



42. Fachtagung Holzbau Baden-Württemberg
Stuttgart, 1 Oktober 2020

Können wir uns mit Holz aus der Klimakrise herausbauen?

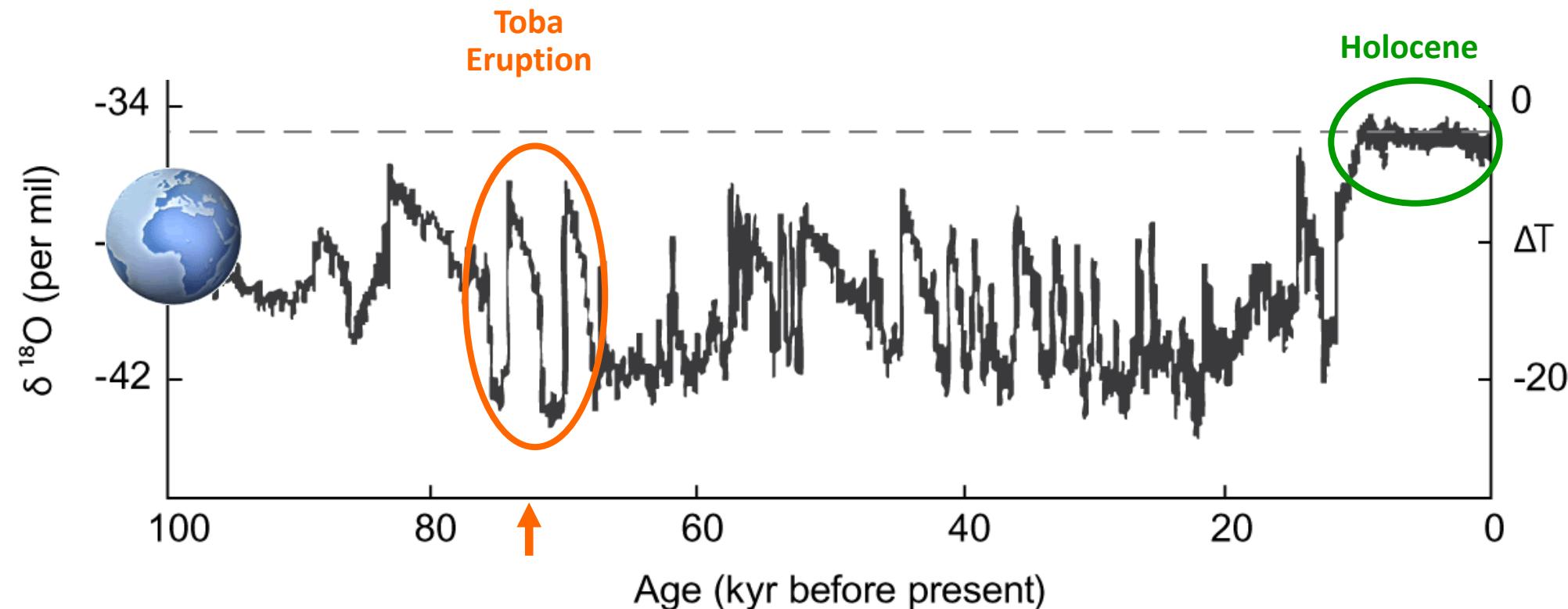
Prof. Dr. Dr. h.c. Hans Joachim Schellnhuber

*Direktor Emeritus, Potsdam-Institut für Klimafolgenforschung (PIK);
Mitglied, Päpstliche Akademie der Wissenschaften;
Mitglied, Wissenschaftlicher Beirat Globale Umweltveränderungen (WBGU)*



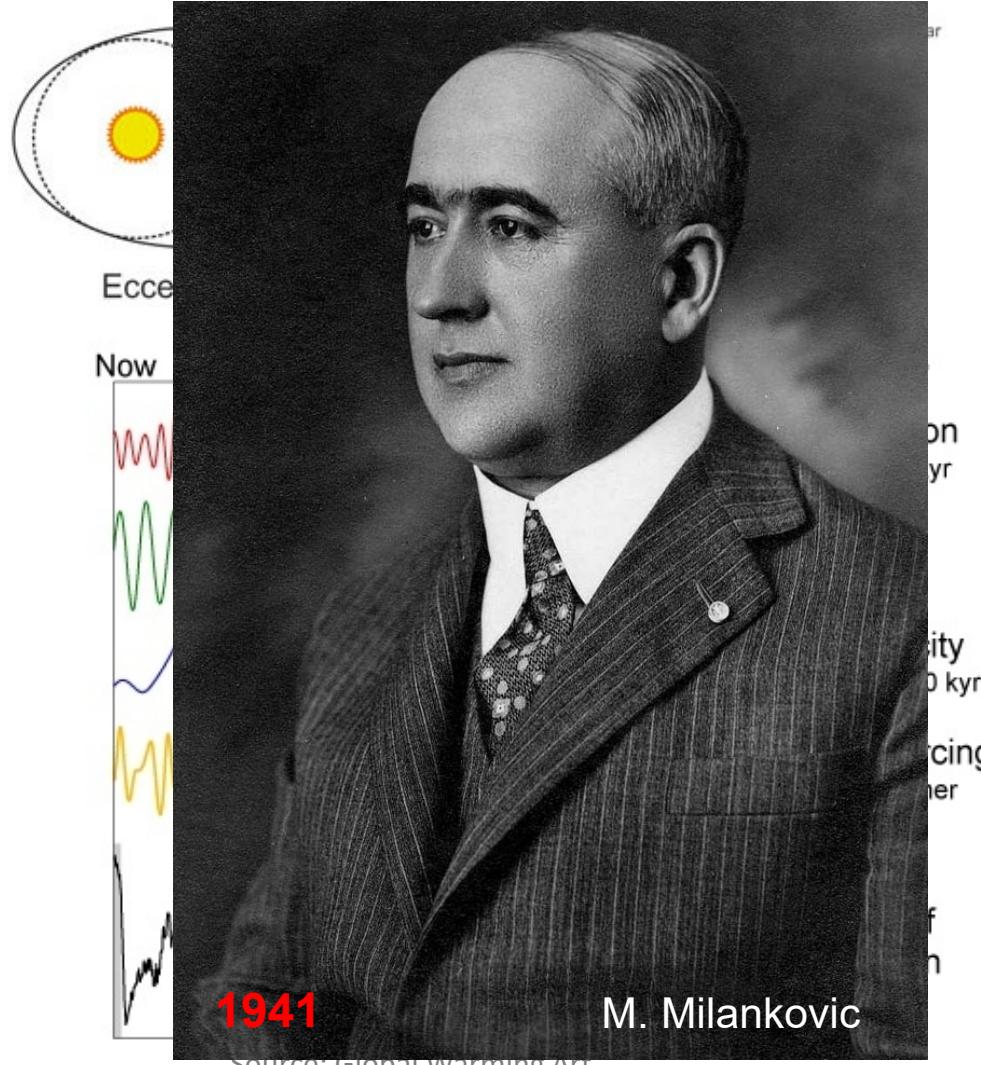


Das Holozän: Vom Eiszeitchaos zum Klimaparadies



Time Series Source: Johan Rockström,
Stockholm Resilience Centre

Warum sich das Klima ändert – längerfristige Faktoren:



Milankovic Cycles



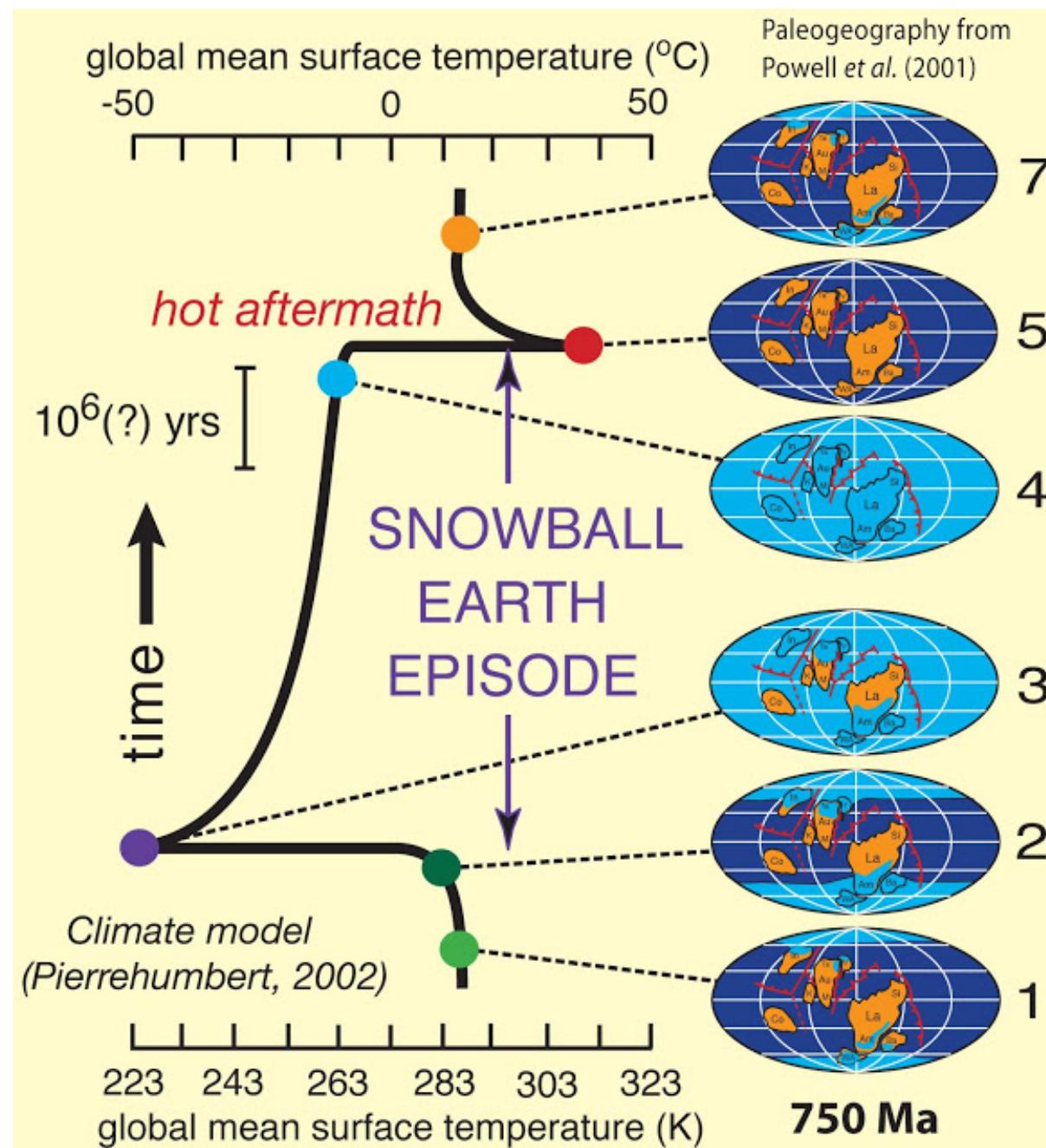
The Greenhouse Effect

Greta Thunberg (Fridays for Future)



Anders Hellberg/Wikimedia Commons

Schneeball Erde



Karbon/Perm: Kohlebildung und Kühlung der Erde

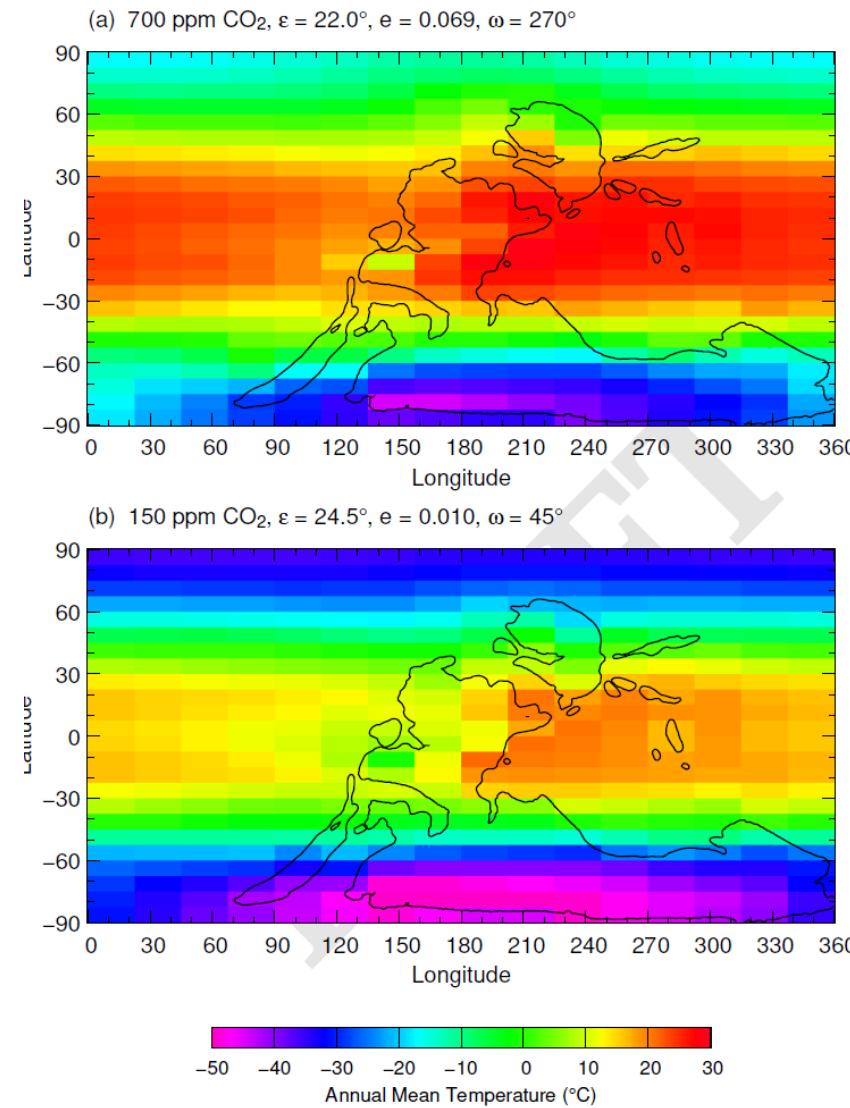
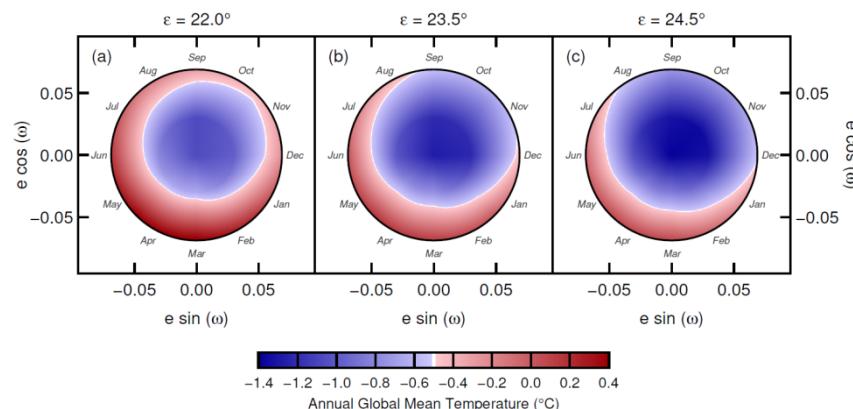
Formation of most of our coal brought Earth close to global glaciation

Georg Feulner^{a,1}

^aPotsdam Institute for Climate Impact Research, Leibniz Association, D-14412 Potsdam, Germany

Edited by Mark H. Thiemens, University of California, San Diego, La Jolla, CA, and approved September 5, 2017 (received for review July 7, 2017)

The bulk of Earth's coal deposits used as fossil fuel today was formed from plant debris during the late Carboniferous and early Permian periods. The high burial rate of organic carbon correlates with a significant drawdown of atmospheric carbon dioxide (CO_2) at that time. A recent analysis of a high-resolution record reveals large orbitally driven variations in atmospheric CO_2 concentration between ~ 150 and 700 ppm for the latest Carboniferous and very low values of 100 ± 80 ppm for the earliest Permian. Here, I explore the sensitivity of the climate around the Carboniferous/Permian boundary to changes in Earth's orbital parameters and in atmospheric CO_2 using a coupled climate model. The coldest orbital configurations are characterized by large axial tilt and small eccentricities of Earth's elliptical orbit, whereas the warmest configuration occurs at minimum tilt, maximum eccentricity, and a perihelion passage during Northern hemisphere spring. Global glaciation occurs at CO_2 concentrations < 40 ppm, suggesting a rather narrow escape from a fully glaciated Snowball Earth state given the low levels and large fluctuations of atmospheric CO_2 . These findings highlight the importance of orbital cycles for the climate and carbon cycle during the late Paleozoic ice age and the climatic significance of the fossil carbon stored in Earth's coal deposits.



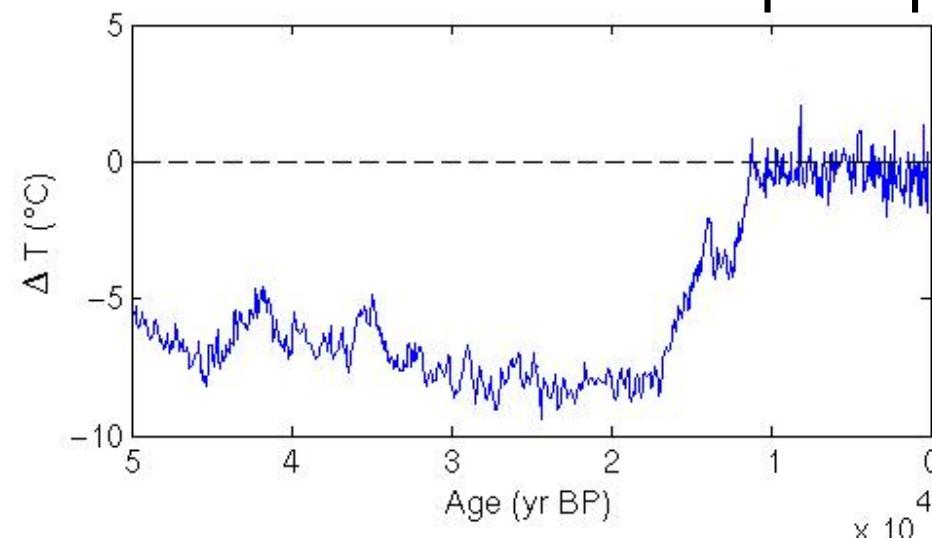
Das Holozän der Revolutionen

Neolithische Revolution

Beginn ~ 10 000 v.Chr.



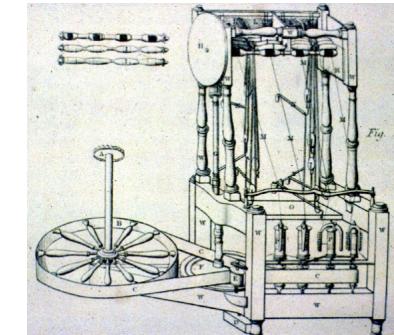
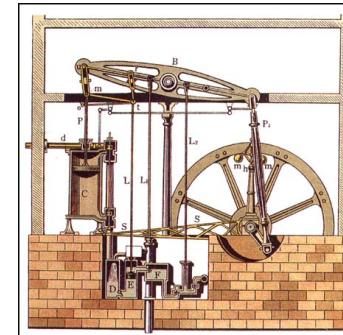
Weltbevölkerung < 1 Million



Industrielle Revolution

James Watts Dampfmaschine (1765)

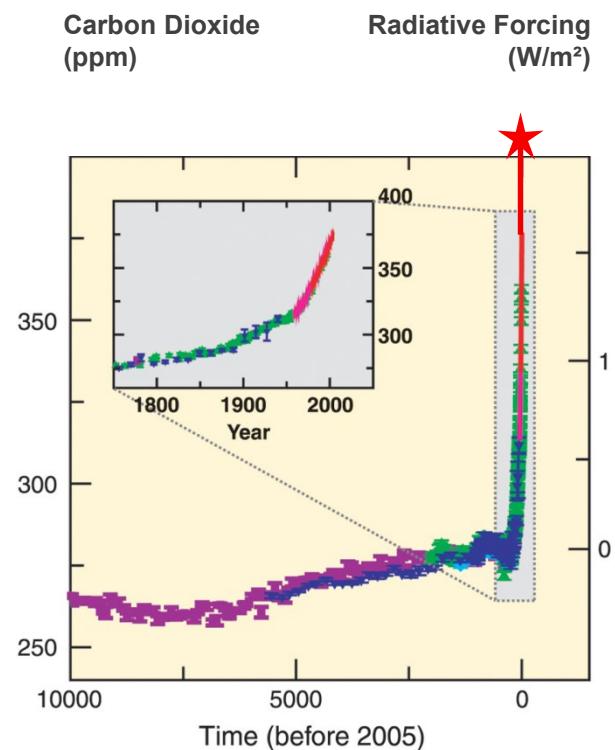
Richard Arkwright Spinnmaschine (1769)



Weltbevölkerung (2050) ~ 9 Milliarden

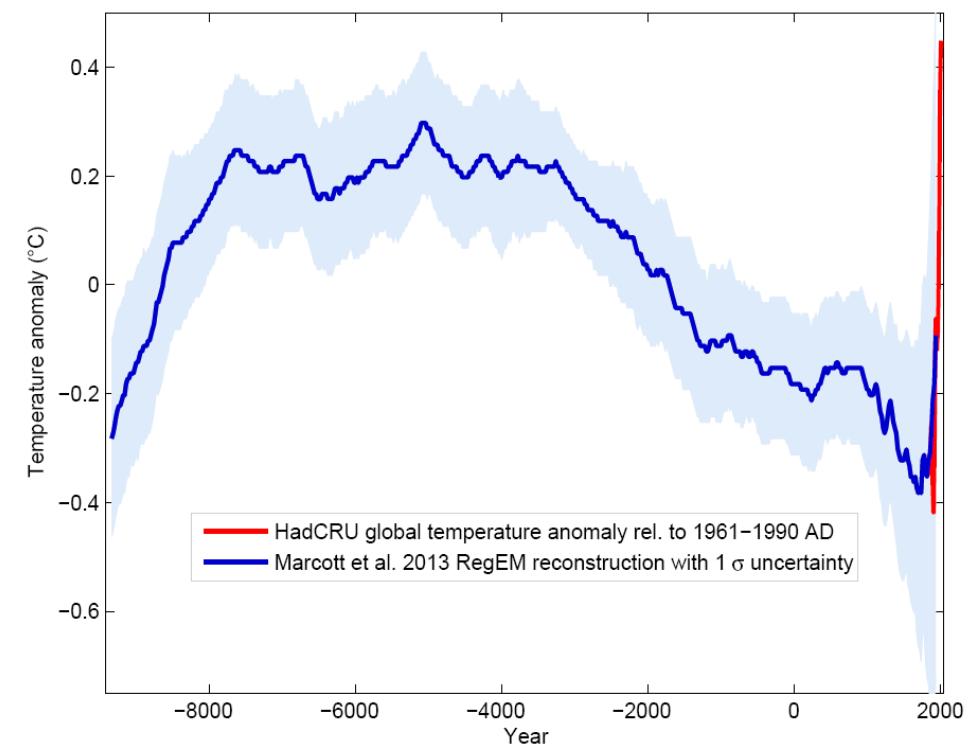
Historische Entwicklung der CO₂ - Konzentration

2020: 417 ppm



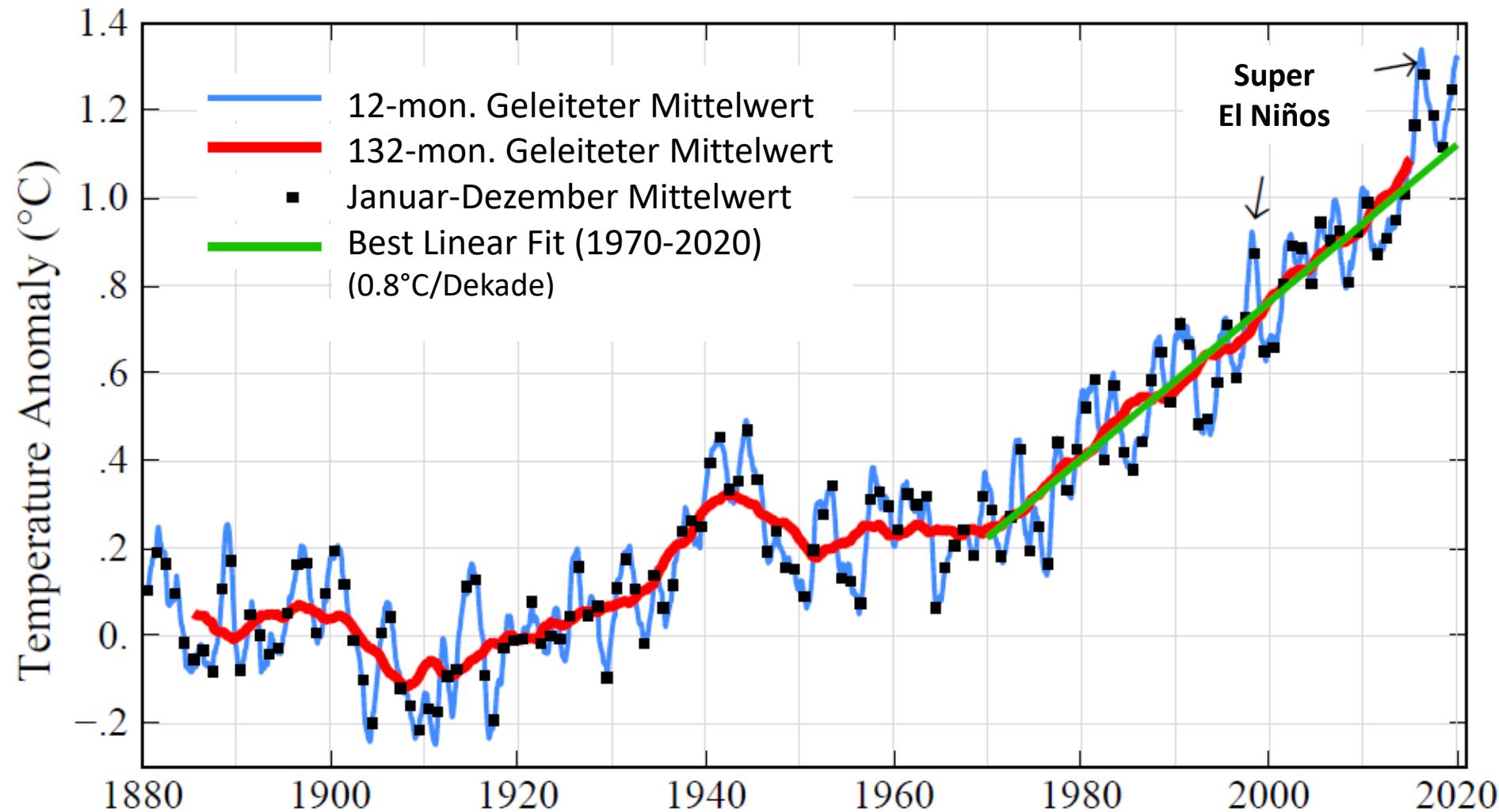
IPCC 2007

Erste globale Temperatur- rekonstruktion für die vergangenen 11000 Jahre



Marcott *et al.*
2013, Science

Globale Durchschnittstemperatur



Das Pariser Abkommen

Nations Unies
Conférence sur les Changements Climatiques 2015

COP21/CMP11

Paris, France



Weltklimarat $\leq 1.5^{\circ}\text{C}$!

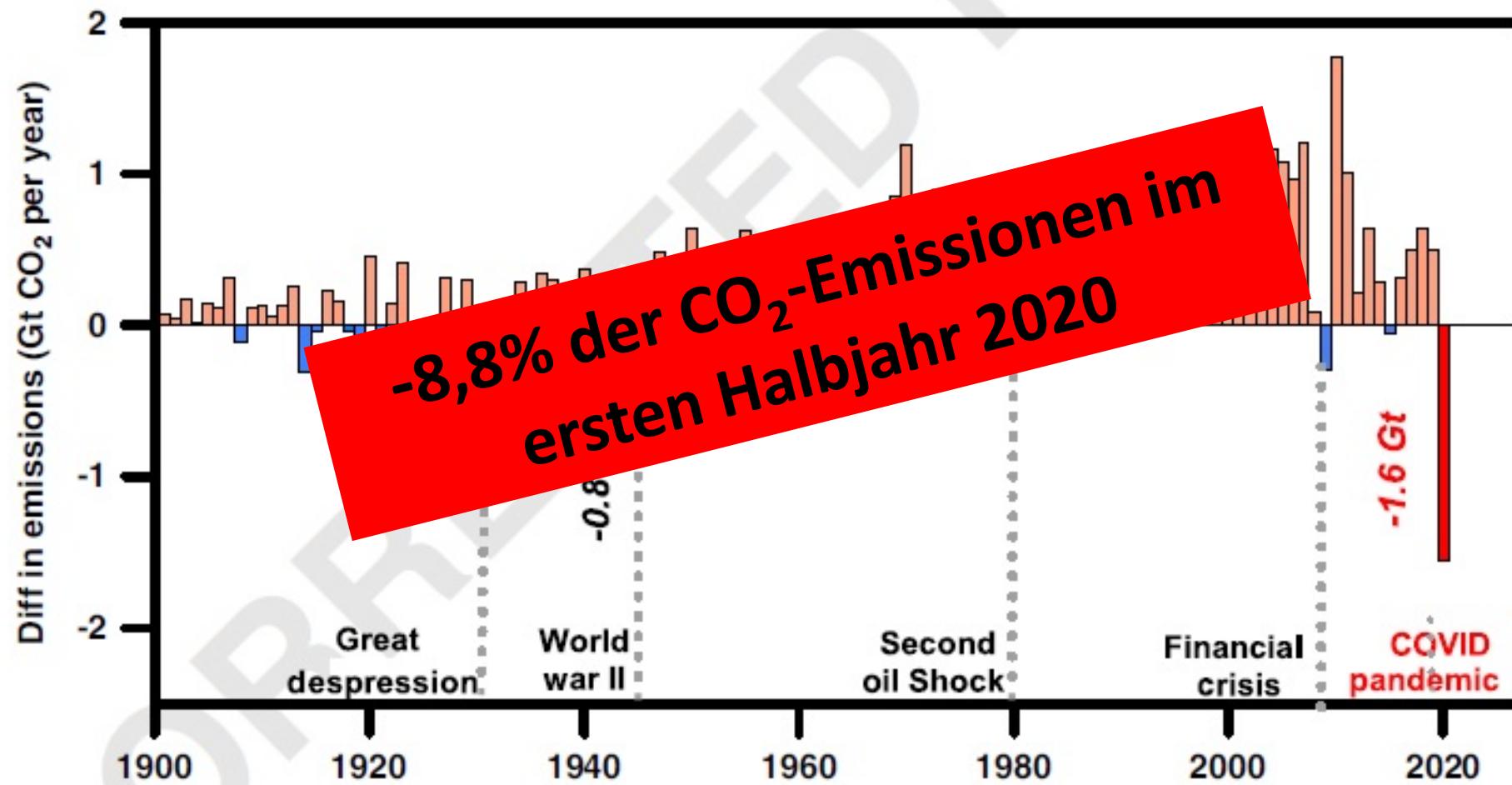
Beschränkung der
Erderwärmung auf
“weit unter” 2 Grad Celsius

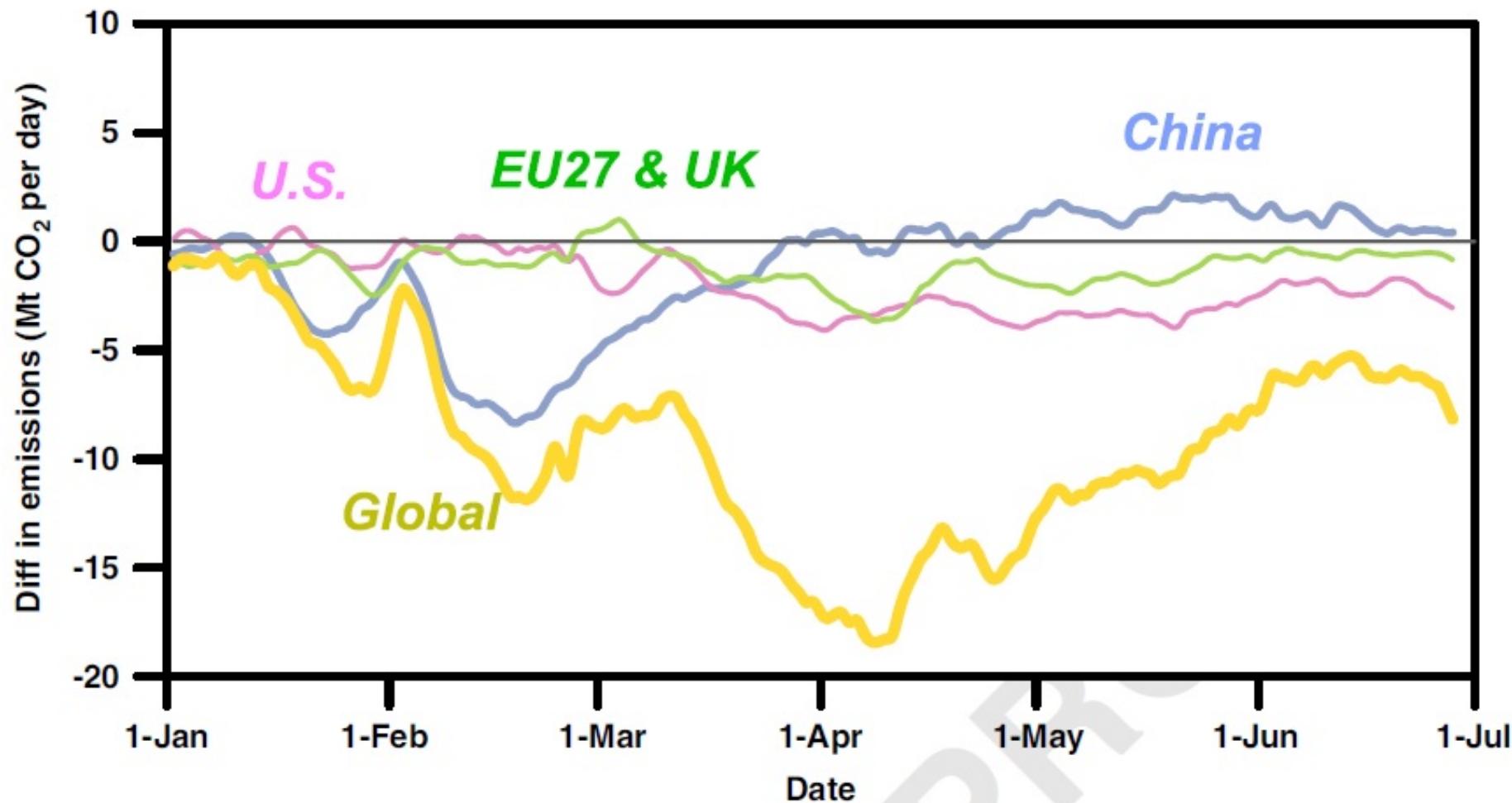
Netto-Null Emissionen von
Treibhausgasen nach Mitte des
21. Jahrhunderts

Nationale Emissionsziele
regelmäßig überprüft und
verschärft

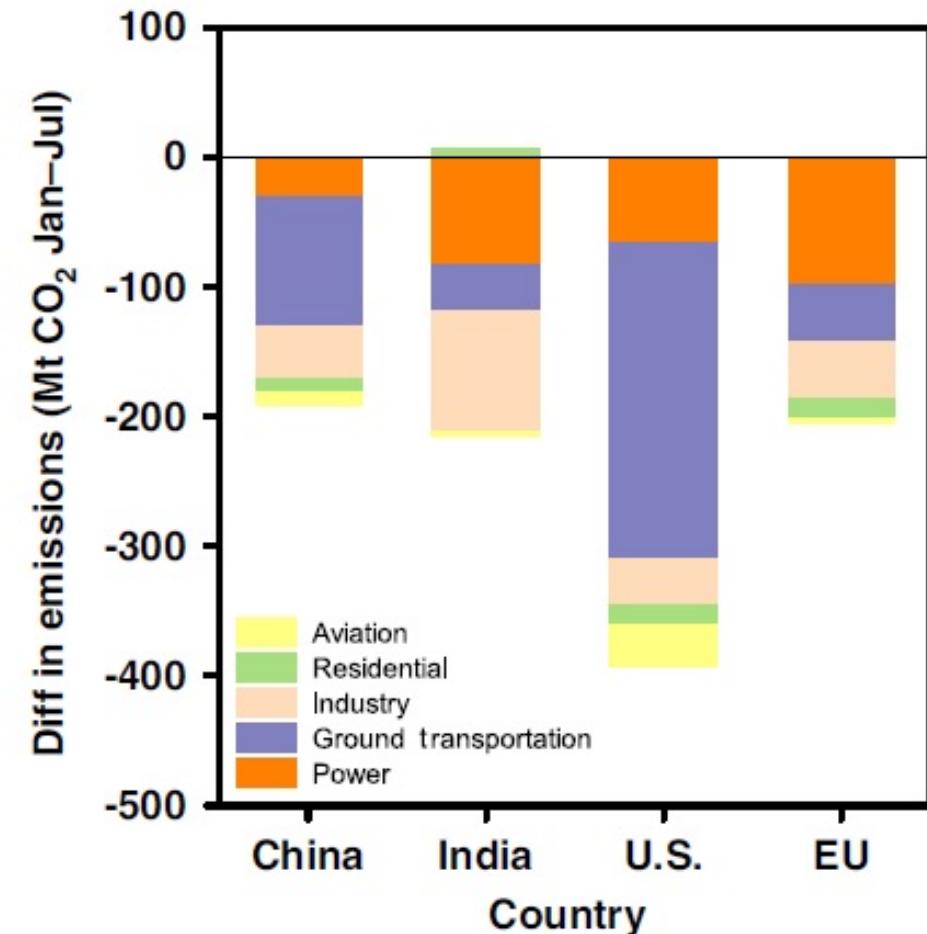
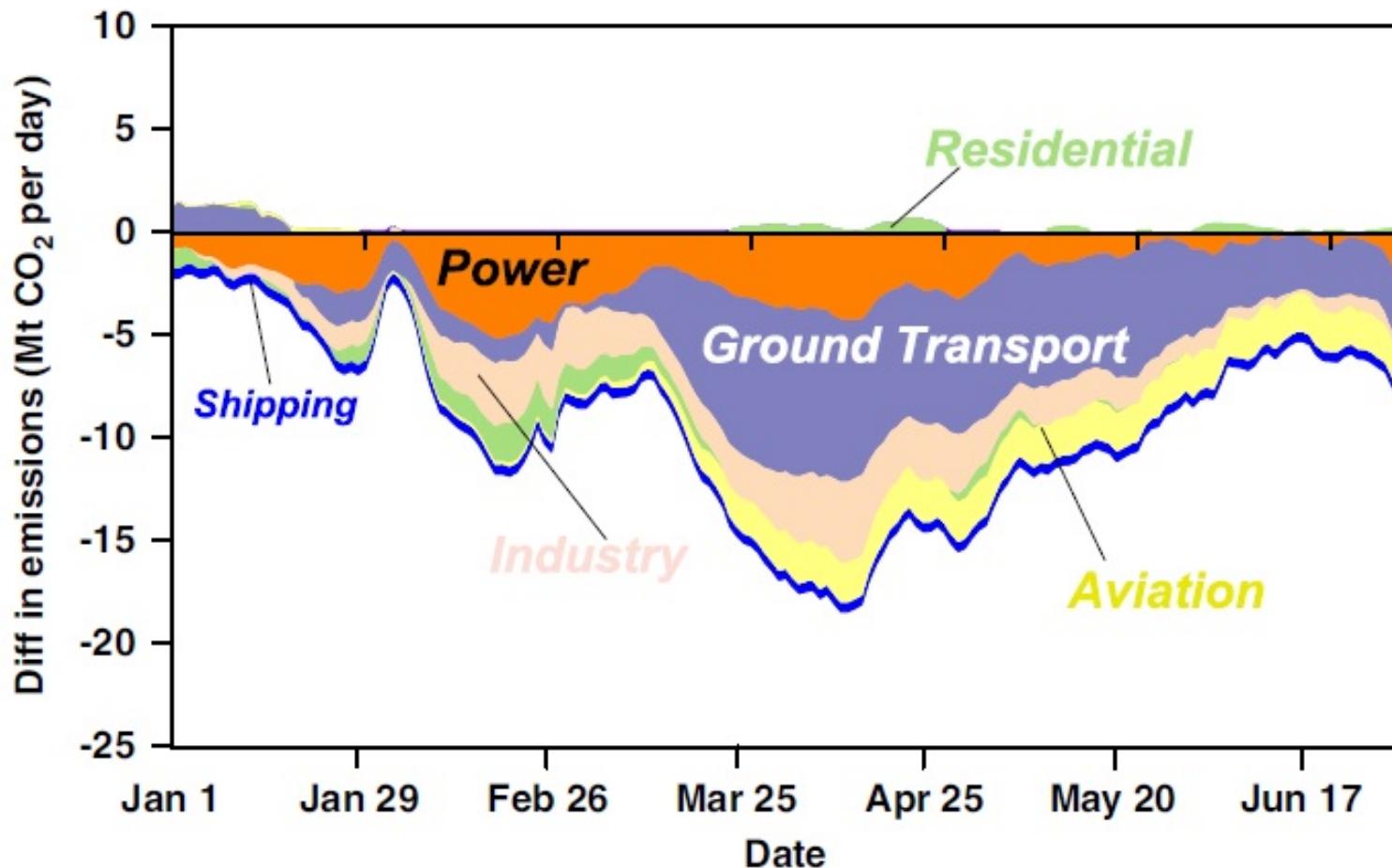
Industrieländer stellen von
2020-2025 jährlich
100 Milliarden USD bereit

Near-real-time monitoring of global CO₂ emissions reveals the effects of the COVID-19 pandemic

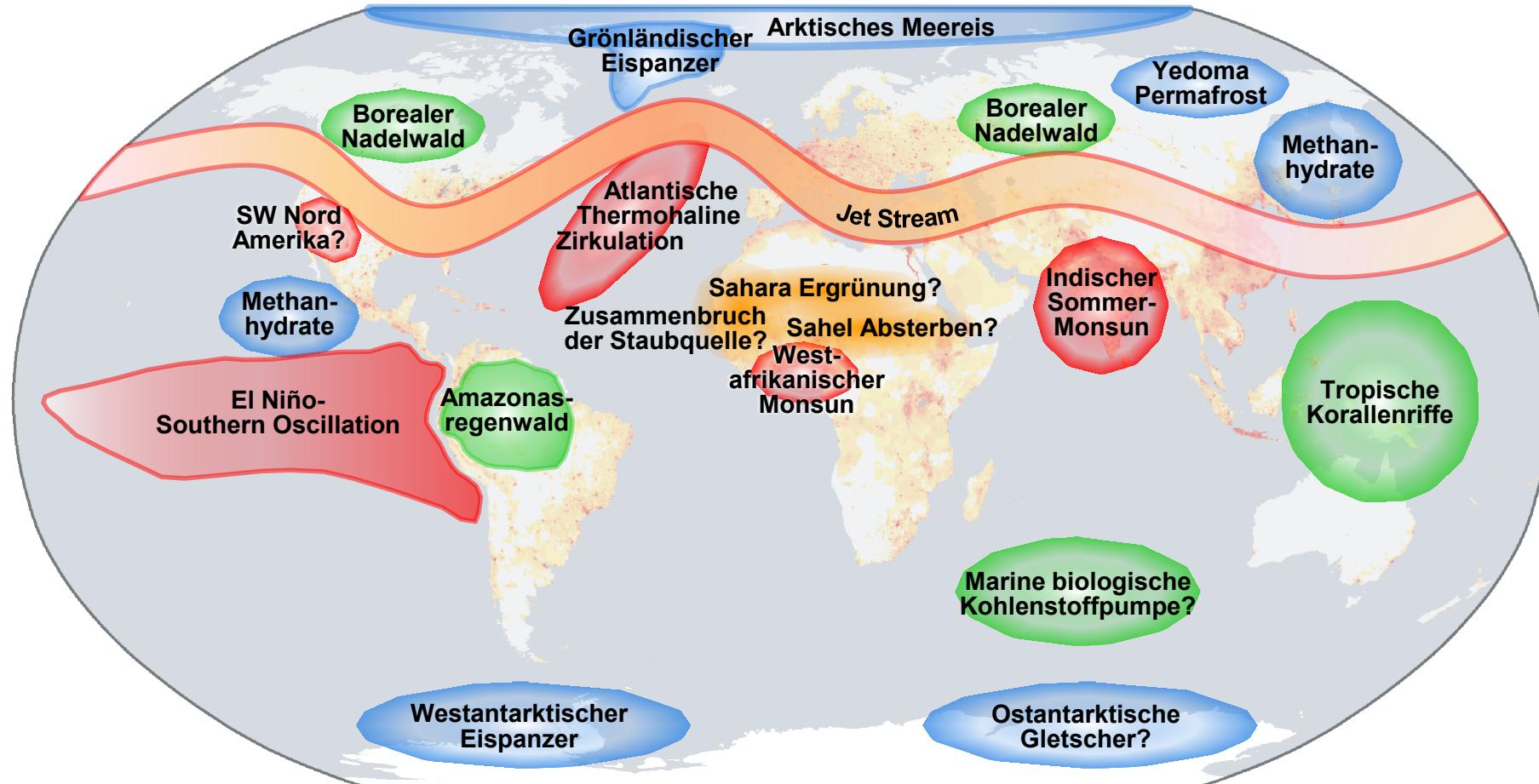




Near-real-time monitoring of global CO₂ emissions reveals the effects of the COVID-19 pandemic

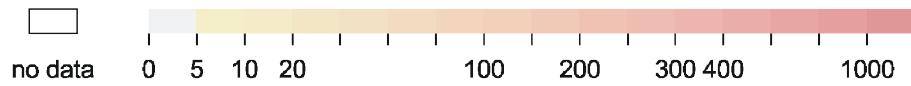


Risiken am Horizont: Kippelemente im Erdsystem



- Elemente der Kryosphäre
- Zirkulationsmuster
- Elemente der Biosphäre

Bevölkerungsdichte [Personen pro km²]



Folge des Klimawandels

14.08.2020

Grönlands Eisschild ist verloren



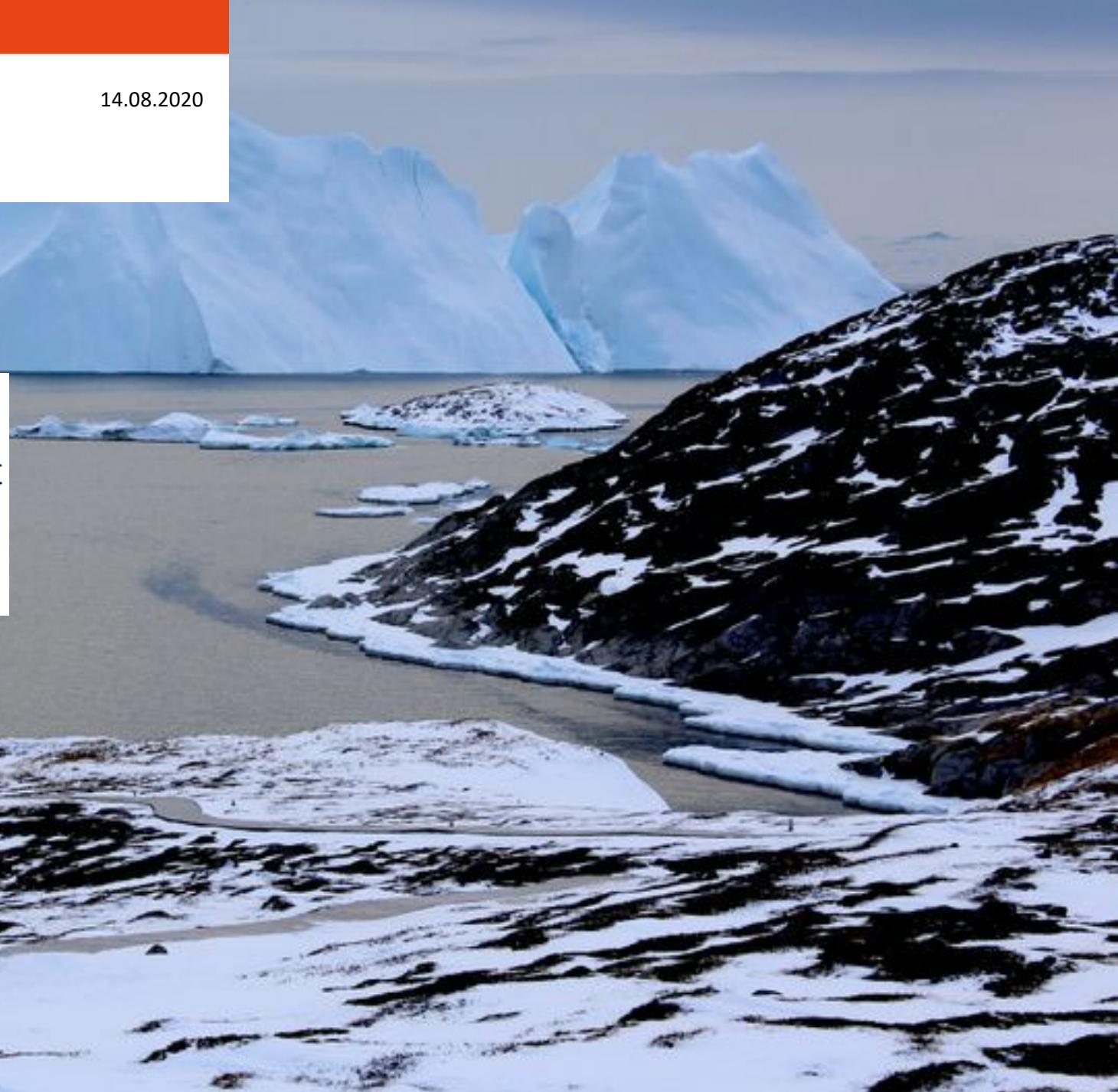
ARTICLE

<https://doi.org/10.1038/s43247-020-0001-2>

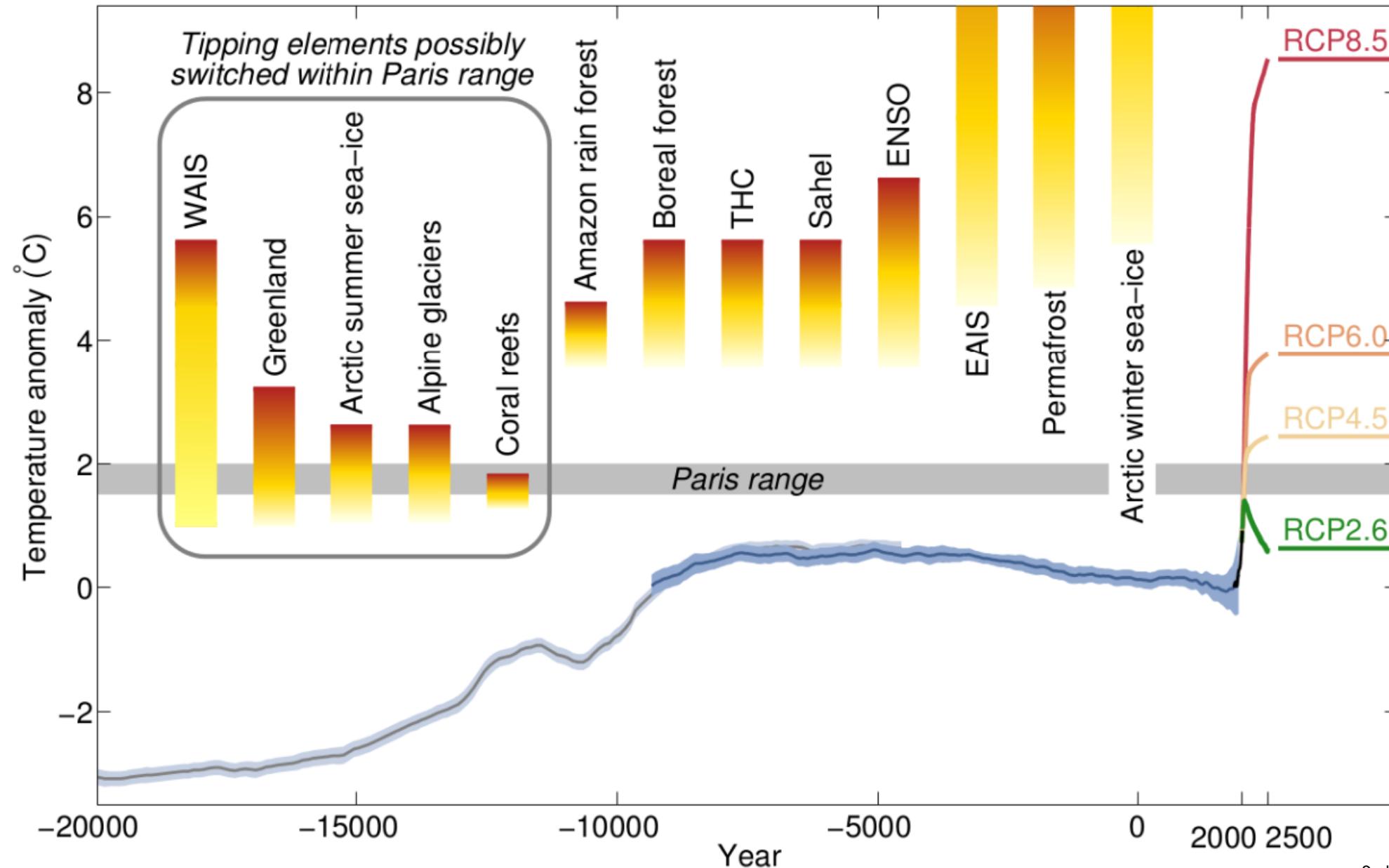
OPEN 13.08.2020

Dynamic ice loss from the Greenland Ice Sheet driven by sustained glacier retreat

Michalea D. King¹✉, Ian M. Howat¹, Salvatore G. Candela¹, Myoung J. Noh¹, Seonsgu Jeong², Brice P. Y. Noël³, Michiel R. van den Broeke¹, Bert Wouters^{3,4} & Adelaide Negrete¹



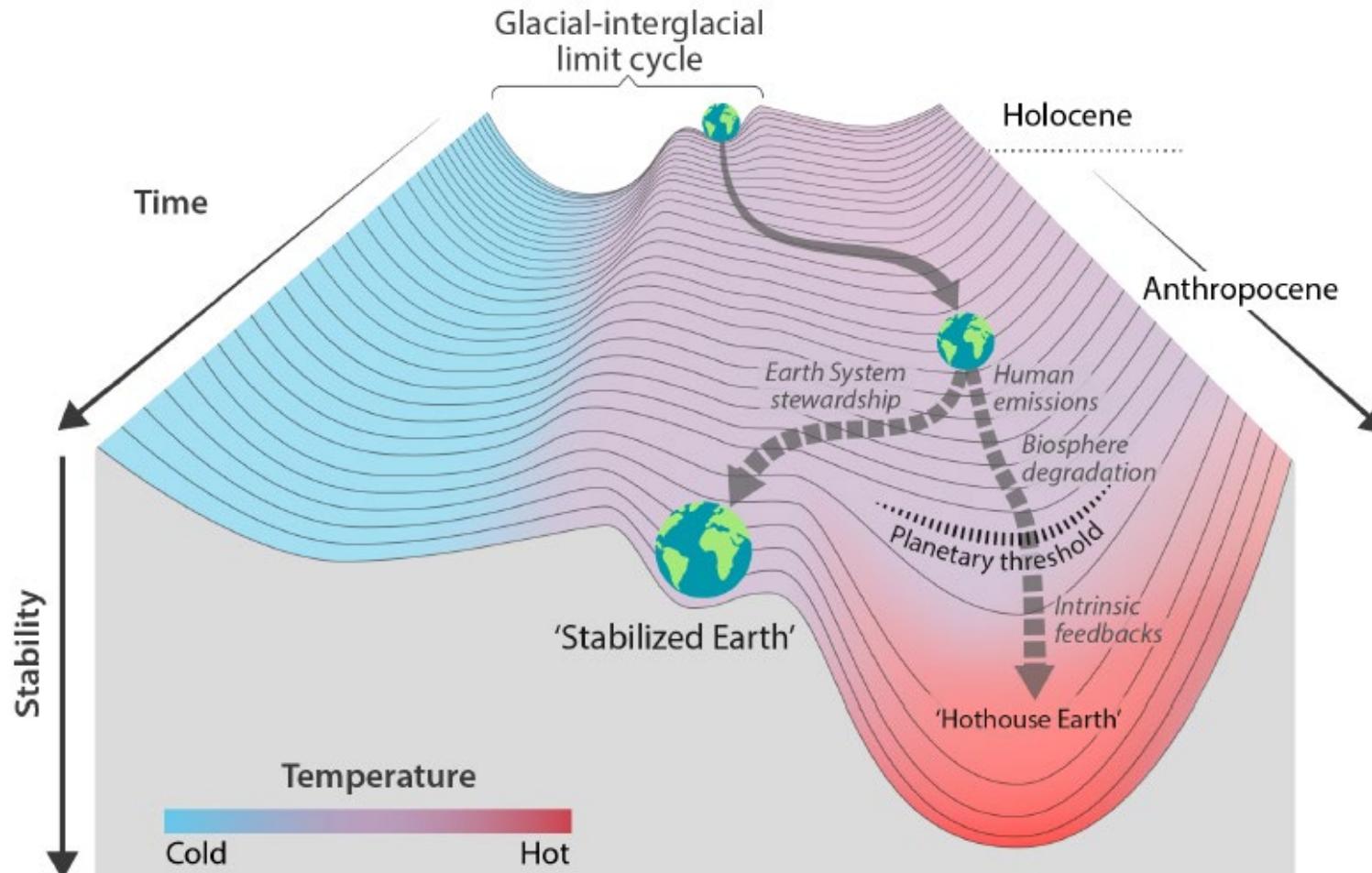
Kipp-Punkte relativ zur 2°C-Leitplanke



Trajektorien des Erdsystems im Anthropozän

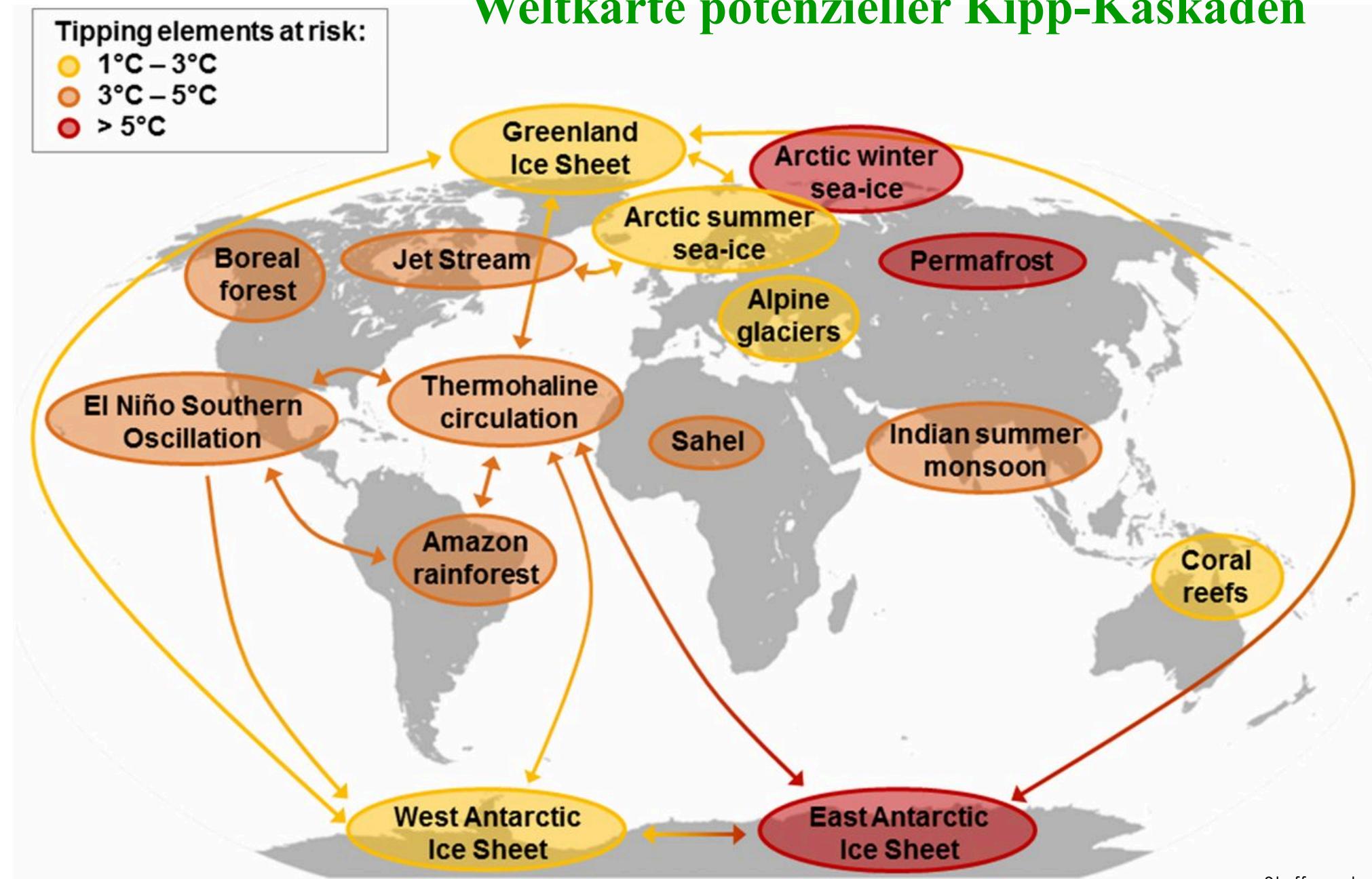
Will Steffen^{a,b,1}, Johan Rockström^a, Katherine Richardson^c, Timothy M. Lenton^d, Carl Folke^{a,e}, Diana Liverman^f, Colin P. Summerhayes^g, Anthony D. Barnosky^h, Sarah E. Cornellⁱ, Michel Crucifix^{j,l}, Jonathan F. Donges^{a,k}, Ingo Fetzer^a, Steven J. Lade^{a,b}, Marten Scheffer^l, Ricarda Winkelmann^{k,m}, and Hans Joachim Schellnhuber^{a,k,m,1}

Edited by William C. Clark, Harvard University, Cambridge, MA, and approved July 6, 2018 (received for review June 19, 2018)

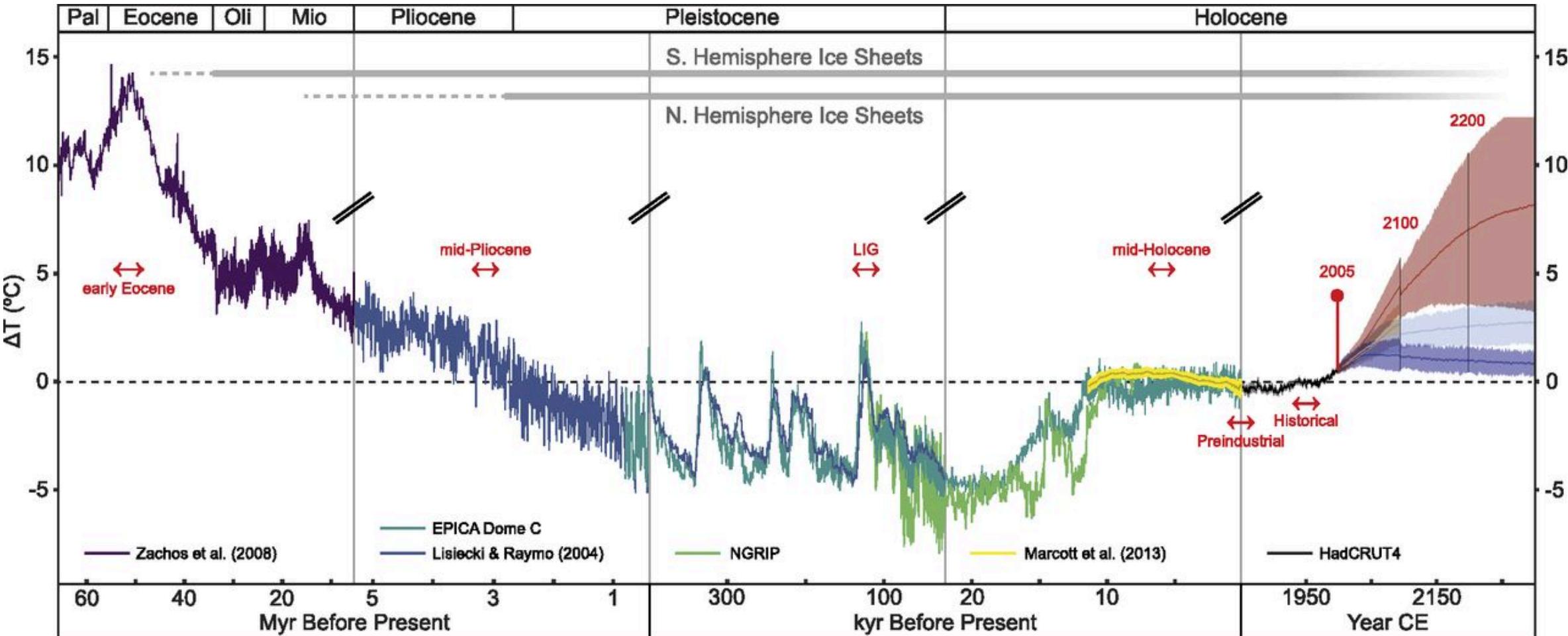


Stabilitätslandschaft, die den Weg des Erdsystems aus dem Holozän zeigt

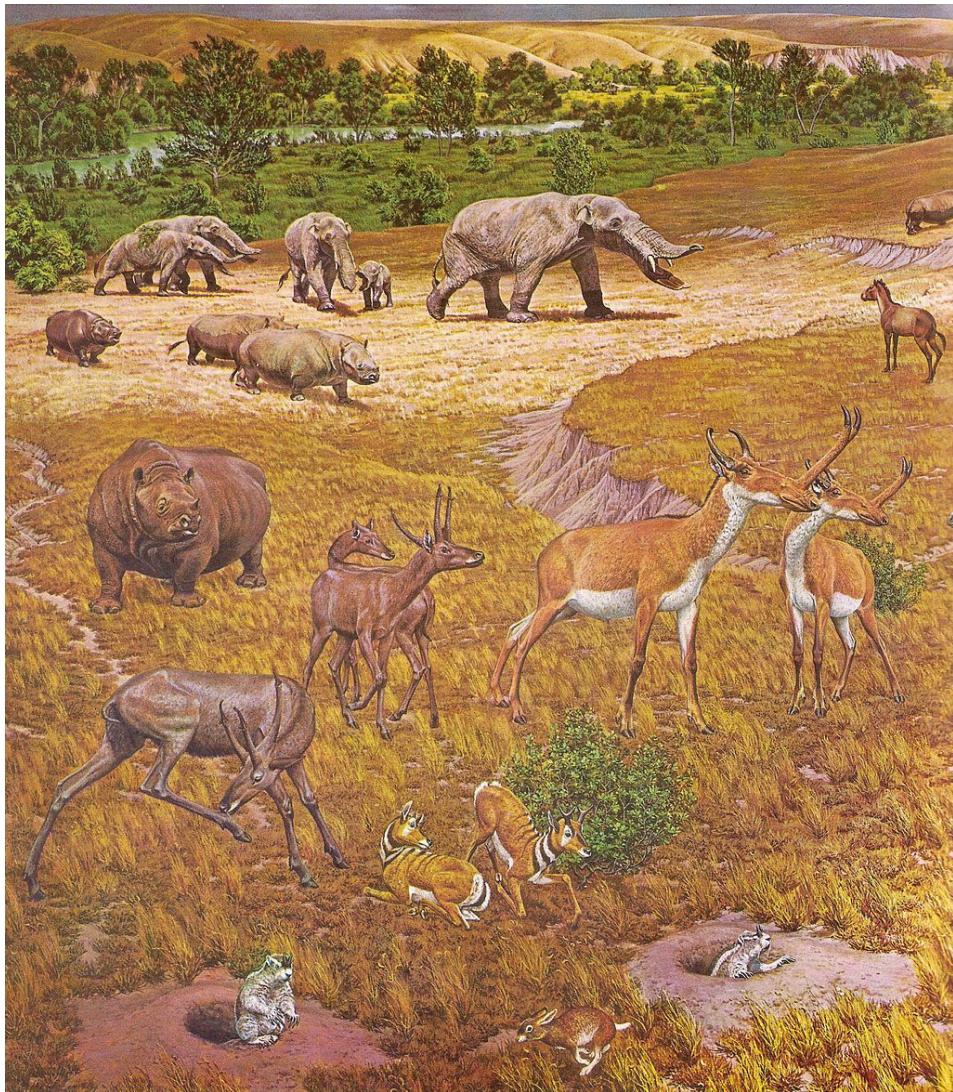
Weltkarte potenzieller Kipp-Kaskaden



Temperaturentwicklungen der letzten 65 Mio Jahre und potentielle geohistorische Analoge für zukünftiges Klima



Pliozän – Der günstigste Fall



Nordamerika im Pliozän (Wandgemälde im Smithsonian Museum)



Mittleres Pliozän (vor 3-4 Millionen Jahren)

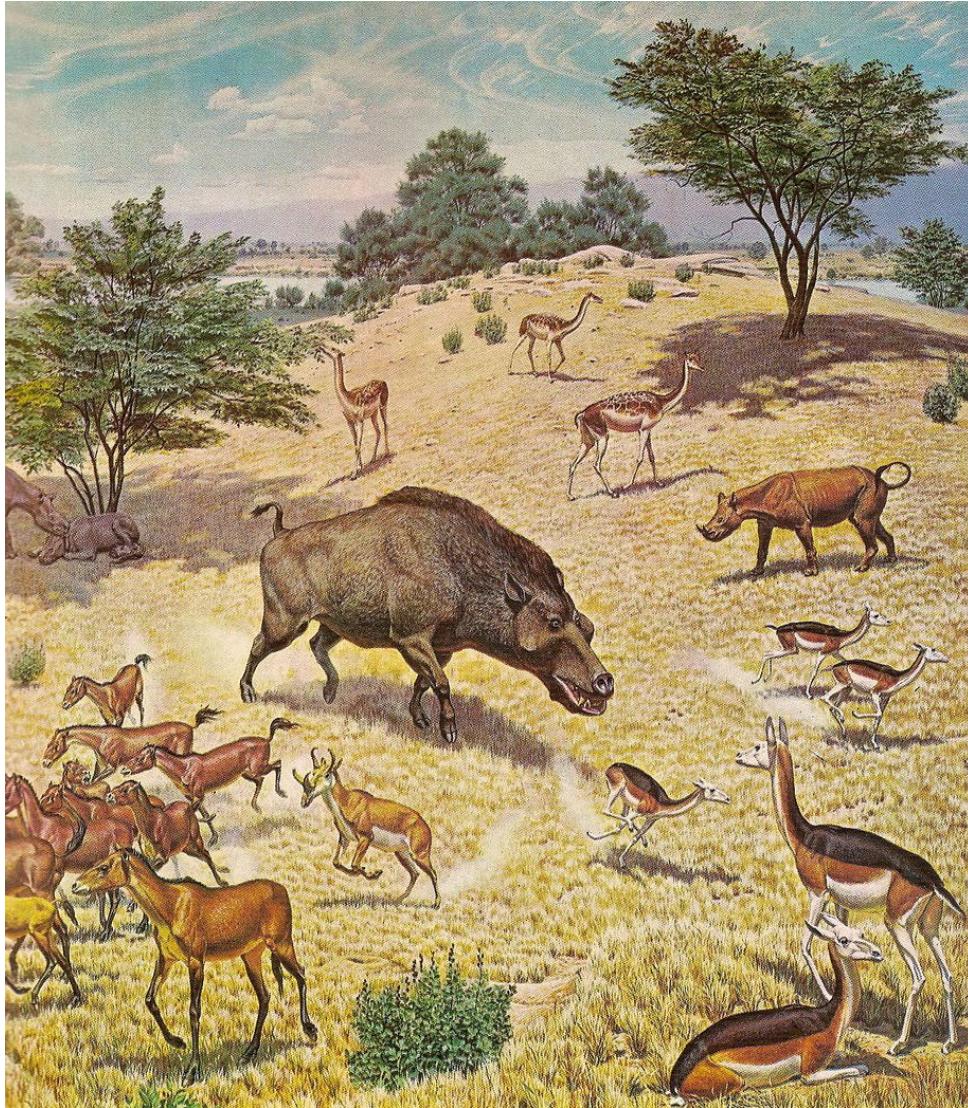
400-450 ppm

+2,0 – 3,0°C



+10 - 22 m

Miozän – Die jetzige Perspektive



Nordamerika im Miozän
(Wandgemälde im Smithsonian Museum)



Mittleres Miozän
(vor 15-17 Millionen Jahren)

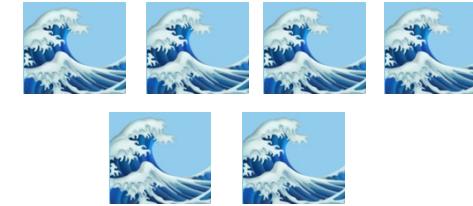
300-500 ppm



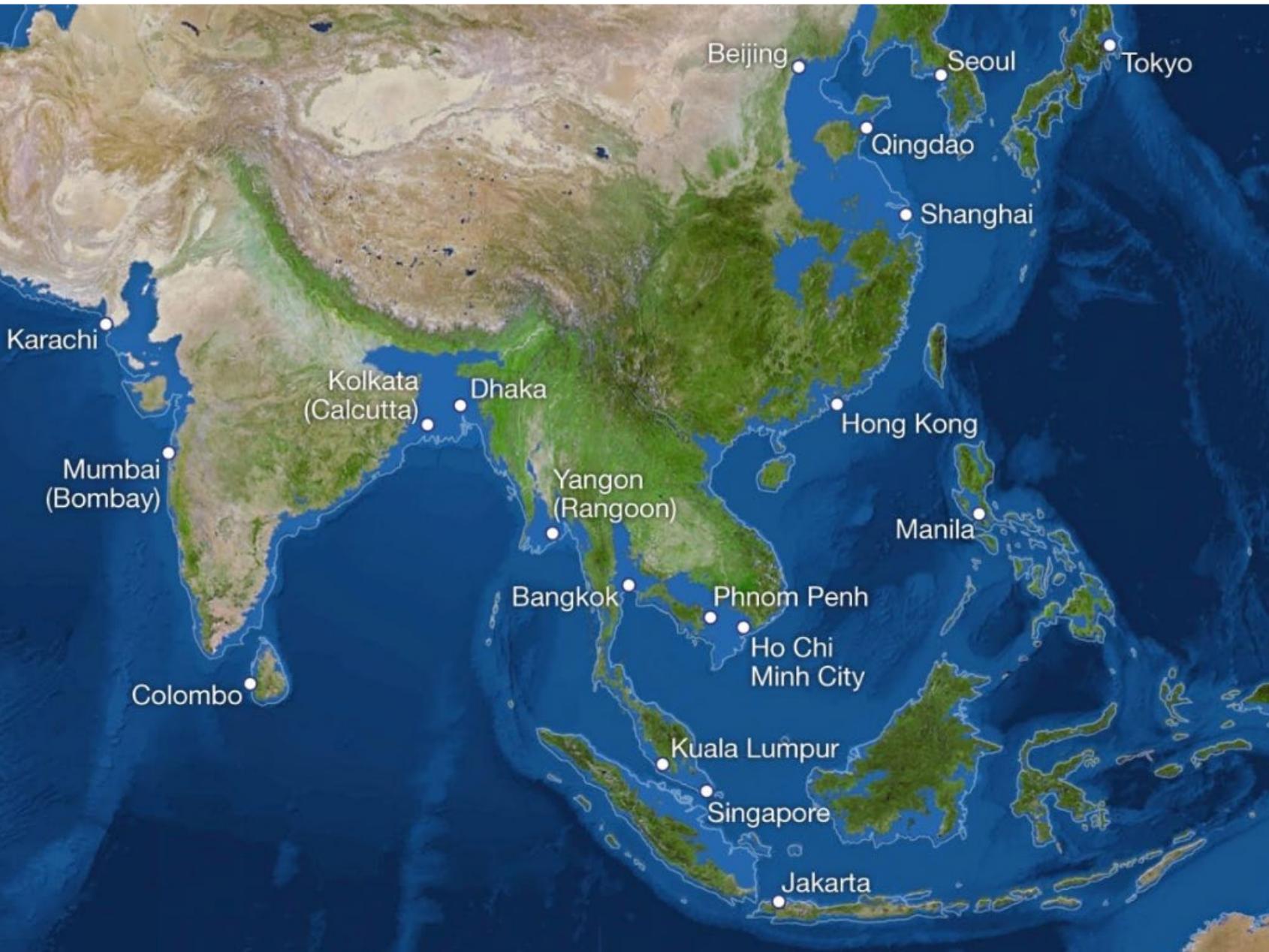
+4,0 – 5,0°C



+10 - 60 m



Wenn das ganze Eis schmilzt

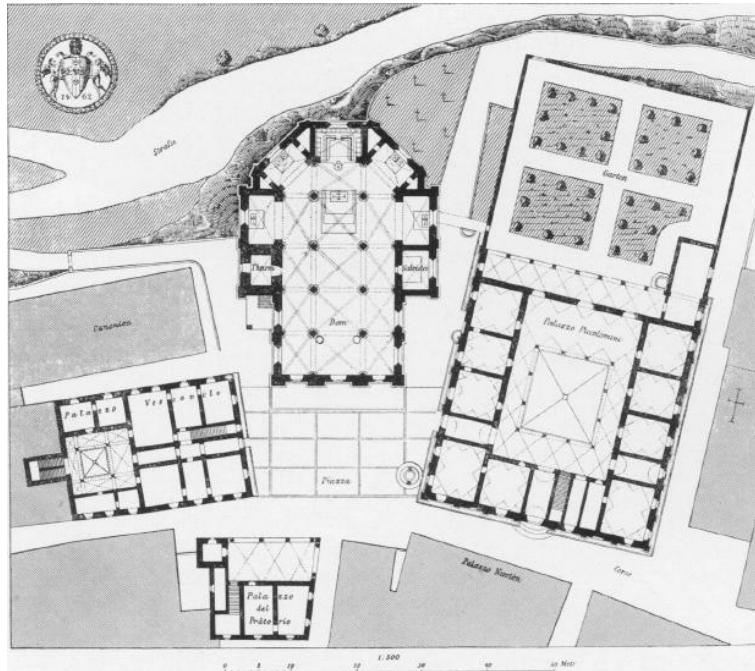




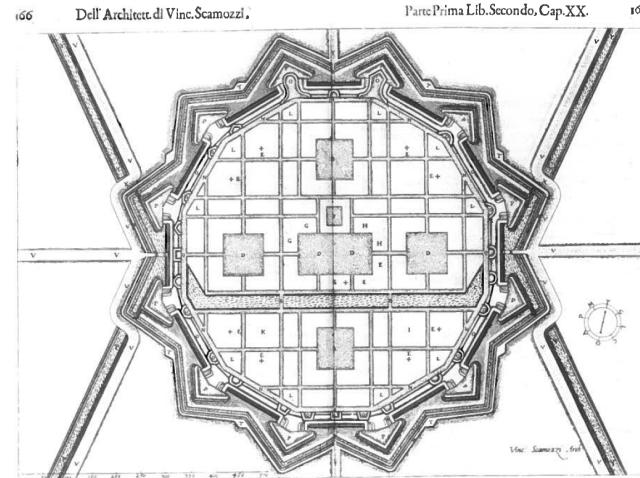
Die ideale Stadt: Eine ewige Obsession



The Ideal Renaissance City, Laurana, 1470



Pienza, Rossellino, 1459



Plan of an Ideal City, Scamozzi, 1615



Highrise of Homes, RISE, 1972



 **Informelle Siedlungen**

Kairo

Source: A. Ilberg, 2009

Zusammenfassung

Der Umzug der Menschheit: Die transformative Kraft der Städte



25. April 2016

**Übergabe des WBGU
Urbanisierungsgutachten
an die deutsche
Bundesregierung**

Eine triviale Antwort auf die Herausforderung der Nachhaltigkeit: Nachverdichtung

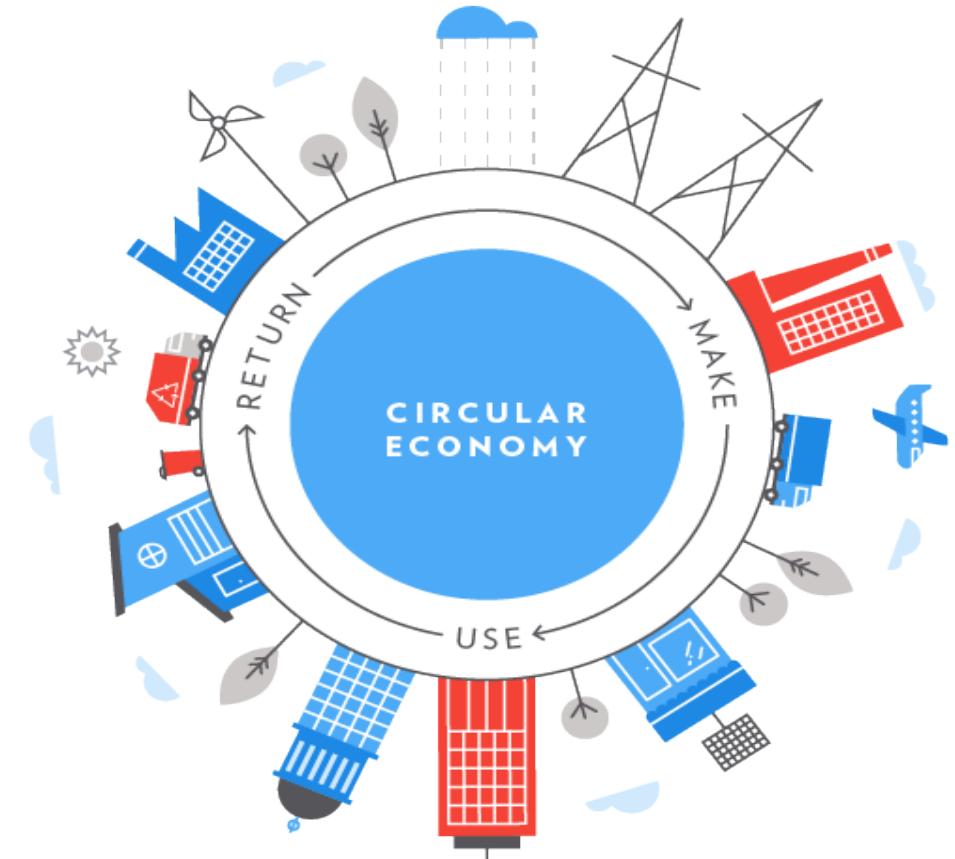


$D_{fractal} \rightarrow 2$

Paris, Foto: Malka

Entwicklungsbausteine für eine Transformation der Städte

- Dezentralisierte Versorgung mit erneuerbarer Energie
- Digitale Revolution
- Cyberspace-Bildung
- Additive Fertigung + 3D-Druck
- Neuartige Materialien
- Kreislaufwirtschaft
- Modulare Mobilität
- Urbane Landwirtschaft
- etc.



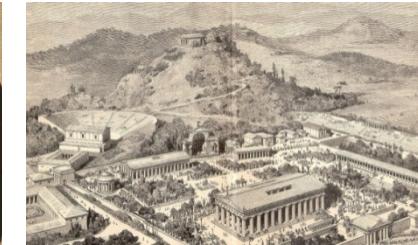
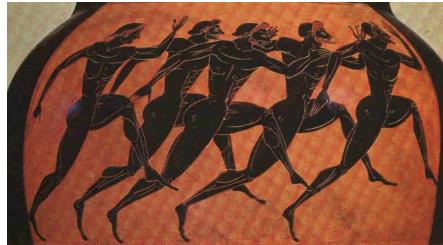
Urban Polyzentrism

Enlightenment Weimar / Jena



Renaissance Northern Italy

Greek Polis



City-states Mesopotamia



Gebäude und der Bausektor sind zusammen verantwortlich für 40% der totalen direkten und indirekten CO2 Emissionen

IEA 2018

Urbane Kohlenstoffsenken:

- Vegetation
- Boden
- Gebäude

Unsichtbare Kosten: Bauwesen und Beton



© Omar Chatriwala/flickr

- Das globale Bauwesen wird bis 2050 so viel neue Infrastruktur benötigen wie bereits seit 1850 errichtet wurde.
- Dadurch wird der größte Teil des CO₂ Budgets (1.5°C) aufgebraucht, wenn konventionelle Materialien wie Beton verwendet werden.
- Allein in China wurde zwischen 2008 und 2010 so viel Beton verbaut, wie im gesamten 20. Jahrhundert in den USA

→ Klimaschutz wird in den Städten entschieden.

CO₂ EMISSIONEN KÖNNEN NICHT AUF NULL REDUZIERT WERDEN, AUCH WENN AUSSCHLIEßLICH ENERGIE AUS ERNEUERBAREN QUELLEN VERWENDET WIRD

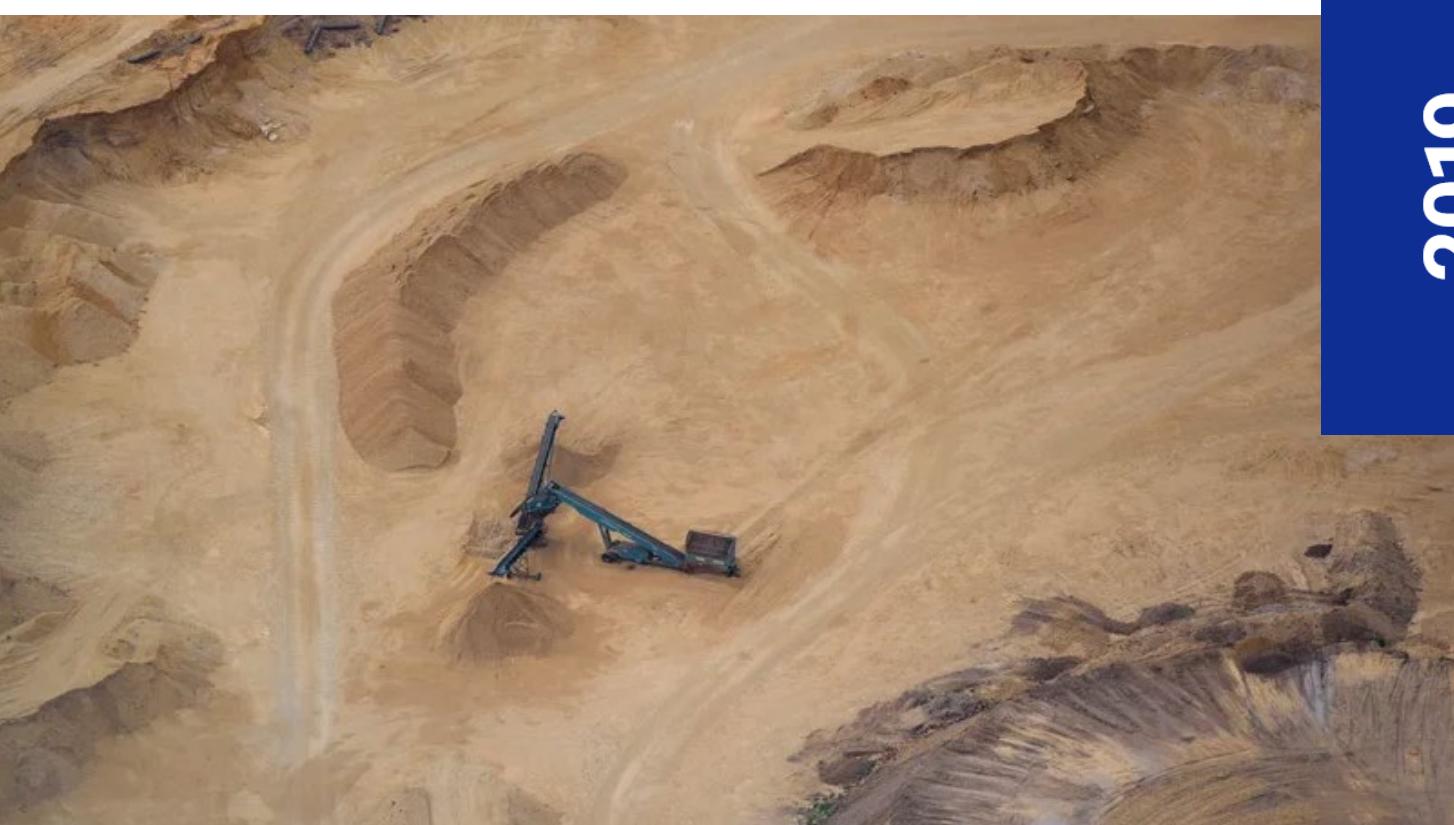


Rohstoffmangel

Der Sand wird knapp

Gemessen am Volumen ist Sand die zweitgrößte gehandelte Ressource der Welt. Doch sein Abbau schadet der Umwelt. Die Vereinten Nationen fordern eine strengere Regulierung.

7. Mai 2019, 10:36 Uhr / Quelle: ZEIT ONLINE, dpa, vk / 128 Kommentare



ZEIT  ONLINE

2019 | Sand and Sustainability:
Finding new solutions for
environmental governance
of global sand resources

UN 
environment
United Nations
Environment Programme



Biomaterialien im Baubereich

PARALLEL STRAND LUMBER

PSL is a composite of wood strands with fibers. The strongest and stiffest engineered wood product available, it is usually the most effective choice for large single beams. Unlike other heavy timber options, PSL is often used in exterior applications because it can be pressure treated.

Manufacturing Process:

1. Selection of log
2. Debarking
3. Peeling into veneers
4. Drying and clamping
5. Adhesive application
6. Assembly
7. Pressing and curing
8. Cutting, marking, and packaging

Product Size:

Up to 7" thick x 18" deep x 60' long

Application:

Beams, columns, and trusses

Trees Used:

Douglas-Fir Larch, Pacific Silver Fir, Southern Yellow Pine, Western Hemlock, and Poplar

Fun Fact:

PSL utilizes waste materials from LVL and plywood manufacturing

NAIL- LAMINATED TIMBER

NLT is created by stacking dimensional lumber together on its edge and fastening it together with nails. Plywood sheathing can be added to one side to allow the product to be used as a wall panel. It is cheaper than other heavy timber options and more widely accepted in building codes because it is simple to make and simple to understand.

Manufacturing Process:

1. Grading and selection of dimensional lumber
2. Fastening individual dimensional lumber, stacked on edge, into one structural element with nails
3. Installing the plywood sheathing (optional)
4. Finishing the underside

Product Size:

Up to 12" thick x 12' wide x 100' long, (width and length of panel only limited by shipping and erection constraints)

Application:

Floors, decks, walls, roofs, stair and elevator shafts

Trees Used:

Spruce-Pine-Fir, Douglas-Fir Larch, Alaska Yellow Cedar, Port Orford Cedar, Southern Yellow Pine, and many other species

Adhesive:

Nails

Fun Fact:

Nail-laminated timber has been used to build warehouses and factories for the past 150 years. It was previously referred to as heavy timber or mill decking.

GLU- LAMINATED TIMBER

Glulam is an engineered product made of two or more layers of lumber glued together with the grain of all layers running parallel to the length. Its composition enables the production of a variety of sizes and shapes, including curves. Glulam's size is limited only by the manufacturing and transportation capabilities. Glulam has many advantages over sawn lumber, such as greater size and strength.

Manufacturing Process:

1. Selection of dimensional lumber
2. Splicing and joining with staggered finger joints
3. Adhesive application
4. Pressing
5. Sanding
6. Cutting, marking, and packaging

Product Size:

Up to 20" thick x 7' wide

Application:

Beams, columns, arches, trusses, and walls

Trees Used:

Douglas-Fir Larch, Southern Yellow Pine, Hem-Fir, and Spruce-Pine-Fir

Fun Fact:

Glulam's earliest use can be traced to a bridge built in Bavaria, Germany in the early 1800s; however, it wasn't until World War II that glulam flourished as a building material due to developments in waterproof glues and fabrication technologies.

CROSS-LAMINATED TIMBER

CLT consists of several boards stacked in alternating directions and glued together. To obtain specific structural capacities, consecutive layers may be placed in the same direction. A typical CLT cross-section contains three to seven boards.

Manufacturing Process:

1. Lumber selection (each piece is up to 2" deep and 9.5" wide)
2. Lumber grouping and planing
3. Adhesive application
4. Panel lay-out and pressing
5. Cutting, marking, and packaging

Product Size:

Up to 15" thick x 10' wide x 64' long

Application:

Walls, floors, roofs, stair and elevator shafts

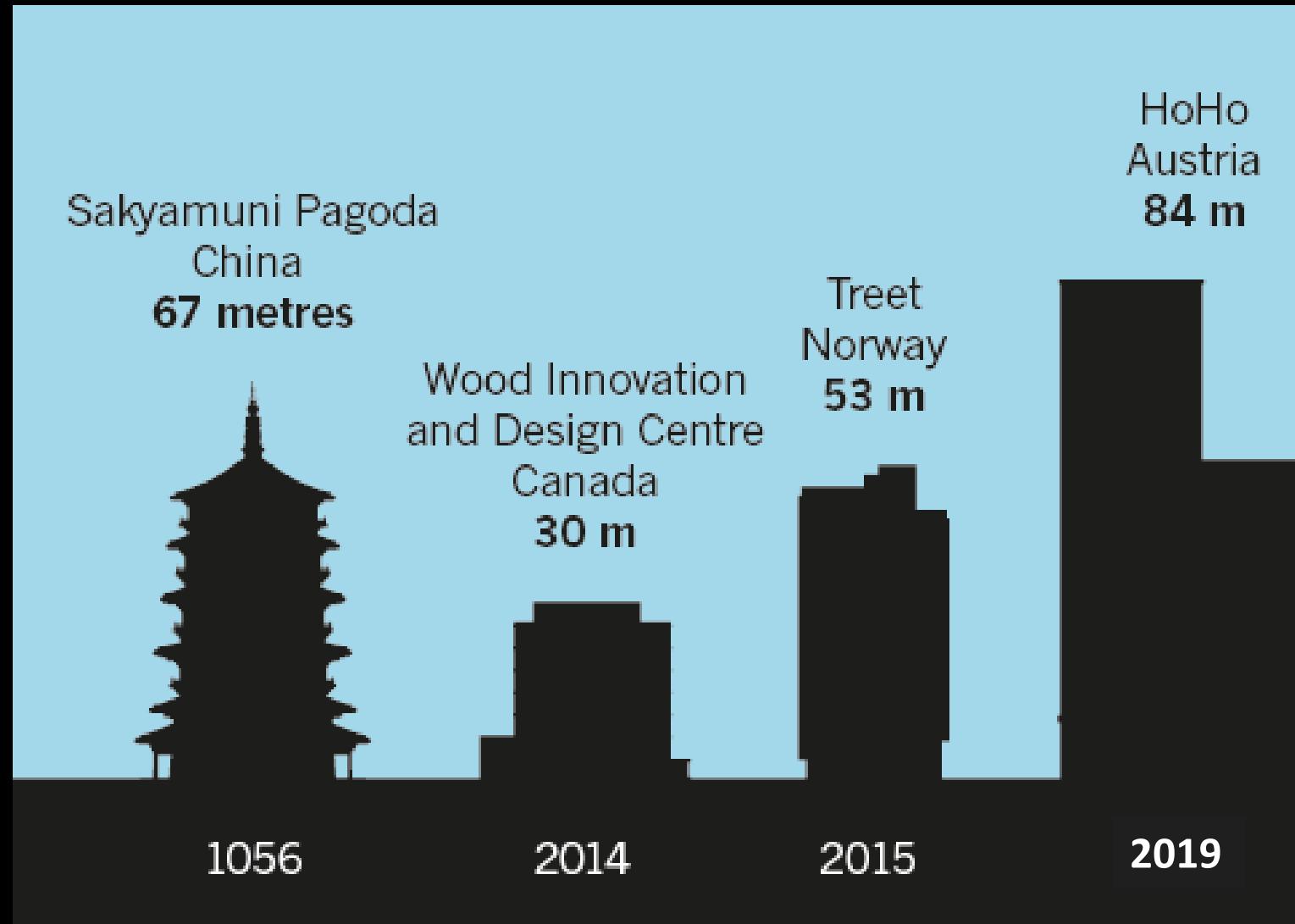
Trees Used:

Douglas-Fir, Spruce-Pine-Fir, Southern Yellow Pine, Black Spruce, and Alaska Yellow Cedar

Fun Fact:

To fabricate CLT, some wood manufacturers utilize lumber from trees killed by the Mountain Pine Beetle.

Hochhäuser aus Holz

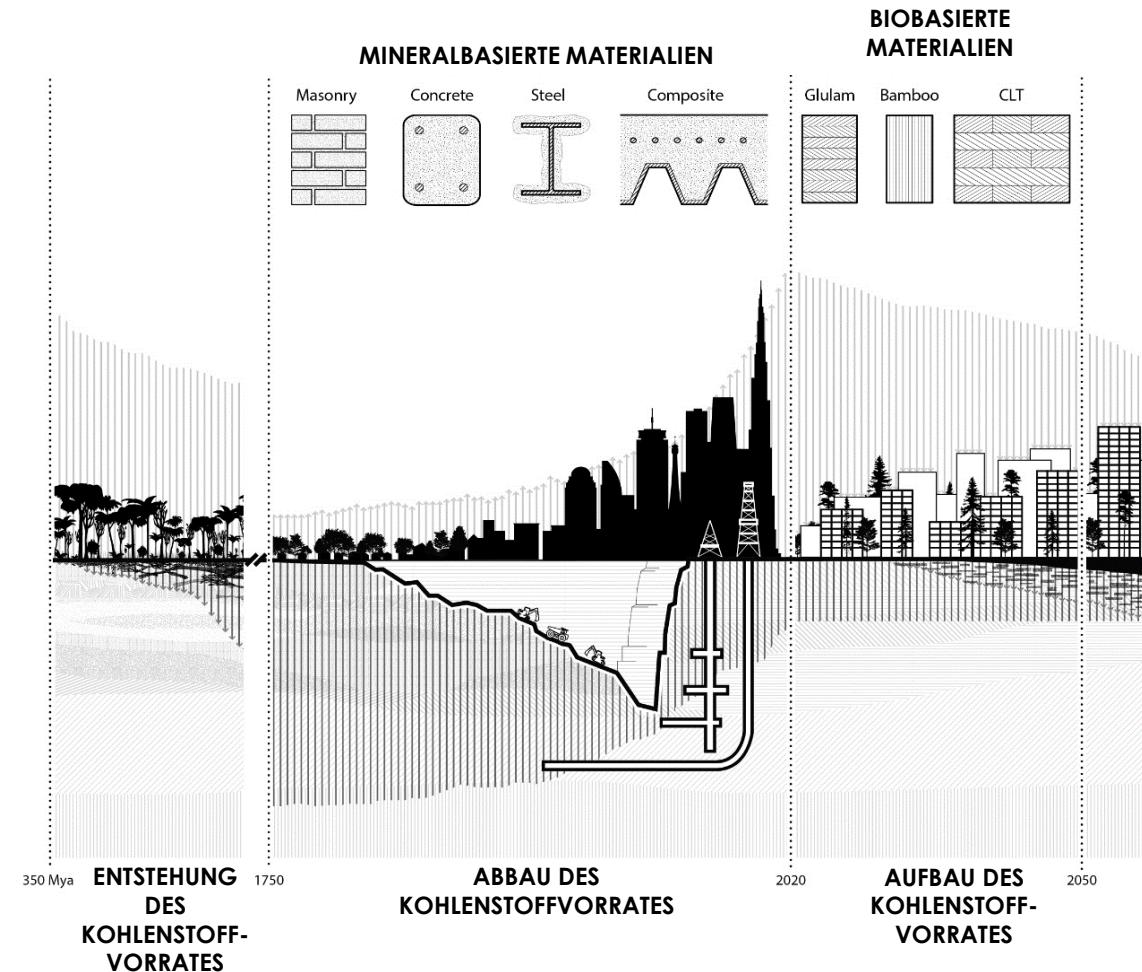


Städte in der Evolution des Kohlenstoffkreislaufes

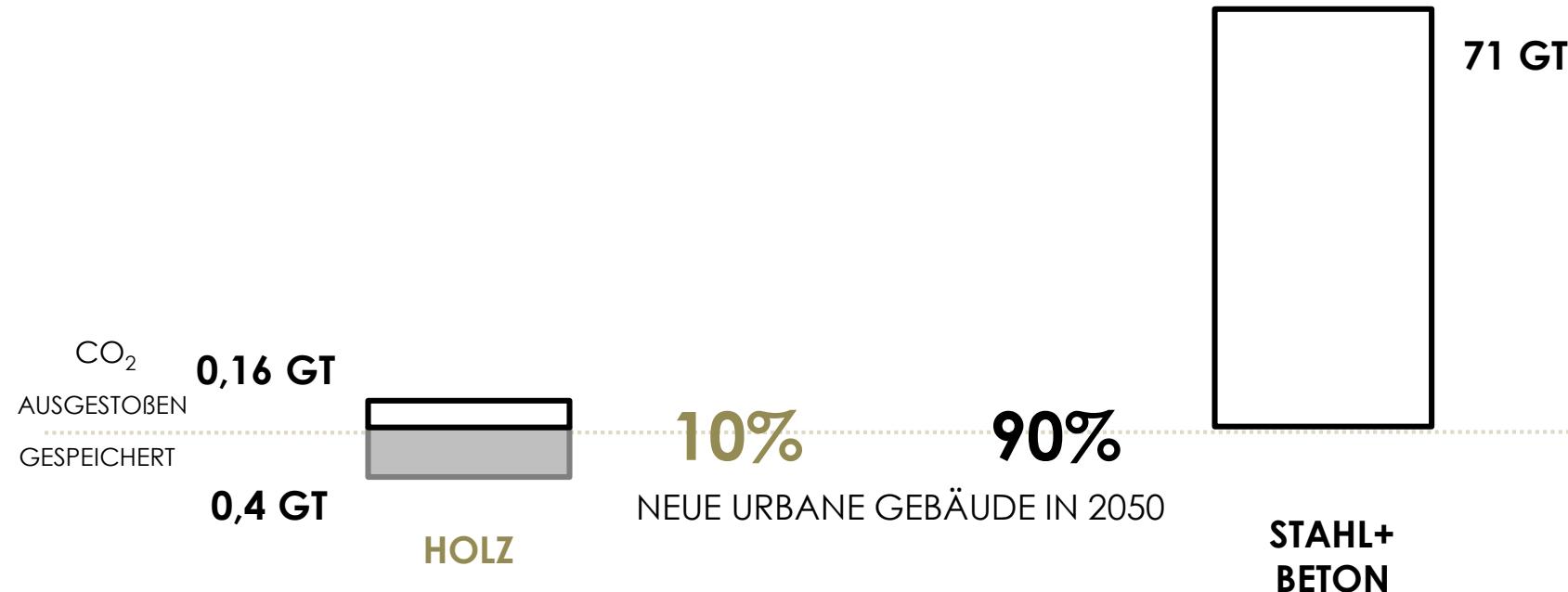
Buildings as a global carbon sink

Galina Churkina , Alan Organschi, Christopher P. O. Reyer, Andrew Ruff, Kira Vinke,

Zhu Liu, Barbara K. Reck, T. E. Graedel & Hans Joachim Schellnhuber

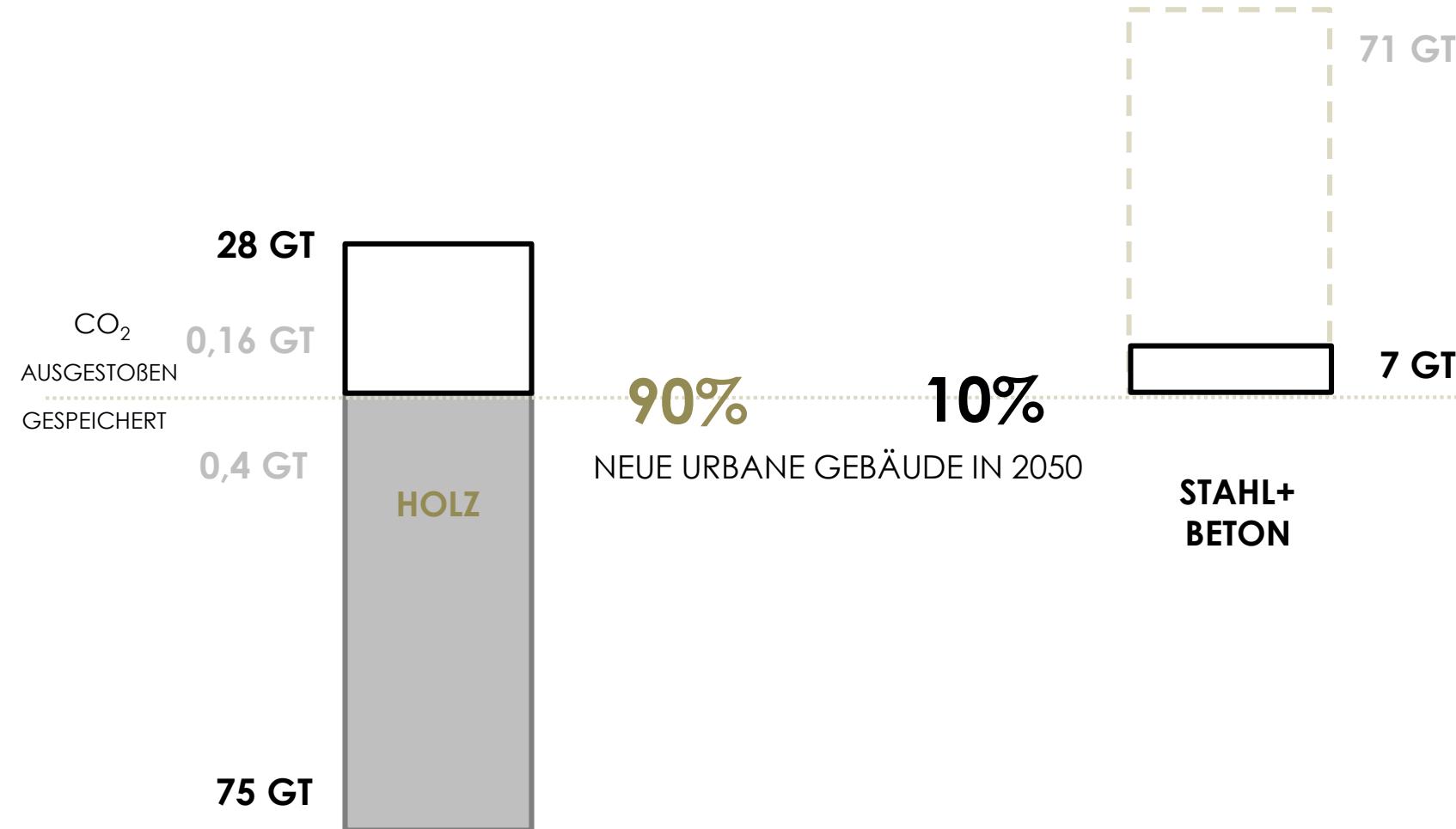


Gebäude als globale Kohlenstoffsenke

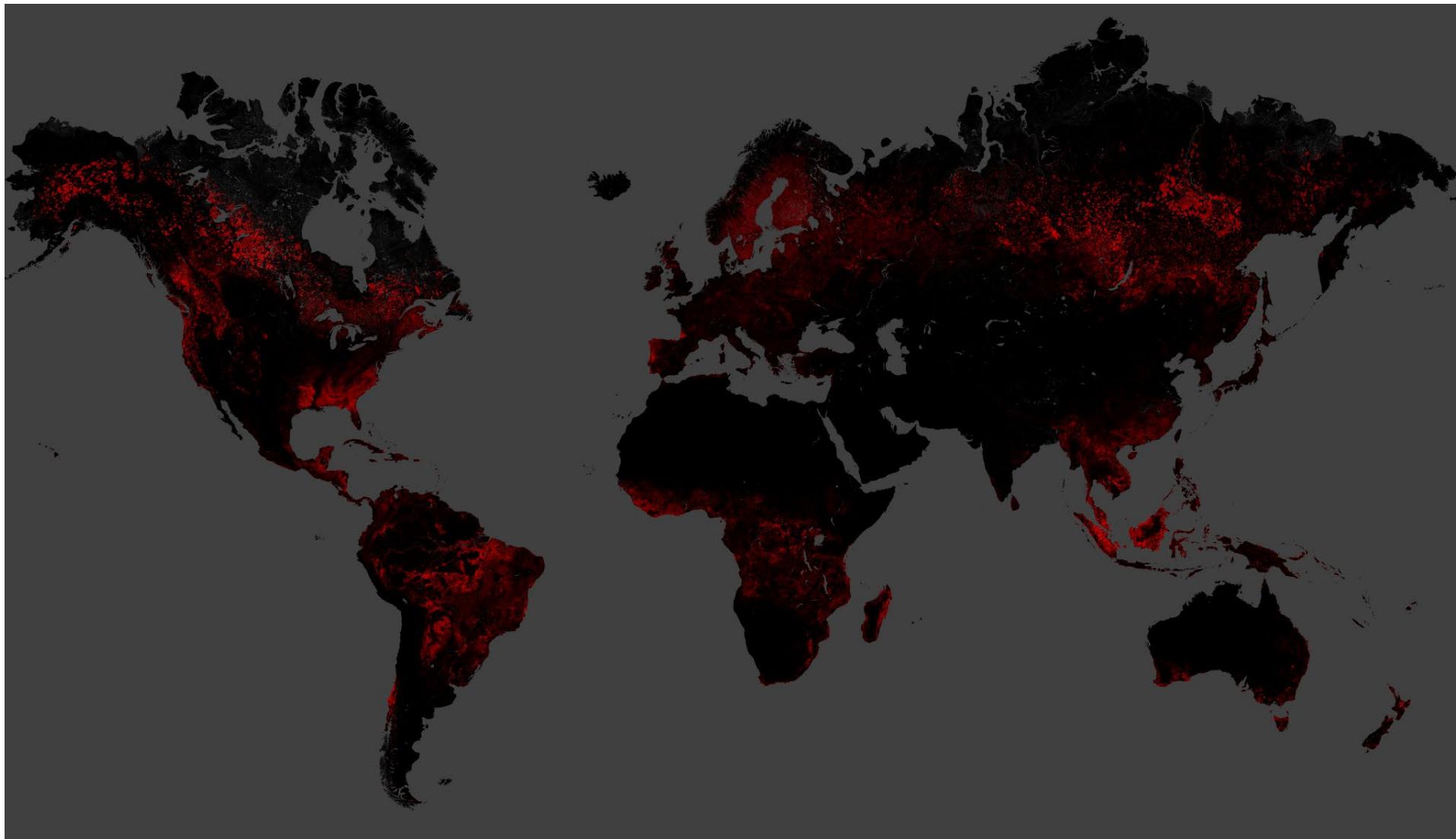




Gebäude als globale Kohlenstoffsenke



Globaler Verlust der Waldfläche





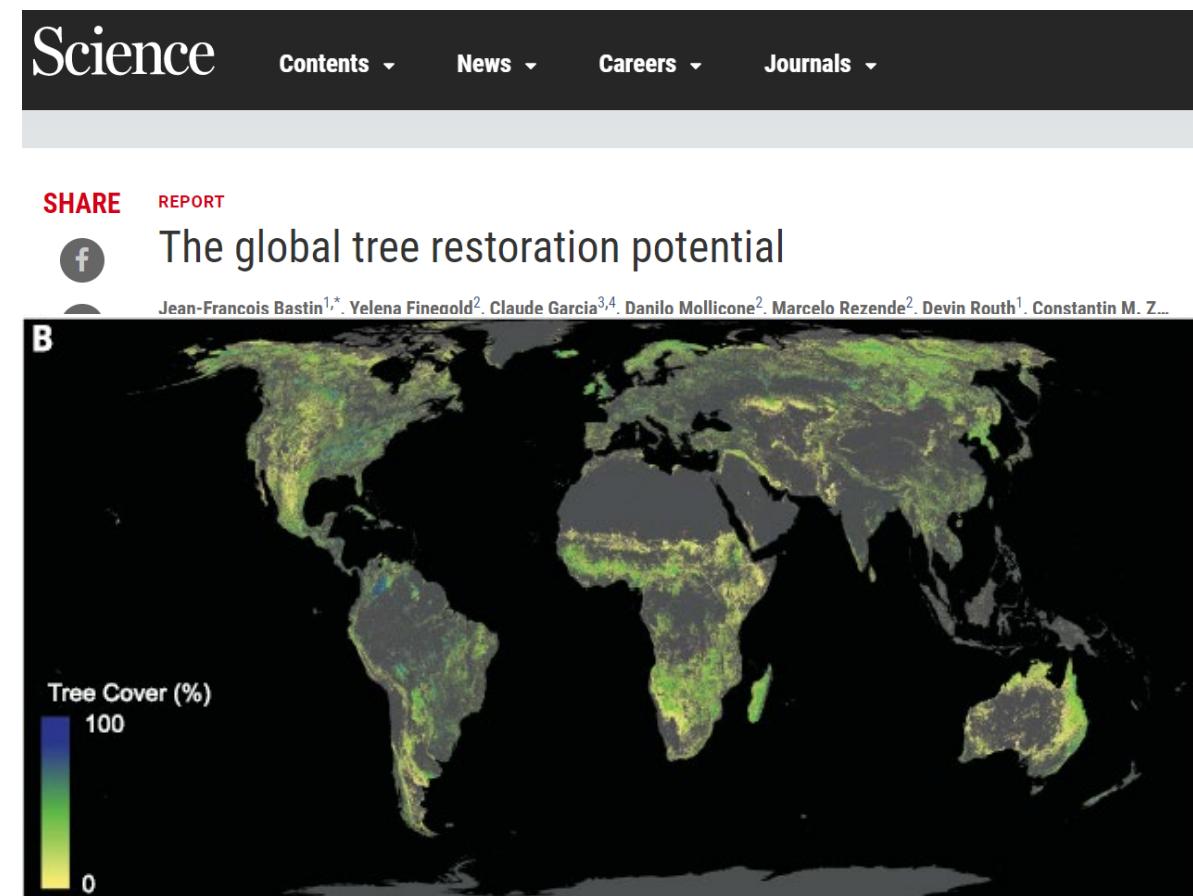
Ist der Kippunkt zum Buchen-Mischwald erreicht?

Keine Frage!



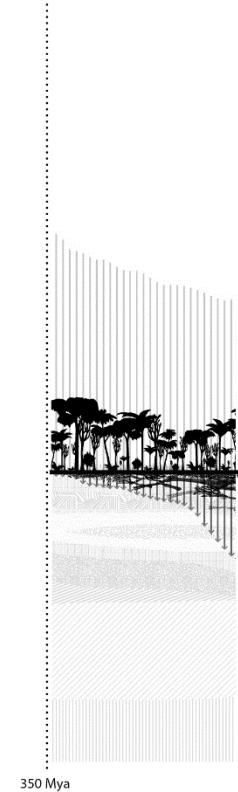
Wildfires in the Amazon basin
Source: AFP

Die Dekarbonisierung muss durch die Erhaltung und Regeneration natürlicher Kohlenstoffsenken unterstützt werden.





Städte im globalen Kohlenstoffkreislauf

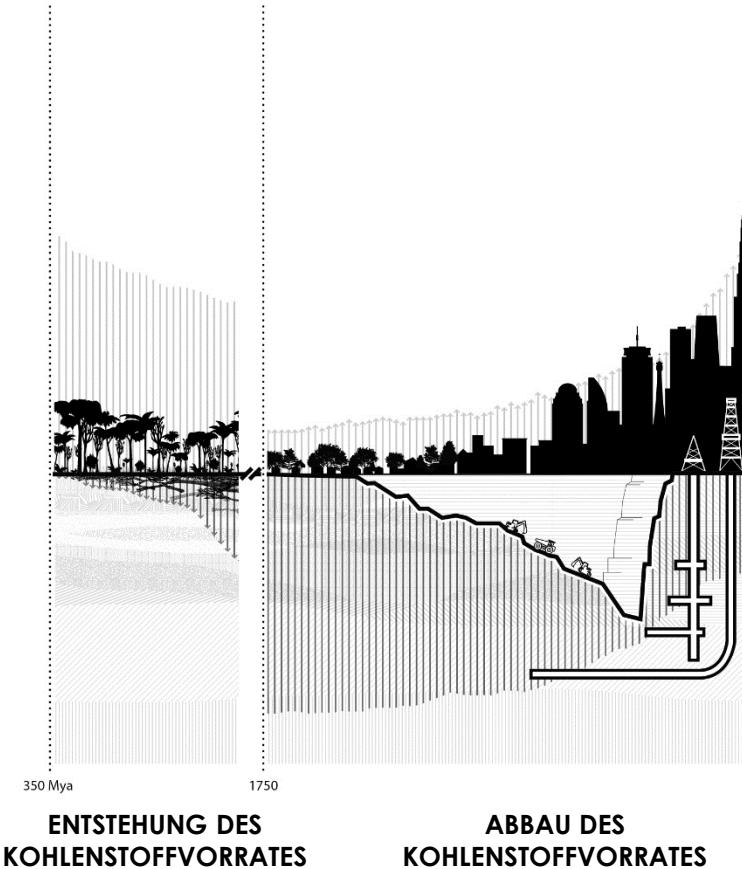


ENTSTEHUNG DES
KOHLENSTOFFVORRATES

Churkina et al. Nature Sustainability: 2020



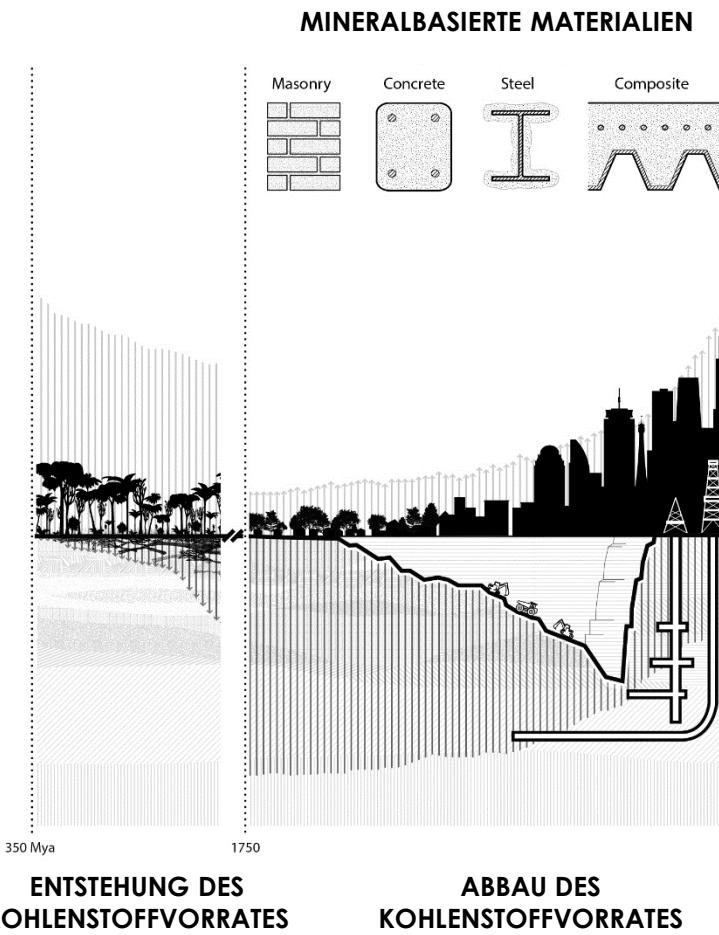
Städte im globalen Kohlenstoffkreislauf



Churkina et al. Nature Sustainability: 2020



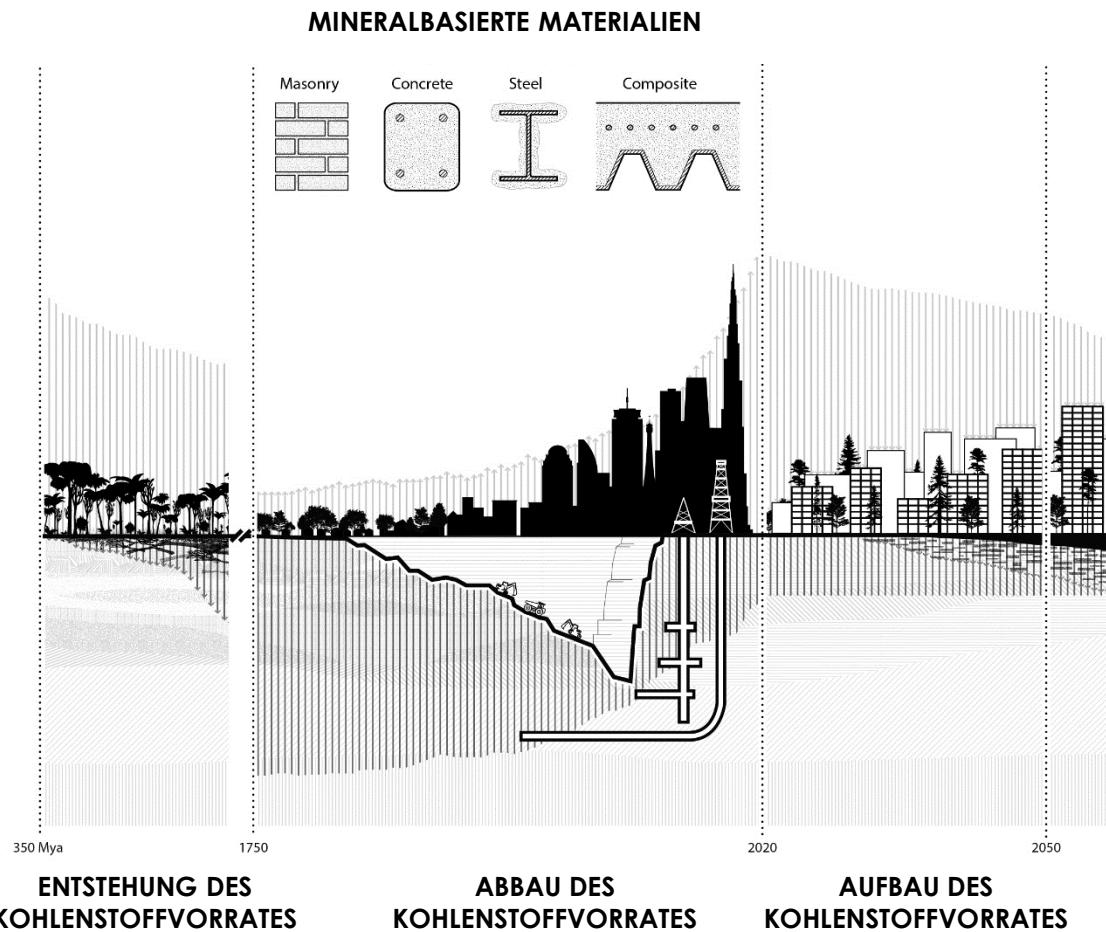
Städte im globalen Kohlestoffkreislauf



Churkina et al. Nature Sustainability: 2020



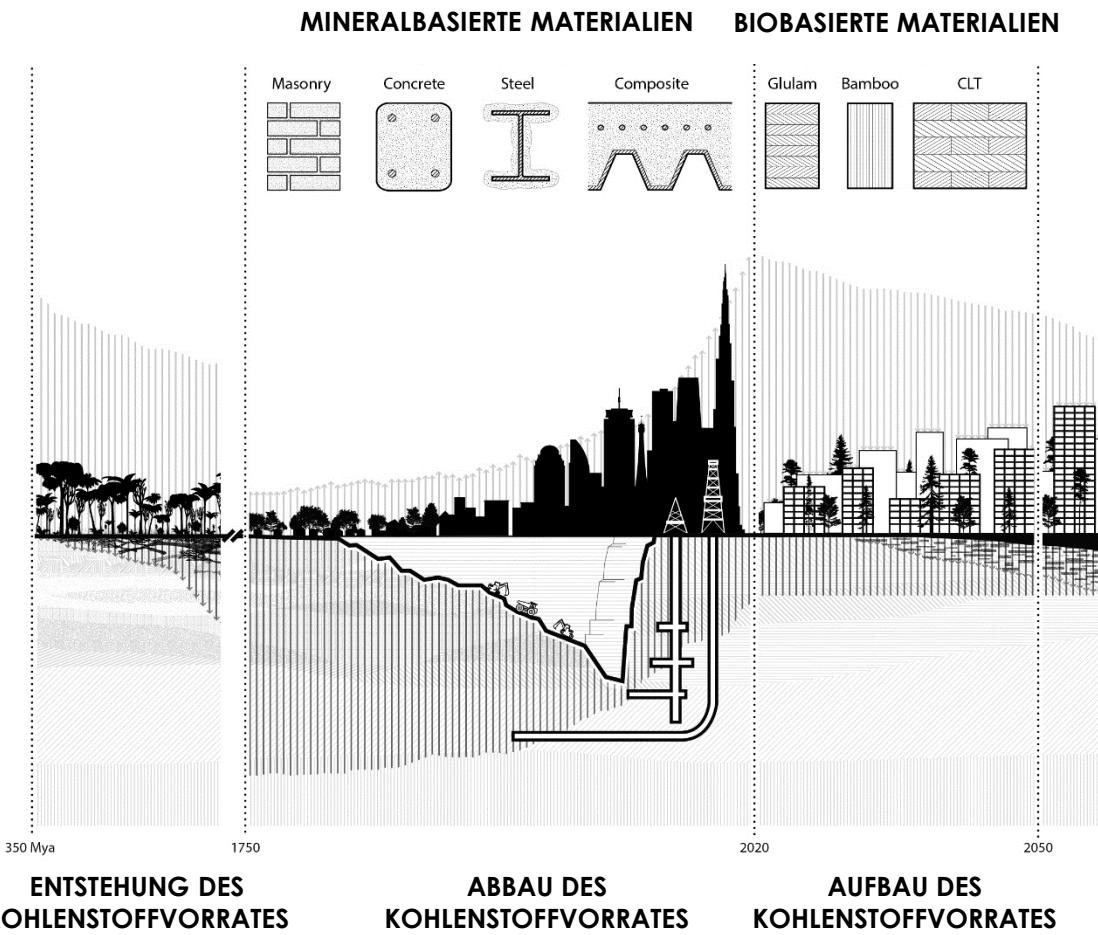
Städte im globalen Kohlestoffkreislauf



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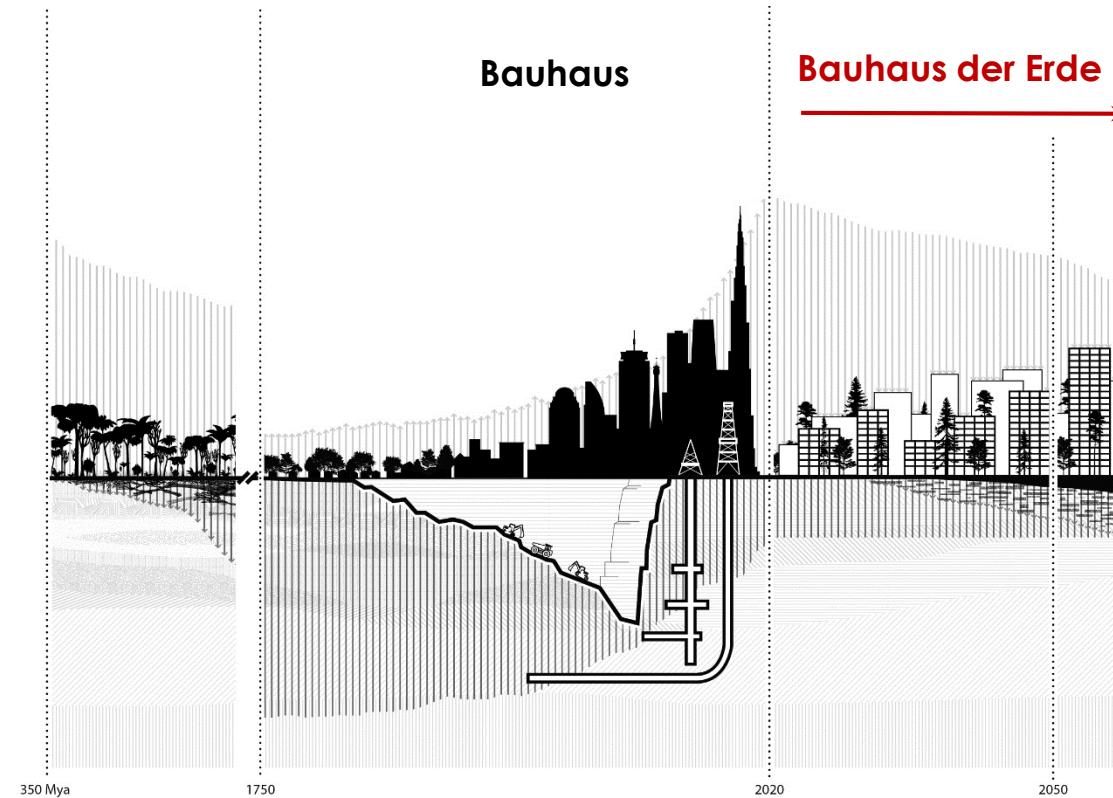
Städte im globalen Kohlestoffkreislauf

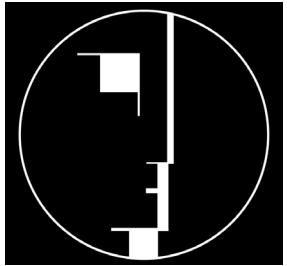


Churkina et al. Nature Sustainability: 2020



Städte im globalen Kohlestoffkreislauf



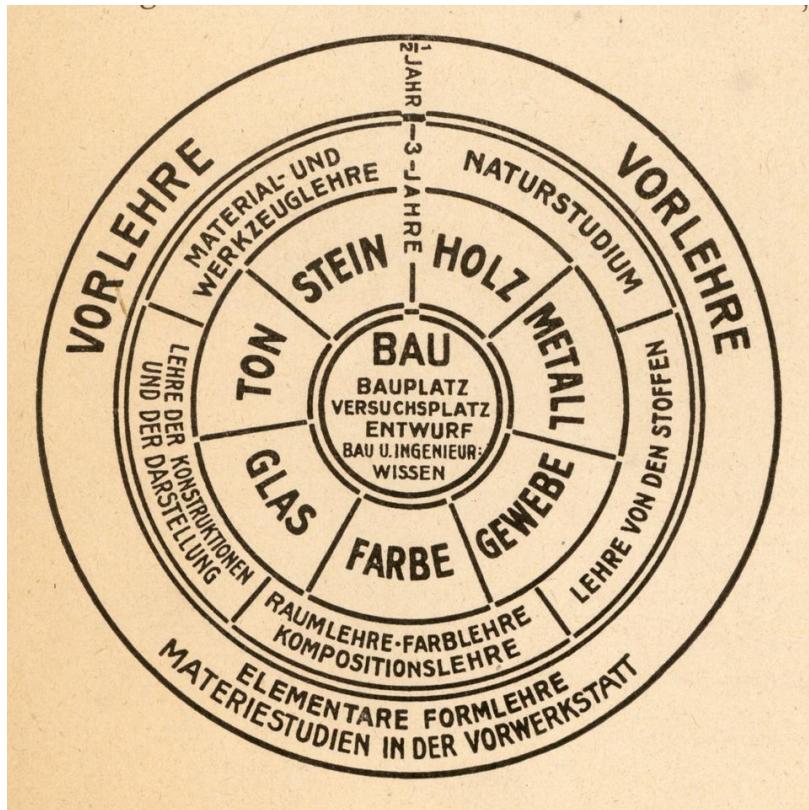


Das Original: Bauhaus (1919 – 1933)

- Gegründet von Walter Gropius in Weimar; später Dessau und Berlin.
- Ein Experimentierfeld der freien und angewandten Kunst, der Gestaltung, der Architektur und der Pädagogik.
- Revolutioniert in knapp 14 Jahren Architektur, Kunst und Handwerk.



Unter einem Dach: Leben, Handwerk & Kunst



Schema zum Aufbau der Lehre am Bauhaus, Gestaltung:
Walter Gropius, 1923. © VG Bild-Kunst Bonn, 2016.

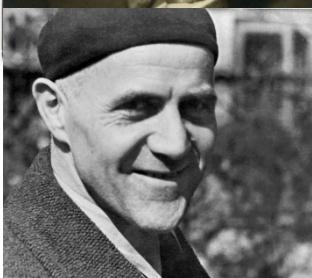


Die Bauhausmeister: Josef Albers, Hinnerk Scheper, Georg Muche, László Moholy- Nagy, Herbert Bayer, Joost Schmidt, Walter Gropius, Marcel Breuer, Wassily Kandinsky, Paul Klee, Lyonel Feininger, Gunta Stölzl, Oskar Schlemmer, 1926



Walter Gropius (1919-1928)

„Gute Architektur sollte eine Widerspiegelung des Lebens selbst sein, und das impliziert eine intime Kenntnis biologischer, sozialer, technischer und künstlerischer Probleme.“



Hannes Meyer (1928-1930)

„Ein Kollektiv ist umso leistungsfähiger, je unterschiedlicher die Talente der Mitwirkenden.“



Ludwig Mies van der Rohe (1930-1933)

„Wir sollten uns bemühen, Natur, Häuser und Menschen zu einer höheren Einheit zusammenzubringen.“

Bauhaus der Erde

... ist eine Innovations-Werkstatt, die sich dem Paradigmenwechsel zu nachhaltiger Architektur, Ernährung und Kleidung im Zeichen der „Großen Transformation“ widmet.

Schwerpunkt Themen Bauhaus der Erde

- Architektonisches Narrativ der Großen Transformation
- Aspekte einer Klima-Architektur
- Materialwende
- Formensprache der Nachhaltigkeit
- „Prekär-Architektur“
- Polyzentrische Raumgestaltung



European Commission - Speech



State of the Union Address by President von der Leyen at the European Parliament Plenary

Brussels, 16 September 2020

Building the world we want to live in:

A Union of vitality in a world of fragility





Building the world we want to live in: A Union of vitality in a world of fragility

The second example are the buildings we live and work in. Our buildings generate 40% of our emissions. They need to become less wasteful, less expensive and more sustainable. And we know that the construction sector can even be turned from a carbon source into a carbon sink, if organic building materials like wood and smart technologies like AI are applied.

I want NextGenerationEU to kickstart a European renovation wave and make our Union a leader in the circular economy.

But this is not just an environmental or economic project: it needs to be a new cultural project for Europe. Every movement has its own look and feel. And we need to give our systemic change its own distinct aesthetic – to match style with sustainability.

This is why we will set up a new European Bauhaus – a co-creation space where architects, artists, students, engineers, designers work together to make that happen.

This is NextGenerationEU. This is shaping the world we want to live in.