



Ethical Challenges in Adapting the Urban Coast for the Post-Holocene in Times of Anthropocene Risks



Hans-Peter Plag
Old Dominion University
Norfolk, VA, USA



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Two ethical principles:

- **A duty not to participate in creating massive harm**
- **A duty to justice**

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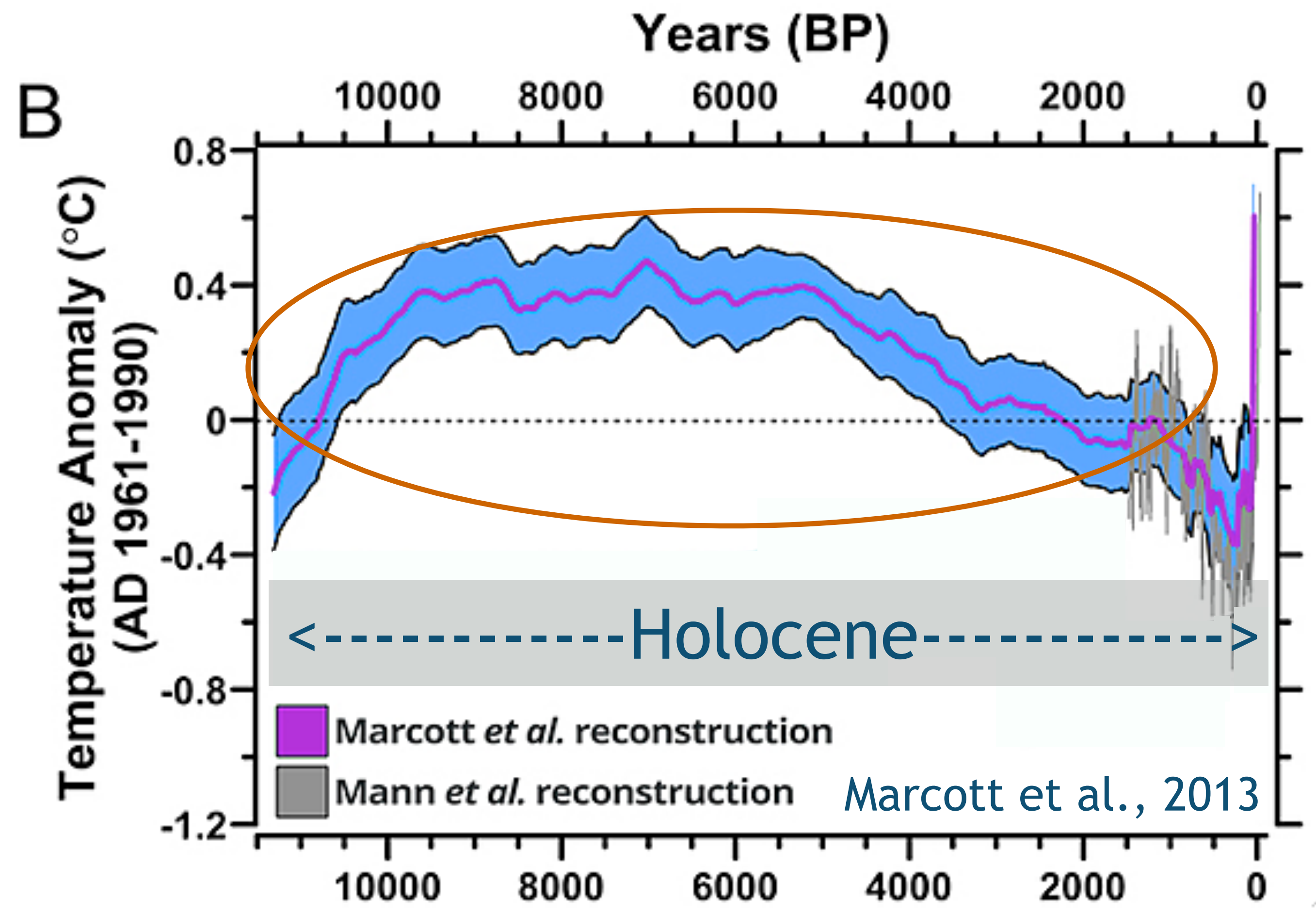


Normalcy Bias: Climate variations are small and sea level is stable — a result of the Holocene

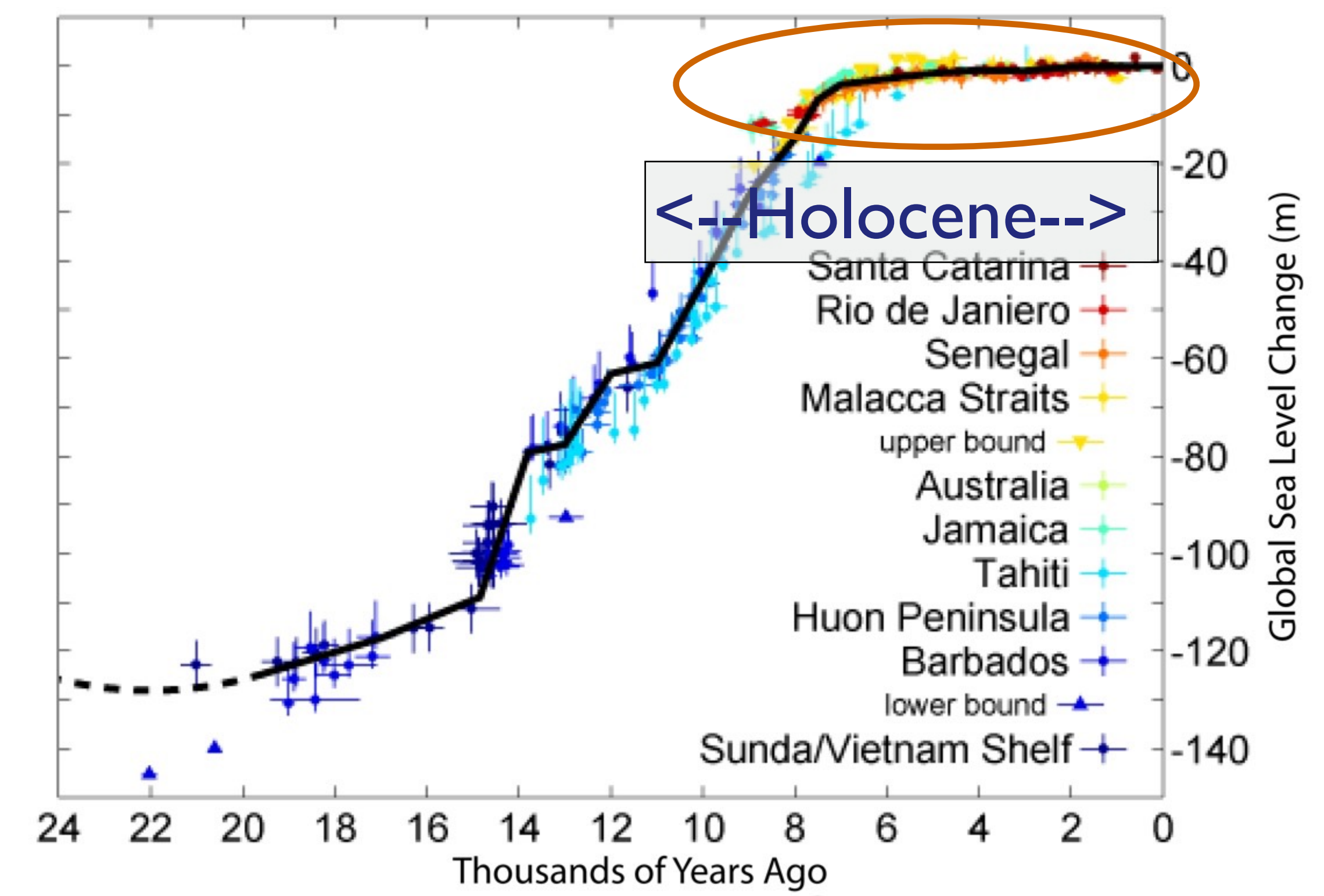
Coming out of the Holocene, the Safe Operating Space for Humanity

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Global Temperature Changes



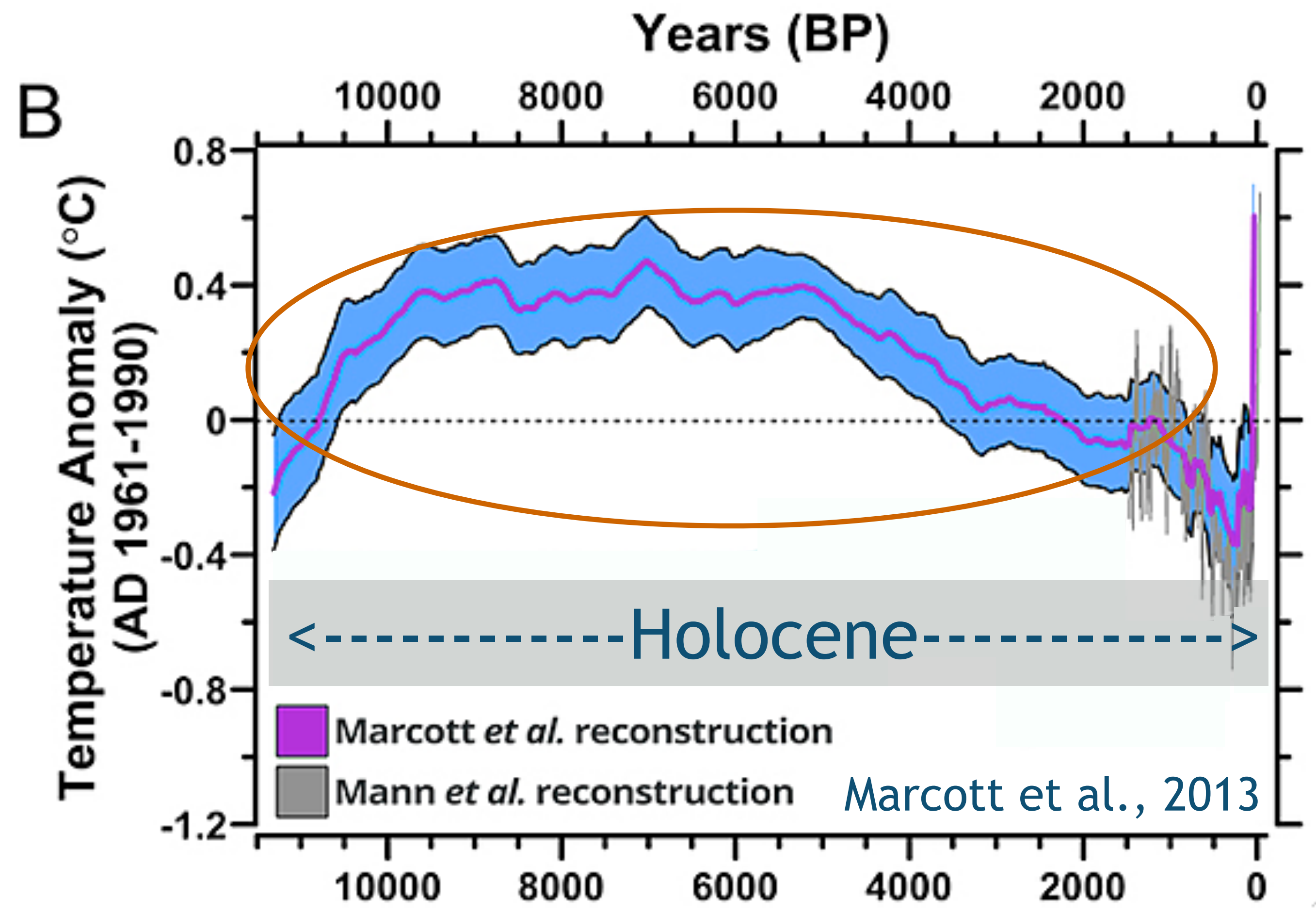
Global Sea Level Changes



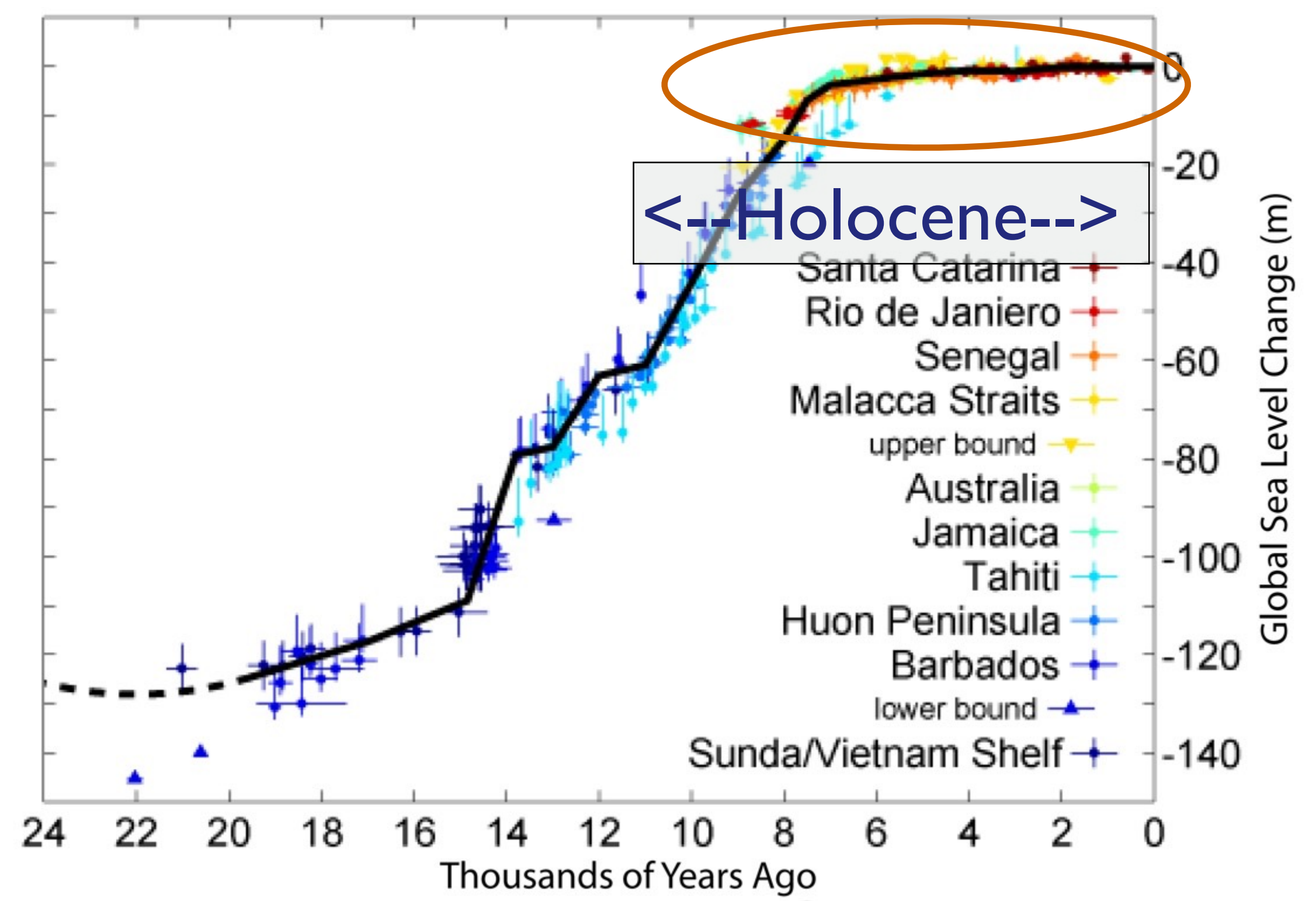
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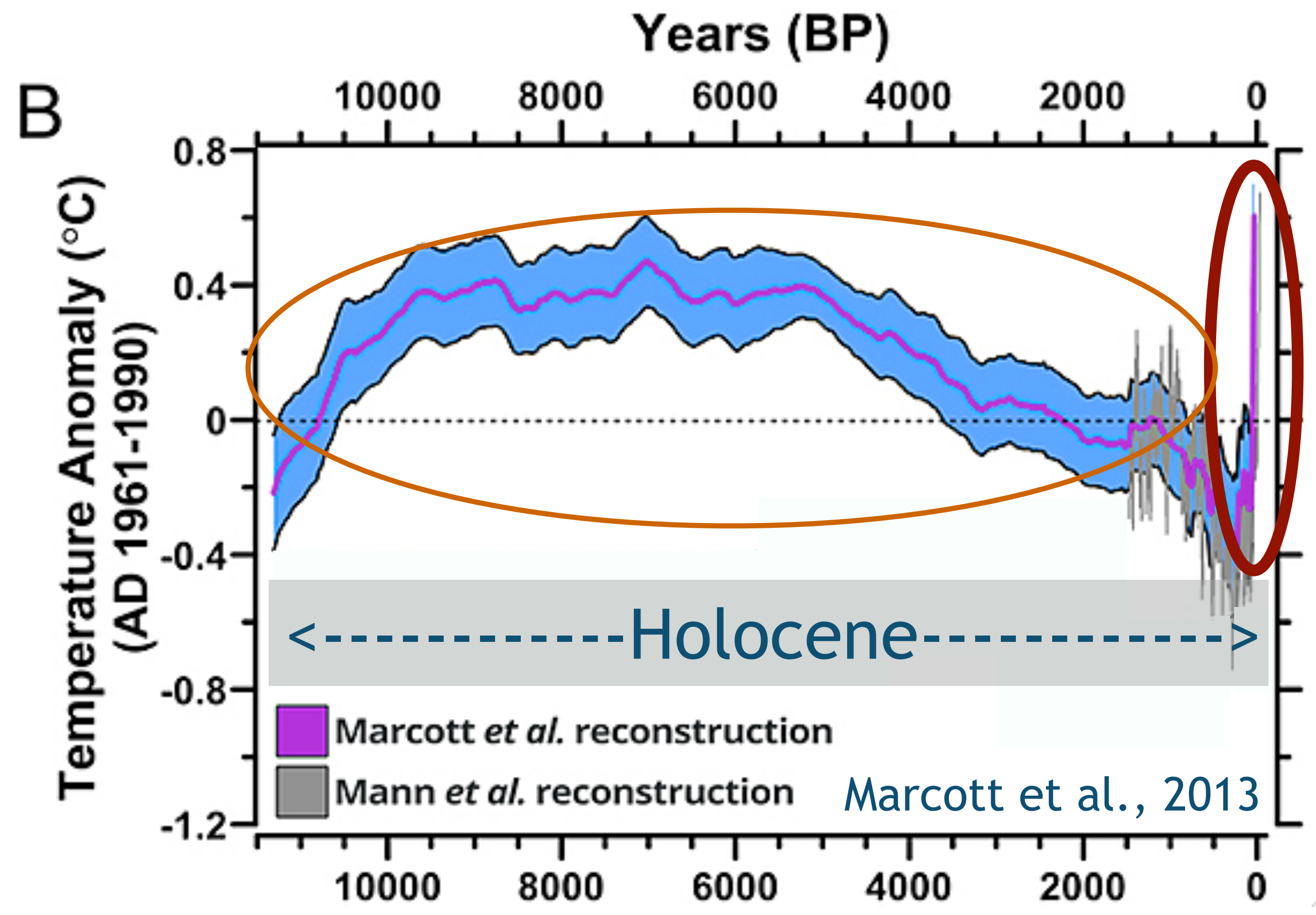


With stable climate and sea level, the Holocene was a safe operating space for humanity.

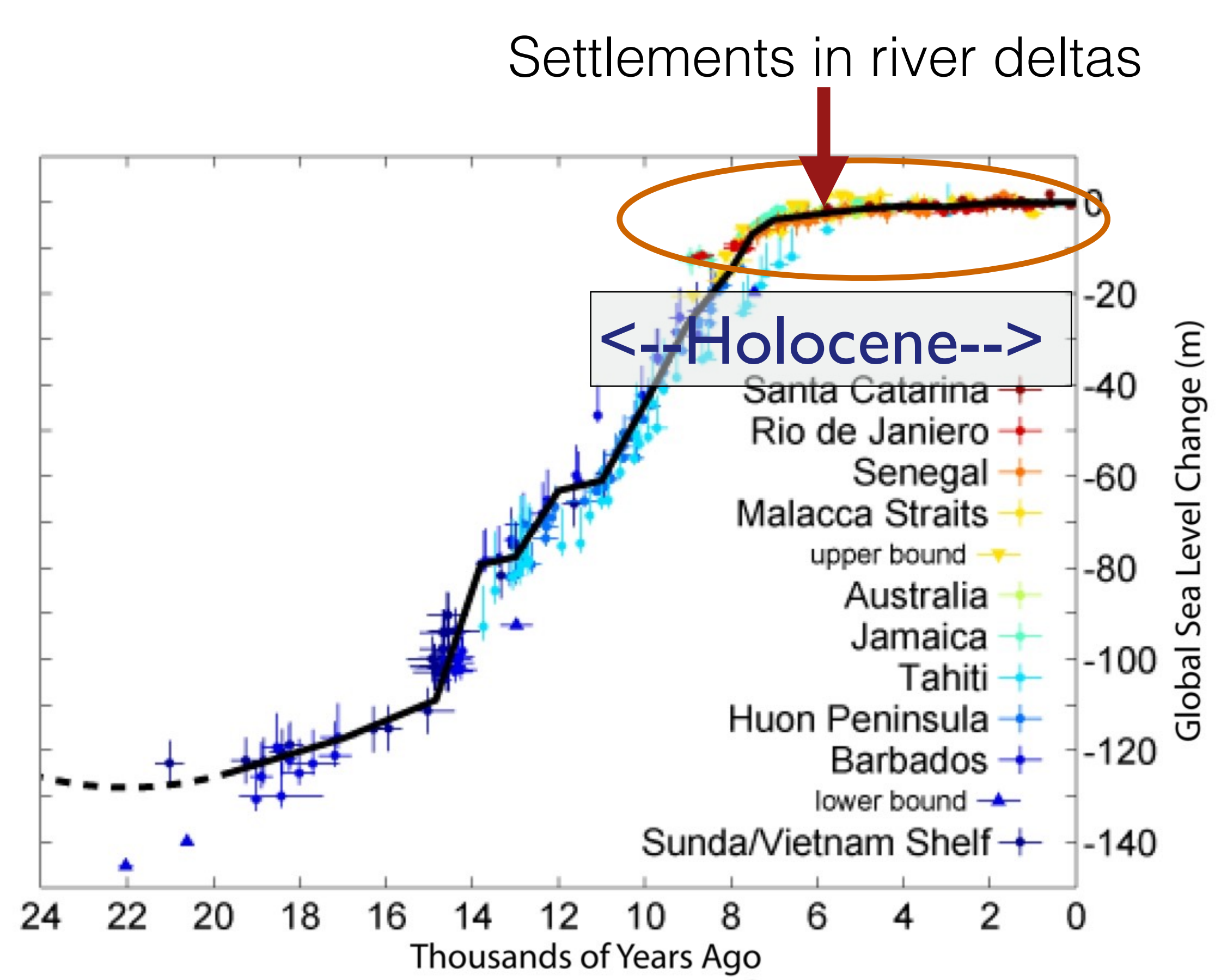
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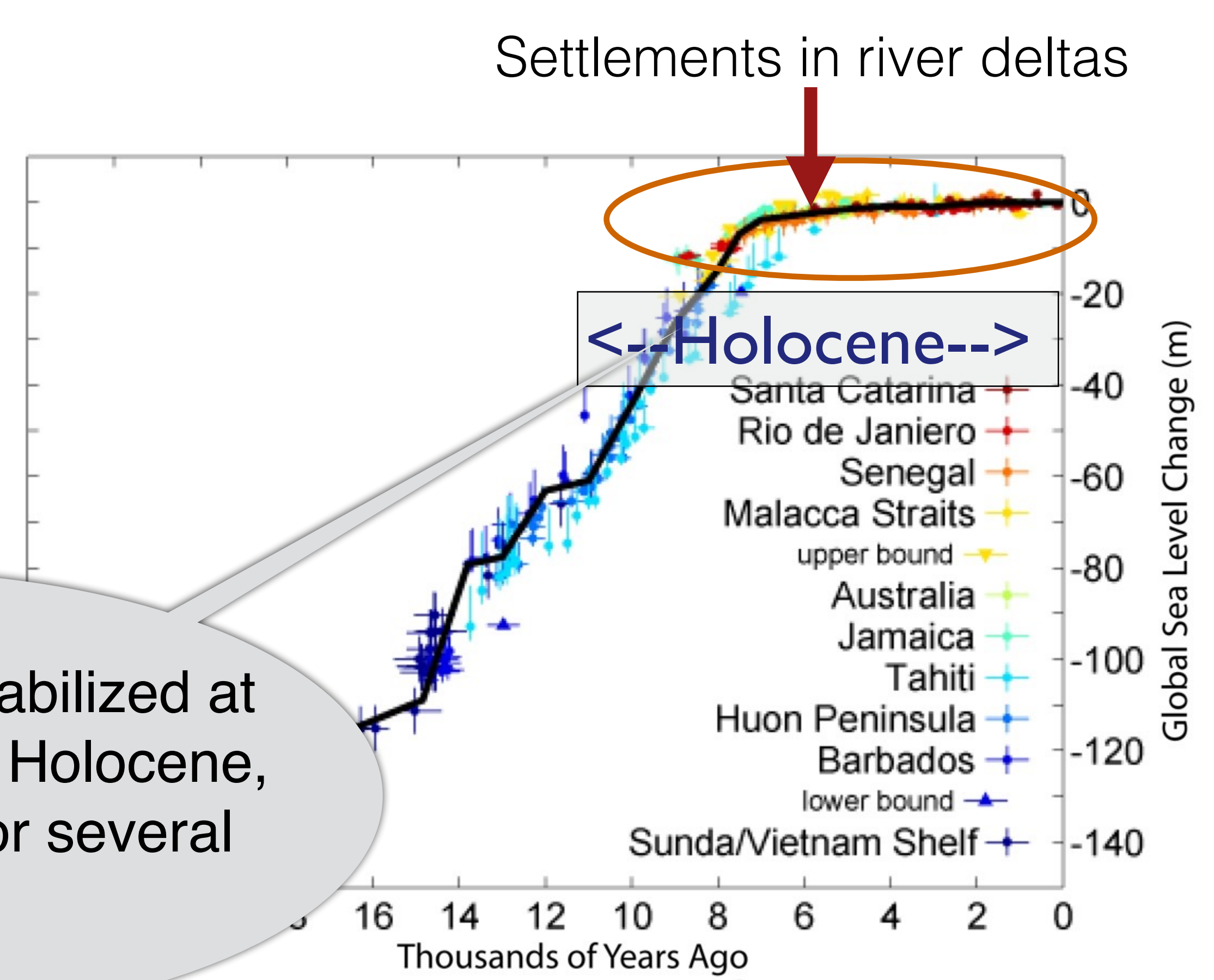
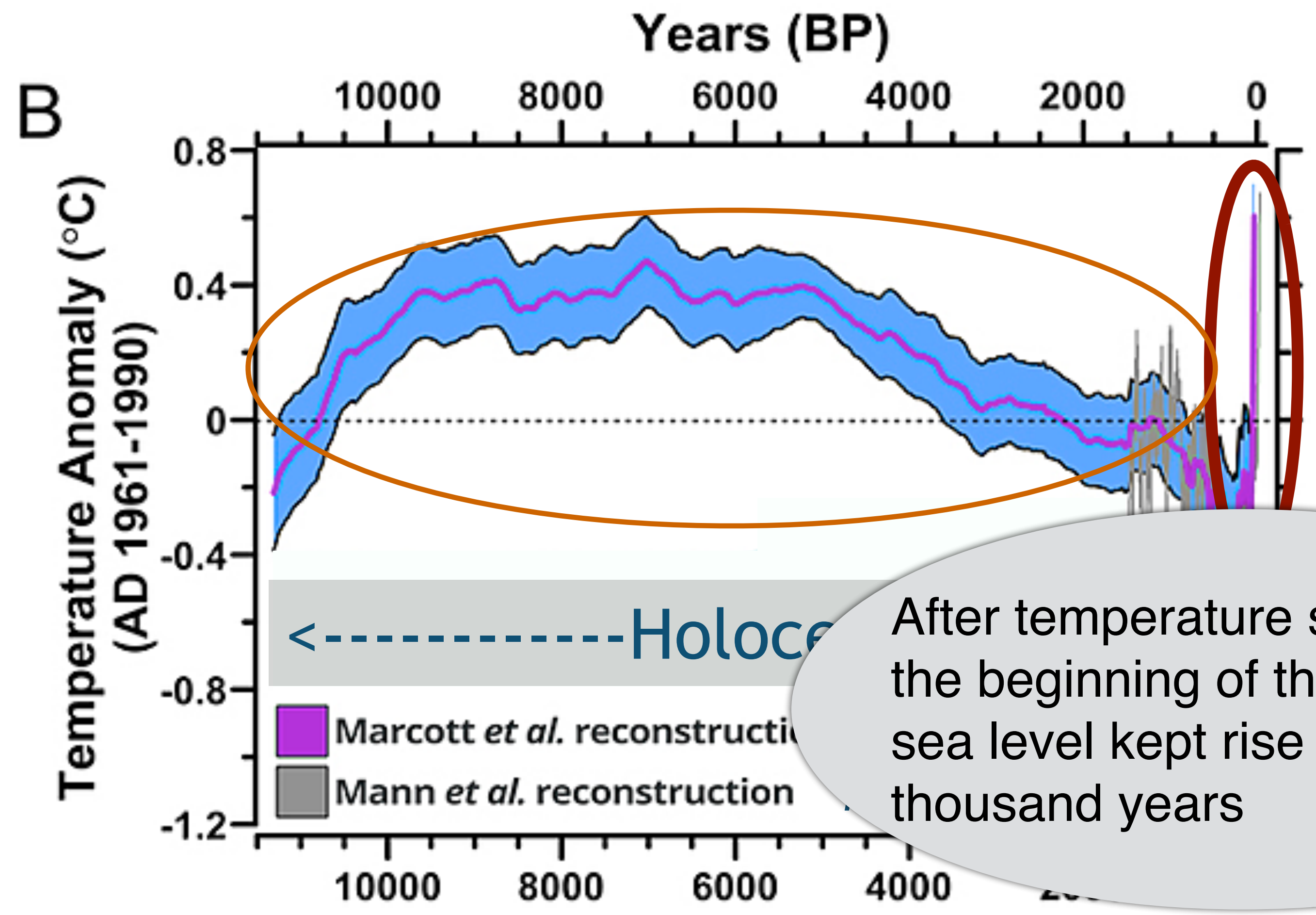
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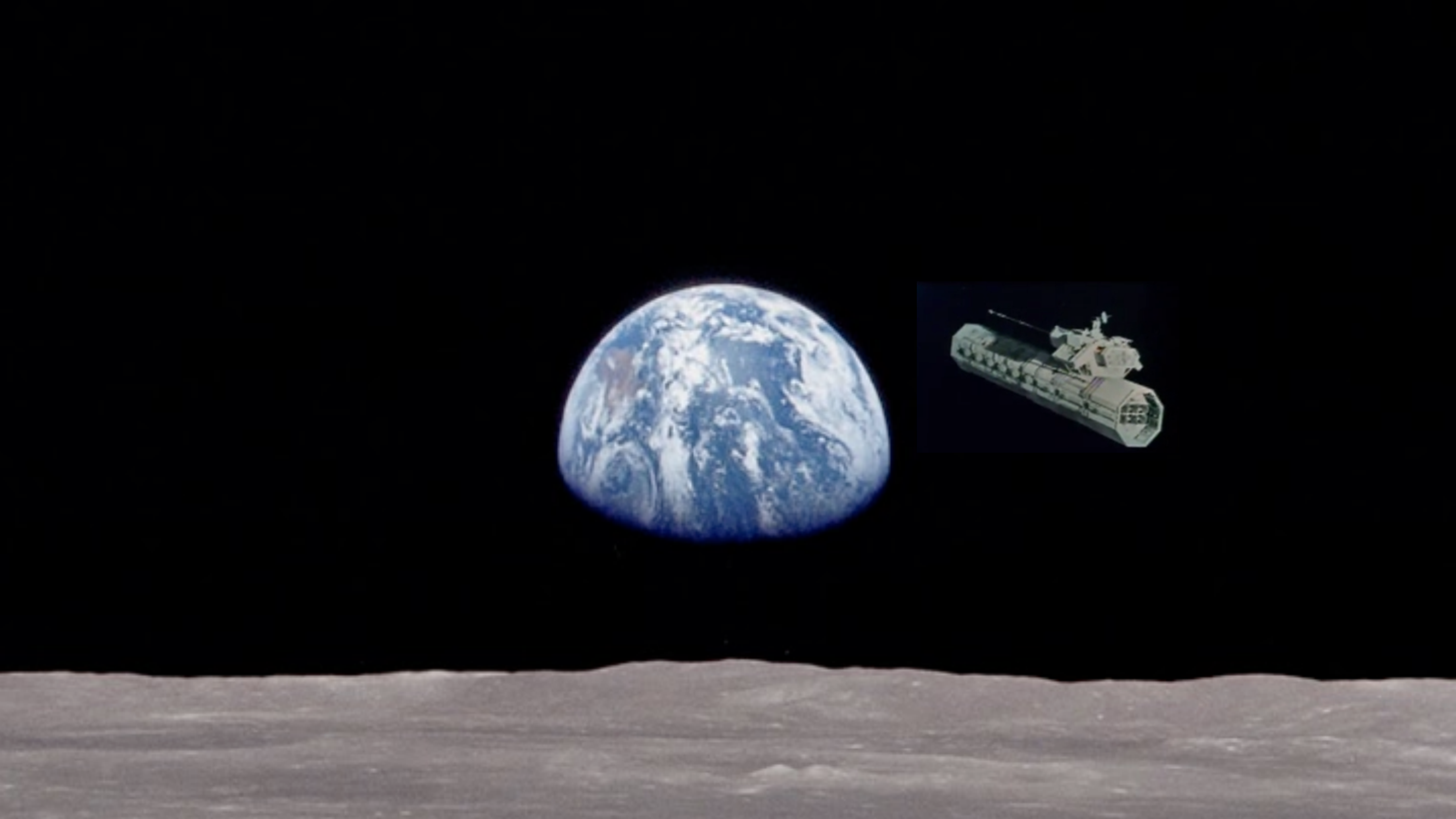


After temperature stabilized at the beginning of the Holocene, sea level kept rise for several thousand years

With stable climate and sea level, the Holocene was a safe operating space for humanity.



Distance determines Perception



Life-Support System for complex web of life aiming for Homeostatis



Life-Support System for complex web of life aiming for Homeostasis

Global Essential Variable: Energy Imbalance: Incoming Energy minus Outgoing Energy

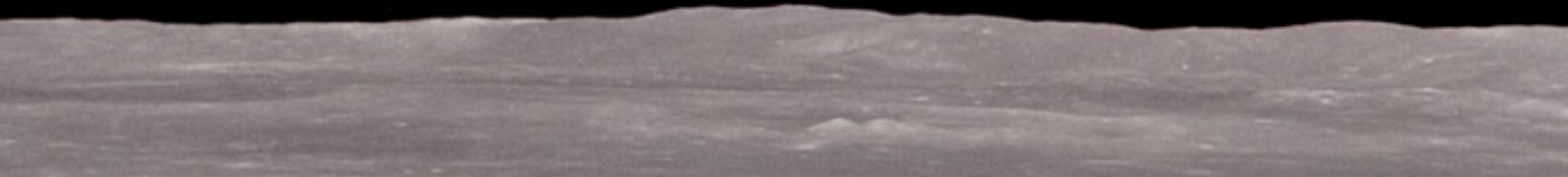


Life-Support System for complex web of life aiming for Homeostasis

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“Healthy Life-Support System”:

Earth’s Energy Imbalance (EEI) due to photosynthesis on the order of 10^{-10} to 10^{-9}



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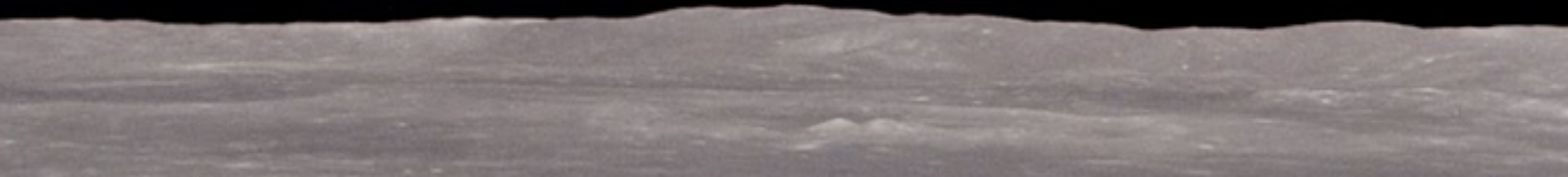
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Imbalance today: 300-320 TW, i.e., on the order of 3×10^{-3}

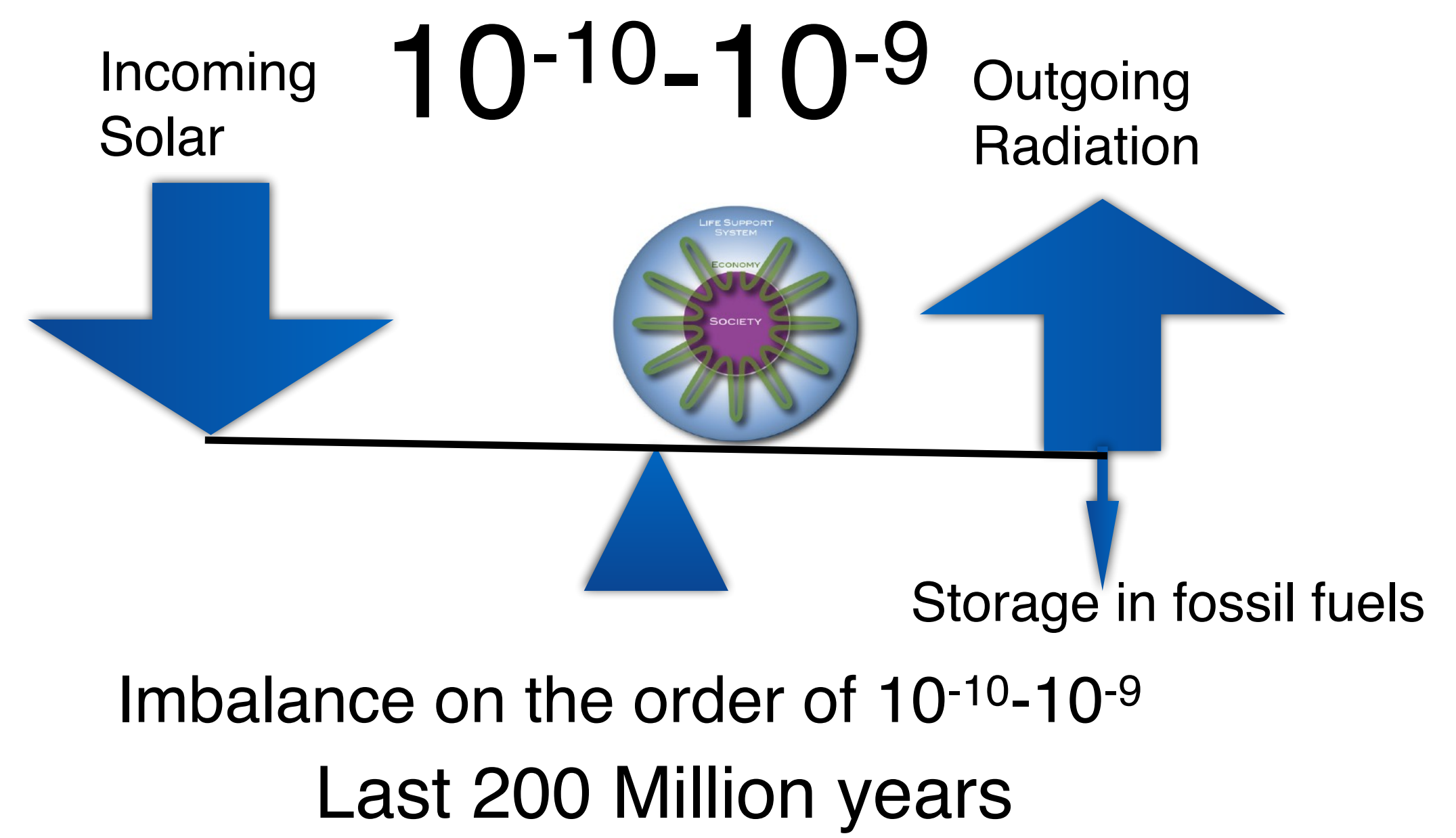
(e.g., Stephens et al., 2012; Trenberth et al., 2014, Cheng et al., 2016)



Earth's Energy Imbalance

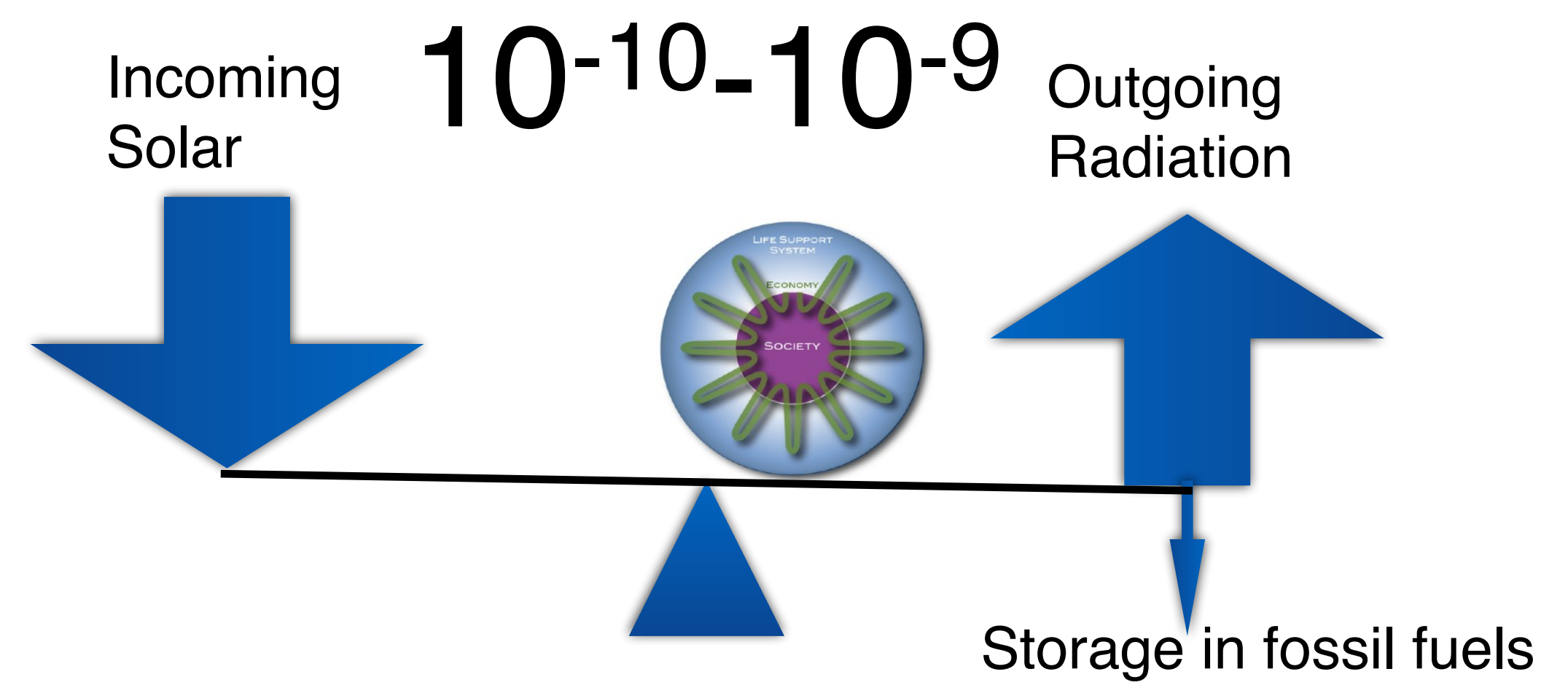
Syndrom of Modern Global Change

Earth's Energy Imbalance



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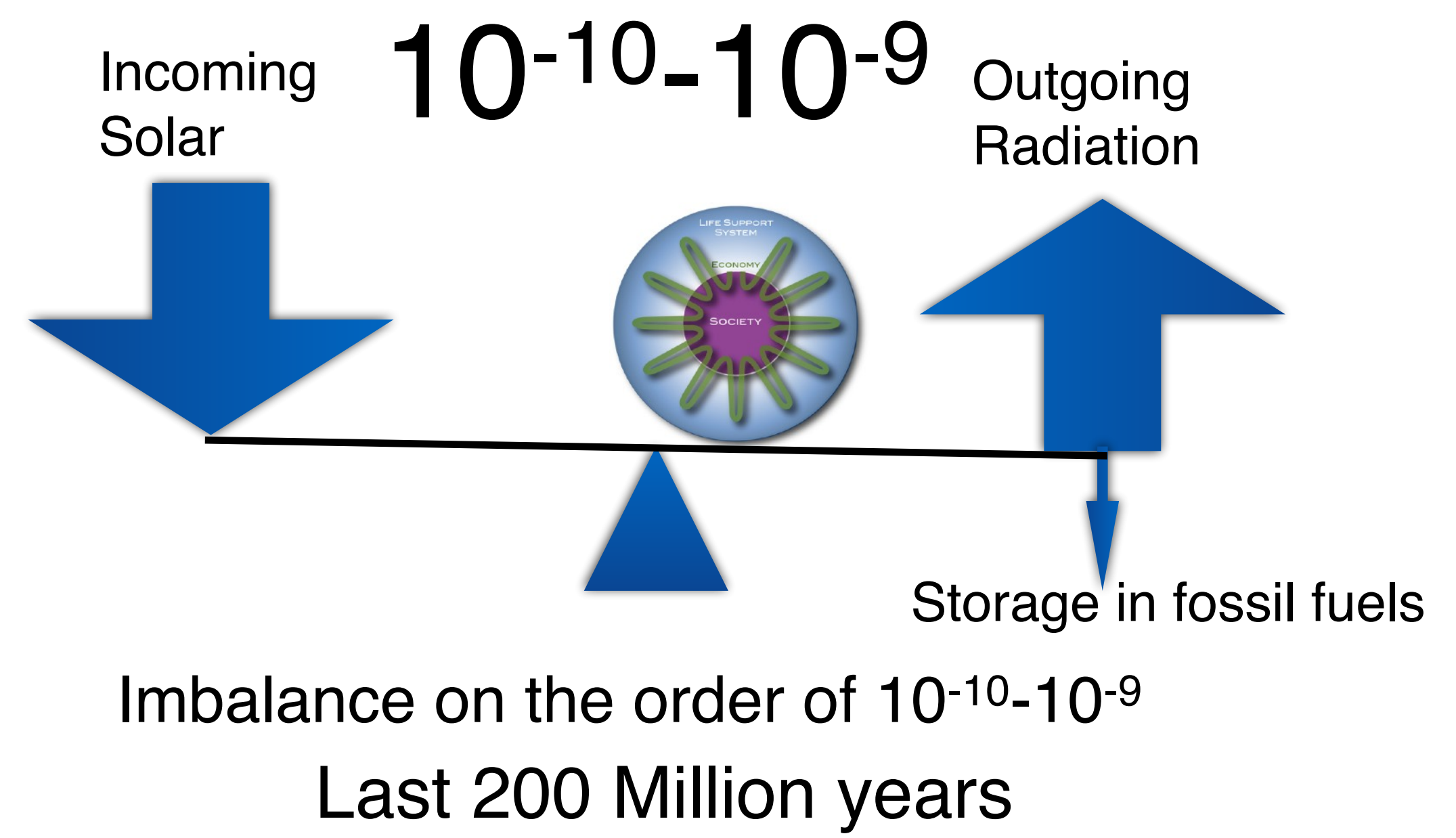


Imbalance on the order of $10^{-10}-10^{-9}$
Last 200 Million years

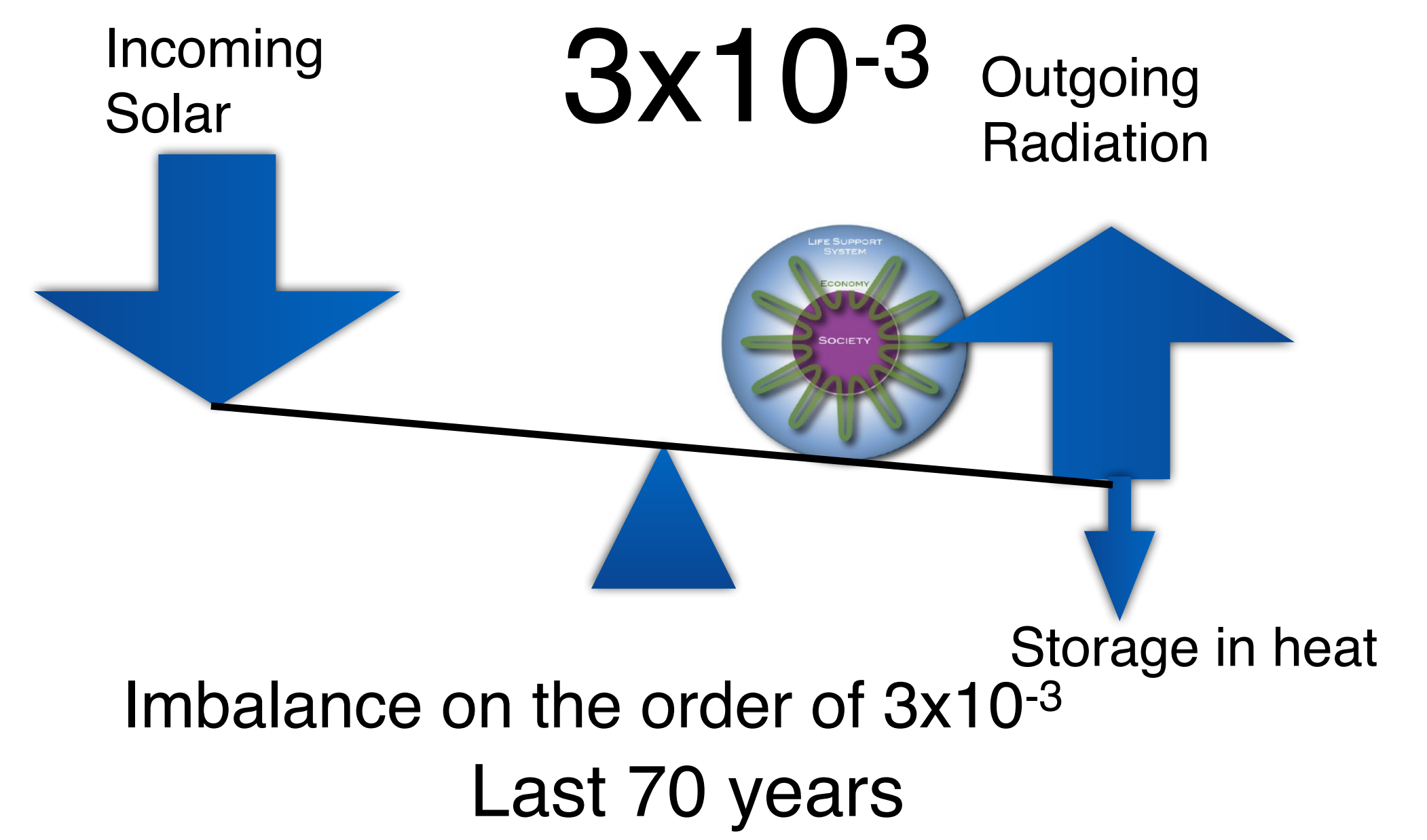
Total energy storage in 200 Myrs:
Order 100-1000 ZetaJoules

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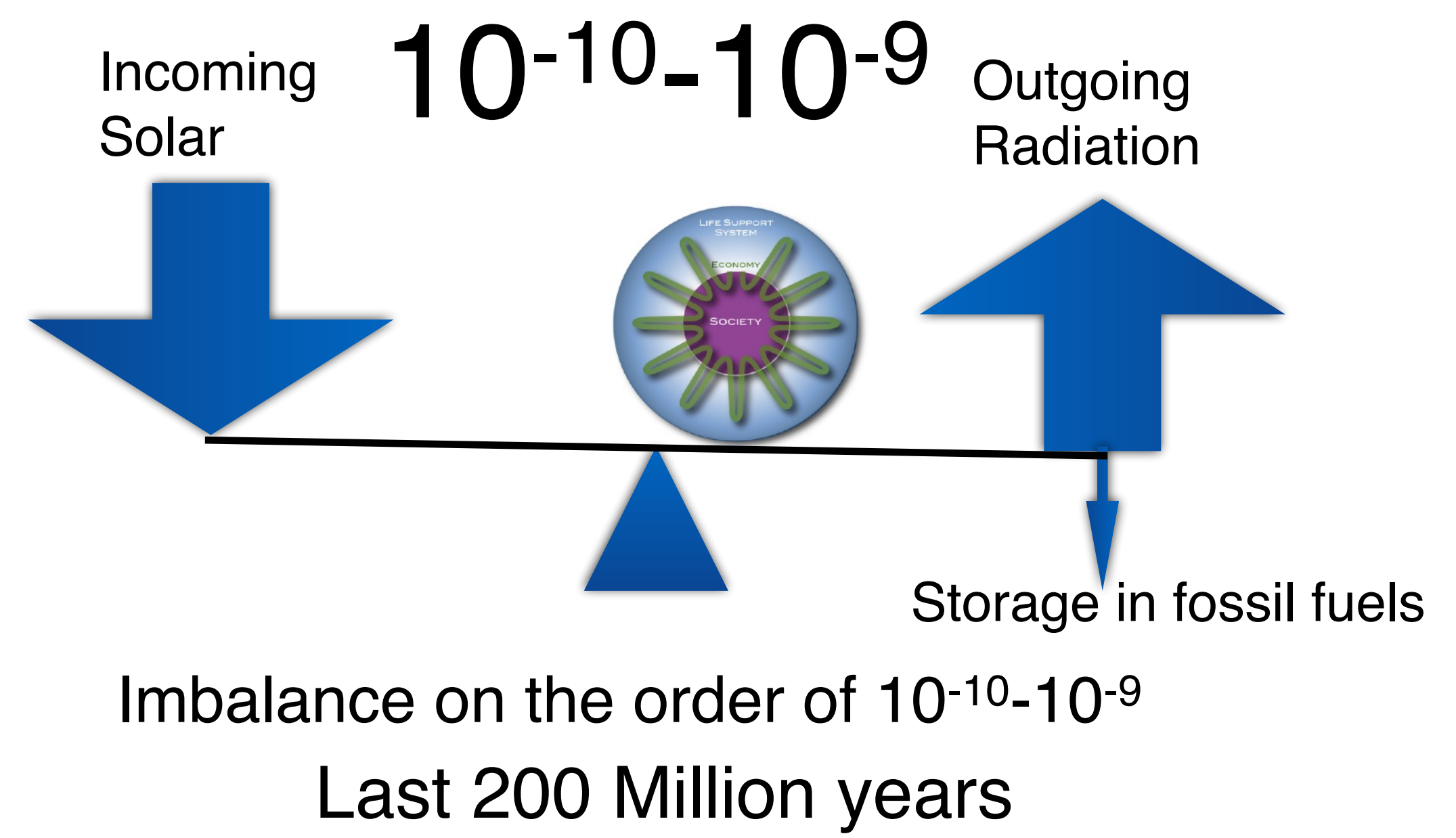
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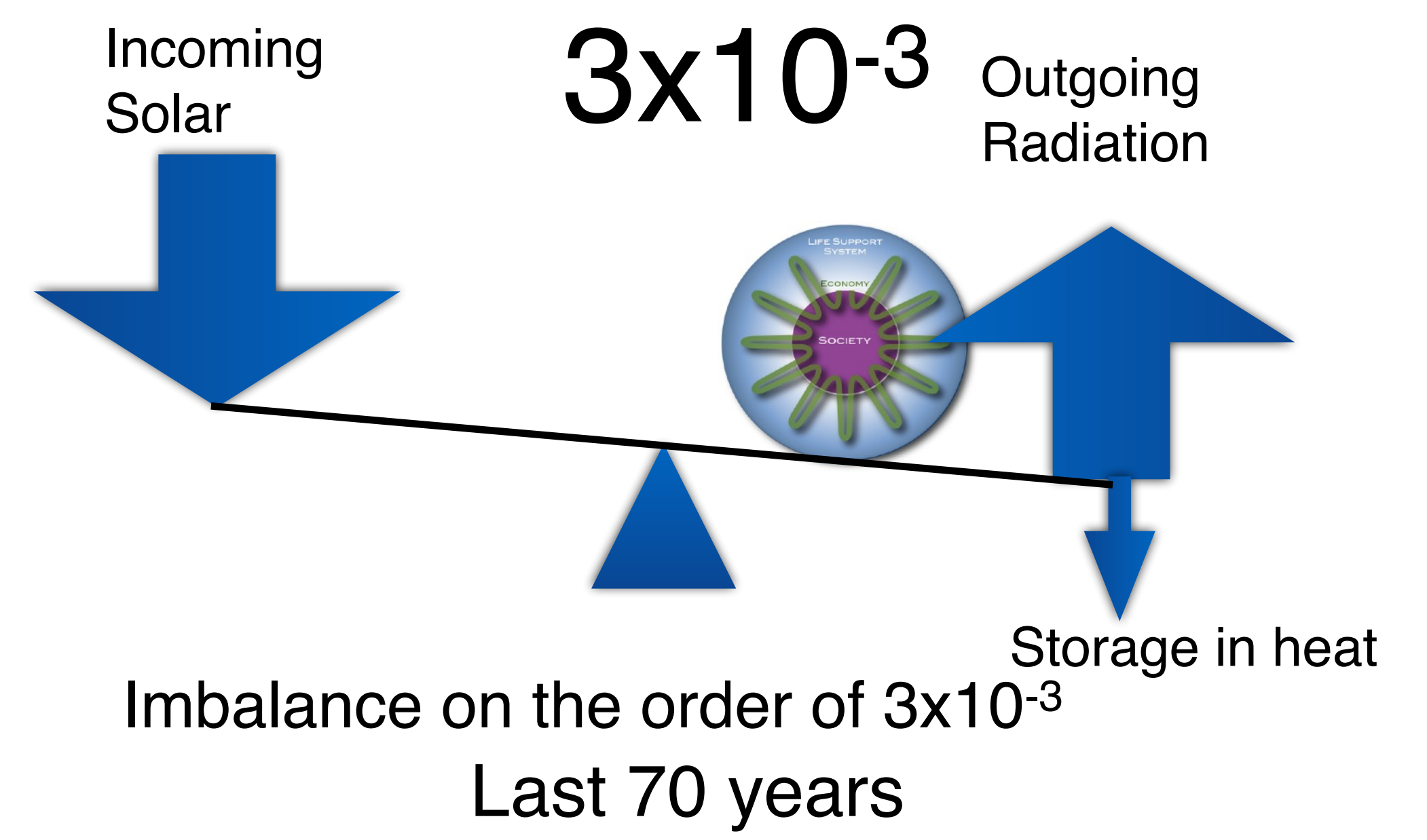
Total energy storage per century:
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Earth's Energy Imbalance

The Earth's Energy Imbalance increased by a factor of 10^6 to 10^7 !



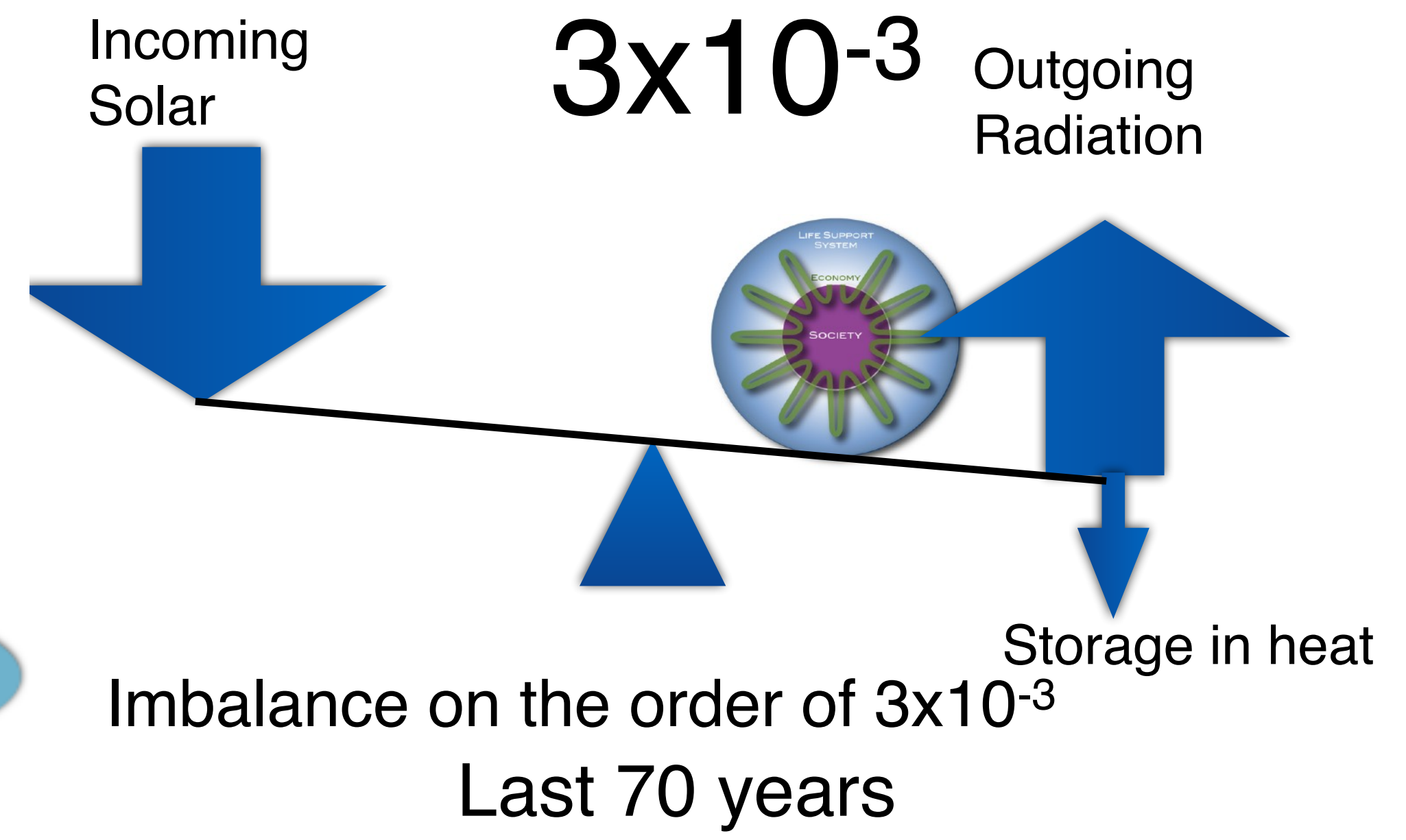
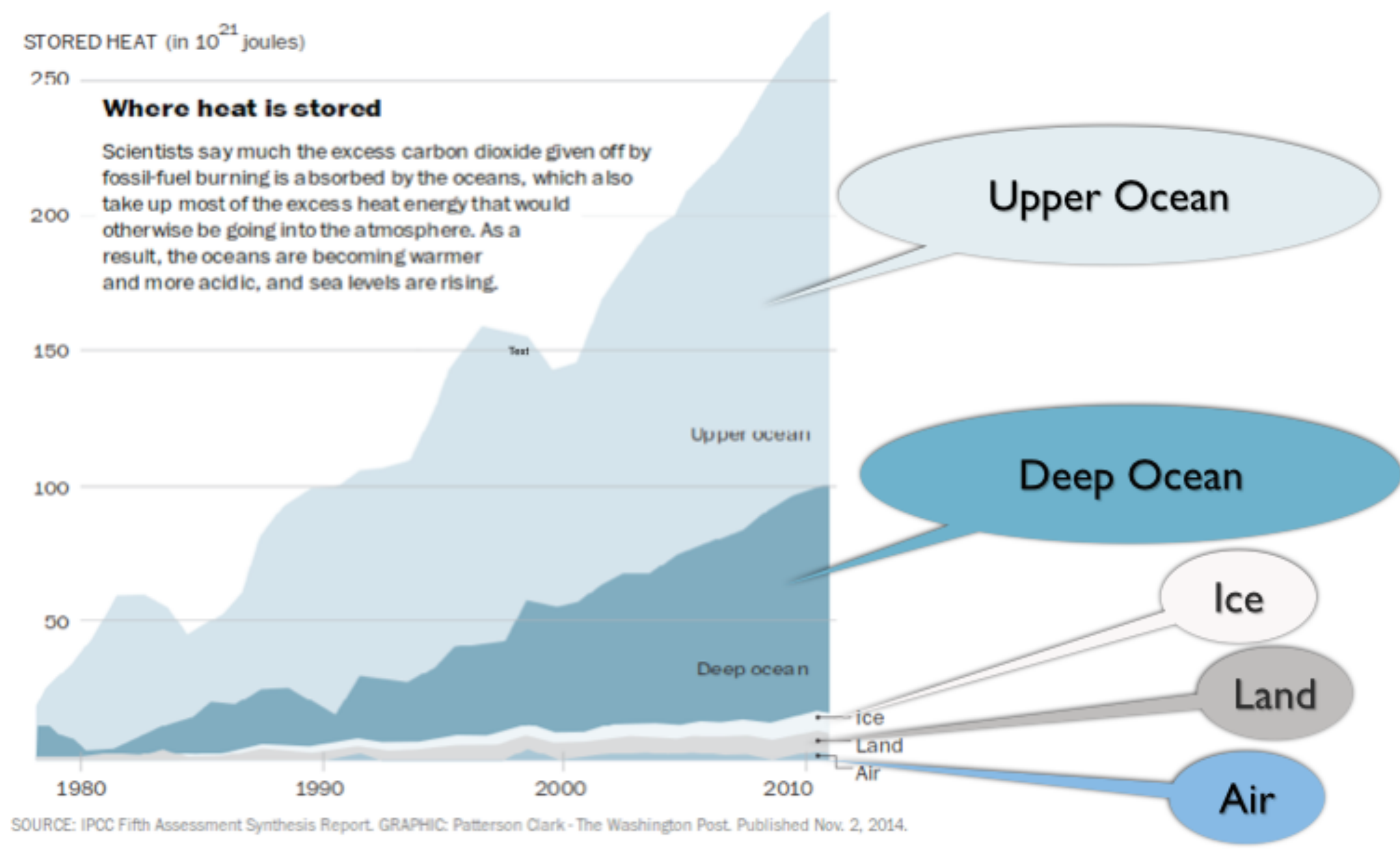
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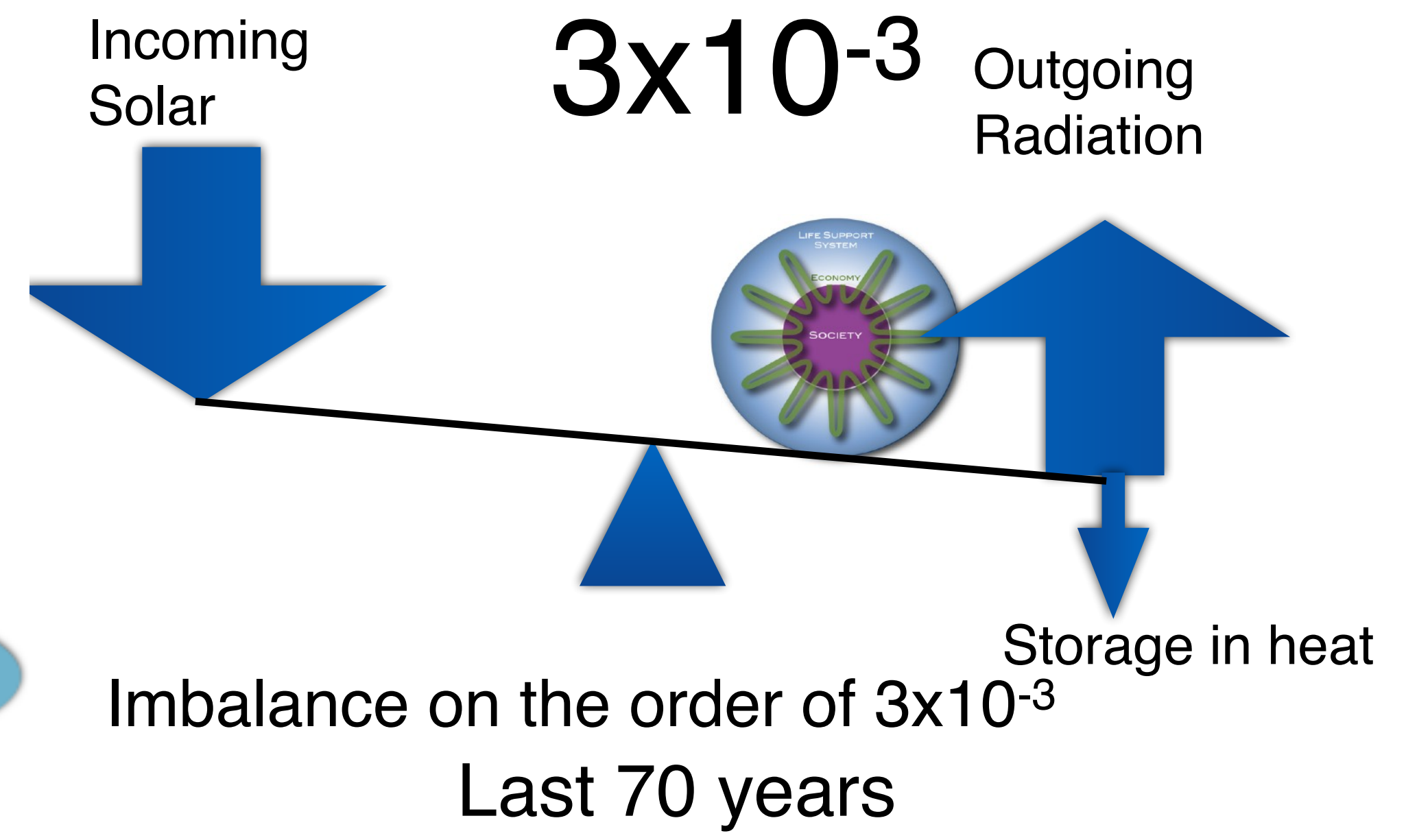
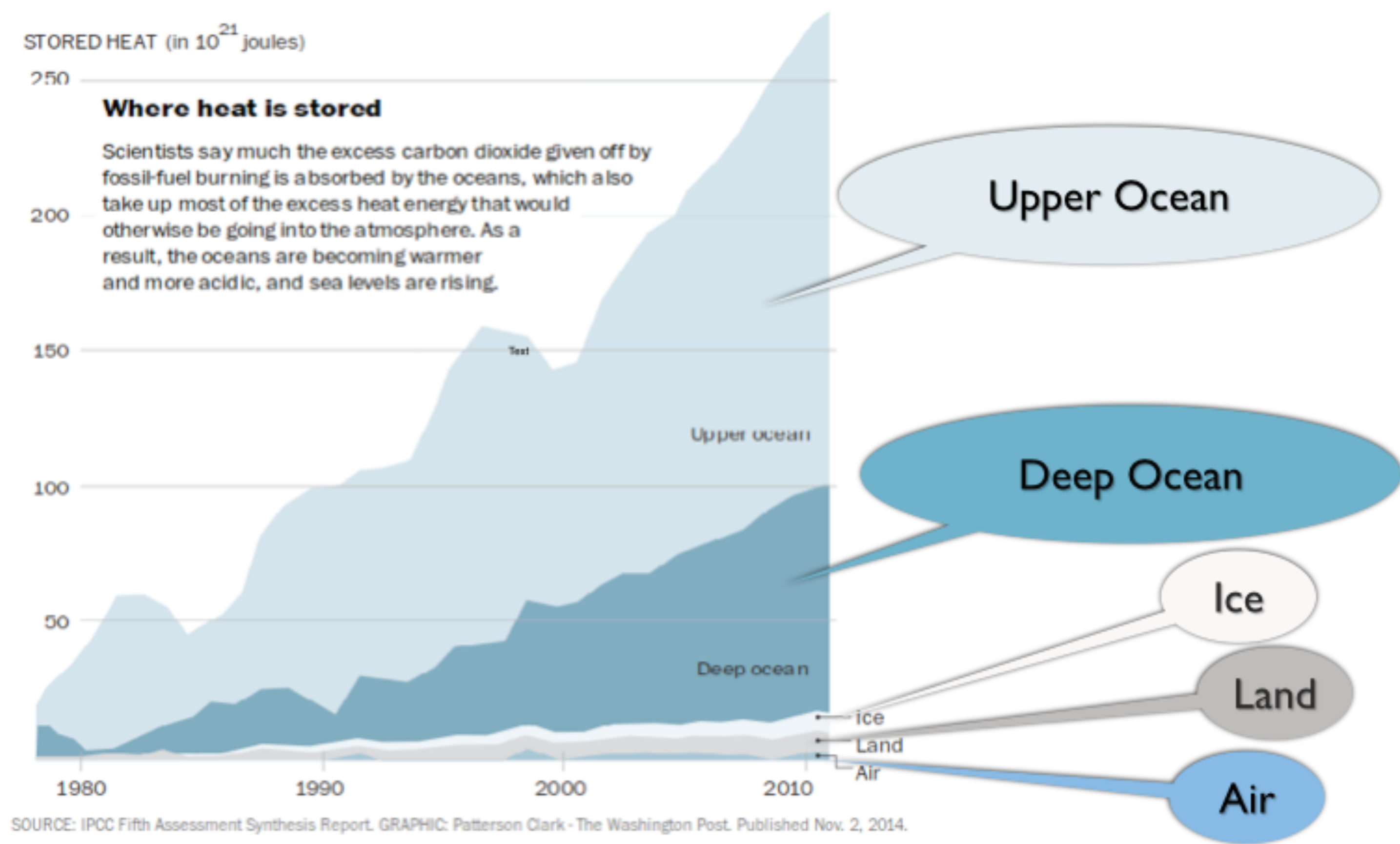
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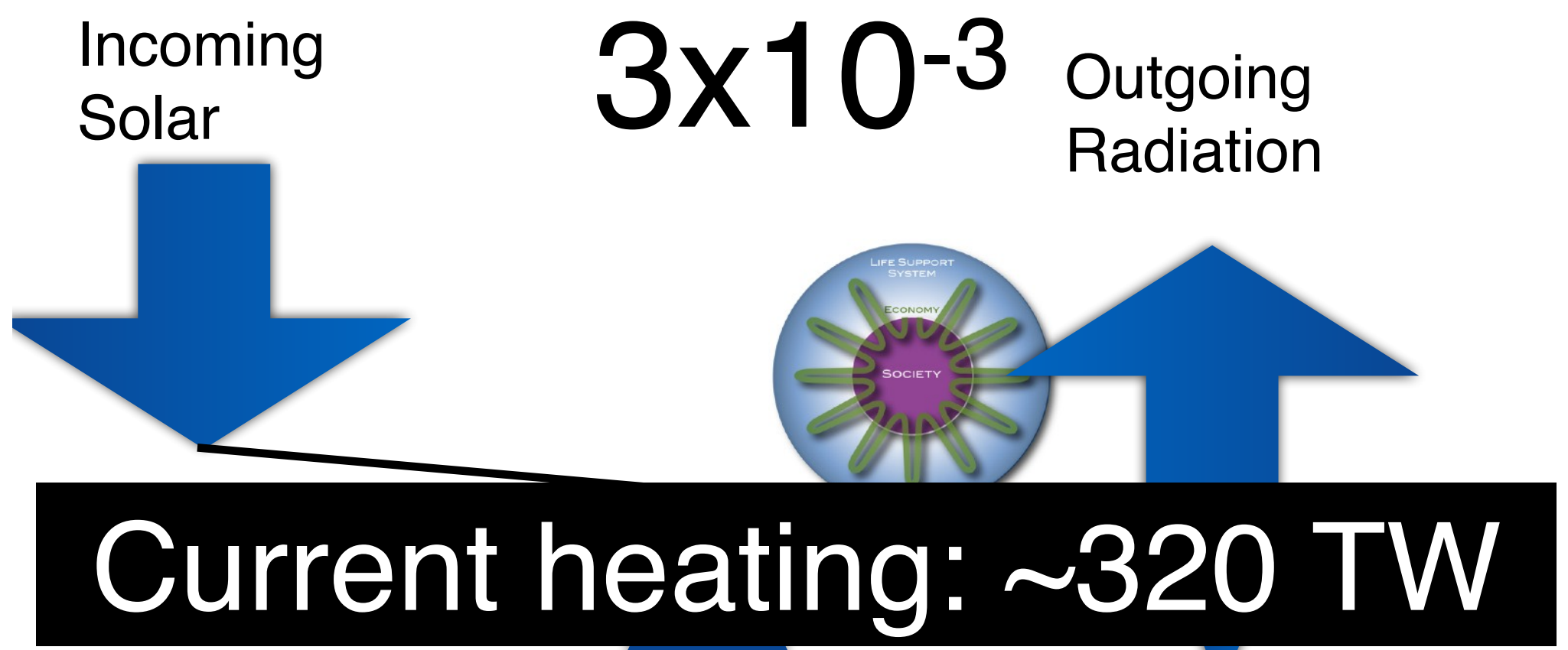
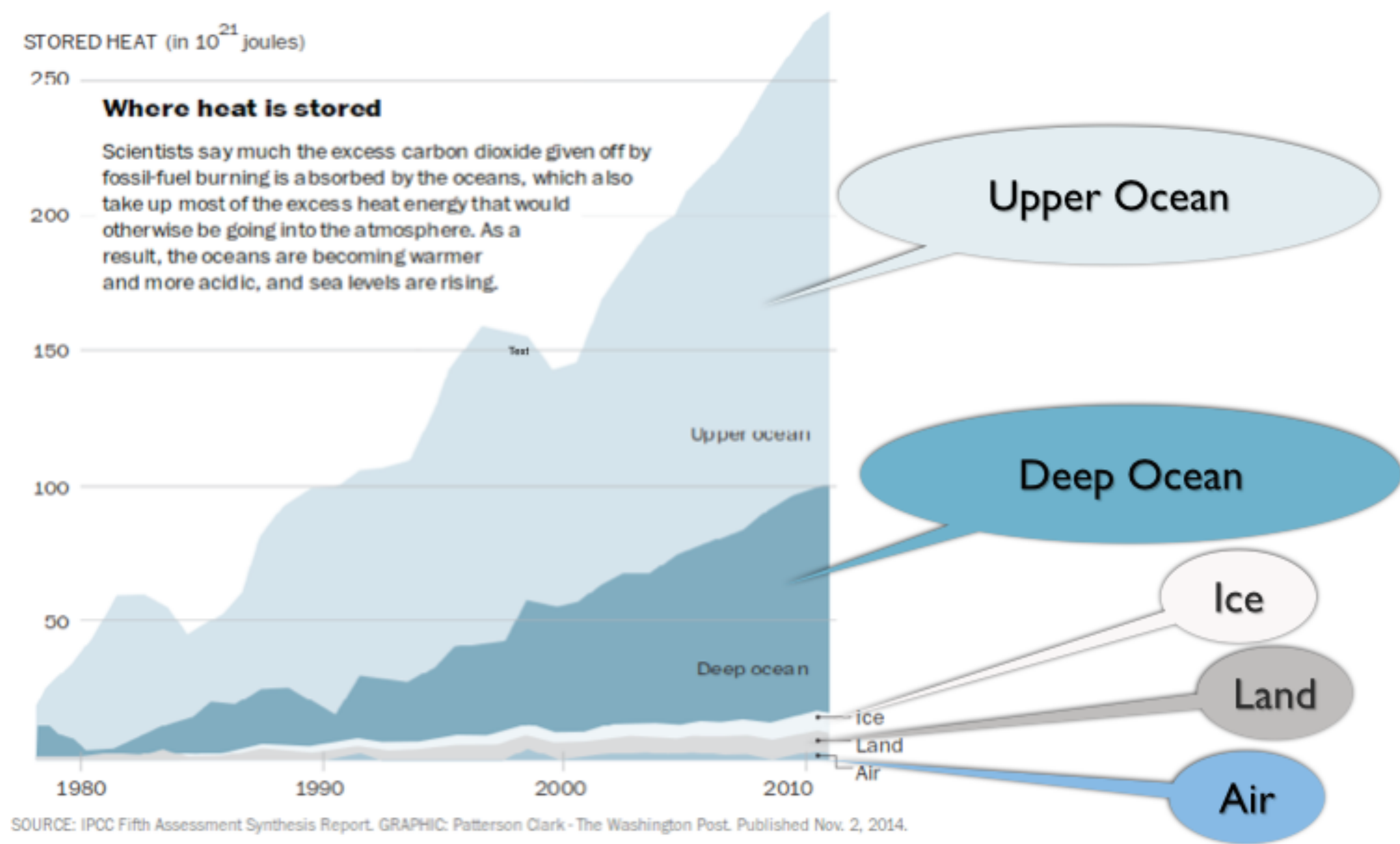


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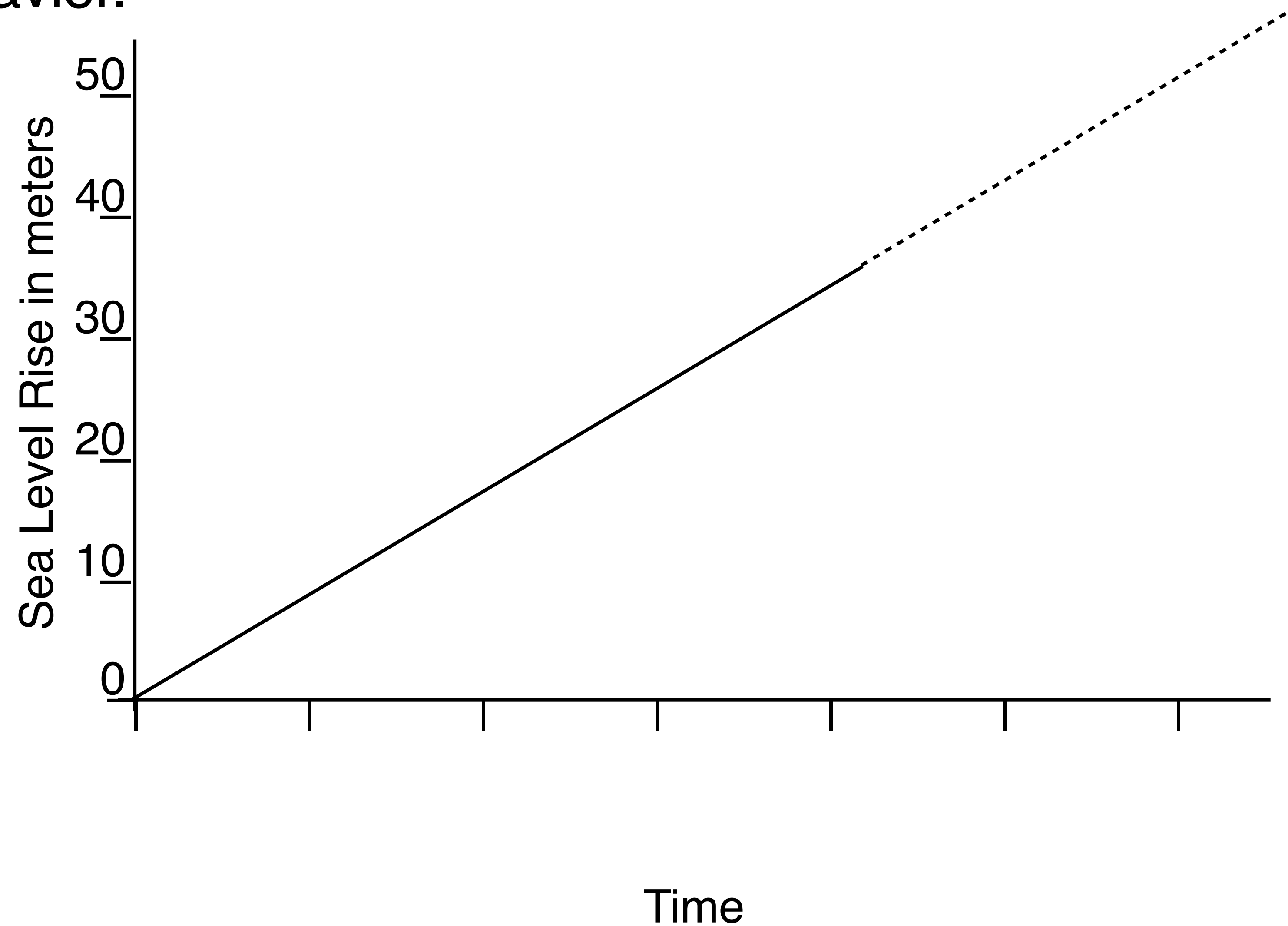
Storage in heat
Imbalance on the order of 3×10^{-3}
Last 70 years

Total energy storage per century:
Order 1000 ZetaJoules

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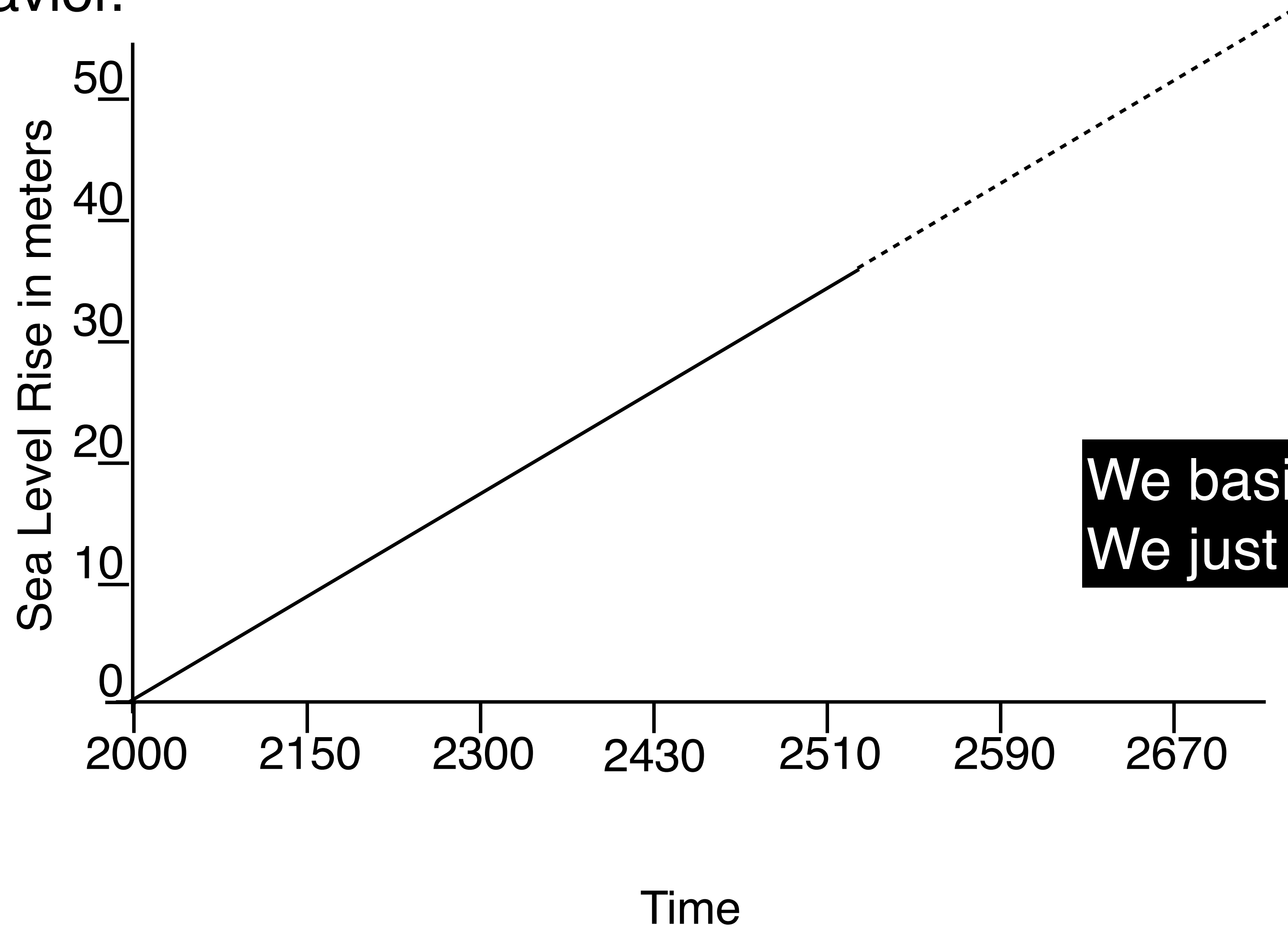
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Spectrum of Possible Futures

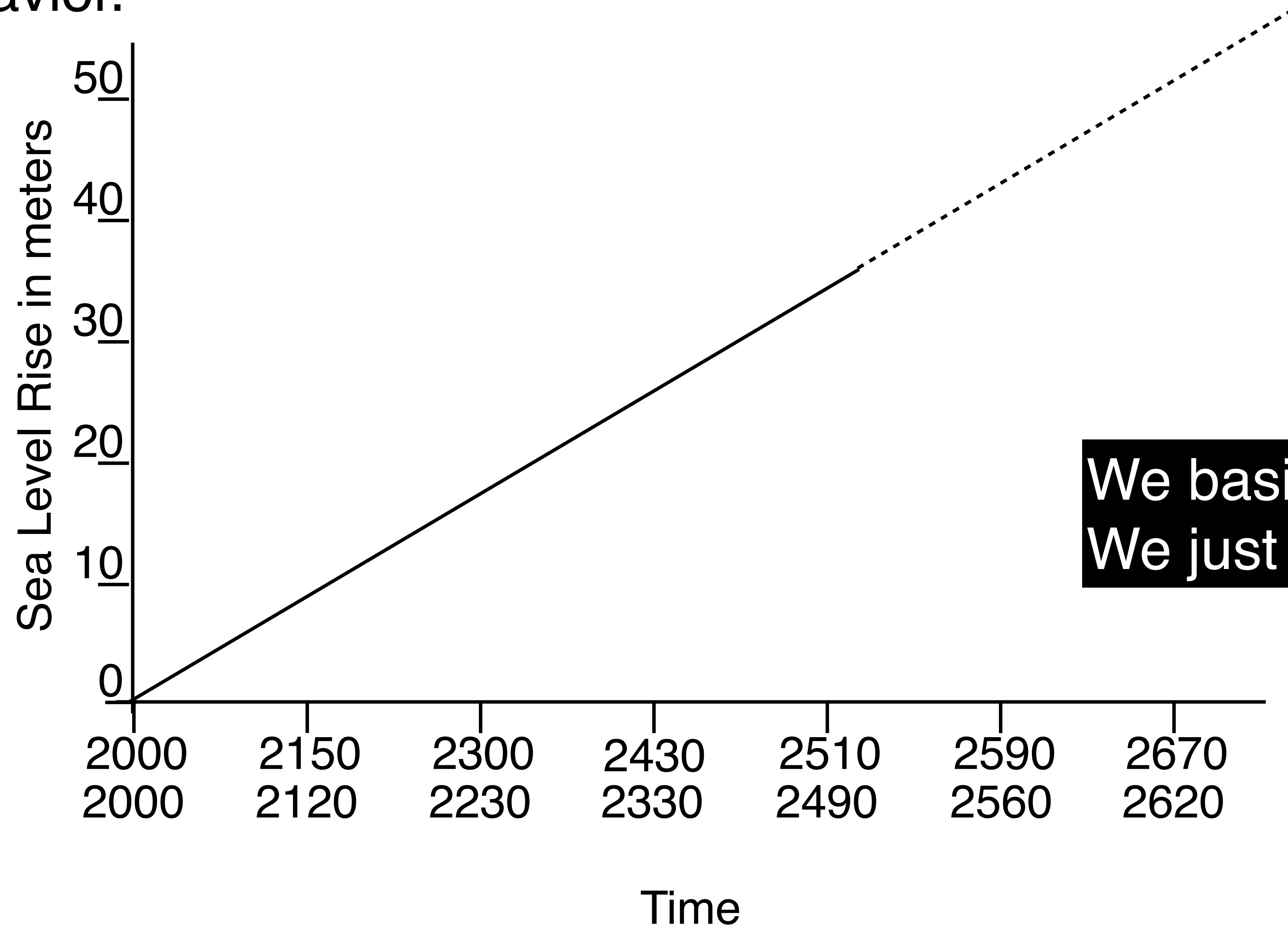
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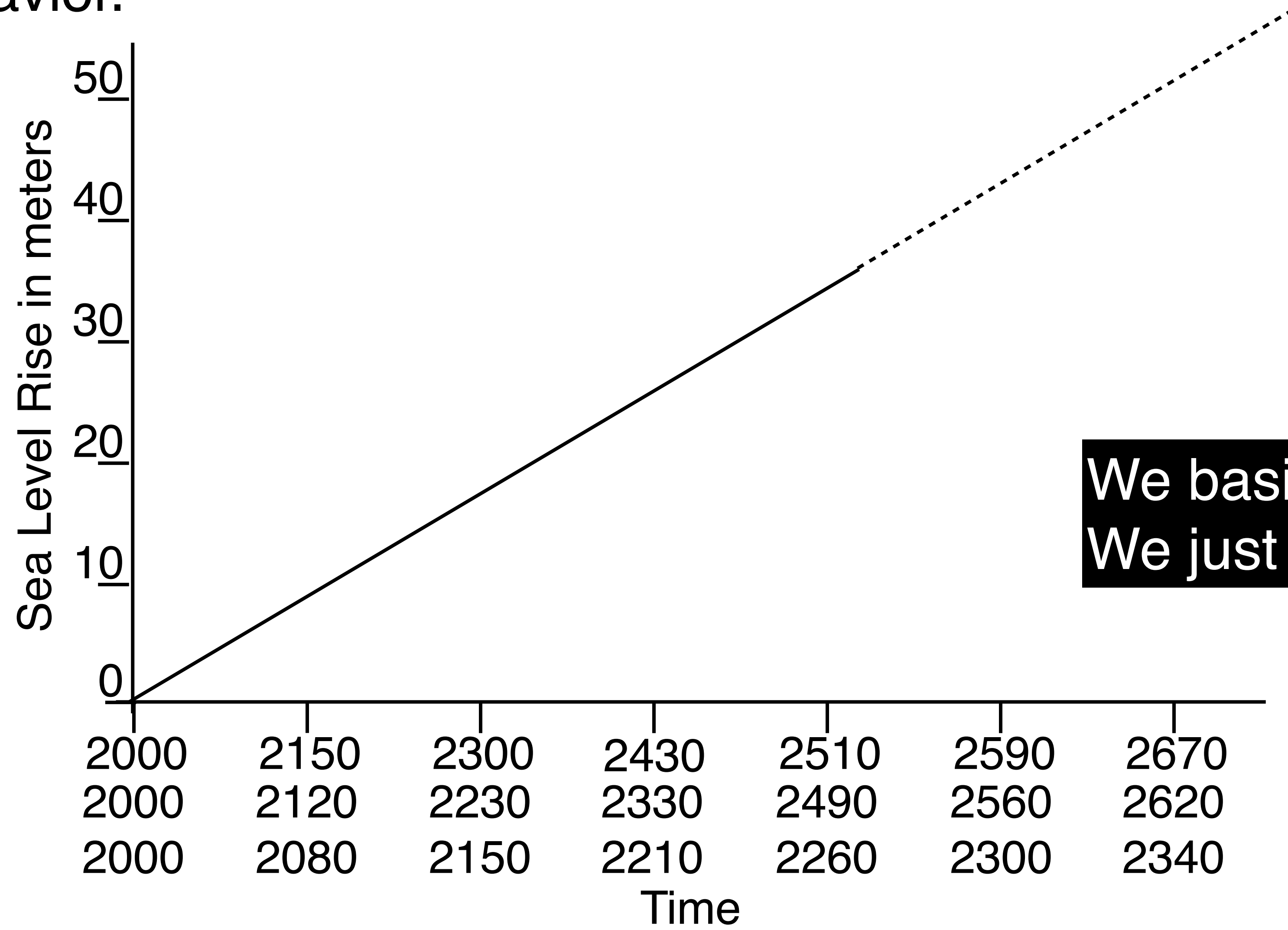
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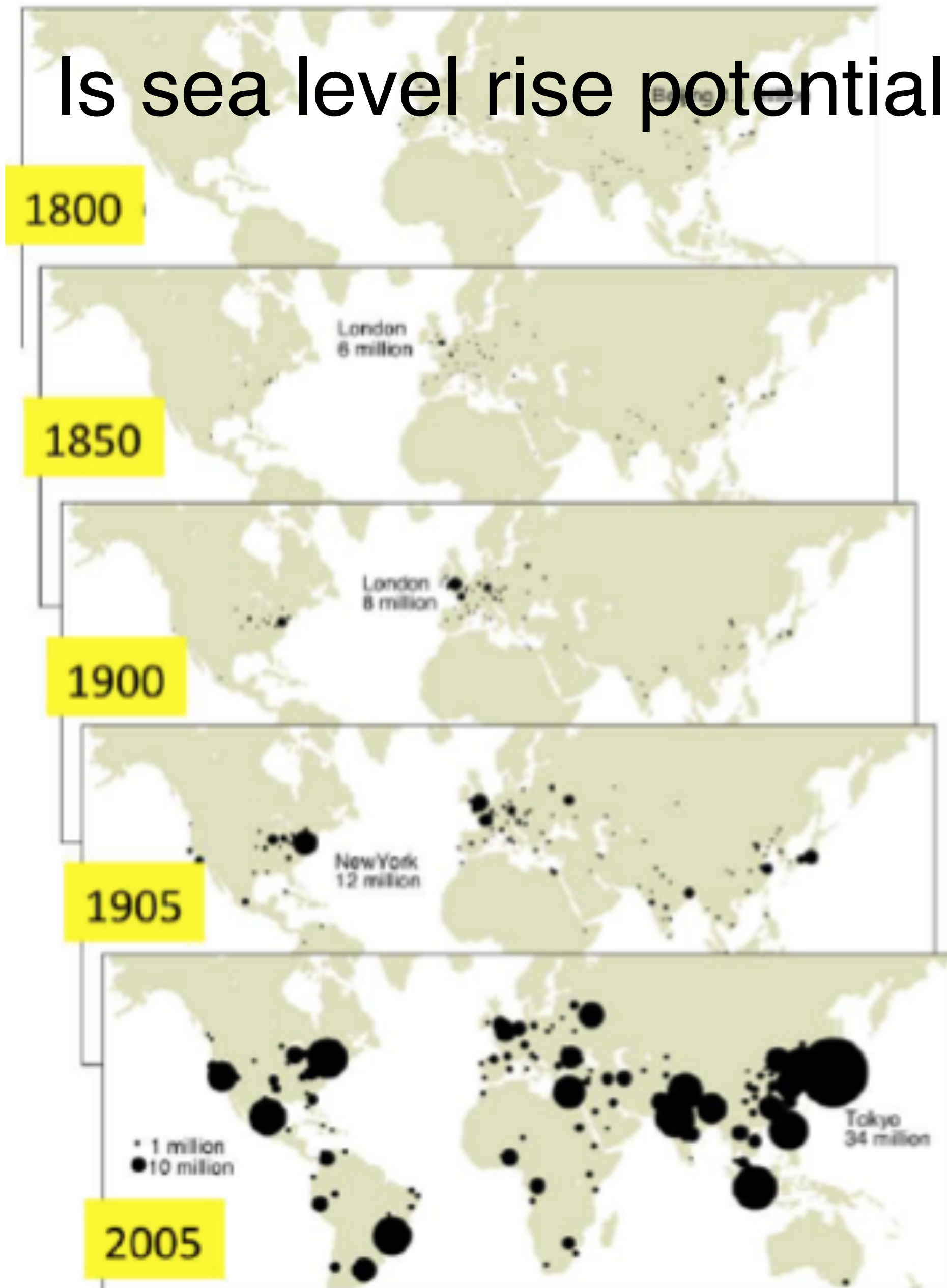
and they suffer from “probability neglect”

They populate the coastal zone and design the built environment as if sea level would never rise.

This creates a global catastrophic risk for future generations with the potential for

- massive harm and
- wide-spread injustice

Is sea level rise potentially a global catastrophic risk?



Population (millions)

- 36.1 Tokyo
 - 20.1 Mexico City
 - 20.1 Mumbai
 - 19.6 Beijing
 - 19.6 São Paulo
 - 19.4 New York
 - 17.0 Delhi
 - 15.8 Shanghai
 - 15.6 Kolkata
 - 14.8 Dhaka
- 198 | 2010 top 10 total

Population (millions)

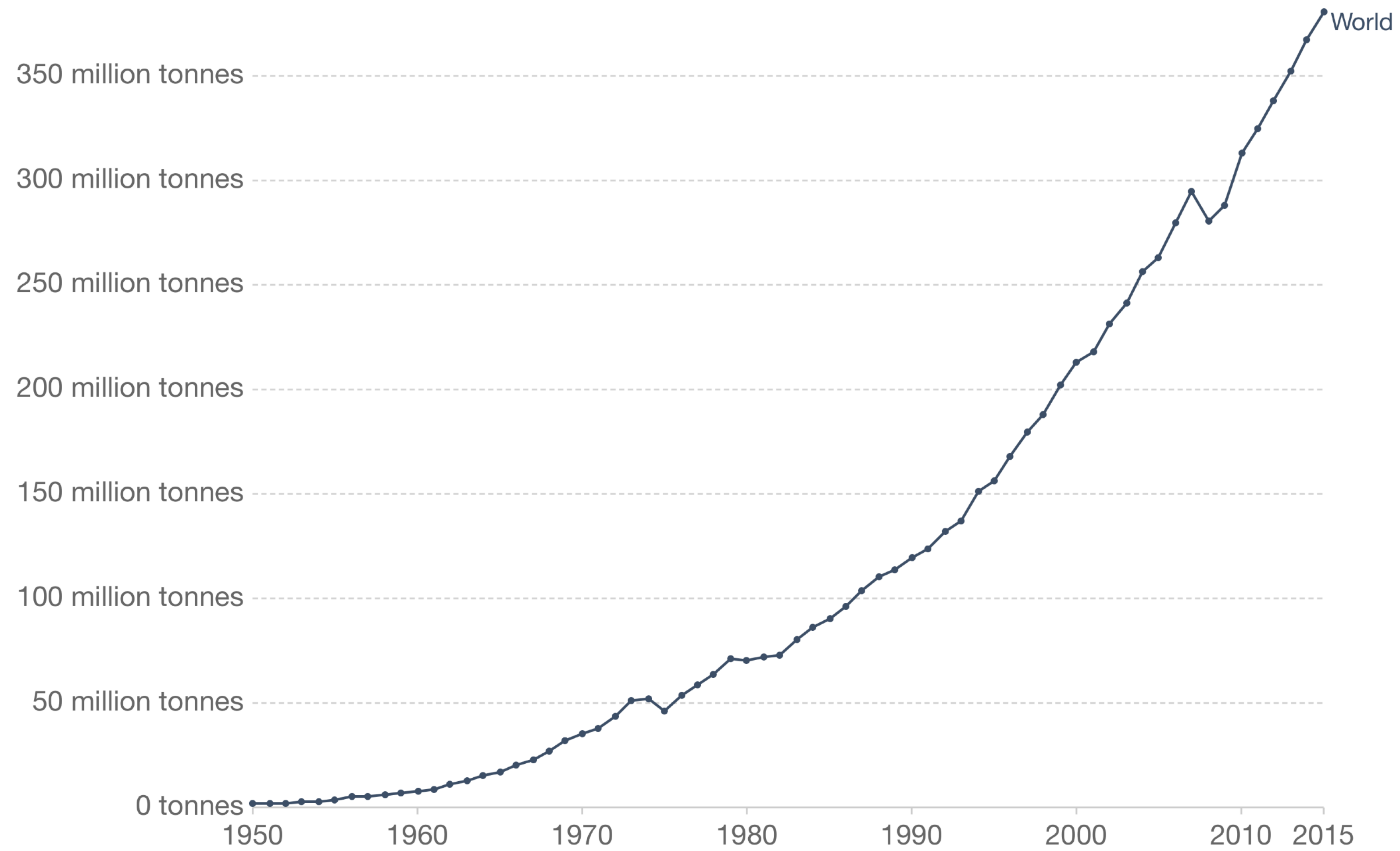
- 88.3 Lagos
 - 83.5 Kinshasa
 - 73.7 Dar Es Salaam
 - 67.2 Mumbai
 - 57.3 Delhi
 - 56.6 Khartoum
 - 56.1 Niamey
 - 54.2 Dhaka
 - 52.4 Kolkata
 - 50.3 Kabul
- 637 | 2100 top 10 total

The 10 largest cities are projected to more than triple in population:
198 => 637 m

Global plastics production, 1950 to 2015

Annual global polymer resin and fiber production (plastic production), measured in metric tonnes per year.

Our World
in Data



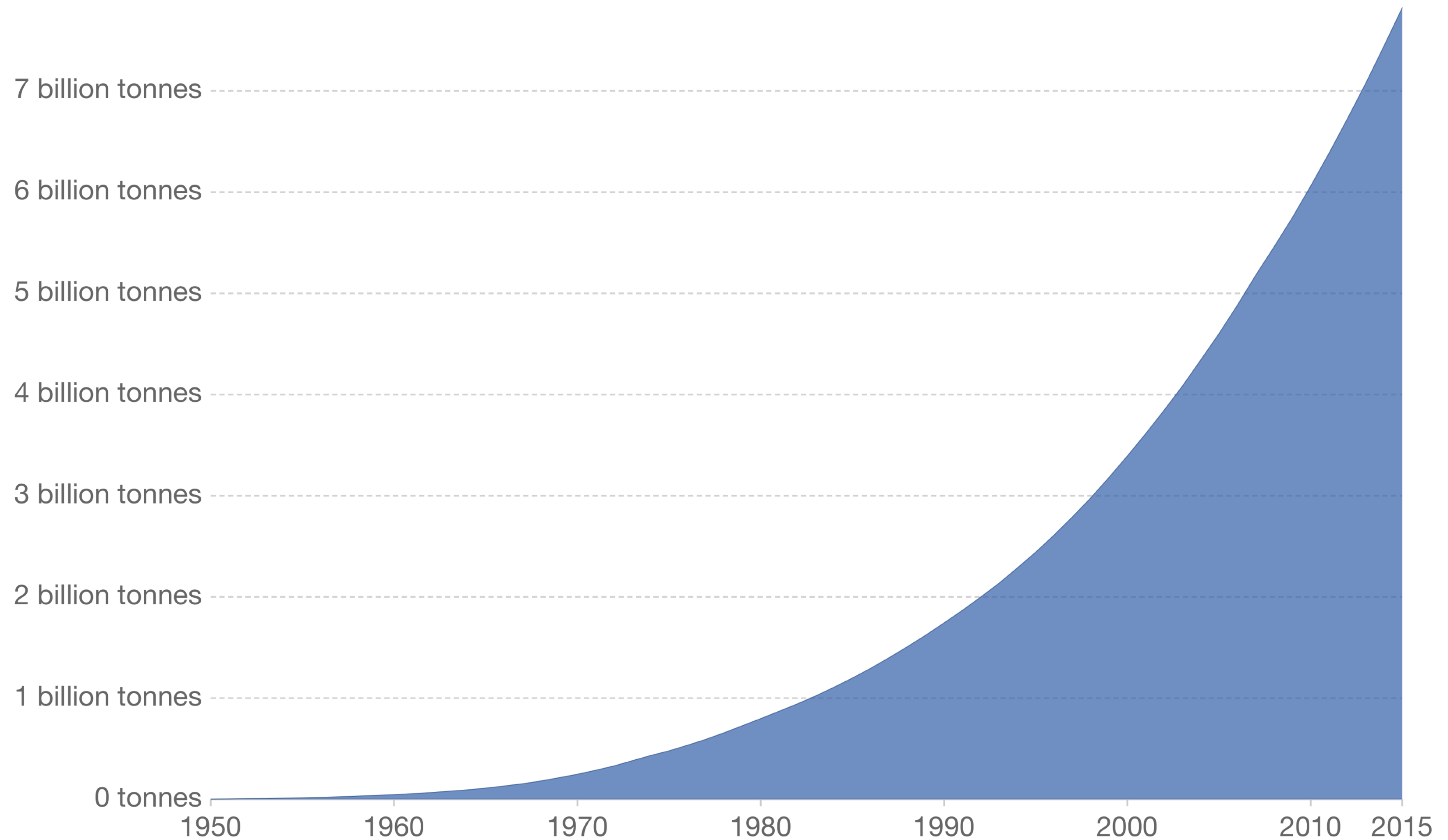
Source: Geyer et al. (2017)

CC BY

Cumulative global plastics production, 1950 to 2015

Cumulative global production of plastics, measured in tonnes.

Our World
in Data

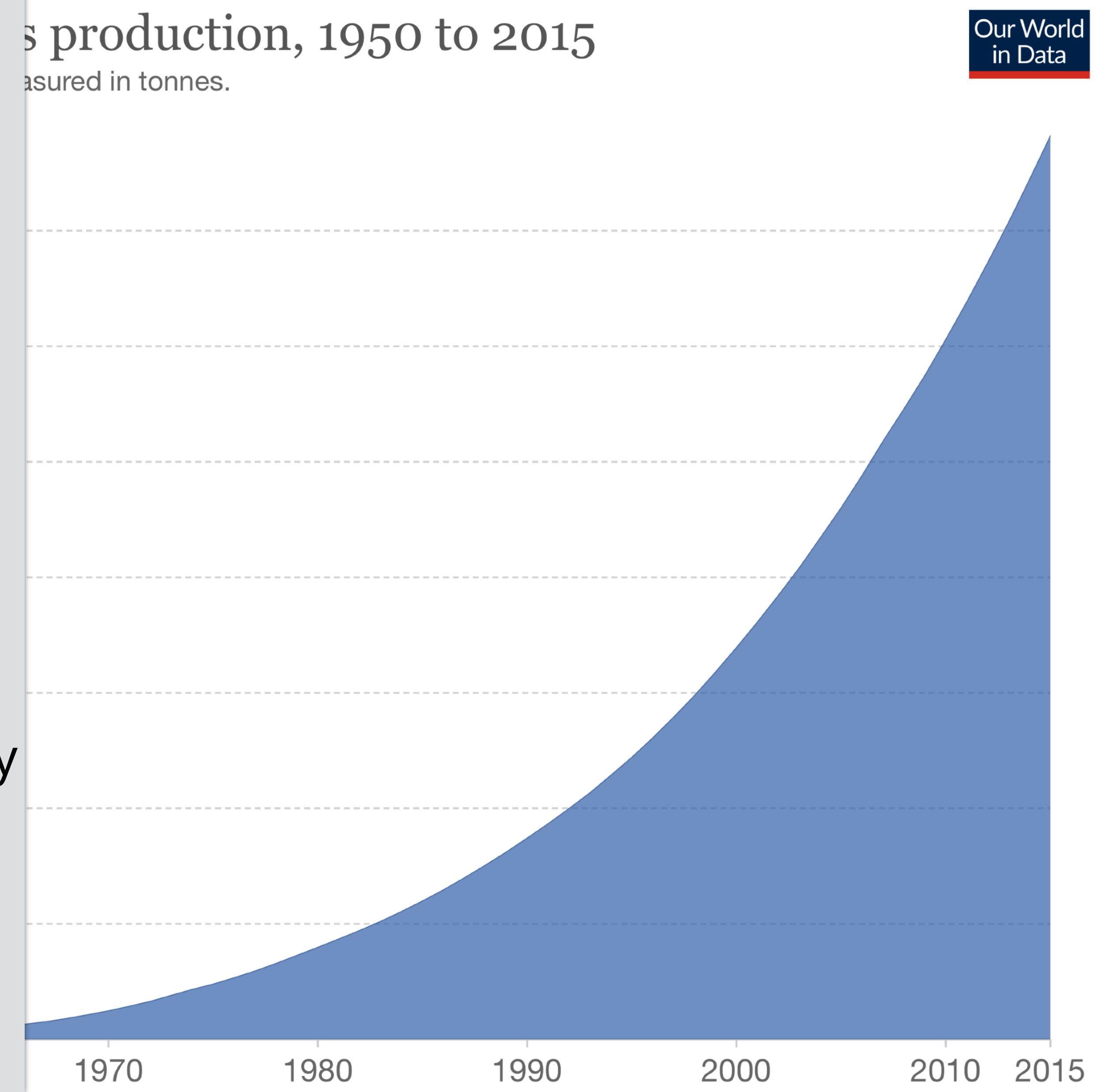


2% annual increase in production:
2025: 550 Mt
2035: 670 Mt
2045: 817 Mt

Total production:
2015: 7 Bt
2045: 26 Bt

1% in the ocean: 260 Mt

In coastal built environment increasingly
prone to disasters:
1.7 Bt



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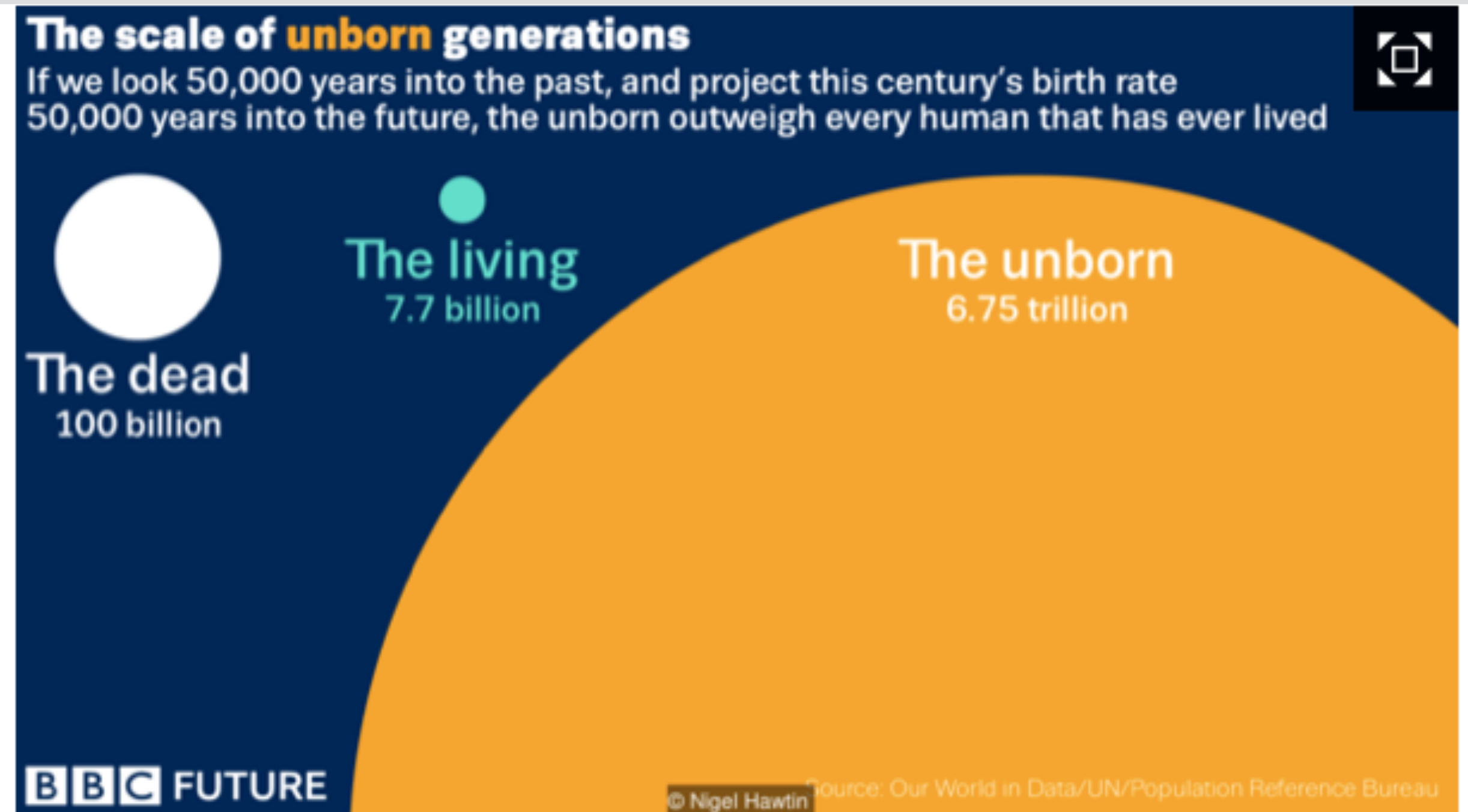
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Plastics in the planetary physiology will impact the 500 billion+ to be born during the next 5,000 years.

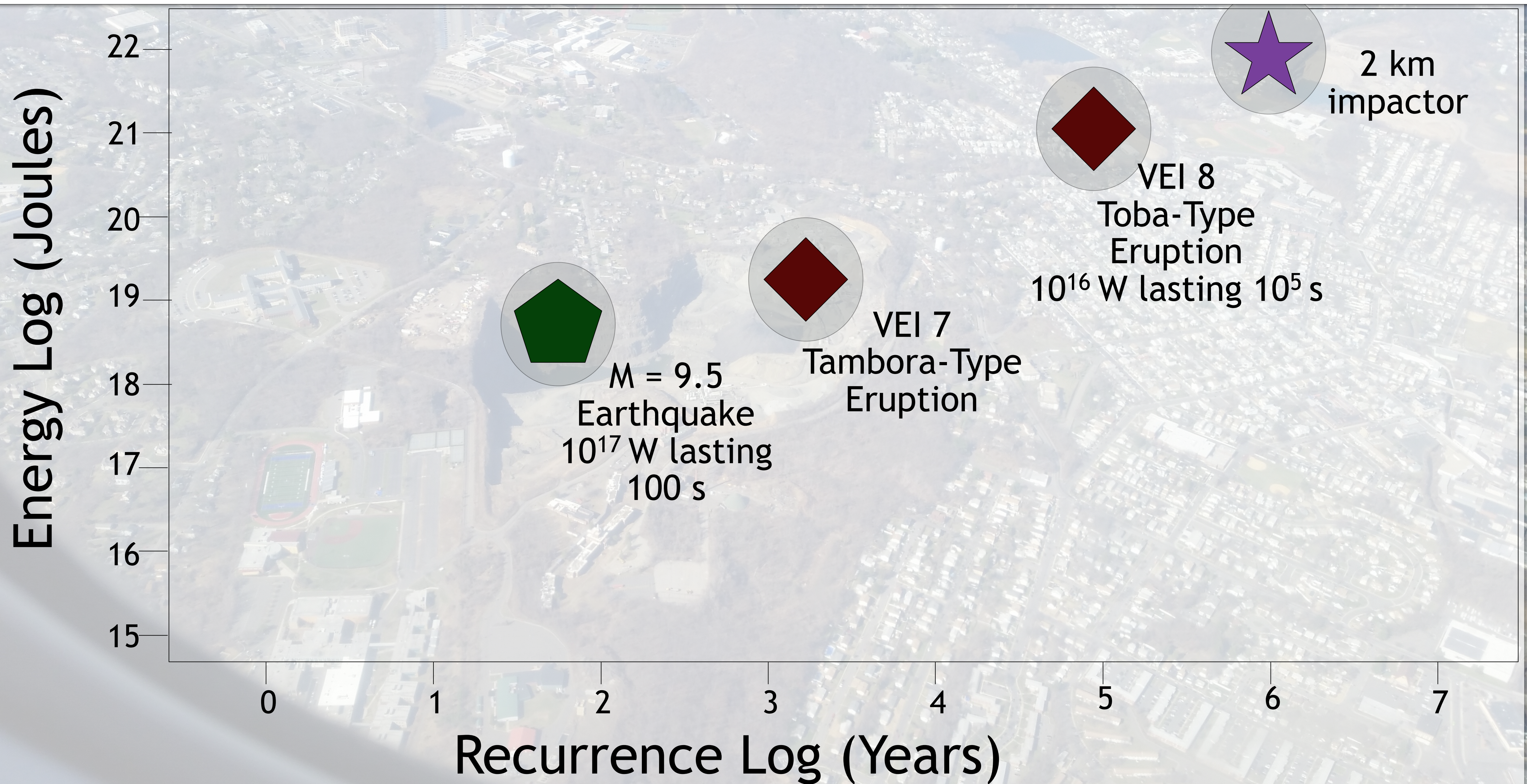
Does the plastics crisis violate the rights of those not yet born?



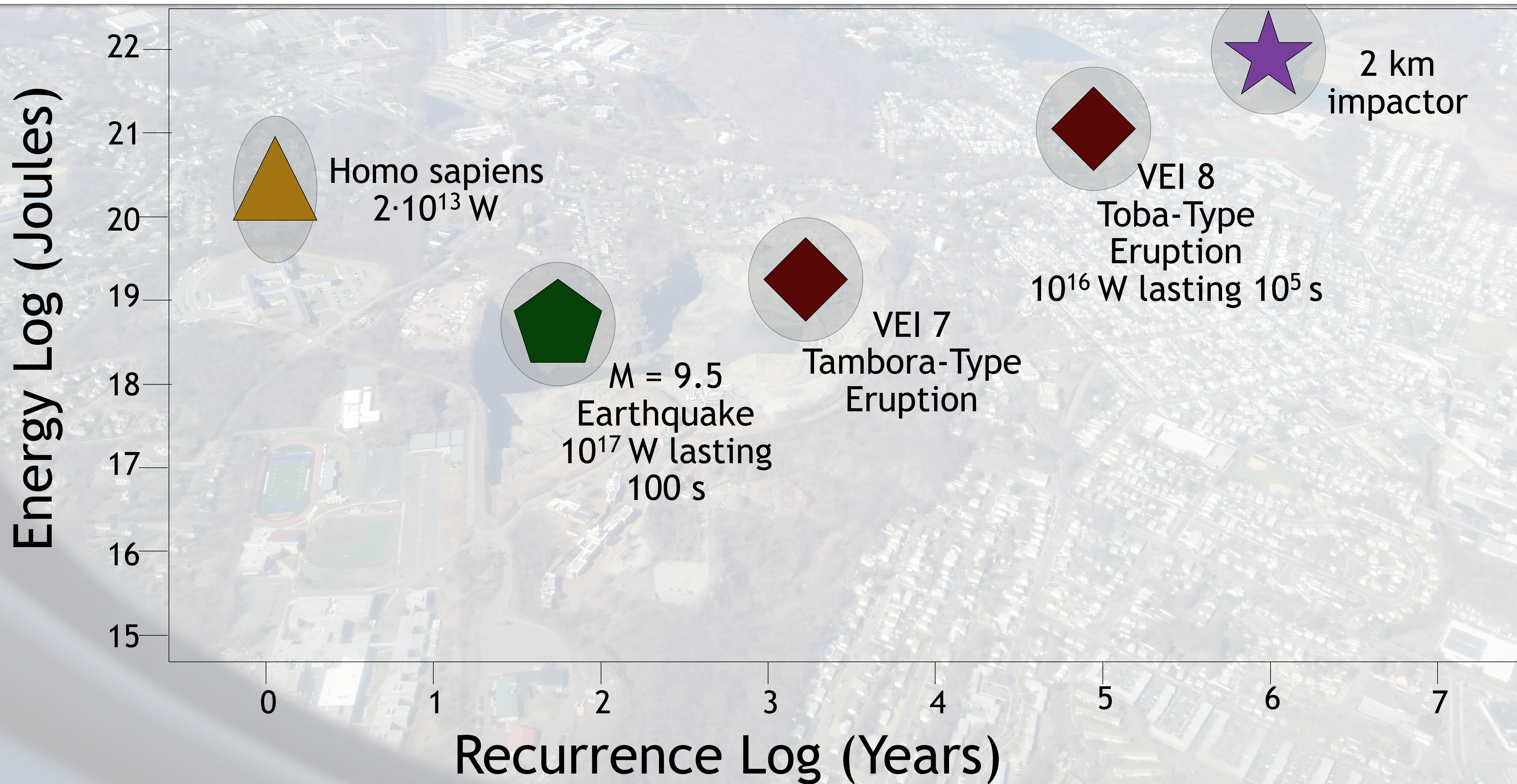
The Role of Home sapiens in the Earth's Life-Support System



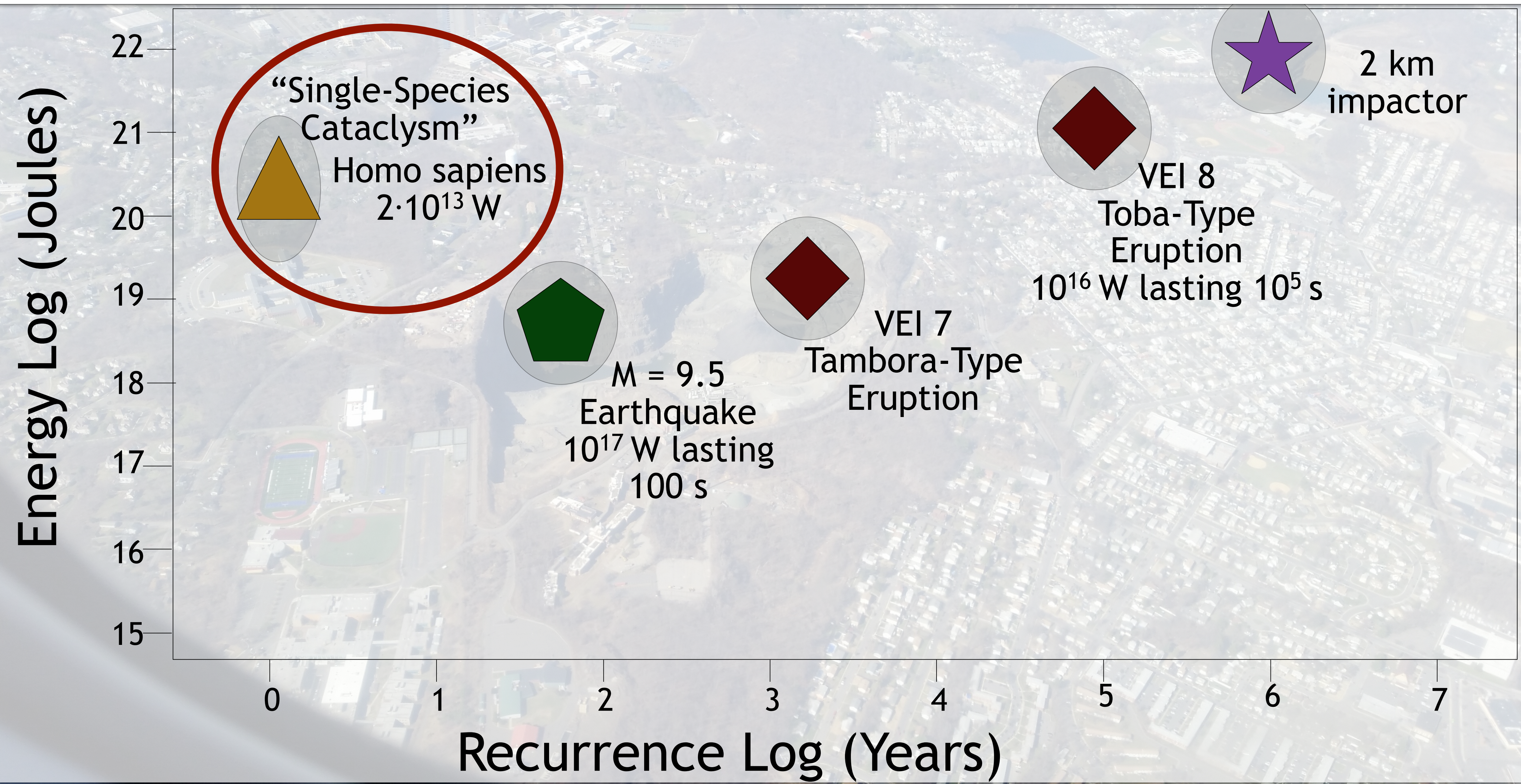
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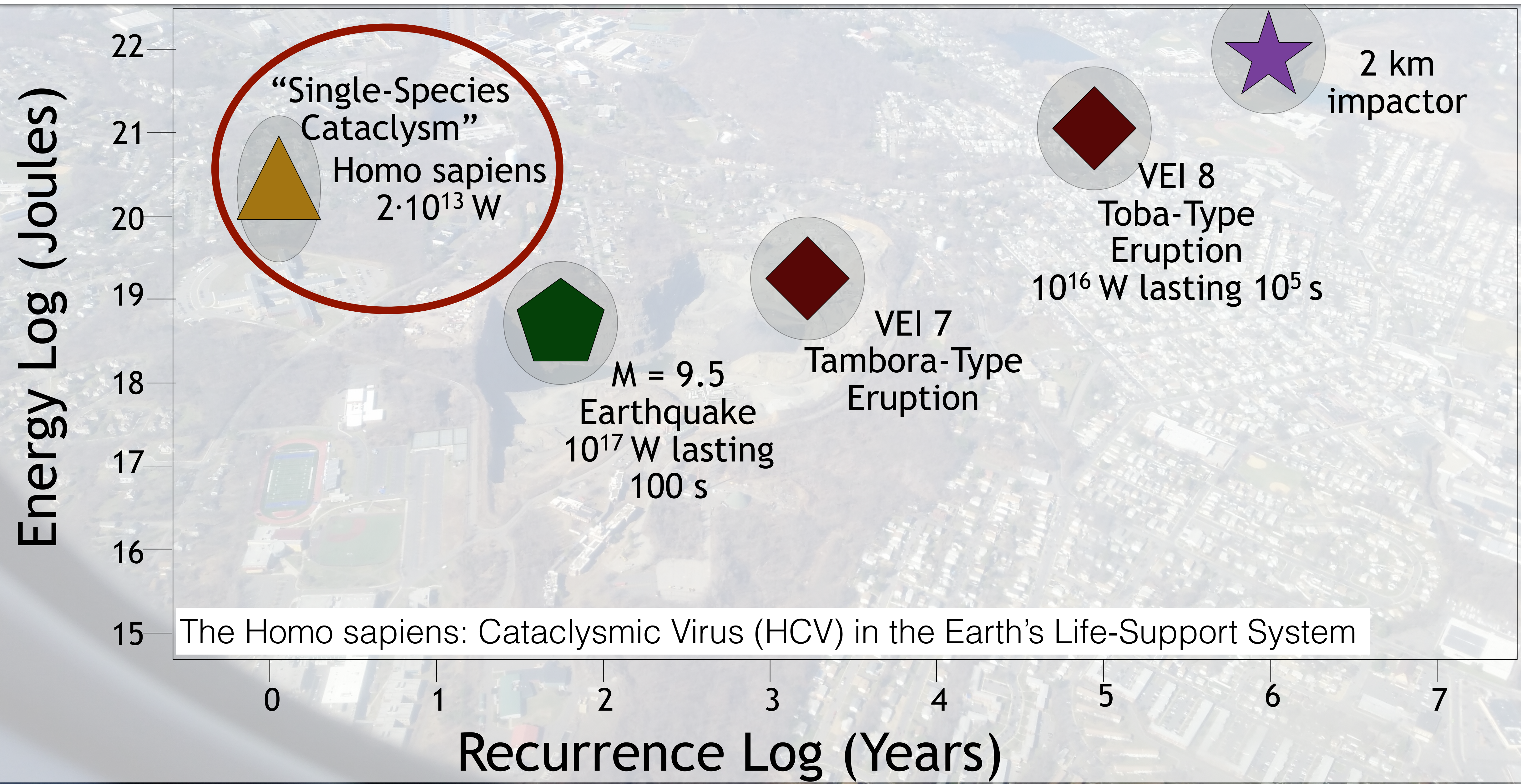
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The Homo sapiens: Cataclysmic Virus (HCV) in the Earth's Life-Support System

Post-Pandemic or Pandemic?

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Earth's life-support system

Goal: increasing biodiversity

Number: 1



Human (HCV)

Goal: unlimited growth

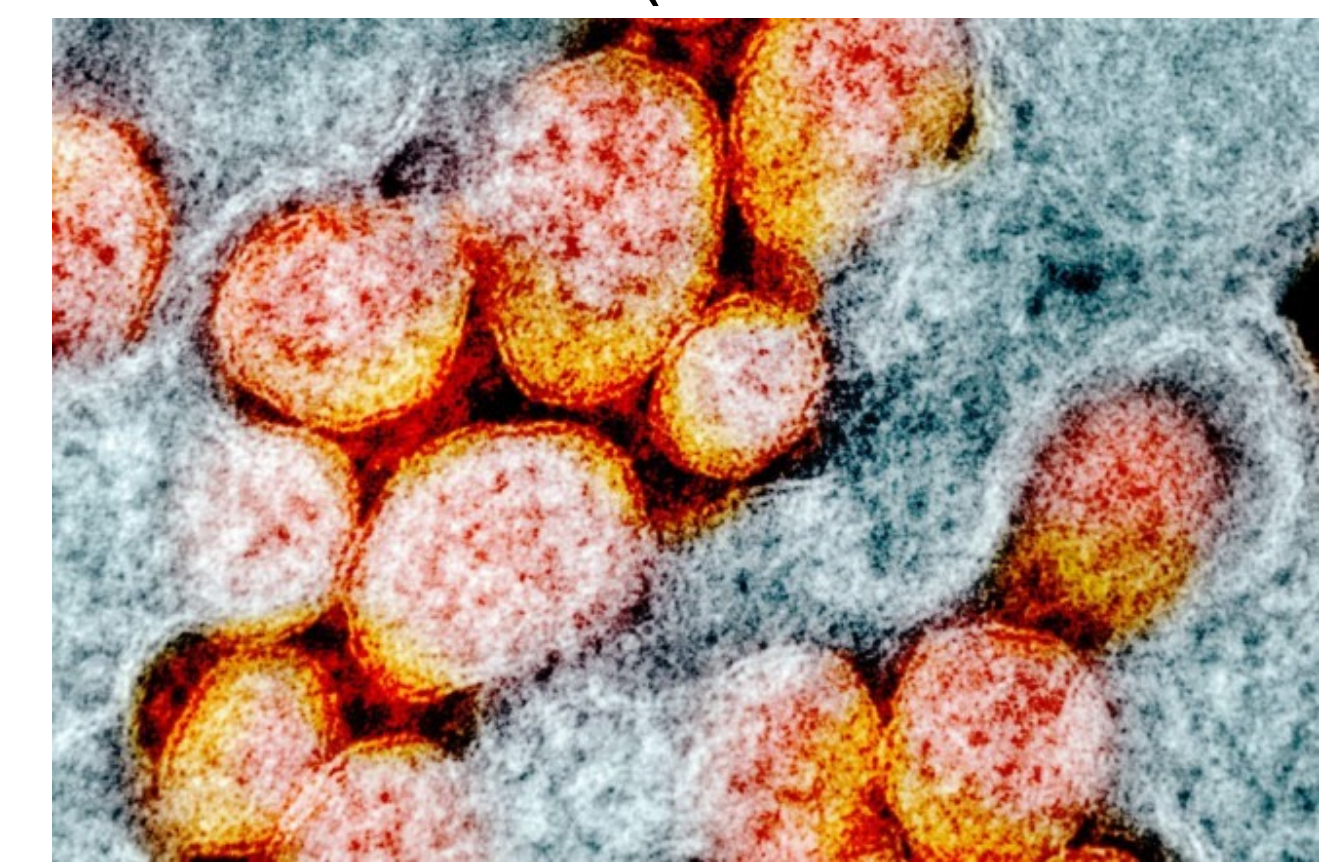
Number: 8 billion



Coronavirus

Goal: unlimited growth

Number: ?(viral load unkown)



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12,742,000 m

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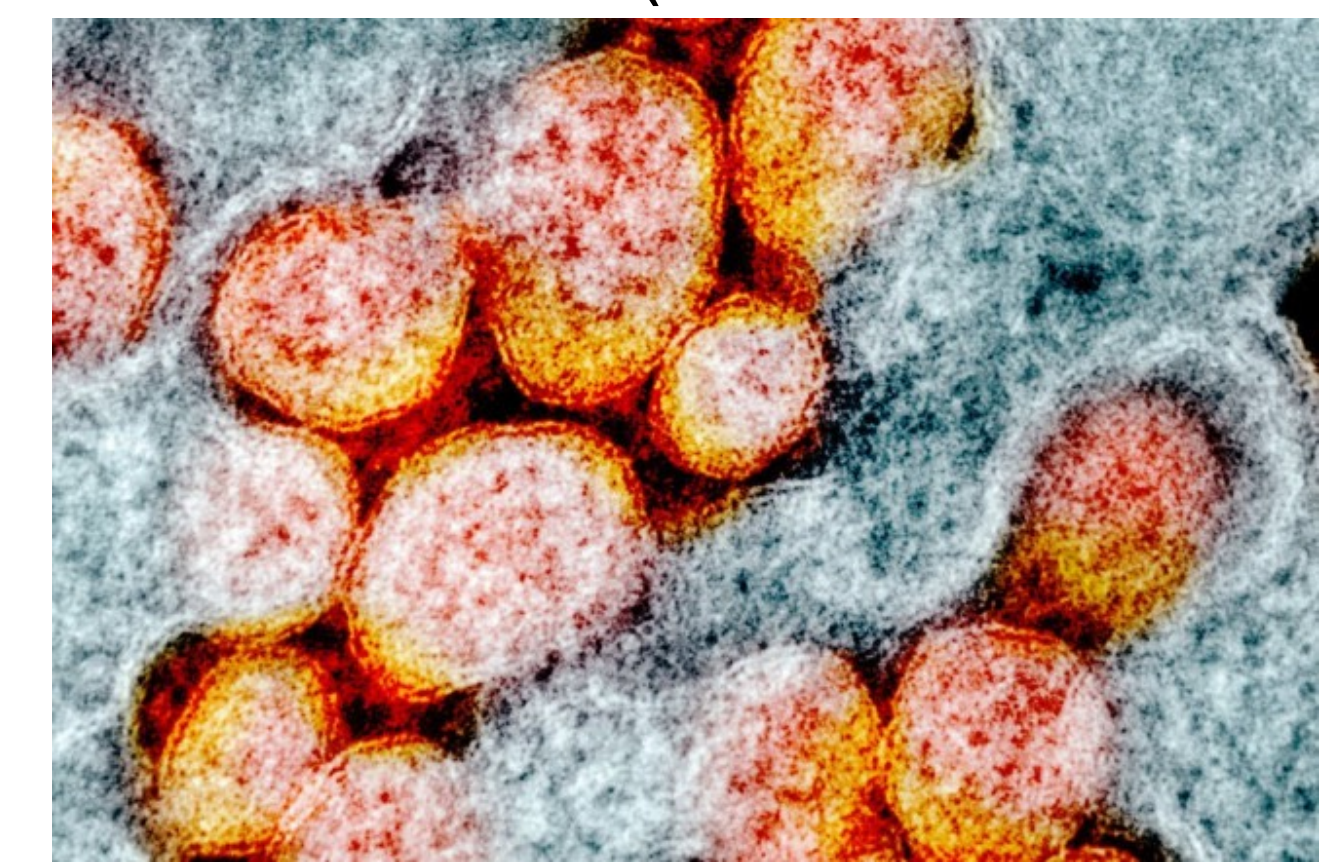
1.8 m

Ratio host/virus: $7 \cdot 10^6$

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Ratio host/virus: $15 \cdot 10^6$



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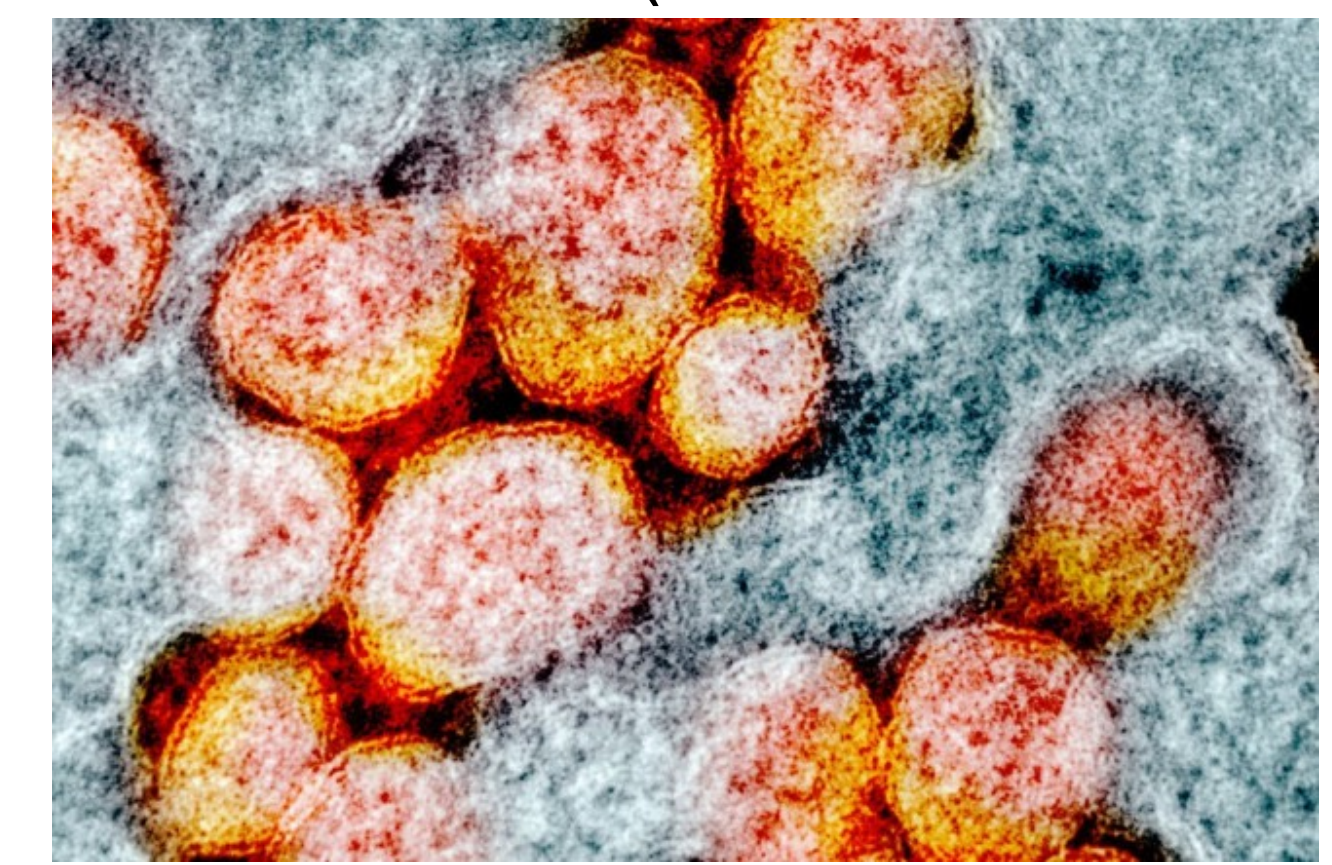
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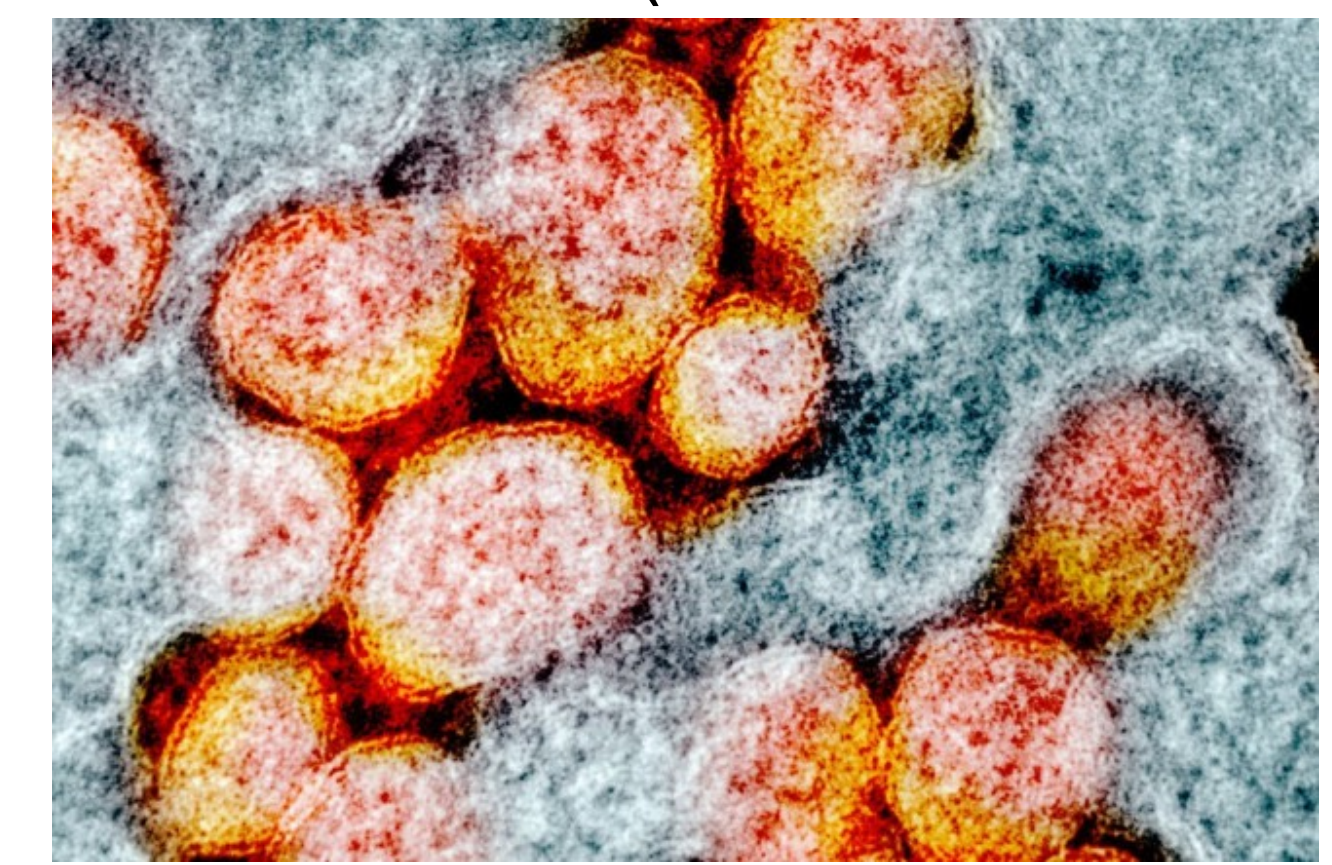
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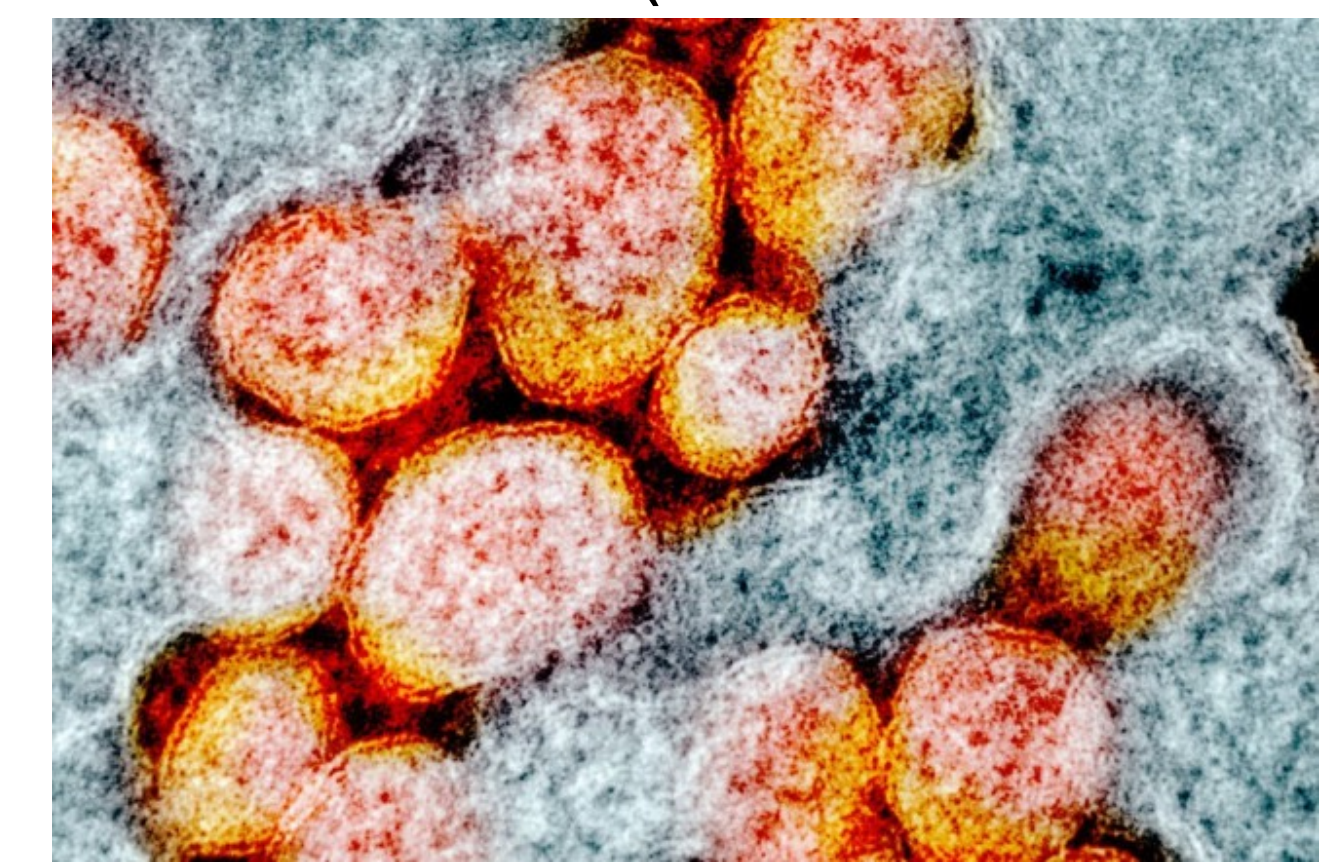


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Homo sapiens: The Anthropogenic Cataclysmic Virus

First species to cause a pandemic in the planetary life-support system

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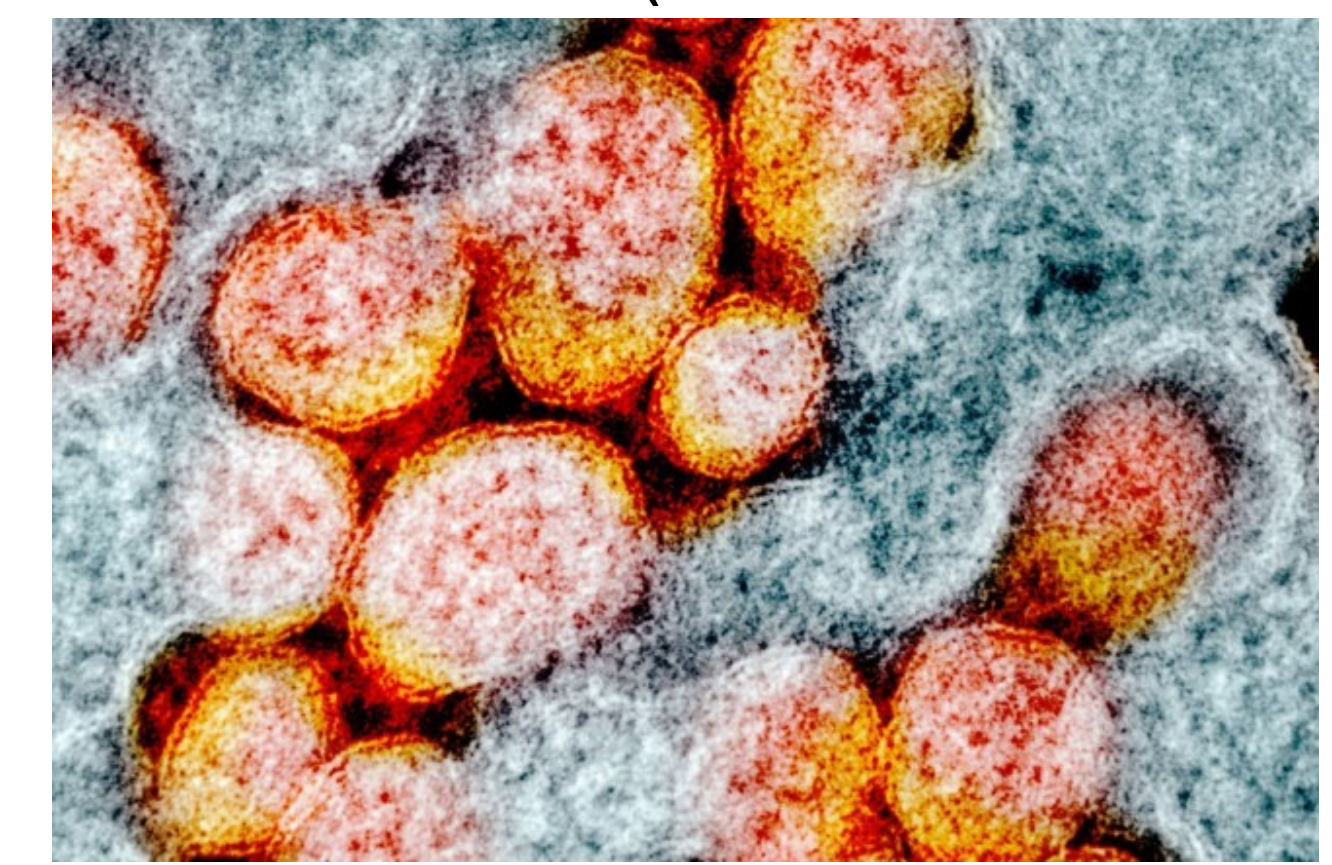
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Can the “virus” transform itself into the “healer”?

Paradigms limit options that are considered

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Sea Level Paradigm:

Current paradigm (normalcy bias based on Holocene experience):

- sea level is very stable
- coastlines don't move horizontally

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Sea Level Paradigm:

Current paradigm (normalcy bias based on Holocene experience):

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New paradigm (proposed based on foresight):

- sea level changes a lot
- coastlines do move horizontally a lot



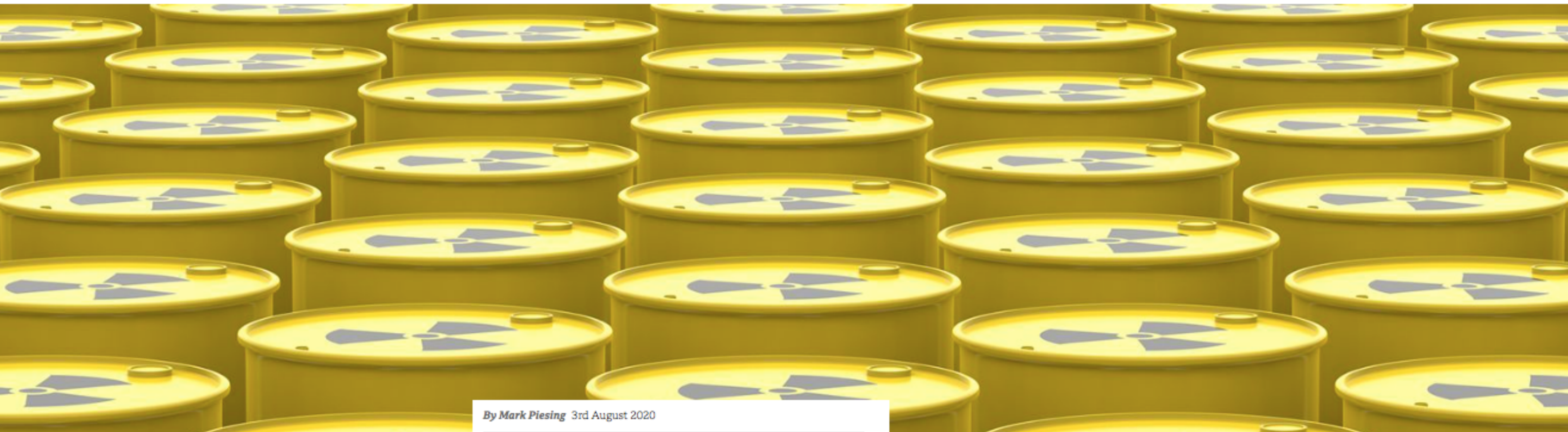
Maybe not New York
but
Jakarta may look like that before the end of the century



Maybe not New York but Jakarta may look like that before the end of the century

NUCLEAR

How to build a nuclear warning for 10,000 years' time



By Mark Piesing 3rd August 2020

ADVERTISEMENT

Adaptation to Post-Holocene

- New paradigm** (based on foresight):
- sea level changes a lot
 - coastlines do move horizontally a lot



- sea level changes a lot
- coastlines do move horizontally a lot

Some fundamental consequences of the new paradigm:

- Redefine/manage real estate property in the coastal zone;
- Design the urban coast with future inundation as design principle;
- Anticipate new extreme events;
- Invent adaptive infrastructure moving with the coast line;
- Live where it is safe and work where it is needed;
- Redistribute risk between individuals, communities, states, country;
- Take responsibility for future generations: convention on marine debris originating from the urban coast.



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We need to constrain the present to liberate the future








"You maniacs! You blew it up! Damn you!
Goddamn you all to hell!"

I saw this movie when I was 20
years old.

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 **Your 20 yr**
Old Self?

The background of the entire image is a composite. On the left, the Statue of Liberty is visible against a blue sky. On the right, a beach scene is shown with waves crashing onto the shore, a person standing near a horse, and another horse in the distance.

"You maniacs! You blew it up! Damn you!
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Let's hope that future generations have something better to say about us ...

I saw this movie when I was 20 years old.



Your 20 yr
Old Self?

A white circle with a thin grey border, centered on the page. Inside the circle, the text 'A few very rich families' is written in a black, sans-serif font.

A few very rich families

