

# Why Increasing Albedo is More Urgent Than Removing Greenhouse Gases for Climate Policy

Planetary Restoration

HOME

CONTACT US

ARTICLES ▼

Robert Tulip, August 2022

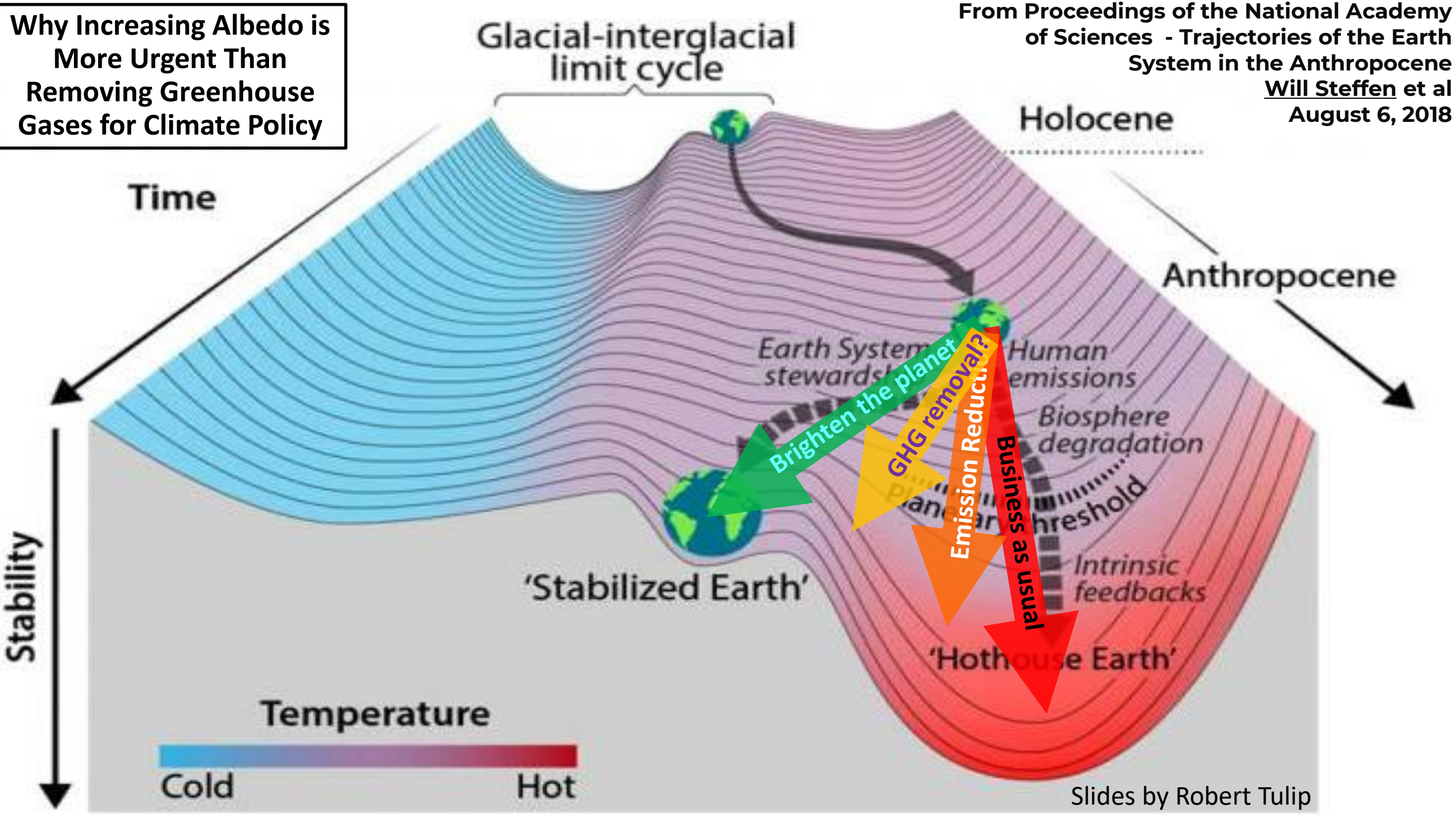
## Planetary Restoration Action Group

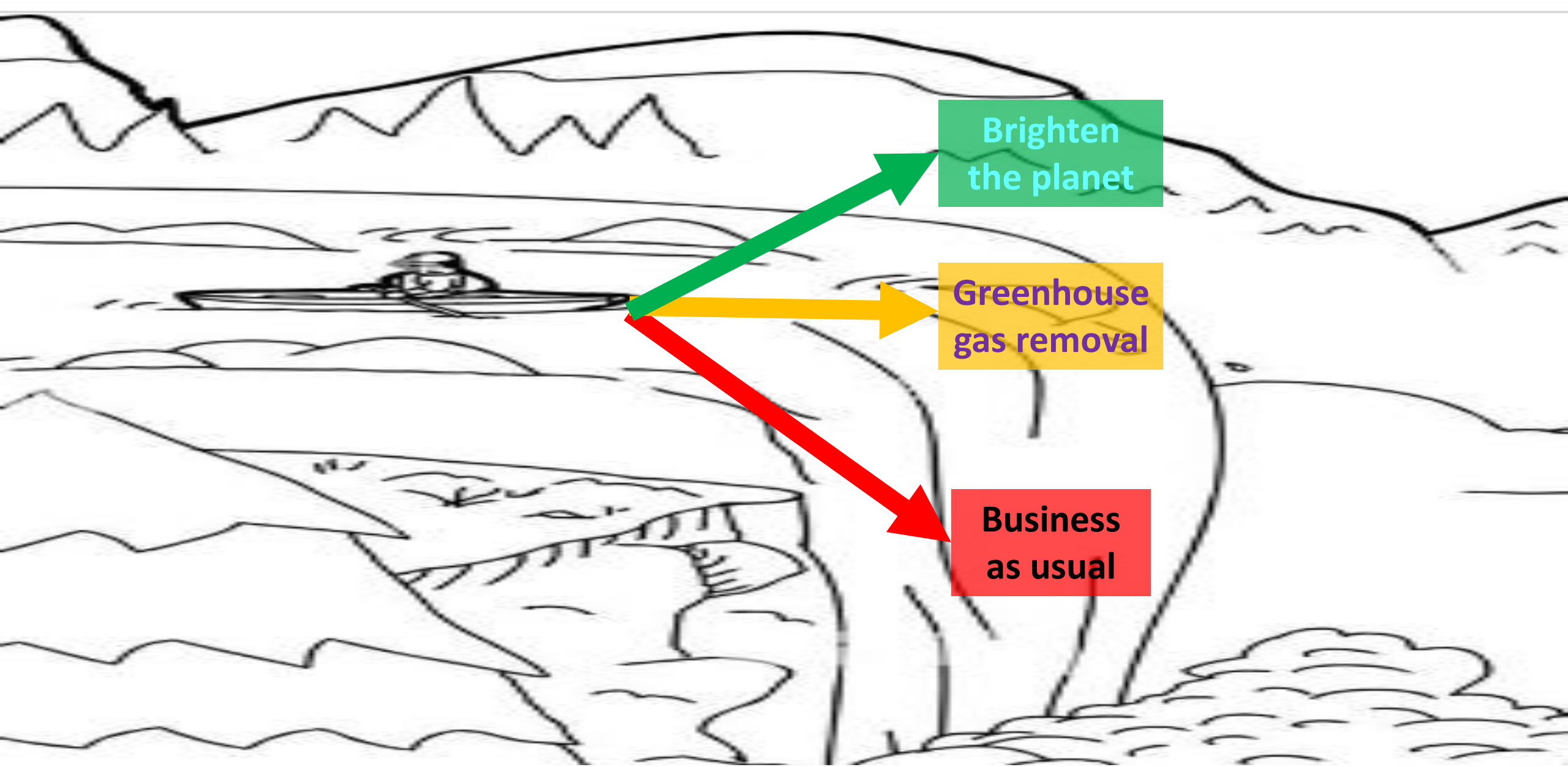
Promoting ways to restore planetary temperature  
and climate to Holocene norms

<https://planetaryrestoration.net/>

**Why Increasing Albedo is More Urgent Than Removing Greenhouse Gases for Climate Policy**

From Proceedings of the National Academy of Sciences - Trajectories of the Earth System in the Anthropocene  
Will Steffen et al  
August 6, 2018





**Brighten  
the planet**

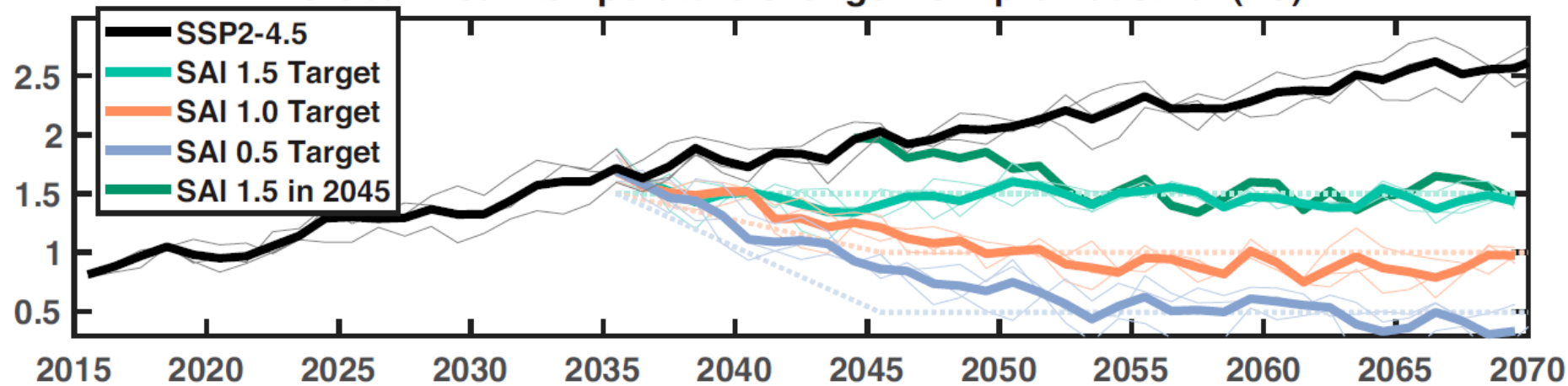
**Greenhouse  
gas removal**

**Business  
as usual**

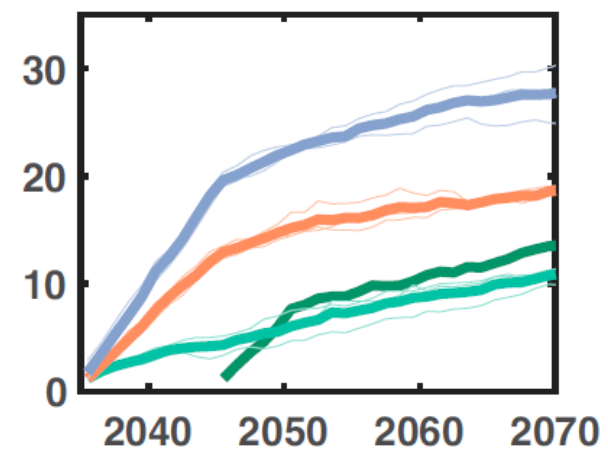
The Summary for Policymakers in the 2019 IPCC [Special Report](#): Global Warming of 1.5° C estimated the remaining carbon budget at 580 GtCO<sub>2</sub> for a 50% probability of limiting warming to 1.5°C.

- This excludes any action to brighten the planet due to concerns about “governance, ethics, and impacts on sustainable development”
- What could a focus on albedo achieve?
- Adding an average of 15 million tonnes (teragrams) of sulphur dioxide to the stratosphere every year from 2035 to 2070 has recently been calculated as likely to reduce average temperature rise by 2°C compared to baseline.

Global mean temperature change from preindustrial (°C)



Needed intervention (Tg-SO<sub>2</sub>/yr)



# Cutting Emissions Is Not Enough

Historic  
Emissions  
670 Gt C  
(2022)



**2020  
Emissions  
15 Gt C**

+

**Effect of  
Annual Paris  
Pledges  
+ 1 Gt C**

=

**2030  
Expected  
Emissions  
16 Gt C**

**Meeting all national pledges to the Paris Accord  
would increase annual emissions by 1 Gt C by 2030**

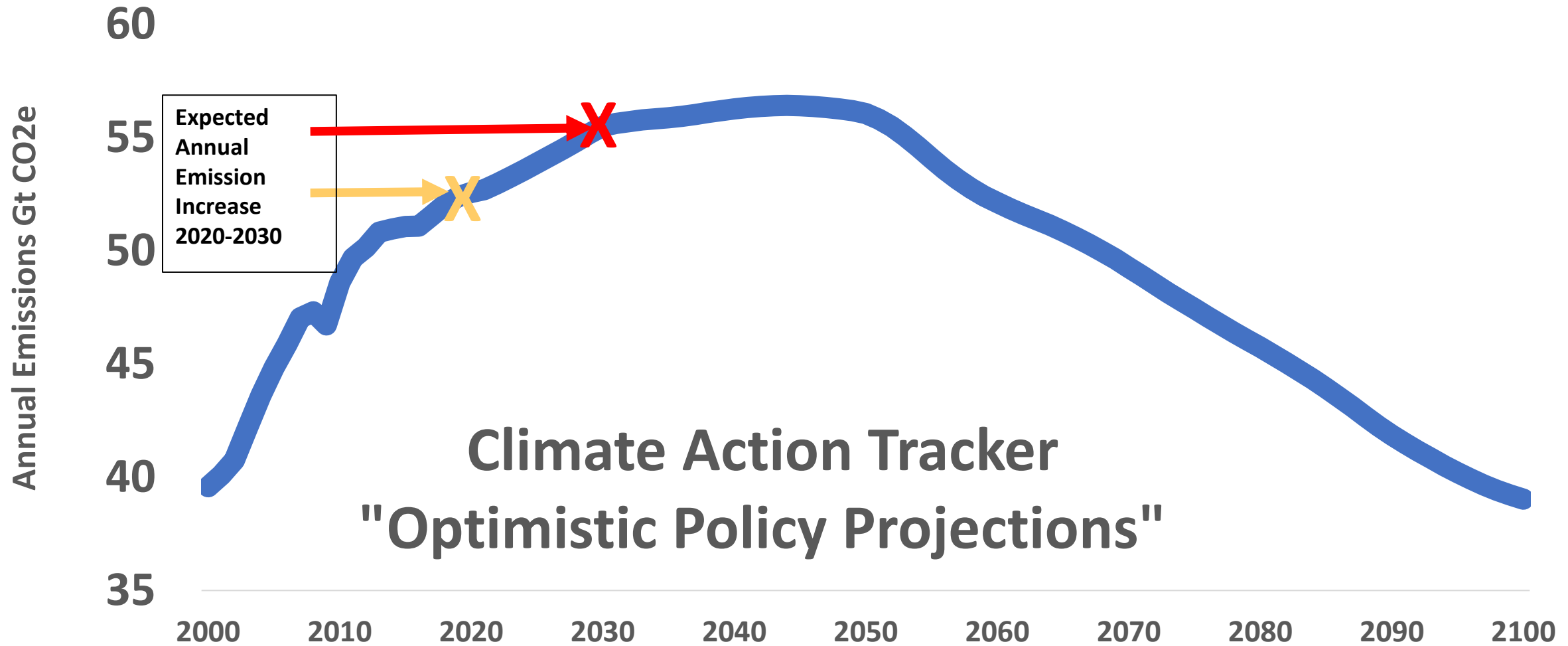
## Climate Arithmetic

Emission reduction slows new emissions (right). It does nothing about the forty times larger committed warming effects of past emissions (left) which will produce Earth System Equilibrium at a higher temperature and higher sea level. Decarbonising the economy is marginal to stabilising the climate, which requires (1) rapid brightening of the planet and (2) removal of past emissions.

One gigatonne of carbon (GtC) (one billion tonnes) equals 3.7 Gt of CO<sub>2</sub> and equivalents. 1Gt = 1 cubic km of water.

Data from Oxford University <https://globalwarmingindex.org/> and Climate Action Tracker (2019).

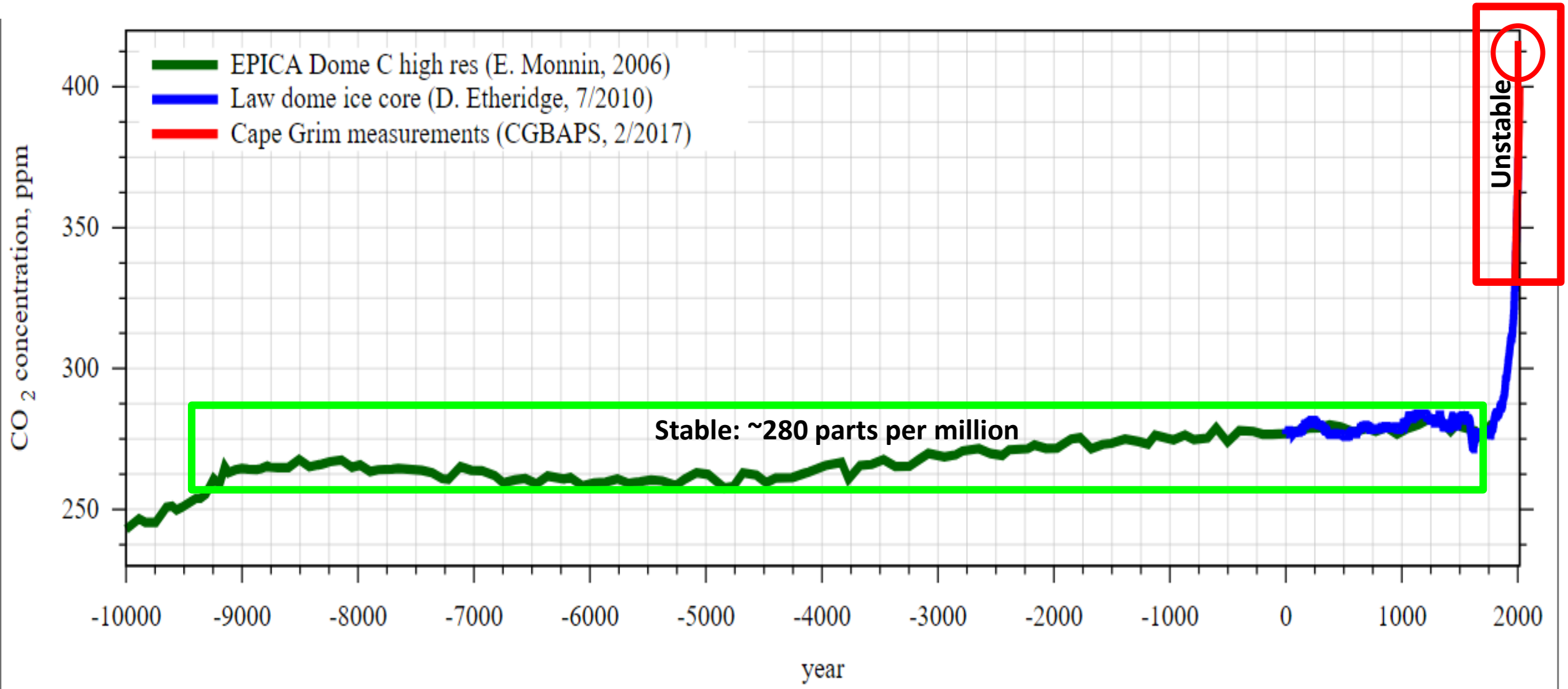
by Robert Tulip

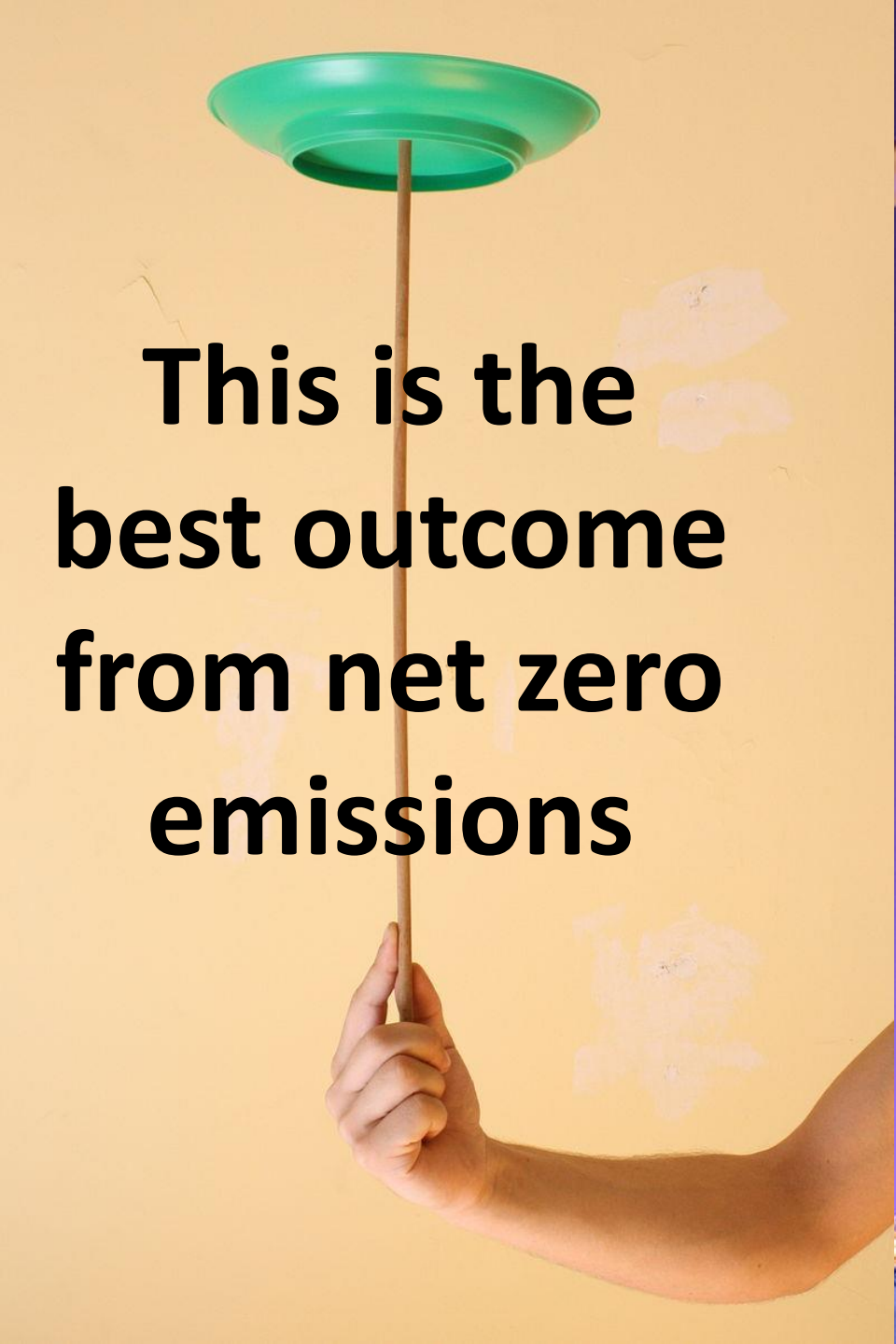


Projected global emissions this century (2019 estimates) if Paris Accord pledges are exceeded. Chart by Robert Tulip, data used with permission from <https://climateactiontracker.org/data-portal/>

# The Climate Instability Problem

## Carbon Dioxide Concentrations over the Holocene

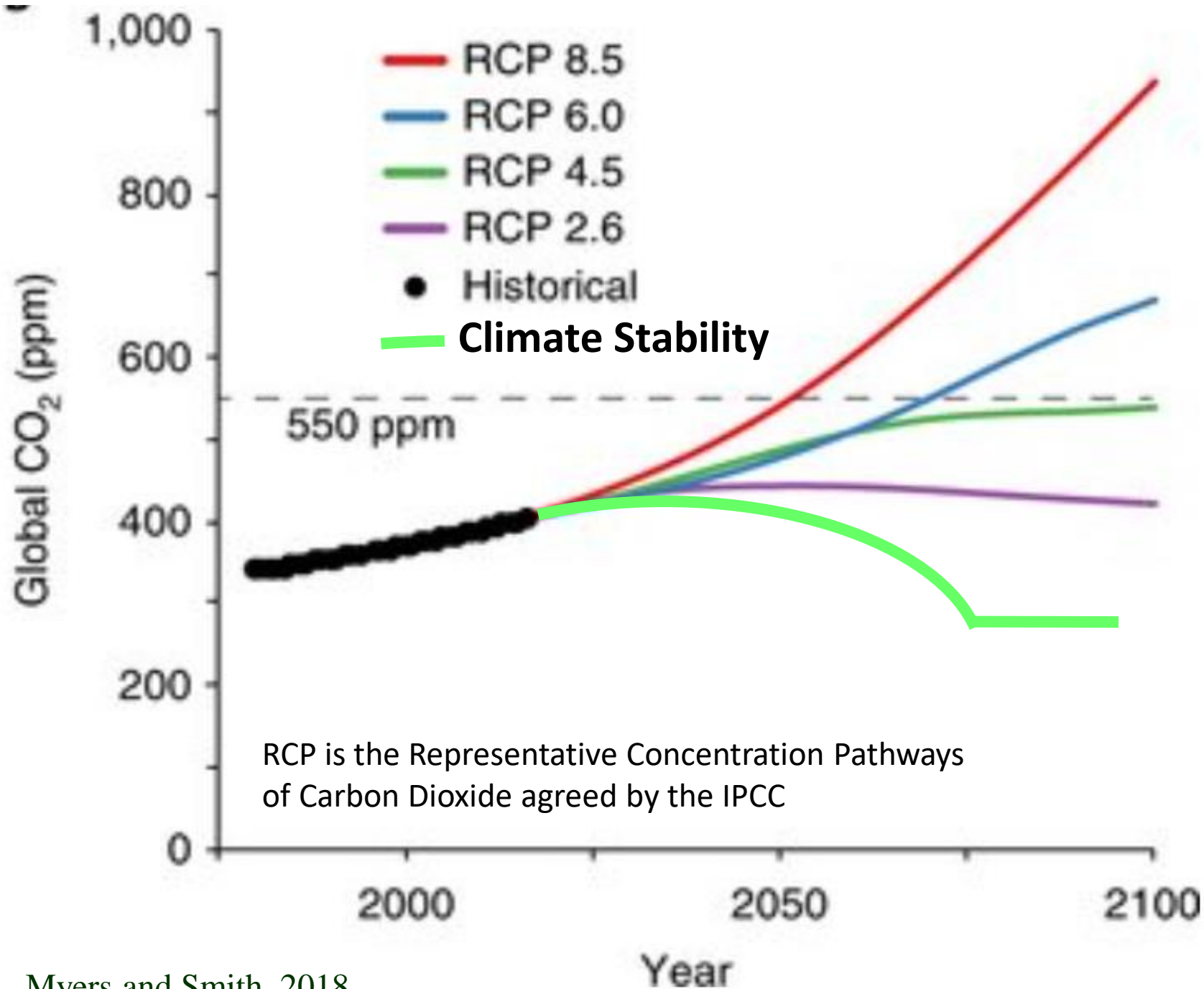




**This is the  
best outcome  
from net zero  
emissions**







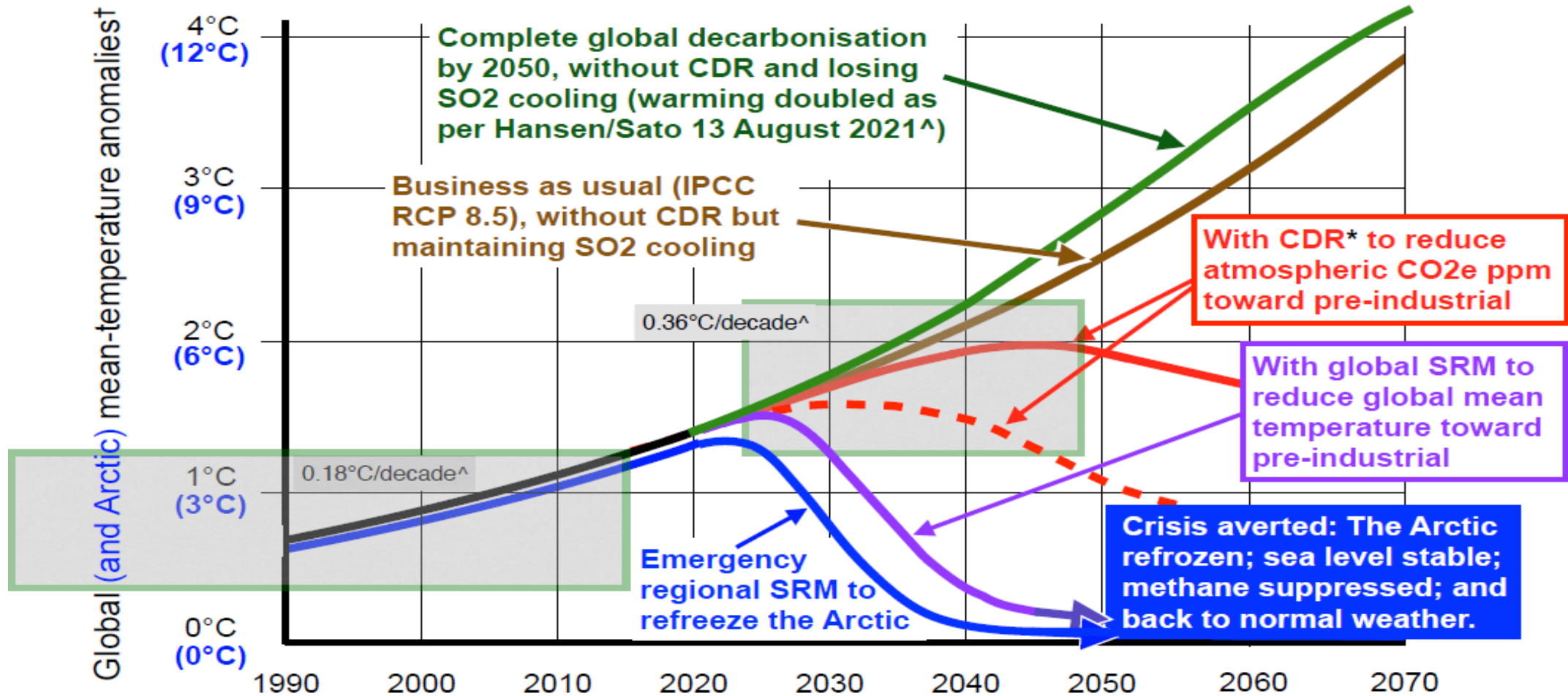
**Net Zero leaves us above the danger line of 550 ppm CO<sub>2</sub>, plus warming from CO<sub>2</sub> equivalents such as methane.**

**That is a highly unstable result.**

**Even the hypothetical “Climate Stability” line is too slow to prevent dangerous tipping points unless we take action to increase albedo.**

**The urgent priority is to brighten the planet.**

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

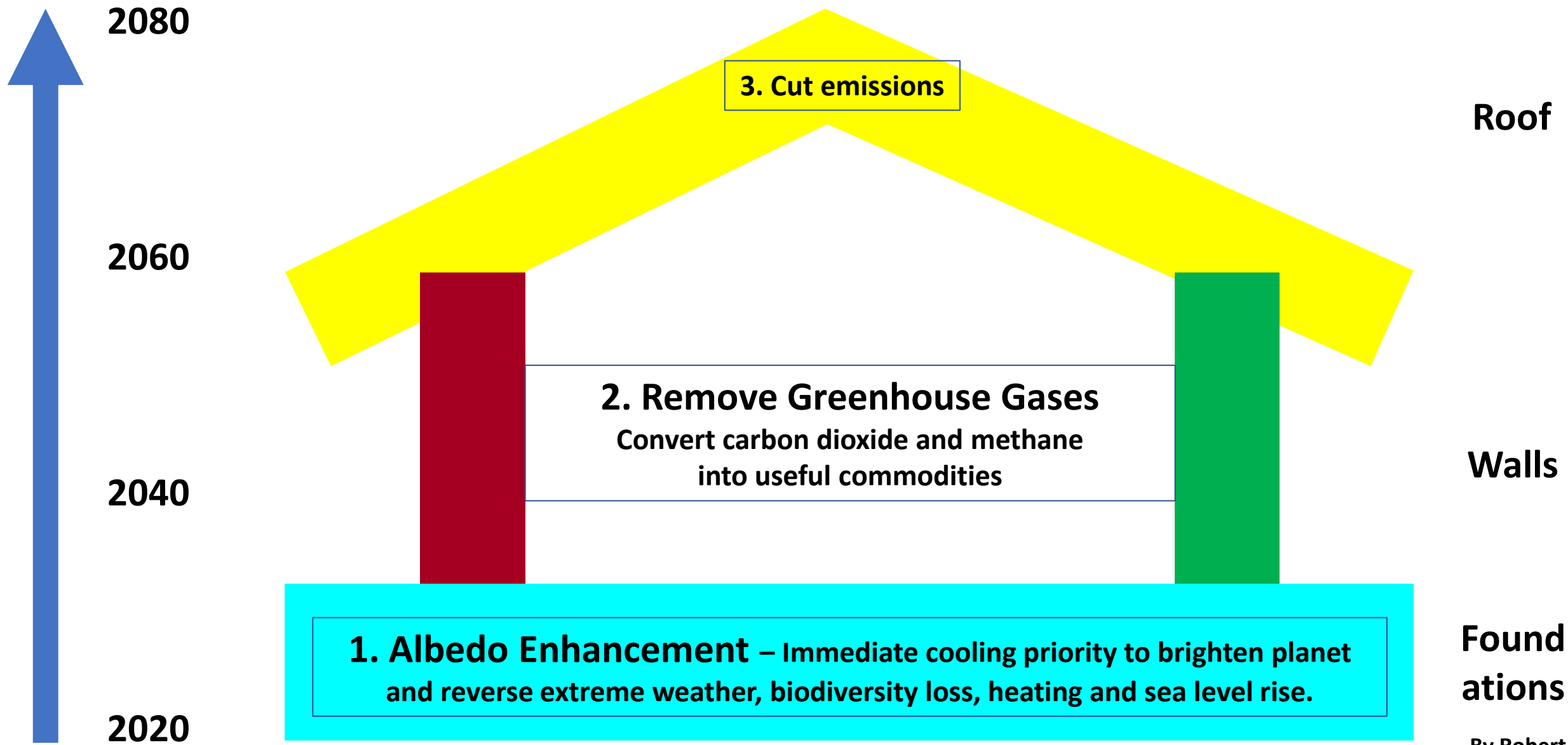


† Global temperatures (Arctic temperatures in blue) are relative to pre-industrial norms.

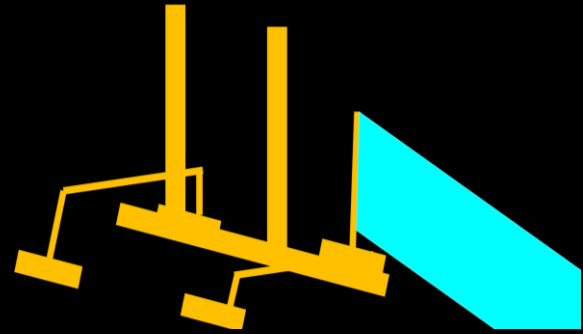
\* CDR at 60+ GtCO2e/year including suppression of methane and black carbon.

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

# Climate Security Timeline



# Marine Cloud Brightening to cool Antarctica



MCB schematic vessel from Paul Beckwith.

## A Safe, Cheap and Quick Way to

1. Freeze Sea Ice
2. Limit Sea Level Rise
3. Protect Biodiversity
4. Prevent Glacier Melt
5. Cool Ocean Currents
6. Reduce Extreme Weather
7. Mitigate Climate Change
8. Increase International Cooperation for Peace, Stability and Security

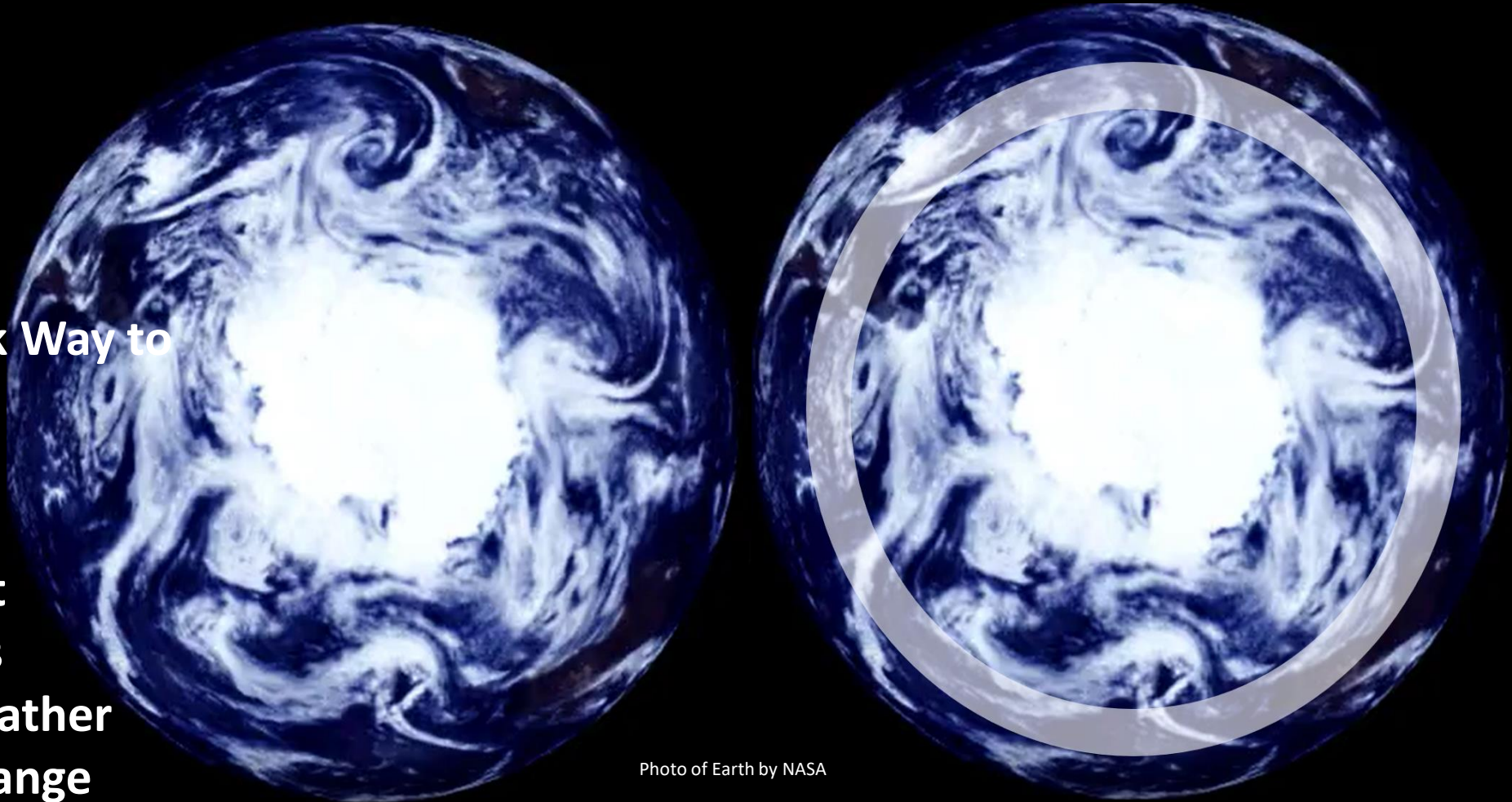


Photo of Earth by NASA

# The Problem



- 1. Cut Emissions**
- 2. Remove CO<sub>2</sub>**
- 3. Solar Geoengineering**

# The Solution is to reverse IPCC Priorities

**1. Brighten the Planet**

**2. Convert GHGs**

**3. Decarbonise the  
Economy**



# **Why Albedo is More Important Than Greenhouse Gas Removal for Climate Policy**

## **The Problem**

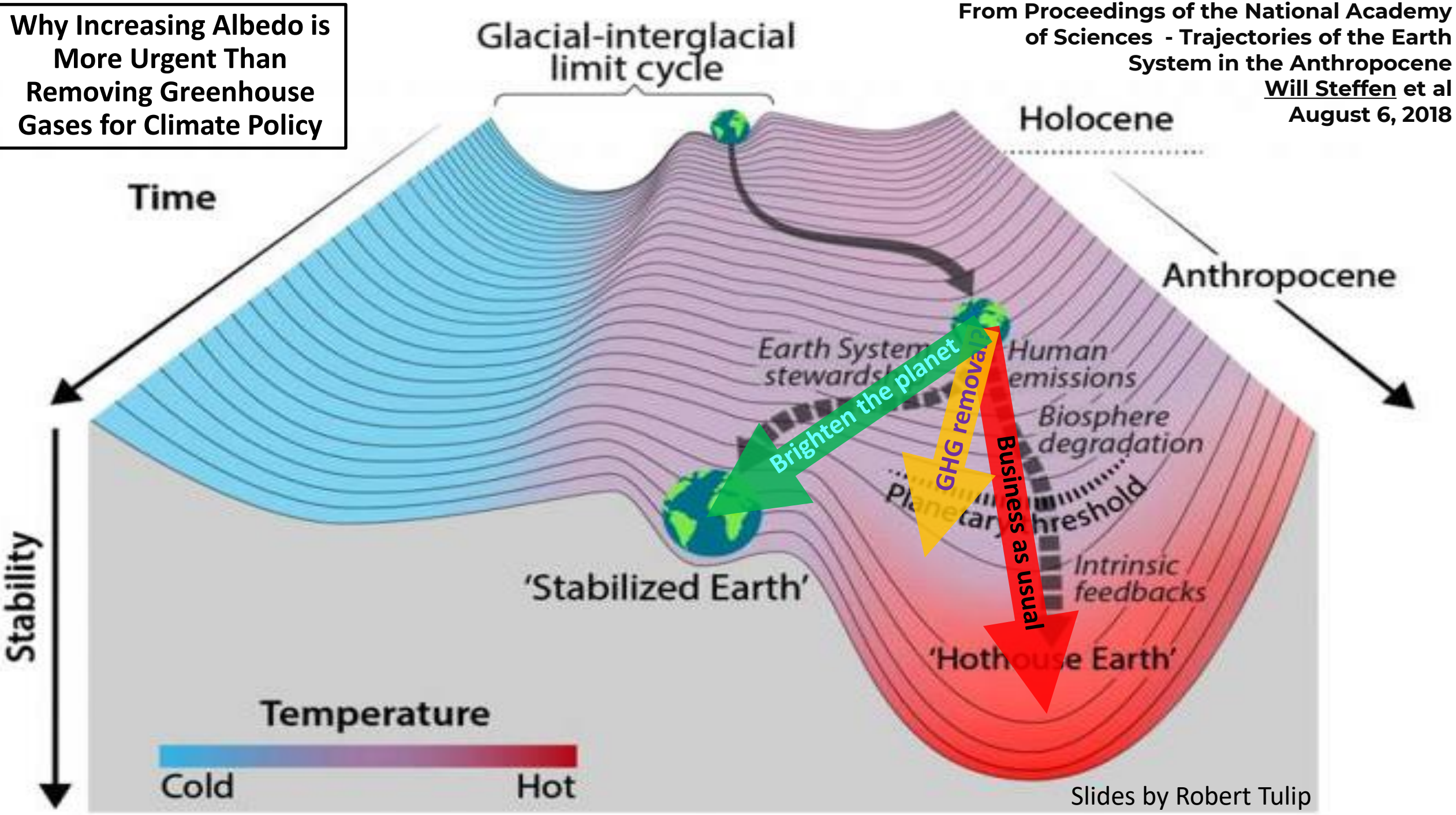
- **Cutting emissions and removing greenhouse gases can't stop climate tipping points**
- **Politics and economics make cutting emissions difficult, expensive and slow.**
- **The world situation is like a canoe headed for a waterfall**
- **Viable cooling technologies lack funds, publicity and political support**

## **The Solution**

- **Reverse the IPCC priority order and put increasing albedo first**
- **A brighter planet can avoid the climate danger zone.**
- **Cooling technologies such as Marine Cloud Brightening are quick, safe and cheap**
- **Fund large scale solar geoengineering research**
- **Governments must cooperate to implement direct cooling measures.**

**Why Increasing Albedo is More Urgent Than Removing Greenhouse Gases for Climate Policy**

From Proceedings of the National Academy of Sciences - Trajectories of the Earth System in the Anthropocene  
Will Steffen et al  
August 6, 2018





# Why Albedo is more important than Greenhouse Gas Removal for Climate Policy

**Proceedings of the National Academy of Sciences  
Trajectories of the Earth System in the Anthropocene  
Will Steffen et al, August 6, 2018**

- “Stability landscape showing the pathway of the Earth System out of the Holocene and thus, out of the glacial–interglacial limit cycle to its present position in the hotter Anthropocene.
- The fork in the road is shown here as the two divergent pathways of the Earth System in the future (broken arrows).
- Currently, the Earth System is on a Hothouse Earth pathway driven by human emissions of greenhouse gases and biosphere degradation toward a planetary threshold at  $\sim 2$  °C, beyond which the system follows an essentially irreversible pathway driven by intrinsic biogeophysical feedbacks.
- The other pathway leads to Stabilized Earth, a pathway of Earth System stewardship guided by human-created feedbacks to a quasi-stable, human-maintained basin of attraction.”