Aquecimento Global e Floresta Amazônica

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Disclaimer

I am not a climatologist

I am not a meteorologist

I am not a remote sensing scientist

I am not a fanatic environmentalist

I am just an old and curious physicist

(with less hair than shows this cartoon!)

Brazil's new foreign minister believes climate change is a Marxist plot

The Guardian

Ernesto Araújo has called climate science 'dogma' and bemoaned the 'criminalisation' of red meat, oil and heterosexual sex

▲ Ernesto Araujo, right, has been nominated by President-elect Jair Bolsonaro, left, to be Brazil's top diplomat. His appointment could undermine Brazil's leading role on climate change. Photograph: Sergio Lima/AFP/Getty Images

Jonathan Watts *Global environment editor*

@jonathanwatts

Thu 15 Nov 2018 17.13 GMT

Brazil's president-elect Jair Bolsonaro has chosen a new foreign minister who believes climate change is part of a plot by "cultural Marxists" to stifle western economies and promote the growth of China.

O aquecimento global e o desmatamento da Floresta Amazônica são preocupantes?

Global Temperature in 2019

James Hansen, Makiko Sato, Gavin Schmidt, Michael Hendrickson

http://www.columbia.edu/.../20200115_Temperature2019.pdf

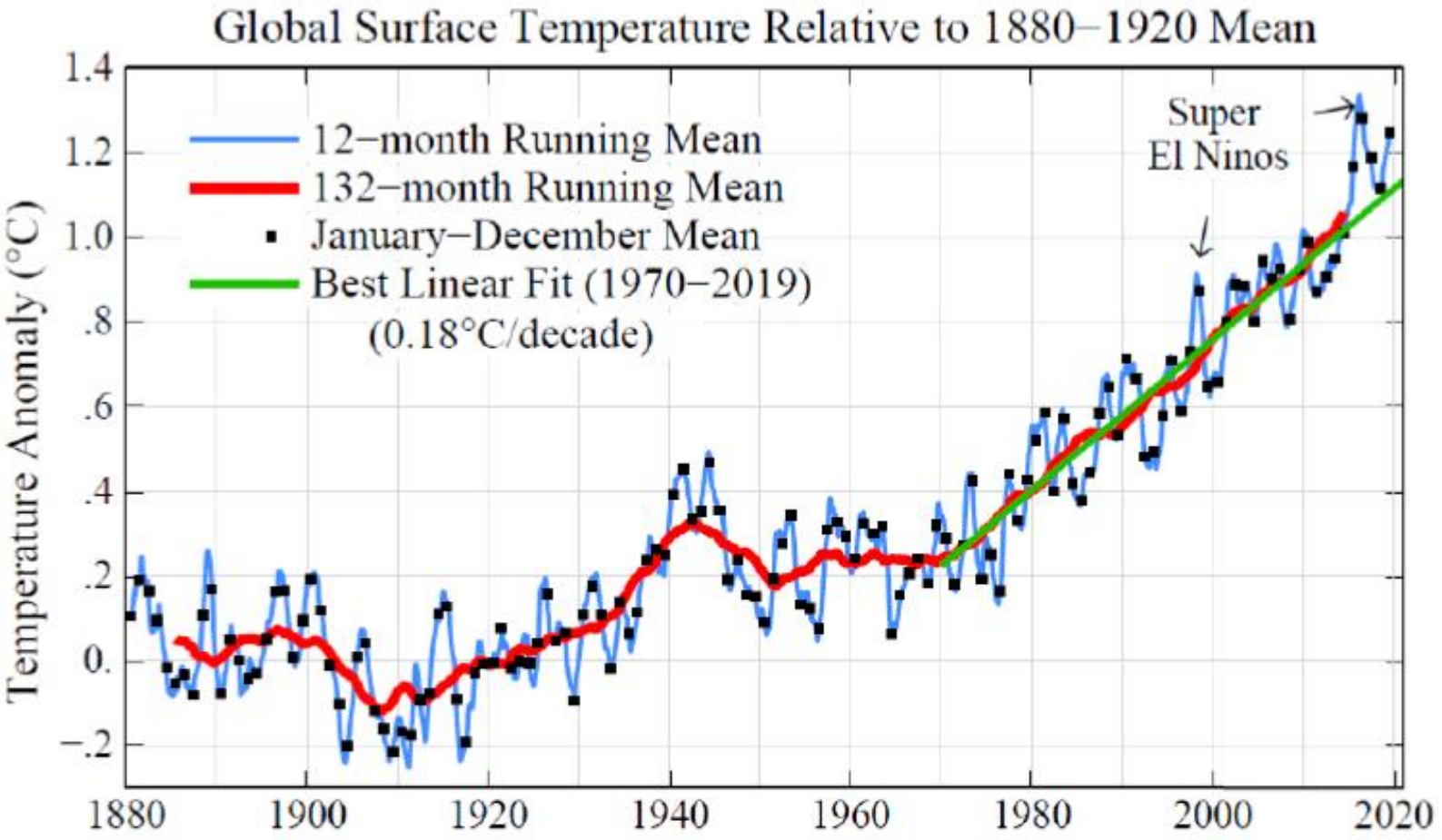
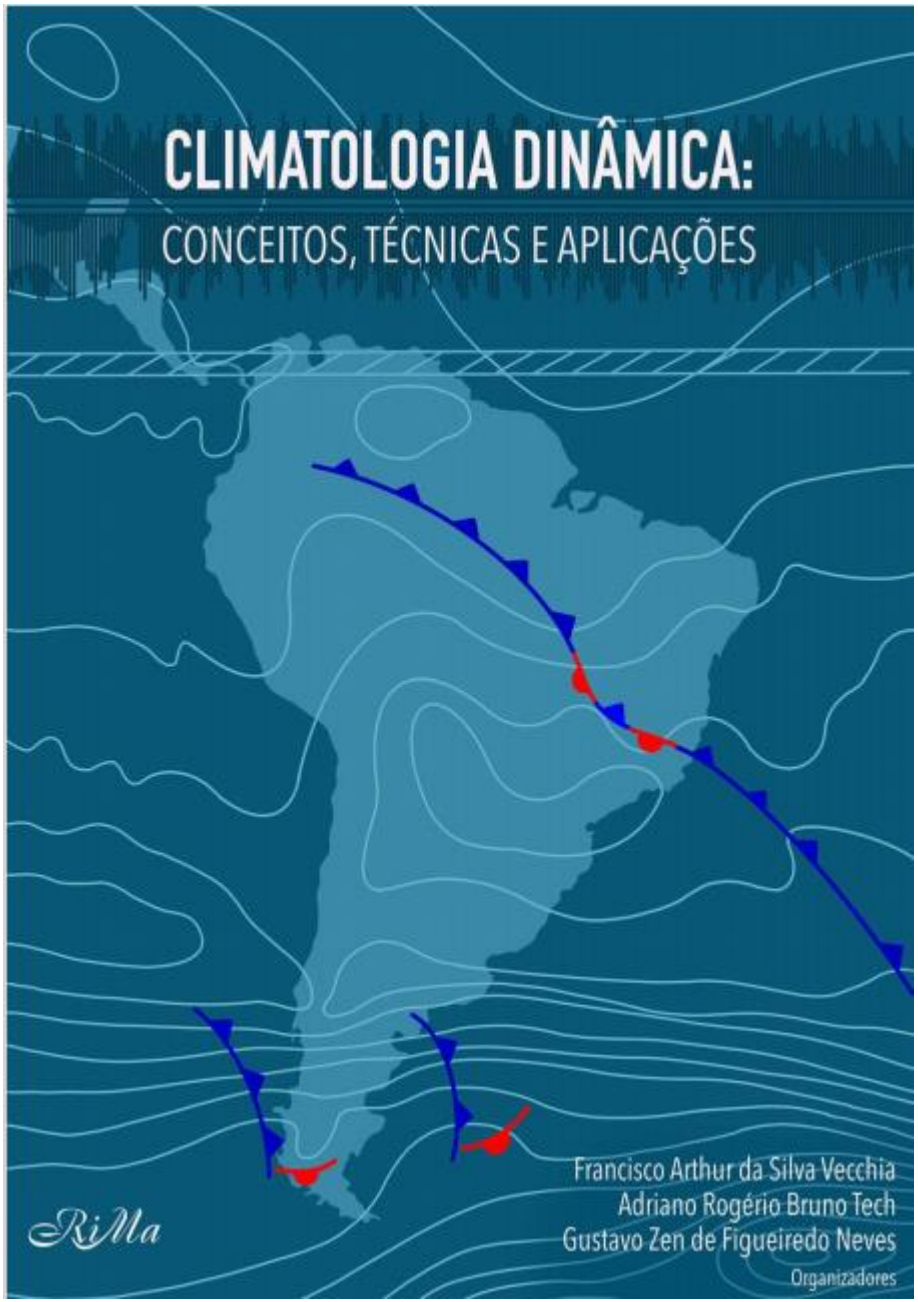


Fig. 1. Global surface temperatures relative to 1880-1920 based on GISTEMP data, which employs GHCN.v4 for meteorological stations, NOAA ERSST.v5 for sea surface temperature, and Antarctic research station data[1].



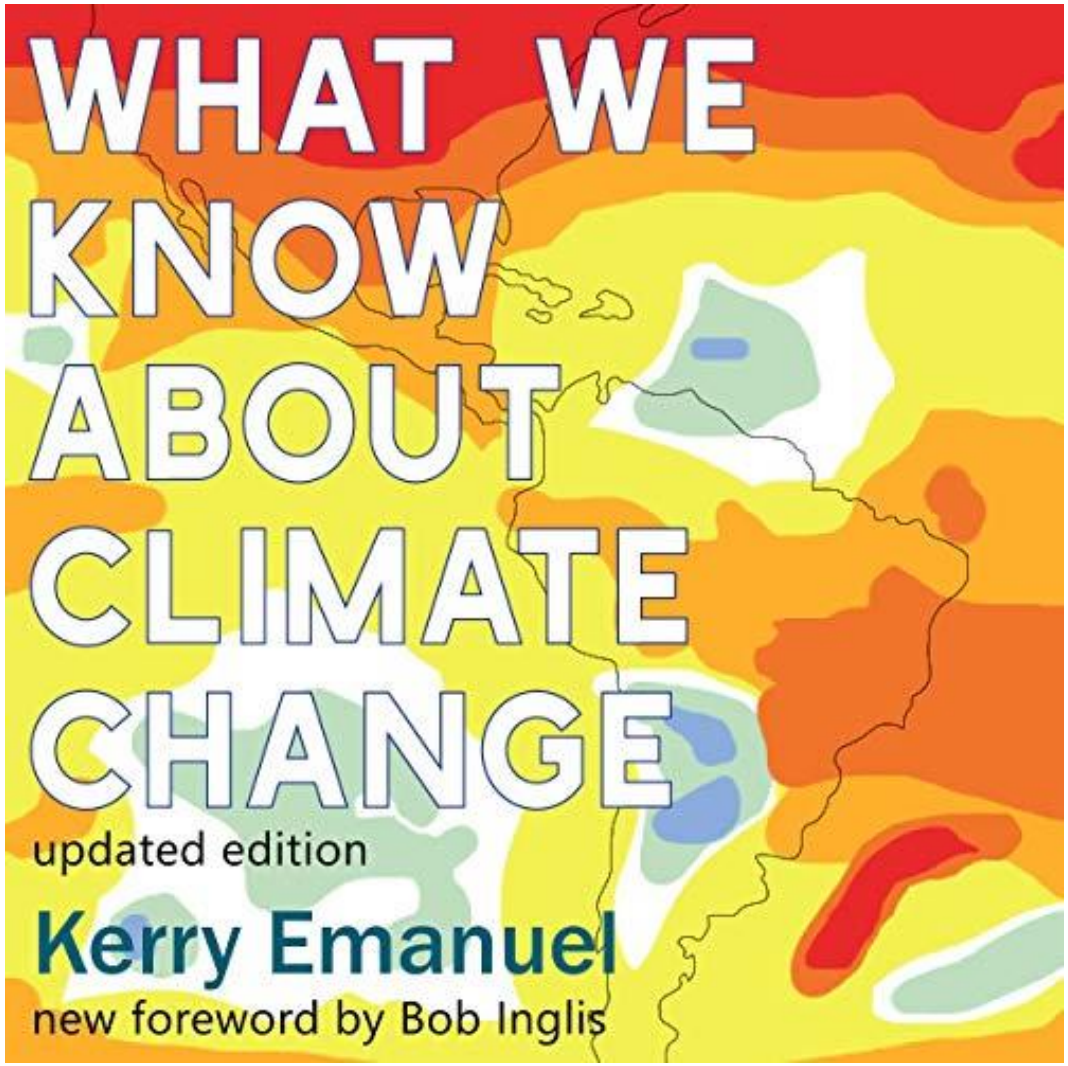
"Nos últimos 30 anos, surgiu hipótese que as variações que ocorrem no clima e no tempo são decorrentes das atividades humanas, notadamente as que queimam combustíveis fósseis emitindo dióxido de carbono (CO2) e metano (CH4)....."

"É afirmado, sem comprovação, que um aquecimento do clima global acima de 2°C, relativo à temperatura do ar do período pré-industrial, teria consequências desastrosas para a Humanidade, ..."

Tais afirmações, porém, não tem bases físicas sólidas, e as projeções climáticas feitas para as próximas décadas são decorrentes de resultados de modelos de simulação de clima global, que são muito rudimentares e não representam adequadamente os processos físicos que controlam o clima global,.....

Luiz Carlos Molion

MIT Press



Capítulo 4
Efeito Antrópico

1. Aumento da concentração de gases do efeito estufa a partir da revolução industrial.
2. Gráfico da temperatura média global, usando medidas existentes (~100 anos) e proxies (milhares de anos) revela que a recente subida não tem precedente.

APS physics

Climate Change

Introduction

Climate can be described as the sum of weather. While the weather is quite variable, the trend over a longer period, the climate, is more stable. However, the climate still changes over time scales of decades to millennia. Ice ages are the prototypical example of a long time scale change. Natural climate changes are due to both the internal dynamics of the climate system and changes in external climate forcings.

Natural and human systems have adapted to the prevailing amount of sunshine, wind, and rain. While these systems can adapt to small changes in climate, adaptation is more difficult or even impossible if the change in climate is too rapid or too large. This is the driving concern over anthropogenic, or human induced, climate change. If climate changes are too rapid then many natural systems will not be able to adapt and will be damaged and societies will need to incur the costs of adapting to a changed climate.

Conclusions

Much of the public debate over climate change has confused the issue of detection of climate change with the inevitability of climate change. The consensus of the scientific community is clear: increasing emissions of greenhouse gases will inevitably cause the levels of greenhouse gases in the Earthís atmosphere to rise, which will change the Earthís climate. While the inevitability of climate change is generally accepted, the magnitude and nature of these changes are still uncertain.

A temperatura da Terra não tem variado substancialmente ao longo de milhares e milhares de anos?

Últimos três milhões de anos:

- períodos amenos durando de 10.000 a 20.000 anos
- períodos com calotas gigantes de gelo, durando cerca de 80.000 anos

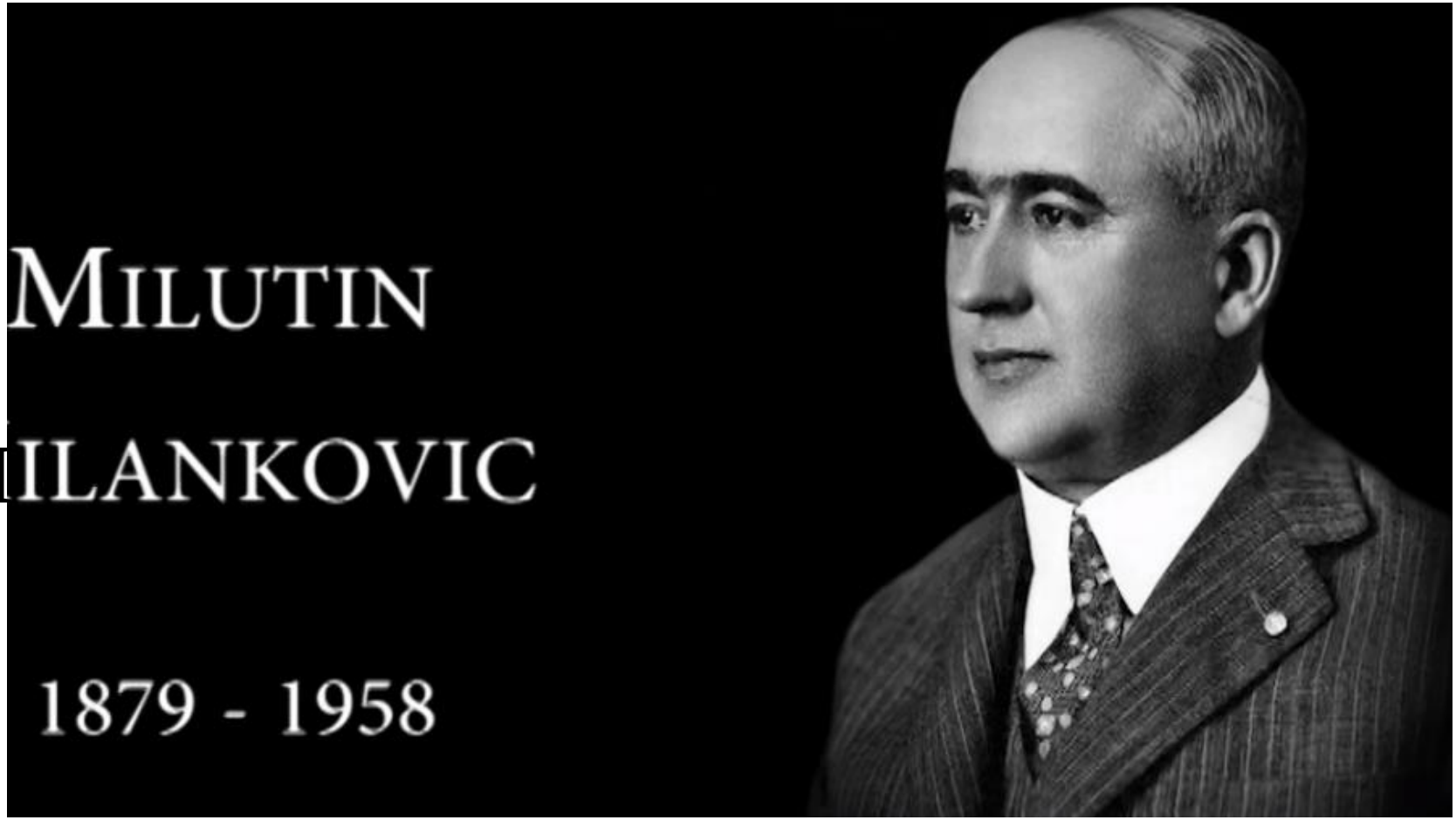
Eoceno (50 milhões de anos)

- Terra “Casa Quente”; livre de gelo, com árvores gigantes próximo dos polos, concentração de CO_2 800 ppm, mais que o dobro da actual, temperatura média ~15C

Era Paleozóica (550 a 250 milhões de anos)

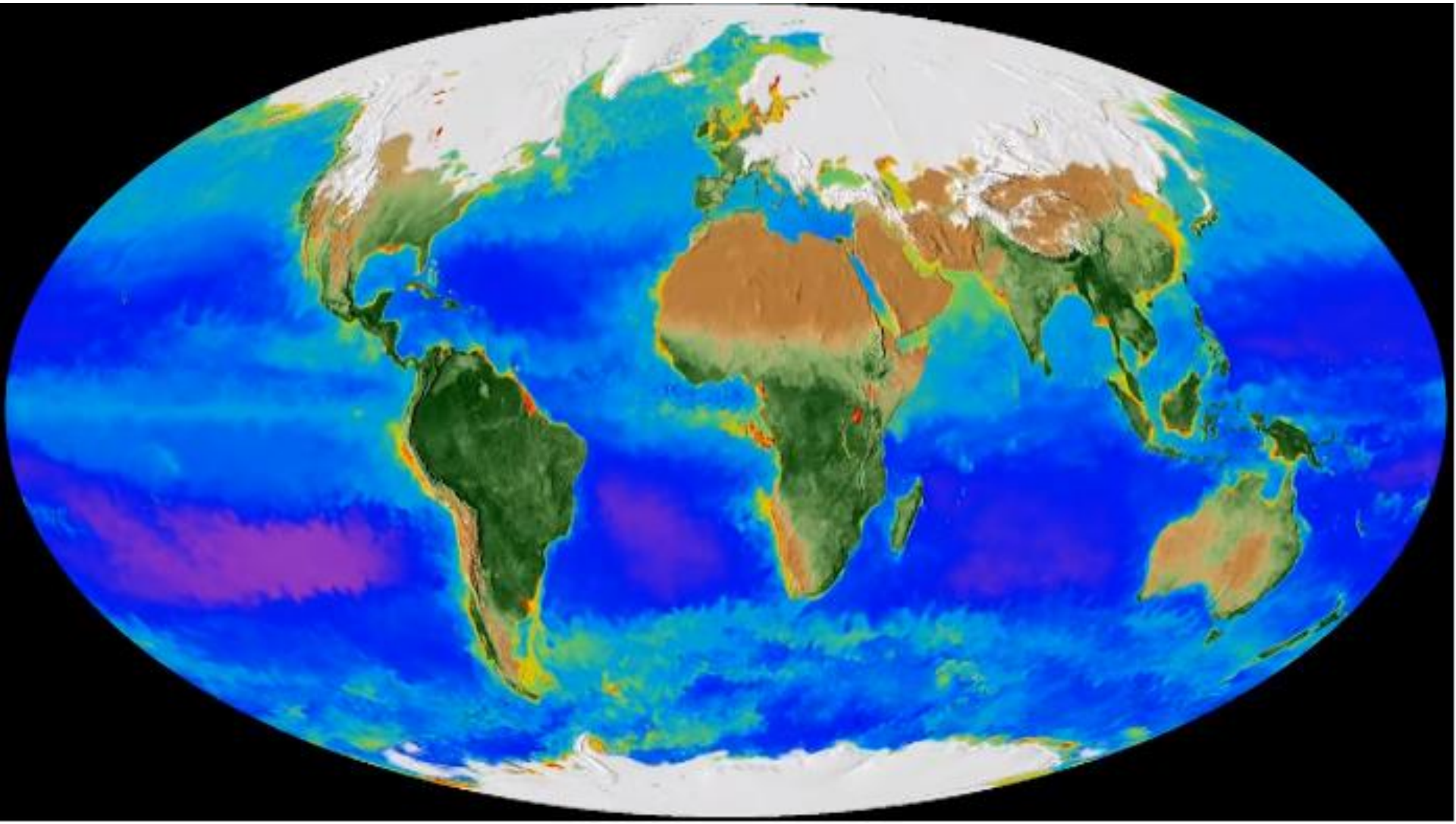
- Terra quase que completamente coberta com gelo várias vezes.

Porque há esta variação entre eras glaciais e mais quente na história do Planeta Terra?

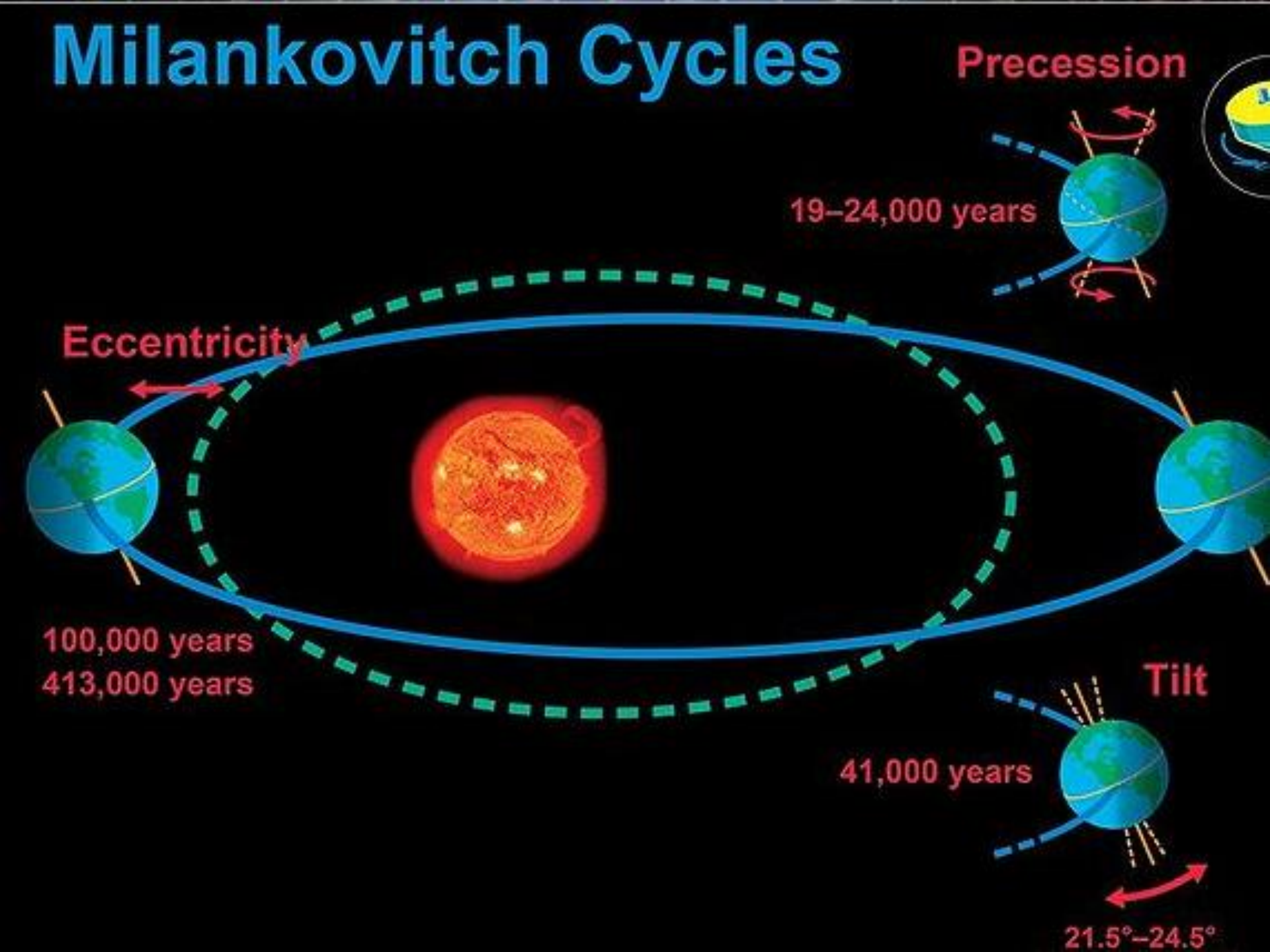


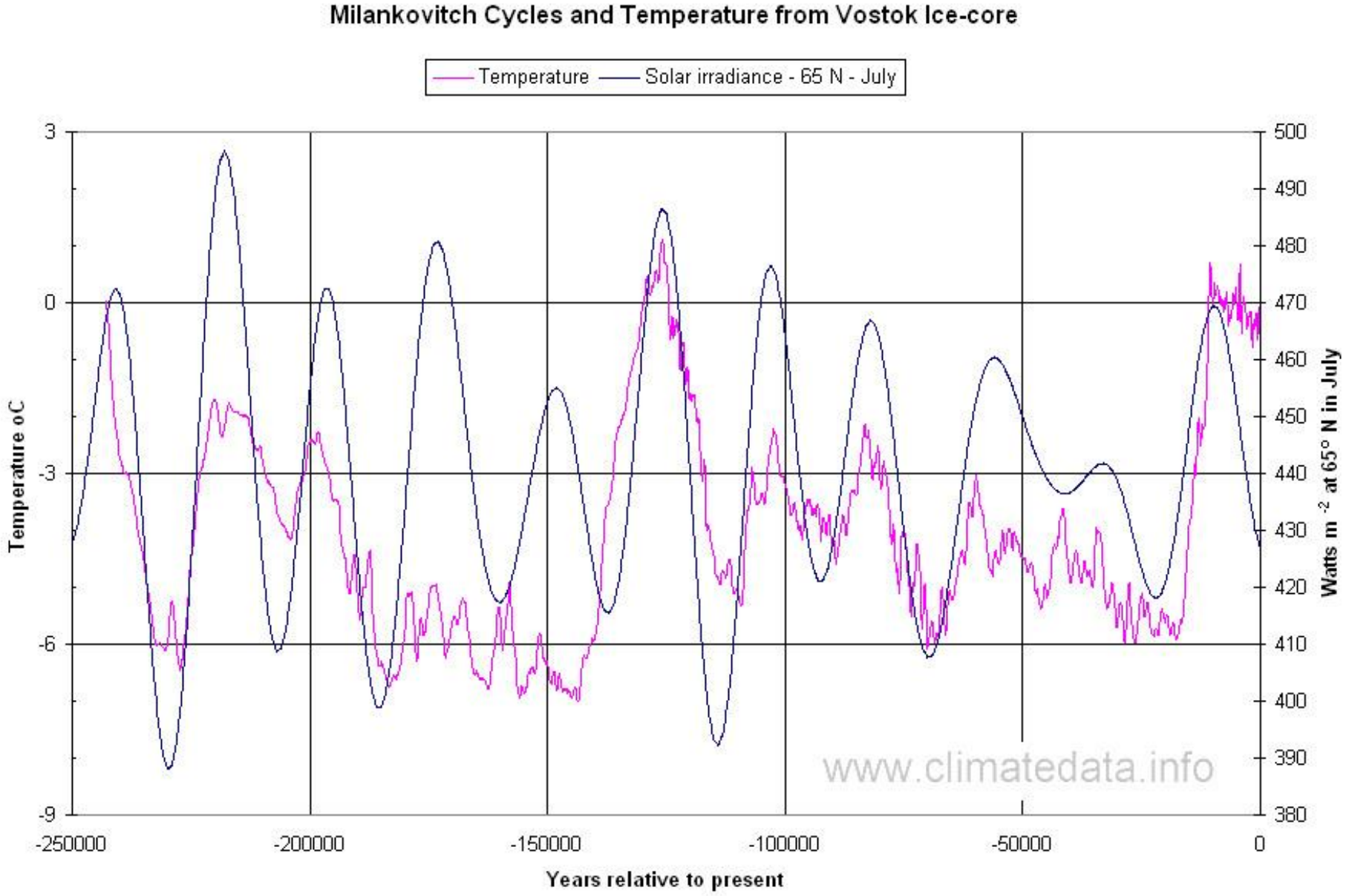
Variações periódicas na órbita e eixo de rotação da Terra, afetando, principalmente, a quantidade de irradiação solar atingindo o Polo Norte

Gêlo no Polo Norte se forma mais facilmente sobre o continente



Milankovitch Cycles




Milankovitch Cycles and Temperature from Vostok Ice-core
Temperature
Solar irradiance - 65 N - July
3
0
-3
-6
-9
Temperature oC
500
490
480
470
460
450
440
430
420
410
400
390
380
Watts m -2 at 65° N in July
-250000
-200000
-150000
-100000
-50000
0
Years relative to present
www.climatedata.info


Hur mäts den
globala
medeltemperaturen?

Concept of Global Average Temperature not clear to the population at large

Four major datasets

- **GISTEMP** – NASA Goddard Institute for Space Science

  https://data.giss.nasa.gov/gistemp/

- **HadCRUT** - UK Met Office Hadley Centre and the University of East Anglia

  https://www.metoffice.gov.uk/hadobs/hadcrut4/

- **MLOST** – National Oceanic and Atmospheric Administration

  https://www.ncdc.noaa.gov/data-access/marineocean-data/mlost

- **JRA** – Japan Meteorological Agency

  http://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/explanat

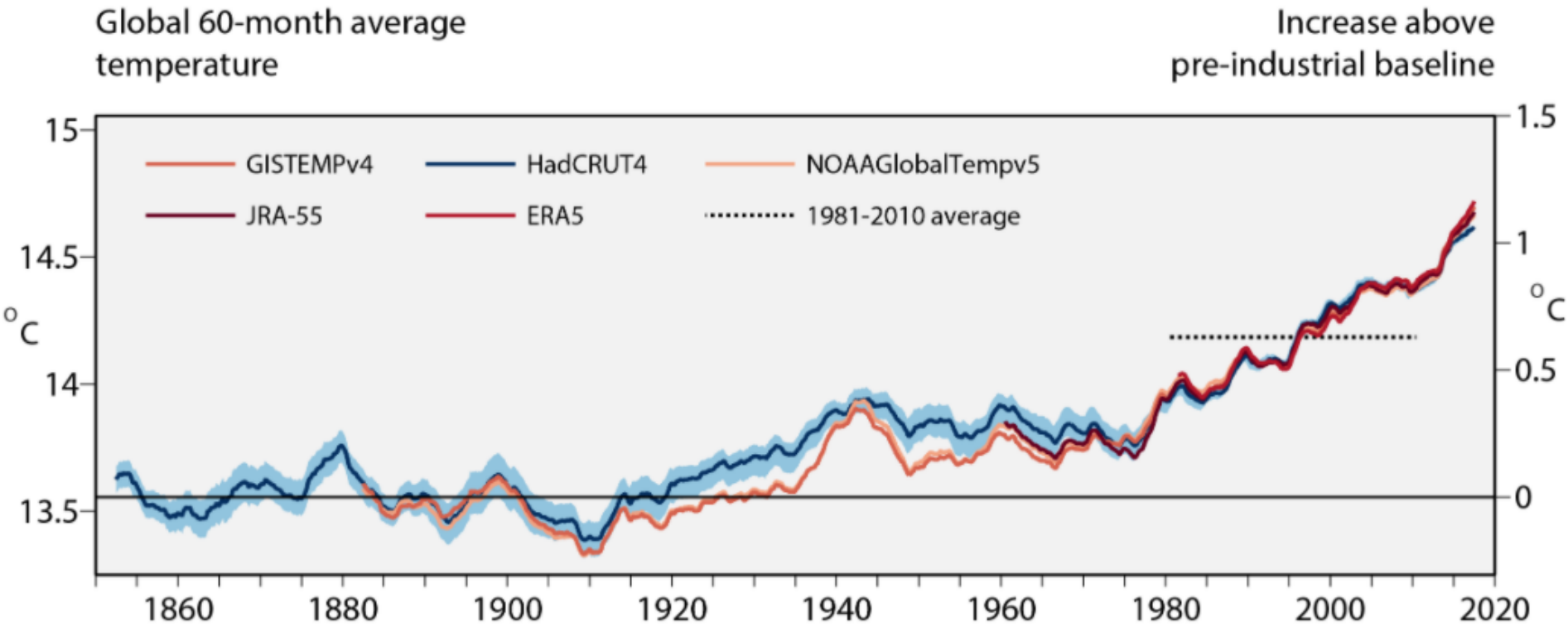
Methodology

(general procedure, but there are variations)

- Combined data from measurements from the air above land and the ocean surface.
- Measurements at each station compared to what is considered normal for that location and time, normally long-term average over a 30-year period. Differences are called "*anomalies*".
- An average is obtained for monthly-mean temperature anomalies against a chosen baseline period in 5° x 5° grid boxes worldwide, in which at least one station exists.
- Monthly mean global temperature anomaly is obtained by averaging the anomalies of all the grid boxes weighted with the area of the grid box.
- Annual and seasonal mean global temperature anomalies are obtained by averaging monthly-mean global temperature anomalies.
- Sliding-window average applied for long time data.

Global Average Temperature at 2m Height

Copernicus Climate Change Service



GISTEM (NASA) NOAA JRA-55 (JMA)

ERA5: Copernicus Climate Change Service

Historical Evolution of Average Temperature

- Widespread instrumental climate data are available for only about one century.
- Proxy climate indicators combined with any very long instrumental records must be used;
  - tree-rings (dendroclimatology),
  - corals,
  - ice cores, and
  - historical documentary records.
- Description of large-scale climate variability during past centuries is therefore somewhat empirical.

PNAS 105, 13252 (2008)

Proxy-based reconstructions of hemispheric and global surface temperature variations over the past two millennia

Michael E. Mann*†, Zhihua Zhang*, Malcolm K. Hughes‡, Raymond S. Bradley§, Sonya K. Miller*, Scott Rutherford¶, and Fenbiao Ni‡

*Department of Meteorology and Earth and Environmental Systems Institute, Pennsylvania State University, University Park, PA 16802; ‡Laboratory of Tree-Ring Research, University of Arizona, Tucson, AZ 85721; §Department of Geosciences, University of Massachusetts, Amherst, MA 01003-9298; and ¶Department of Environmental Science, Roger Williams University, Bristol, RI 02809

Communicated by Lonnie G. Thompson, Ohio State University, Columbus, OH, June 26, 2008 (received for review November 20, 2007)

Following the suggestions of a recent National Research Council report [NRC (National Research Council) (2006) *Surface Temperature Reconstructions for the Last 2,000 Years* (Natl Acad Press, Washington, DC).], we reconstruct surface temperature at hemispheric and global scale for much of the last 2,000 years using a greatly expanded set of proxy data for decadal-to-centennial climate changes, recently updated instrumental data, and complementary methods that have been thoroughly tested and validated with model simulation experiments. Our results extend previous conclusions that recent Northern Hemisphere surface temperature increases are likely anomalous in a long-term context. Recent warmth appears anomalous for at least the past 1,300 years whether or not tree-ring data are used. If tree-ring data are used, the conclusion can be extended to at least the past 1,700 years, but with additional strong caveats. The reconstructed amplitude of change over past centuries is greater than hitherto reported, with somewhat greater Medieval warmth in the Northern Hemisphere, albeit still not reaching recent levels.

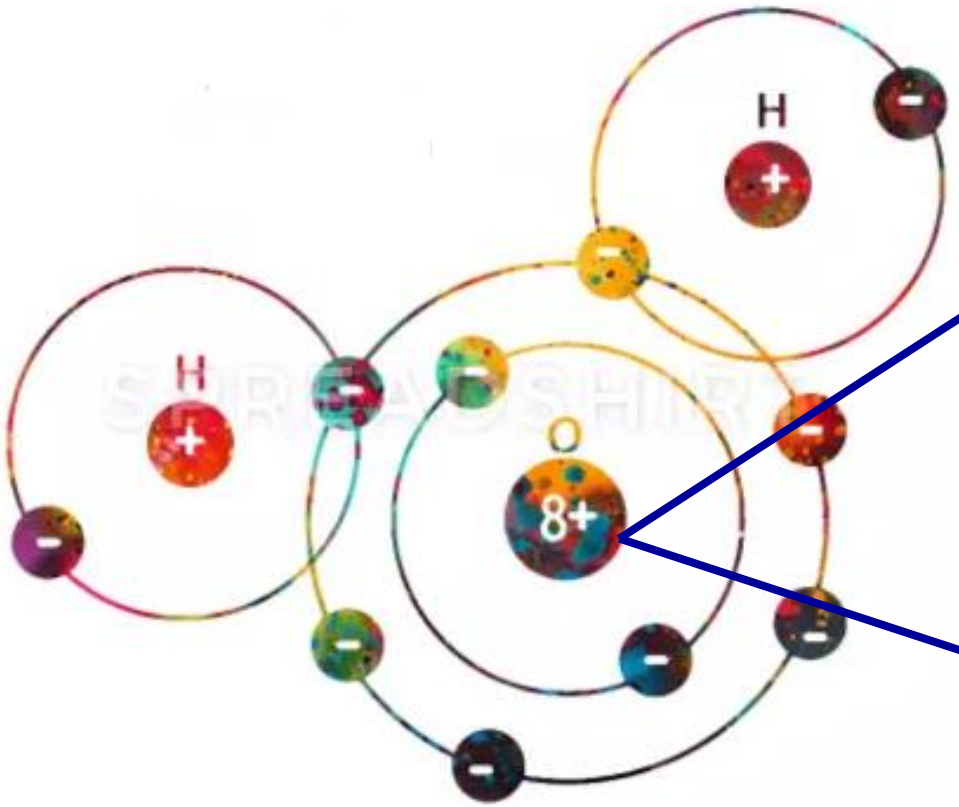
posite) and predictand (i.e., the instrumental hemispheric mean temperature series). Lee *et al.* (21) have recently compared a number of variants on the CPS approach.

Distinct from the CPS methods are the so-called climate field reconstruction (CFR) approaches, which instead assimilate proxy records into reconstructions of the underlying spatial climate patterns (15–18, 20, 22–26). Hemispheric or global means, as well as particular indices of interest, can be computed directly from the spatial pattern reconstructions. The CFR method offers the obvious advantage over the CPS method in that the spatial pattern of changes are available, e.g., for comparisons with model-predicted patterns of past climate change (27, 28). Most CFR methods make use of nonlocal "reduced space" relationships between predictors (e.g., sparse early instrumental measurements or longer-term proxy climate data) and predictand (the full spatial field targeted for reconstruction) through the use of large-scale covariance information (15, 17, 18, 29, 30). Such methods are useful in the context of proxy-based climate reconstruction because they take advantage of

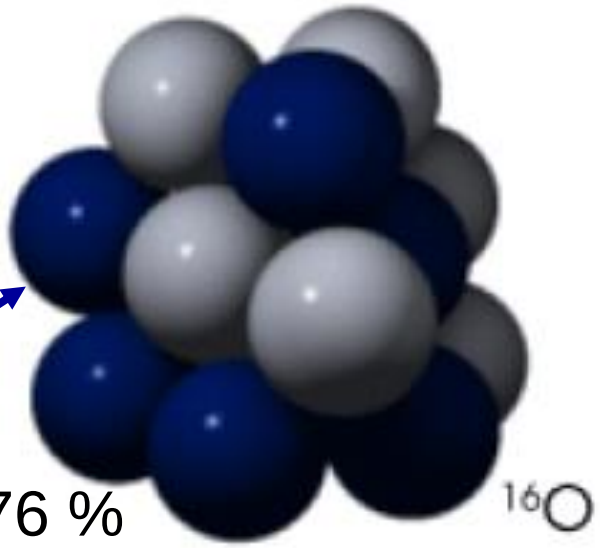
The Oxygen Isotope Ratio Method

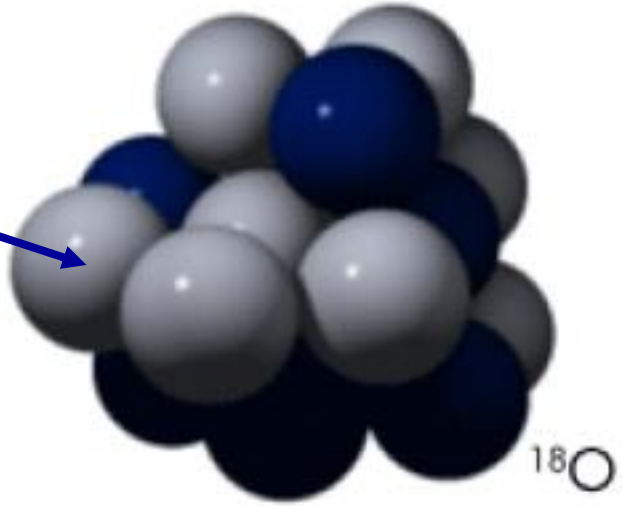
[H.A. Lowenstam and S. Epstein; Journal of Geology 62, 207 (1954)]

[W. Dansgaard, *et al*; Science 166, 377 (1969)]



99,76 %

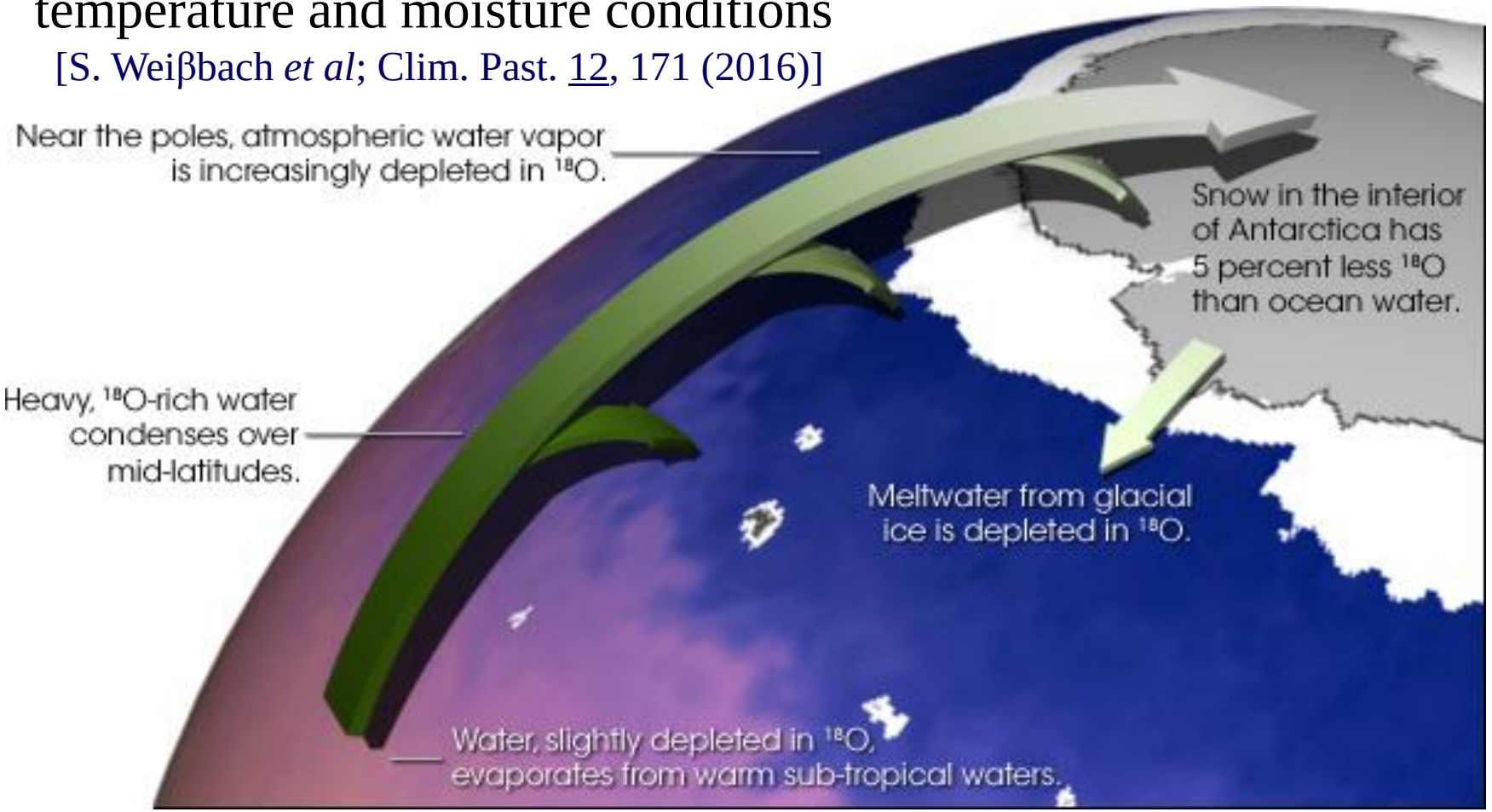




^{18}O concentration in ice cores depends on

- equilibrium and kinetic fractionation processes during evaporation at the ocean surface;
- poleward air-mass transport and condensation of precipitation,
- temperature and moisture conditions

[S. Weiβbach *et al*; Clim. Past. 12, 171 (2016)]



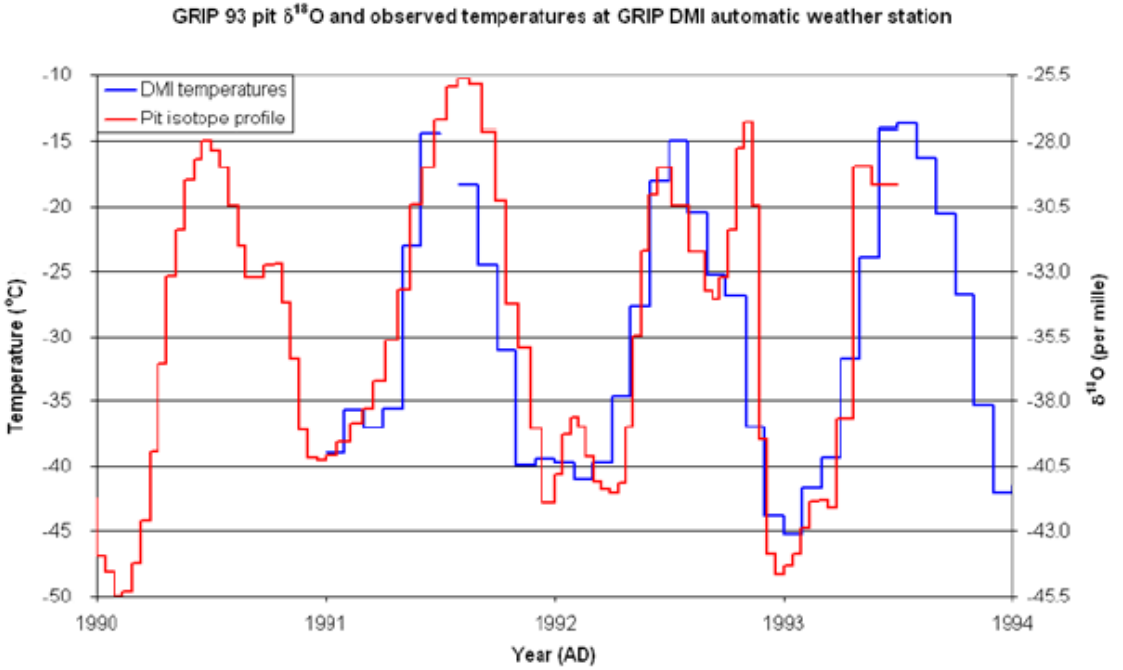
https://earthobservatory.nasa.gov/features/Paleoclimatology_OxygenBalance/oxygen_balance.php

Related Proxies

- Oxygen isotope ratio in ice cores
- Oxygen isotope ratio in marine sediments (200-500m depth)

- Depth-time scale determined by ^{14}C method and seasonal variation of ^{18}O concentration
- CO_2 concentration measured in trapped air bubbles

Seasonal calibration
Greenland Ice Core Project
[B. Stauffer; Science 260, 1766 (1993)]



https://www.climate4you.com/GlobalTemperatures.htm

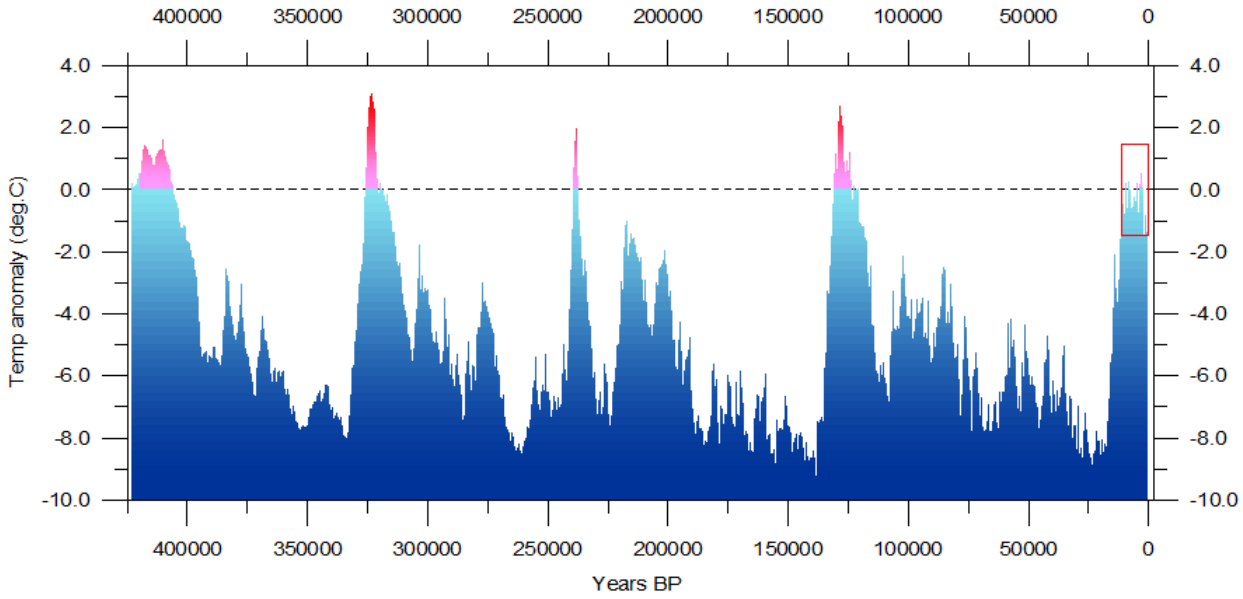
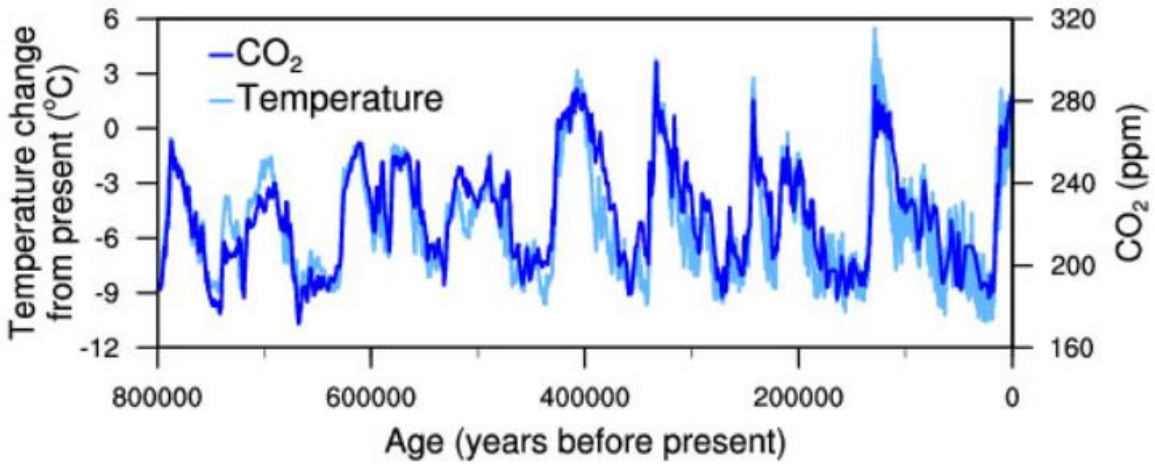


Fig.2. Reconstructed global temperature over the past 420,000 years based on the Vostok ice core from the Antarctica (Petit et al. 2001). The record spans over four glacial periods and five interglacials, including the present. The horizontal line indicates the modern temperature. The red square to the right indicates the time interval shown in greater detail in the following figure.

https://www.ncdc.noaa.gov/global-warming/temperature-change



Discovery of the Greenhouse Effect

- **Jean Fourier (1824)**

  [J. Fourier, *Remarques générales sur les temperatures du globe terrestre et des espaces planétaires*; Ann. Chim. Phys. 27, 136 (1824)]

  $T = ? \rightarrow$ average temperature to reach equilibrium between infrared radiation and power received from the Sun;

  $T \approx -13C \rightarrow$Earth atmosphere must absorb infrared radiation.

- **John Tyndall (1859)**

  Measurement of infrared absorption by atmospheric gases

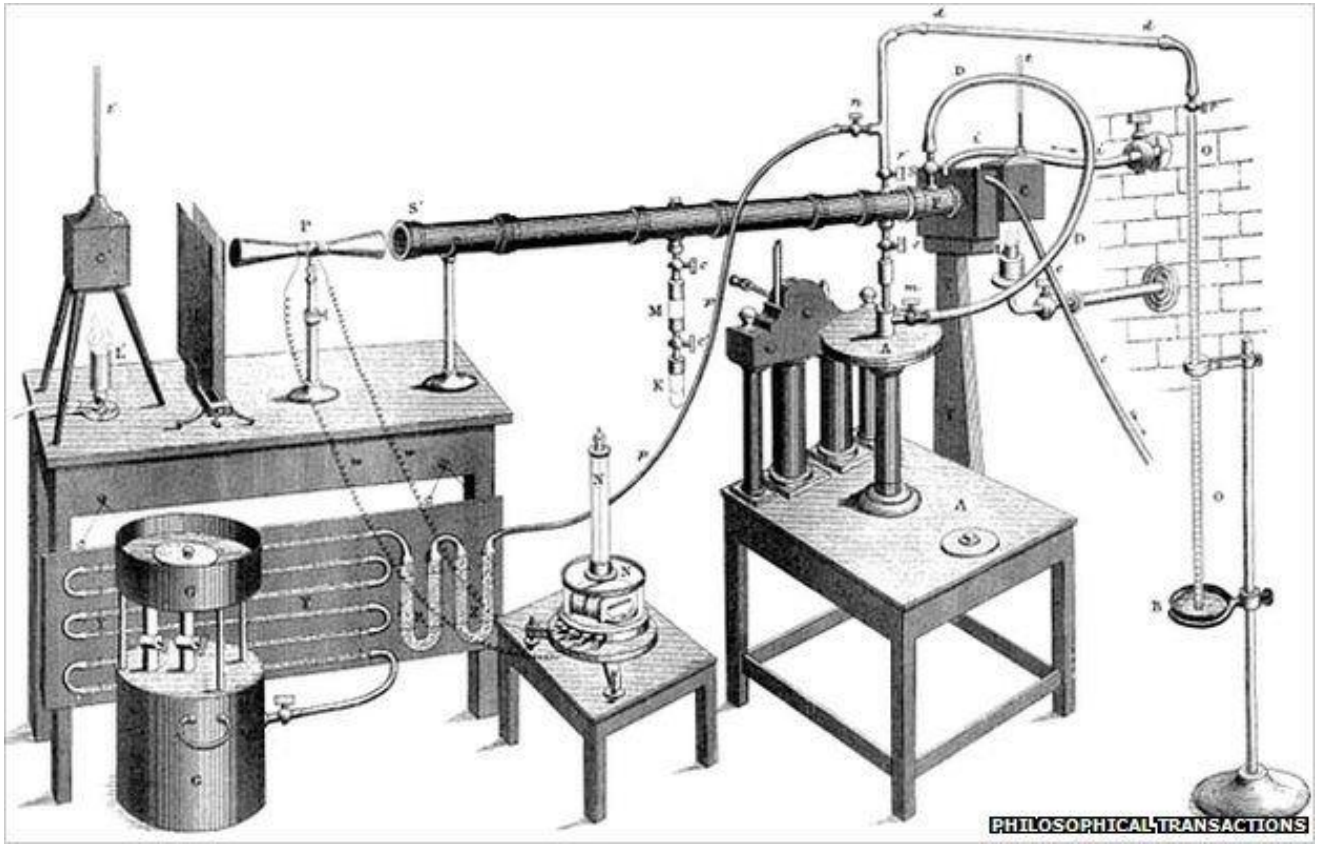
- **Svante Arrehnius (1896)**

  Theoretical prediction: if the CO_2 atmospheric concentration would double, increase in average temperature $\sim 4.5K$.

- **Guy Callendar (1938)**

  Data from 147 meteorological stations: $\Delta T \approx 0.3C$ between 1880 and 1937.

John Tyndall



On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground

Svante Arrhenius

Philosophical Magazine and Journal of Science
Series 5, Volume 41, April 1896, pages 237-276.

Arrhenius's paper is the first to quantify the contribution of carbon dioxide to the greenhouse effect (Sections I-IV) and to speculate about whether variations in the atmospheric concentration of carbon dioxide have contributed to long-term variations in climate (Section V). Throughout this paper, Arrhenius refers to carbon dioxide as "carbonic acid" in accordance with the convention at the time he was writing.

Contrary to some misunderstandings, Arrhenius does not explicitly suggest in this paper that the burning of fossil fuels will cause global warming, though it is clear that he is aware that fossil fuels are a potentially significant source of carbon dioxide (page 270), and he does explicitly suggest this outcome in later work.

THE

LONDON, EDINBURGH, AND DUBLIN

PHILOSOPHICAL MAGAZINE

AND

JOURNAL OF SCIENCE.

[FIFTH SERIES.]

APRIL 1896.

XXXI. *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.* *By* Prof. SVANTE ARRHENIUS *.

I. *Introduction*: *Observations of* Langley *on Atmospherical Absorption.*

A GREAT deal has been written on the influence of the absorption of the atmosphere upon the climate. Tyndall † in particular has pointed out the enormous importance of this question. To him it was chiefly the diurnal and annual variations of the temperature that were lessened by this circumstance. Another side of the question, that has long attracted the attention of physicists, is this: Is the mean temperature of the ground in any way influenced by the presence of heat-absorbing gases in the atmosphere? Fourier‡ maintained that the atmosphere acts like the glass of a hot-house, because it lets through the light rays of the sun but retains the dark rays from the ground. This idea was elaborated by Pouillet §; and Langley was by some of his researches led to the view, that "the temperature of the earth under direct sunshine, even though our atmosphere were present as now, would probably fall to −200° C., if that atmosphere did not possess the quality of selective

* Extract from a paper presented to the Royal Swedish Academy of Sciences, 11th December, 1895. Communicated by the Author.
† 'Heat a Mode of Motion,' 2nd ed. p. 405 (Lond., 1865).
‡ *Mém. de l'Ac. R. d. Sci. de l'Inst. de France*, t. vii. 1827.
§ *Comptes rendus*, t. vii. p. 41 (1838).

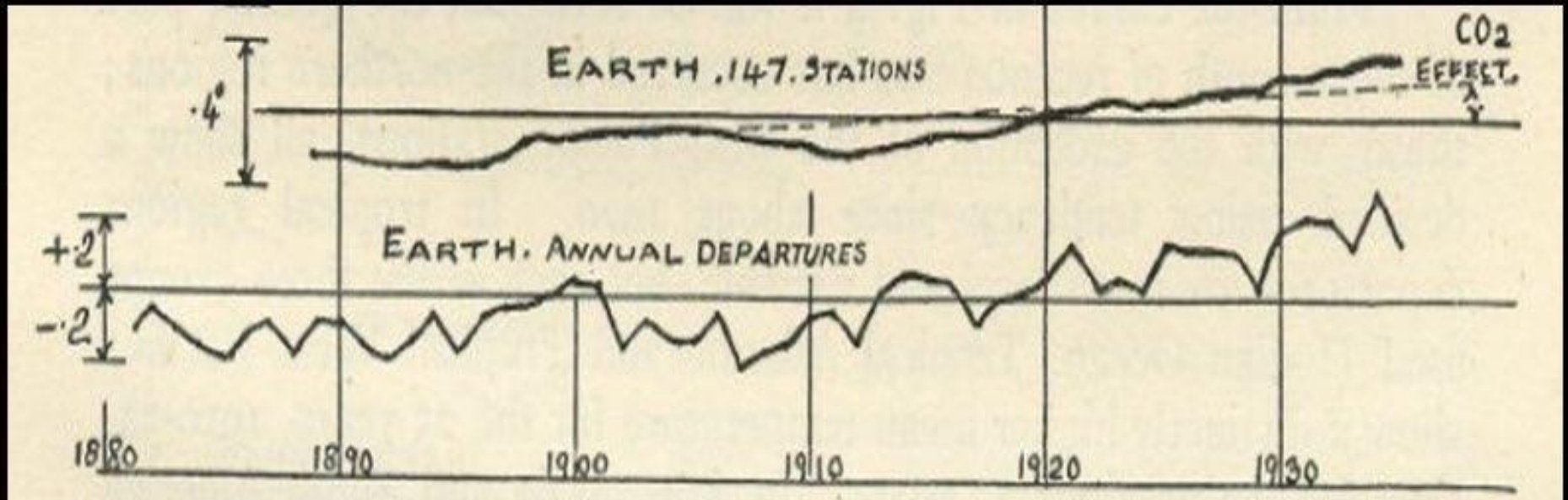


FIG. 4.—Temperature variations of the zones and of the earth. Ten-year moving departures from the mean, 1901-1930, °C.

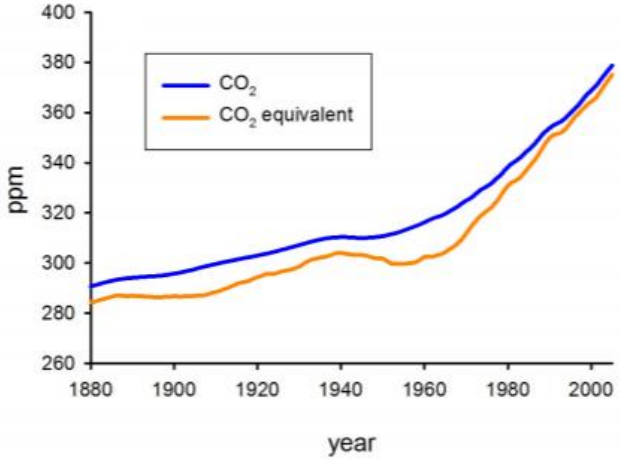
Guy Callendar first discovered the world was warming in 1938

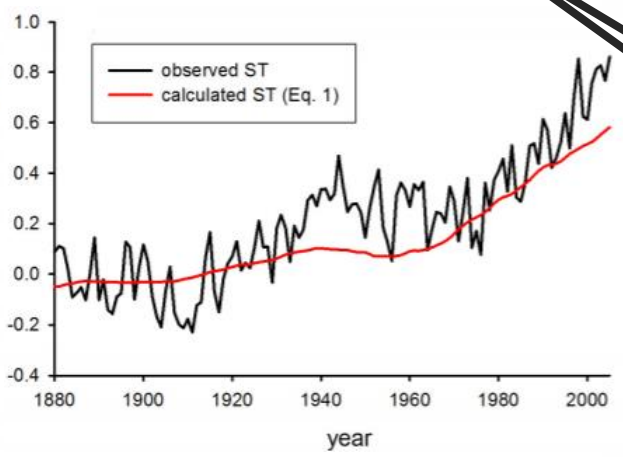
How Reliable are Predictions of Global Warming ?

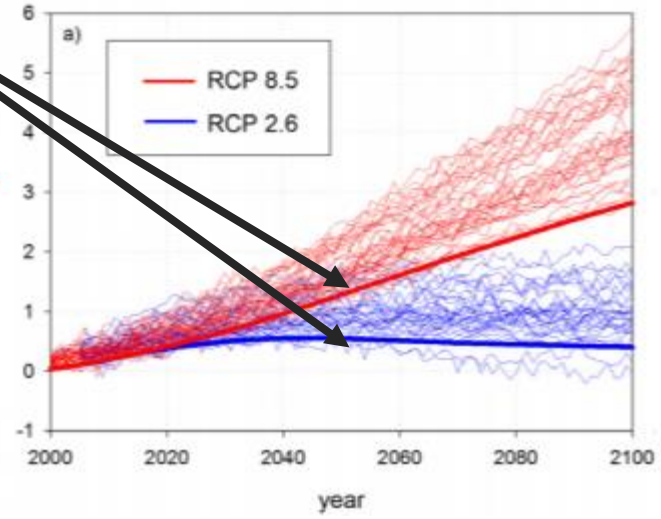
[T.R. Anderson, E. Hawkins, and P.D. Jones; Endeavour 40, 178 (2016)]

- IPCC projections based upon ensemble average of results from complex state-of-the-art Earth System Models.
- Although climate system evolution is rather complex, its core physics is just radiative transfer!
- Callendar´s results can be adjusted by

$$\Delta T = 2.28 \ln(pCO_2/100) - 250;\ \Delta T(C); pCO_2(ppm)$$







Corrente do Golfo atinge nível mais fraco em 100 anos

Risk of tipping the overturning circulation due to increasing rates of ice melt

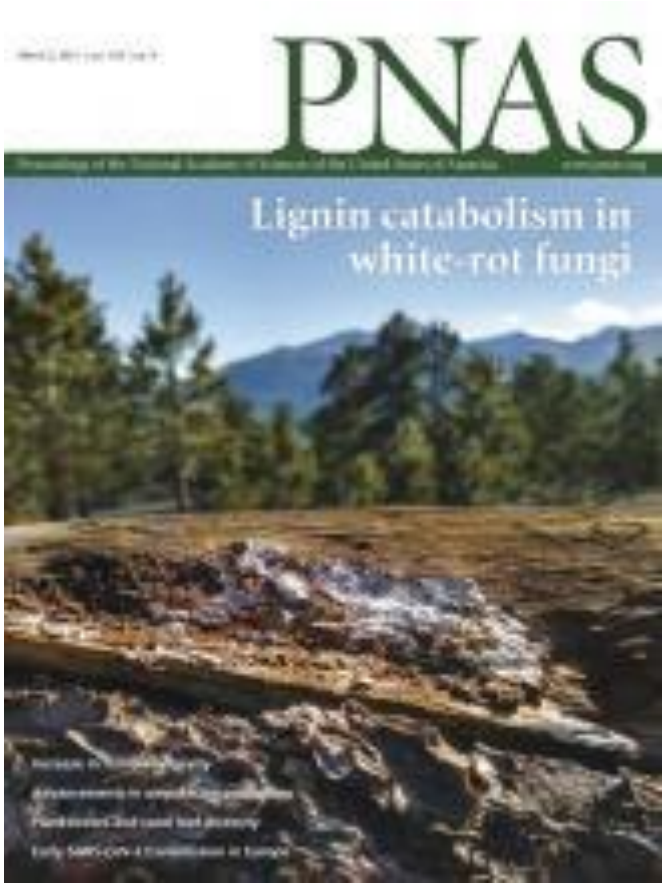
Johannes Lohmann and Peter D. Ditlevsen
+ See all authors and affiliations

PNAS March 2, 2021 118 (9) e2017989118; https://doi.org/10.1073/pnas.2017989118

Edited by Michel Crucifix, Universite Catholique de Louvain, Louvain-la-Neuve, Belgium, and accepted by Editorial Board Member Jean Jouzel January 15, 2021 (received for review August 25, 2020)

Significance

Ongoing greenhouse gas emissions put elements of the Earth system at risk for crossing critical thresholds (tipping points), leading to abrupt irreversible climate change. Measures for reducing emissions should keep Earth in the safe operating space away from tipping points. Here we show that increasing rates of change of ice melt can induce a collapse of the Atlantic Meridional Overturning Circulation in a global ocean model, while no critical threshold in ice melt is crossed and slower increases to the same level of ice melt do not induce tipping. Moreover, the chaotic dynamics of the climate make such a collapse hard to predict. This shows that the safe operating space of the Earth system might be smaller than previously thought.



Stefan Rahmstorf (Instituto de Pesquisa do Impacto Climático de Potsdam)

"*Se continuarmos a impulsionar o aquecimento global, o sistema da corrente do Golfo enfraquecerá ainda mais – 34% a 45% até 2100 -, de acordo com a última geração de modelos climáticos*"


SEQUESTRO DE CARBONO

Importância da Amazônia no Sequestro de Carbono

Oliver L. Phillips*† , Roel J. W. Brienen†
and the RAINFOR collaboration

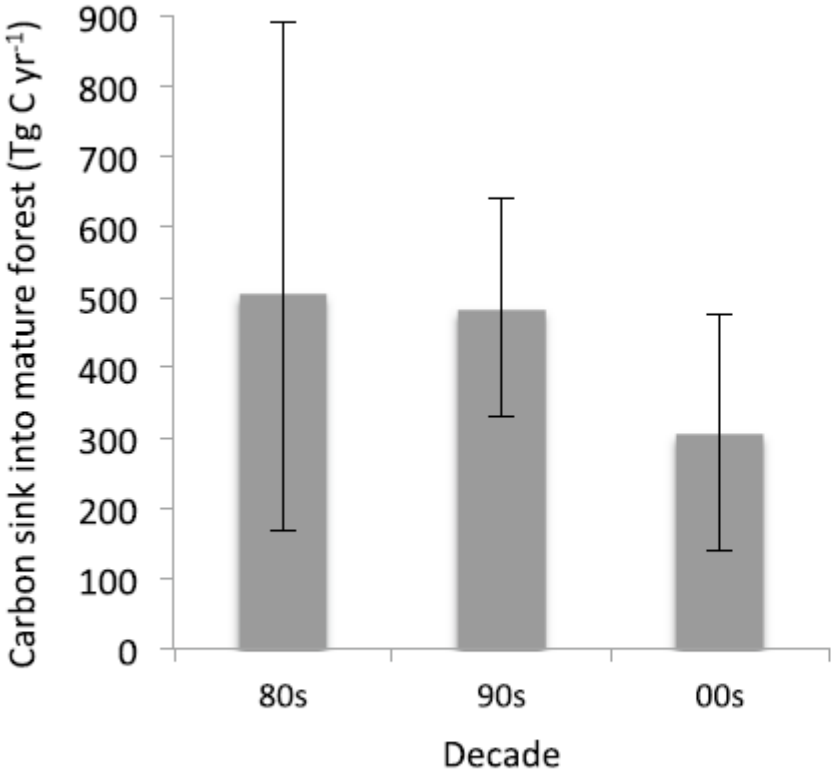


Fig. 1 Estimated carbon sink into mature forest biomass in the Amazon basin for each of the three decades since 1980. *Error bars* show 95% confidence intervals

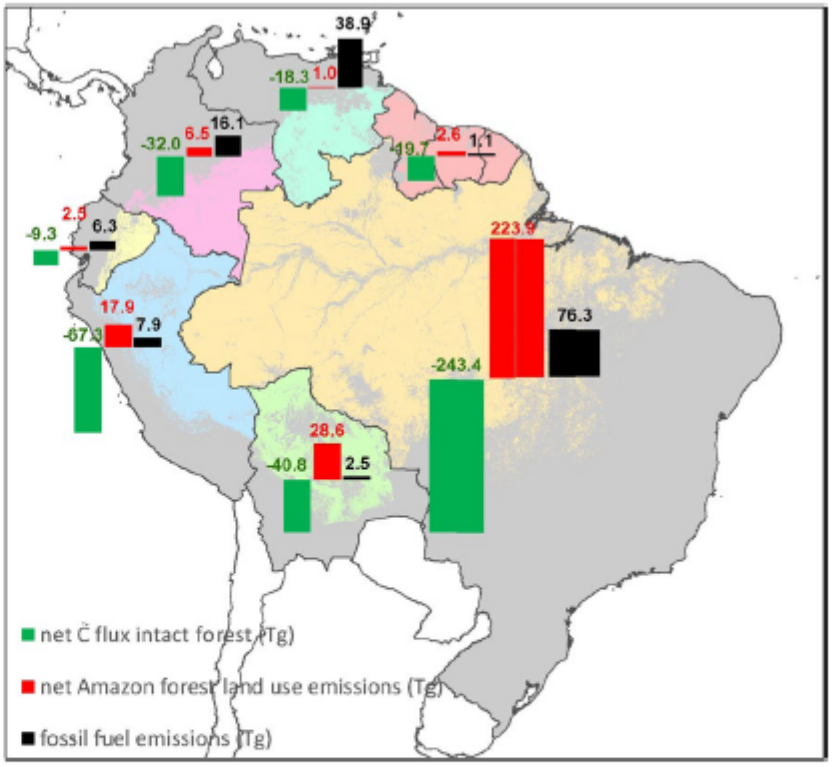
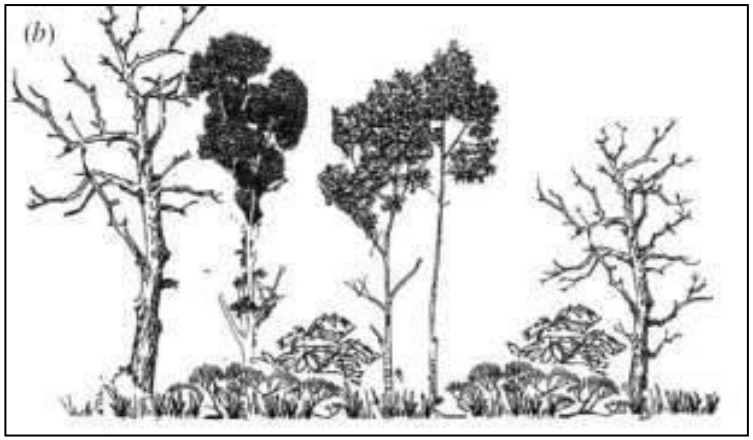
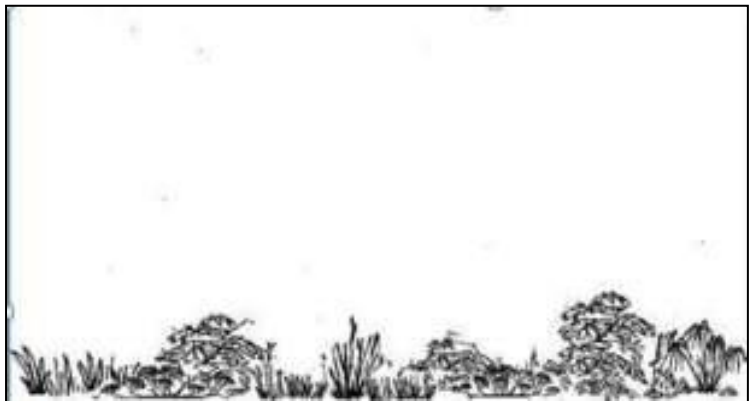


Fig. 2 Estimated Amazon carbon fluxes 1980–2010. For each nation three fluxes are represented: the net C flux mature forests (*green* and negative), the net fluxes from deforestation, i.e., losses from deforestation and degradation minus gains from regrowth (*red* and positive), and fossil fuel emissions (*black* and positive). Units are in Tg carbon per year ($=10^{12}$ g C yr^{-1})

Brazil's Monitoring Systems: PRODES and DETER





time

dialy deforestation alerts (DETER)

yearly rates of clear cuts (PRODES)

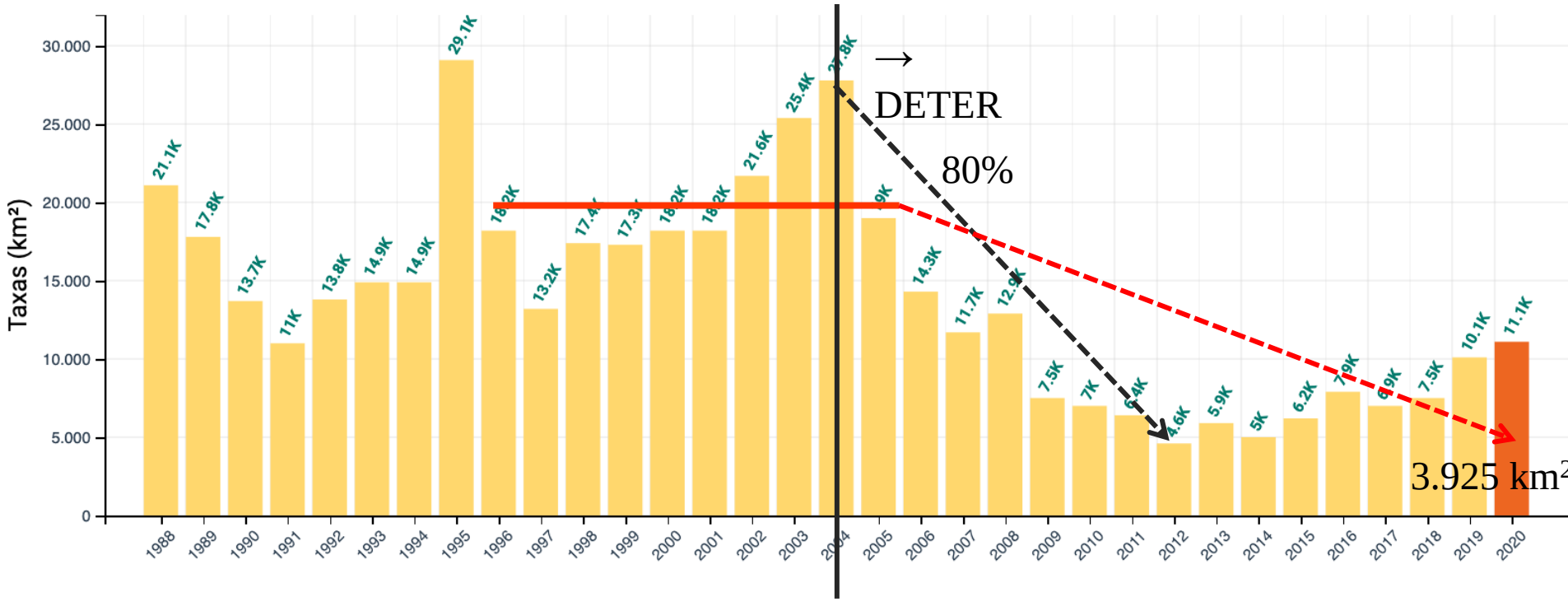
PRODES – Program for monitoring Amazonia by satellite

http://terrabrasilis.dpi.inpe.br

PRODES utilizes images from LANDSAT 8 / OLI, CBERS 4;4A e IRS-2 satellites with 20m to 30m resolution. Operational since 1988

PRODES – Program for monitoring Amazonia by satellite

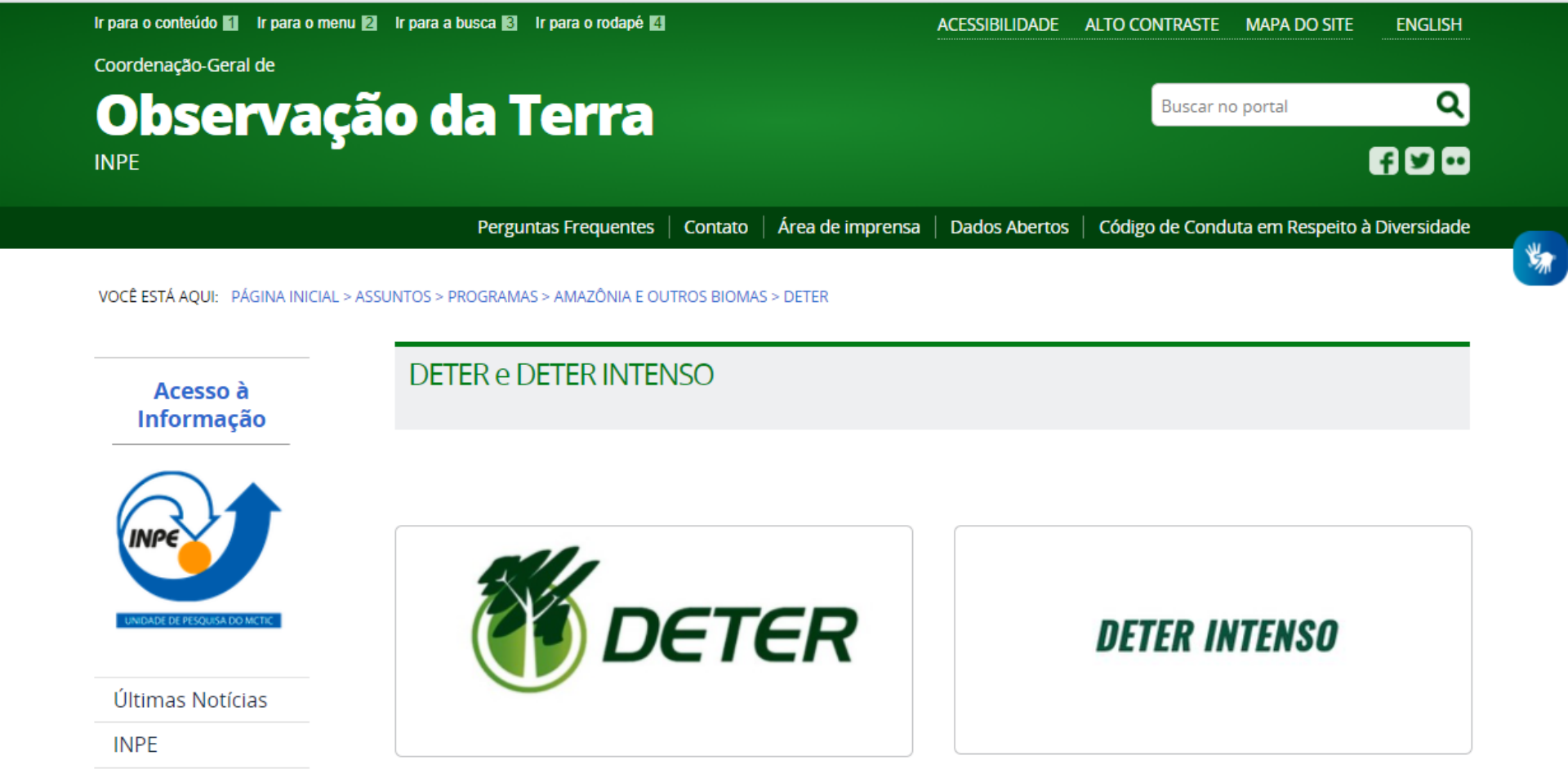
http://terrabrasilis.dpi.inpe.br



Science (2007) - "Brazil´s monitoring system is the envy of the world"

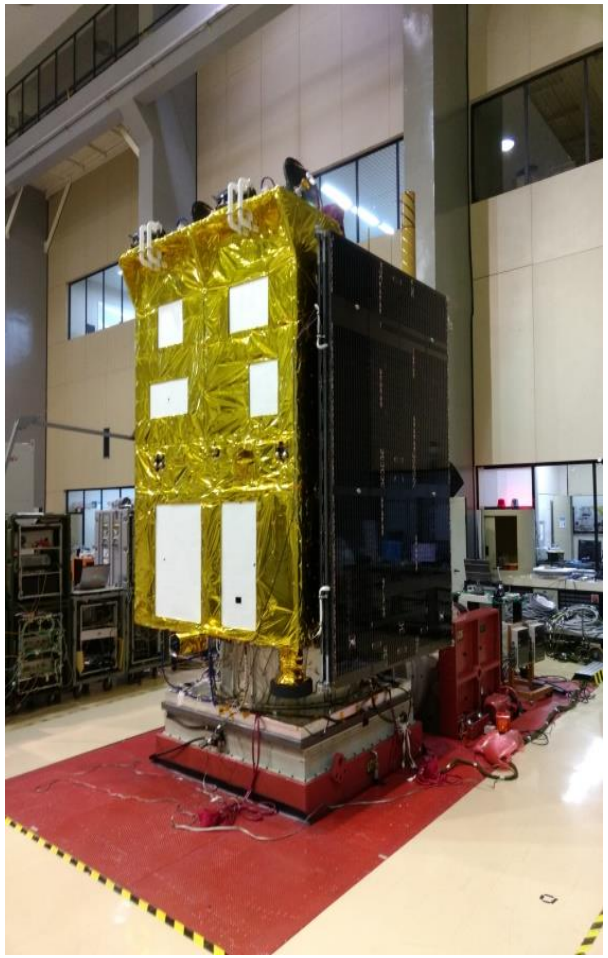
Nature (2012) - "The biggest environmental success story in a decade"

DETER – Daily alerts of evidences of changes in the forest covering in the Amazon

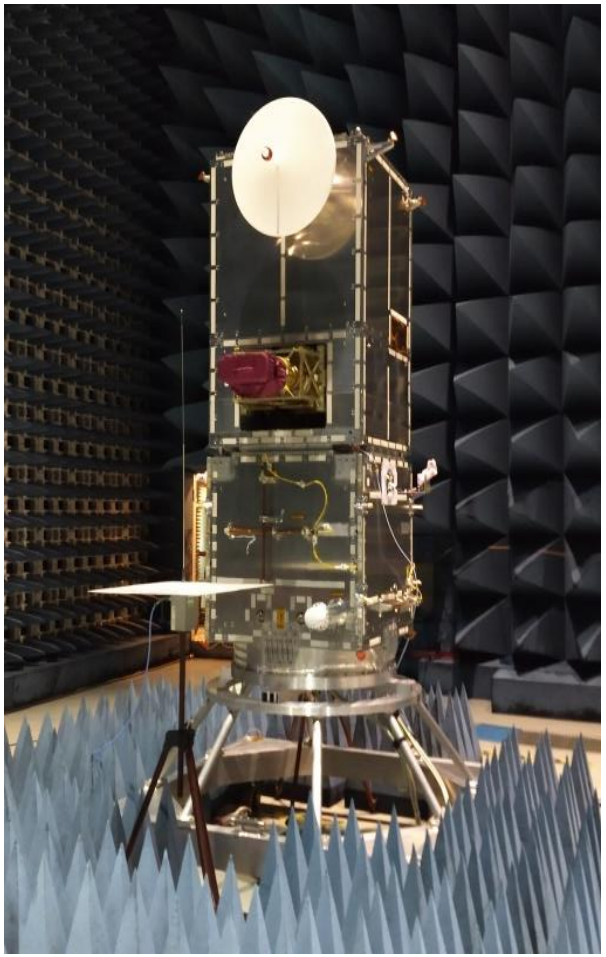


DETER utilizes images from CBERS 4&4A and IRS to produce daily alerts of selective logging, degradation, and deforestation in plots above 3 hectares. Operational since 2004

Recent Remote Sensing Satellites Developed by INPE

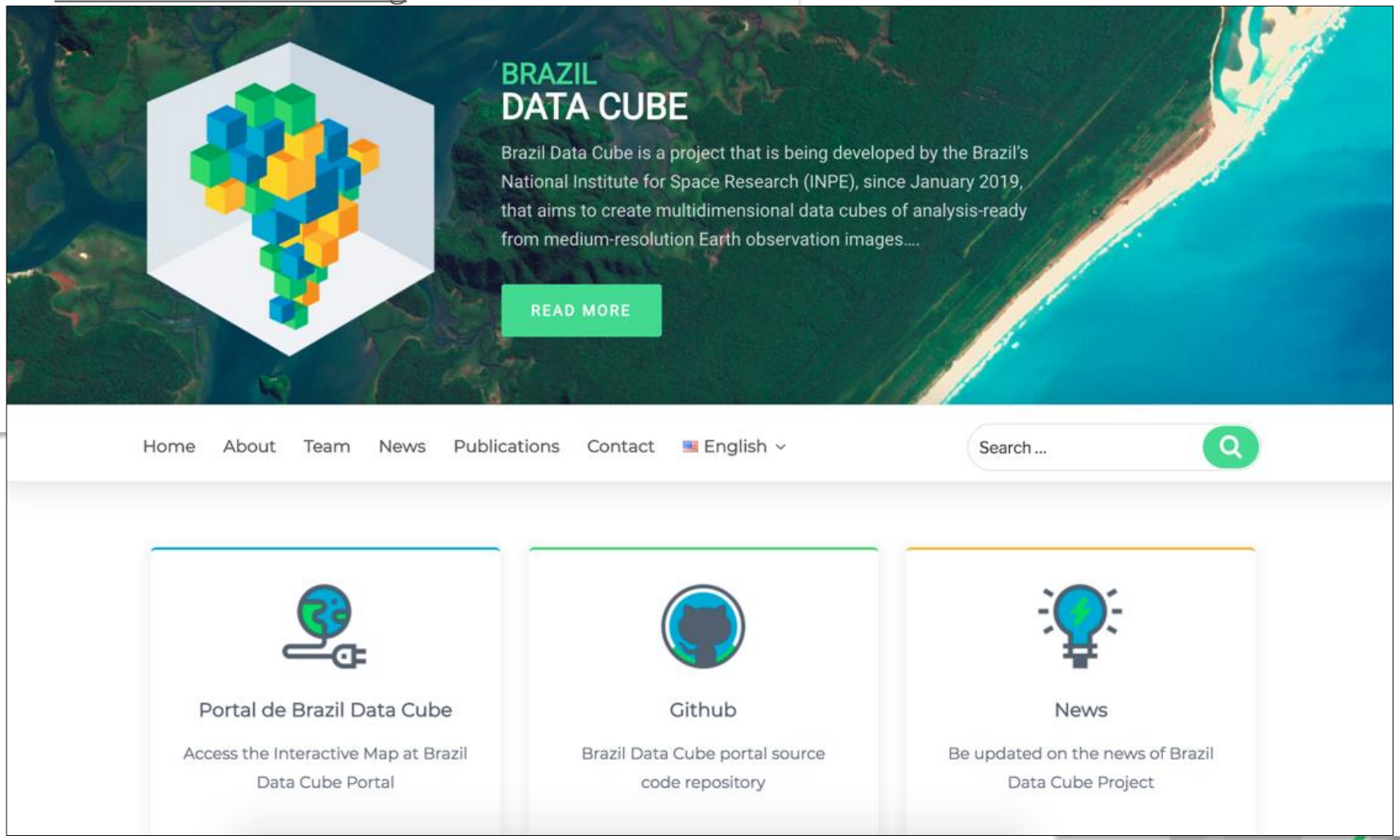


CBERS-04A
1950 kg; 630 km/heliosynchronous
Launched December 2019



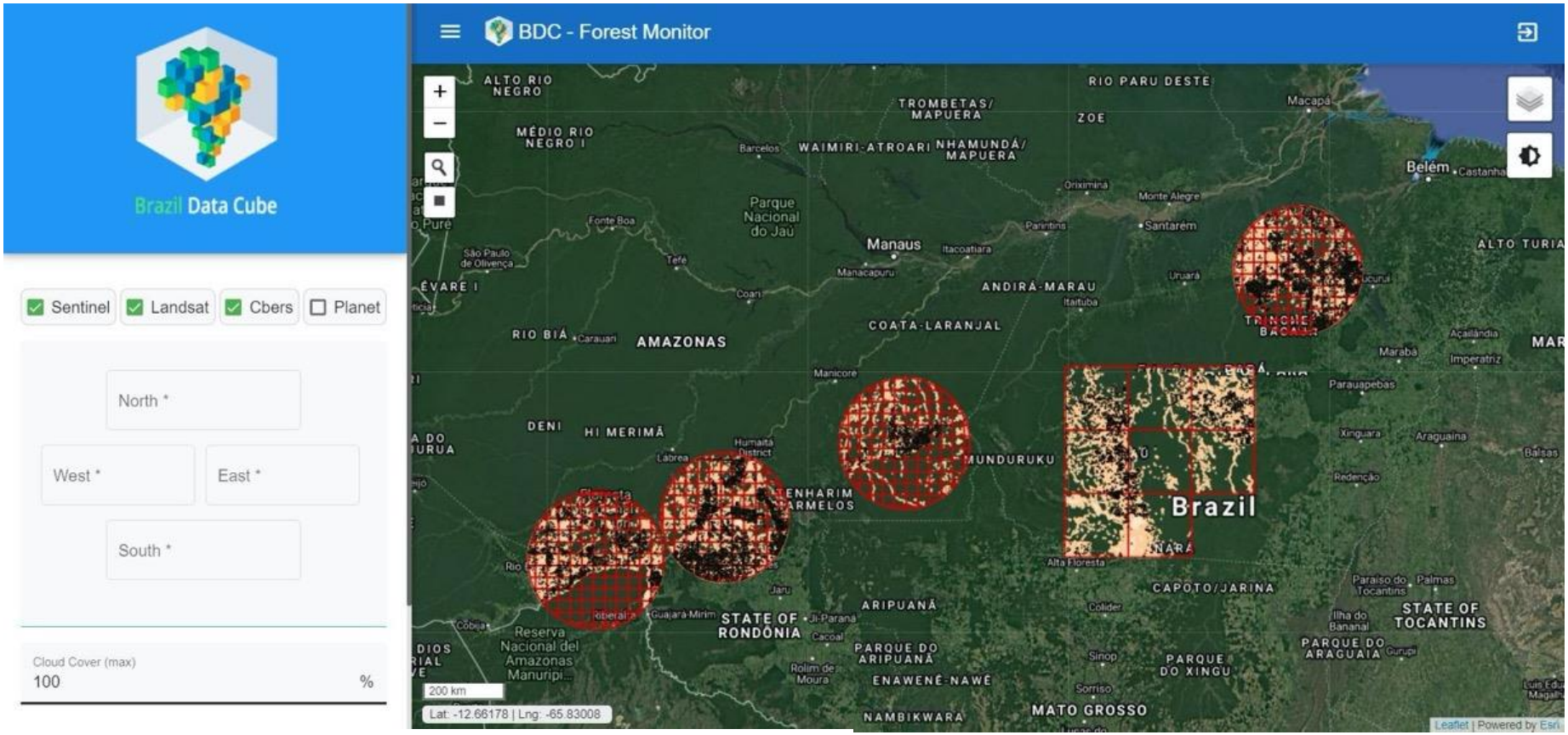
AMAZONIA 1
700 kg;750 km/heliosynchronous
To be launched March 2021

www.brazildatacube.org



DETER - Intenso

Mapeia alertas usando dado Sentinel, Landsat, CBERS em áreas específicas



http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/deter/deter-intenso

Não seguro | brazildatacube.org/pt/brazil-data-cube/

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BRAZIL DATA CUBE

Brazil Data Cube é um projeto que está
janeiro de 2019, pelo Instituto Naciona
(INPE), Brasil, com o objetivo de criar c
multidimensionais prontos para anális
média resolução espacial de imagens

LEIA MAIS

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Monitoring the Amazon Forest with LIDAR

[K. Lim *et al*; Progress in Physical Geography 27, 88 (2003)]

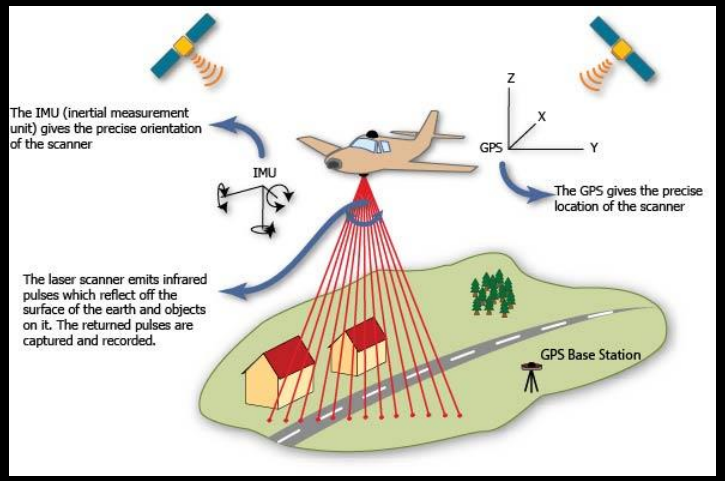
Main features

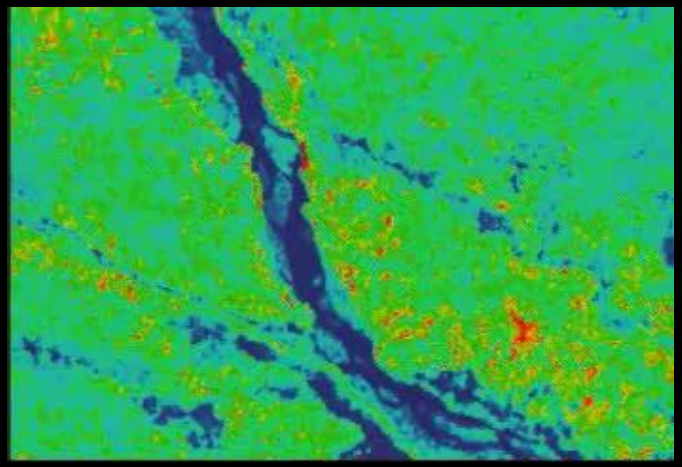
- Possibility to record a dense array of distance return values (several laser returns per cm^2 over ranges of $50m$), which are assembled into the highly detailed 3D reconstruction of the surfaces.
- LIDAR can be used to map the forests by measuring the vertical structures of the canopy and its density.
- Modelling forest above-ground carbon density by integrating air-borne LIDAR and satellite data.
- Fusion of hyperspectral and LIDAR remote sensing data for classification of complex forest areas.

1. Light Detection And Ranging (LIDAR)

- ✓ **For terrestrial remote sensing, infrared wavelength is emploed..**
- ✓ **Good tool for height measurements, such as the height of forest dossel.**

LIDAR integrated sensor hyperspectral – Carnegie Airborne Observatory (CAO)





Height of dossel – Sensor LIDAR LVIS-NASA

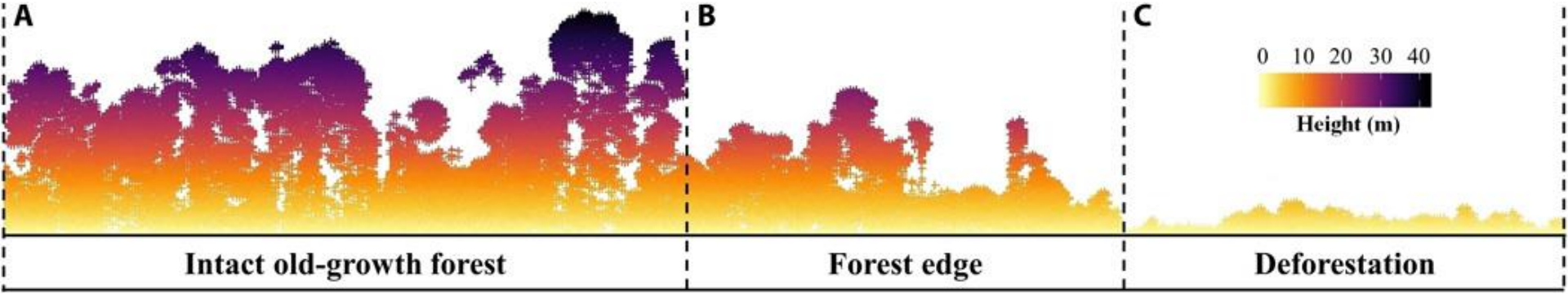
Science Advances
2 OCTOBER 2020

Persistent colapse of biomass in Amazonian forest edges following deforestation leads to unaccounted carbono losses

C.H.L. Silva Jr., L.E.O.C. Aragão, L.O. Anderson, M.G. Fonseca, *et al*

Methodology

- 30m spatial resolution forest change datasets based on optical images from the Landsat series of Earth Observation satellites.
- Airborne LIDAR data collected over Amazonian forests.



Point cloud data collected in the northeast of the Pará state, 2014, with 420 m of length. The points represent the vegetation height normalized by the terrain altimetry. (A) Nondegraded old-growth forest, where tree heights reach up to 40 m. (B) Forest edge (width of 120 m), where the height reaches up to 25 m. (C) Deforested area with vegetation regrowth (height up to 5 m)

Conclusions

- Forest fragmentation, a resulting feature of the deforestation process, promotes indirect carbon losses induced by edge effect. This process is not implicitly considered by policies for reducing carbon emissions in the tropics.
- Considering the edge effect in Amazonia over the 2001 to 2015 period, the authors find that carbon losses associated with edge effect $(947\ TgC)$ corresponded to one-third of losses from deforestation $(2592\ TgC)$.
- Despite a notable negative trend of $7\ TgC/year$ in carbon losses from deforestation, the carbon losses from edge effect remained unchanged, with an average of $63 \pm 8\ TgC/year$.
- Carbon losses caused by edge effect is thus an additional unquantified flux that can counteract carbon emissions avoided by reducing deforestation, undermining the Paris Agreement's bold targets.

The Brazilian Amazon deforestation rate in 2020 is the greatest of the decade

To the Editor — In 2012, Brazil achieved an unprecedented feat among tropical countries by reducing deforestation rates in Amazonia by 84% (4,571 km²) compared to the historical peak of 2004, when 27,772 km² of forests were clear-cut[1] (Fig. 1). This achievement resulted from multiple government initiatives, particularly the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm)[2,3] and international pressure, such as the soy and beef moratoria[4].

Pesquisadores compilaram 57 mudanças promovidas pelo governo Bolsonaro em dispositivos legais que enfraqueceram regras de preservação

in the last two years[1]. In 2019, 10,129 km² of forest was clear-cut, an increase of 34% compared to 2018 (7,536 km²). In 2020, the Brazilian Amazon

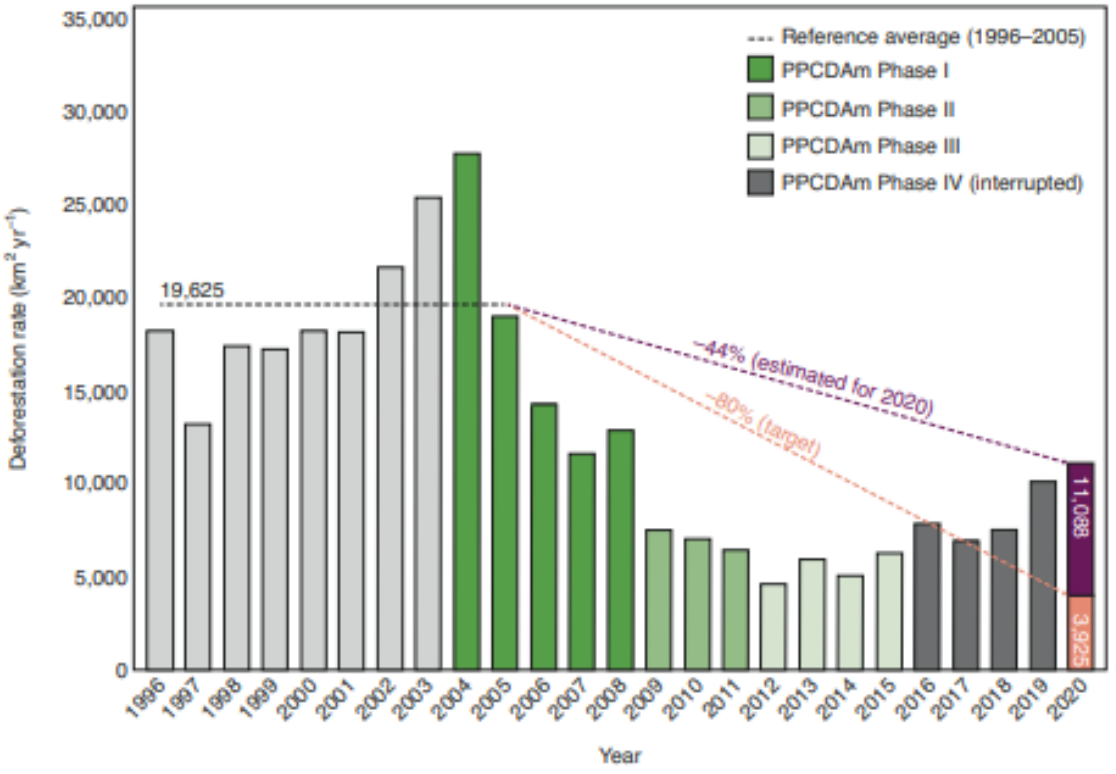
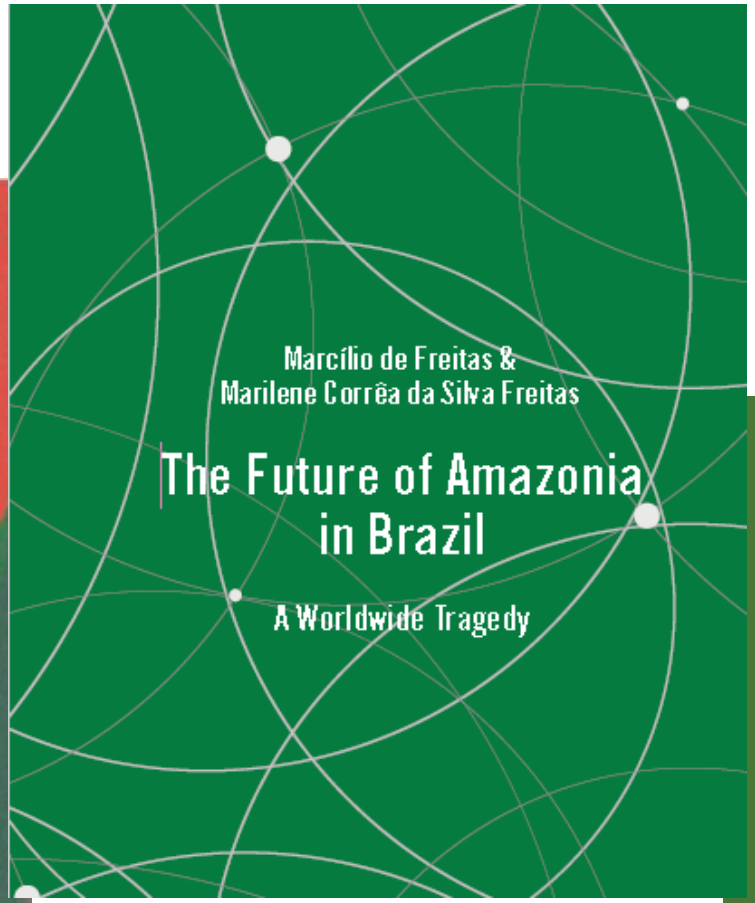


Fig. 1 | Deforestation on the rise. Official deforestation rates for the Brazilian Amazon, taken from PRODES[1]. The target 80% reduction from the 1996–2005 average is also shown. Bar colours represent phases of the Brazilian government's Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm).

É possível promover o desenvolvimento sustentável na Amazônia ?



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AGOSTO 2020

SOLUÇÕES TECNOLÓGICAS PARA A RASTREABILIDADE DA CADEIA DE SUPRIMENTOS NA AMAZÔNIA BRASILEIRA:

Oportunidades para o setor financeiro

Brodie Ferguson, Júlia Sekula e Ilona Szabó

BioEnergy Research
https://doi.org/10.1007/s12155-020-10176-x

Senna reticulata: a Viable Option for Bioenergy Production in the Amazonian Region

Adriana Grandis[1] · Bruna C. Arenque-Musa[1] · Marina C. M. Martins[1] · Thais Olivar Maciel[1] · Rachael Simister[2] · Leonardo D. Gómez[2] · Marcos S. Buckeridge[1]

Received: 13 April 2020 / Accepted: 28 July 2020

Abstract

Senna reticulata is an Amazonian tree that quickly accumulates high biomass. It grows widely in the north of Brazil occupying degraded regions and is popularly known as "matapasto" (pasture-killer) due to its aggressive colonization strategy. When its aerial parts are harvested, *S. reticulata* recolonizes the pasture quickly recovering biomass production. In this work, we examined the potential of *S. reticulata* for bioenergy production in the Amazon region and the effect of a CO_2 enriched atmosphere on its biomass composition. Nearly 50% of the biomass of the aerial parts is non-structural carbohydrates (NSC). Concerning structural carbohydrates, pectins (25% and 23%), hemicelluloses (11% and 16%), and cellulose (4% and 14%) contents were very similar in leaves and stems, respectively. Lignin varied considerably among organs, being 35% in roots, 7% in stems, and 10% in leaves. Although elevated CO_2 did not change significantly cell wall pools, lignin content was reduced in leaves and roots. Furthermore, starch increased 31% in leaves under elevated CO_2, which improved saccharification by 47%. We conclude that *Senna reticulata* is a suitable species for use as a bioenergy feedstock in the tropics and specifically for remote communities in the Amazonian region.

Nobre, I. and Nobre. C. A. The Amazonia Third Way Initiative: the role of technology to unveil the potential of a novel tropical biodiversity-based economy. In: Loures, L. C. (Org.). Land Use - Assessing the Past, Envisioning the Future. Open Access Book, IntechOpen, 31p., 2018. ISBN 978-953-51-6945-1 (in press). Available for download at:

https://www.intechopen.com/online-first/the-amazonia-third-way-initiative-the-role-of-technology-to-unveil-the-potential-of-a-novel-tropical

The Amazonia Third Way Initiative: The Role of Technology to Unveil the Potential of a Novel Tropical Biodiversity-Based Economy

Ismael Nobre and Carlos A. Nobre

Additional information is available at the end of the chapter

Abstract

Abstract For the last two decades, the Amazon development debate has been torn between attempts to reconcile two rather opposing views of land use: on one hand, a vision of setting aside large tracts of the Amazon forests for conservation purposes (referred hereafter to as The First Way) and, on the other hand, seeking a 'sustainable' resource-intensive development, mostly through agriculture/livestock, energy and mining (referred hereafter to as The Second Way). The decrease of Brazilian Amazon deforestation from 2005 to 2014 (about 75% decline) opens a window of opportunity to conceive a novel sustainable development paradigm: The Amazonia Third Way initiative (A3W). It can represent a new opportunity emerging to protect the Amazon ecosystems and the indigenous and traditional peoples who are their custodians and at the same time develop a vibrant, socially inclusive biodiversity-driven 'green economy' in the Amazon by harnessing Nature's value through the physical, digital and biological technologies of the 4th Industrial Revolution (4IR). 4IR technologies are increasingly harnessing these assets across many industries from pharmaceutical to energy, food, cosmetics, materials and mobility, and making profits. A3W addresses ways to channel to the Amazon the benefits of the 4IR for the creation of bio-industries and local development as it protects the forests.

Keywords: Amazon, Fourth Industrial Revolution, Amazonia Third Way, Amazonia 4.0, Amazon sustainable development, land use

A M A Z O N I A 4 . 0

Establishment of the *Amazonia Institute of Technology (AmIT)*

The **Amazonia Institute of Technology** (**AmIT**) will be the central driver of ambitious science, technology, and innovation-based product development of a deforestation-free and restorative Amazonian economy. It will be the home of research and education in the Amazon that effectively promotes sustainable and socially inclusive bio-economies of standing forests and flowing rivers. This note summarizes key reasons and timelines for its establishment, and related operational and finance considerations.

On behalf of the Amazonia 4.0 initiative of the Institute for Advanced Studies, University of Sao Paulo, Brazil, and with collaboration of MIT's Environmental Solutions Initiative, we propose to embark on a fast-paced process for science-based, intelligent, sustainable bioeconomy development in the Amazon.