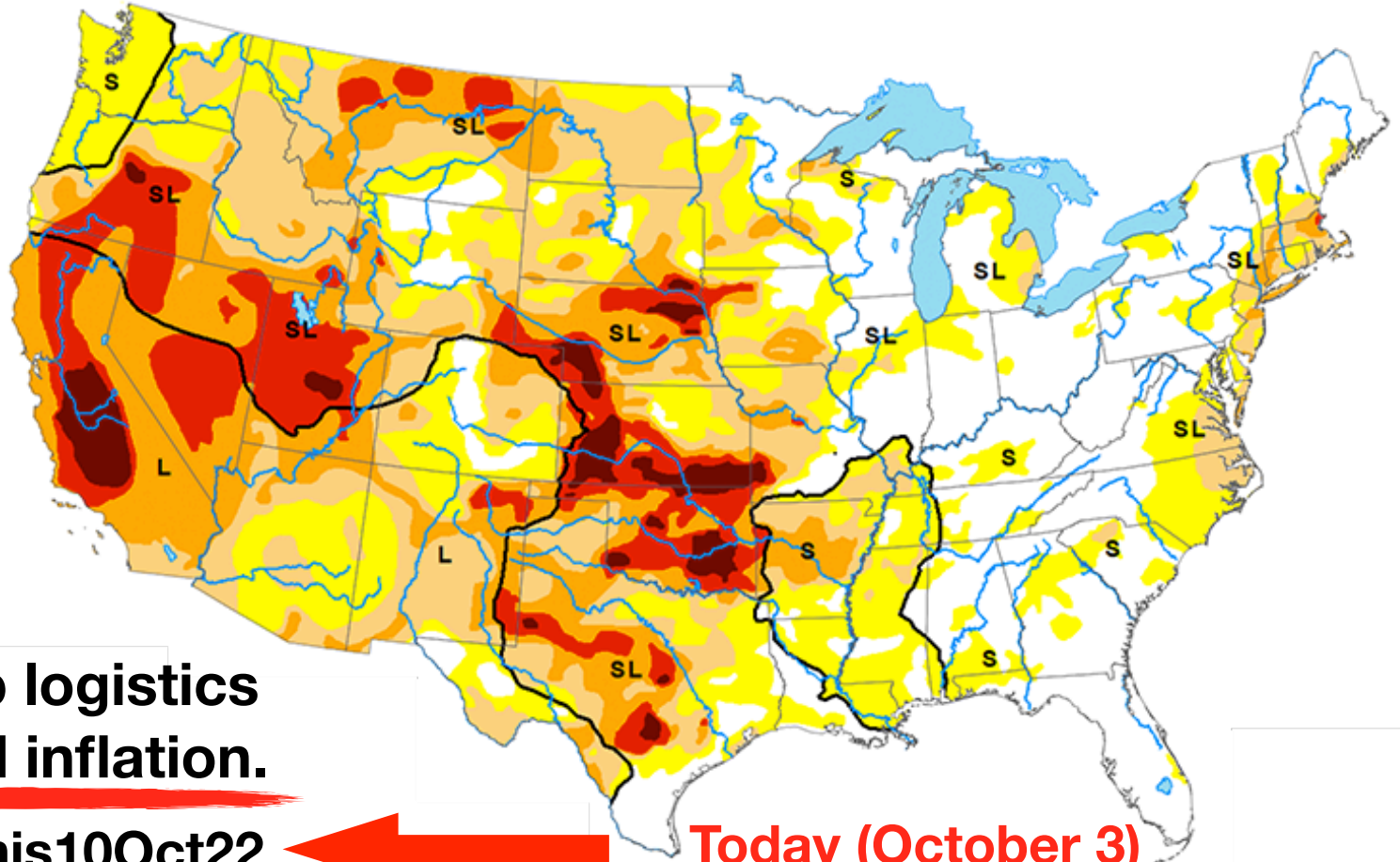
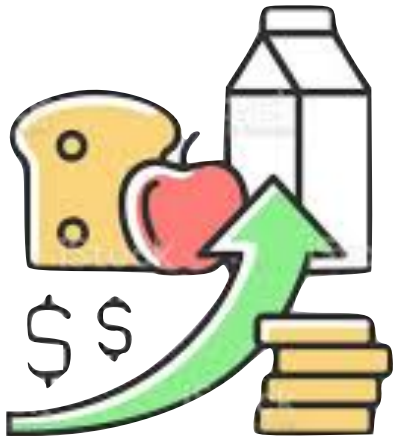


Doug Grandt - Putney, VT

1965-1970	B.S. Industrial Engineering (minor in Petroleum Engineering)
1970-1972	Humble Oil (computer simulation for Prudhoe Bay strategy)
1972-1996	APL and NYK ocean shipping (Corporate Planning, etc.)
1997-1999	AT&T systems Y2K remediation Project Manager
1999-2005	K/P Printing, Direct Mail and Fulfillment (VP, Data Processing)
2005-2012	California EPA / Air Resources Board (GW Solutions Act of 2006)
2012-2020	Retired and deployed Rex Tillerson campaign (TellRex.com)
2007-2022	Al Gore's "The Climate Project" (now "Climate Reality")
2007-2022	1Sky.org (now 350.org) lobbied California Senators and Reps.)
2009-2015	Citizens' Climate Lobby (~60 lobby meetings in DC)
2014-2022	Lobby Nebraska and Vermont Congressional delegations
2011	Tarsands Action at the White House (arrested)
2012	Tar Sands Blockade in East Texas (arrested - 48 hours)
2013-2016	Bold Nebraska and various pipeline direct actions
2015-2020	Advise and assist Senator Sanders' Climate & Env. staff
2019-2020	Lobbied (letters, email) Senator Murkowski and Manchin
2016	Standing Rock (4 stays during August through November)
2019	Fire Drill Fridays with Jane Fonda (arrested twice)
2018-2022	Healthy Climate Alliance, Restore Our Climate, PRAG, HPAC

Map released: September 29, 2022

Data valid: September 27, 2022

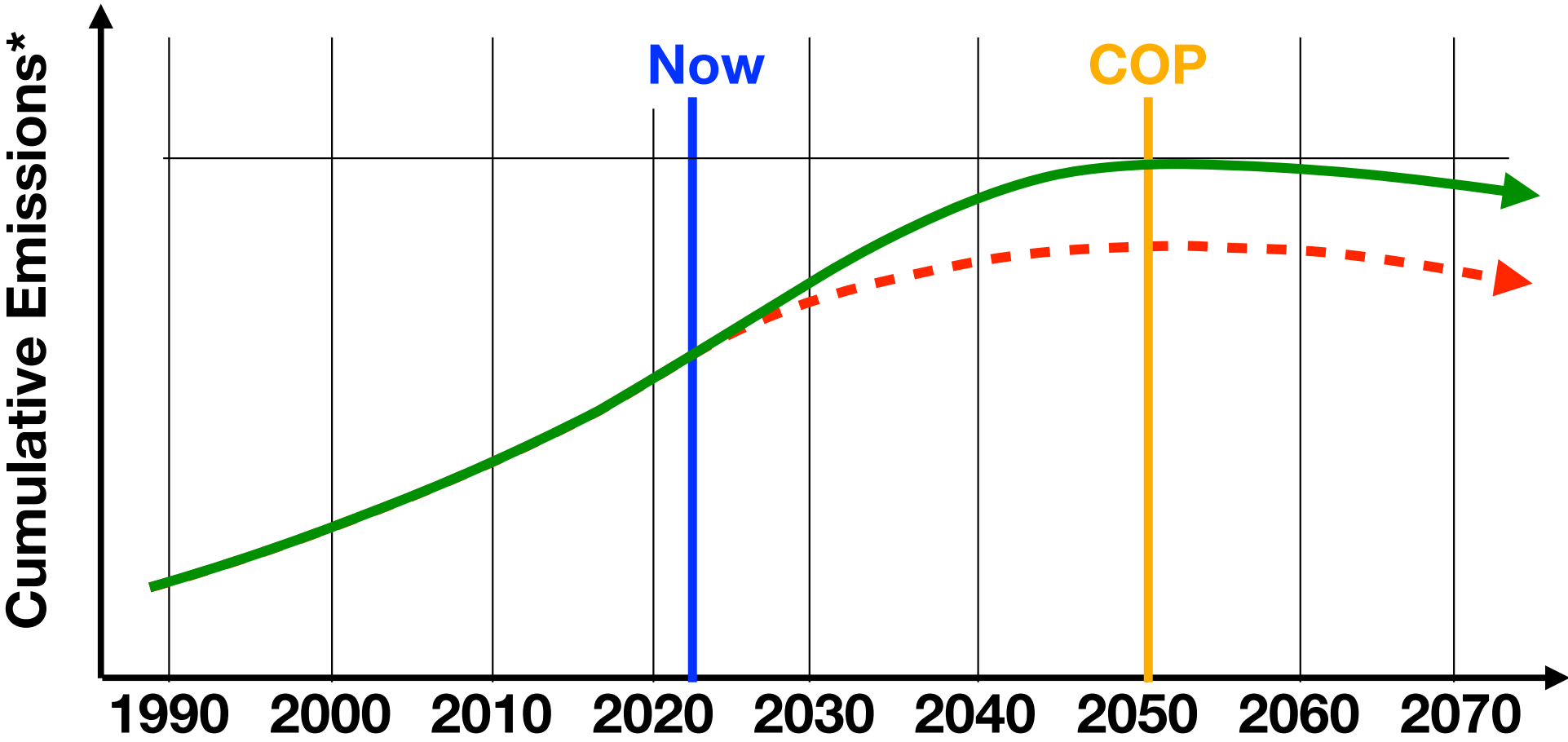


Mississippi crop logistics
exacerbate food inflation.

[Bit.ly/ABCmemphis10Oct22](https://bit.ly/ABCmemphis10Oct22)

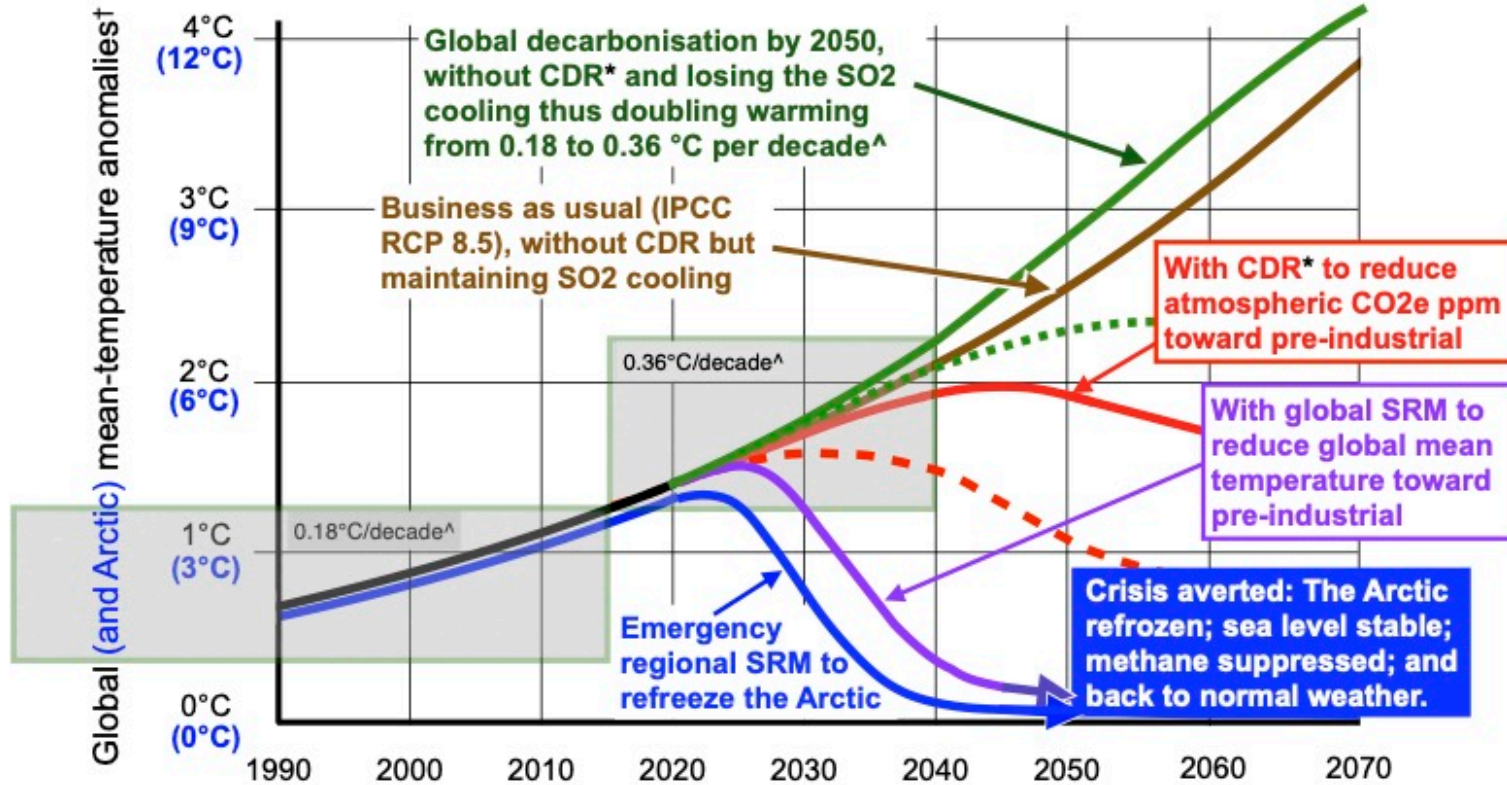
Today (October 3)

Atmospheric CO2 Concentration (ppm)



* Conceptual - complicated by the "Faustian Bargain" (Hansen)

Global-mean and Arctic temperature trajectories for various scenarios, with and without CO2 removal (CDR*) and Solar Radiation Management (SRM)



--- and --- are projections from certain models

† Global temperatures (Arctic temperatures in blue) are relative to pre-industrial norms.

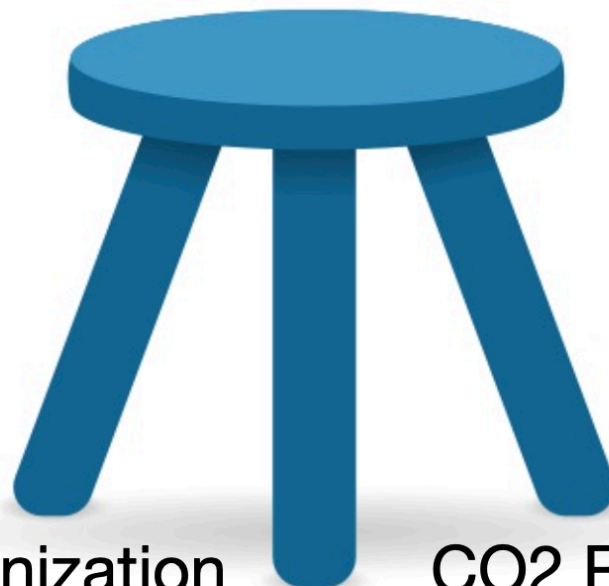
* CDR at 60+ GtCO2e/year including suppression of methane and black carbon.

^ July Temperature Update: *Faustian Payment Comes Due*, published 13 August 2021, James Hansen and Makiko Sato

12 Feb 2021 Temperature trajectories diagram

© Planetary Restoration Action Group (2021)

Updated 20 February 2022



Decarbonization

CO2 Removal

Cool the Arctic

Third Act Vermont - Climate Action Team - October 4

Existential threats (here and now)
Michael Mann: “Urgency and agency”

Long term drought

- Canada (Ontario, Prairie provinces)
- Southwest (CA to TX) 43% US
- South America & Central America
- Europe (France, Portugal, Norway)
- Africa
- China
- India
- Indonesia
- UK

Life threatening emergencies
Global urgent response now
Mass migration for survival

Extreme Flooding (same list of regions)
Agricultural Failure (crops & livestock)
Potable Water (ground, rivers, glaciers)
Irrigation Water Supply (same sources)
Canadian Heat Dome
Texas Deep Freeze

Not simply “climate change” (**albedo**)
Exacerbated by **jetstream & polar vortex**
Cause: **pole-to-tropics temp gradient**

Google Groups - Participants - Emails and zoom meetings

Healthy Climate Alliance	Zoom - fortnightly (Saturdays)
Healthy Planet Action Coalition	Zoom - fortnightly (Thursdays)
Planetary Restoration Action Group	Zoom - fortnightly (Mondays)
Nature-based Ocean & Atmospheric Cooling	Zoom - fortnightly (Mondays)
Restore Our Climate (dot) Earth (non-profit)	Zoom - ex-weekly (Sunday)
Arctic Methane Emergency Group	Email only
Carbon Dioxide Removal	Email only

SME (Subject matter experts)
Scientists
Professors
Engineers
Policymakers

Australia	3
France	1
Germany	1
Italy	1
New Zealand	1
Switzerland	1
UK	1 dozen
USA	3 dozen

PHYS  **ORG**

April 28, 2022

DIMINISHING ARCTIC SEA ICE HAS LASTING IMPACTS ON GLOBAL CLIMATE





MAY DAY

DISTRESS SIGNAL
LIFE THREATENING
EMERGENCY

MAY DAY

Earth's Albedo 1998–2017 as Measured From Earthshine

[P. R. Good](#), [E. Pallé](#), [A. Chepurko](#), [S. Shoumko](#), [P. Montañes-Rodriguez](#), [S. E. Koch](#)

First published: 29 August 2021 — <https://doi.org/10.1029/2021GL094888>

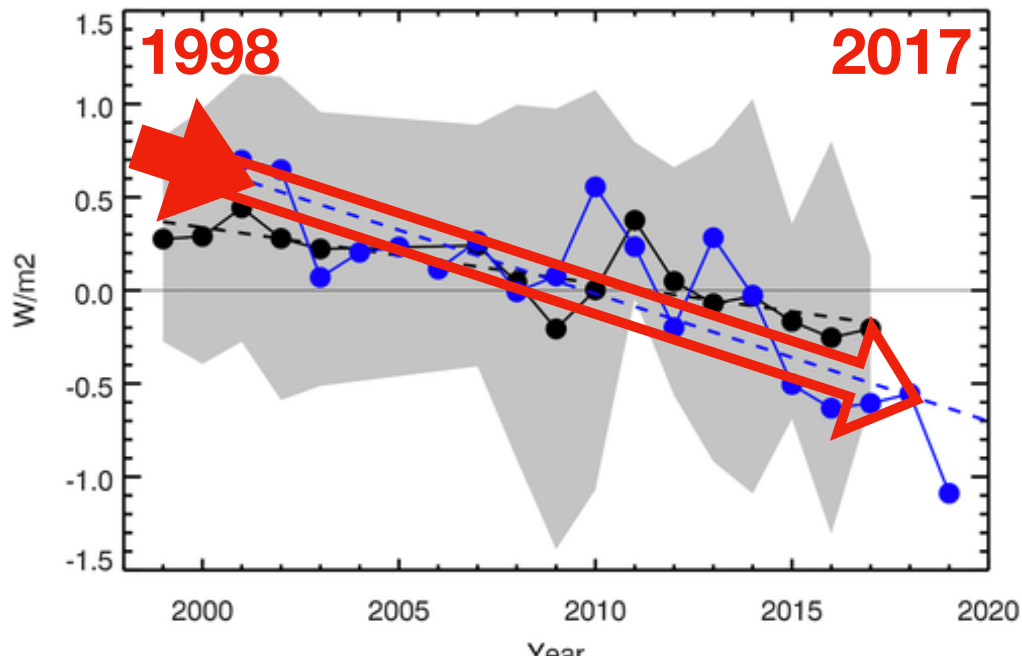
2.2 Earthshine Data Analysis

The full methodology for determining albedo from earthshine is detailed in two lengthy papers, see Qiu et al. (2003) and Pallé et al. (2003), and analyses of the data up through 2014 were given in several papers (Pallé et al., 2004, 2009, 2016). Briefly, we observe the relative brightness of two fiducial regions (Crisium and Grimaldi) on opposing edges of the Moon, one being in the sunshine and the other in the earthshine, with the role of each switching depending on whether the Moon is waxing or waning. For a given night, following Qiu et al. (2003) and Pallé et al. (2003), the apparent albedo, is determined as

$$p^*(\beta) = \frac{3}{2f_L(\beta)} \frac{p_b f_b(\theta)}{p_a f_a(\theta_0)} \frac{I_a / T_a}{I_b / T_b} \frac{R_{em}^2}{R_e^2} \frac{R_{es}^2}{R_{ms}^2},$$

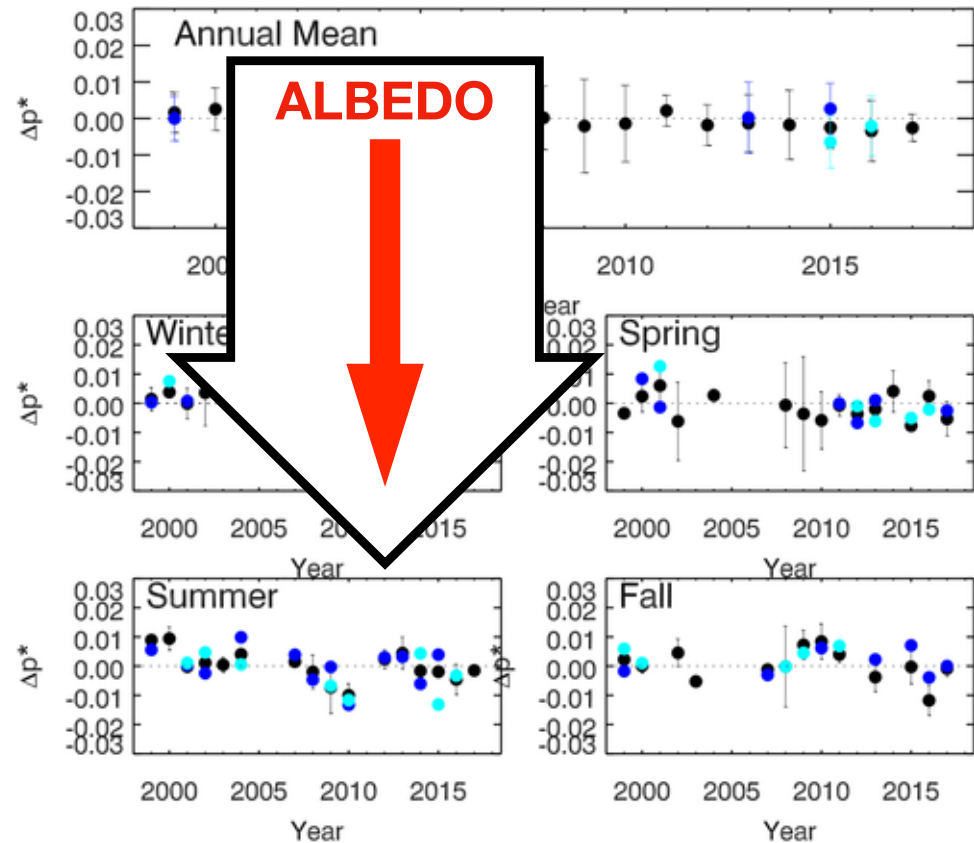


<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094888>



Reflectivity decrease -25%

Earthshine annual mean albedo anomalies 1998–2017 expressed as reflected flux in W/m^2 . The error bars are shown as a shaded gray area and the dashed black line shows a linear fit to the Earthshine annual reflected energy flux anomalies. The CERES annual albedo anomalies 2001–2019, also expressed in W/m^2 , are shown in blue. A linear fit to the CERES data (2001–2019) is shown with a blue dashed line. Average error bars for CERES measurements are of the order of $0.2 W/m^2$.



Mean annual and seasonal albedo trends, 1998–2017, from earthshine observations from Big Bear Solar Observatory. Black points represent the annual (top panel) and seasonal (lower four panels) average albedo deviation from the mean. The blue and cyan points represent annual and seasonal data from the positive (east-looking) and negative (west-looking) lunar phases, respectively.

LOST RADIATIVE FORCING

is about equal to

ANTROPOGENIC FORCING

EARTH SHINE
REFLECTIVITY
ALBEDO

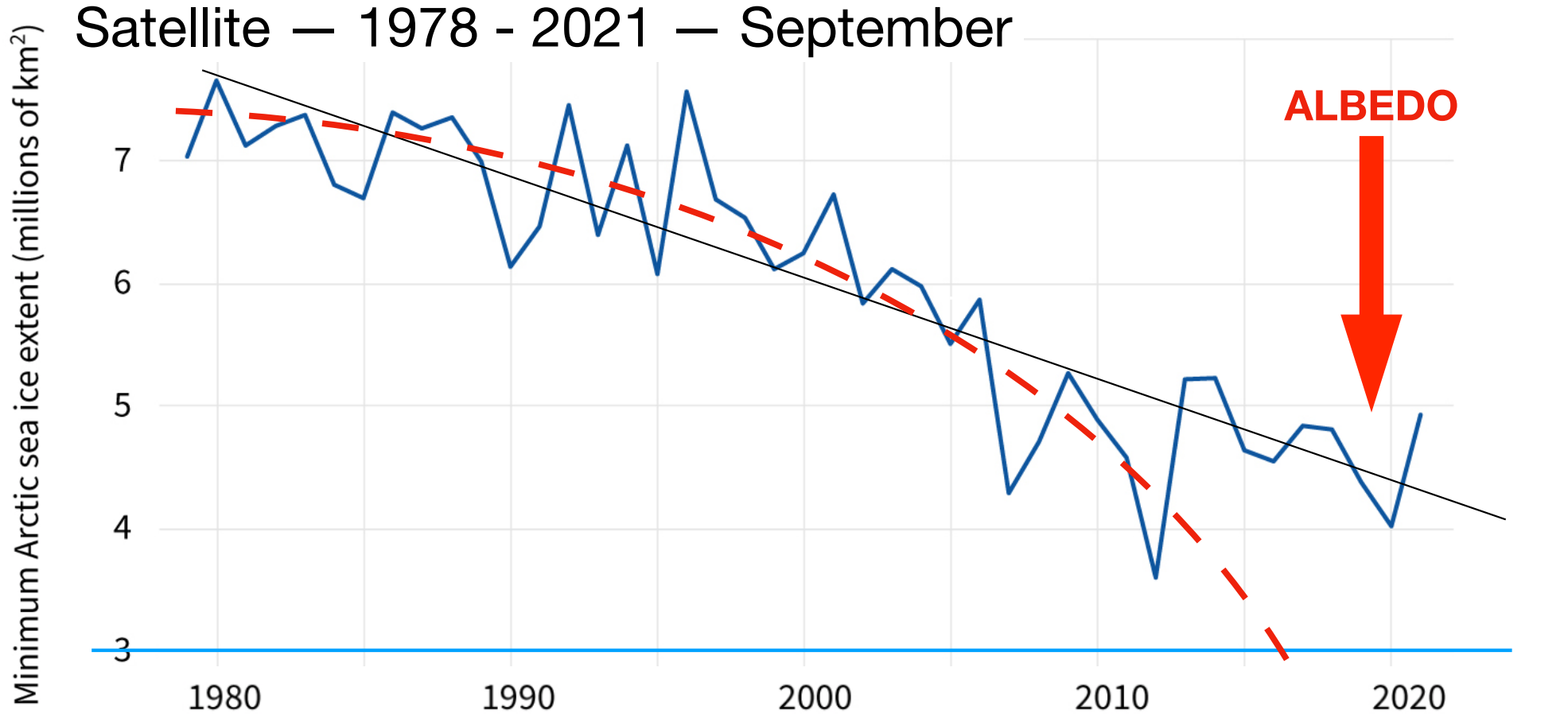
ALBEDO

OIL
GAS
COAL

The two-decade decrease in earthshine-derived albedo corresponds to an increase in radiative forcing of about 0.5 W/m^2 which is climatologically significant (Miller et al., 2014). For comparison, total anthropogenic forcing increased by about 0.6 W/m^2

over the same period.

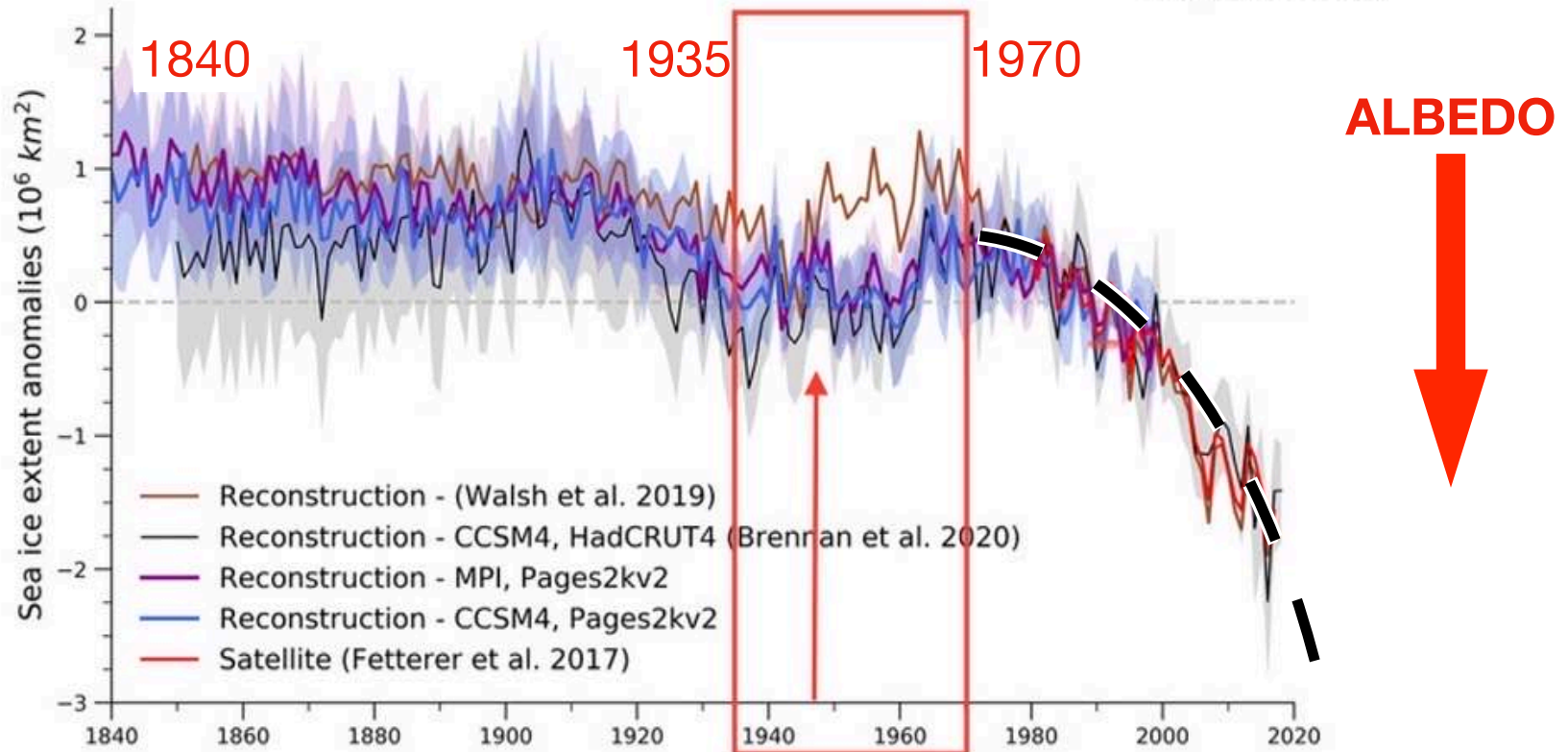
ARCTIC SEA ICE YEARLY MINIMUM



<https://www.climate.gov/news-features/understanding-climate/climate-change-arctic-sea-ice-summer-minimum>

Unprecedented Decline of Arctic Sea Ice

Feb, March 2022



9 March 2022, Nature Climate Change, ARCTIC SEA ICE Unprecedented decline, Jasper Franke
15 Feb 2022, AMS, Reconstructing Arctic Sea Ice over the Common Era Using Data Assimilation

Peter Carter, Climate Emergency Institute

Warming due to Arctic snow and ice loss may well exceed 2 W/sq m, i.e. it could more than double the net warming now caused by all emissions by all people of the world.

Professor Peter Wadhams, 2012:

<http://arctic-news.blogspot.com/2012/07/albedo-change-in-arctic.html>



Loss of Arctic sea ice is effectively doubling mankind's contribution to global warming.

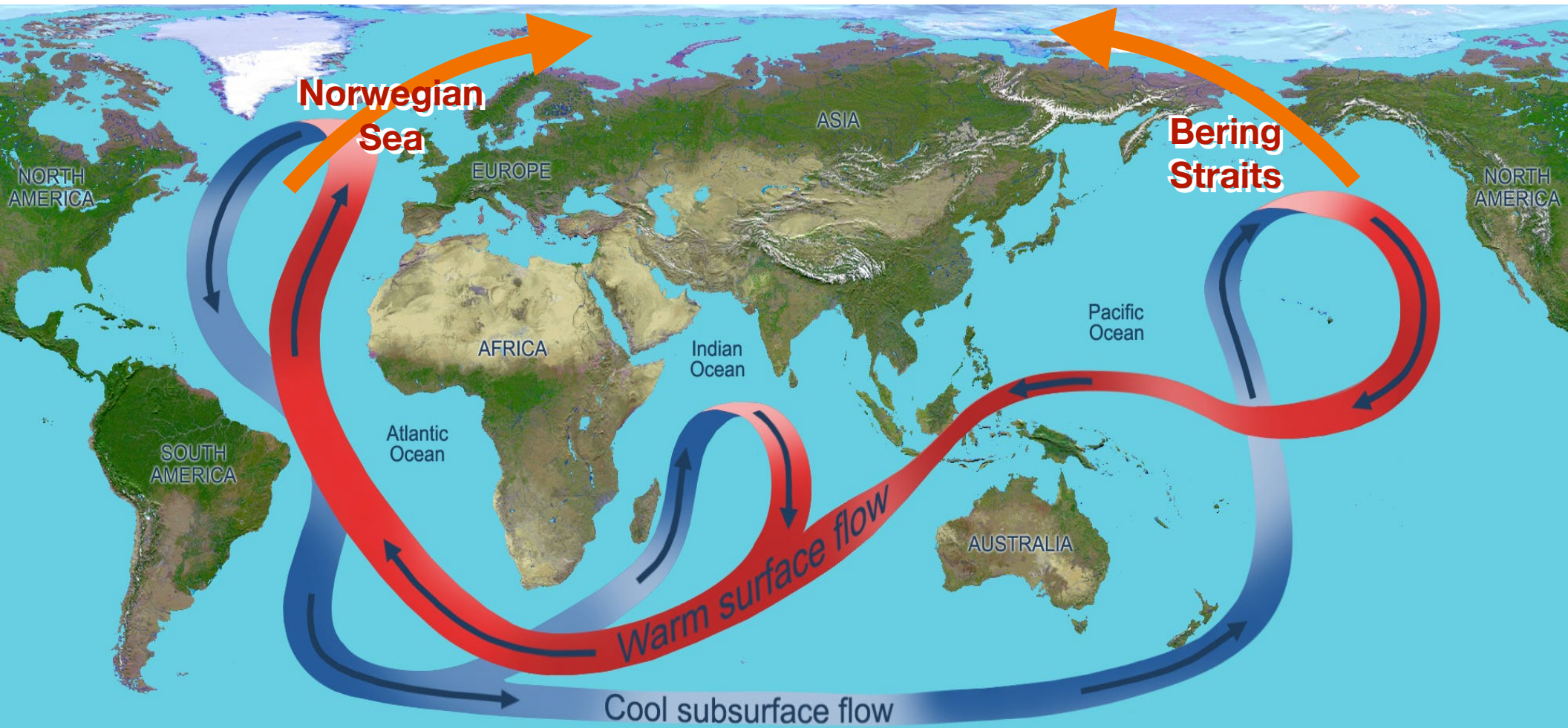
Increased absorption of the sun's rays is "the equivalent of about 20 years of additional CO2 being added by man".

Professor Peter Wadhams in: Arctic ice melt 'like adding 20 years of CO2 emissions',
by Susan Watts, September 5, 2012.

We consider
release of up to
50 Gt of predicted
amount of hydrate
storage as highly
possible for abrupt
release at any time.

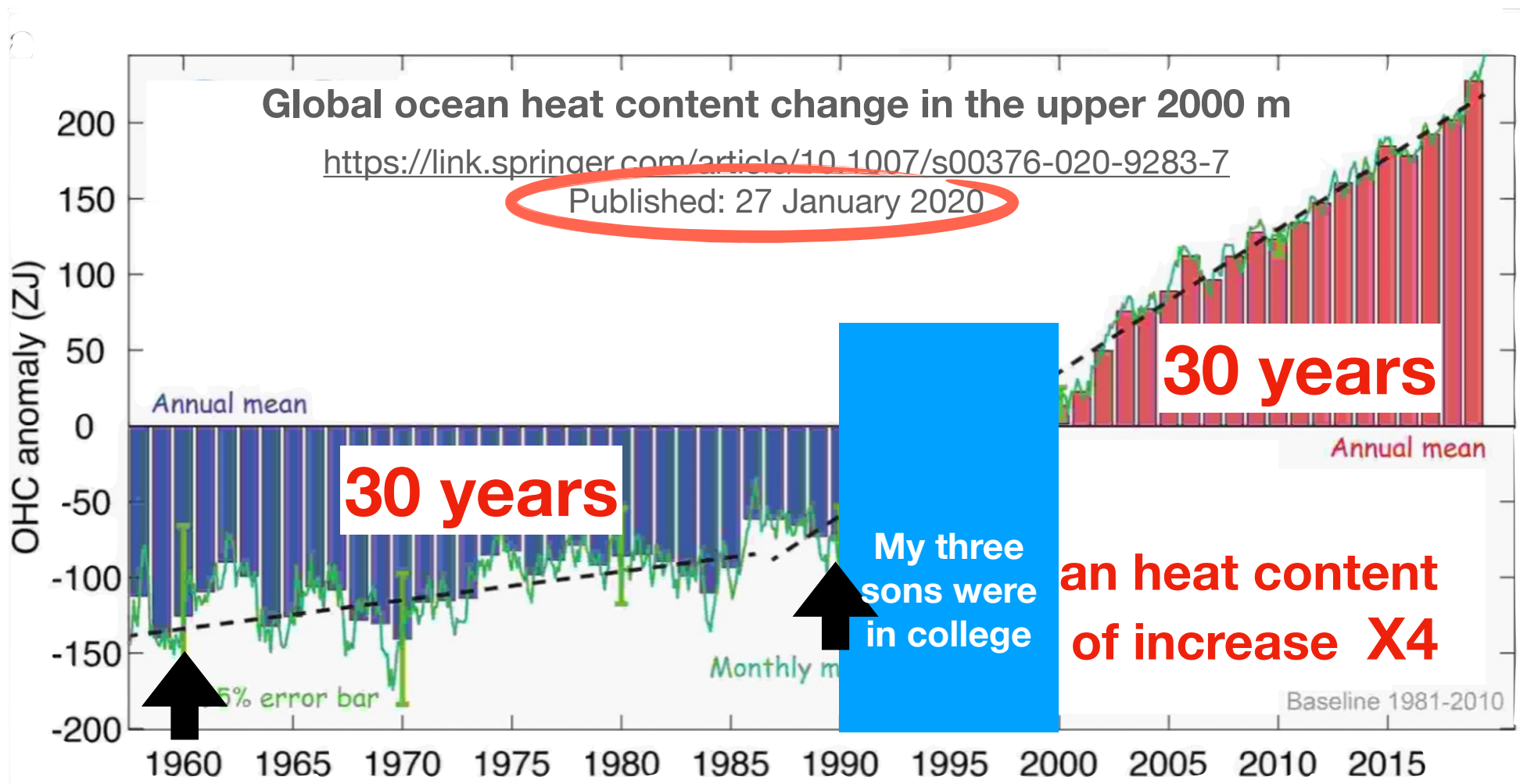
Created for Arctic-news.blogspot.com by Sam
Carana with Nick Breeze video frame and quote
from 2008 EGU paper by Natalia Shakhova et al





**Thermohaline circulation or MOC:
Meridional overturning circulation**

Record Setting Ocean Warmth Continued in 2019



Not simply “climate change” (albedo)
Exacerbated by jetstream & polar vortex
Cause: pole-to-tropics temp gradient

**Stratosphere
(high altitude)**

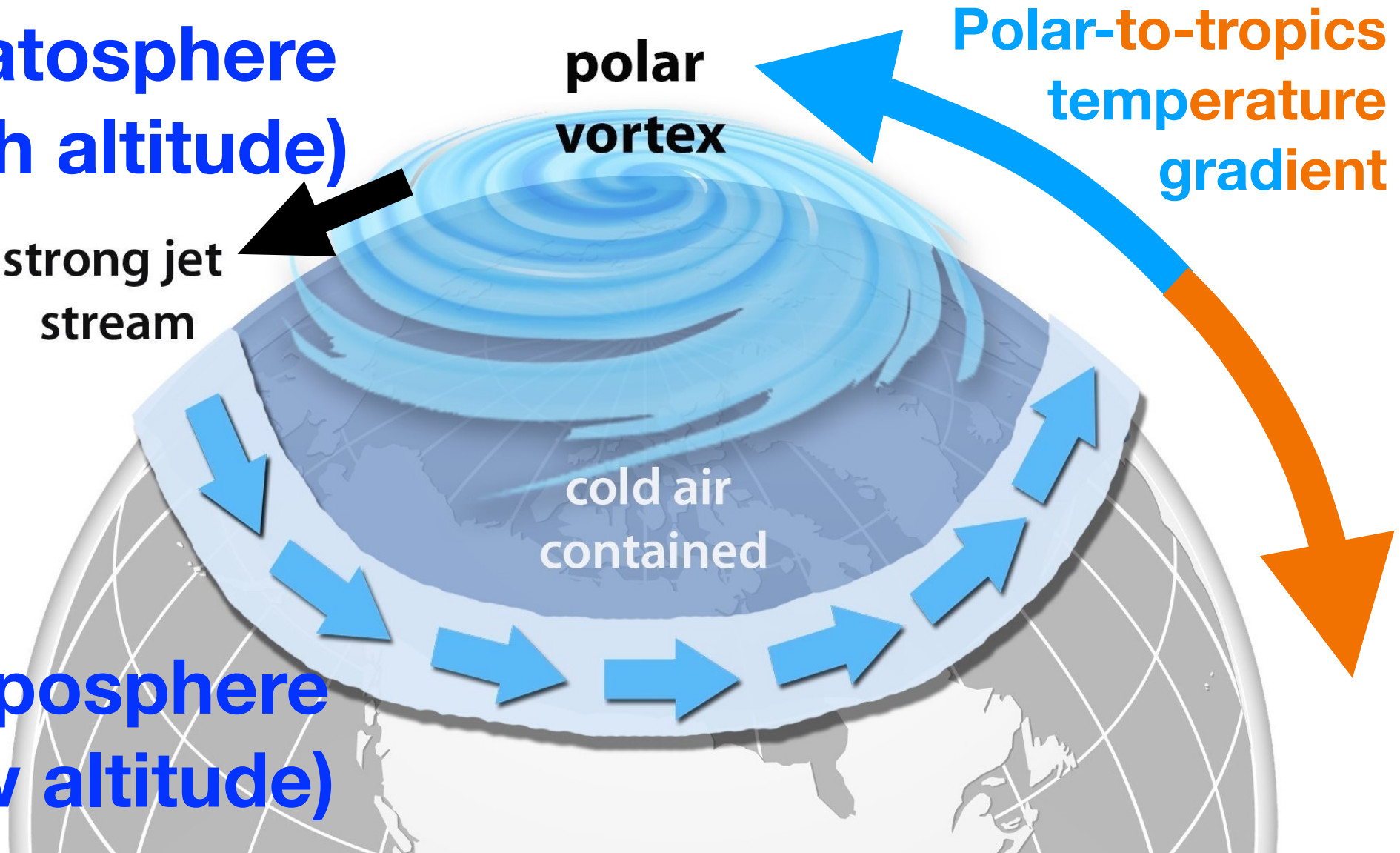
**polar
vortex**

**Polar-to-tropics
temperature
gradient**

**strong jet
stream**

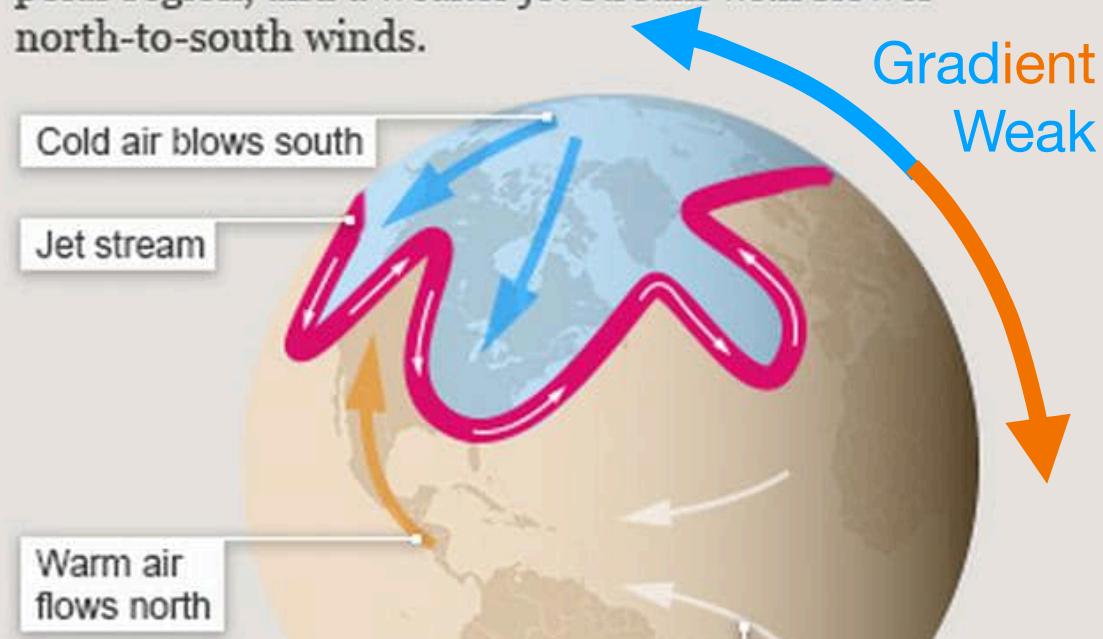
**cold air
contained**

**Troposphere
(low altitude)**

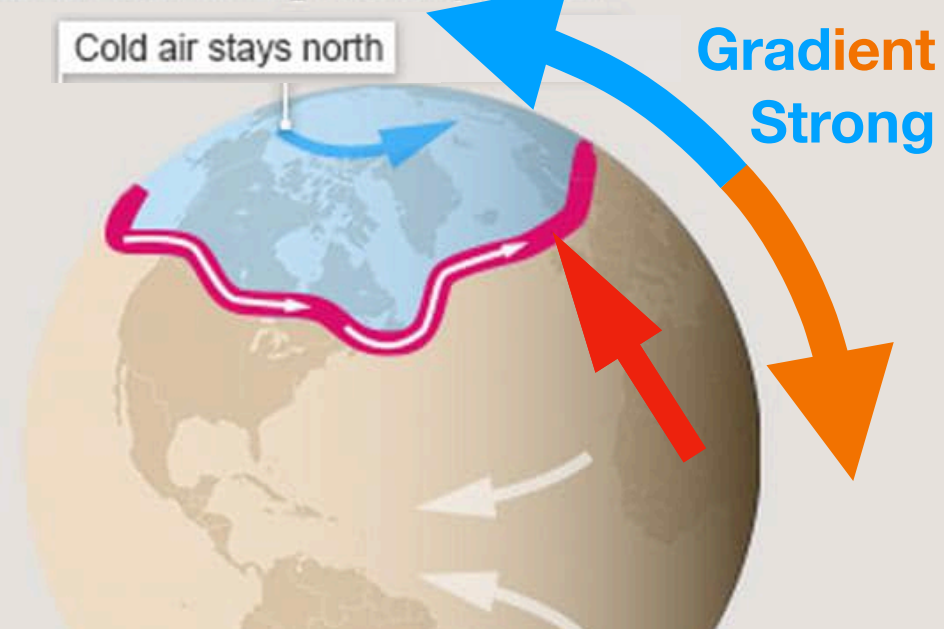


How Arctic winds affect weather patterns

Temperatures dip when there is high pressure in the polar region, and a weaker jet stream with slower north-to-south winds.



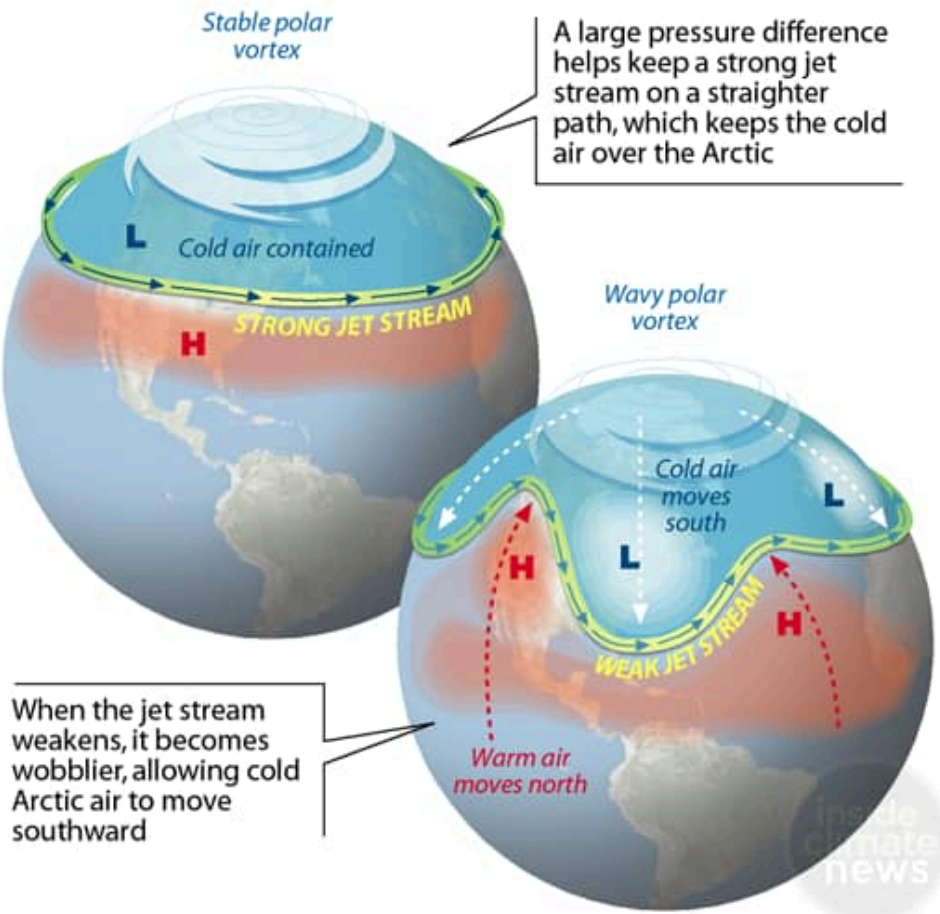
Milder weather when there is low pressure in the Arctic and strong westerly winds.



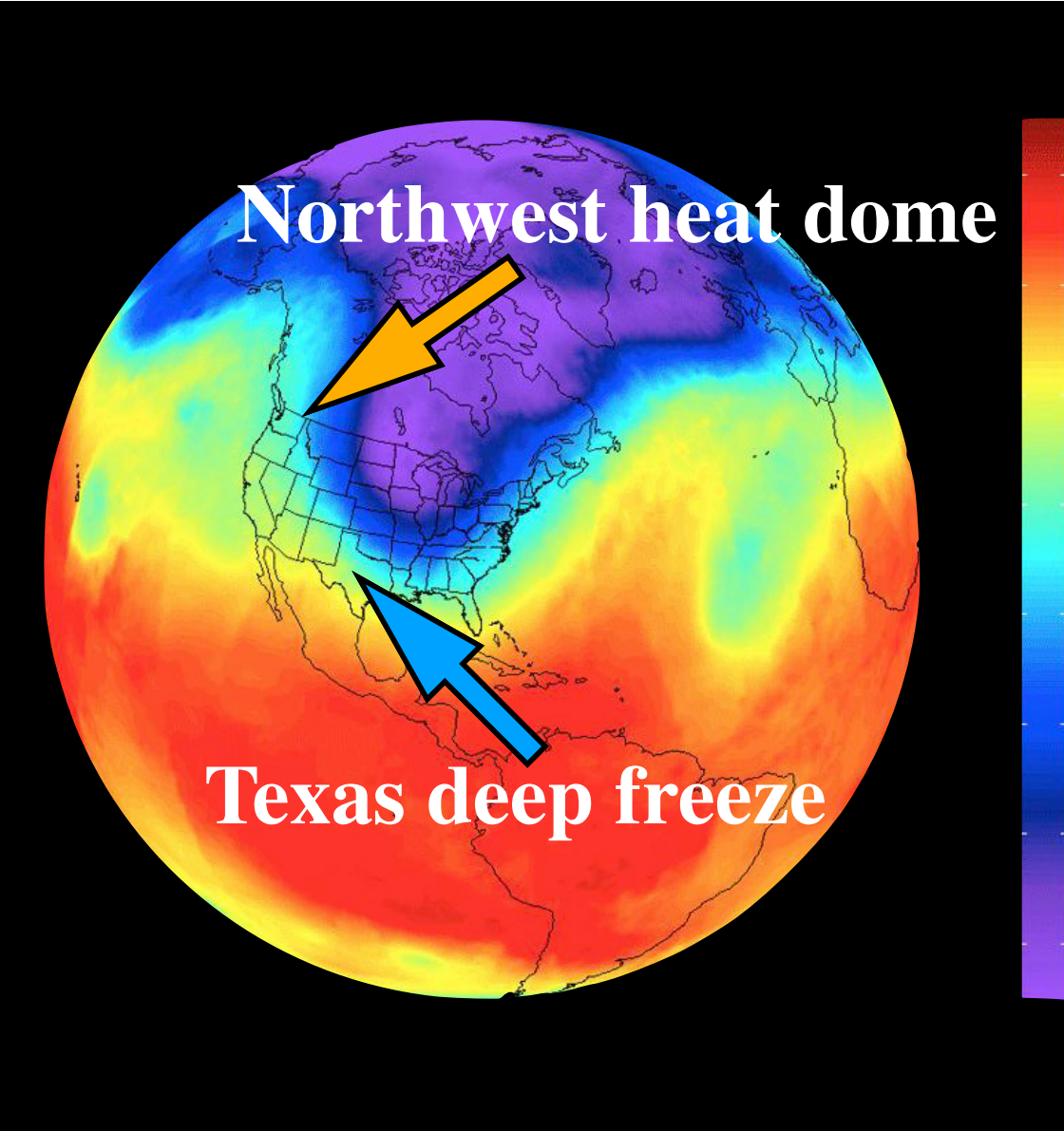
The Arctic is warming three times faster than the global average

Polar Vortex Explained

The polar vortex is a large area of low pressure and cold air over Earth's North and South Poles. When the jet stream weakens, it becomes wavier, allowing that cold air to dip southward in places while warmer air pushes northward elsewhere.



When the jet stream weakens, it becomes wobblier, allowing cold Arctic air to move southward



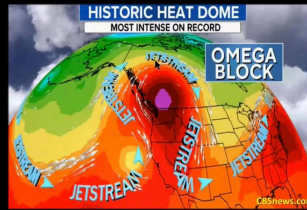
SOURCES: NOAA; Scientific American

PAUL HORN / InsideClimate News

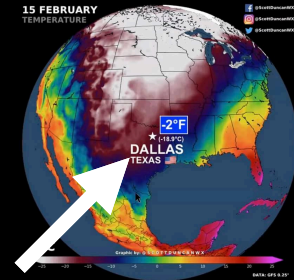
Bit.ly/FrancisVortex



WHY?
Crazy jet stream
↓
crazy weather!



Temperatures
on 15 February
2021

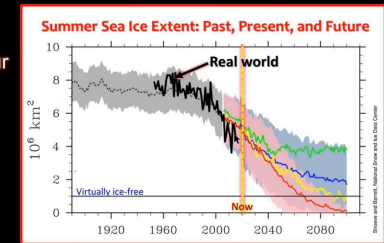


Why was this
cold spell so
extreme?

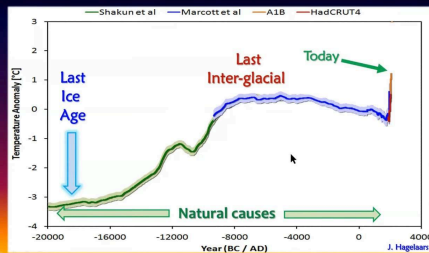


What does our
future hold?

The sea ice
story...



20,000 Years of Global Temperatures



Dr. Jennifer Francis

The Arctic Meltdown: Why It Matters to Us All

28th Annual Kuehnast Lecture
in the Fields of Meteorology and Climatology



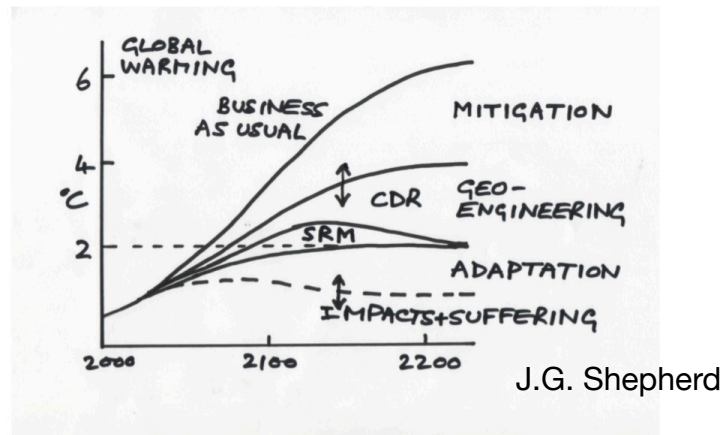
To curtail the jetstream & polar vortex misbehavior,
restore the pole-to-tropics temperature gradient.



The “napkin diagram” of multiple responses to climate change

J. G. Shepherd¹

The idea of deploying a combination of responses to climate change is illustrated in Figure 1, a simple sketch of how global mean temperature (and the associated impacts) might evolve over the next two centuries (Long and Shepherd 2014), both without any active climate response (“business as usual”), and with some mix of both conventional mitigation, and phased implementation of both SRM and CDR climate remediation methods. Specifically, this illustrates how one might attempt to limit the rise of global mean temperature to some specific level (here about 2°C) using such a combination of responses. This sketch was first presented to the Asilomar International Conference on Climate Intervention Technologies² in March 2010, and has become known as the “napkin diagram”.



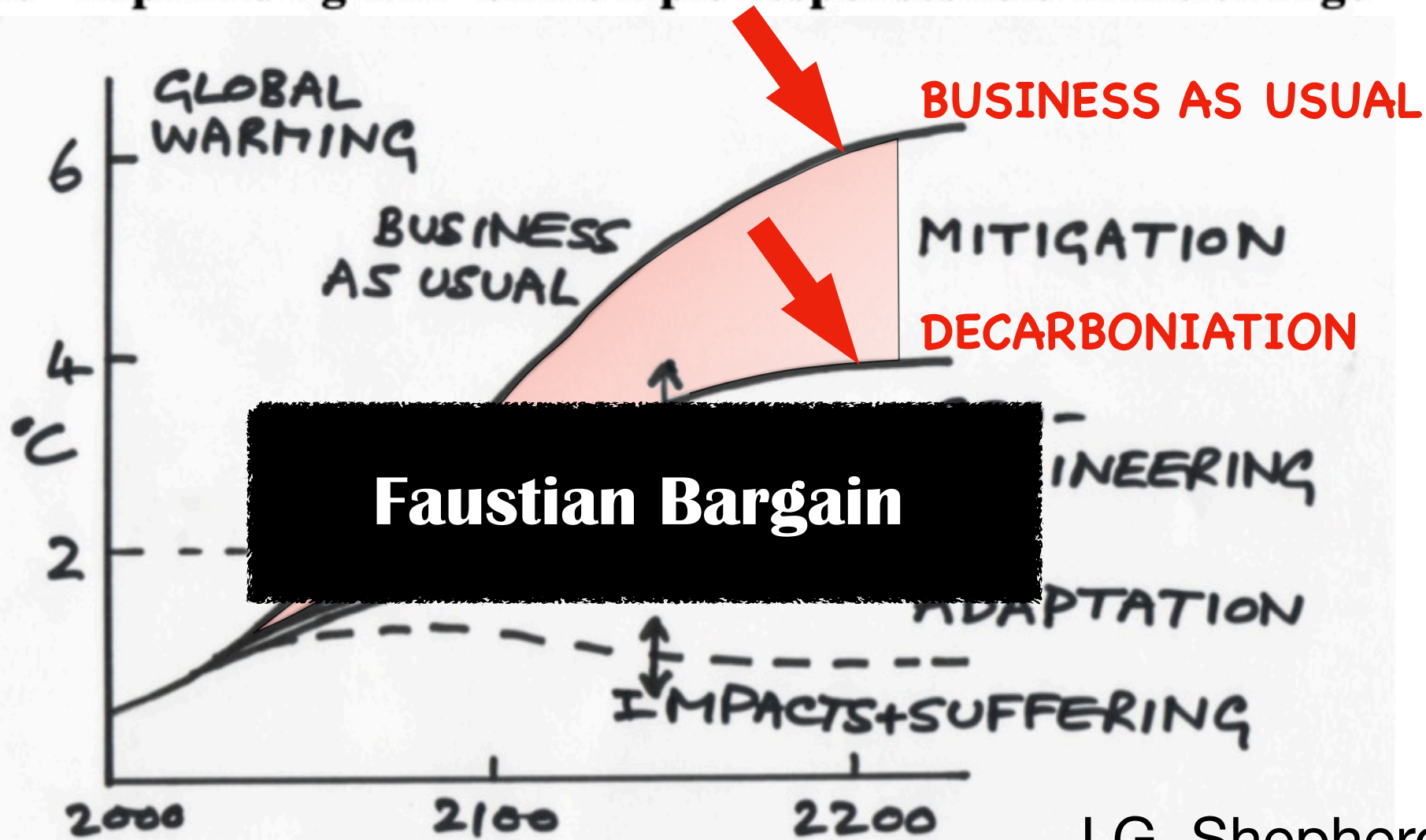
John Holdren (2006) had previously argued that humanity will need to combine three approaches to climate change: mitigation, adaptation, and suffering. To these we could potentially now add a further approach: remediation. This portfolio of responses (Mitigation, Adaptation, Remediation, and Suffering) would therefore constitute a four-fold way to deal with anthropogenic climate change. It would involve some mix of mitigation and remediation, as well as adaptation, but also just accepting the impacts of changes to which adaptation proves to be impossible (or is regarded as unaffordable). All of the responses involve costs and risks. The first three involve those of action, and the last those of inaction, i.e. the damage to people, property, and ecosystems and the human suffering caused by whatever level of climate change is accepted, *after* the impacts have been reduced by the other responses.

Long, J. and Shepherd, J. G. (2014). "The Strategic Value of Geoengineering Research." *Global Environmental Change, Handbook of Global Environmental Pollution 1: 757-770.*

¹ Ocean & Earth Sciences, University of Southampton, National Oceanography Centre, Southampton SO14 3ZH, UK, www.jgshpherd.com

² <http://www.climate.org/resources/climate-archives/conferences/asilomar.html>

The "napkin diagram" of multiple responses to climate change



J.G. Shepherd



Faustian Bargain



Faustian Bargain

Dr. Faustus contemplates the bargain with Mephistopheles²

Doubling Down on Our Faustian Bargain

29 March 2013

James Hansen, Pushker Kharecha, Makiko Sato

Summary. Humanity is doubling down on its Faustian climate bargain by pumping up fossil fuel particulate and nitrogen pollution. The more the Faustian debt grows, the more unmanageable the eventual consequences will be. Yet there are plans to build more than 1000 coal-fired power plants and plans to develop some of the dirtiest oil sources on the planet. These plans should be vigorously resisted. We are already in a deep hole – it is time to stop digging.

Humanity's Faustian climate bargain is well known.^{1,2} Humans have been pumping both greenhouse gases (mainly CO₂) and aerosols (fine particles) into the atmosphere for more than a century. The CO₂ accumulates steadily, staying in the climate system for millennia, with a continuously increasing warming effect. Aerosols have a cooling effect (by reducing solar heating of the ground) that depends on the rate that we pump aerosols into the air, because they fall out after about five days.

Doubling Down on Our Faustian Bargain

29 March 2013

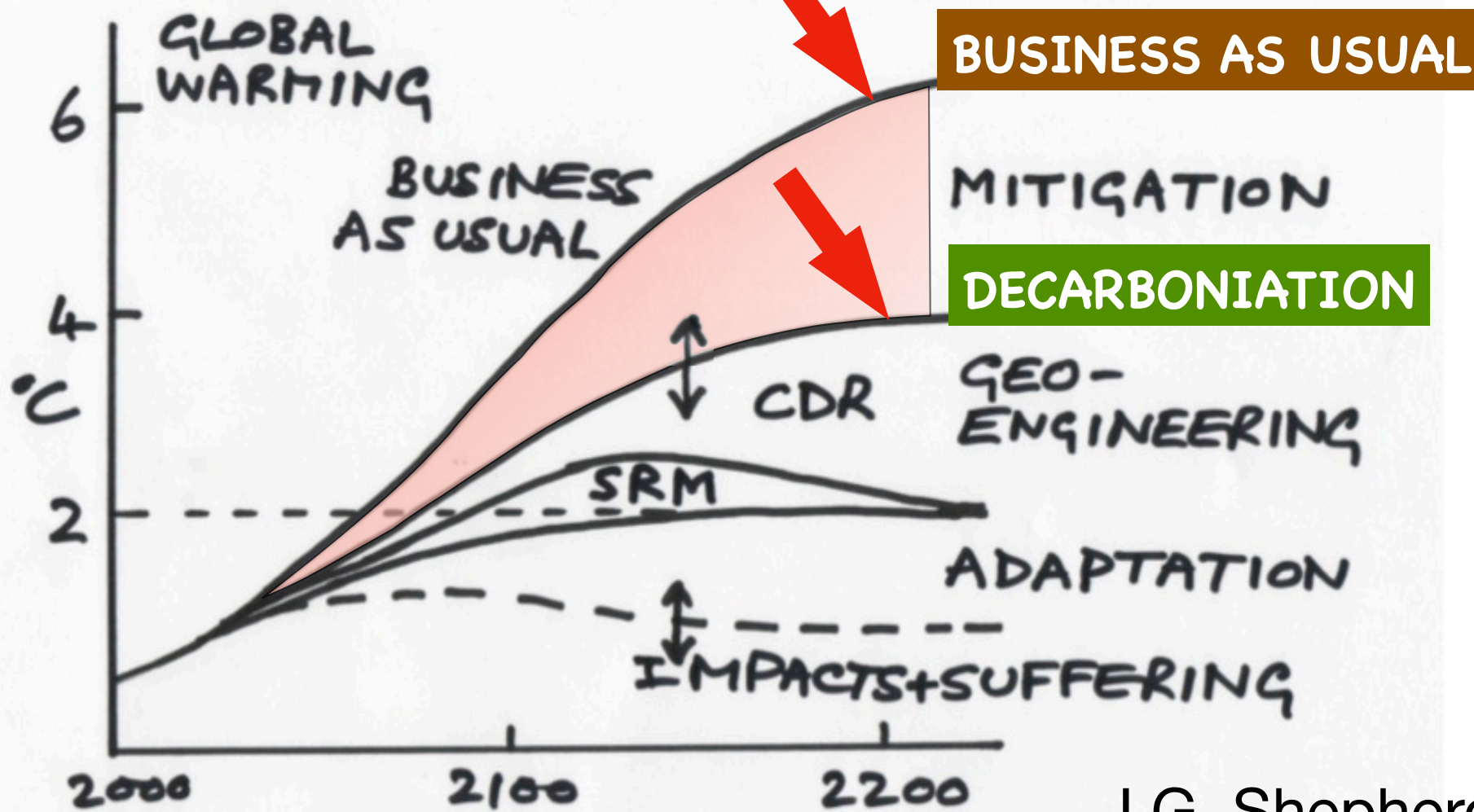
James Hansen, Pushker Kharecha, Makiko Sato

Summary. Humanity is doubling down on its Faustian climate bargain by pumping up fossil fuel particulate and nitrogen pollution. The more the Faustian debt grows, the more unmanageable the eventual consequences will be. Yet there are plans to build more than 1000 coal-fired power plants and plans to develop some of the dirtiest oil sources on the planet. These plans should be vigorously resisted. We are already in a deep hole – it is time to stop digging.

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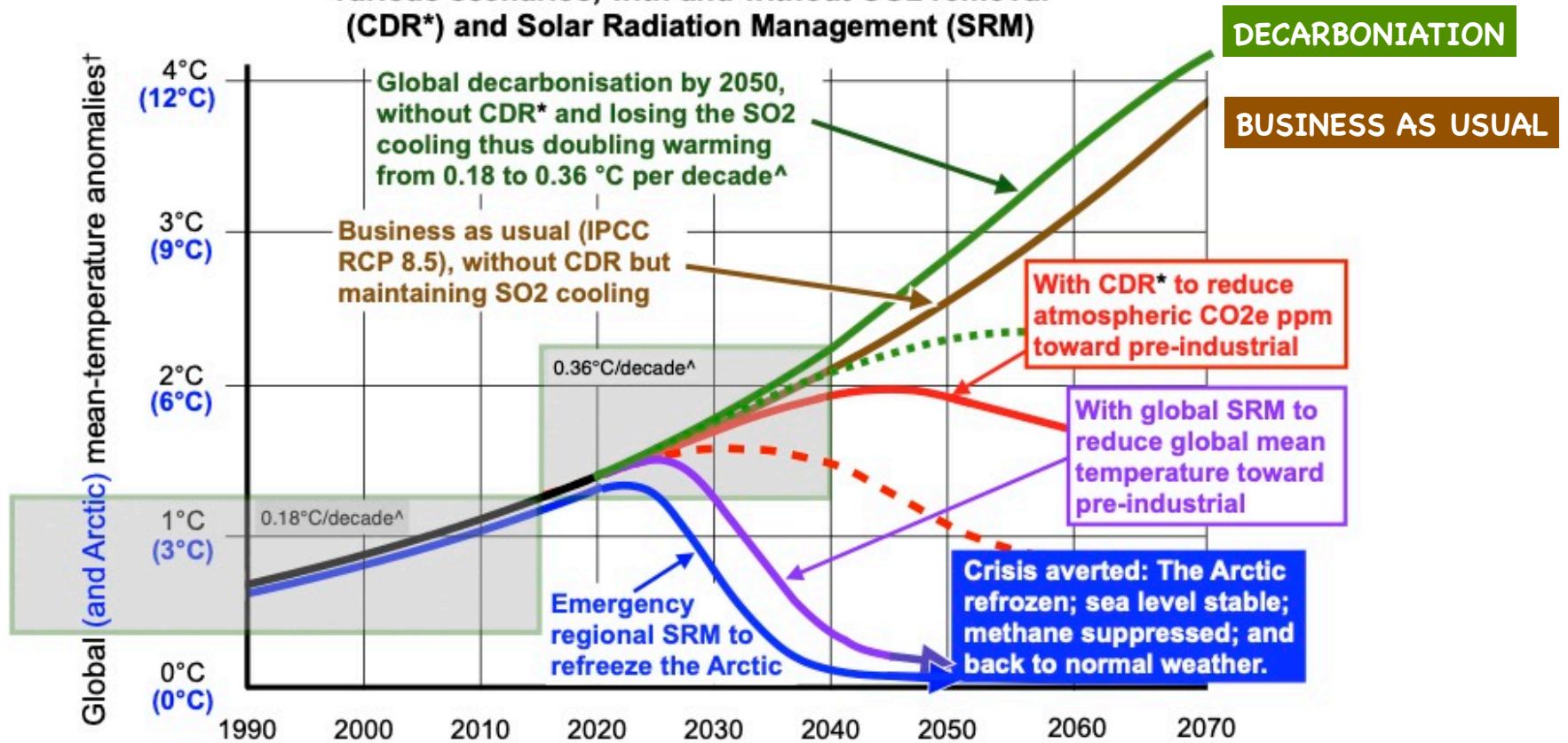
when aerosols decline or cease, so does aerosol cooling

The “napkin diagram” of multiple responses to climate change



J.G. Shepherd

Global-mean and Arctic temperature trajectories for various scenarios, with and without CO2 removal (CDR*) and Solar Radiation Management (SRM)



--- and --- are projections from certain models

† Global temperatures (Arctic temperatures in blue) are relative to pre-industrial norms.

* CDR at 60+ GtCO₂e/year including suppression of methane and black carbon.

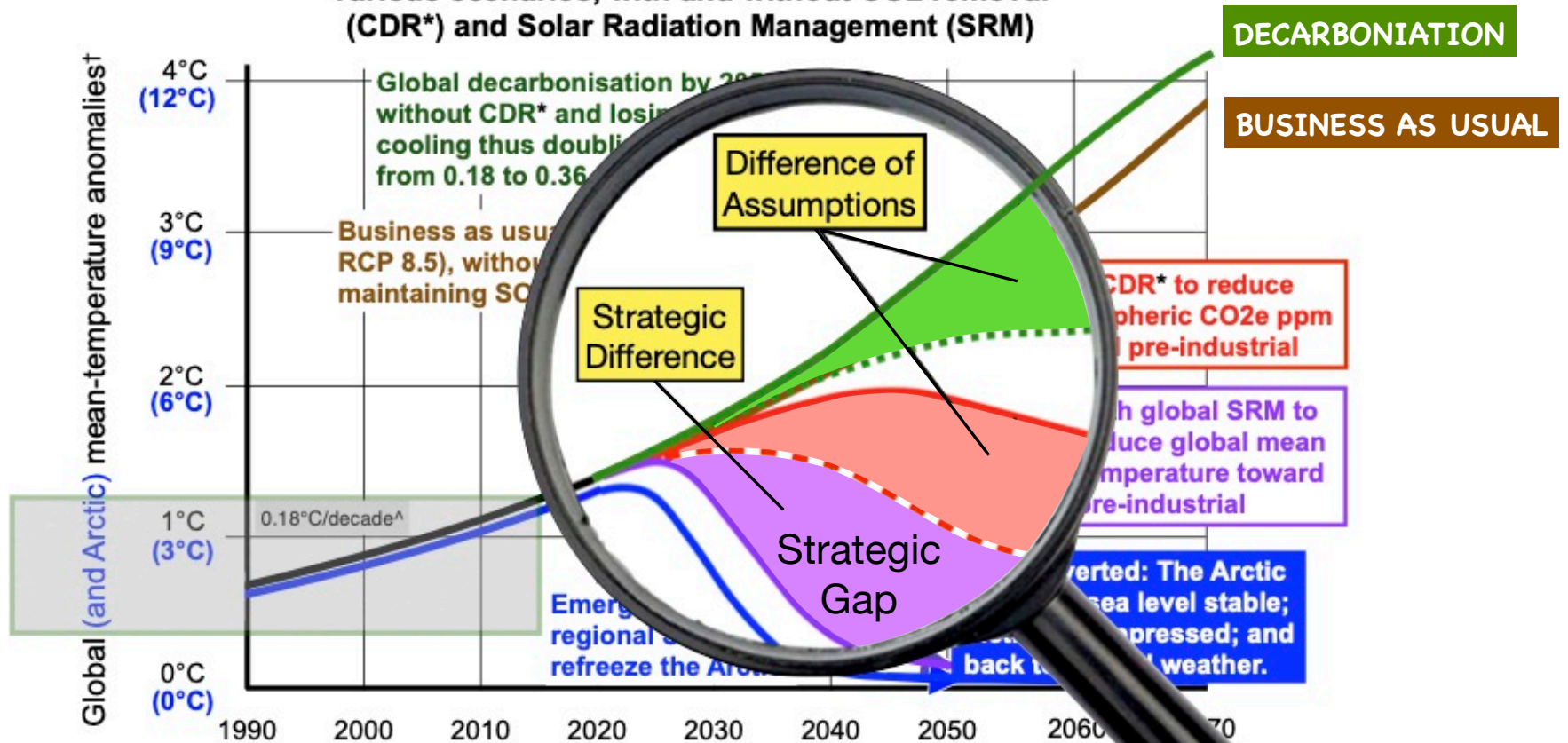
^ July Temperature Update: *Faustian Payment Comes Due*, published 13 August 2021, James Hansen and Makiko Sato

12 Feb 2021 Temperature trajectories diagram

© Planetary Restoration Action Group (2021)

Updated 20 February 2022

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 ^ July Temperature Update: *Faustian Payment Comes Due*, published 13 August 2021, James Hansen and Makiko Sato

CDR – Carbon Dioxide Removal

**#RemoveCO2 is imperative.
What is the cost and
effectiveness?**



Nature-based Ocean & Atmospheric Cooling and Carbon Dioxide Removal

Refreezing Arctic Ice cap

Marine cloud brightening

Kelp and algae farming

Biochar and sequestration

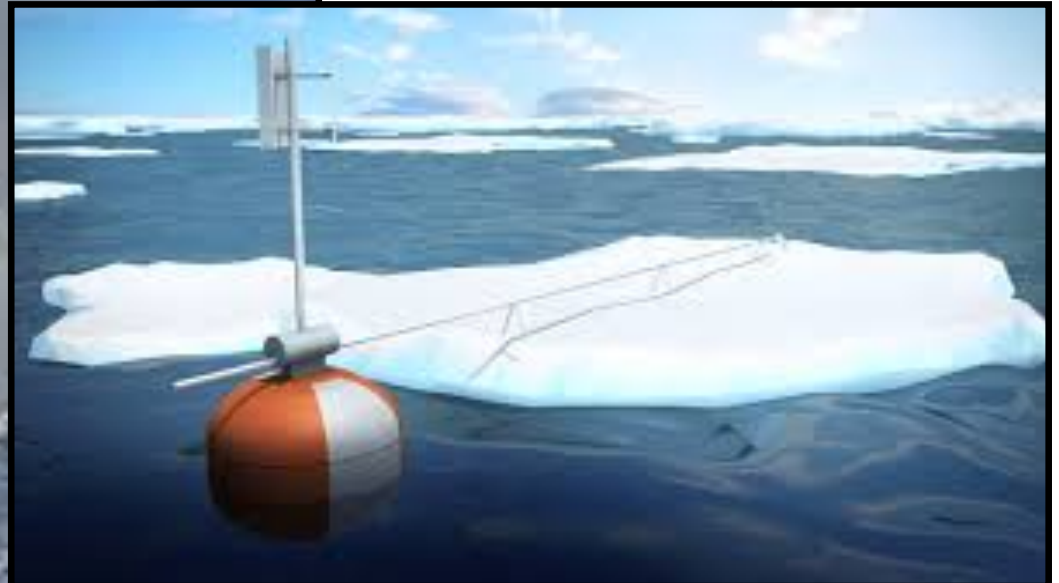
Restore fisheries & whales

Emiliana huxleyi - DMS



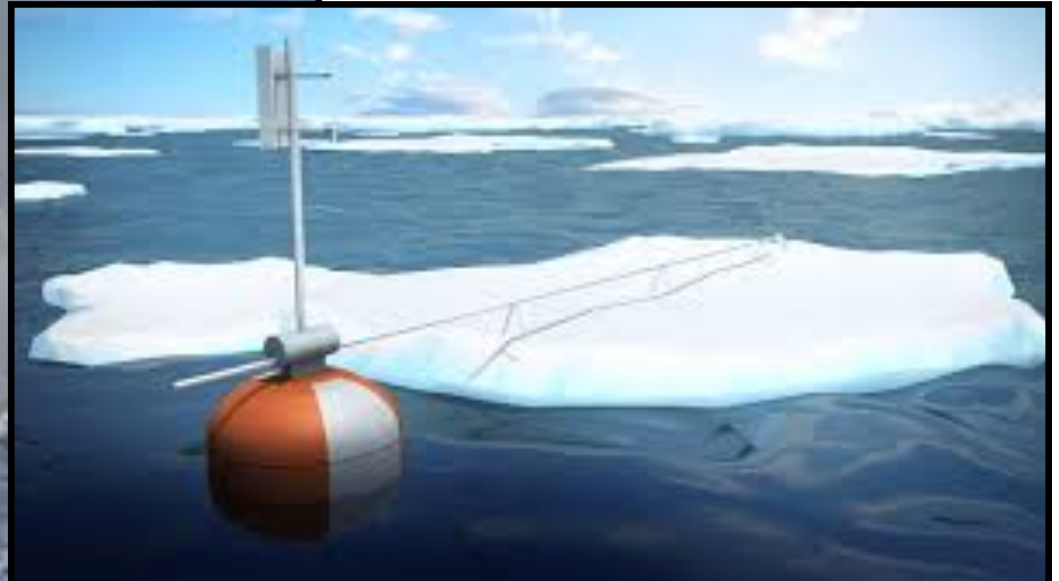
Nature-based Ocean & Atmospheric Cooling and Carbon Dioxide Removal

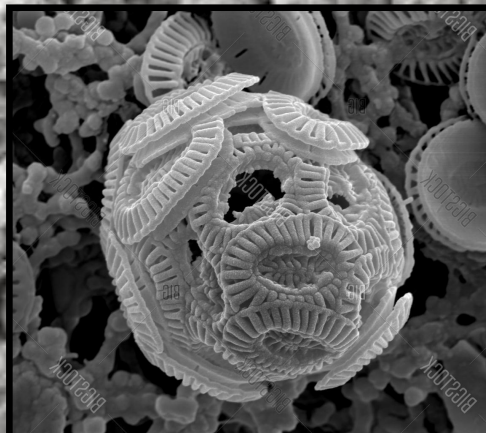
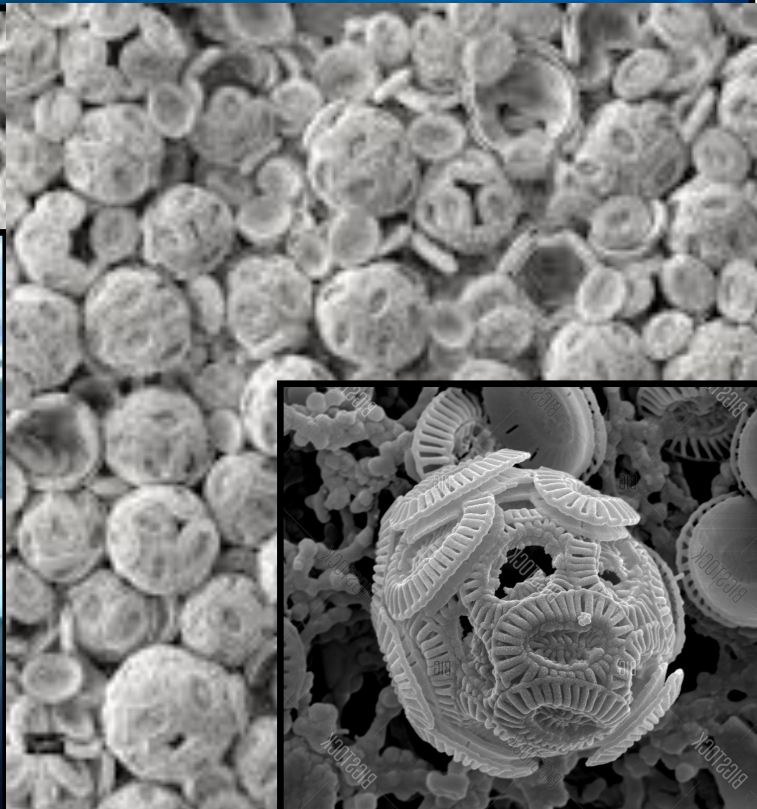
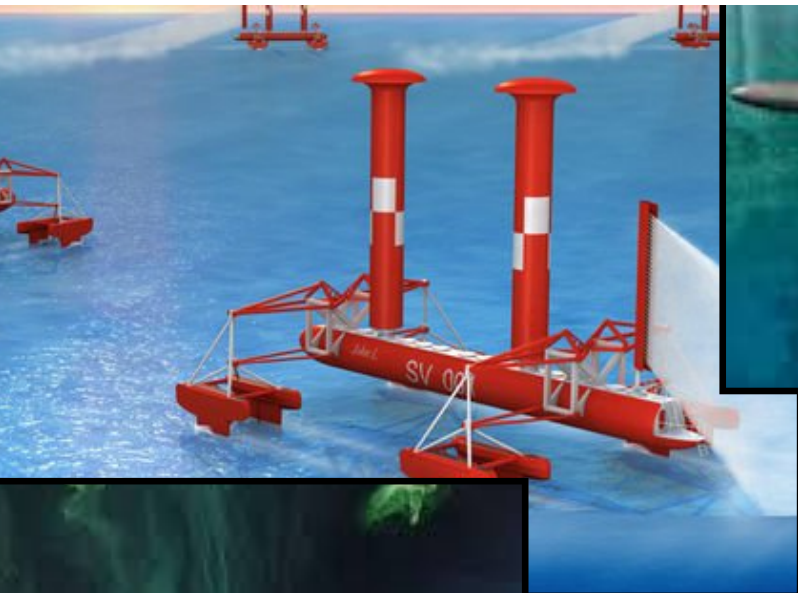
- ✓ Refreezing Arctic Ice cap
 - ✓ Marine cloud brightening
 - ✓ Kelp and algae farming
- Biochar and sequestration
Restore fisheries & whales
Emiliana huxleyi - DMS



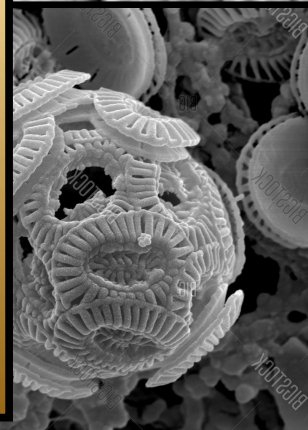
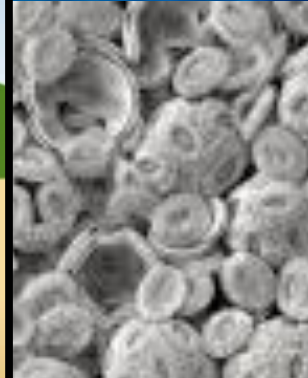
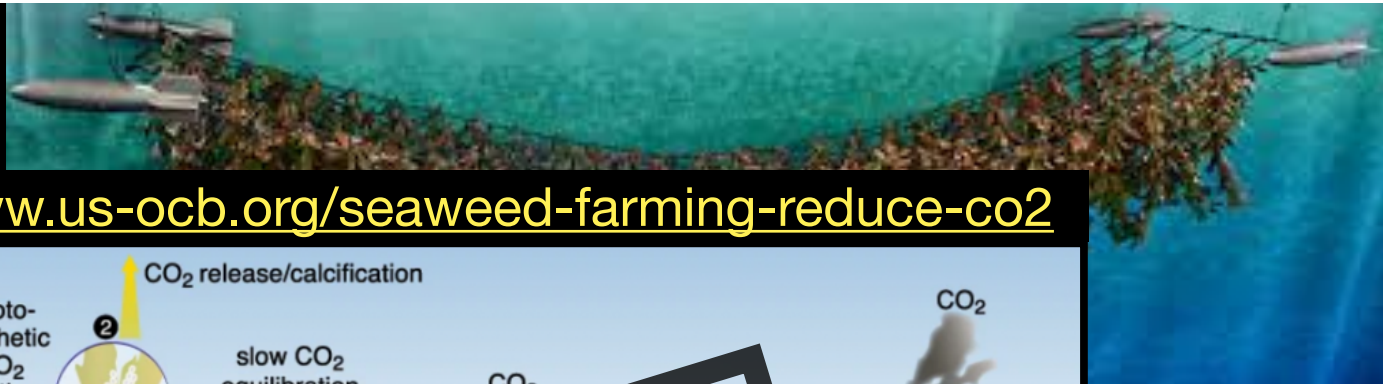
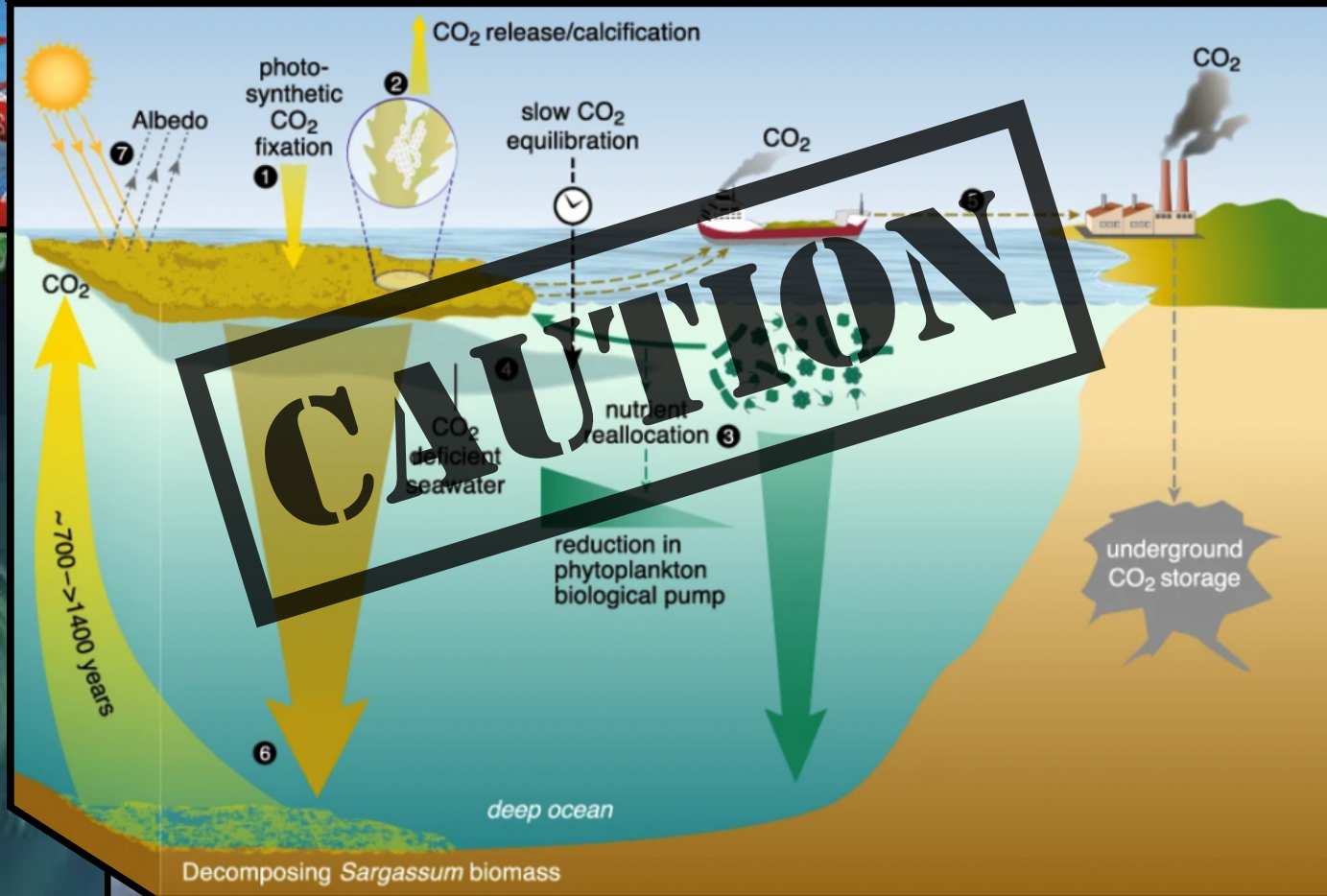
Nature-based Ocean & Atmospheric Cooling and Carbon Dioxide Removal

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Restore fisheries & whales
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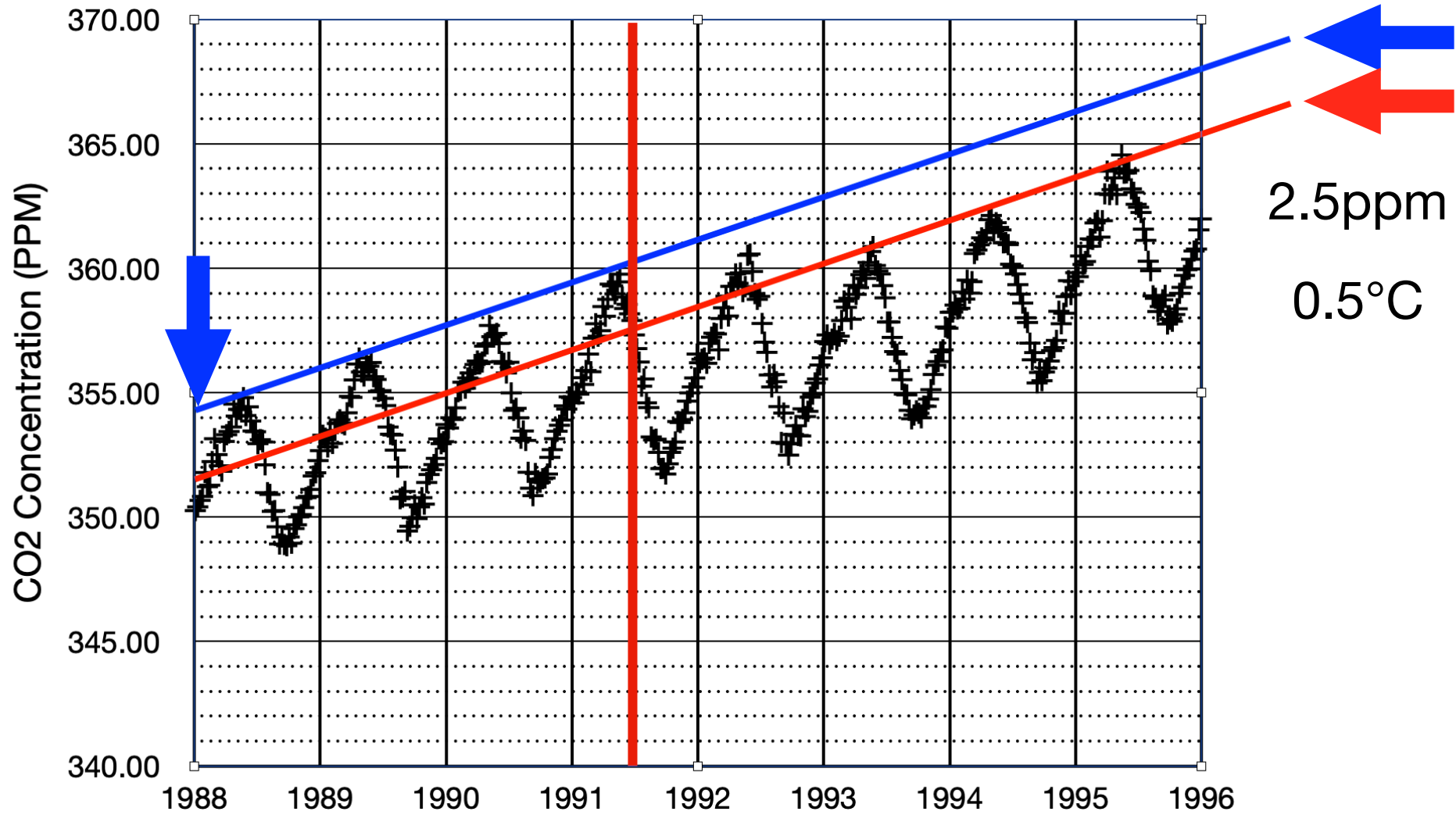


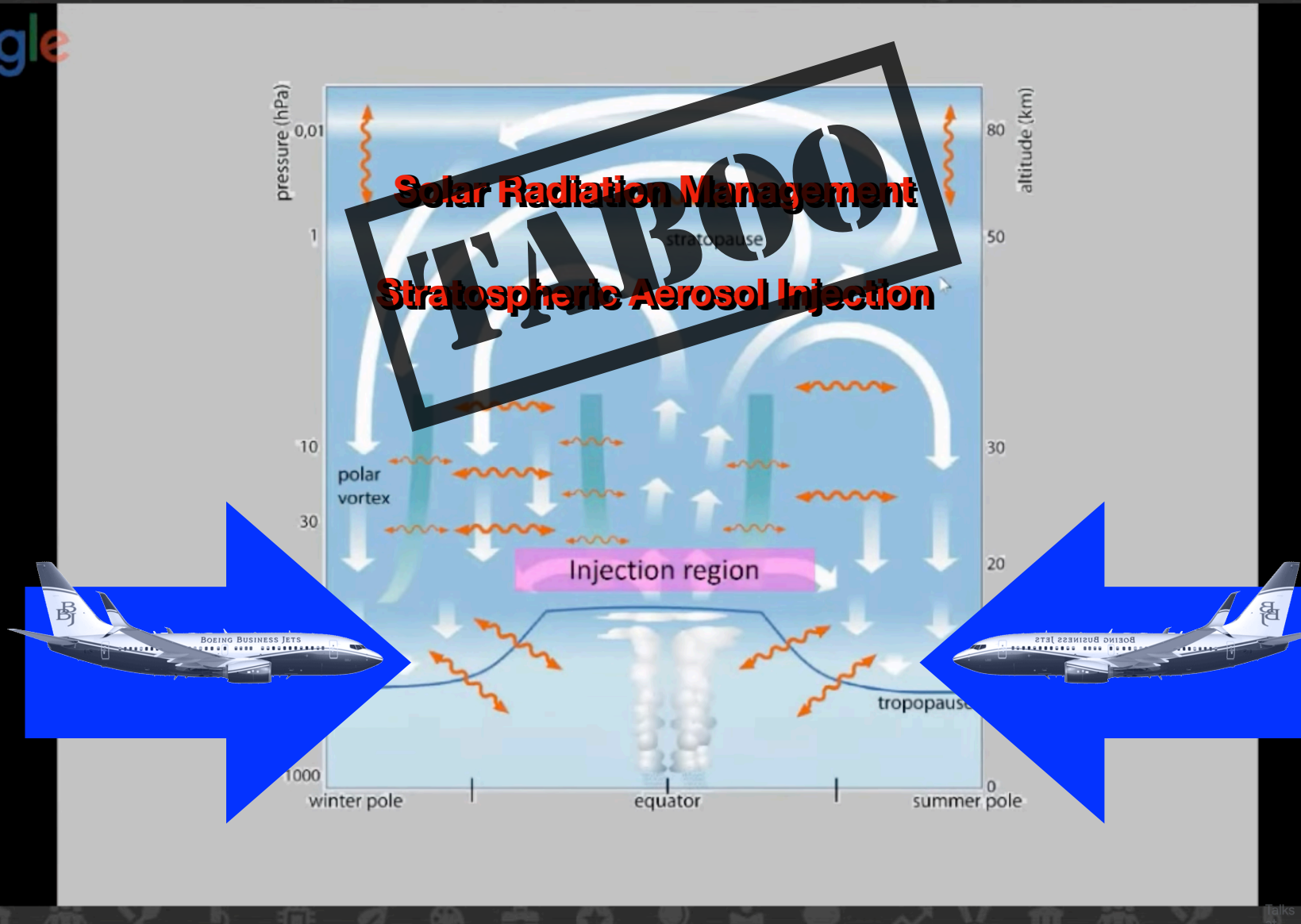
<https://www.us-ocb.org/seaweed-farming-reduce-co2>





Mount Pinatubo Eruption - June 15, 1991





WPR[®]

WORLD POLITICS REVIEW[®]


Solar Geoengineering Could Buy Us Time to Get to Net Zero

Stewart M. Patrick
April 25, 2022 - Monday

[Bit.ly/WPR25Apr22](https://www.worldpoliticsreview.com/articles/30489/with-mitigation-climate-change-research-should-add-solar-geoengineering)



<https://www.worldpoliticsreview.com/articles/30489/with-mitigation-climate-change-research-should-add-solar-geoengineering>

A large, vibrant rainbow arches across a bright blue sky filled with soft, white clouds. The rainbow's colors are clearly visible, transitioning from red on the left to violet on the right. The overall scene is bright and clear, suggesting a sunny day after a rain shower.

**Thanks to delays
and half-measures,
we are now courting
catastrophe.**

Stewart M. Patrick
April 25, 2022 - Monday

[Bit.ly/WPR25Apr22](https://bit.ly/WPR25Apr22)