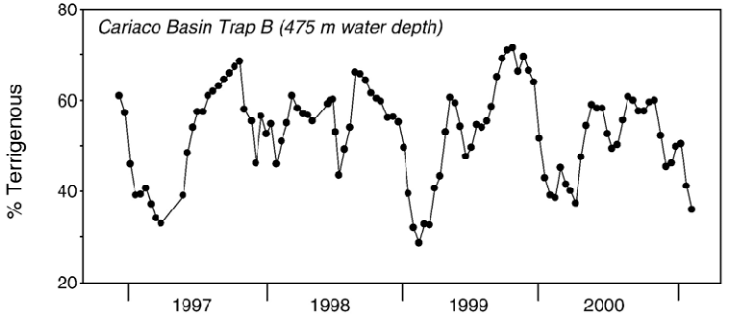
[a] Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, USA
[b] Geoforschungszentrum Potsdam, Potsdam D-14473, Germany

Received 15 May 2004; accepted 20 October 2005

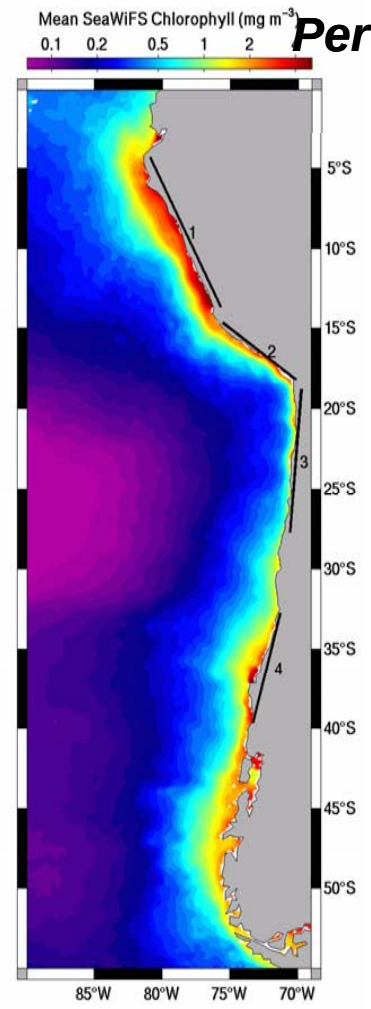




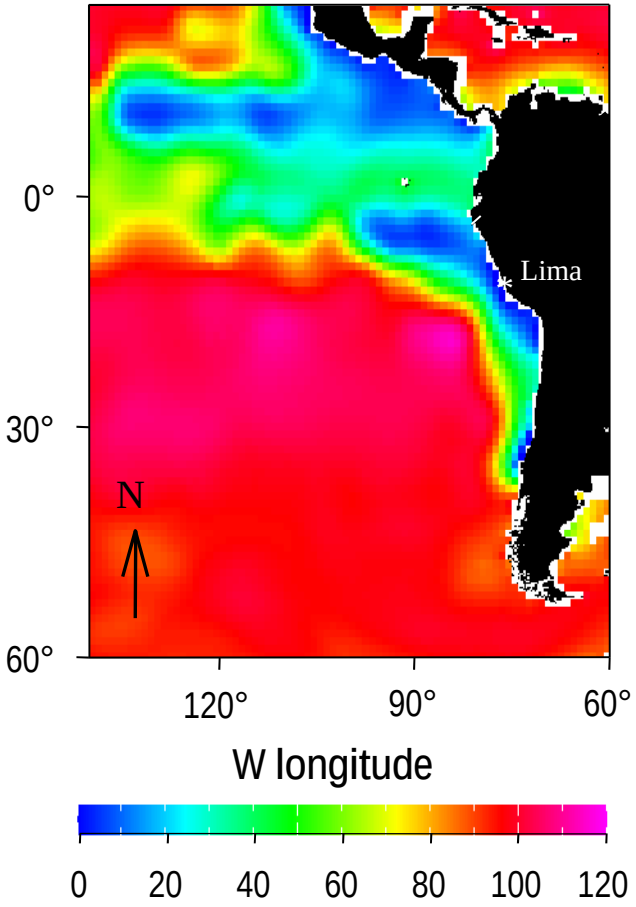




Peruvian continental margin characteristics

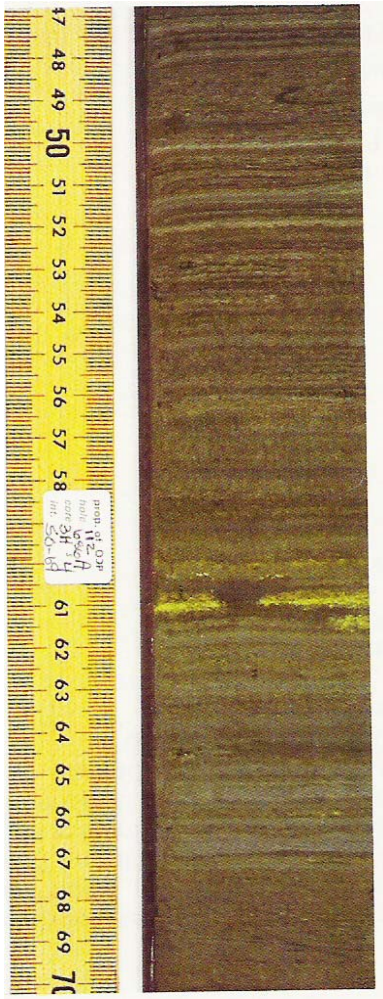


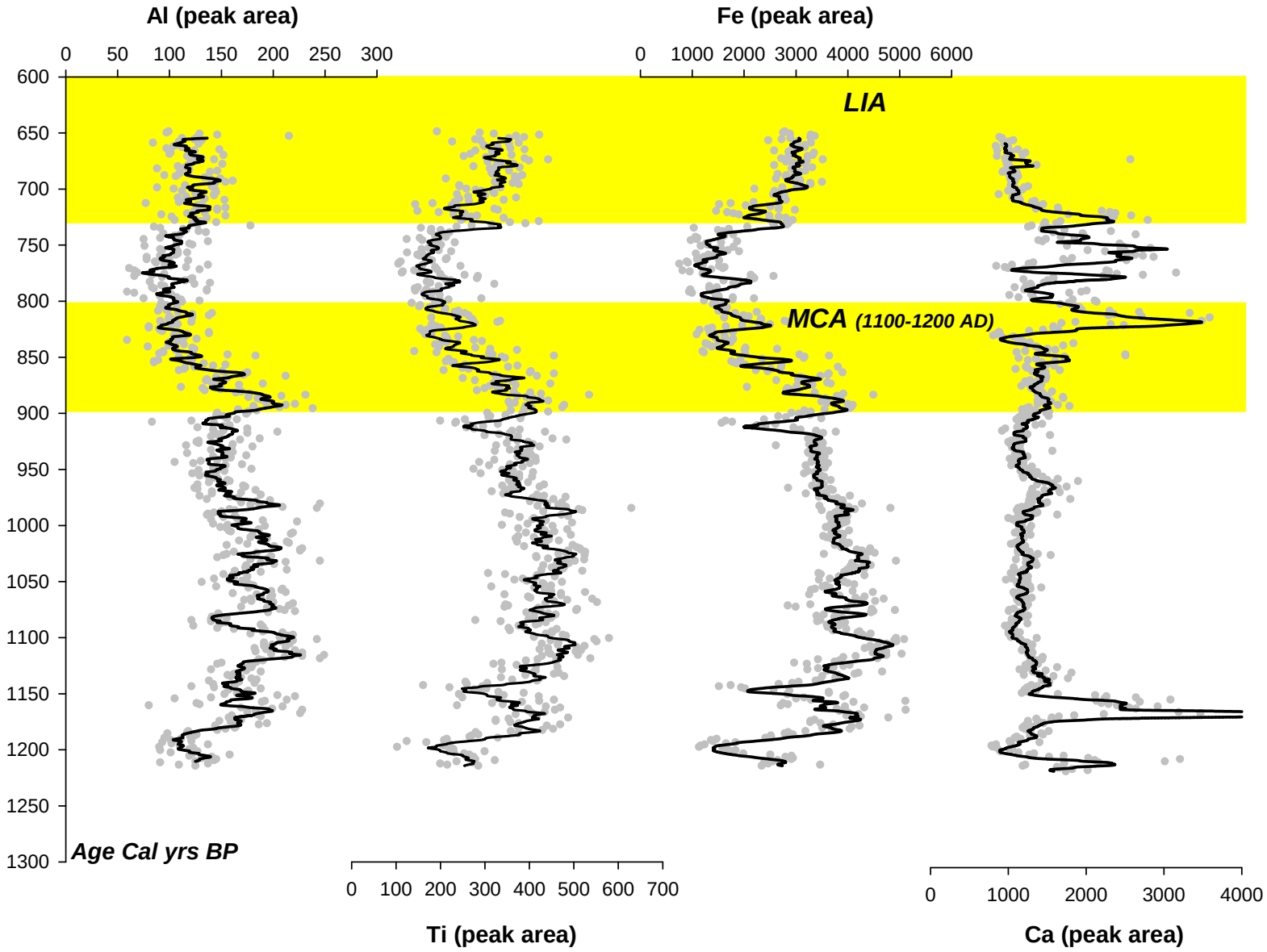
Chlorophyll-a concentration (mg m^{-3})



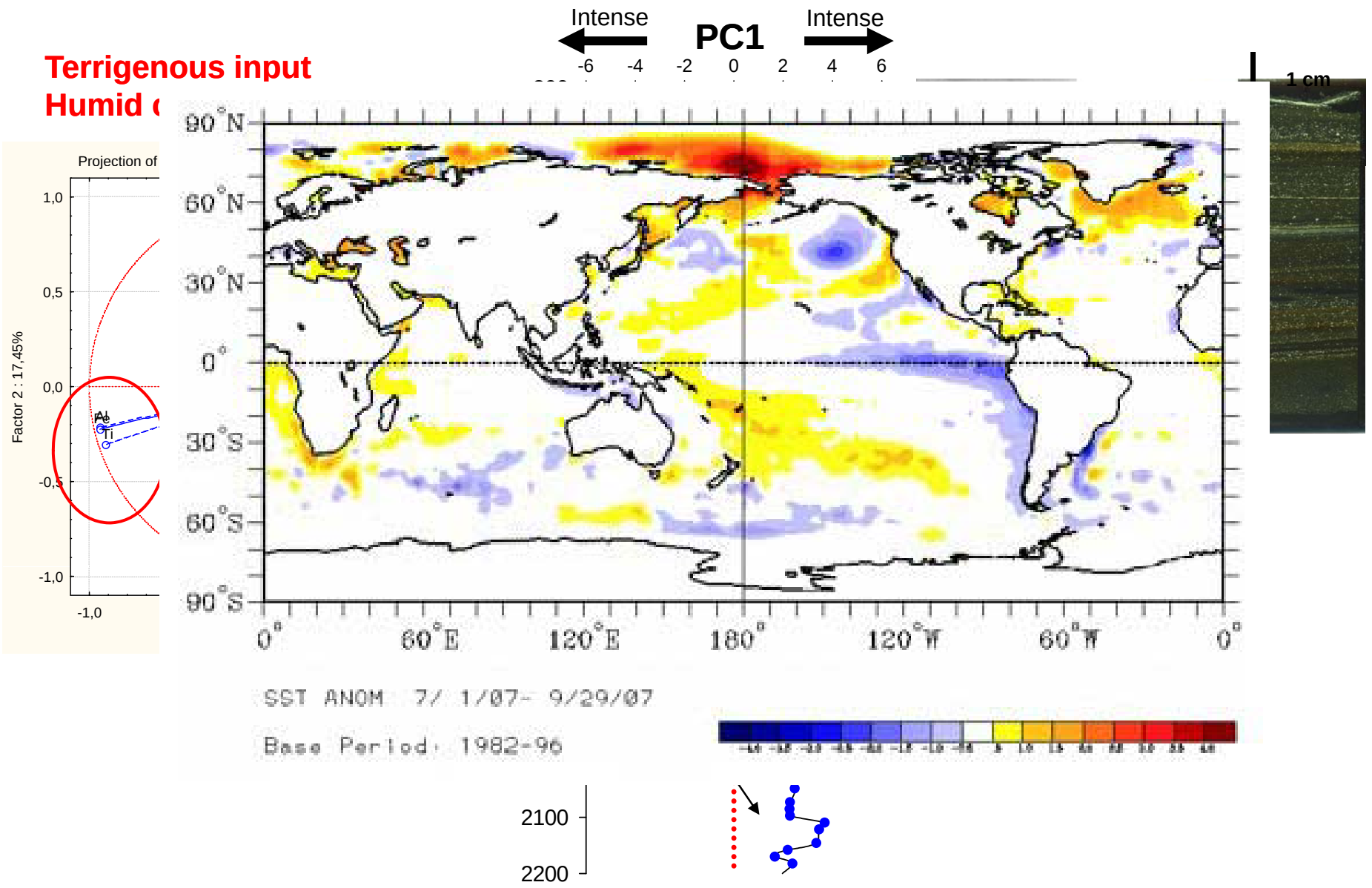
Dissolved oxygen (% saturation) 100 m depth

Sediments without bioturbation




Al (peak area)
0 50 100 150 200 250 300
Fe (peak area)
0 1000 2000 3000 4000 5000 6000
LIA
MCA (1100-1200 AD)
600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300
Age Cal yrs BP
0 100 200 300 400 500 600 700
Ti (peak area)
0 1000 2000 3000 4000
Ca (peak area)

Terrigenous input ***Productivity***

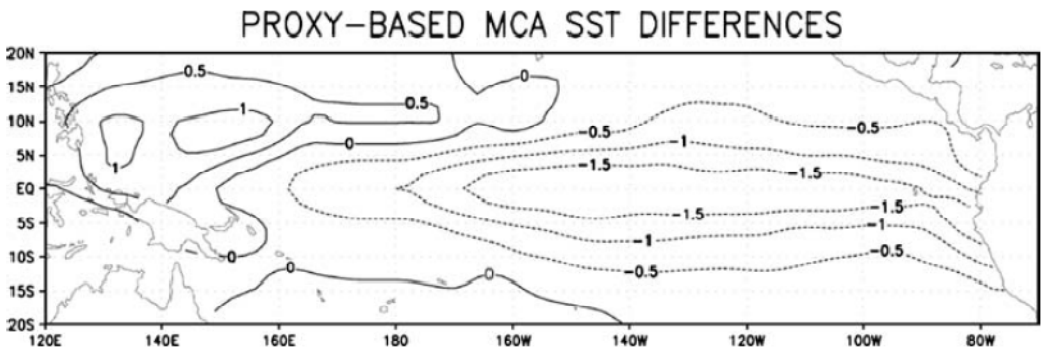


Sifeddine et al., Progress In Oceanography. Submitted

Climatic Change (2007) 83:241–285
DOI 10.1007/s10584-007-9239-2

Tropical Pacific – mid-latitude teleconnections in medieval times

Nicholas E. Graham • Malcolm K. Hughes •
Caspar M. Ammann • Kim M. Cobb •
Martin P. Hoerling • Douglas J. Kennett •
James P. Kennett • Bert Rein • Lowell Stott •
Peter E. Wigand • Taiyi Xu



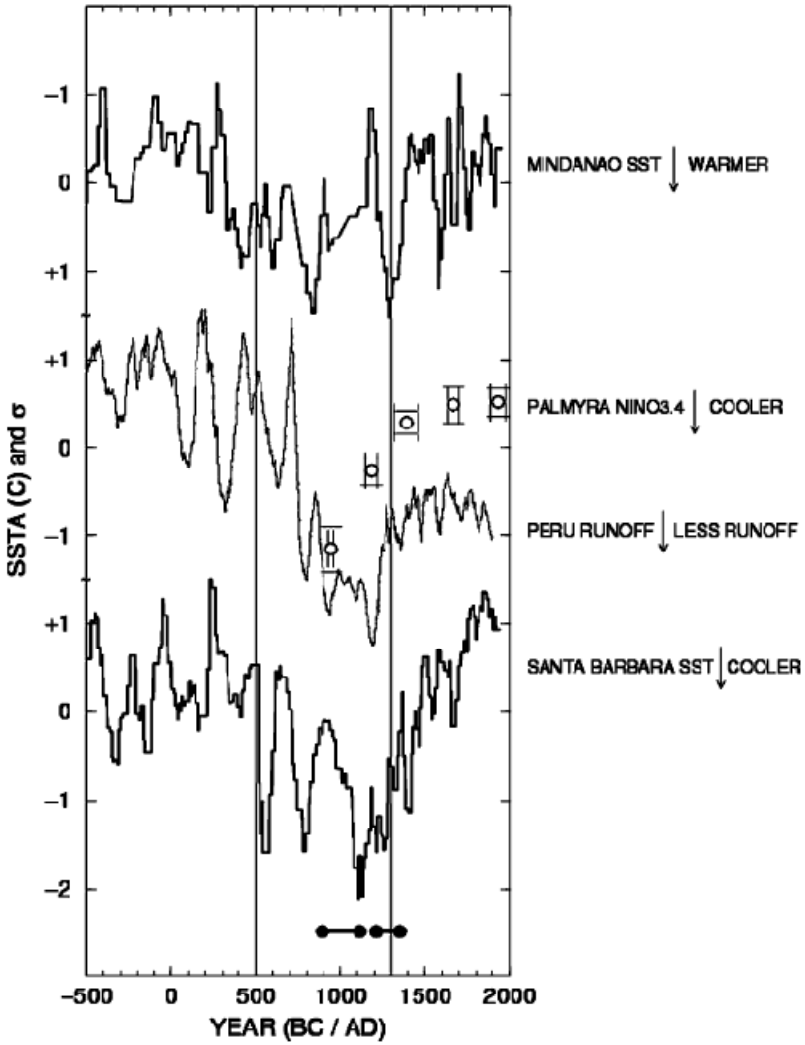
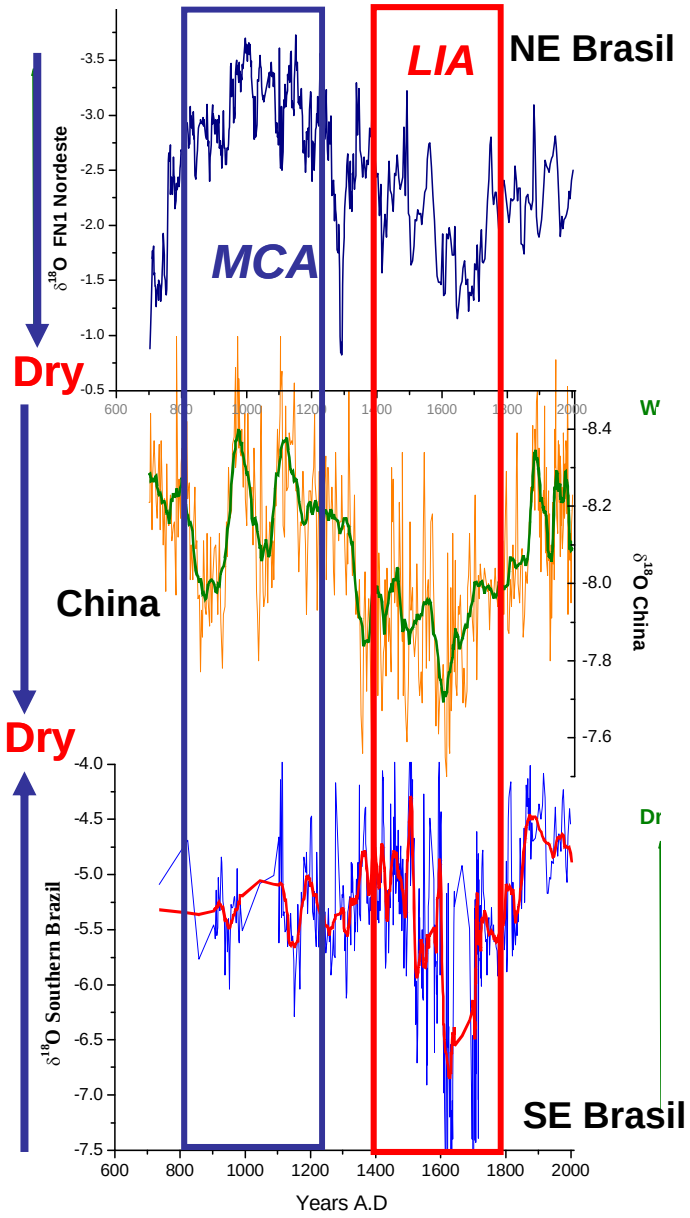


Fig. 2 Proxy-inferred tropical MCA Pacific SST pattern used for CCM3 experiments; values are differences (*C*) from modern averages

in the western plains. This Medieval Climate Anomaly (MCA) was followed by wetter conditions and warming coastal SSTs during the transition into the "Little Ice Age" (LIA). Proxy records from the tropical Pacific Ocean show contemporaneous changes indicating cool central and eastern tropical Pacific SSTs during the MCA, with warmer than modern temperatures in the western equatorial Pacific. This pattern of mid-latitude and tropical

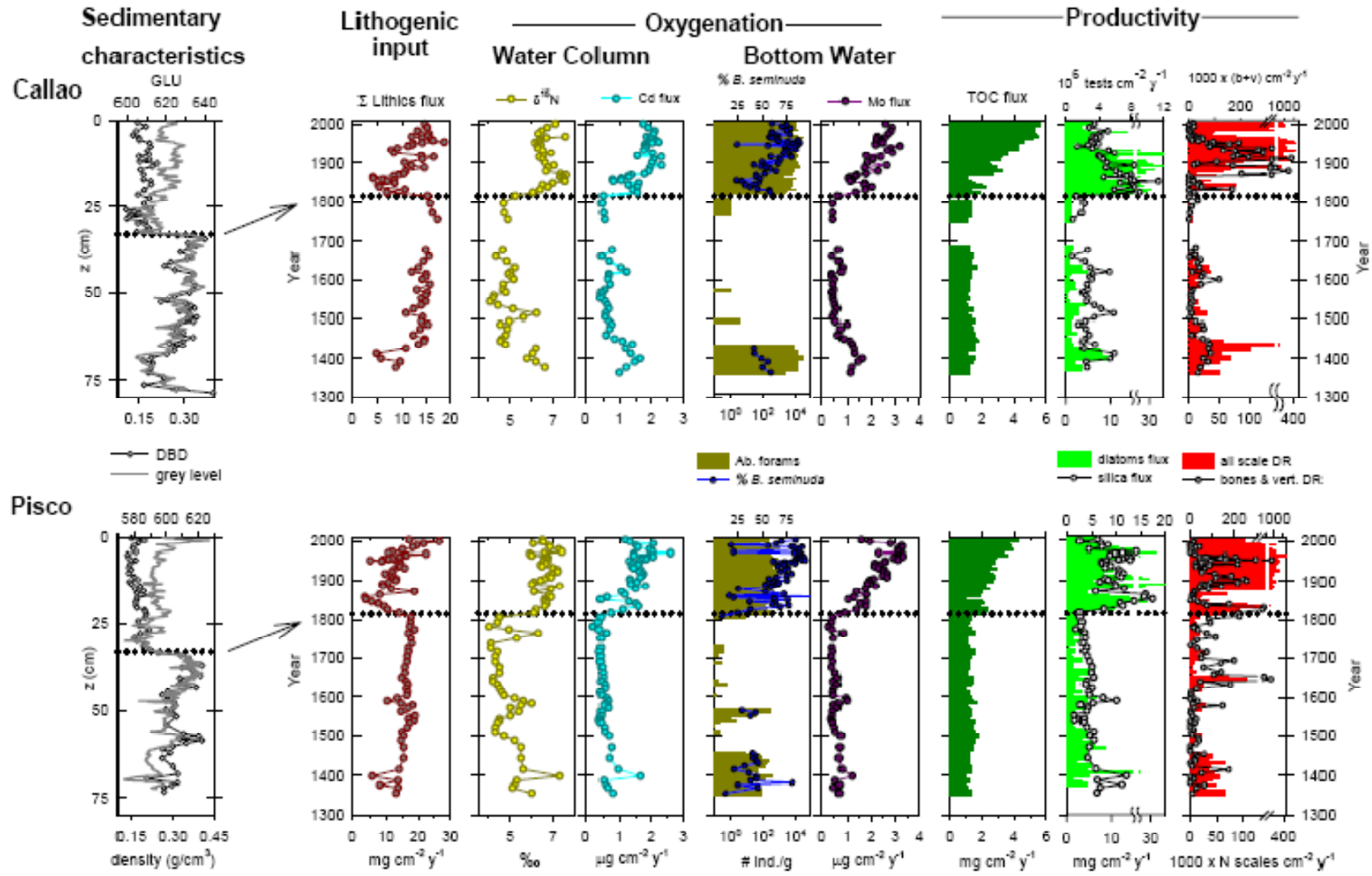

NE Brasil
LIA
MCA
δ18O FN1 Nordeste
Dry
China
δ18O China
Dry
δ18O Southern Brazil
SE Brasil
Years A.D

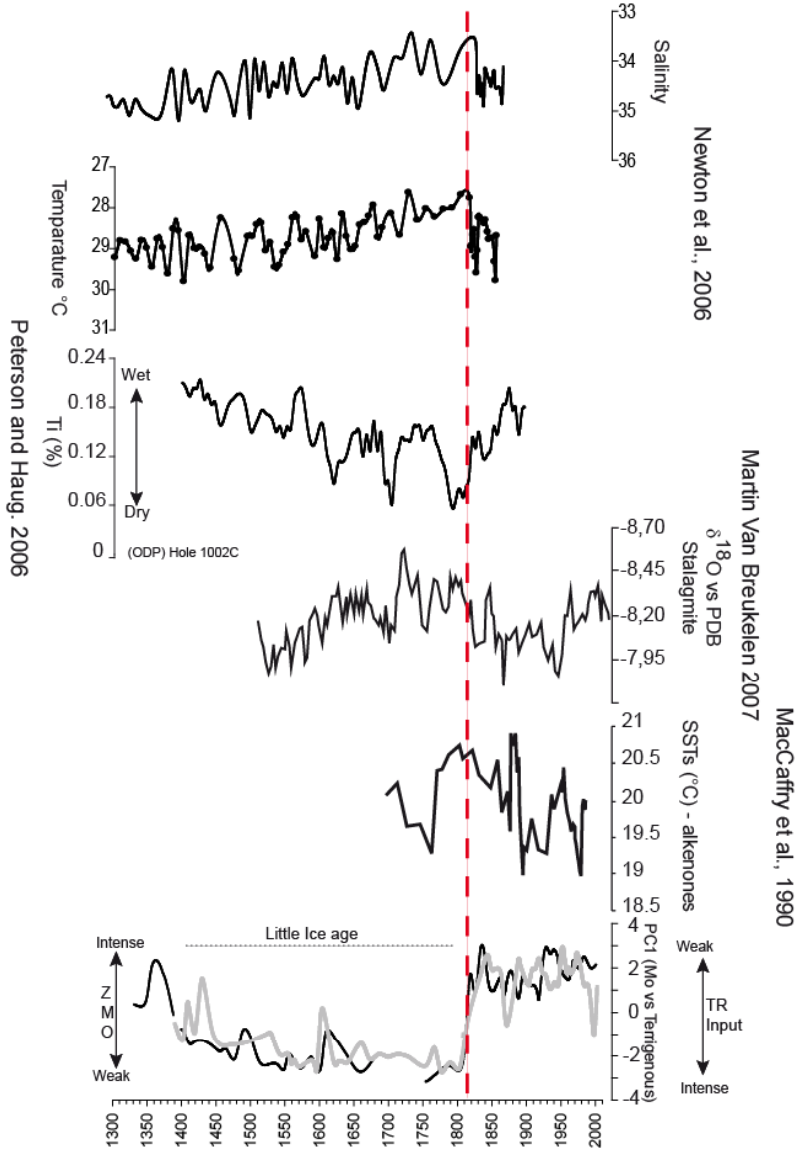
Rapid reorganization in ocean biogeochemistry off Peru towards the end of the Little Ice Age

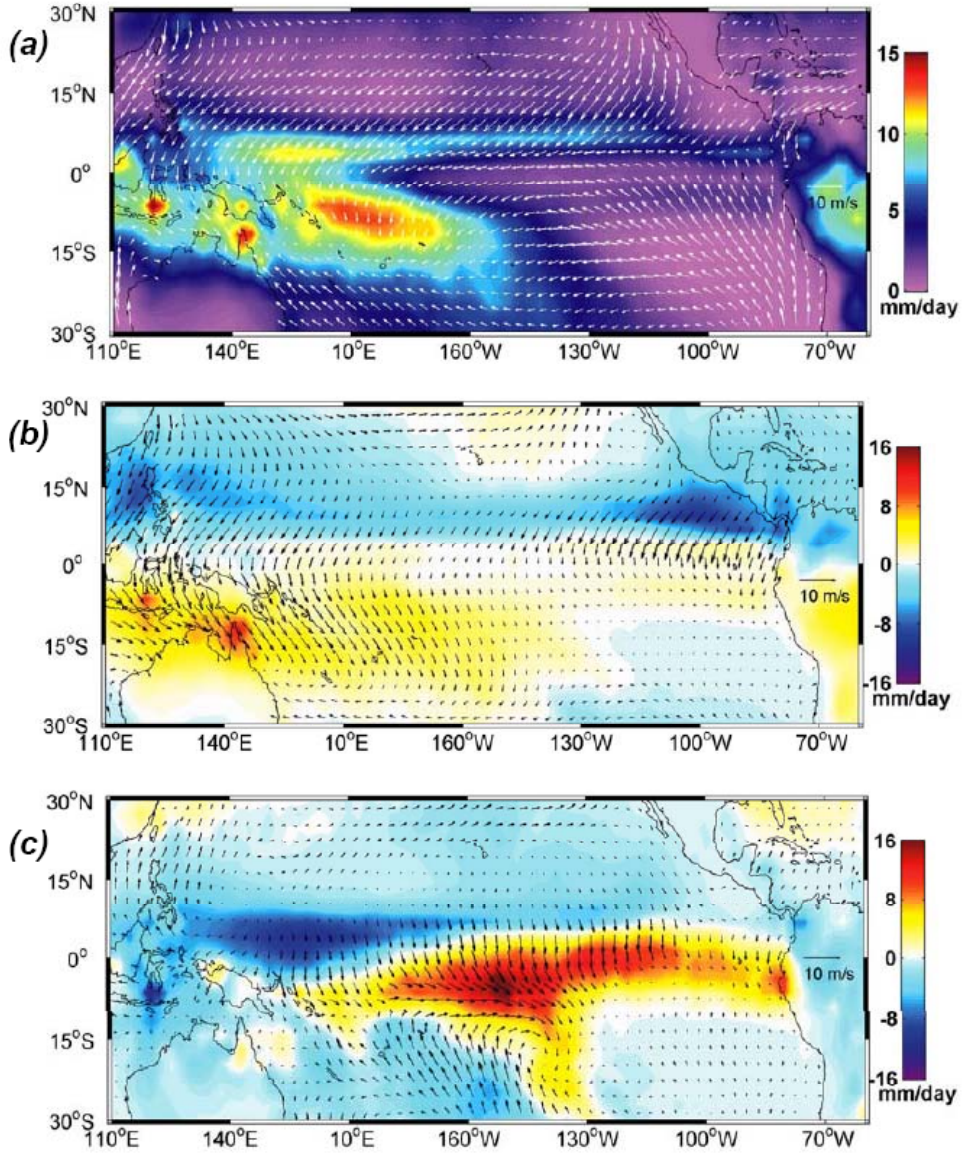
D. Gutiérrez[1], A. Sifeddine[2], D. B. Field[3,*], L. Ortlieb[2], G. Vargas[4], F. P. Chávez[3], F. Velazco[1], V. Ferreira[5], P. Tapia[6], R. Salvatteci[1,5], H. Boucher[2], M. C. Morales[7], J. Valdés[8], J.-L. Reyss[9], A. Campusano[1], M. Boussafir[10], M. Mandeng-Yogo[2], M. Garcia[2], and T. Baumgartner[5]

Biogeosciences, 6, 1–14, 2009
www.biogeosciences.net/6/1/2009/

Biogeosciences



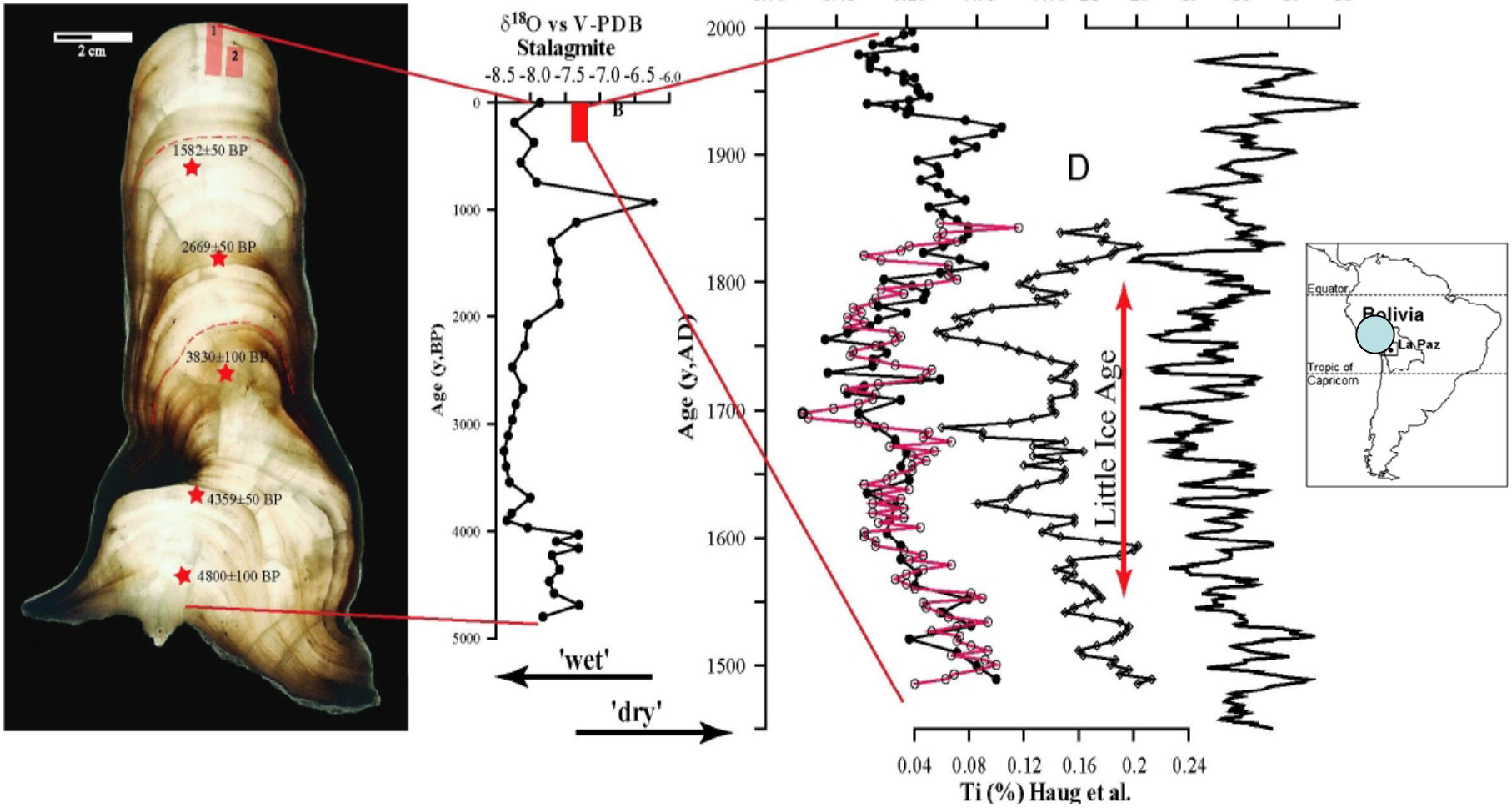

Salinity
33
34
35
36
Newton et al., 2006
Temparature °C
27
28
29
30
31
Peterson and Haug, 2006
Ti (%)
0.24
0.18
0.12
0.06
0
Wet
Dry
(ODP) Hole 1002C
δ18O vs PDB
Stalagmite
-8,70
-8,45
-8,20
-7,95
Martin Van Breukelen 2007
SSTs (°C) - alkenones
21
20.5
20
19.5
19
18.5
MacCaffry et al., 1990
Little Ice age
Intense
Z
M
O
Weak
PC1 (Mo vs Terrigenous)
4
2
0
-2
-4
Weak
TR
Input
Intense
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000


(a)
(b)
(c)
30°N
15°N
0°
15°S
30°S
110°E
140°E
10°E
160°W
130°W
100°W
70°W
10 m/s
mm/day
15
10
5
0
16
8
-8
-16

A STABLE ISOTOPE PALEOCLIMATE RECORD OF LATE HOLOCENE AMAZONIAN SPELEOTHEMS

H.B. Vonhof (1), L. Romero Pittman (2), D. Kroon (1)

(1) FALW Free University, Amsterdam, the Netherlands, (2) INGEMMET (Peruvian Geological Survey), Lima, Peru



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Quaternary Research 70 (2008) 198–212

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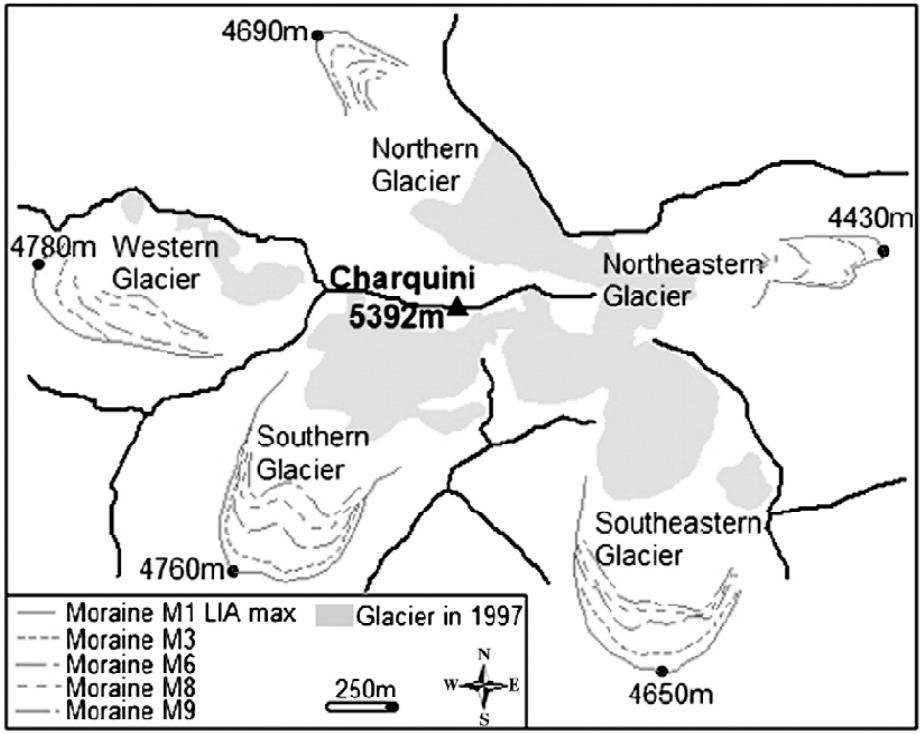
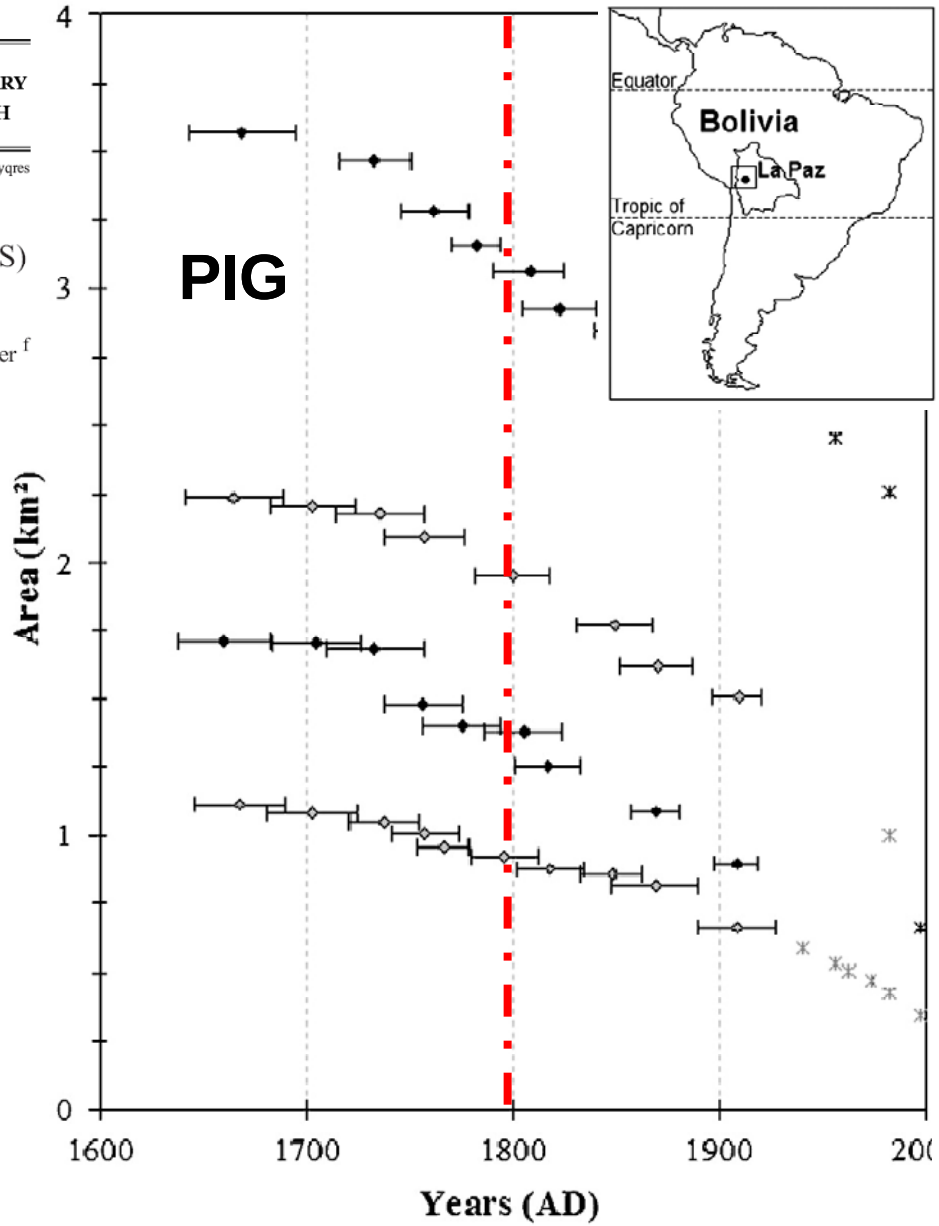
A chronology of the Little Ice Age in the tropical Andes of Bolivia (16°S) and its implications for climate reconstruction

Antoine Rabatel [a,b,*], Bernard Francou [c], Vincent Jomelli [d], Philippe Naveau [e], Delphine Grancher [f]





PALEO TRACES

XVIII BRAZILIAN WATER RESOURCES SYMPOSIUM

Campo Grande city - Brazil, November 22 to 26, 2009

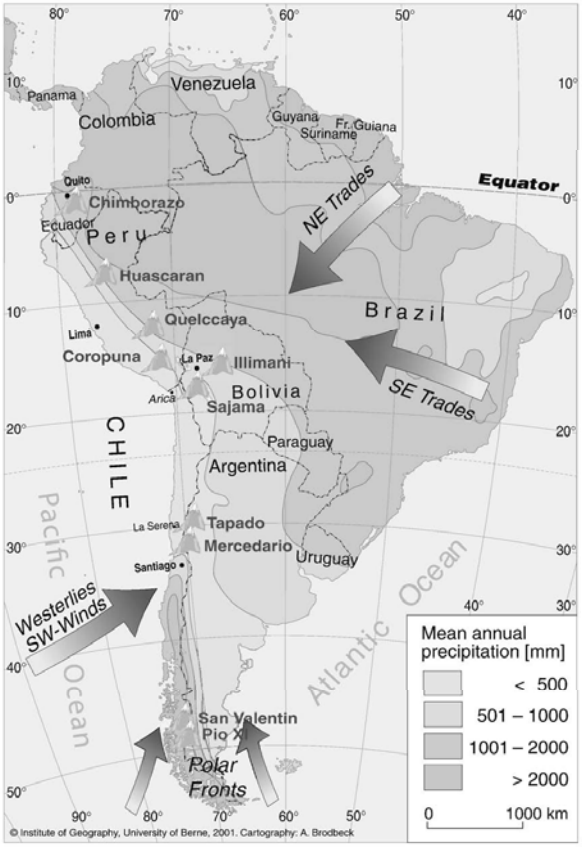
Contents lists available at ScienceDirect

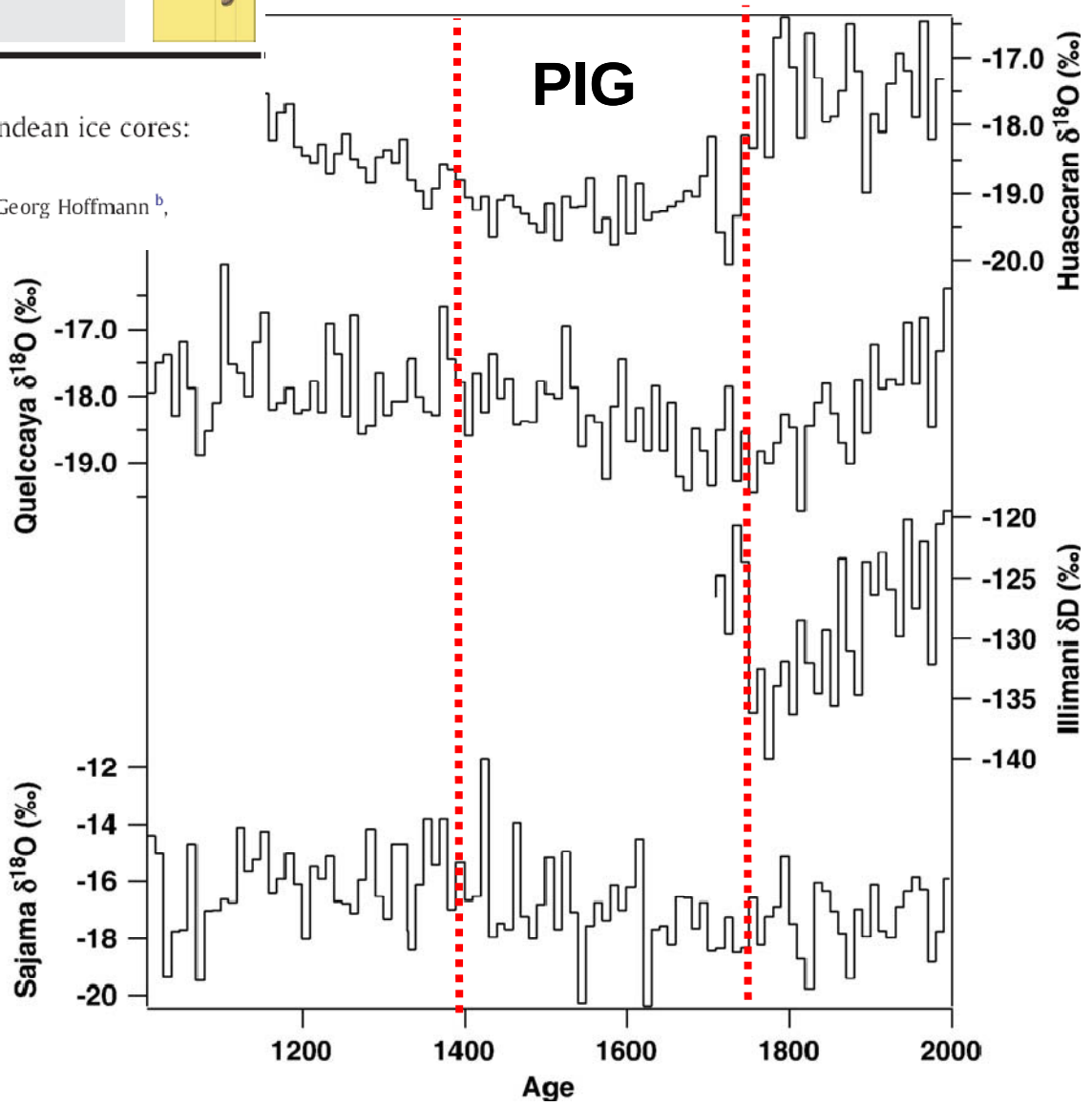
Palaeogeography, Palaeoclimatology, Palaeoecology

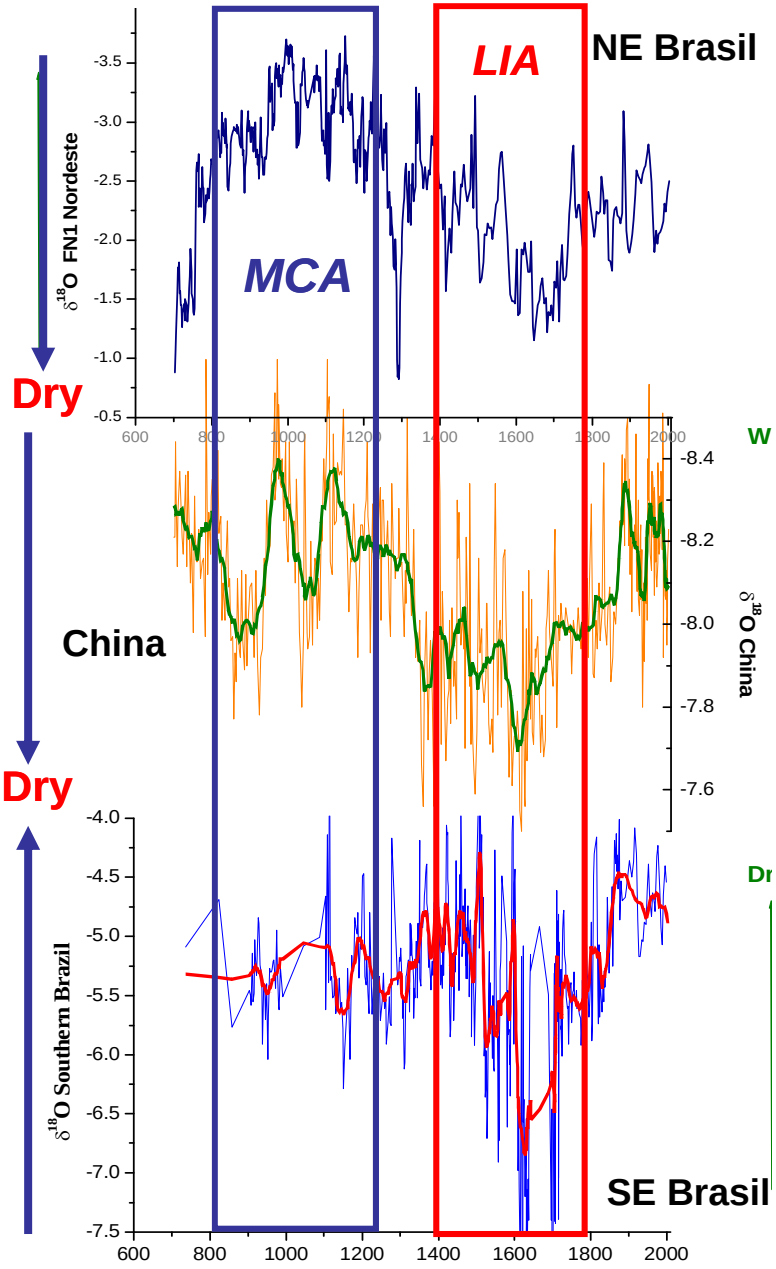
journal homepage: www.elsevier.com/locate/palaeo

Climate variability during the last 1000 years inferred from Andean ice cores: A review of methodology and recent results

Françoise Vimeux [a,b,*], Patrick Ginot [c], Margit Schwikowski [d], Mathias Vuille [e], Georg Hoffmann [b], Lonnie G. Thompson [f], Ulrich Schotterer [g]







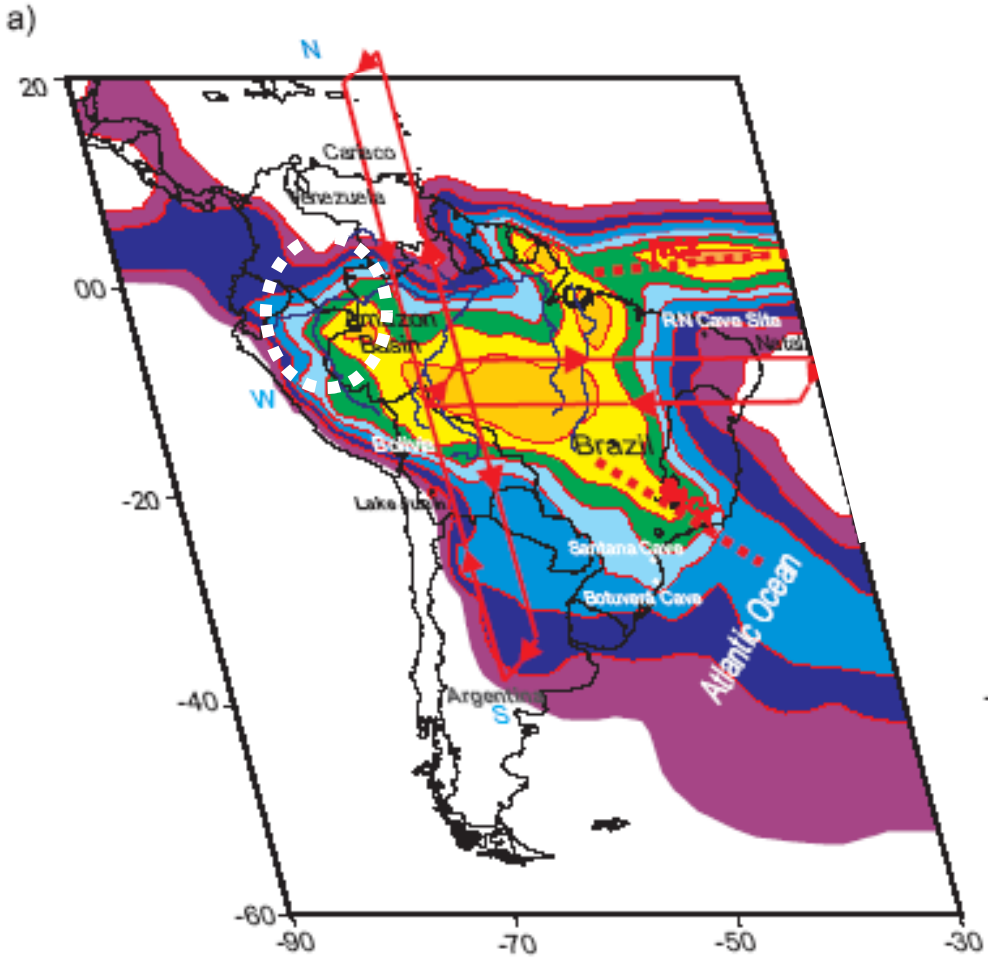
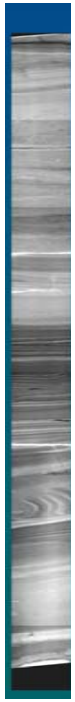
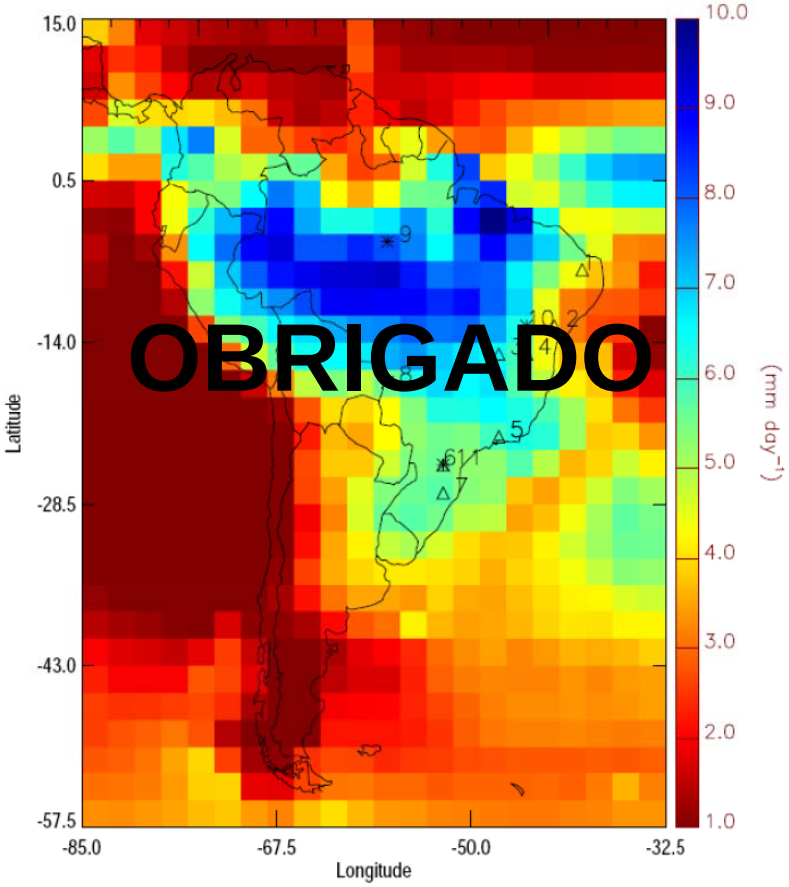


Figure S3: Schematic diagram showing austral summer (DJF) precipitati
blue and purple indicating dry anomalies) in South America and related c
a) high summer insolation in the southern hemisphere during the last 4,0
southern hemisphere between 9,000 and 6,000 years (early and mid-Hol




15.0
0.5
-14.0
-28.5
-43.0
-57.5
Latitude
-85.0
-67.5
-50.0
-32.5
Longitude
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
(mm day^{-1})
OBRIGADO