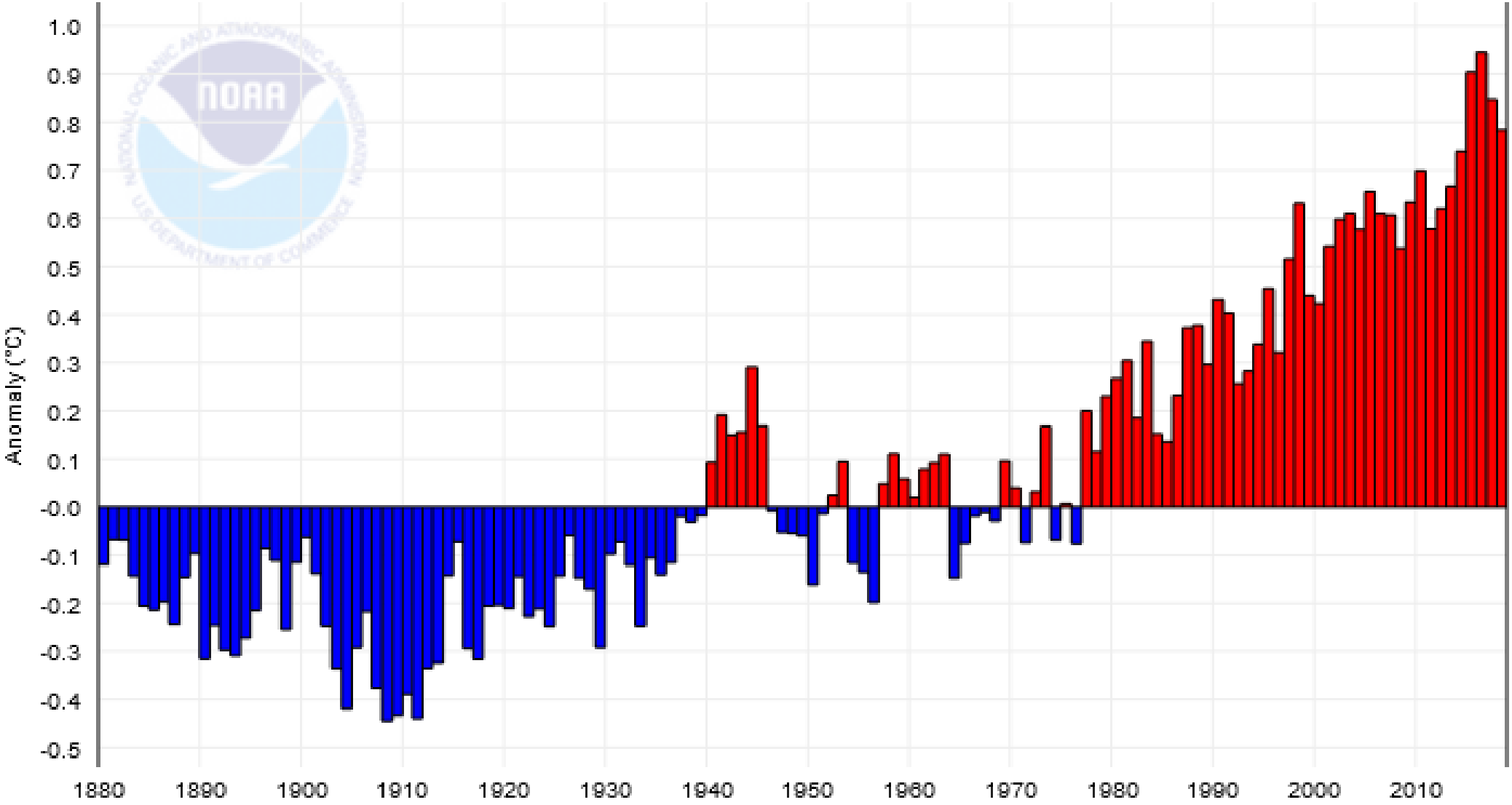
Basiswissen zur Klimakrise

- ein wissenschaftlicher Leitfaden -

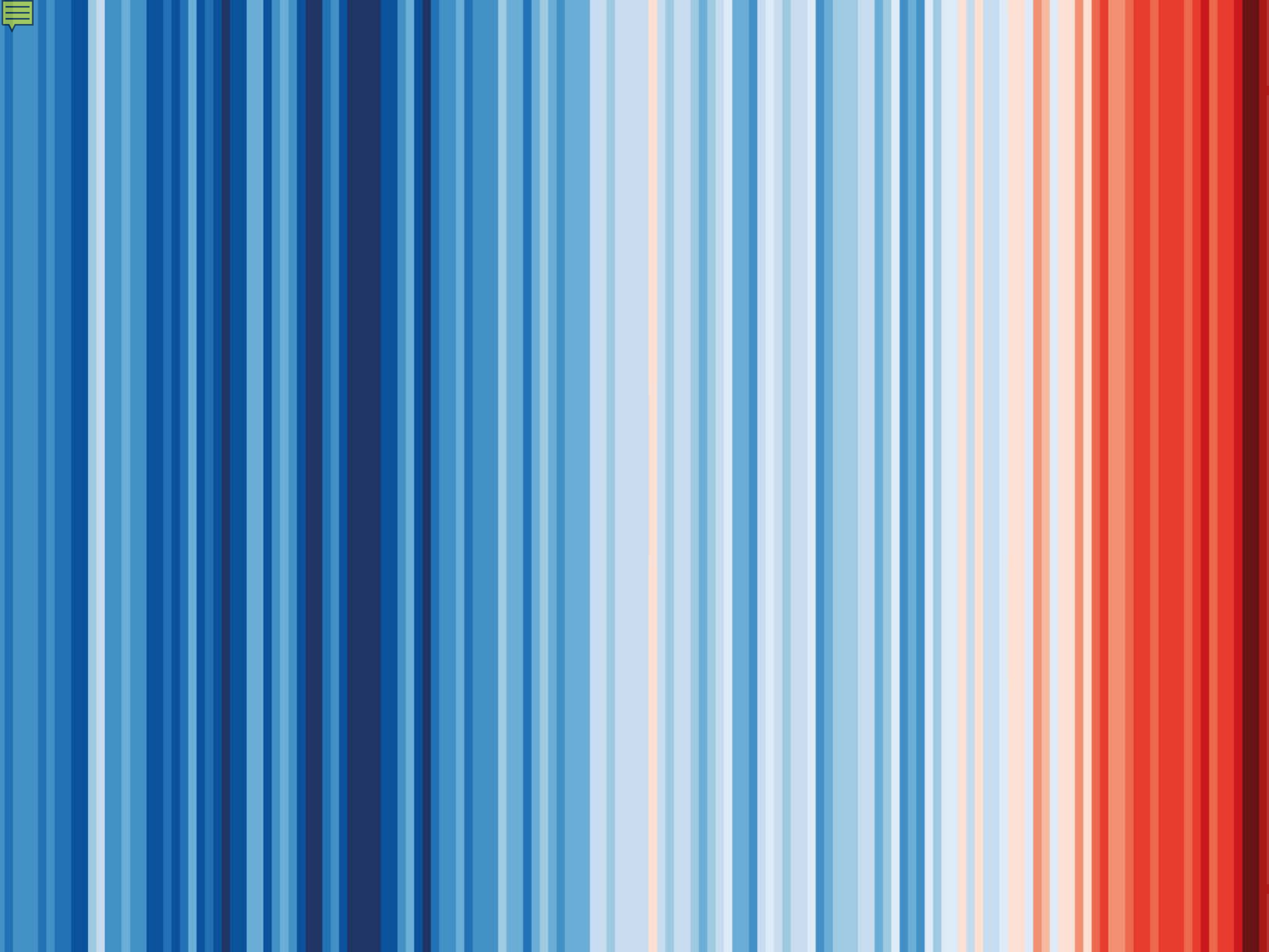
Viola Rädle

26.11.2019

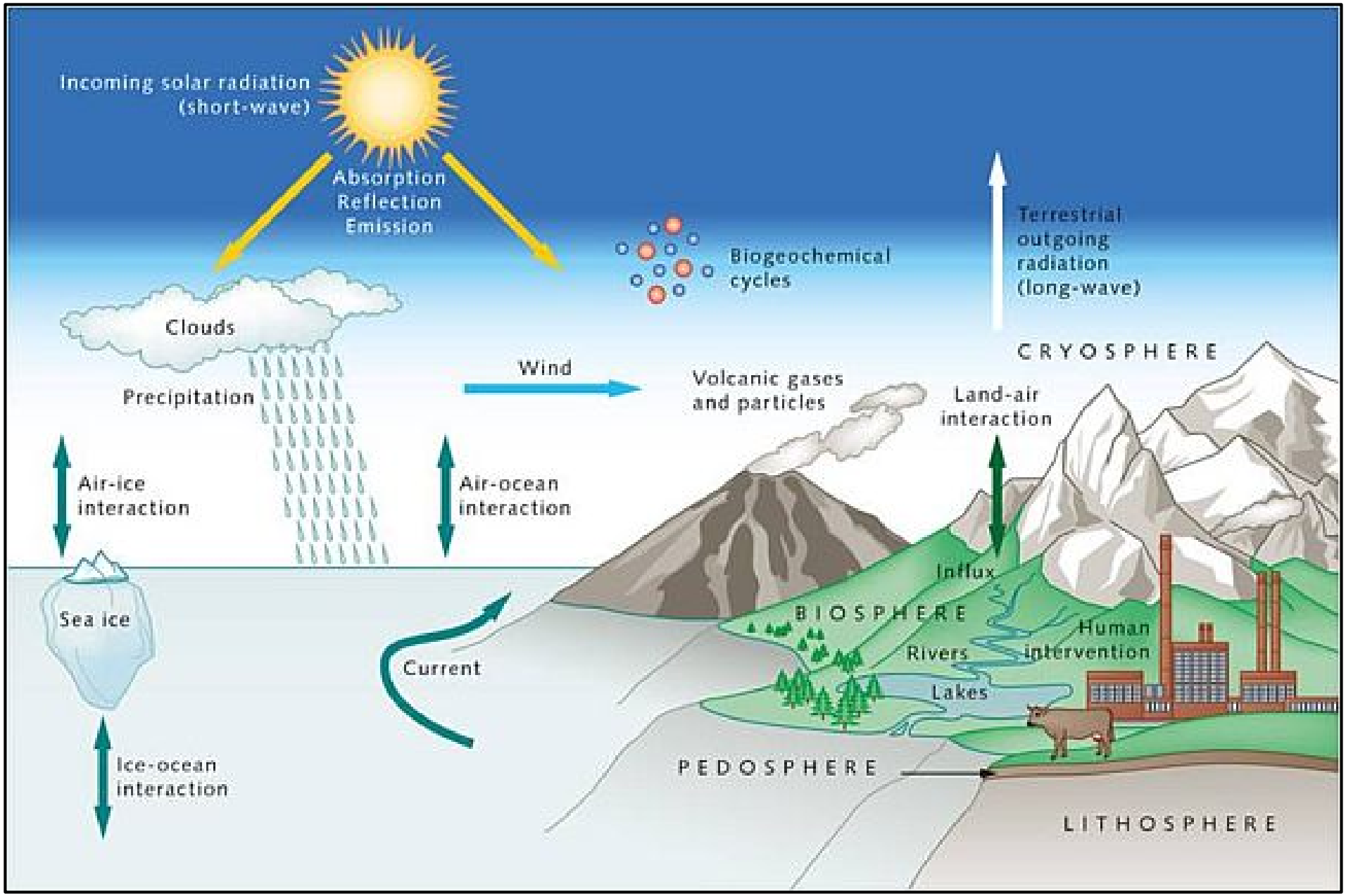
Globale Temperaturen seit 1880



https://www.ncdc.noaa.gov/cag/global/time-series

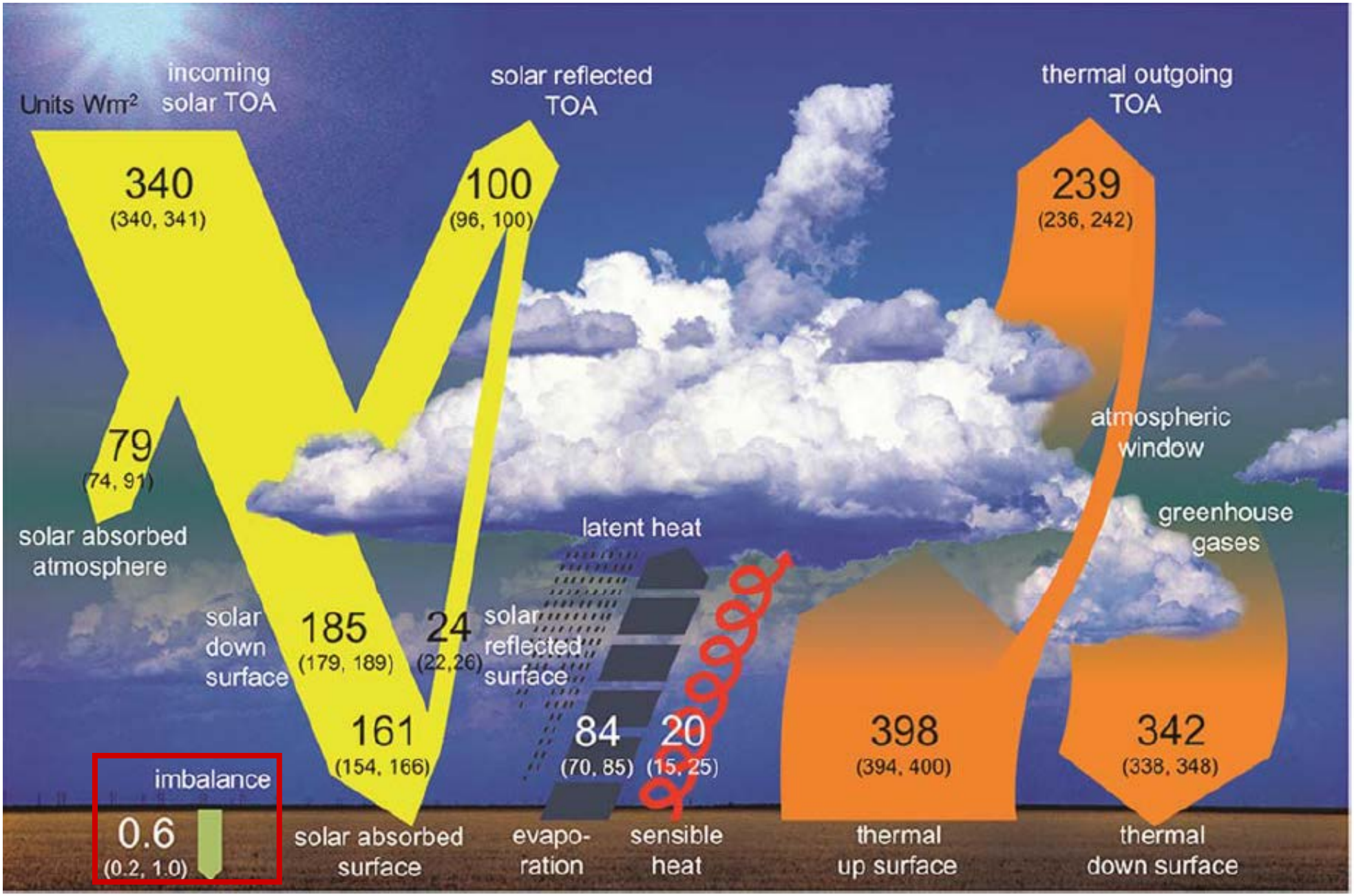


Das globale Klimasystem

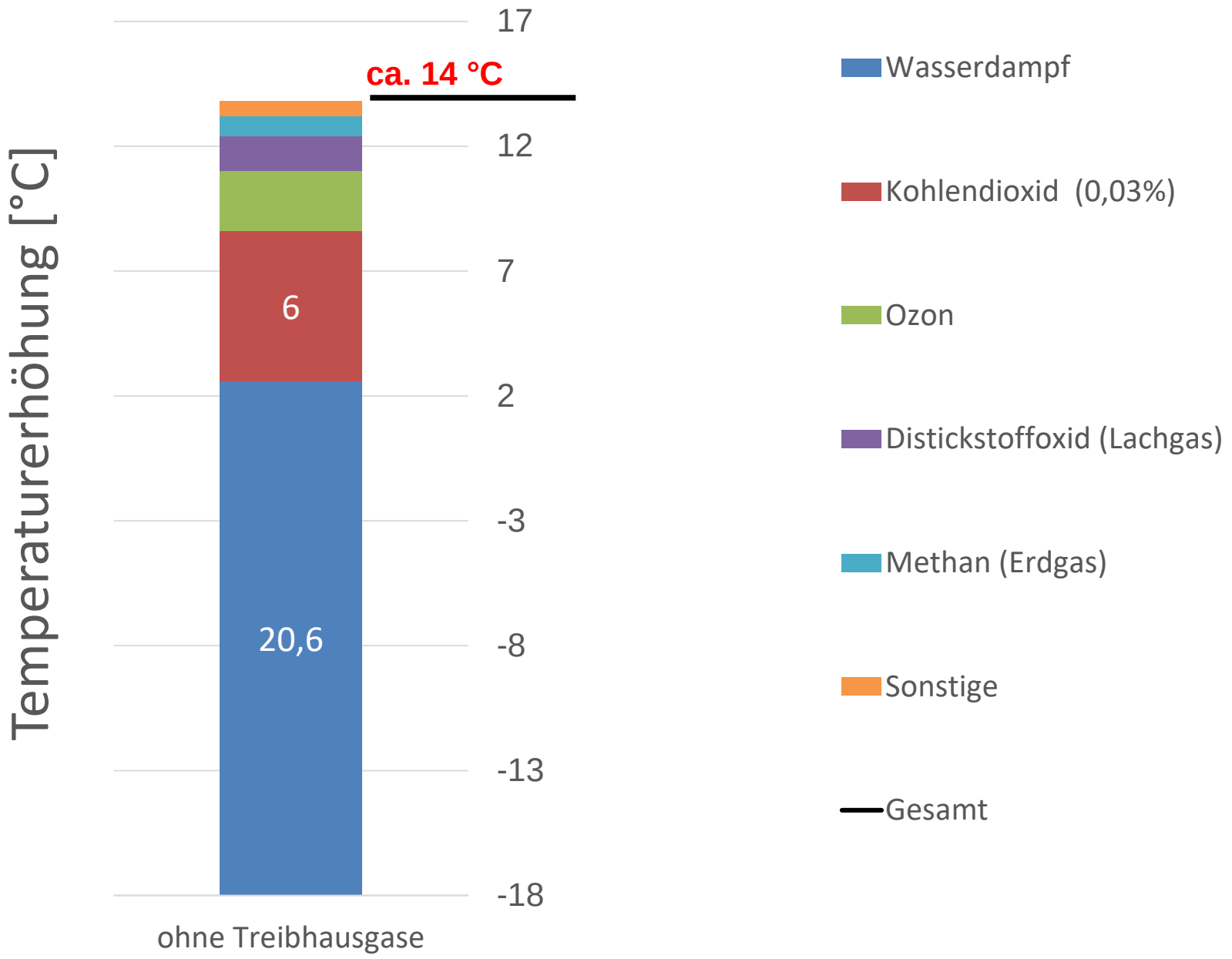


https://www.climatechangeinaustralia.gov.au/en/climate-campus/modelling-and-projections/climate-models/theory-and-physics/

Die Strahlungsbilanz der Erde

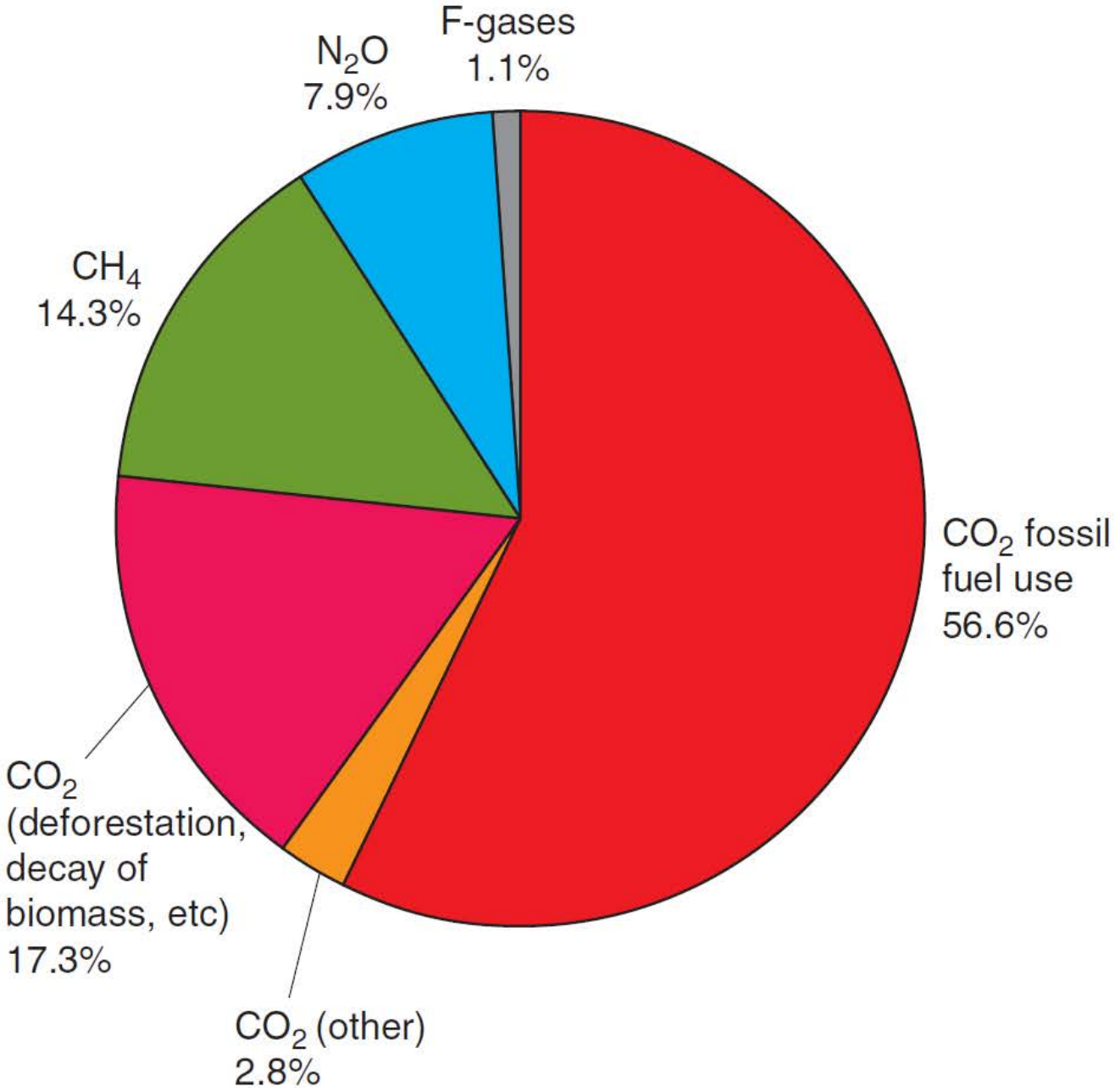


Natürlicher Treibhauseffekt: Einflüsse verschiedener Gase



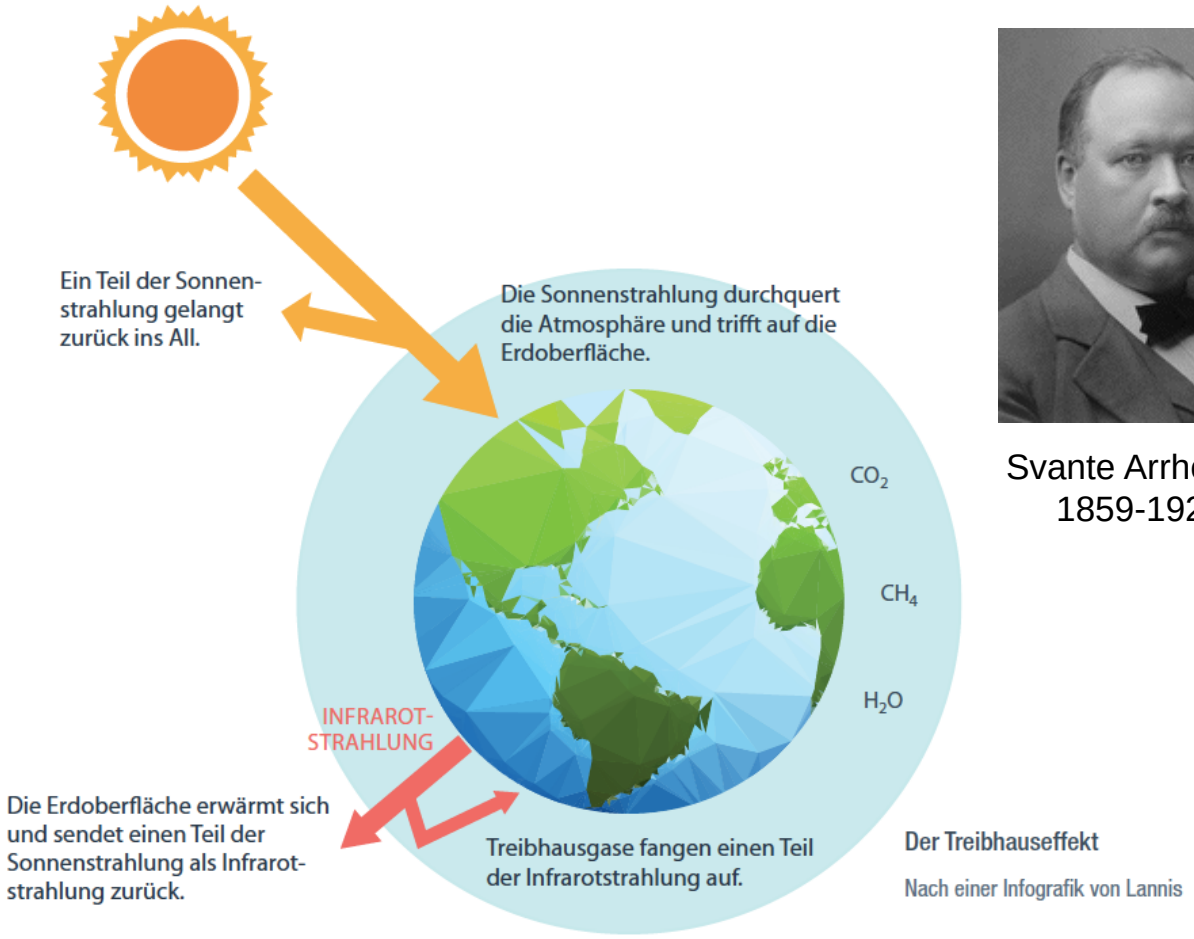
ALLABY, M. greenhouse gas. *A Dictionary of Earth Sciences* 257 (2008).

Treibhauseffekt durch anthropogene Emissionen



Archer and Rahmstorf, 2010. The Climate Crisis. Cambridge University Press.

Der Treibhauseffekt



Der Treibhauseffekt

Nach einer Infografik von Lannis

Svante Arrhenius
1859-1927

THE

LONDON, EDINBURGH, AND DUBLIN

PHILOSOPHICAL MAGAZINE

AND

JOURNAL OF SCIENCE.

[FIFTH SERIES.]

APRIL 1896.

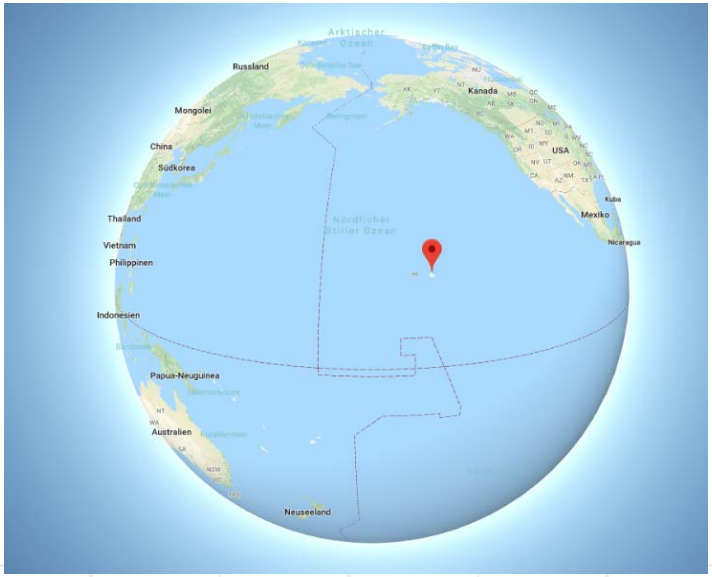
XXXI. *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.* *By* Prof. SVANTE ARRHENIUS *.

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).

CO_2-Konzentration in der Atmosphäre: Keeling-Kurve



CO_2-Konzentration (ppm)

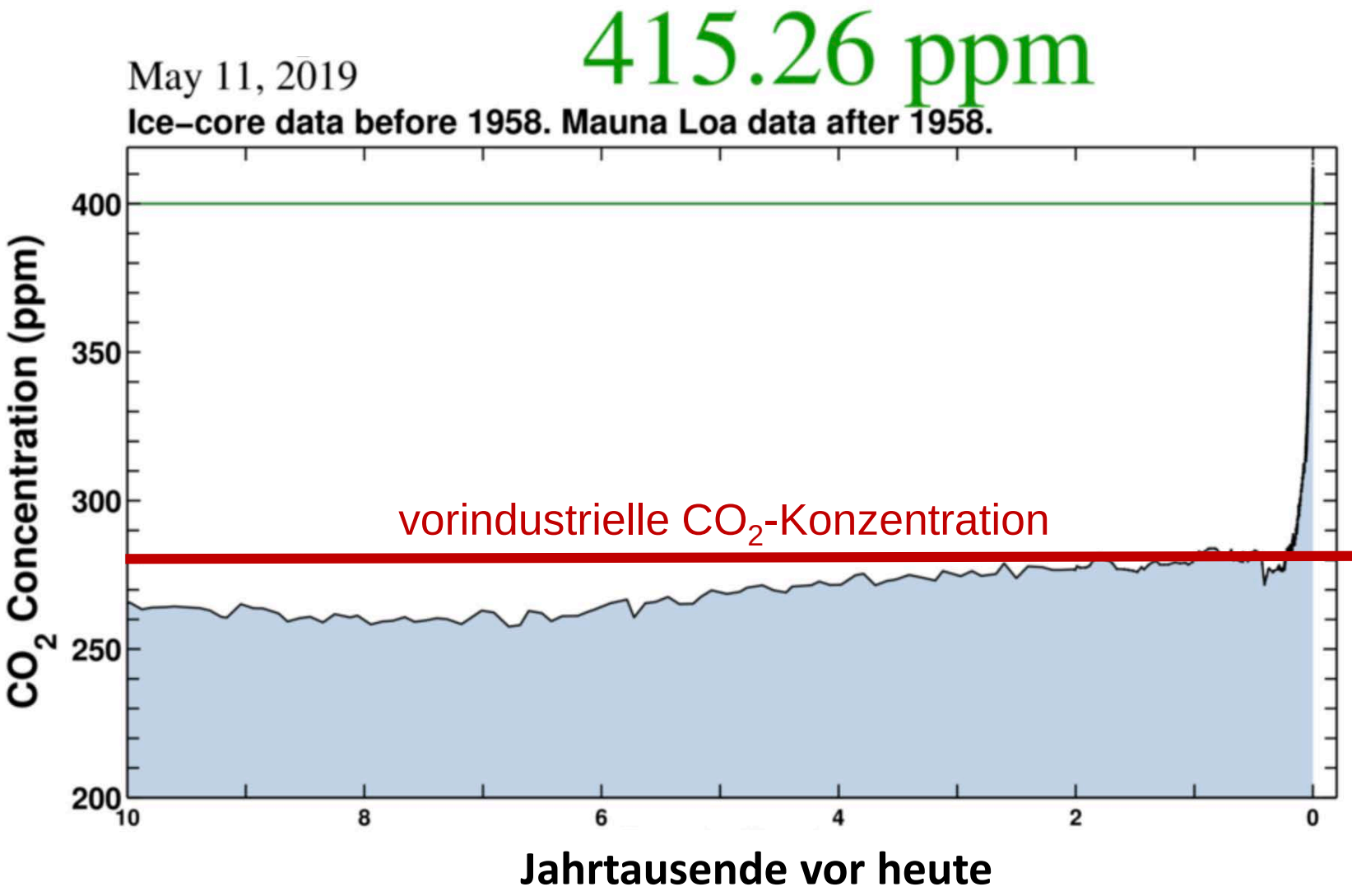
400
380
360
340
320

1960
1970
1980
1990
2000
2010
2020

Jahr

http://scrippsco2.ucsd.edu/graphics_gallery/mauna_loa_record/

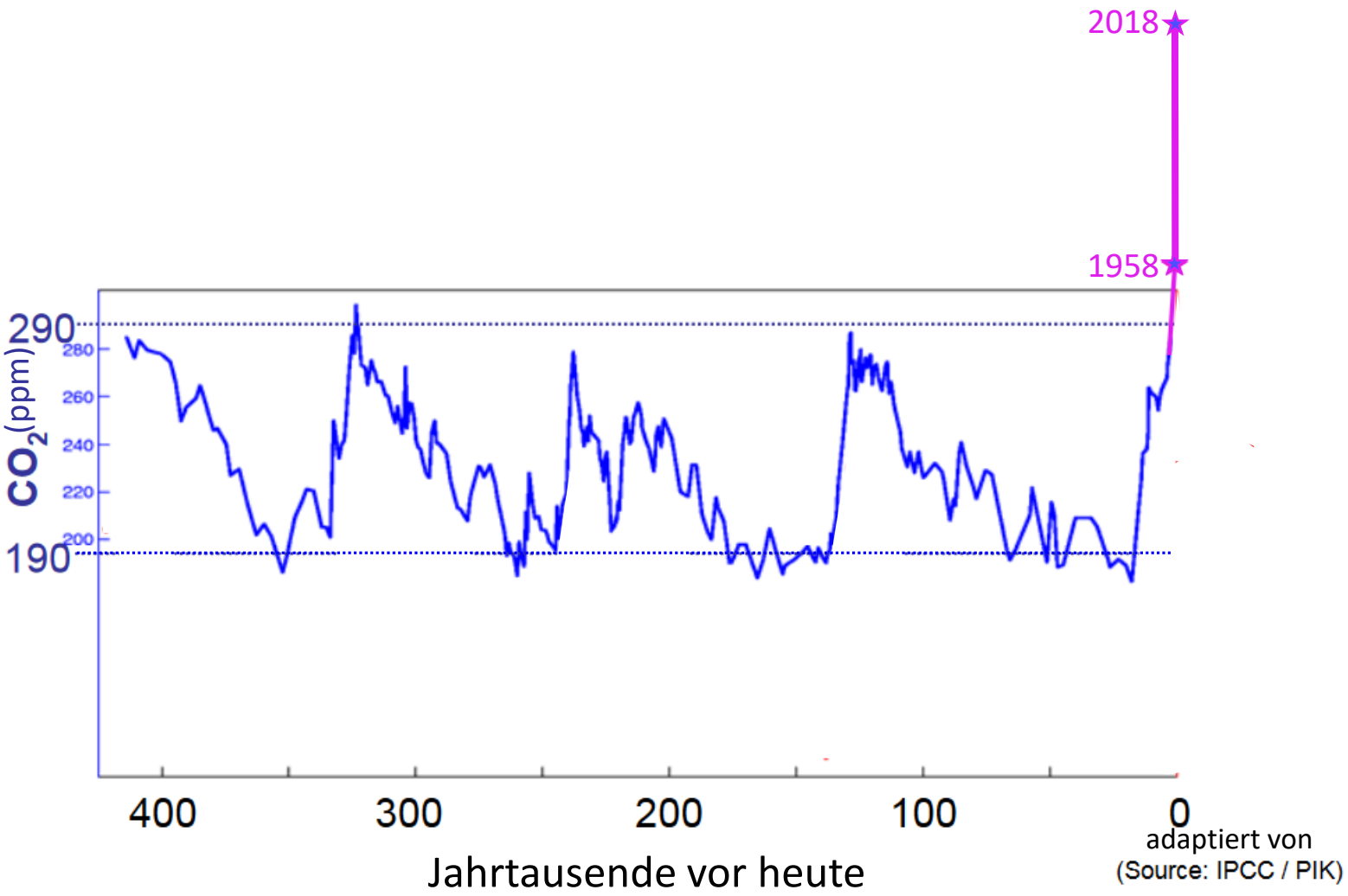
Klimageschichte: atm. CO_2 (10.000 Jahre)



Baseline:
280ppm

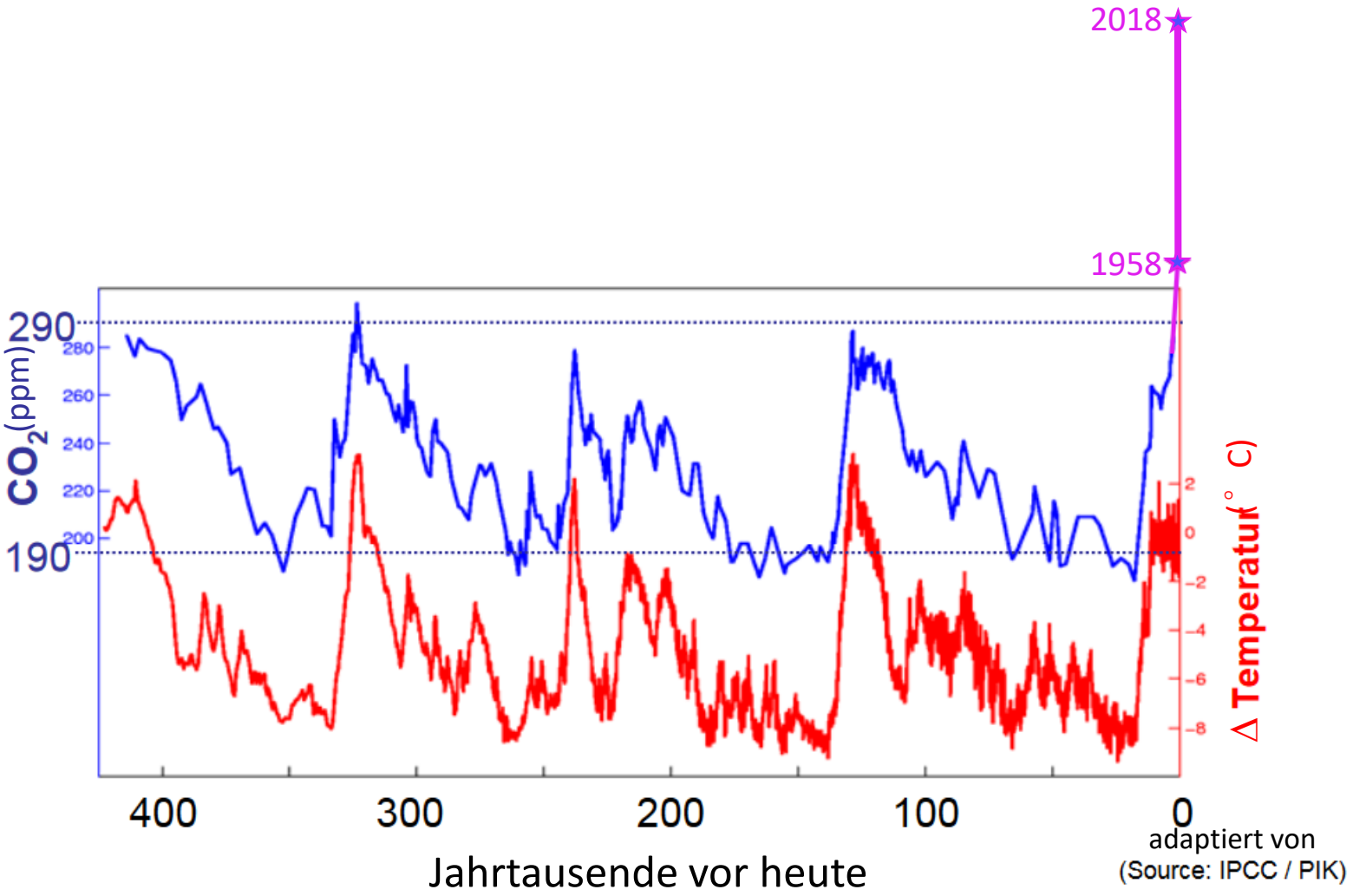
https://techcrunch.com/2019/05/12/co2-in-the-atmosphere-just-exceeded-415-parts-per-million-for-the-first-time-in-human-history/

Klimageschichte: atm. CO_2 (400.000 Jahre)



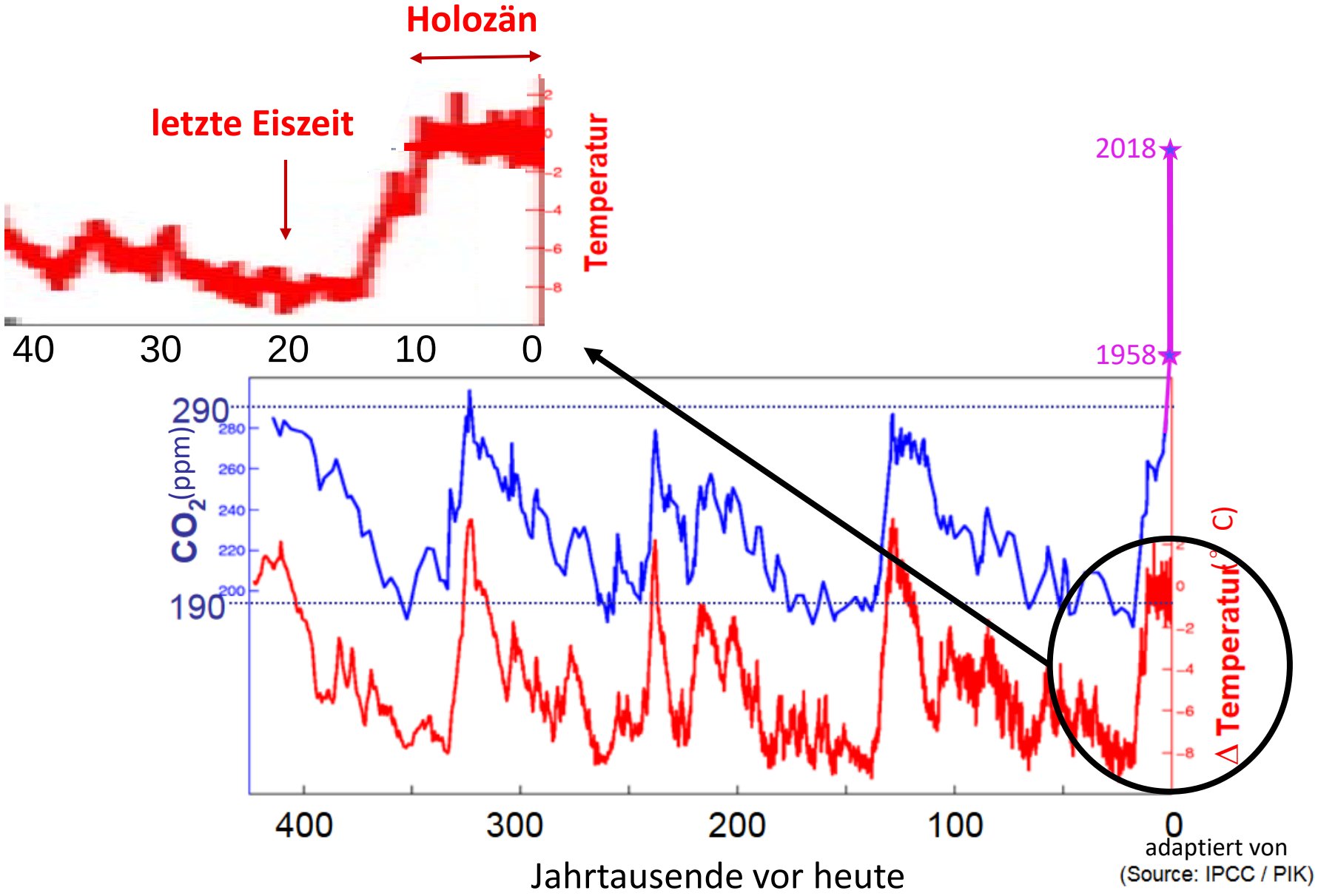
http://www.pik-potsdam.de/~stefan/5datasets_rahmstorf.pdf

Klimageschichte: atm. CO_2 (400.000 Jahre)



http://www.pik-potsdam.de/~stefan/5datasets_rahmstorf.pdf

Klimageschichte: atm. CO_2 (400.000 Jahre)

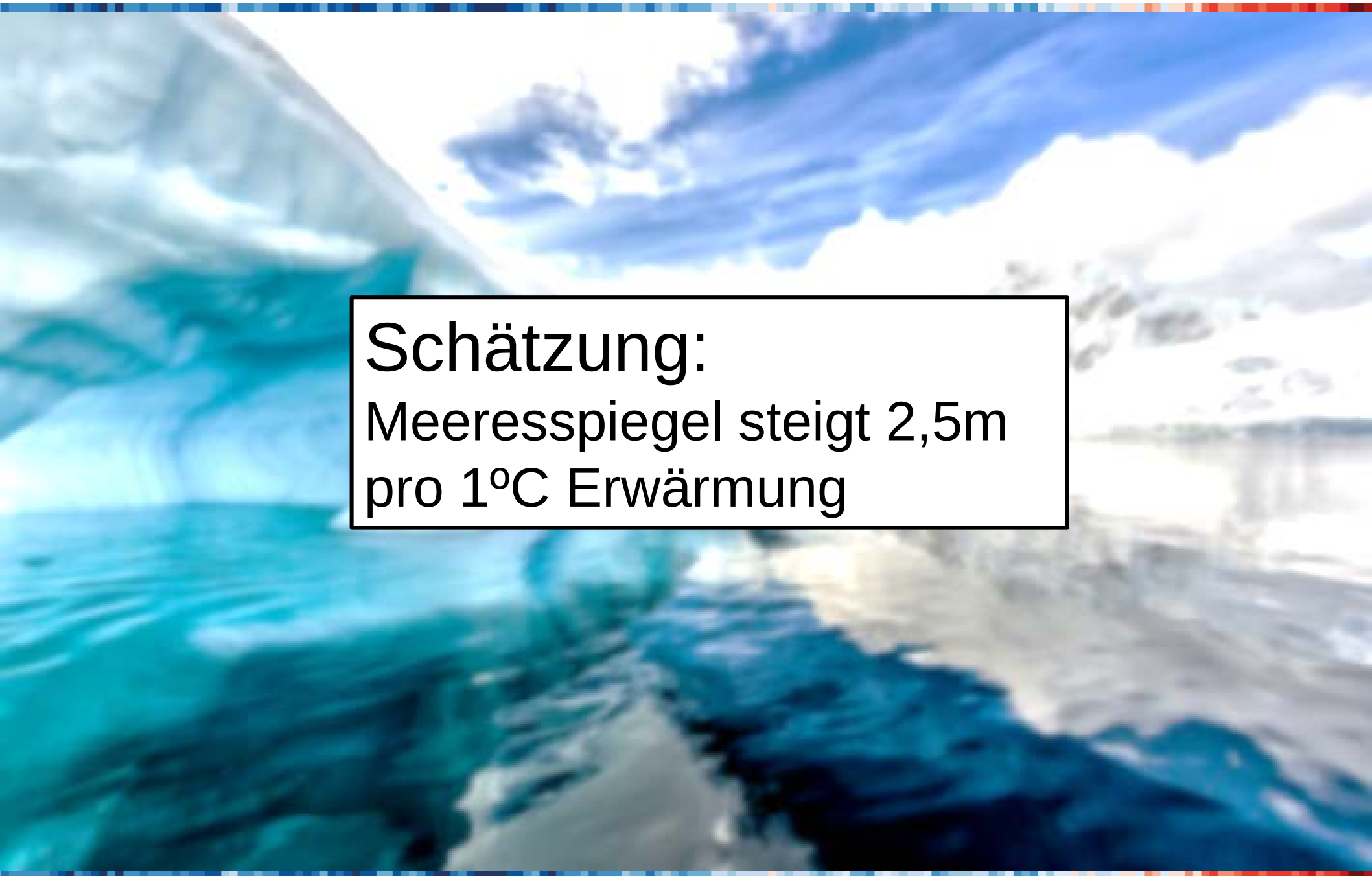


http://www.pik-potsdam.de/~stefan/5datasets_rahmstorf.pdf

Die Kryosphäre

https://besthqwallpapers.com/Uploads/22-10-2017/25171/thumb2-antarctica-4k-iceberg-south-ocea-glaciers.jpg/

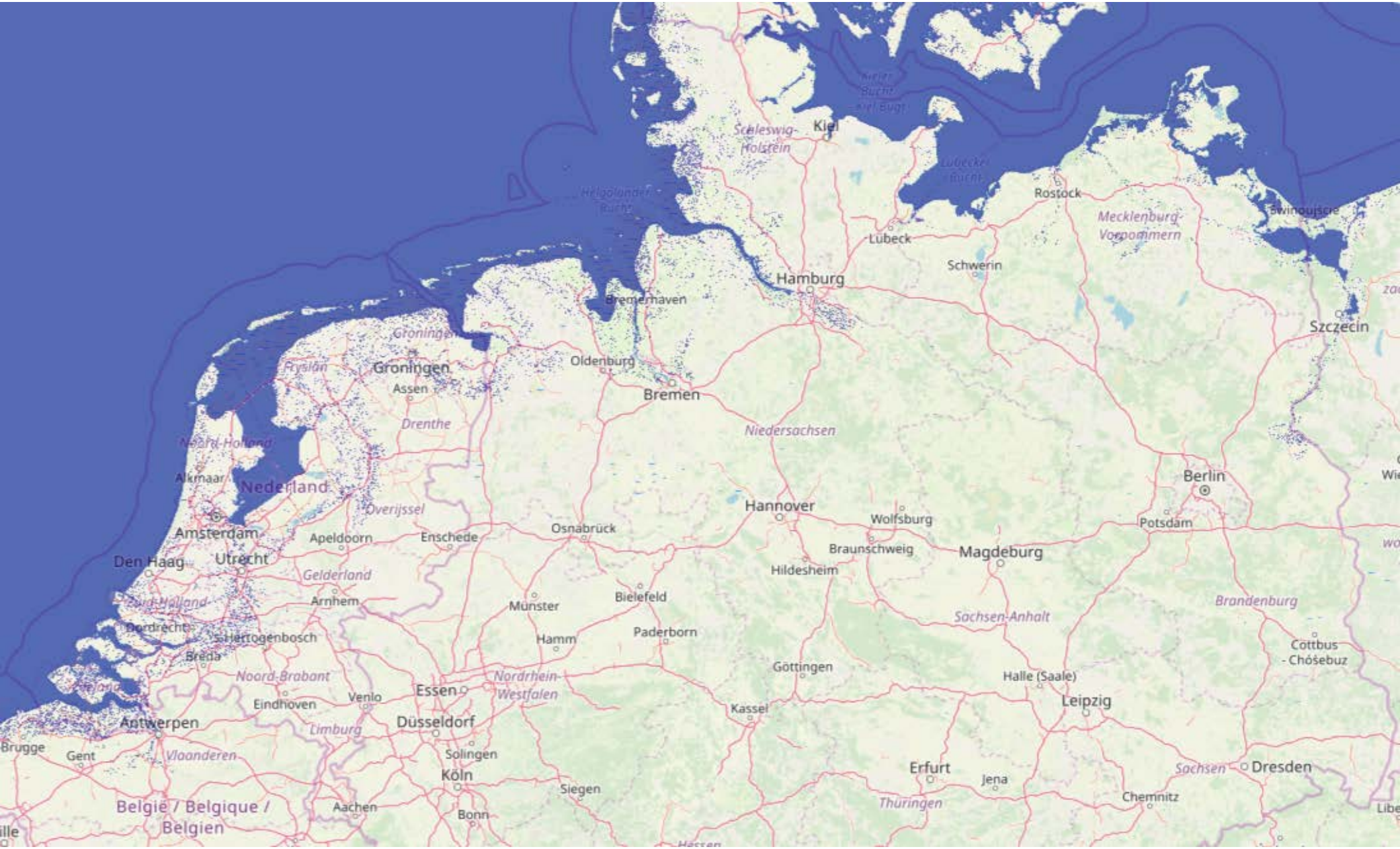
Die Kryosphäre



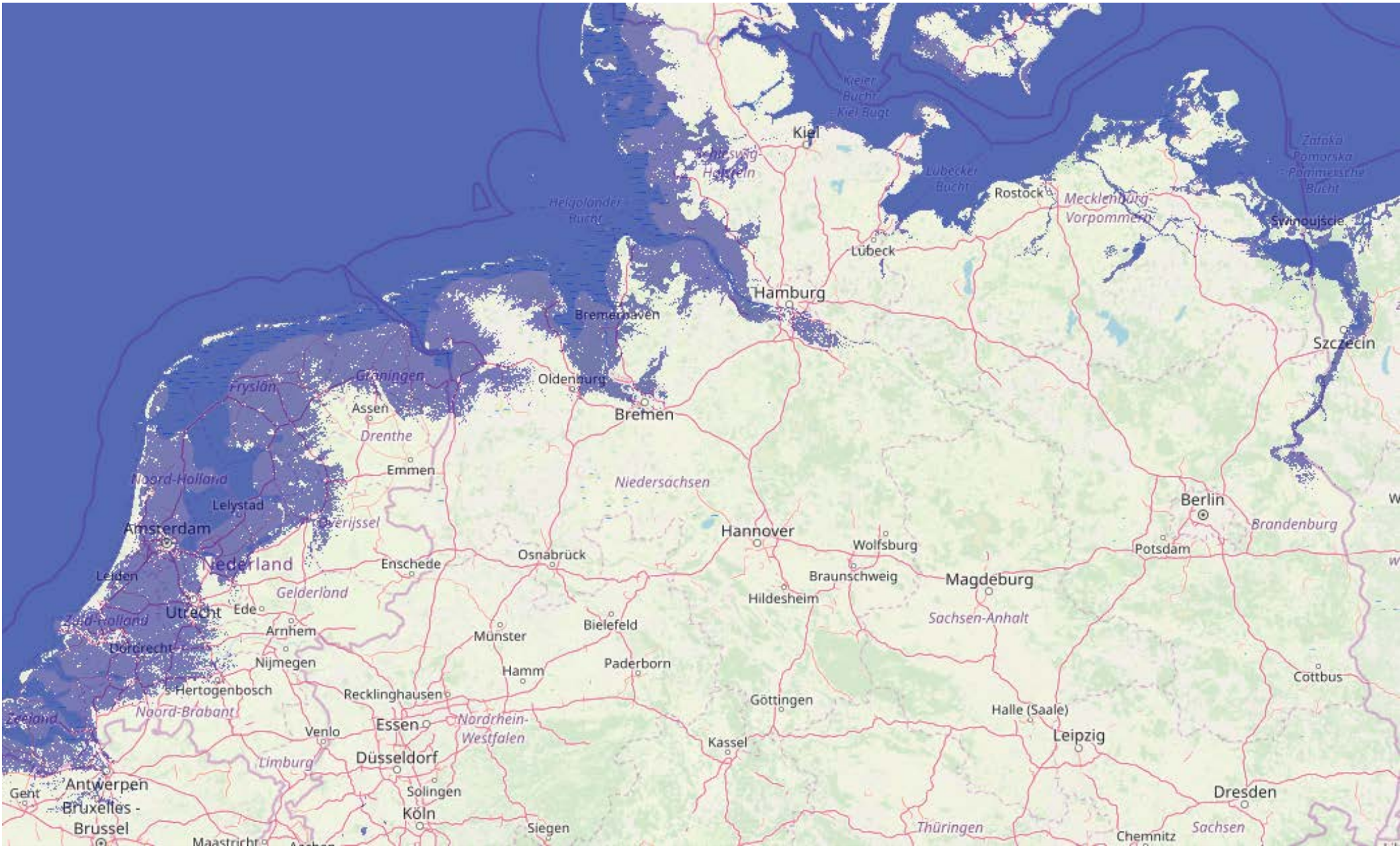
Schätzung:
Meeresspiegel steigt 2,5m
pro 1ºC Erwärmung

https://besthqwallpapers.com/Uploads/22-10-2017/25171/thumb2-antarctica-4k-iceberg-south-ocea-glaciers.jpg/

Meeresspiegel aktuell

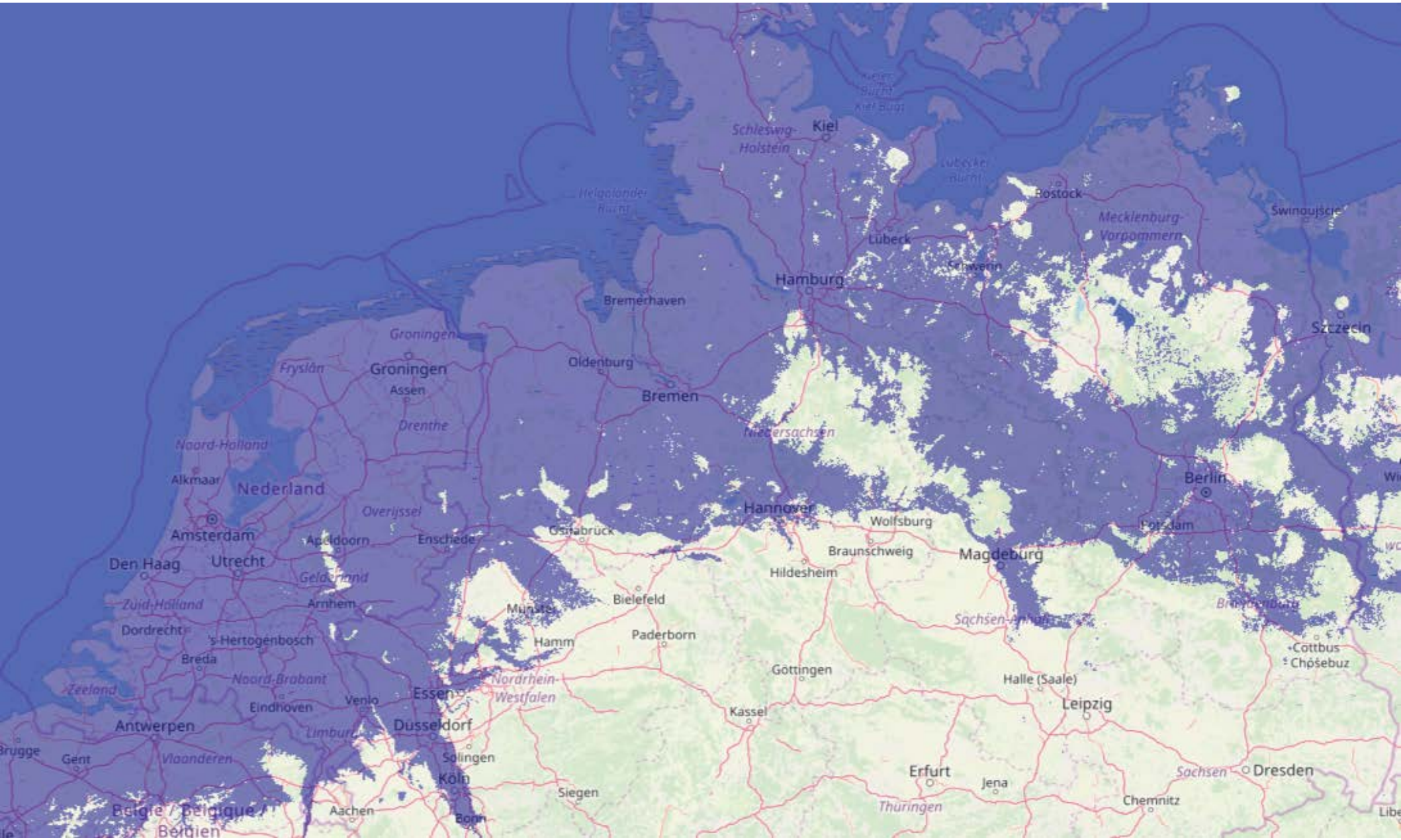


Meeresspiegel: +1m (ca. 2100 n.Chr.)



Meeresspiegel: +6m (ca. 2500 n.Chr.)

Meeresspiegel: +60 m

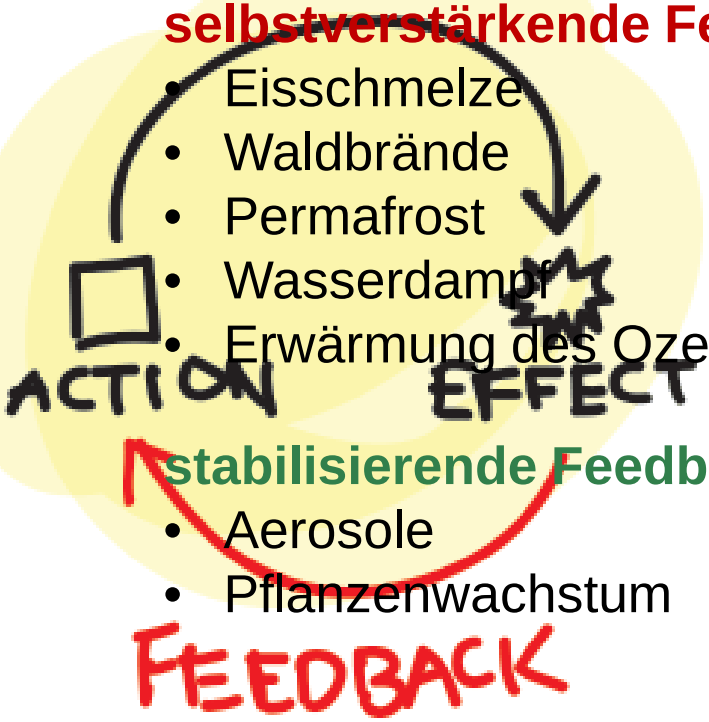


Meereis in der Arktis (2019)

https://earthsky.org/earth/2019-arctic-sea-ice-minimum-2nd-lowest

Klimafeedback

Welche Folgen hat der Temperaturanstieg?



selbstverstärkende Feedback-Loops:

- Eisschmelze
- Waldbrände
- Permafrost
- Wasserdampf
- Erwärmung des Ozeans

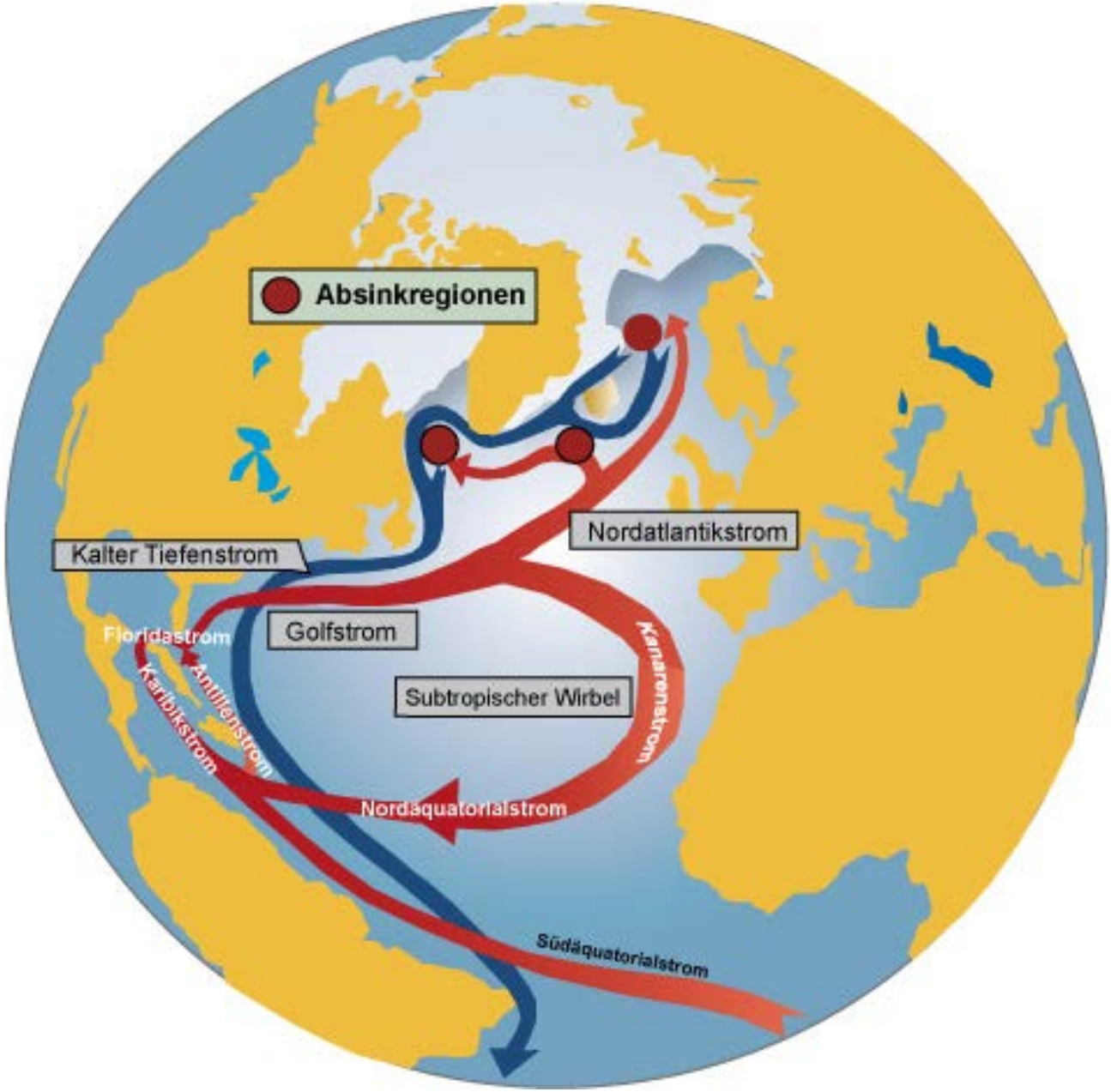
stabilisierende Feedback-Loops:

- Aerosole
- Pflanzenwachstum

Der Ozean

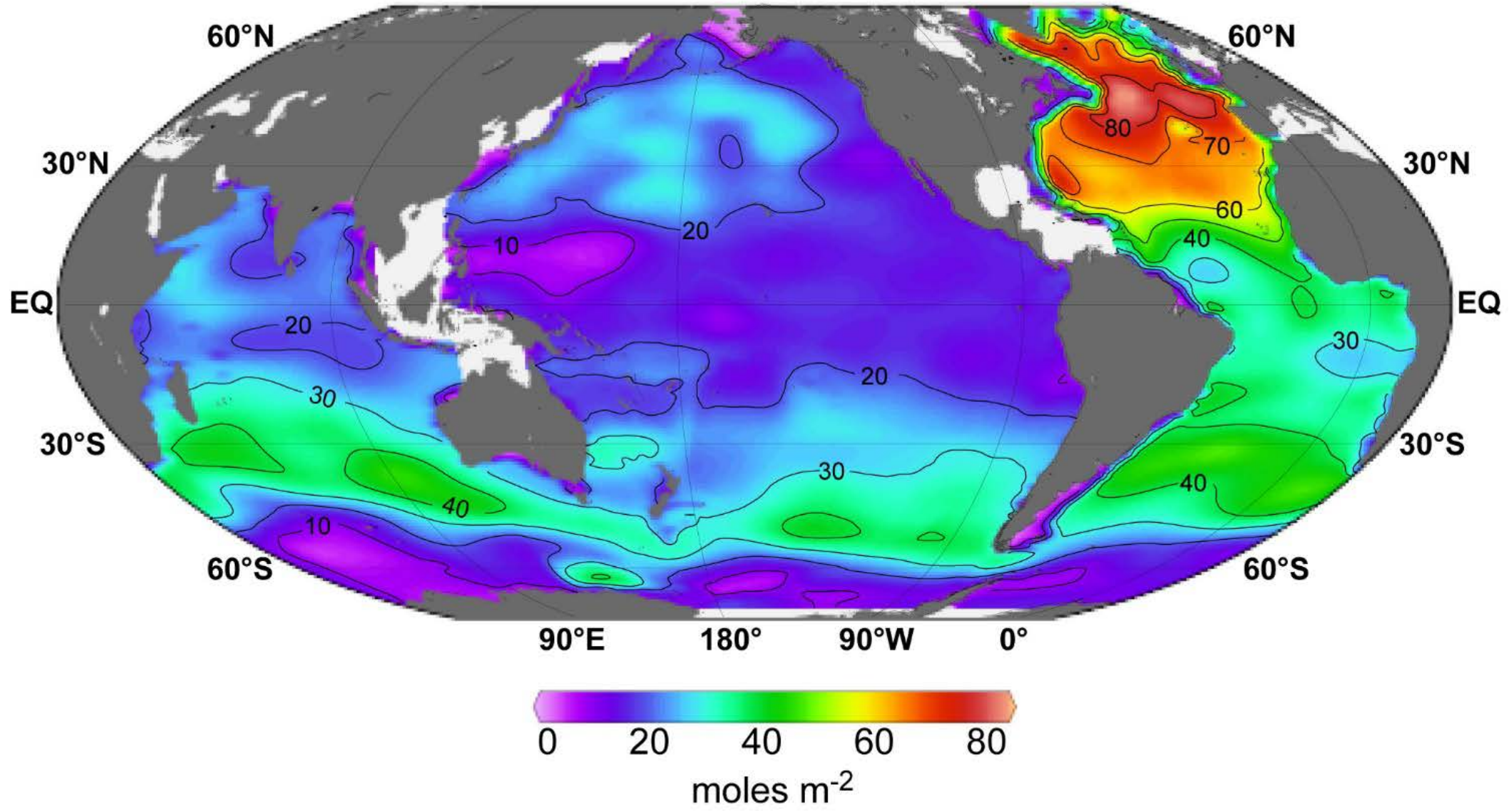
https://www.kabeleinsdoku.de/themen/natur-und-mensch/mythos-ozean

Ozeanzirkulation: Der Golfstrom



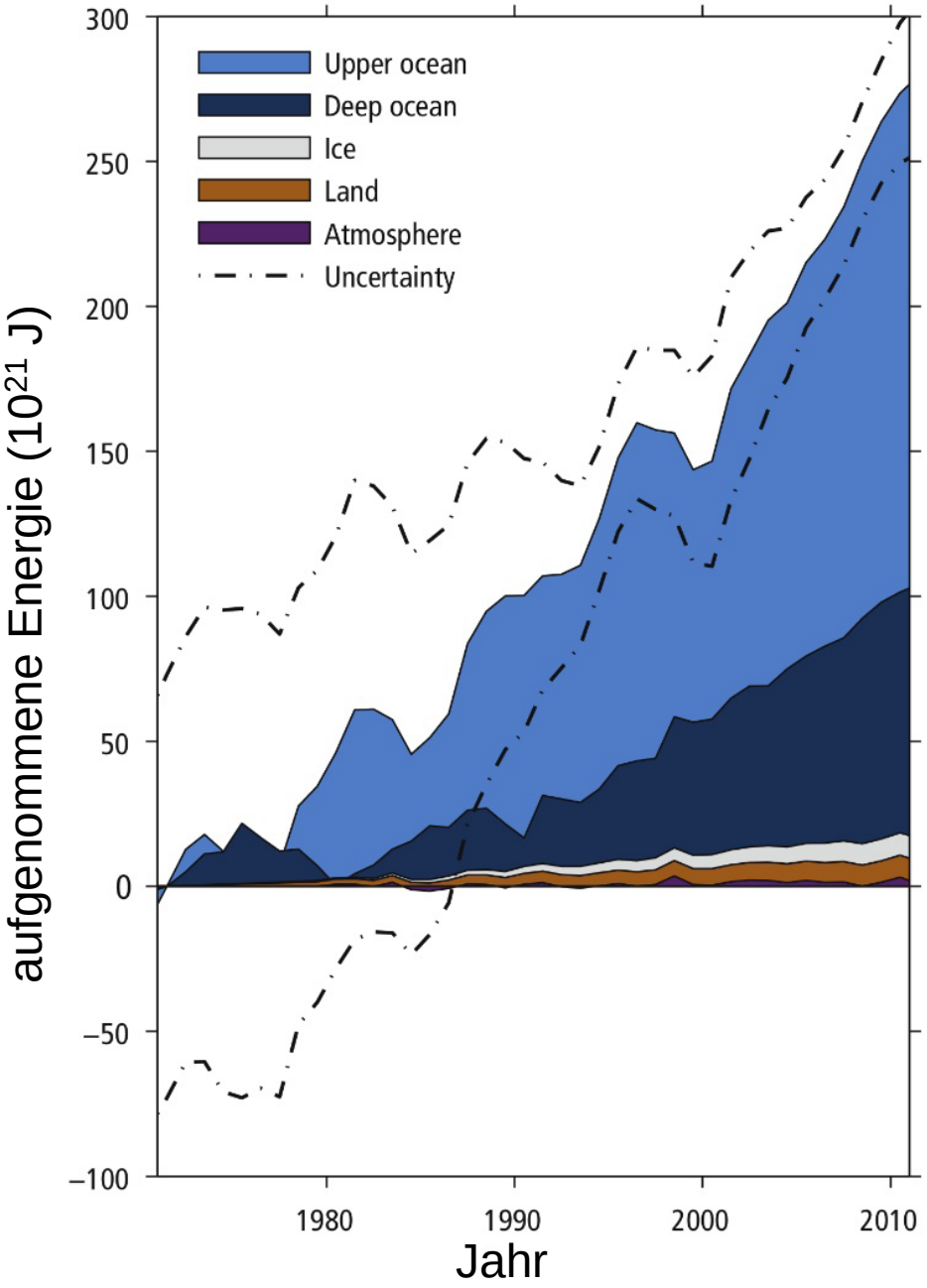
https://wiki.bildungsserver.de/klimawandel/index.php/Globales_F%C3%B6rderband_(einfach)

Anthropogenes CO_2 im Ozean



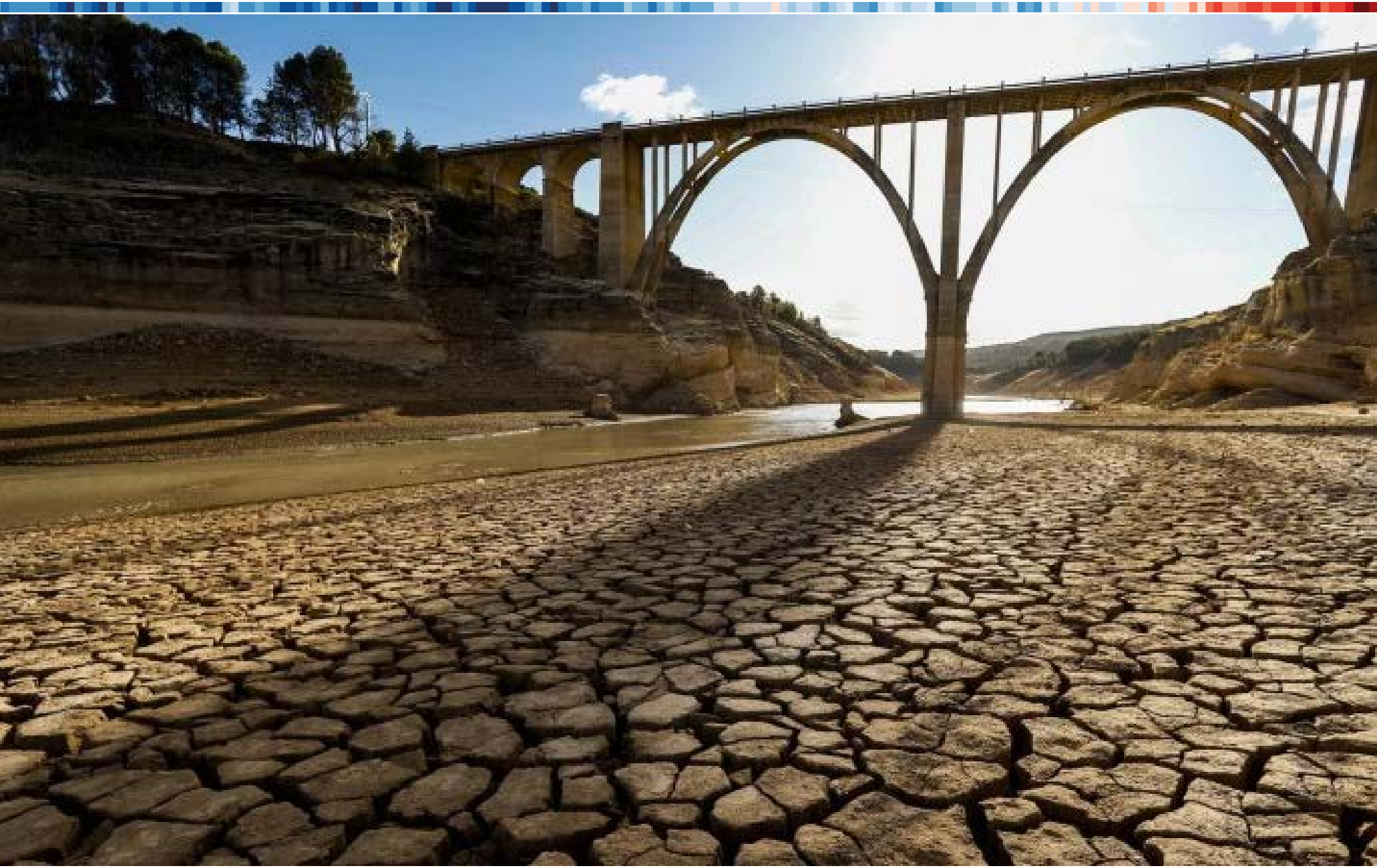
https://www.pmel.noaa.gov/co2/story/Ocean+Carbon+Storage

Energieaufnahme: Der Ozean als Puffersystem



IPCC 2013: Energy-accumulation-within-the-Earths-climate-system

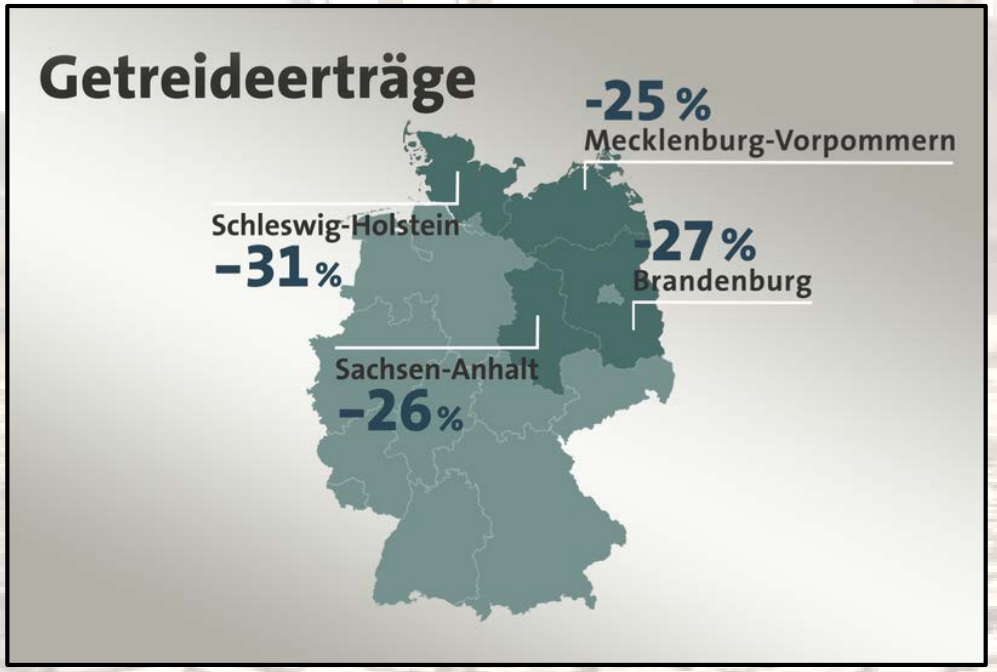
Extremwetter



www.deutschlandfunk.de/trockenheit-in-spanien-mondlandschaft-statt-wassersport.795.de.html

Extremwetter: Hitzesommer 2018

Deutschland: Landwirtschaft



Schadensumfang: ca. 3 Mrd Euro

Unterstützung durch Bund & Länder: 340 Mio Euro

stock.adobe.com/vom (Bundesministerium für Ernährung und Landwirtschaft)
https://www.tagesschau.de/inland/duerre-157.html, https://www.tagesschau.de/wirtschaft/duerreschaeden-105.html

Extremwetter

www.zeit.de/politik/ausland/2015-08/fluechtlinge-mittelmeer-tote-schiff-italienische-kuestenwache

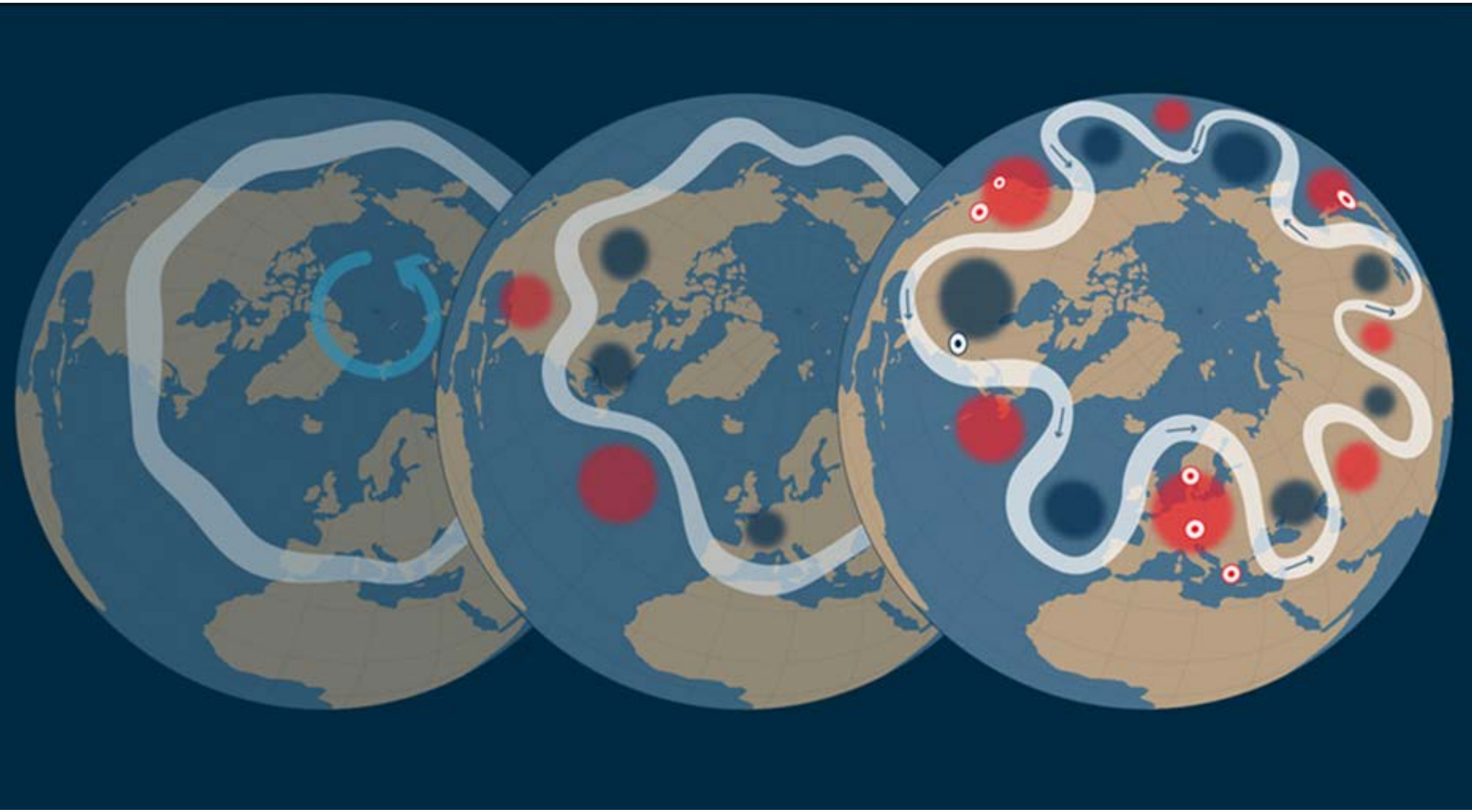
Extremwetter: Niederschlagsmenge

https://indianexpress.com/article/technology/science/extreme-rainfall-events-over-central-india-tripled-since-1950-study-4875917/

Extremwetter: Stürme

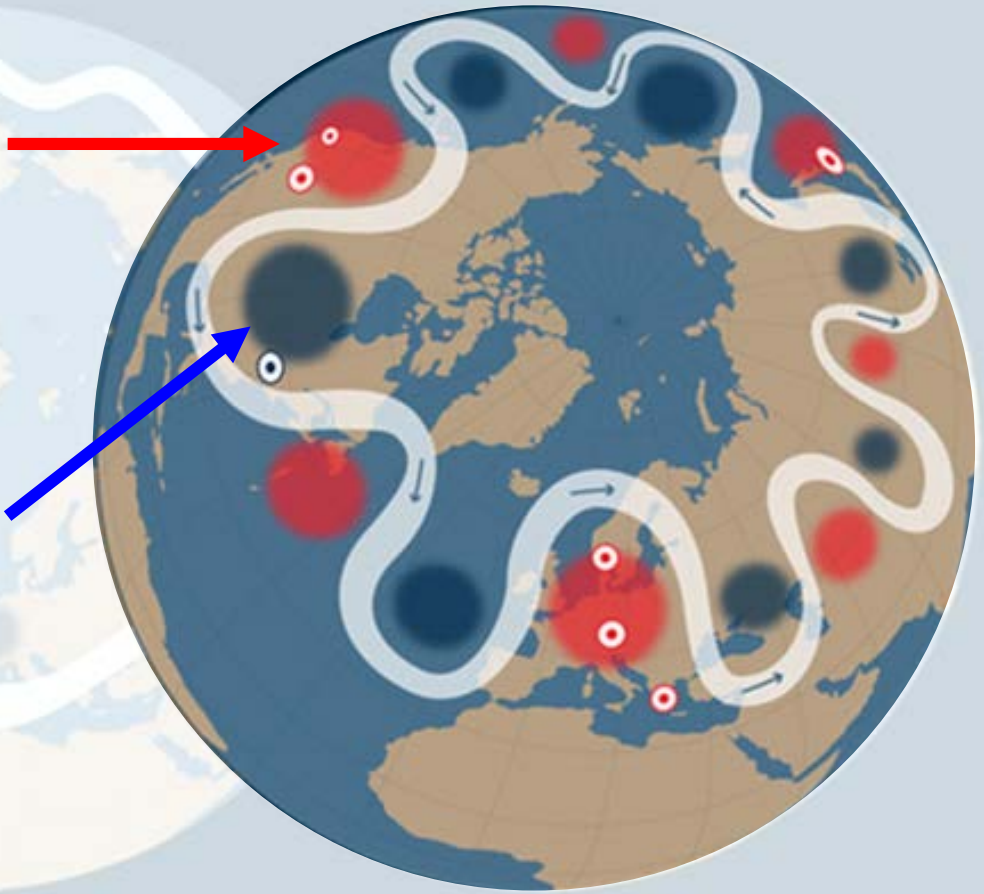
https://sealevel.nasa.gov/news/93/nasa-sees-hurricane-irma-affecting-south-florida

Extremwetter: Planetare Wellen



https://www.ews-schoenau.de/energiewende-magazin/zur-sache/jetstream-wenn-der-klimamotor-stottert/

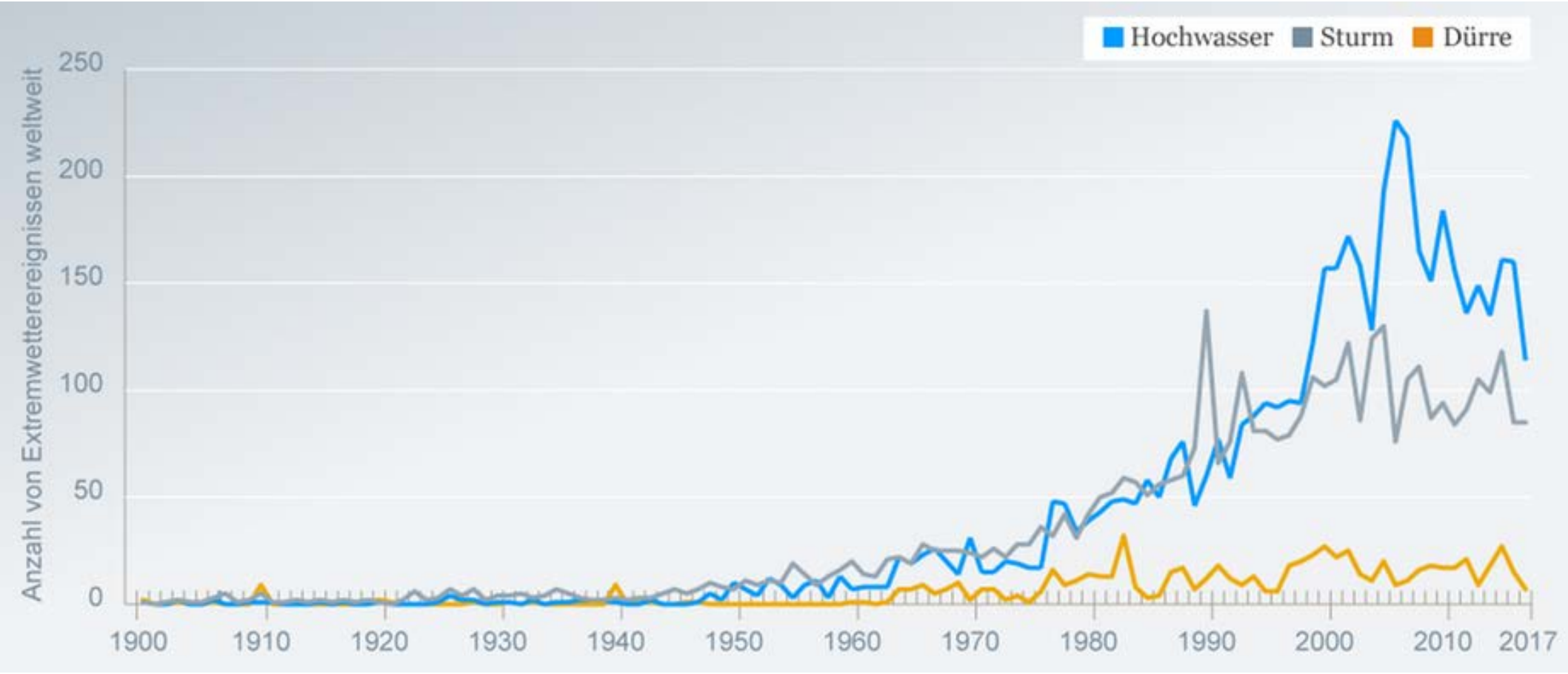
Extremwetter: Planetare Wellen (Sommer 2018)



https://www.n-tv.de/panorama/31-Menschen-sterben-in-den-Flammen-article20716187.html
https://www.noen.at/in-ausland/usa-schwere-ueberschwemmungen-in-texas-hochwasser-sturm-usa-163298974#

https://medium.com/@simon_black/climate-deniers-arent-stupid-they-re-empowered-eb3188e5c883

Anzahl von Extremwetterereignissen (weltweit)



The Emergency Events Database (EM-DAT)

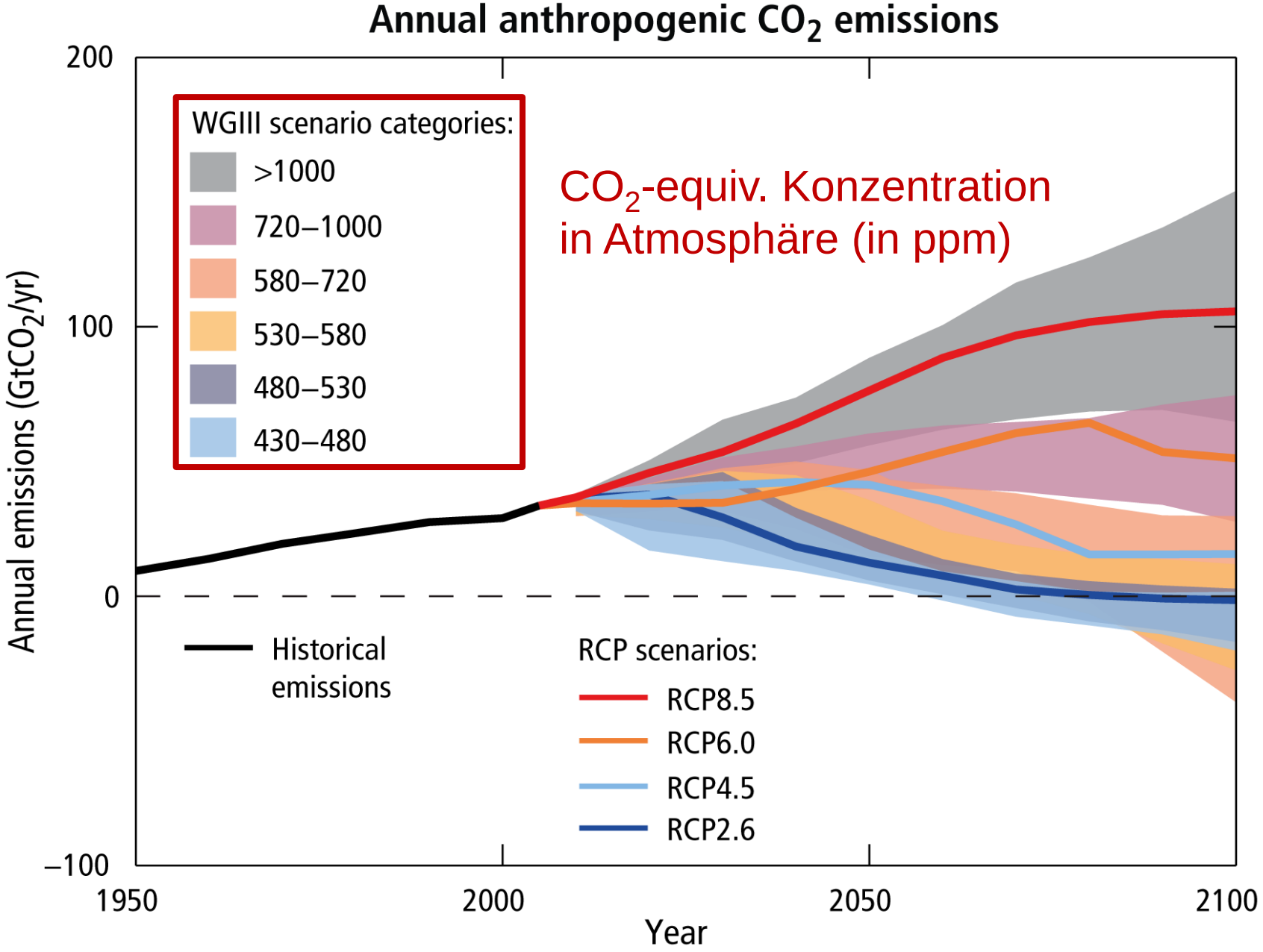
Der Weltklimarat: IPCC (gegründet 1988)

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

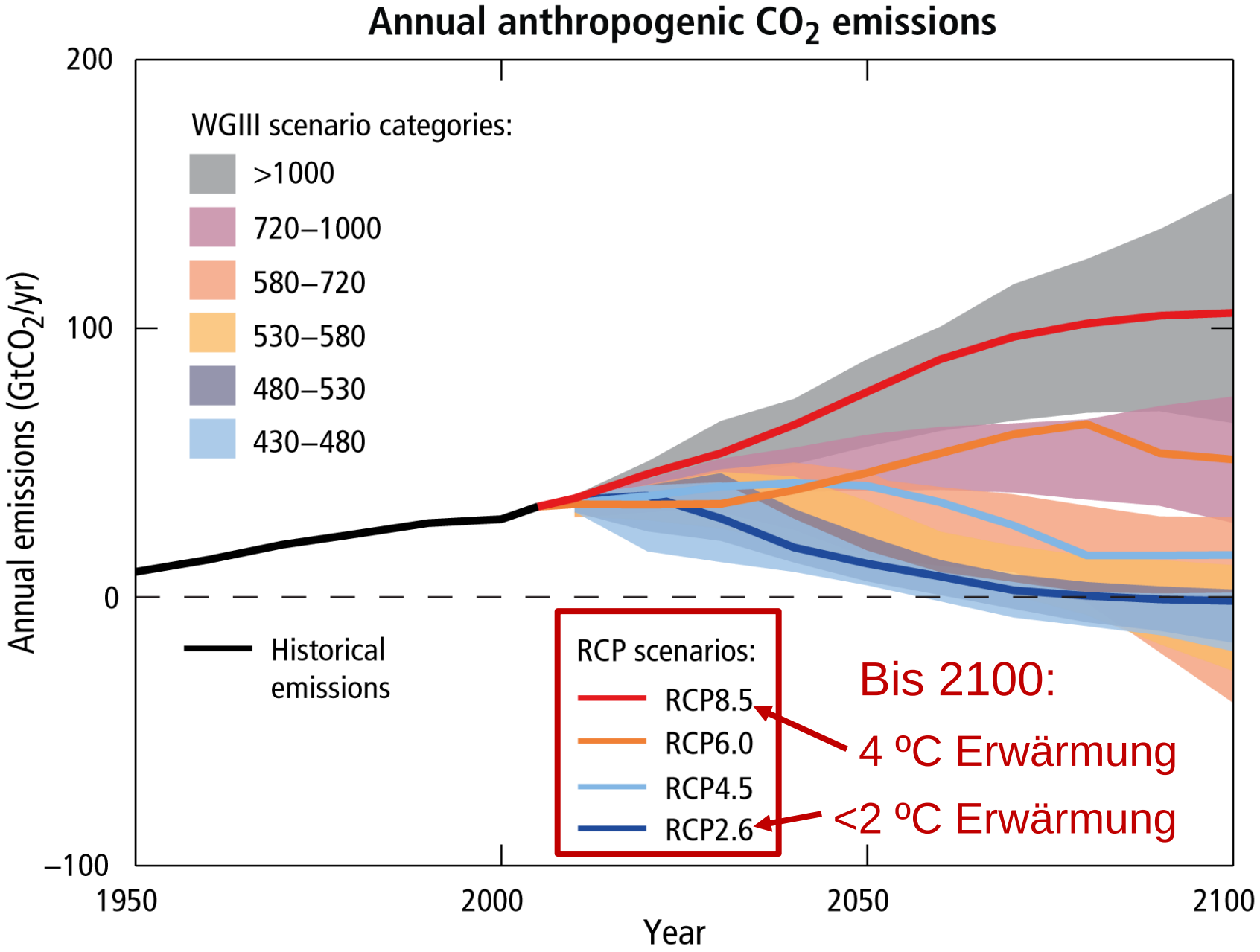
IPCC 2018, https://www.zdf.de/nachrichten/heute/weltklimarat-faq-100.html

IPCC CO_2-Emissionspfade (global)

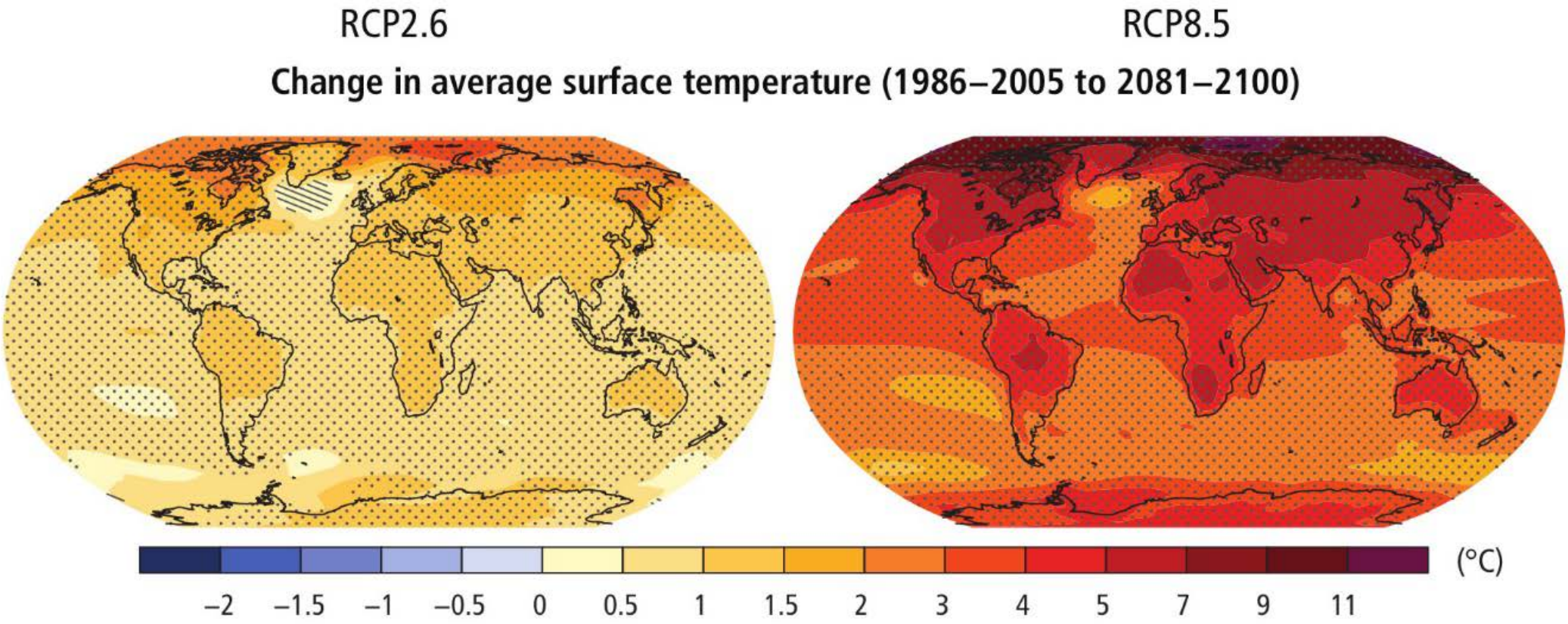


IPCC 2014

IPCC: jährliche CO_2-Emissionen (global)



IPCC Klimamodelle: Oberflächentemperaturen

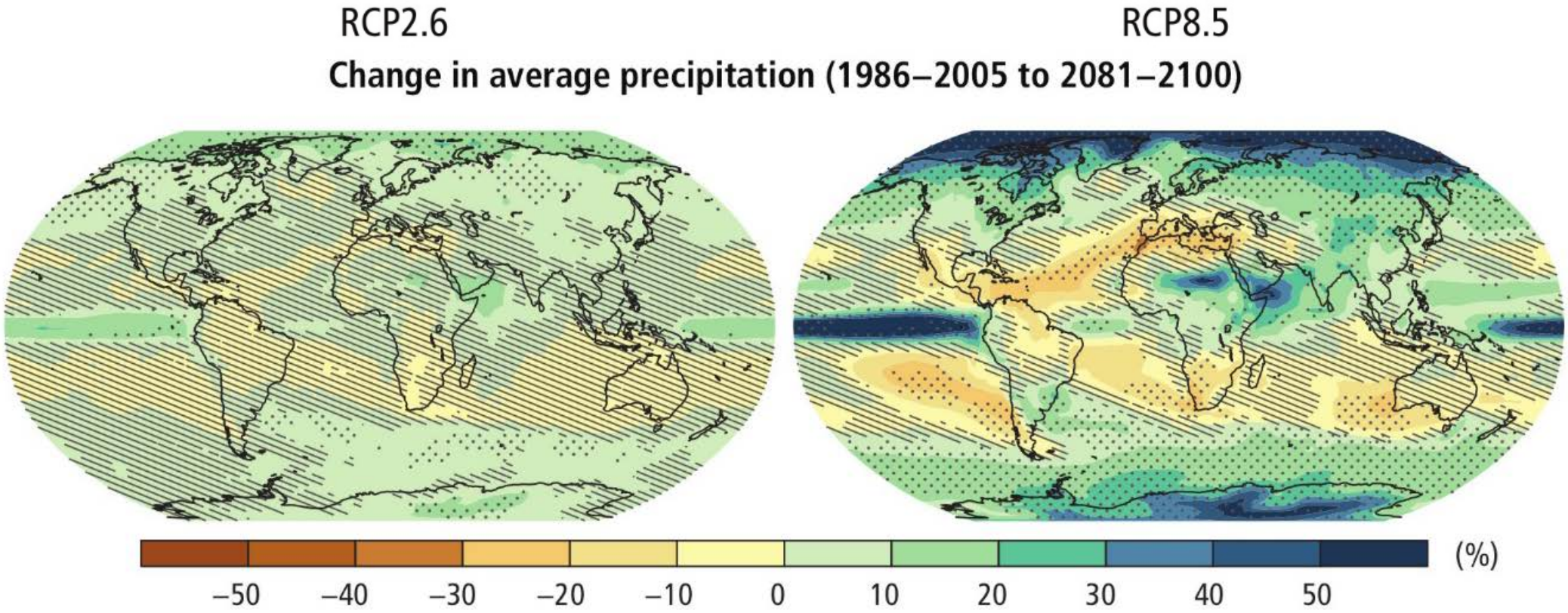


<2 ºC Erwärmung

4 ºC Erwärmung

IPCC, 5th assessment report

IPCC Klimamodelle: Niederschlag



<2 ºC Erwärmung

4 ºC Erwärmung

IPCC, 5th assessment report

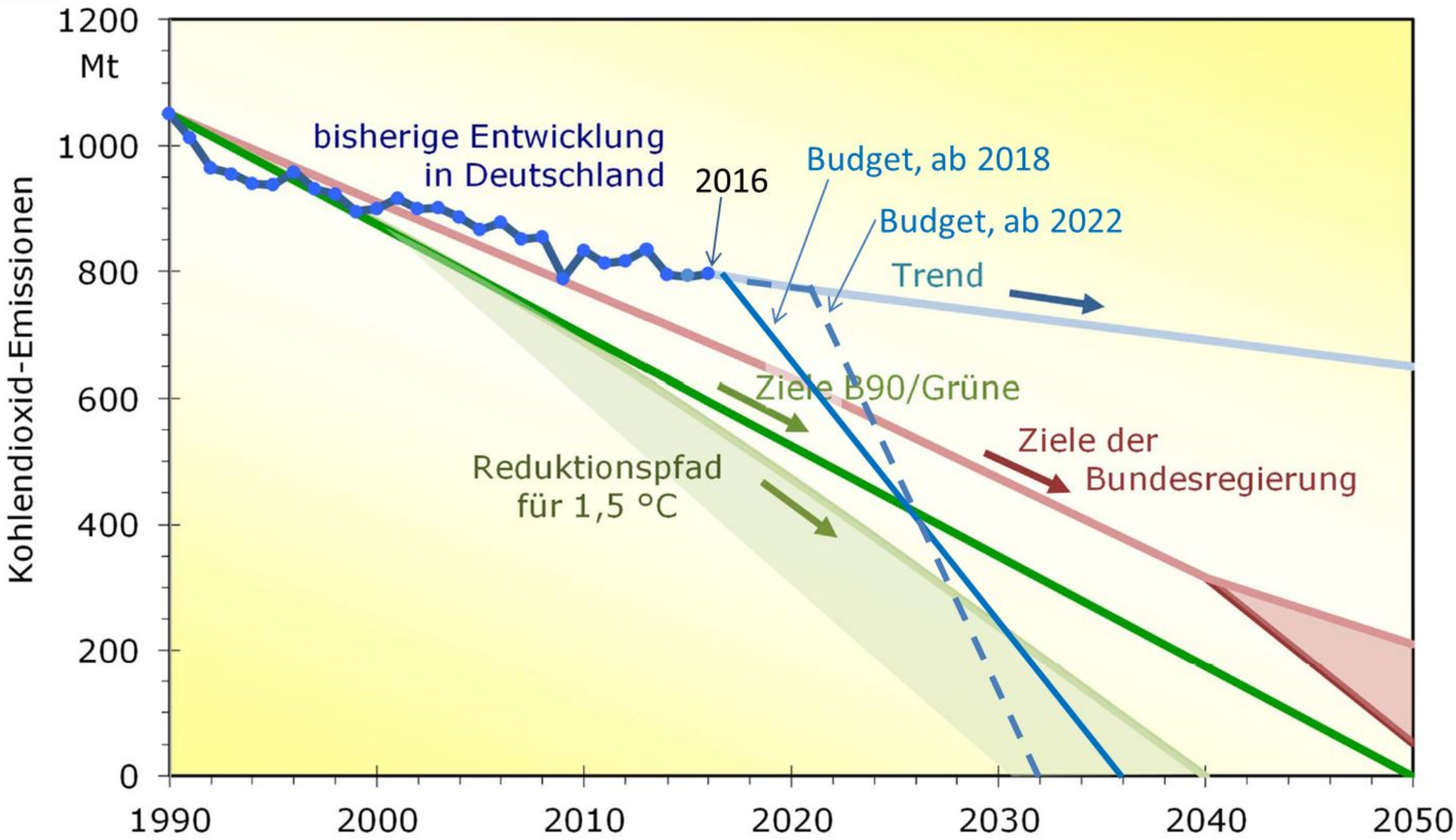
Das Pariser Abkommen (COP21, 2015)

- *Begrenzung der Erderwärmung auf deutlich unter 2 Grad*
- *Keine weitere Belastung der Atmosphäre durch Treibhausgase in der zweiten Hälfte des Jahrhunderts*
- *Hilfe für die ärmsten Länder bei der Bewältigung durch Klimawandel verursachter Schäden*
- *Regelmäßige Überprüfung der Ziele in allen Staaten*

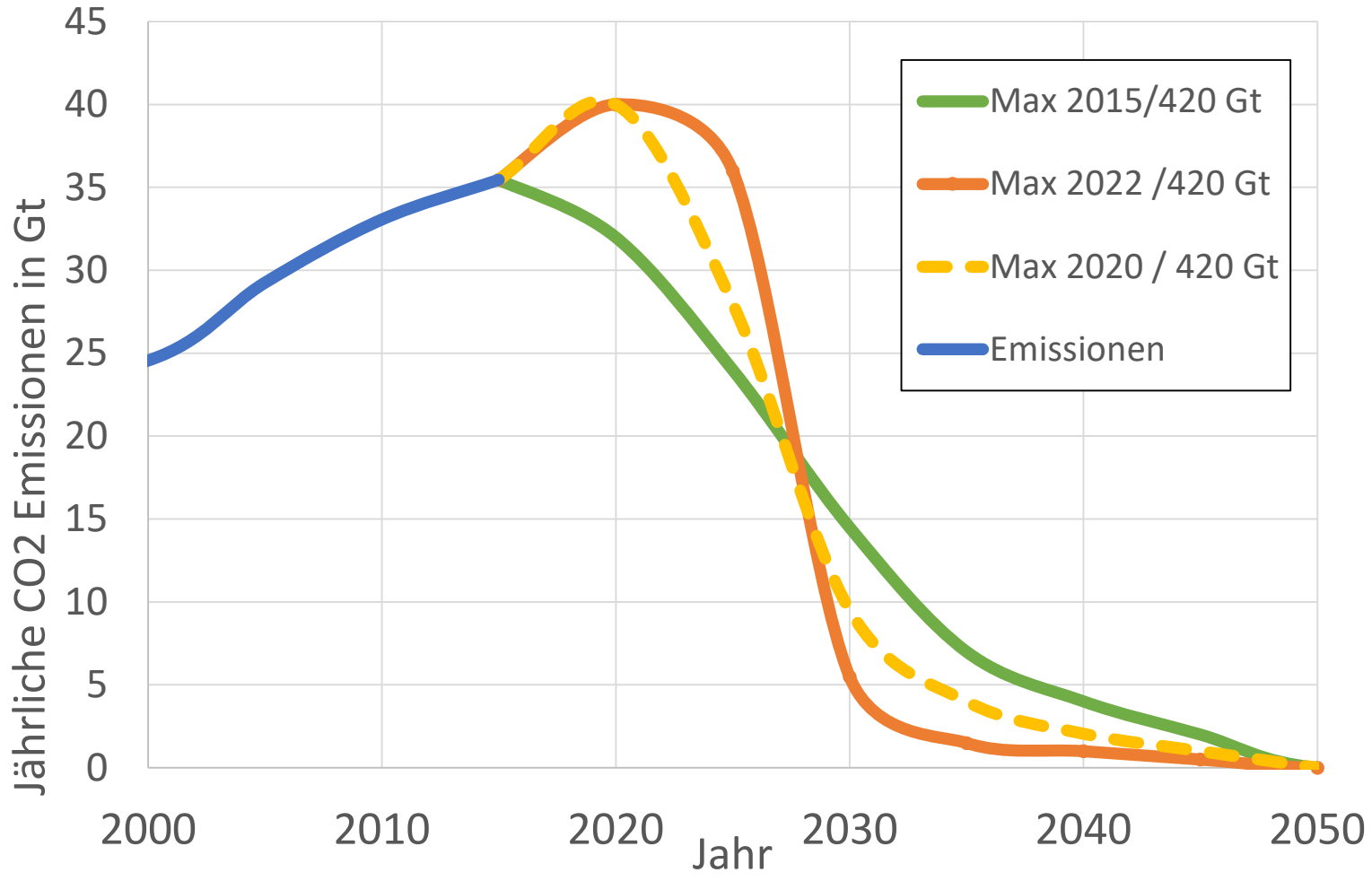
COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Deutsches CO_2-Budget bis 2050



Weltweites CO_2 Budget bis 2050



Je später die Reduktion der CO_2-Emissionen beginnt, desto stärker muss sie sein und desto höher ist die Wahrscheinlichkeit, dass das 1,5° - Ziel nicht erreicht wird.

Handlungsmöglichkeiten

https://www.careelite.de/nachhaltig-leben-tipps-alltag/

Handlungsmöglichkeiten

https://taz.de/Kommentar-Fridays-for-Future/!5583849/

https://fridaysforfuture.de/neustartklima/