Climate Change and IPCC: An Introduction

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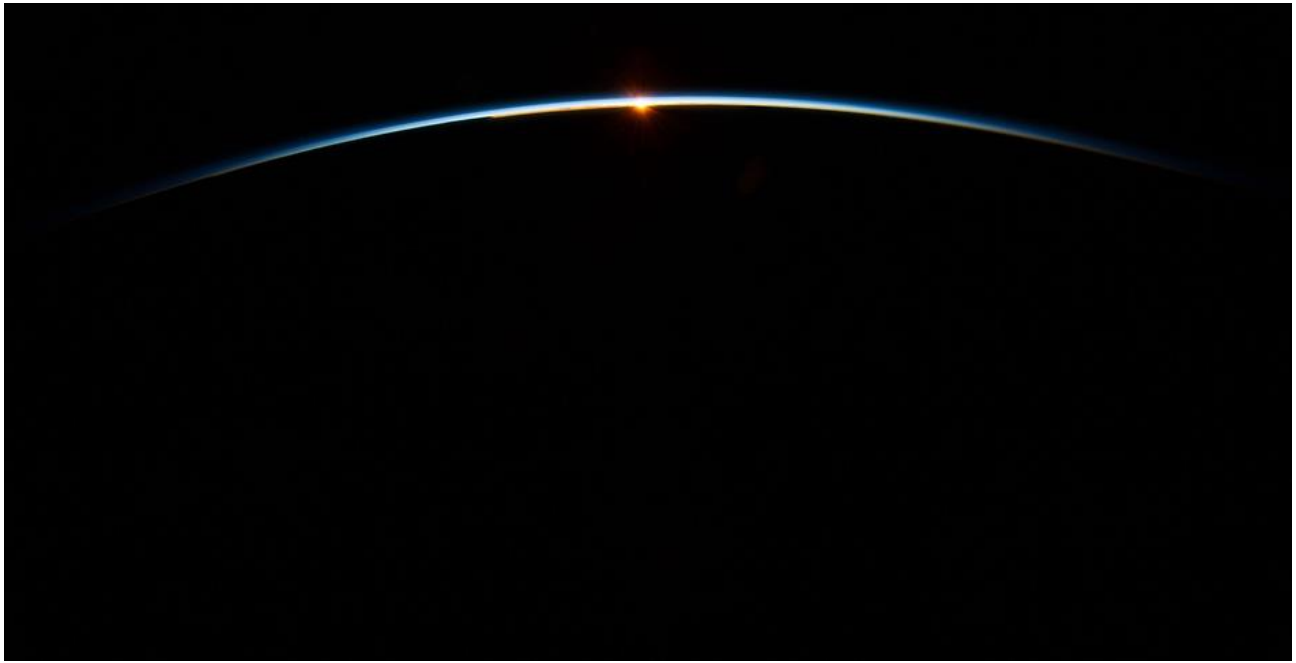
Université de Liège, course CLIM026, Liège, 7 April 2025

Thanks to the Walloon Government (funding the Walloon Platform for IPCC) and to my team at the Université catholique de Louvain for their support

That small blue dot is the Earth, a seen from Cassini, orbiting Saturn, 1.44 billion km from us, on 19-7-2013

@JPvanYpersele

Our atmosphere is thin and fragile (as seen by ISS crew on 31 July 2013)



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Let us think about the future of these children from Machakos (Kenya) in a warming climate

Photo:
@JPvanYpersele
April 2015

IPCC or GIEC?

- **IPCC = Intergovernmental Panel on Climate Change**
- **GIEC = Groupe d’experts Intergouvernemental sur l’Évolution du Climat**

Why the IPCC ?

Established by WMO and UNEP in 1988

to provide policy-makers with an objective source of information about

- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options (adaptation & mitigation).

WMO=World Meteorological Organization

UNEP= United Nations Environment Programme

IPCC: Intergovernmental Panel on Climate Change

- Installed by UN through World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) in 1988
- Organises each 5-7 years a scientific assessment of published literature on climate change, its impacts and its response options
- By teams of scientists from all continents
- Primarily to inform the policymakers of the UN member states

UN General Assembly resolution 43/53 (1988) calling for the IPCC creation

- "a comprehensive review and recommendations with respect to:
  - (a)The state of knowledge of the science of climate and climatic change;
  - (b)Programmes and studies on the social and economic impact of climate change, including global warming;
  - (c) Possible response strategies to delay, limit or mitigate the impact of adverse climate change;
  - (d)The identification and possible strengthening of relevant existing international legal instruments having a bearing on climate;
  - (e)Elements for inclusion in a possible future international convention on climate".

d

The Role of the IPCC is …

"… to **assess** on a comprehensive, objective, open and transparent basis the **scientific, technical and socio-economic information** relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation."

"IPCC reports should be **neutral with respect to policy**, although they may need to **deal objectively with scientific, technical and socio-economic factors** relevant to the application of particular policies."

Principles Governing IPCC Work, paragraph 2
Source: http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles.pdf

The IPCC was awarded the 2007 **Nobel Peace Prize** (together with Al Gore)

"…for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change"

The Norwegian Nobel Committee added:

« According to the IPCC, there is a real danger that the climate changes may also increase the danger of war and conflict, because they will place already scarce natural resources, not least drinking water, under greater pressure and put large population groups to flight from drought, flooding, and other extreme weather conditions. »

Structure IPCC

Intergovernmental Panel
195 member States appointing National Focal Points.

The Secretariat
Oversees the process and provides support.

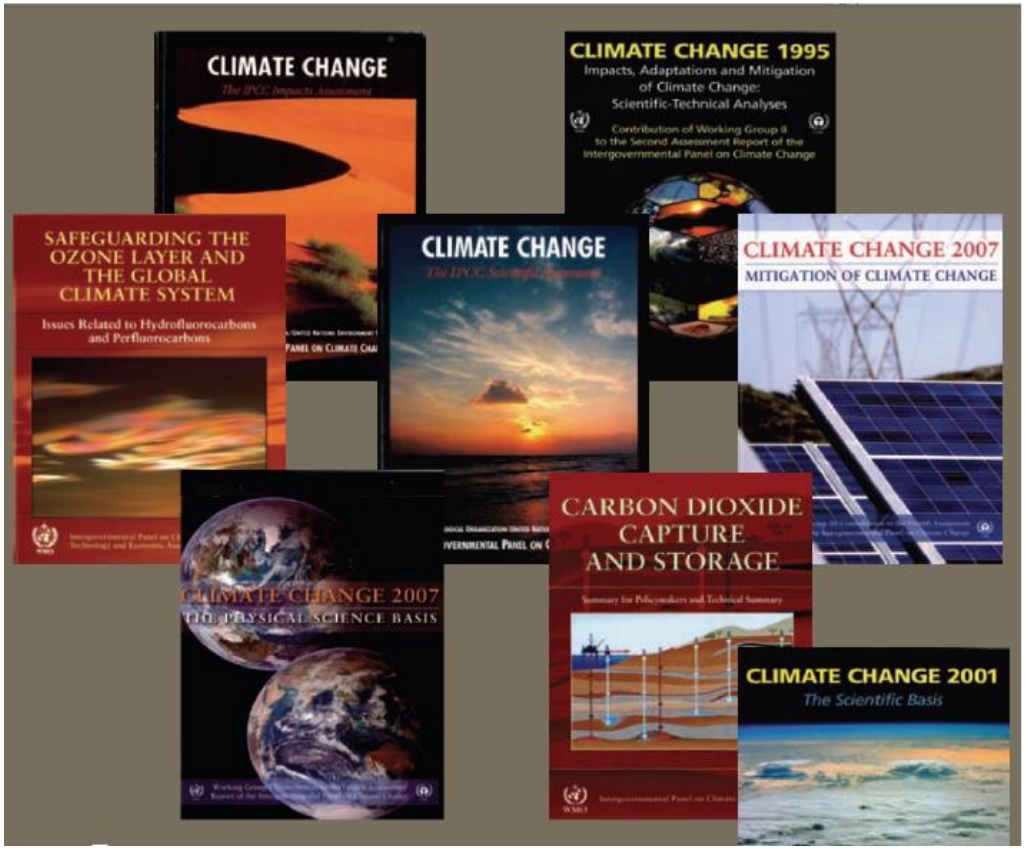
Hundreds of **scientists and experts from around the world** are involved in the preparation of IPCC reports.

Technical Support Units (TSUs)
Each Working Group and the TFI is supported by a TSU.

IPCC Products

- **Assessment reports:**
  comprehensive picture of the present state of understanding of climate change (1990 – 1995 – 2001 – 2007 - 2013/14 – 2021/23)
  - SPM : summary for policy makers; TS : technical summary
- **Special reports:** assessment / a specific issue (next slide)
- Methodology reports:
  methodologies for national greenhouse gas inventories, used by Parties to the UNFCCC to prepare their national communications
- Technical papers: focus on a specific topic, drawing material from other IPCC reports (e.g. climate change and water)
- Workshop and Expert meeting reports: = supporting material, commissioned or supported by the IPCC, but not reviewed following IPCC procedures, and not accepted / adopted by the IPCC

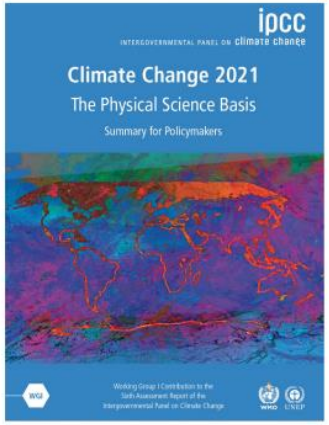
IPCC Main Products: 'Assessment & Special Reports'



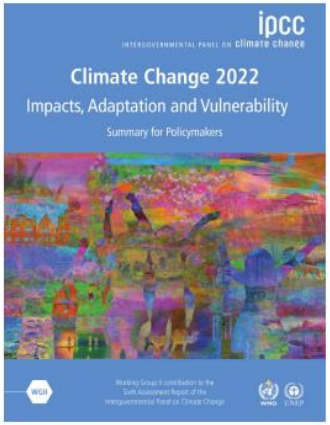
Assessment Reports: full assessment for each of the IPCC Working Groups

Special Reports: assessment of a specific theme

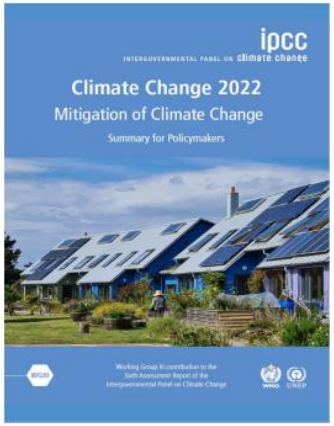
The 6th Assessment Report (AR6):



234 authors, **65** countries
14,000+ scientific papers
78,000+ review comments



270 authors, **67** countries
34,000+ scientific papers
62,000+ review comments



278 authors, **65** countries
18,000+ scientific papers
59,000+ review comments

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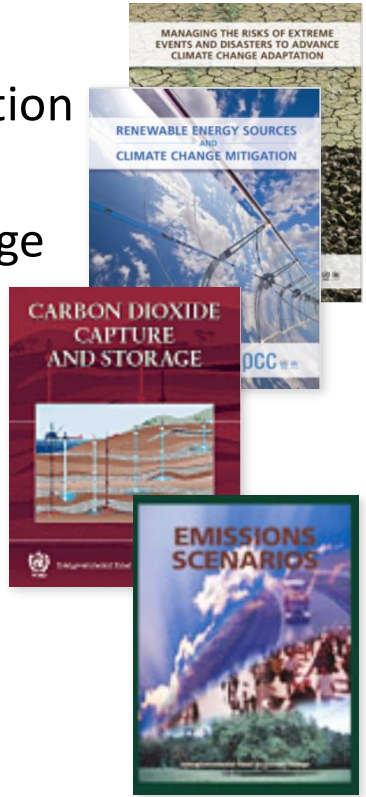
Some IPCC Special reports

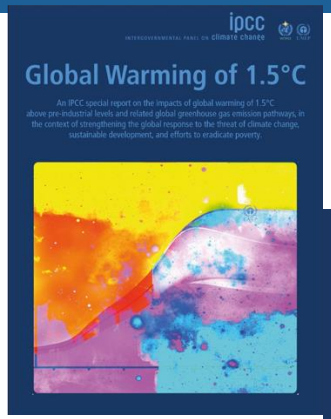
- Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX, 2012)
- Renewable Energy Sources and Climate Change Mitigation (SRREN, 2011)
- Carbon Dioxide Capture and Storage (2005)
- Safeguarding the Ozone Layer and the Global Climate System (2005)
- Methodological and Technological Issues in Technology Transfer (2000)
- Emissions Scenarios (SRES, 2000)



Most recent IPCC Special reports

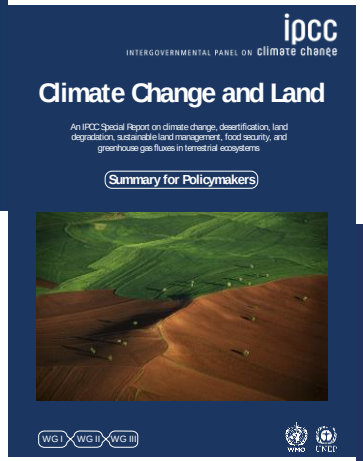
- SR15, 2018

(1.5°C Warming)

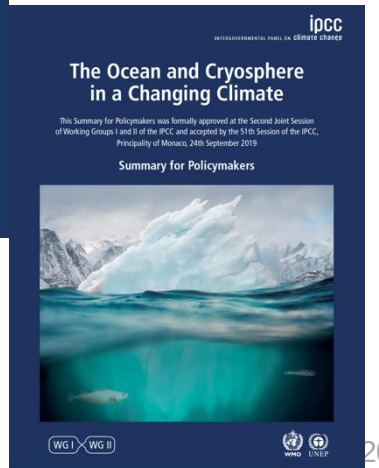


SRLand, 2019

(Climate change and land-related-issues)



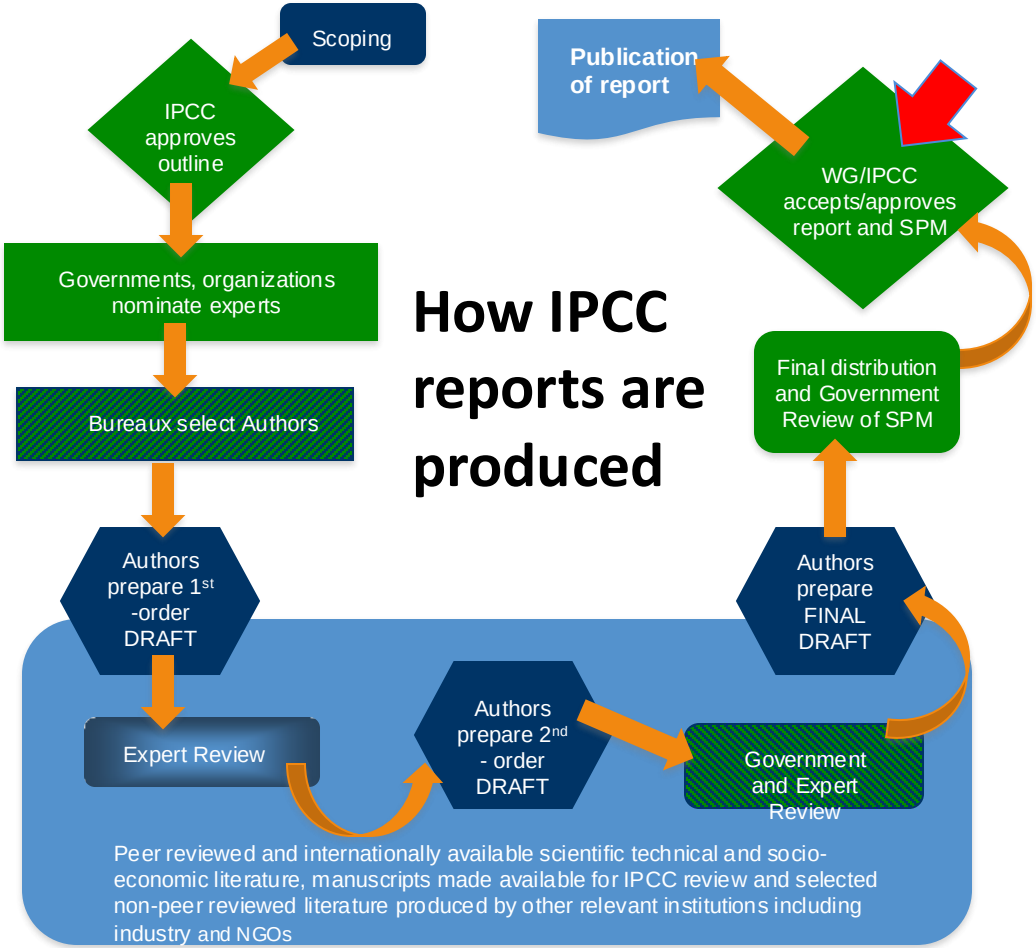
SROCC, 2019
(CC, ocean and cryosphere)



What is a ‘Scientific Assessment’ IPCC-style?

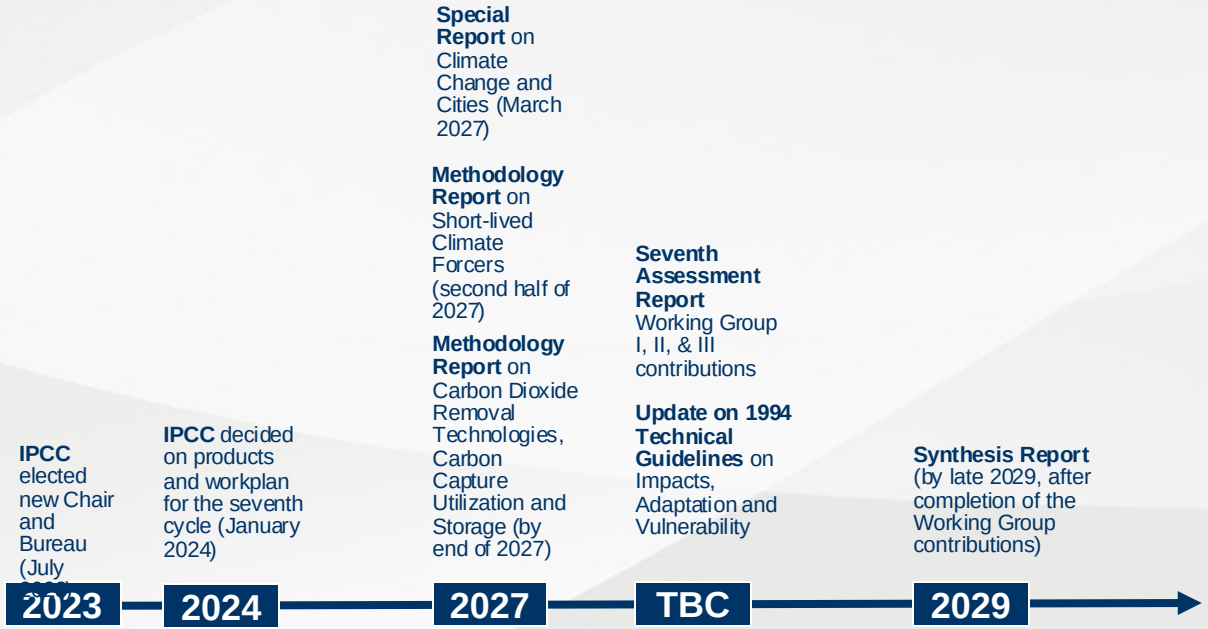
- It addresses topics identified through a scoping process and agreed by the Plenary
- It draws key conclusions from the full span of available (mostly peer- reviewed) scientific literature
- It is written by a diverse group of qualified authors from all regions of the world– taking different views into account
- Review by voluntary experts and by governments is key to its quality
- When appropriate, its findings are labelled with uncertainty qualifiers

How IPCC reports are produced



Report Process | Ten Steps

Seventh Assessment Cycle | Timeline



Typical implementation plan

2025	
7 March-17 April	Call for Author nominations
30 June – 2 July	Decision on selection of Authors
27-31 October or 1-5 December *depending on location*	Joint First Lead Author Meeting
2026	
27 April - 1 May	Second Lead Author Meeting
10 August - 2 October	Expert Review of the First Order Draft
2 - 6 November	Third Lead Author Meeting
2027	
3 May - 25 June	Expert and Government Review of the Second Order Draft
26-30 July	Fourth Lead Author Meeting
20 December - 25 February	Final Government Distribution of the Final Draft and Final Government Review of the Summary for Policy Makers
2028	
1 - 5 May	Approval of the Summary for Policymakers and acceptance of the underlying Report

Not Approved!!

Tentative Implementation plans available for WG1, WG2 and WG3 not approved!!

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Engagement with the IPCC

- **Coordinating Lead Author (CLAs)** are responsible for coordinating work on major sections of a report such as chapters.

- **Lead Authors (LAs)** are responsible for the production of designated sections of the report within a chapter on the basis of the best scientific, technical and socio-economic information available.

- **Review Editors (REs**) help identify expert reviewers, ensure that all substantive comments are afforded appropriate consideration, and advise Lead Authors on how to handle contentious or controversial issues

- More Information on the roles is available in Annex 1 of Appendix A to the Principles Governing IPCC Work.

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Other ways to engage with IPCC

How to Participate in IPCC

- **Contributing Authors** provide specific knowledge or expertise in a given area and help ensure that the full range of views held in the scientific community is reflected in the report. Selection via CLAs and Las.

- **Chapter Scientists** provide technical and logistical support to author teams.

- **Expert Reviewers** comment on the accuracy and completeness of the scientific assessment contained in the drafts. An Expert Reviewer may decide to comment on one section of the report, on a complete chapter, or on the report as a whole.

- **Contribute to literature.** Cut-off approximately one to three months before completion of the final draft. More information: IPCCFactSheet_Literature.pdf

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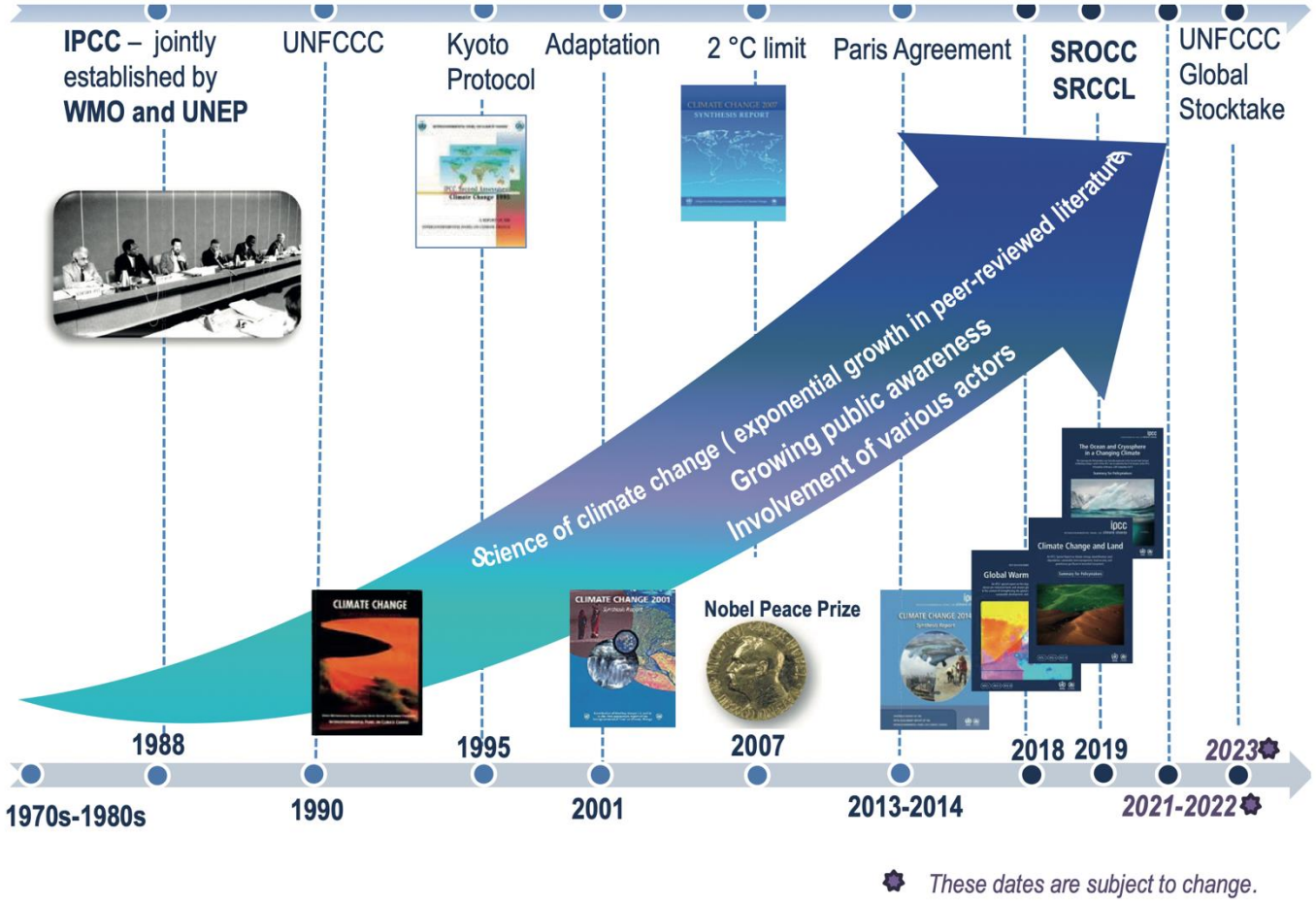
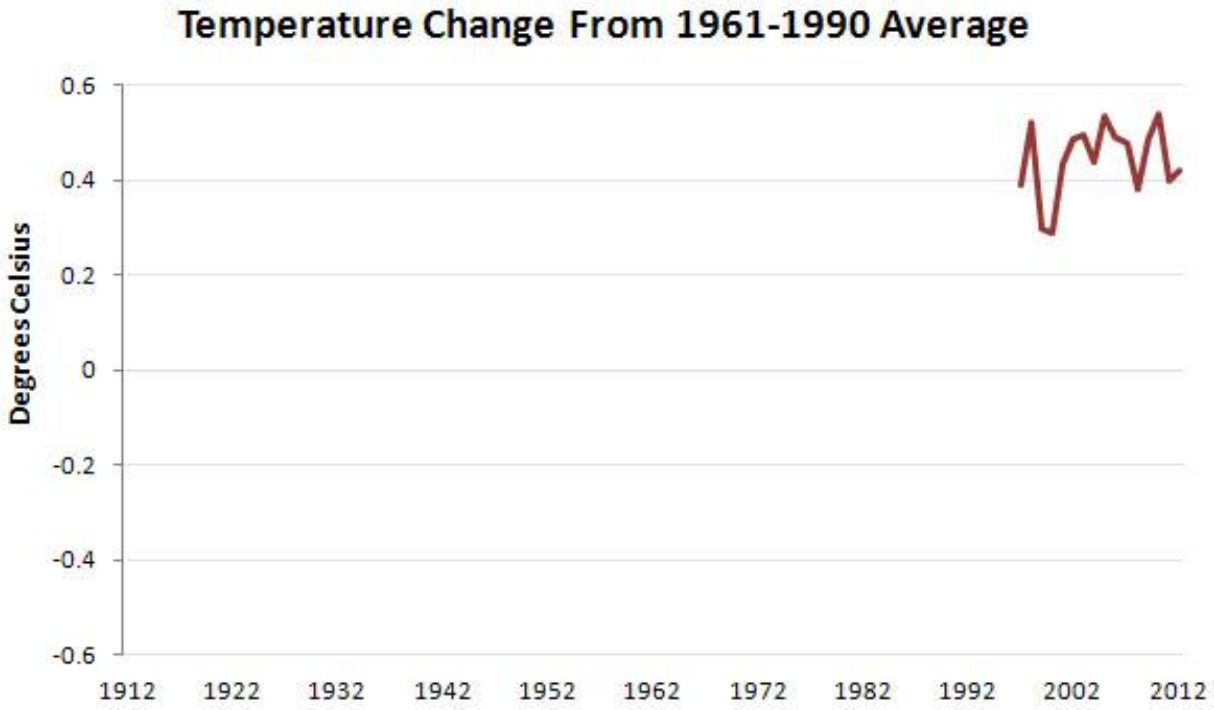
IPCC is the global voice of climate!



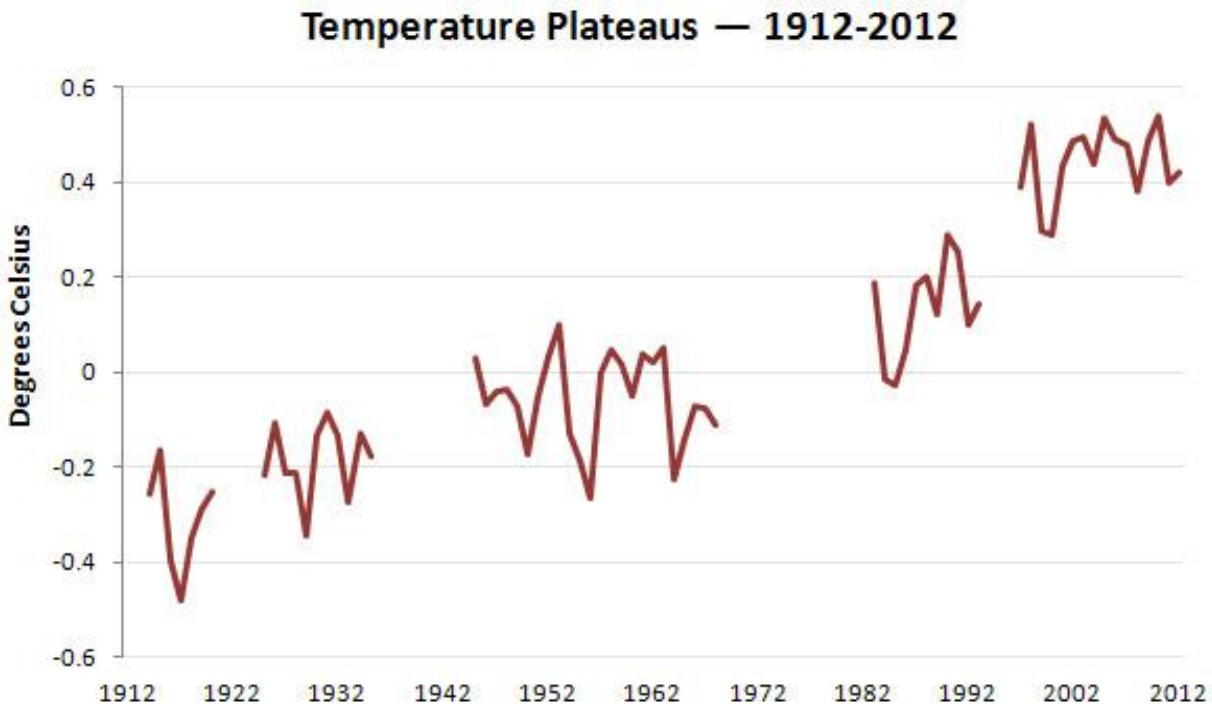
Source: IPCC web site, 2023

Source: @JohnfoCook



http://www.motherjones.com/kevin-drum/2012/10/lying-statistics-global-warming-edition

Lying With Statistics, Global Warming Edition



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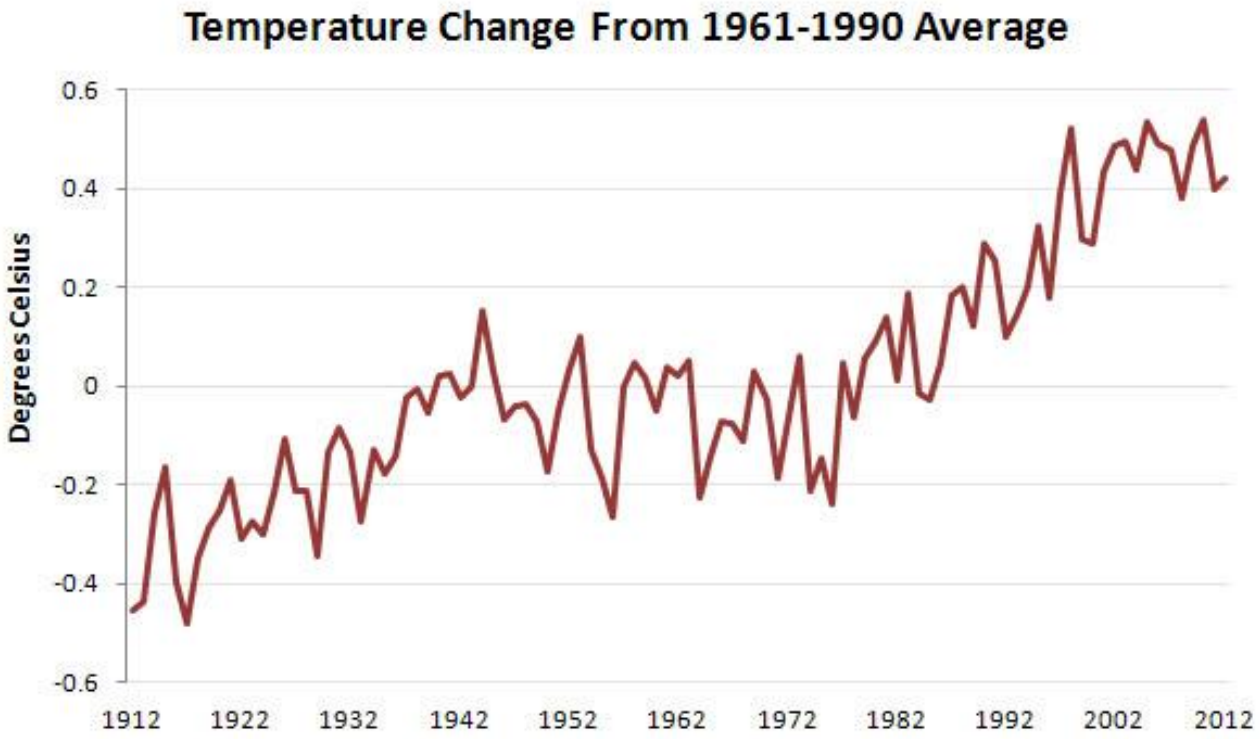
Lying With Statistics, Global Warming Edition



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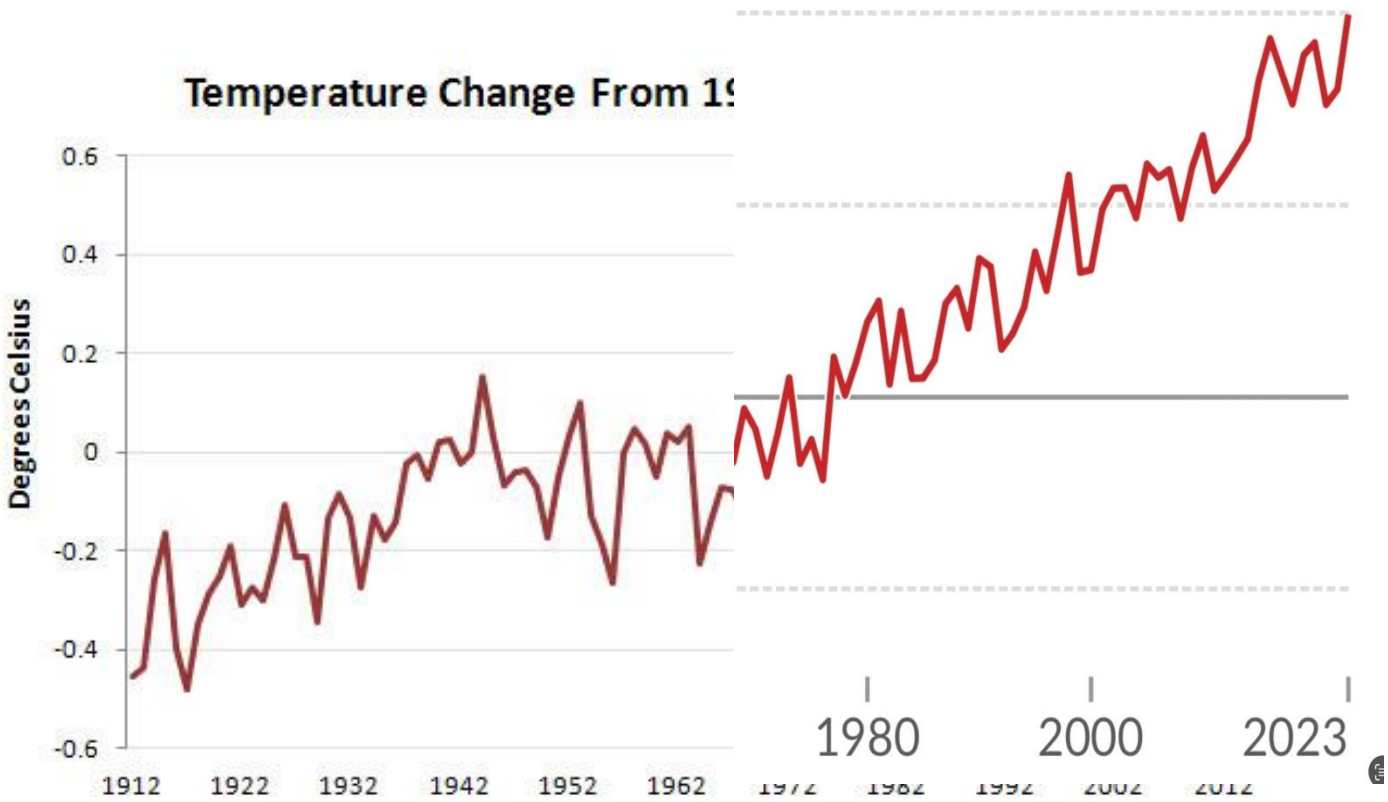

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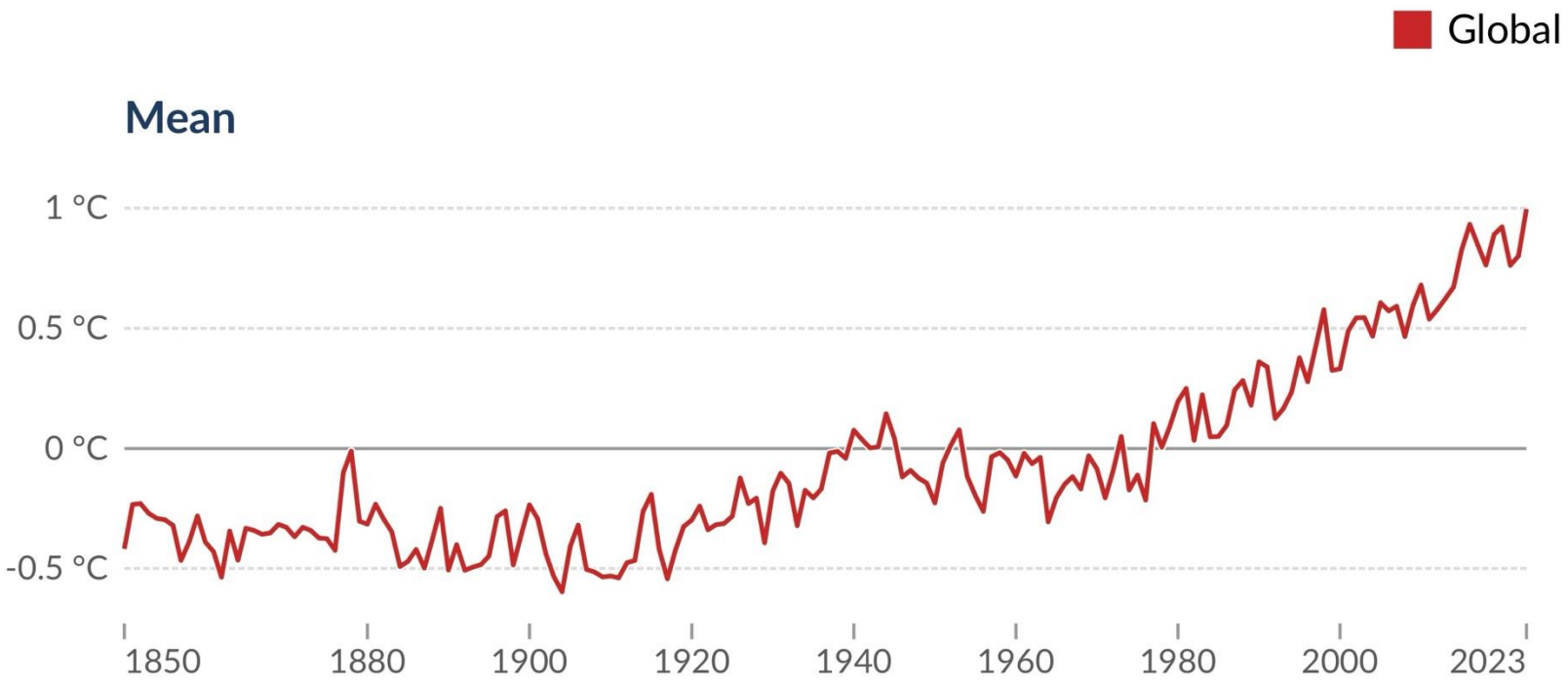


Plot: Our World in Data; **Data source:** Met Office Hadley Centre (2023)

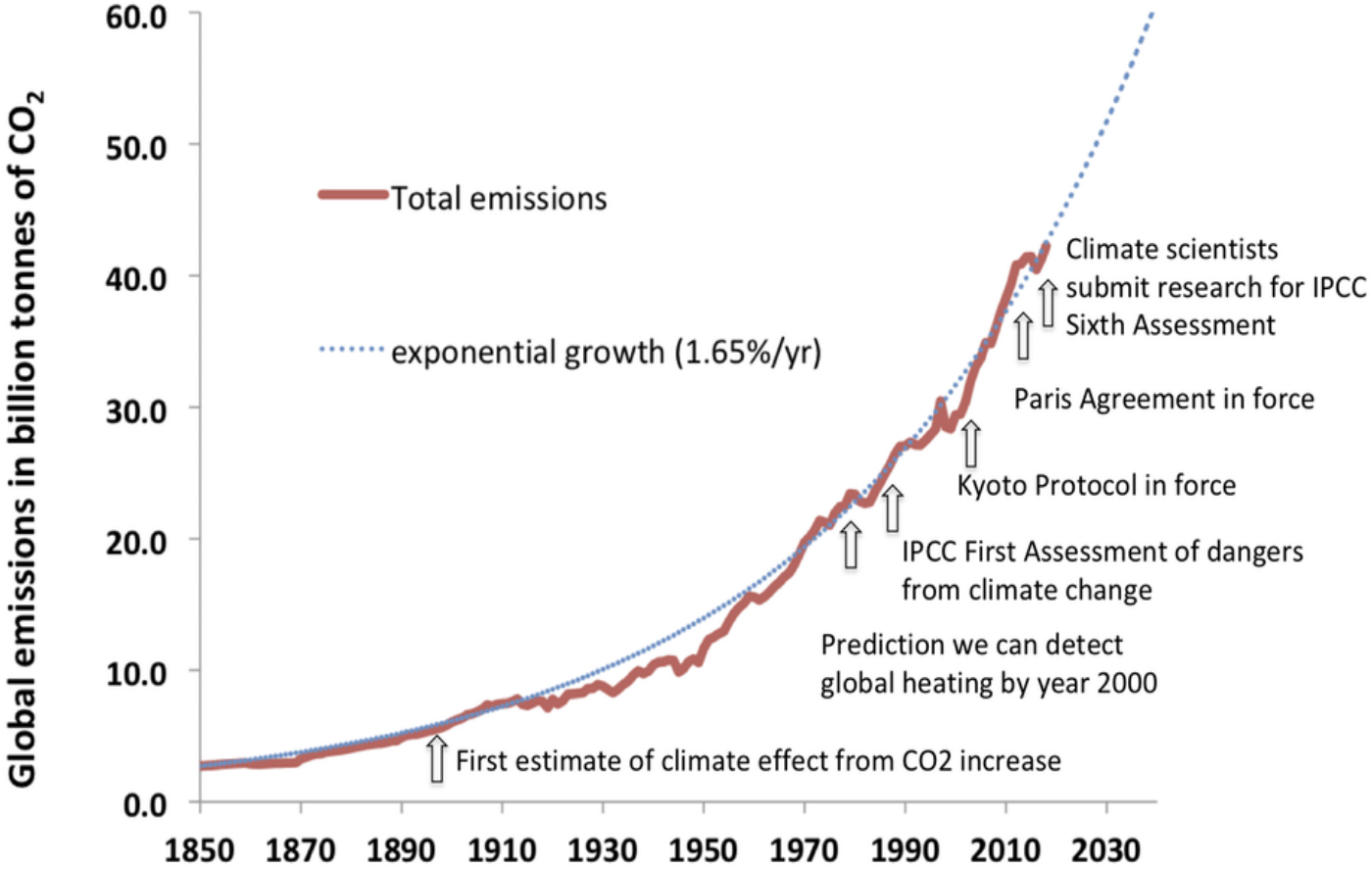
In the USA alone, organizations which sow doubt about climate change spend almost a billion dollars/year! (Brulle 2014, average numbers for 2003-2010)

The European Union fares a little better, but many Brussels lobbyists try to dilute the EU environmental efforts (see the car industry…)

@JPvanYpersele

The « merchants of doubt » have evolved in their arguments:

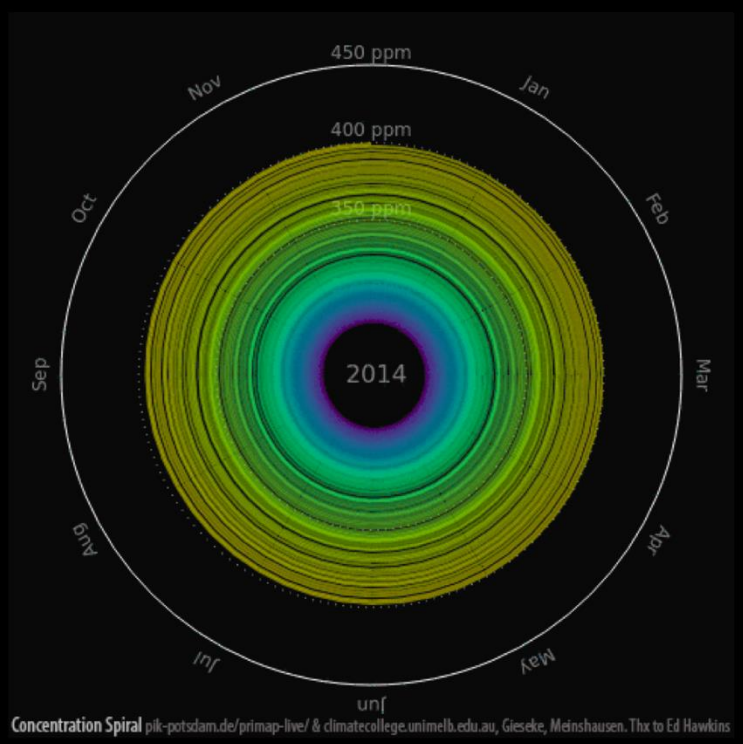
- Existence of global warming
- Human responsability in the warming
- Cost of decarbonization
- Drawbacks from alternatives

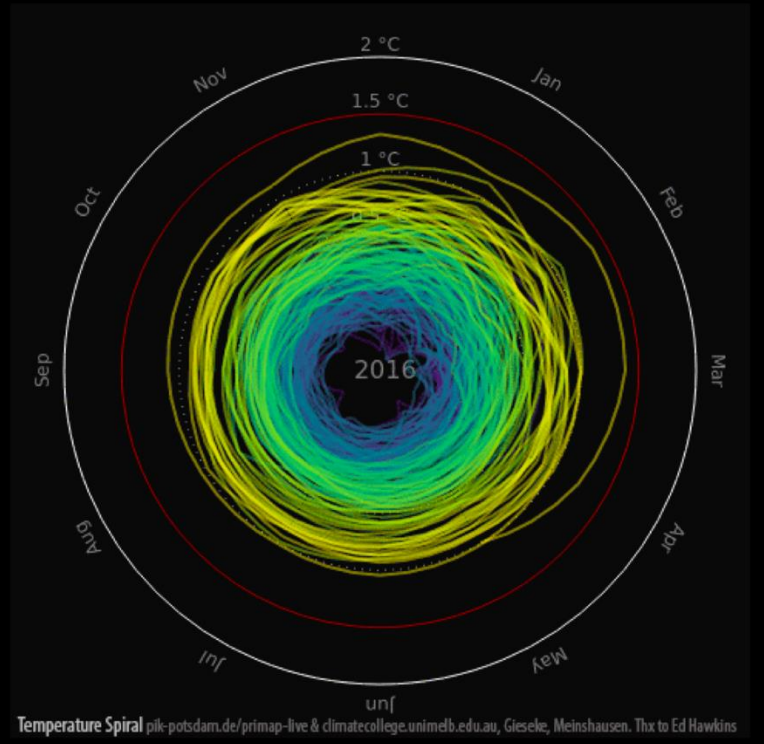


Source: Wolfgang Knorr, in The Conversation (2019)

It’s real

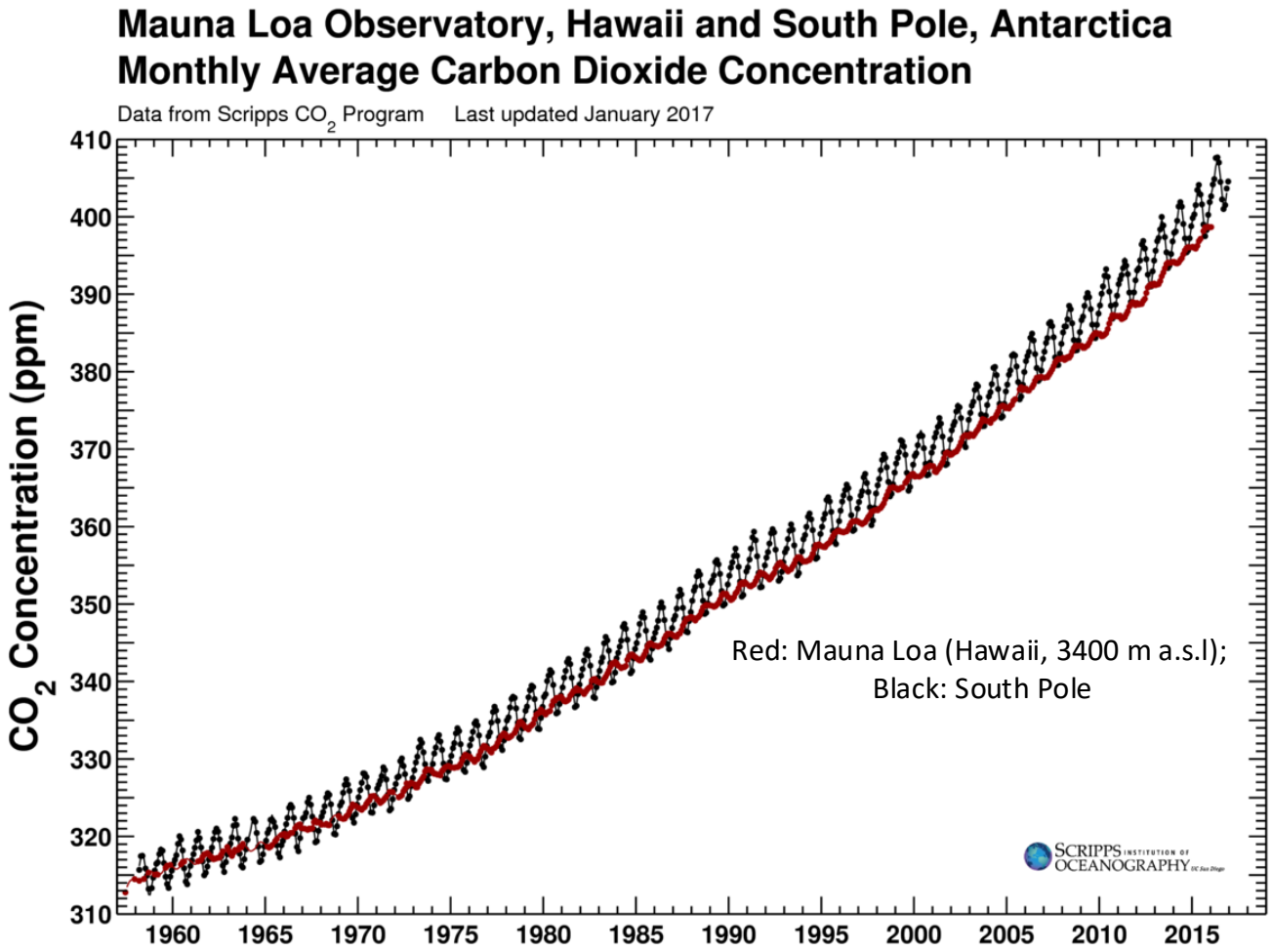
CO_2 Concentration and Temperature spirals



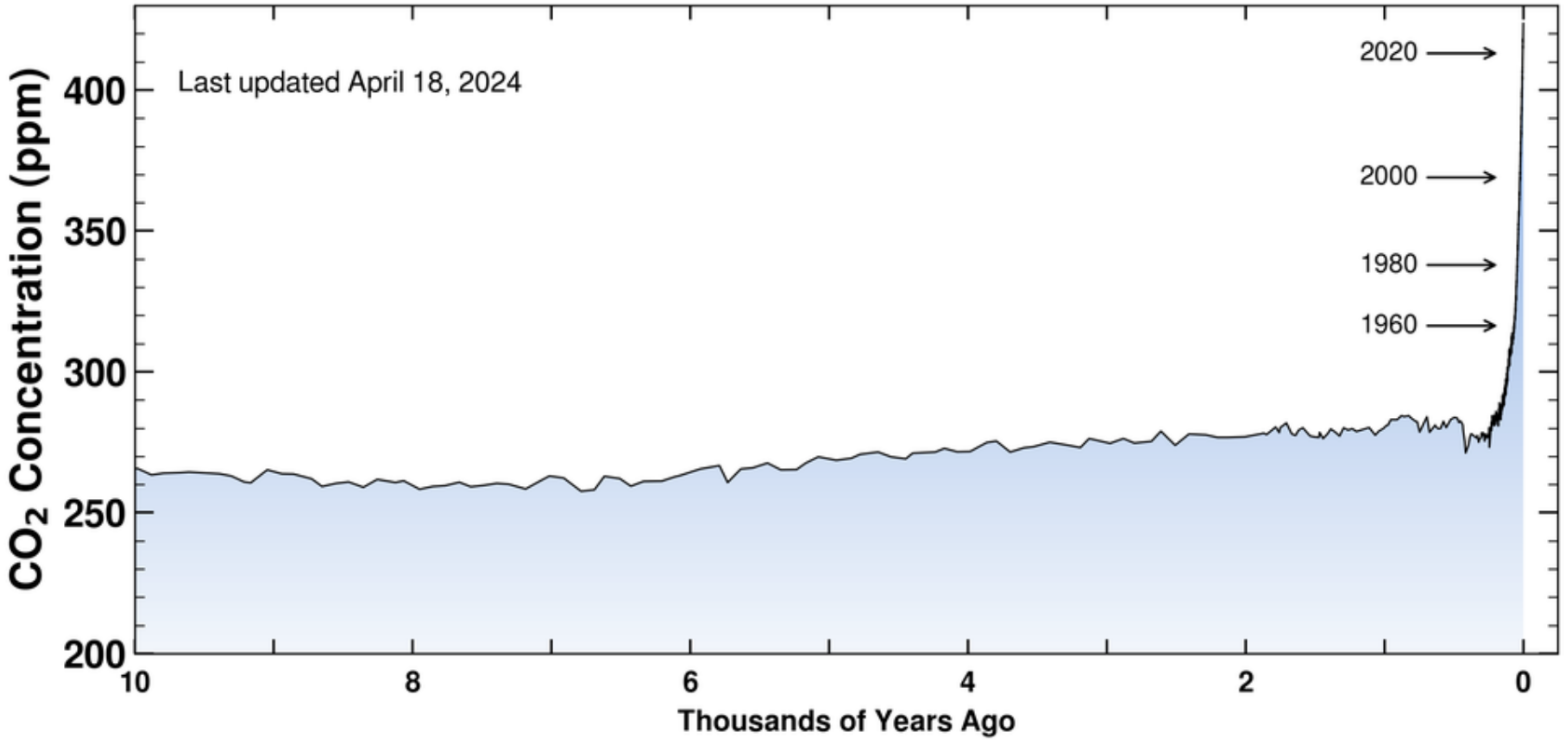


CO_2 Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animation available on http://openclimatedata.net/climate-spirals/concentration-temperature/

Atmospheric CO_2 concentration

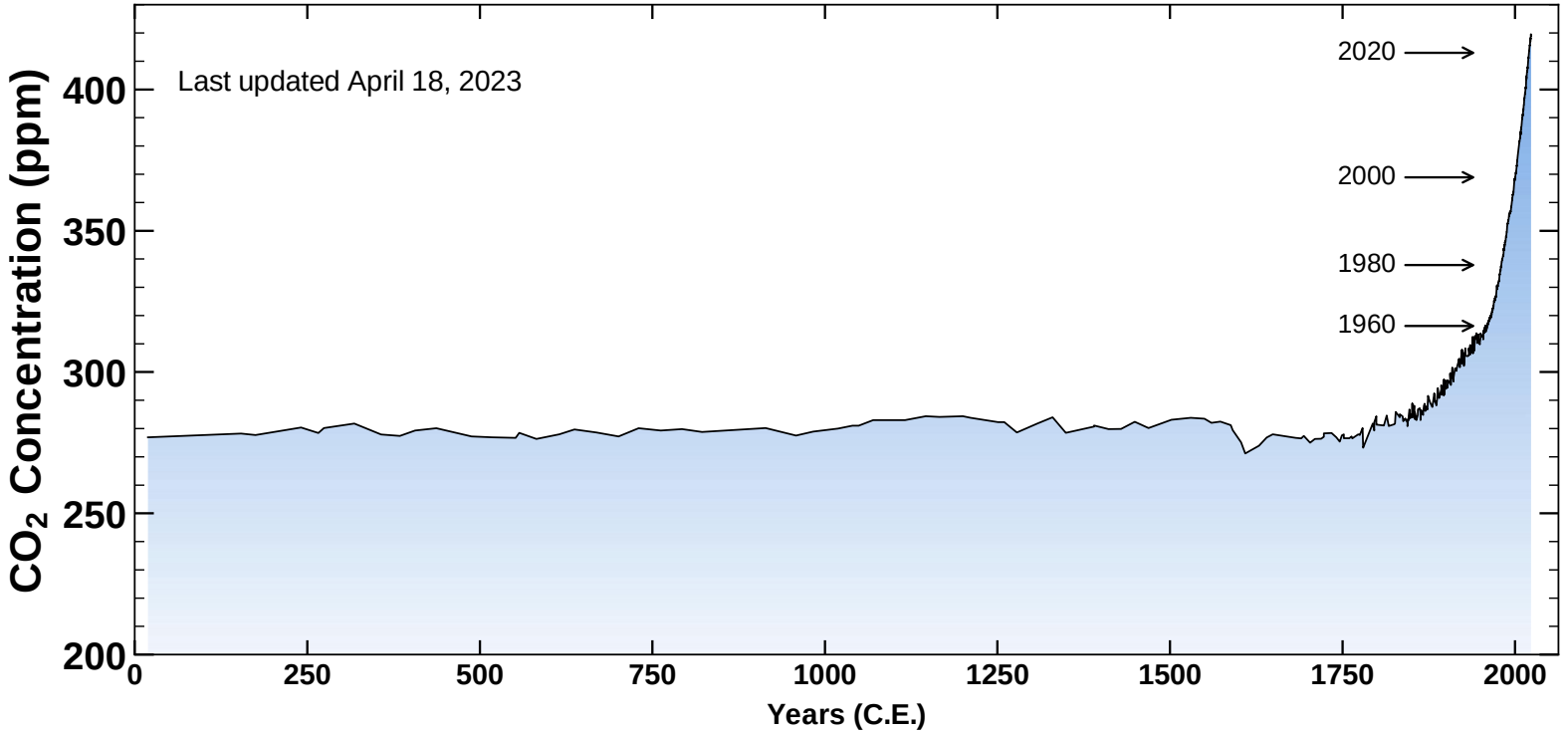


CO_2 Concentration 18 April 2024: 427,14 ppm (Keeling curve + last 10000 years)



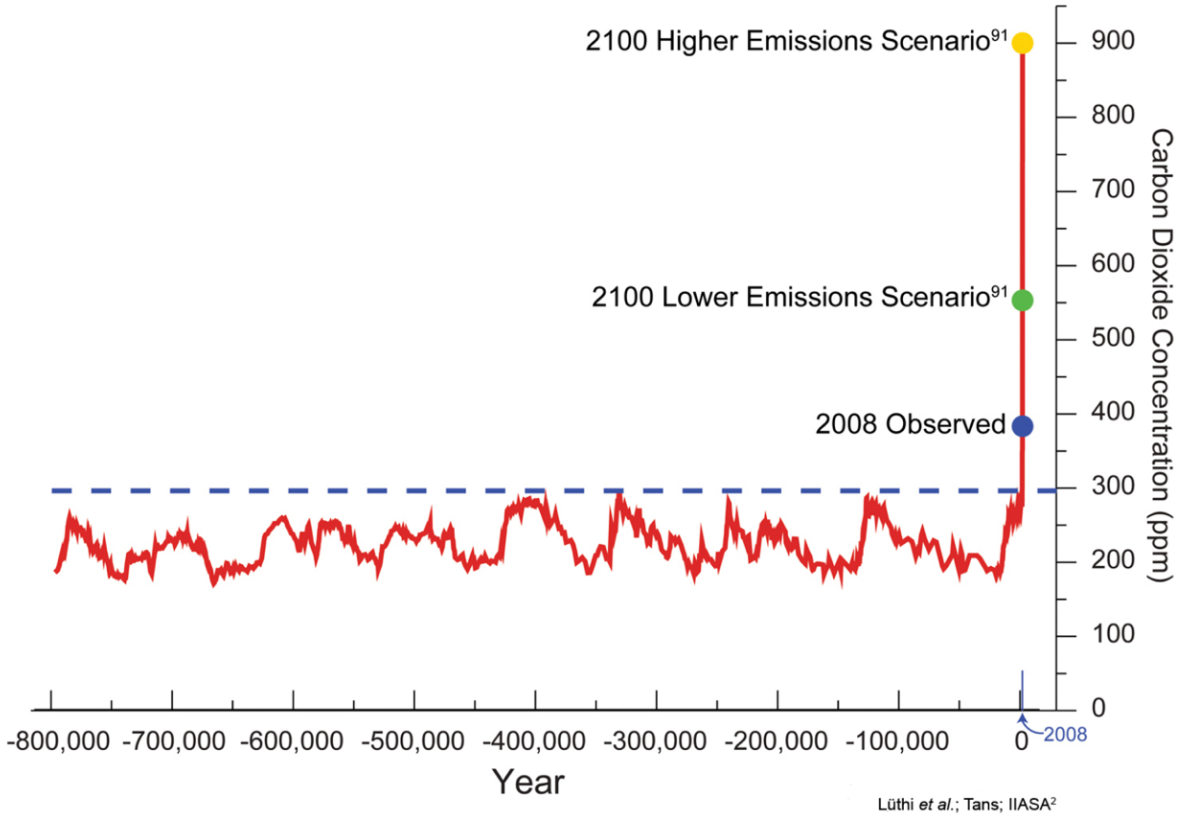
Source: scripps.ucsd.edu/programs/keelingcurve/

CO_2 Concentration 18 April 2023: 424,03 ppm (Keeling curve + last 2000 years)



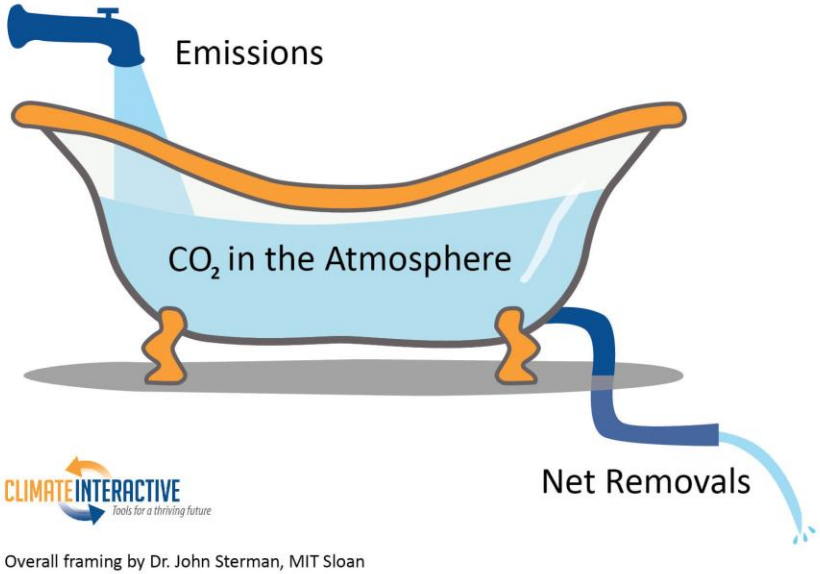
Source: scripps.ucsd.edu/programs/keelingcurve/

Atmospheric CO_2 over the last 800000 years



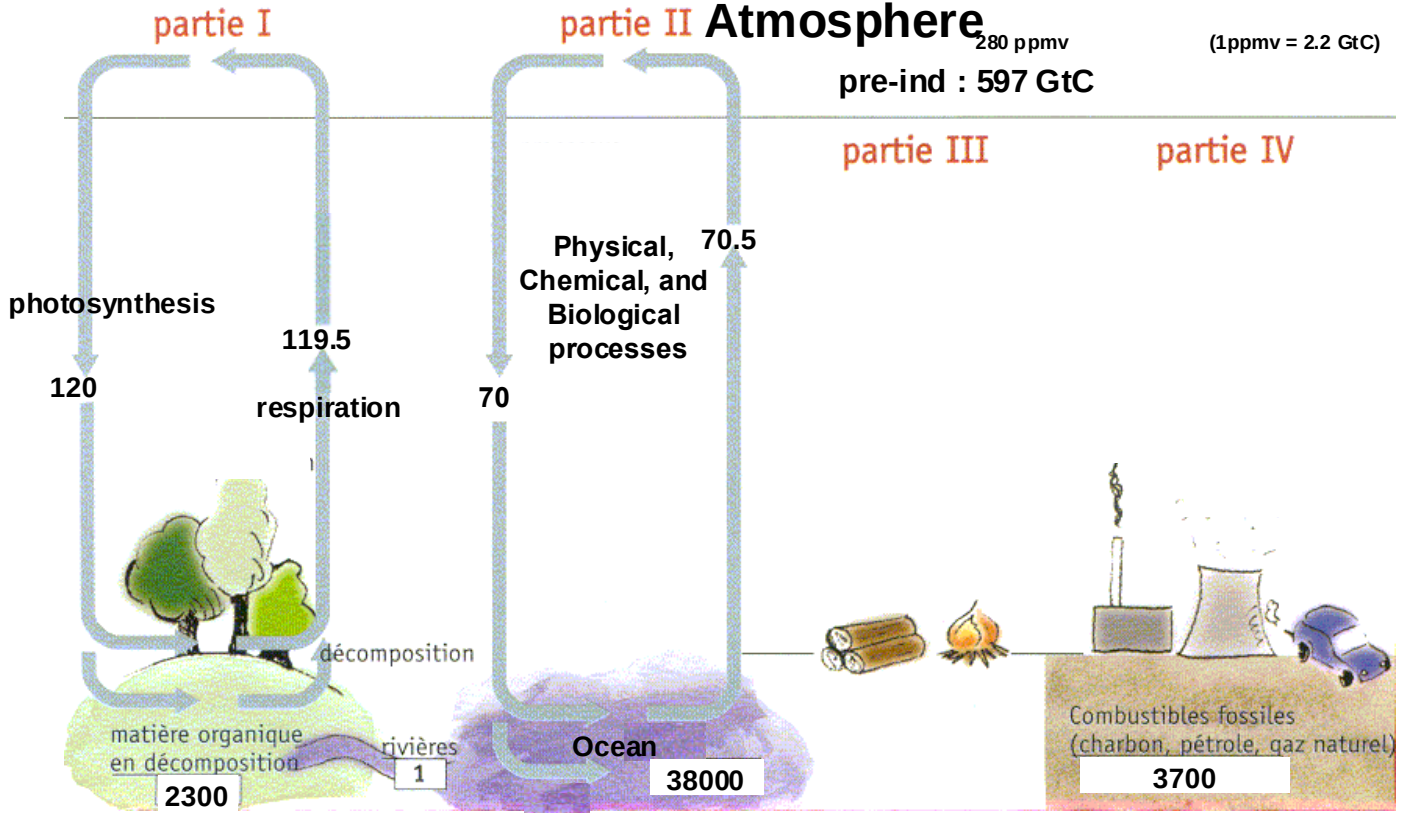
U.S. Global Change Research Program: Lüthi *et al.*; Tans; IIASA2

The Carbon Bathtub



Source: @CarbonInteractive

Carbon cycle: unperturbed fluxes

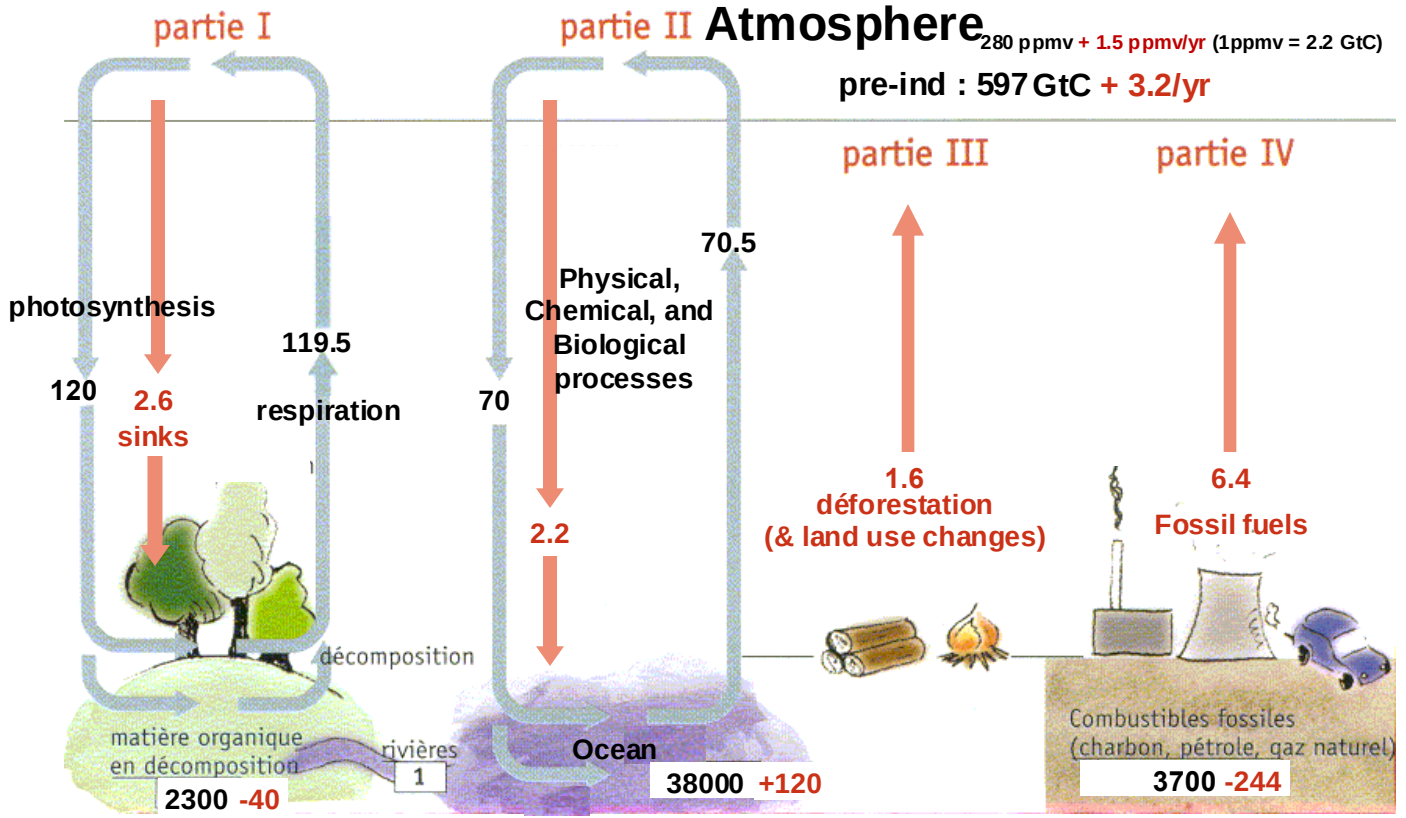


Units: GtC (billions tons of carbon) or GtC/year (multiply by 3.7 to get $GtCO_2$)

vanyp@climate.be

Carbon cycle: perturbed by human activities

(numbers for the decade 1990-1999s, based on IPCC AR4)



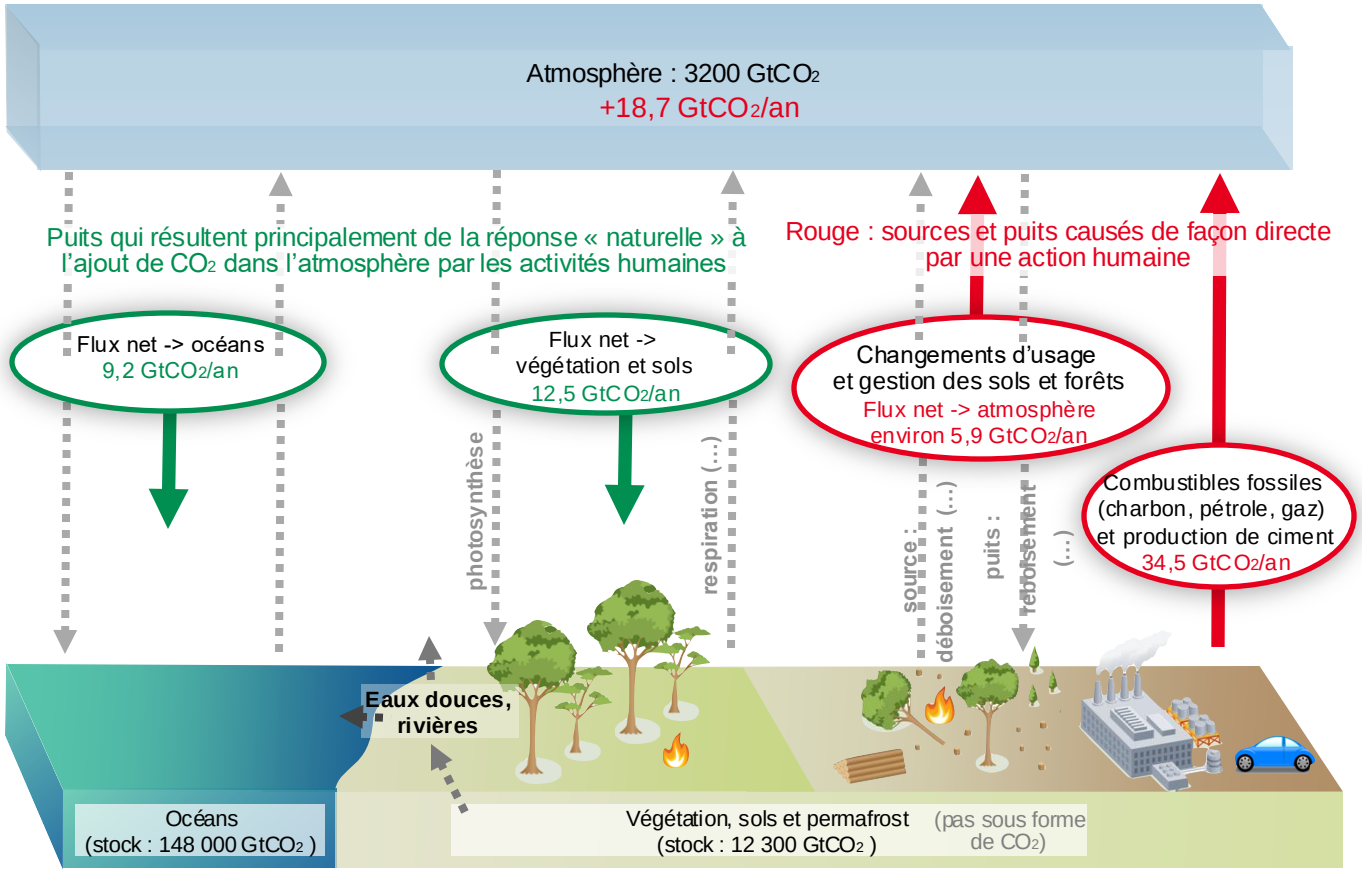
Units: GtC (billions tons of carbon) or GtC/year

Stocks!

vanyp@climate.be

Cycle du carbone

D'après l'AR6, simplifié

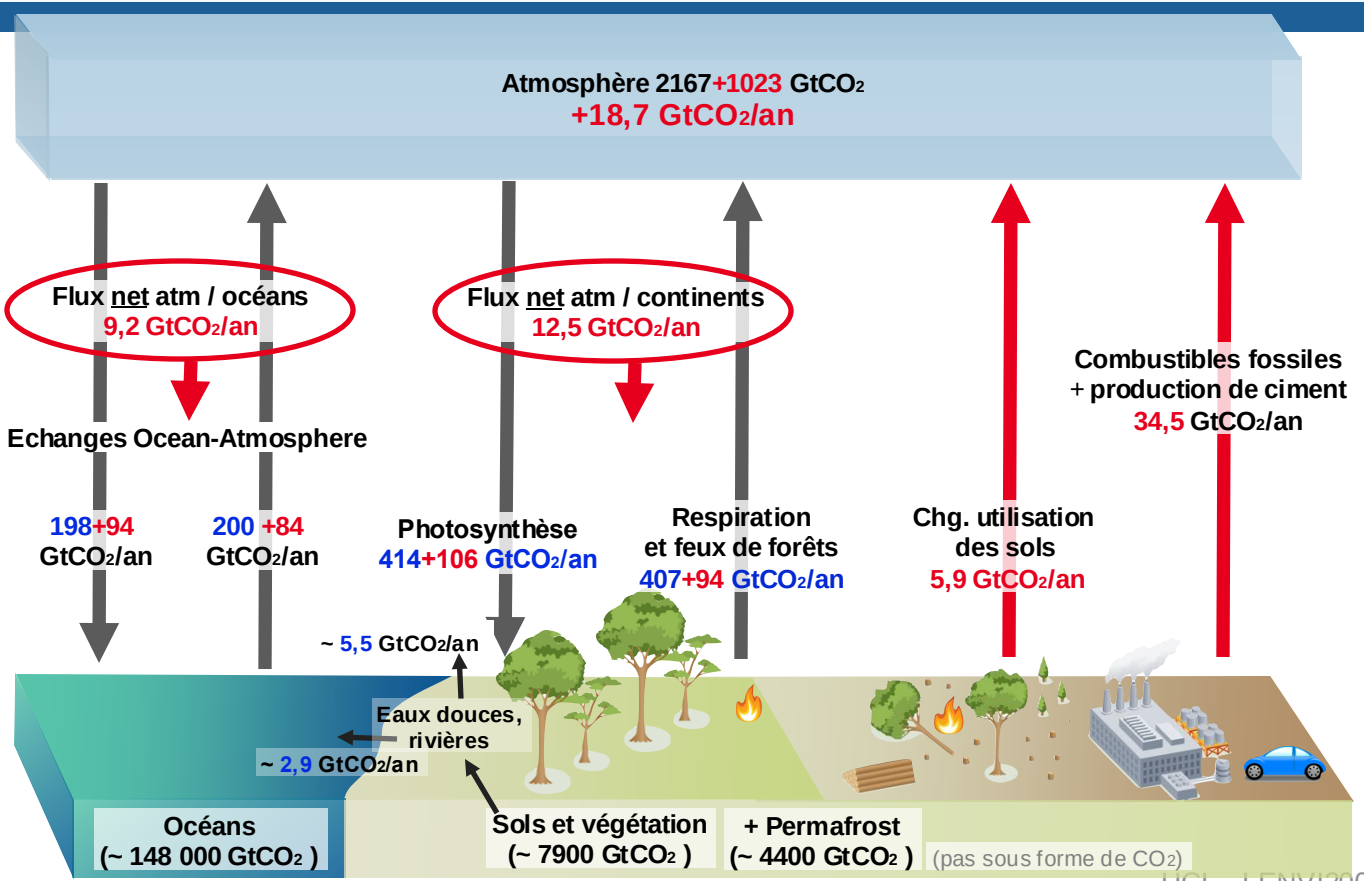


Source : AR6 GT1 chapitre 5 (figure 5.12) - adapté / simplifié

Cycle du carbone

Valeurs AR6 (2021), arrondies

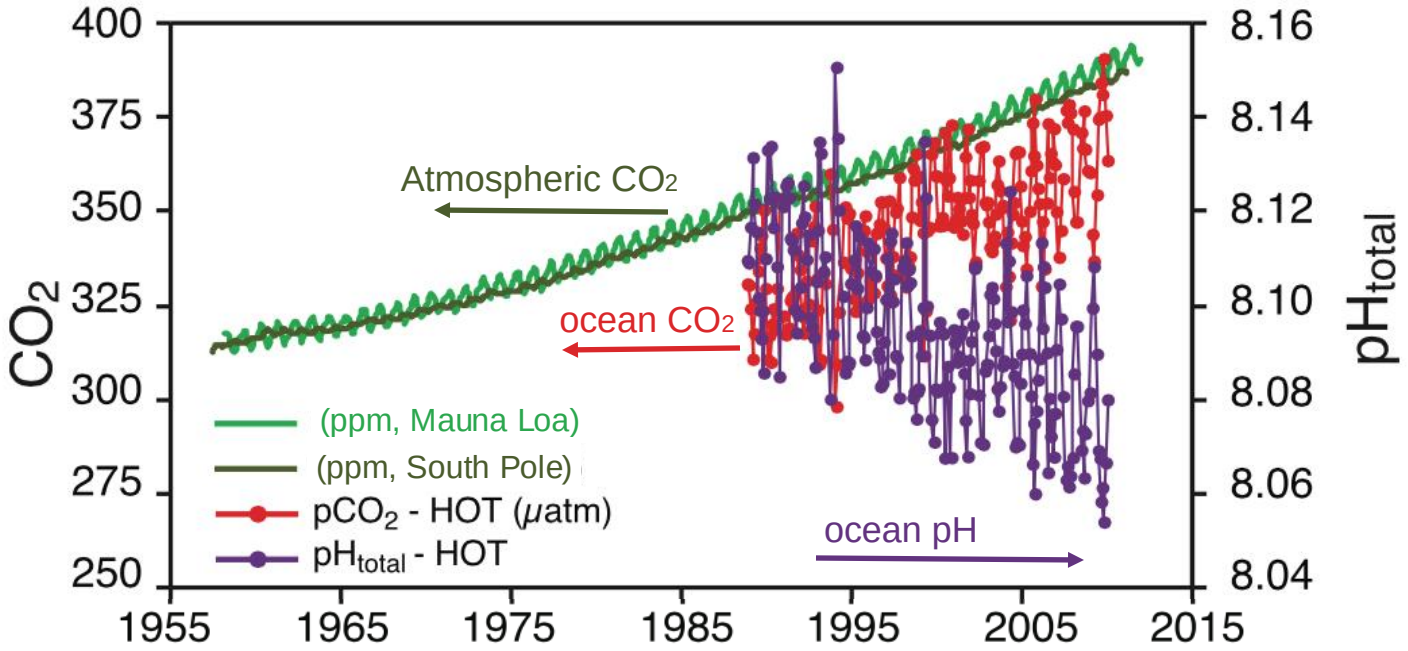
Bleu : pré-industriel
Rouge : influence humaine (années 2010-19)
$GtCO_2$ = milliards de tonnes de dioxide de carbone



Source : AR6 GT1 chapitre 5 (figure 5.12) - adapté / simplifié

Atmospheric CO_2 and ocean pH

- Les océans ont absorbé ~40% du CO_2 émis par les activités humaines

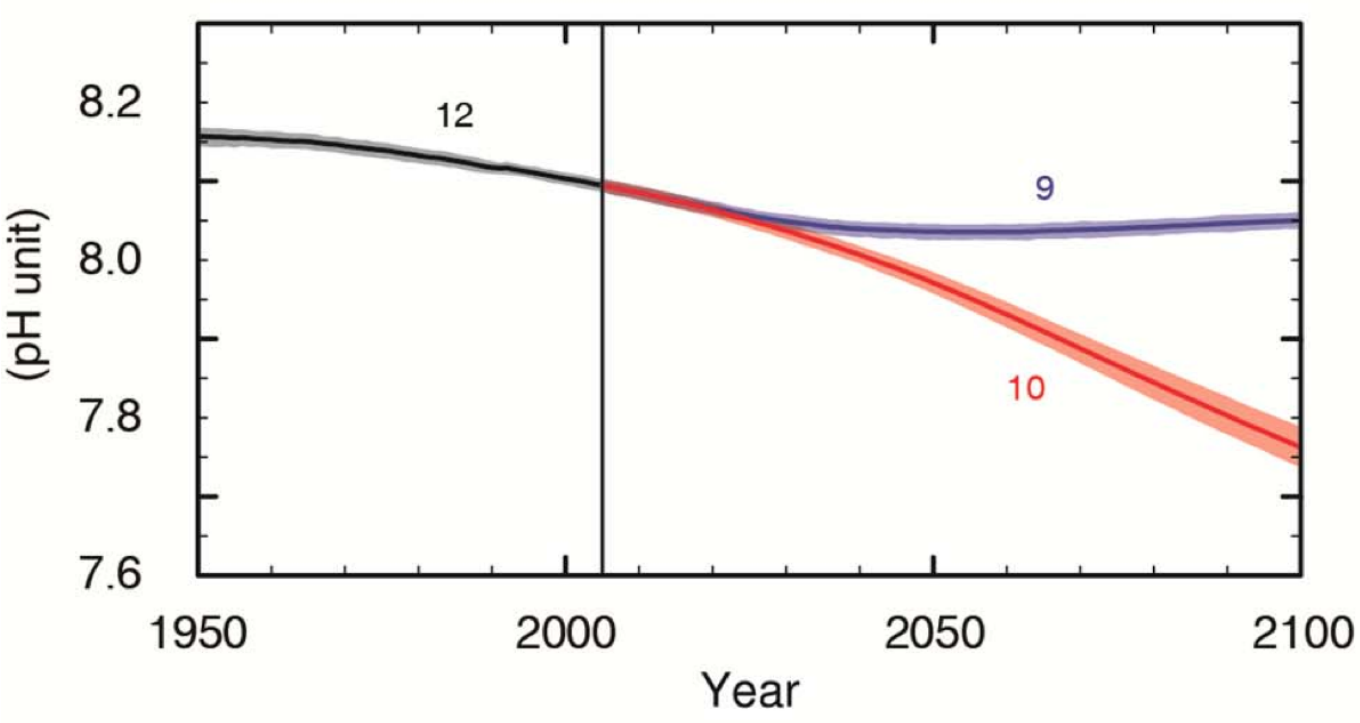


Formation d'acide carbonique $CO_{2(aq)} + H_2O \rightleftarrows H_2CO_3$

Source : IPCC AR5 WGI figure TS.5

Global ocean surface pH (projections)

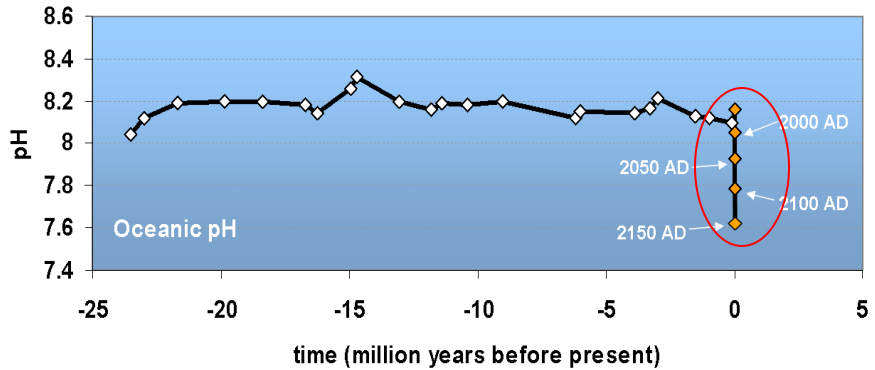
Ocean Acidification, for RCP 8.5 (orange) & RCP2.6 (blue)



IPCC AR5 WGI, Fig SPM 07

Oceans are Acidifying Fast …….

Changes in pH over the last 25 million years



"Today is a rare event in the history of the World"

- **It is happening now, at a speed and to a level not experienced by marine organisms for about 60 million years**
- **Mass extinctions linked to previous ocean acidification events**
- **Takes 10,000's of years to recover**

Turley et al. 2006

Slide courtesy of Carol Turley, PML

The carbon cycle is policy-relevant

- **CO_2 accumulates in the atmosphere as long as human emissions are larger than the natural absorption capacity**
- **Historical emissions from developed countries therefore matter for a long time**
- **As warming is function of cumulated emissions, the carbon « space » is narrowing fast (to stay under 1.5 or 2° C warming)**

Climatic Change: Are We on the Brink of a Pronounced Global Warming? (Broecker,1975)

Table 1. Reconstruction and prediction of atmospheric CO_2 contents based on fuel consumption data.

Year	Chemical fuel CO_2 ($\times 10^{16}$ g)	Excess atmospheric CO_2* ($\times 10^{16}$ g)	Excess atmospheric CO_2 (%)	Excess atmospheric CO_2 (ppm)	CO_2 content of the atmosphere† (ppm)	Global temperature increase‡ (°C)
1900	3.8	1.9	0.9	2	295	0.02
1910	6.3	3.1	1.4	4	297	.04
1920	9.7	4.8	2.2	6	299	.07
1930	13.6	6.8	3.1	9	302	.09
1940	17.9	8.9	4.1	12	305	.11
1950	23.3	11.6	5.3	16	309	.15
1960	31.2	15.6	7.2	21	314§	.21
1970	44.0	22.0	10.2	29	322§	.29
1980‖	63	31	14	42	335	.42
1990‖	88	44	20	58	351	.58
2000‖	121	60	28	80	373	.80
2010‖	167	83	38	110	403	1.10

*On the assumption that 50 percent of the CO_2 produced by the burning of fuel remains in the atmosphere. †The preindustrial atmospheric partial pressure of CO_2 is assumed to be 293 ppm. ‡Assumes a 0.3°C global temperature increase for each 10 percent rise in the atmospheric CO_2 content. §Value observed on Hawaii for 1960, 314 ppm; value for 1970, 322 ppm (*8*). ‖Post-1972 growth rate taken to be 3 percent per year.

Ecrit pour les jeunes (et moins jeunes), avec des liens vers des ressources utiles

Disponible gratuitement, 6X/an: www.plateforme-wallonne-giec.be

To go further :

- www.climate.be/vanyp : my slides (under « conferences »)
- www.ipcc.ch : IPCC
- www.skepticalscience.com : answers to the merchants of doubt arguments
- www.plateforme-wallonne-giec.be : IPCC-related in French, free newsletter
- **X/Twitter: @JPvanYpersele & @IPCC_CH**