

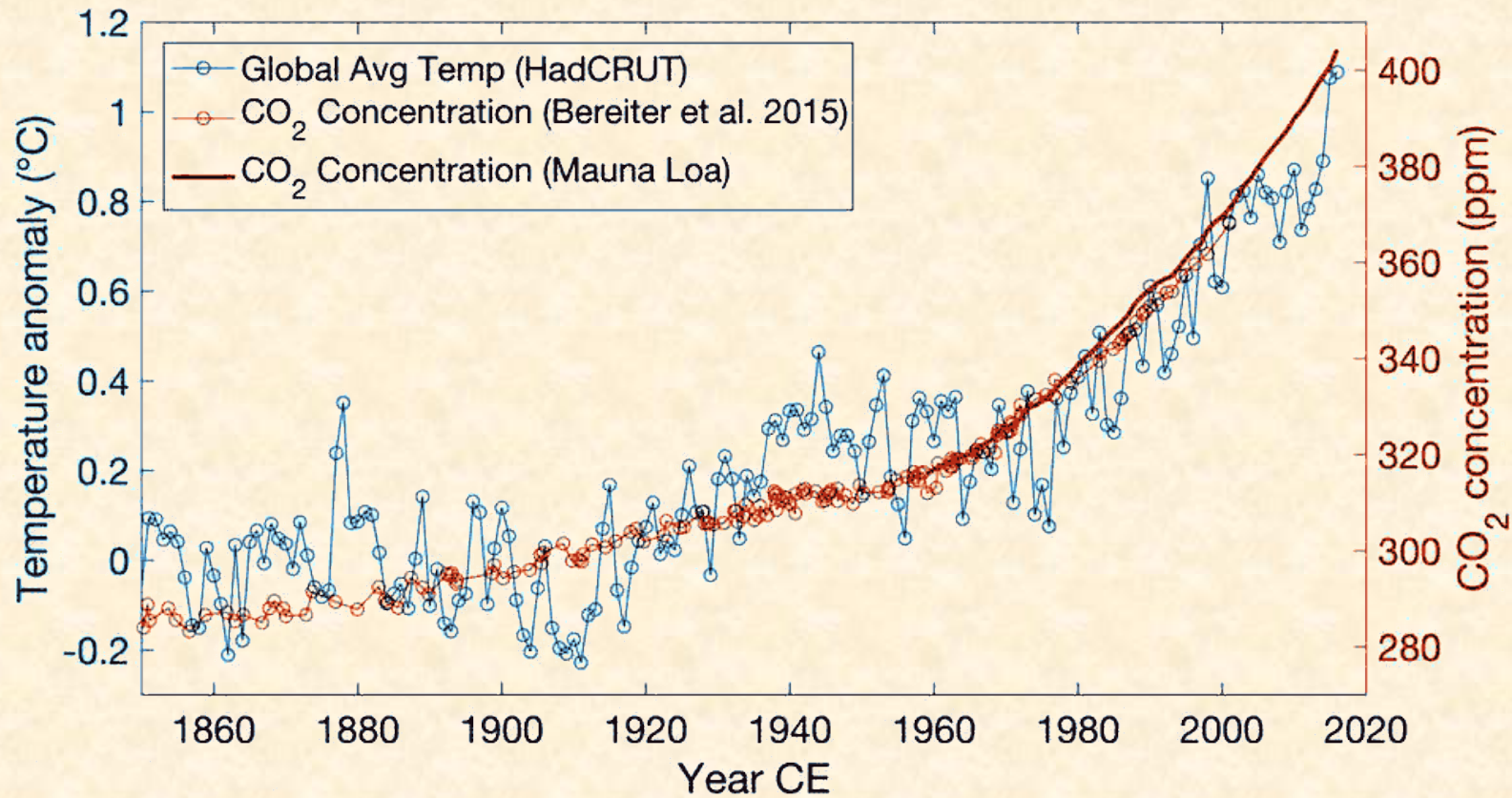
# Searching for Natural Climate Change

Javier Vinós, PhD

# Searching for Natural Climate Change

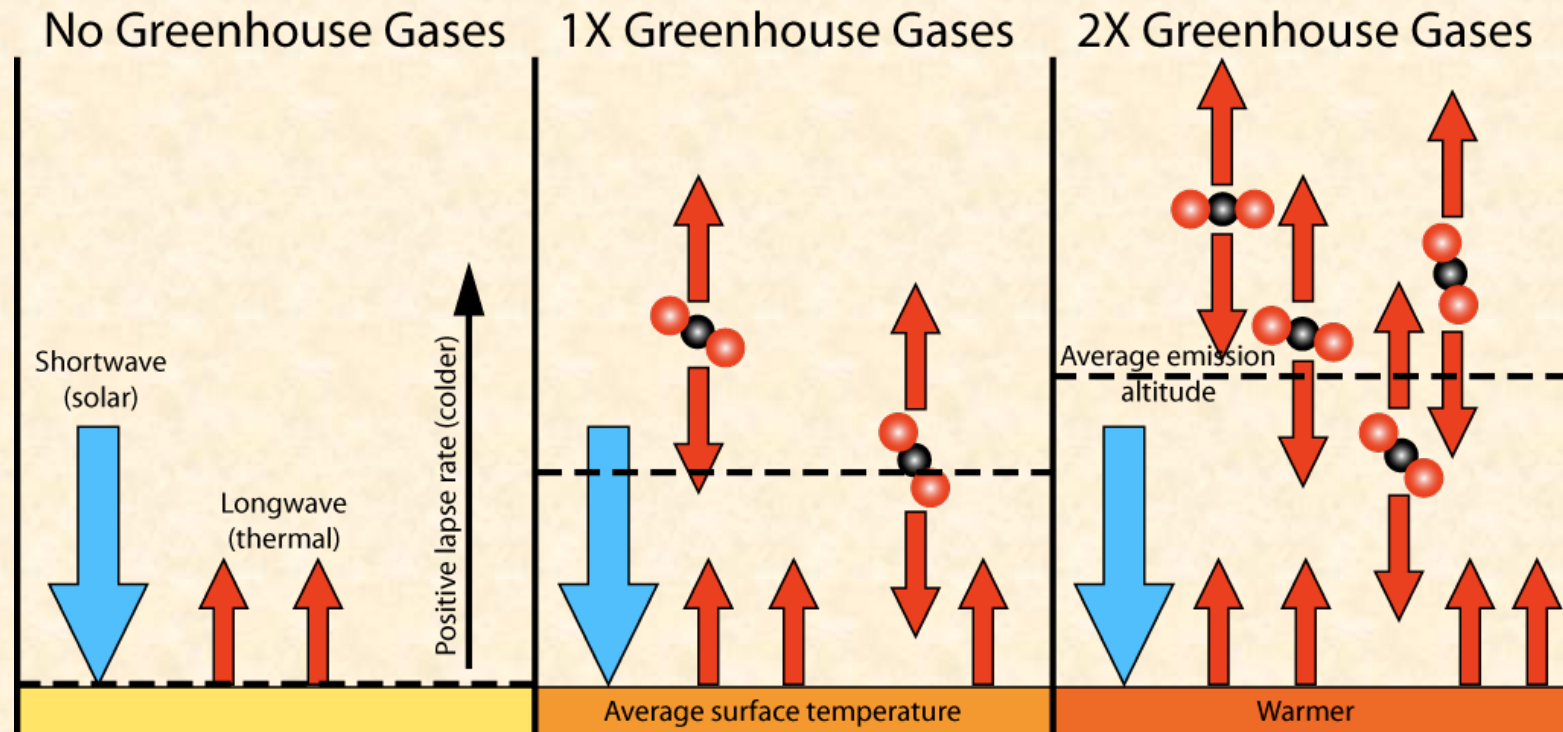
## I. The IPCC Answer

# IPCC defends a greenhouse gas cause



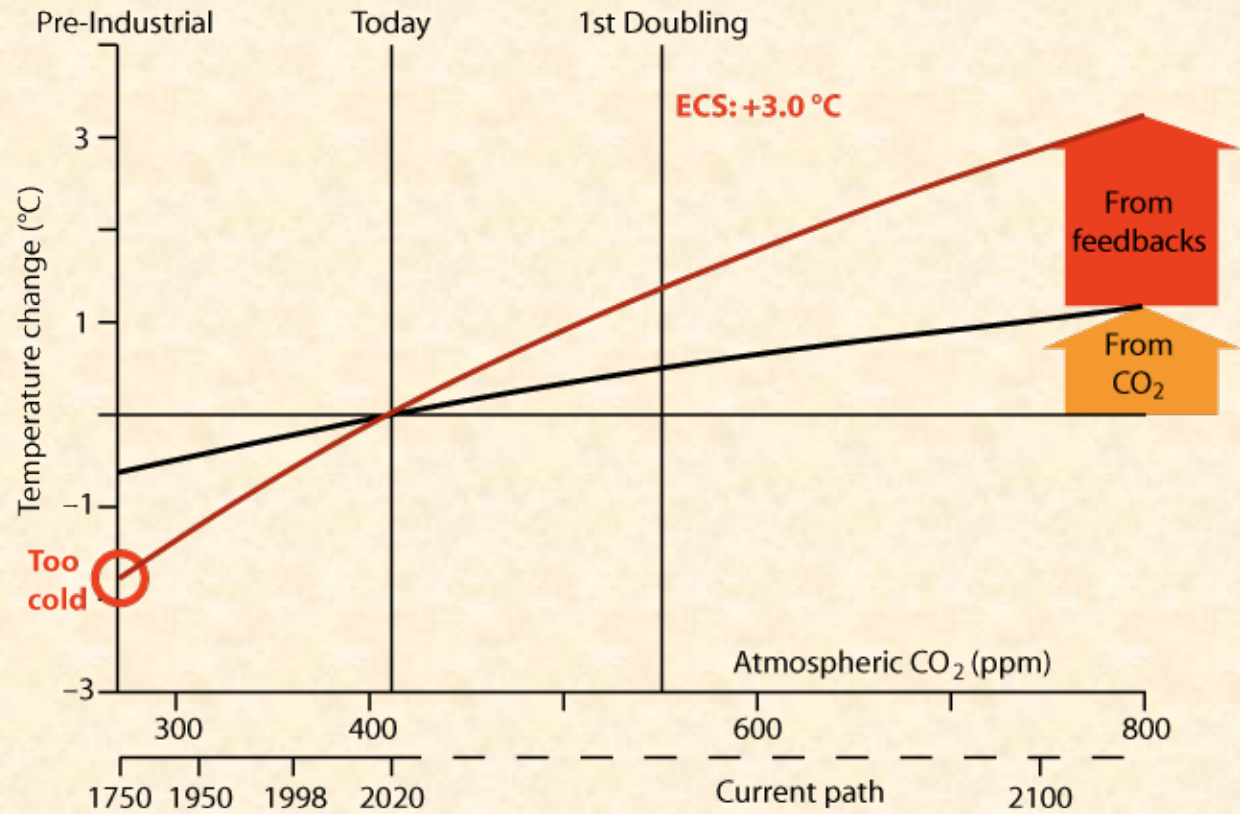
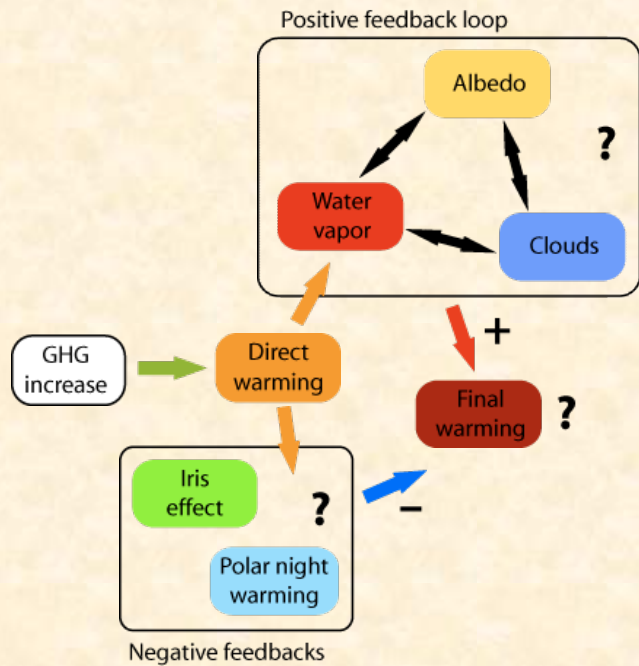
of anthropogenic origin

# IPCC defends a greenhouse gas cause



of anthropogenic origin

# Not much warming from greenhouse gases

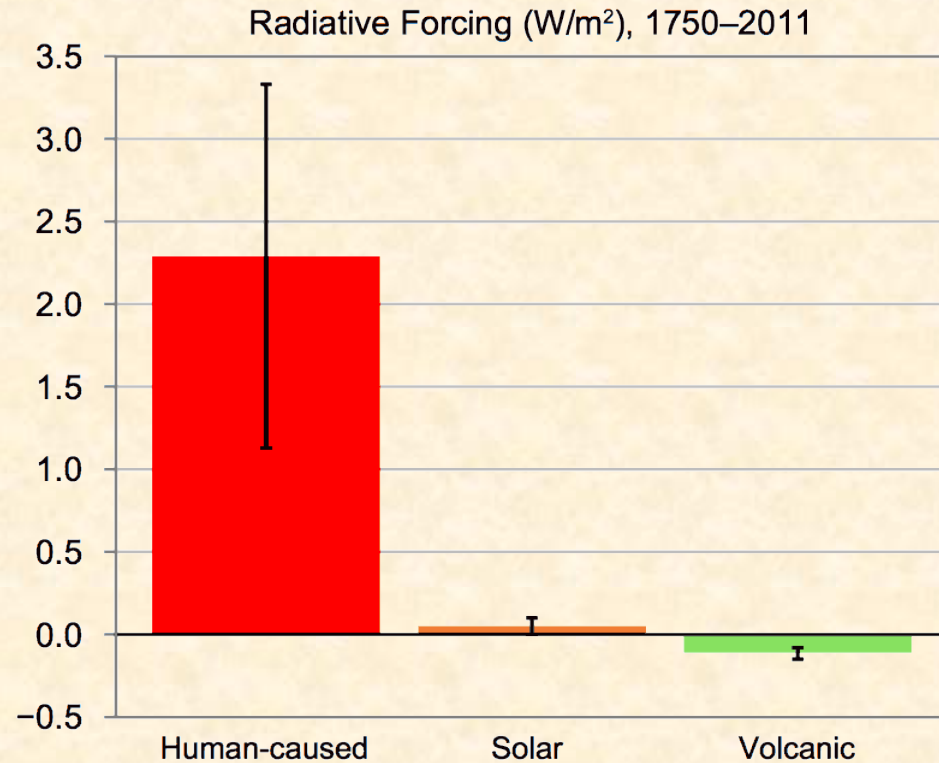


most from poorly known feedbacks

# IPCC defends an anthropogenic cause

**Since 1750 !!!**

Climate Science Special Report:  
Fourth National Climate Assessment  
Vol. I 2017 Figure ES.2



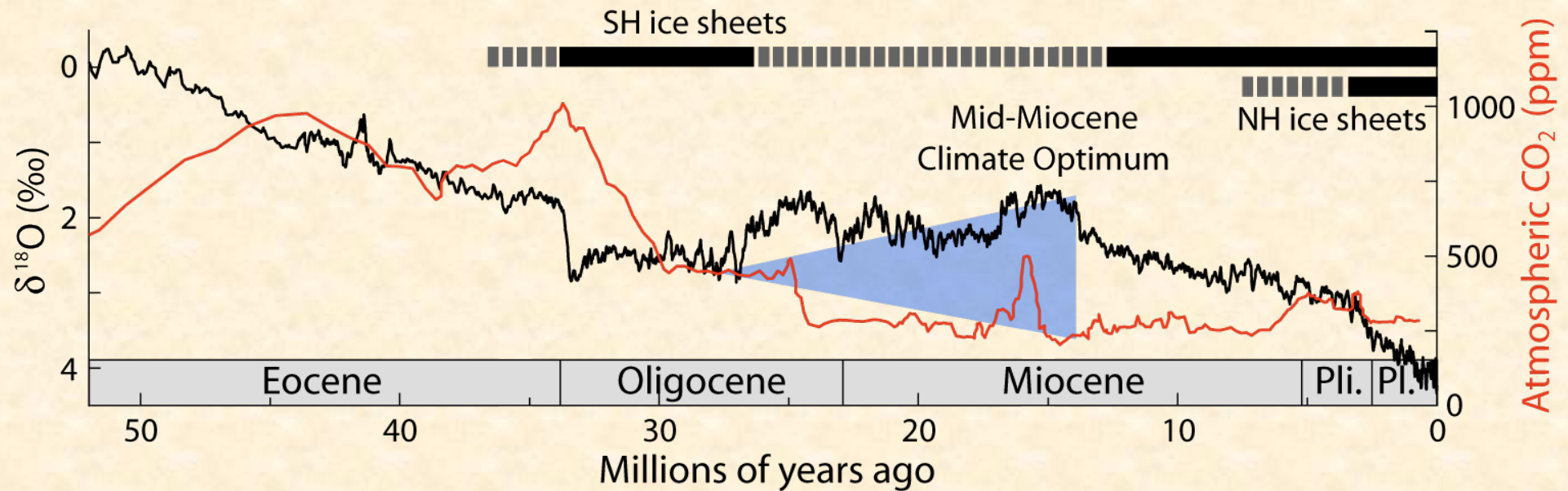
natural climate change is not even considered

# Searching for Natural Climate Change

- I. The IPCC Answer
  - All anthropogenic, mostly greenhouse gases
- II. What the Past Tells Us About Natural Climate Change



# No correlation with CO<sub>2</sub> changes

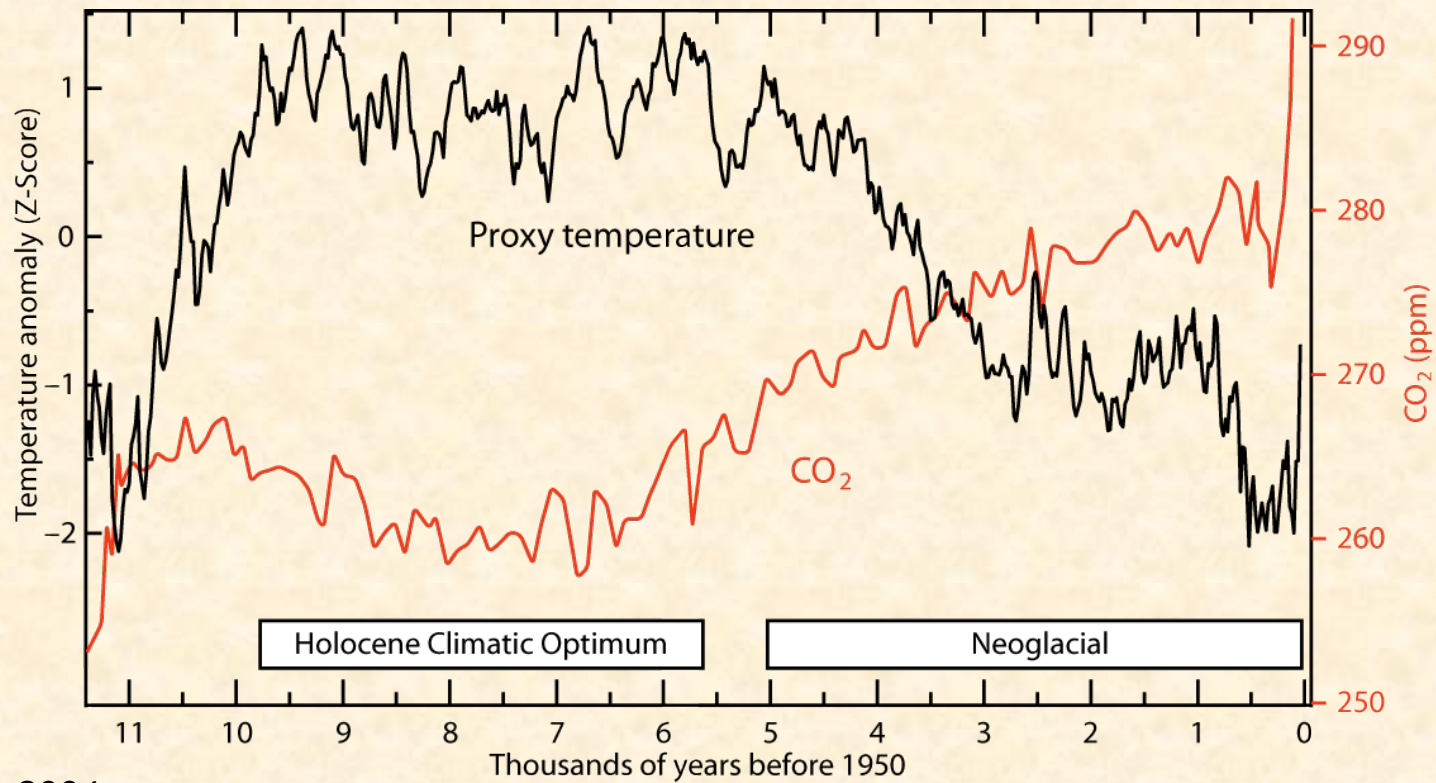


Zachos et al. 2001  
Beerling & Royer 2011

there's more to climate change than CO<sub>2</sub>



# No correlation with CO<sub>2</sub> changes

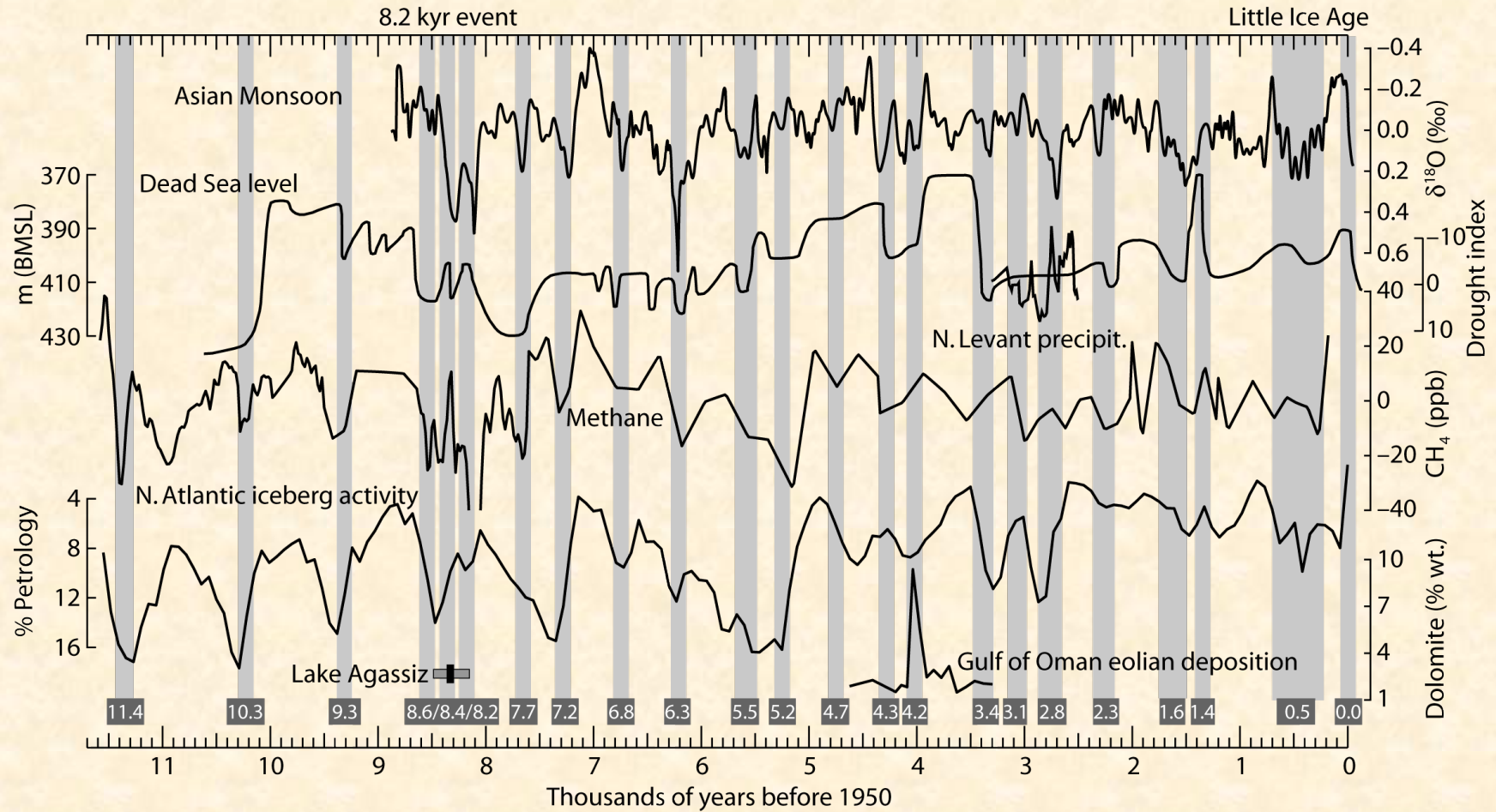


Vinós 2022  
Monnin et al. 2004

there's more to climate change than CO<sub>2</sub>

# Multitude of abrupt climate events

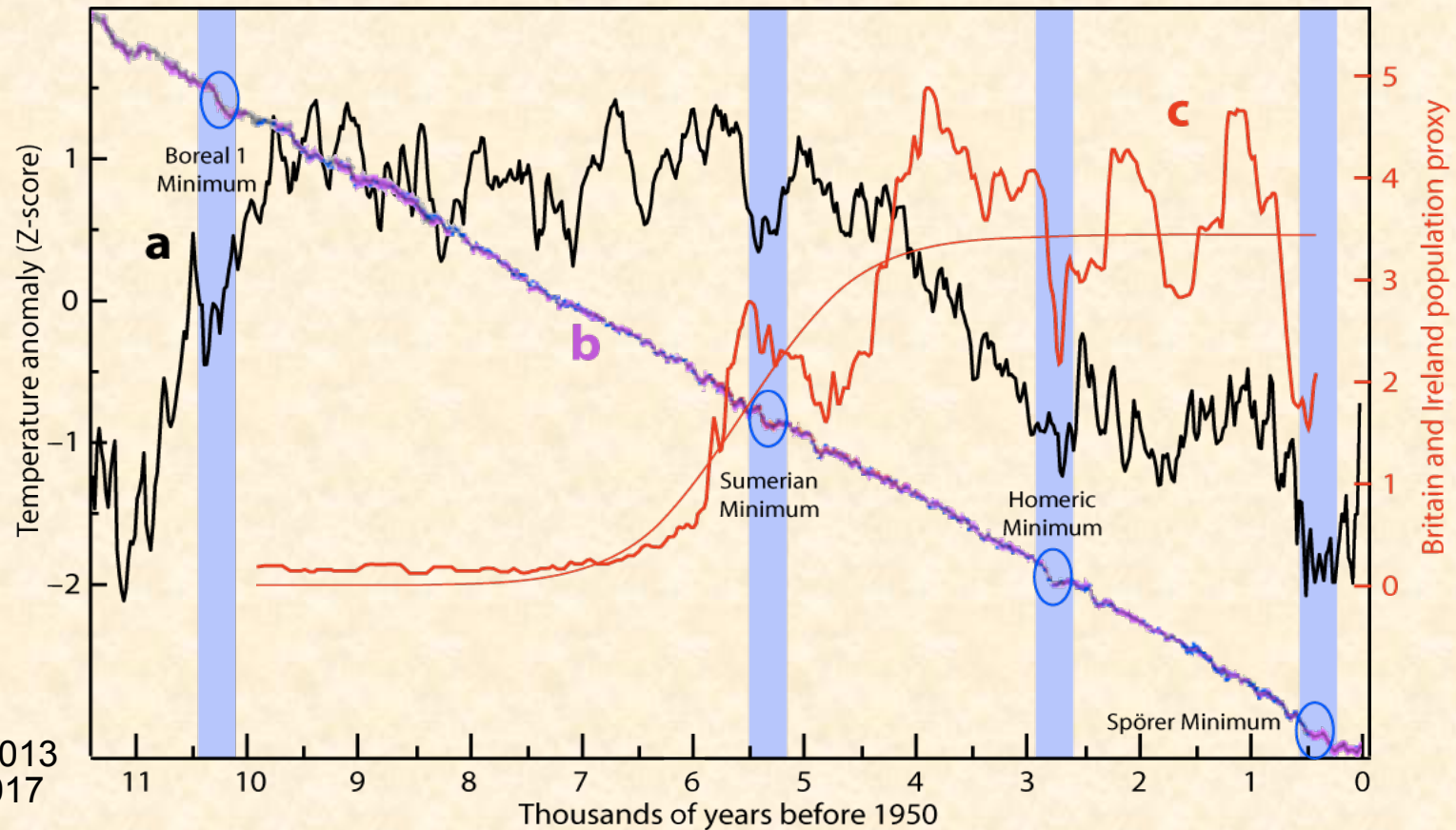
Vinós 2022  
and sources within



# Multitude of abrupt climate events

Date (ka BP)	Name	Temperature effect (1)	Middle East precipitation (2)	Indian/Asian Monsoon (3)	Methane (4)	Bond Event (5)	Proposed cause (6)	Periodicity (7)	Reference (8)
11.4	Pre-Boreal Oscillation	Cooling			Decrease	8	Low solar activity	1000	Björck et al., 1997
10.3	Boreal Oscillation 1	Cooling		Weaker	Decrease	7	Low solar activity	2500/1000	Björck et al., 2001
9.3	Boreal Oscillation 2	Cooling	Reduced	Weaker	Decrease	6	Low solar activity	1000	Zhang et al., 2018
8.6		Cooling	Reduced	Unaffected	Decrease	5b			Gavin et al., 2011
8.4	8.2 kyr ACE	Cooling	Increased	Weaker	Increase	5b	Low solar activity	1000	Rohling & Pälike, 2005
8.2		Cooling	Increased	Weaker	Decrease	5b	Meltwater pulse		Lewis et al., 2012
7.7		Cooling	Increased	Weaker	Decrease	5a	Low solar activity	2500	Berger et al., 2016
7.2		Cooling	Unaffected	Weaker	Decrease	5a	Low solar activity	1000	Berger et al., 2016
6.8		Cooling	Reduced	Weaker	Decrease	4c			
6.3		Cooling	Reduced	Weaker	Decrease	4b	Low solar activity	1000	Fleitmann et al., 2007
5.5		Cooling	Reduced	Weaker	Decrease	4a			
5.2	5.2 kyr ACE	Cooling	Reduced	Unaffected	Decrease	4a	Low solar activity	2500/1000	Thompson et al., 2006
4.7		Cooling	Unaffected	Unaffected	Decrease	3b			
4.3		Warming?	Reduced	Weaker	Decrease				
4.2	4.2 kyr ACE	Cooling	Reduced	Weaker	Increase	3a	Impact? (9)		Cullen et al., 2000
3.4		Cooling	Reduced	Unaffected	Increase	2b			
3.1	Late Bronze ACE	Warming?	Reduced	Unaffected	Decrease				Kaniewski et al., 2015
2.8	2.8 kyr ACE	Cooling	Increased	Weaker	Increase	2a	Low solar activity	2500	Chambers et al., 2007
2.3		Cooling	Reduced	Weaker	Decrease	1c	Low solar activity	1000	
1.6	Dark Ages ACE	Cooling	Reduced	Weaker	Decrease	1b			Helama et al., 2017
1.4		Warming?	Increased	Unaffected	Increase				Helama et al., 2017
0.5	Little Ice Age	Cooling	Reduced	Weaker	Decrease	0	Low solar activity	2500/1000	
0.0	Global Warming	Warming	Reduced	Weaker	Increase		Greenhouse gases		

# Solar variations play an important role



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Reimer et al. 2013  
Bevan et al. 2017

very good agreement between independent sources

# Paleo-climatologists recognize it

*“In view of these findings, we call for an in-depth multi-disciplinary assessment of the potential for solar modulation of climate on centennial scales.”*

**Rohling et al. 2002**

*“On a centennial scale, the successive climatic events which punctuated the entire Holocene in the central Mediterranean coincided with cooling events associated with deglacial outbursts in the North Atlantic area and decreases in solar activity during the interval 11700–7000 cal BP, and to a possible combination of NAO-type circulation and solar forcing since ca. 7000 cal BP onwards.”*

**Magny et al. 2013**

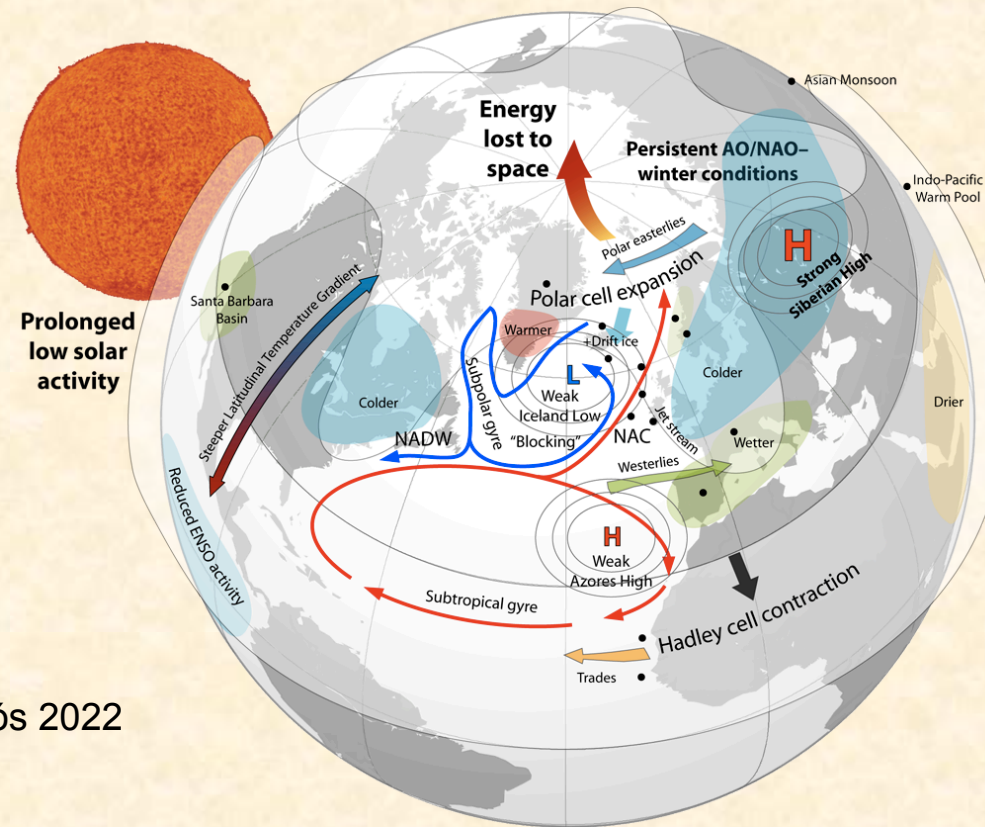
*“Our results imply that small variations in solar irradiance induced pronounced cyclic changes in northern high-latitude environments. They also provide evidence that centennial-scale shifts in the Holocene climate were similar between the subpolar regions of the North Atlantic and North Pacific, possibly because of Sun-ocean-climate linkages.”*

**Hu et al. 2003**

Over 50 authors in just 3 papers,... but they are not listened to



# Low solar activity effect from over 100 articles



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a complete reorganization of the atmosphere, that takes several decades to a century, induces severe cooling

# Searching for Natural Climate Change

## I. The IPCC Answer

- All anthropogenic, mostly greenhouse gases

## II. What the Past Tells Us About Natural Climate Change

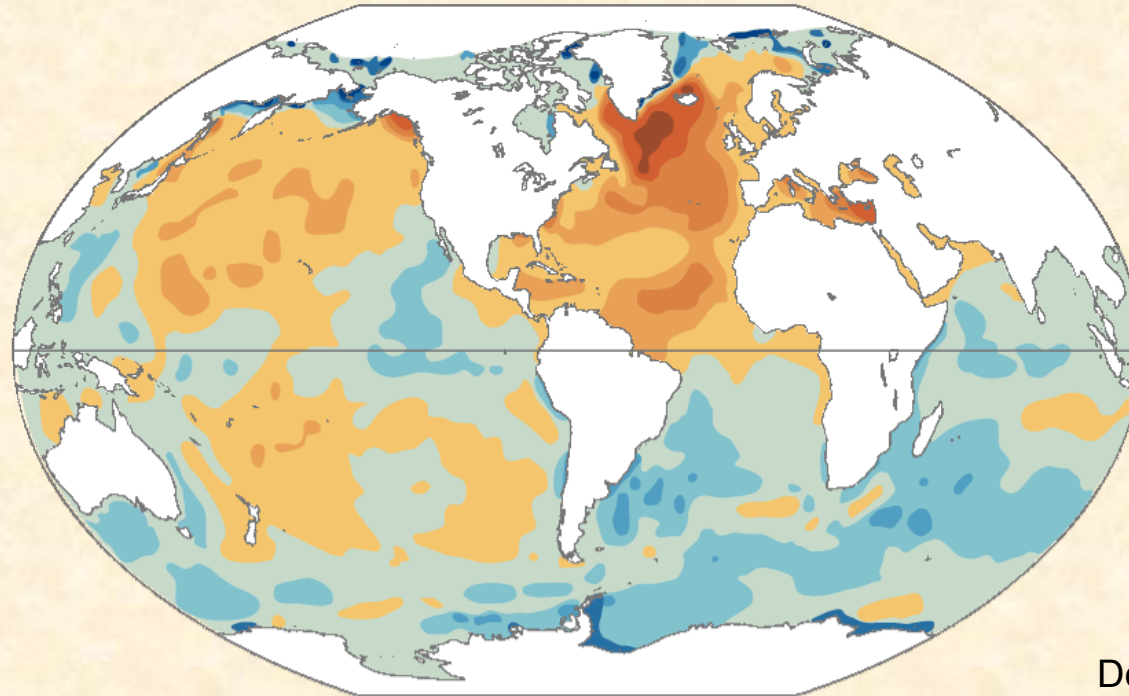
- Climate change does not correlate to CO<sub>2</sub> changes
- Lots of abrupt climate events when GHGs did not change significantly
- Several of those events correlate with solar activity changes

## III. What Science Tells Us About Natural Climate Change



# Multidecadal oceanic oscillations

Atlantic  
Multidecadal  
Oscillation

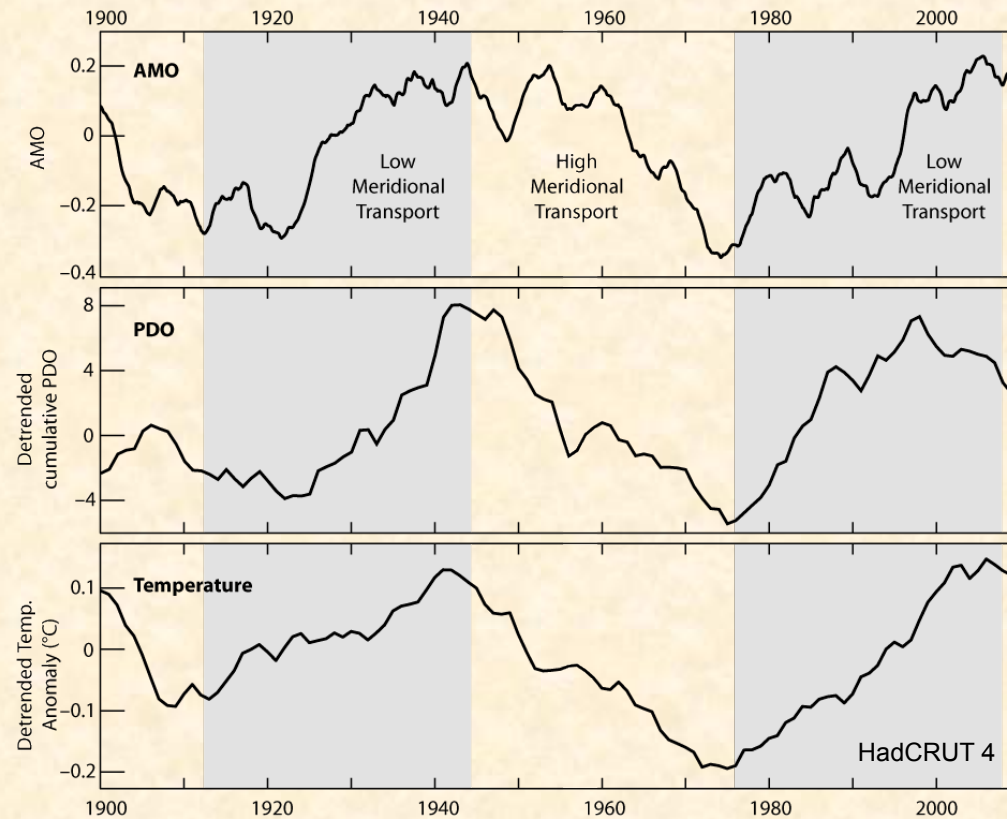


Deser et al. 2010



discovered after anthropogenic GHGs were blamed for  
climate change by the IPCC

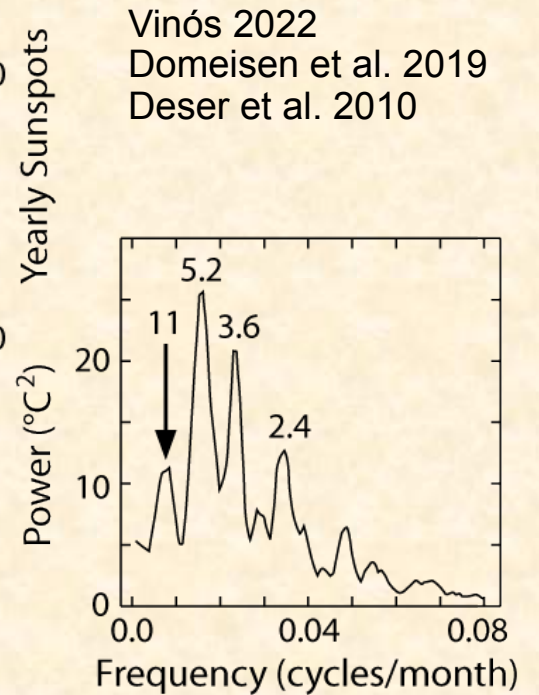
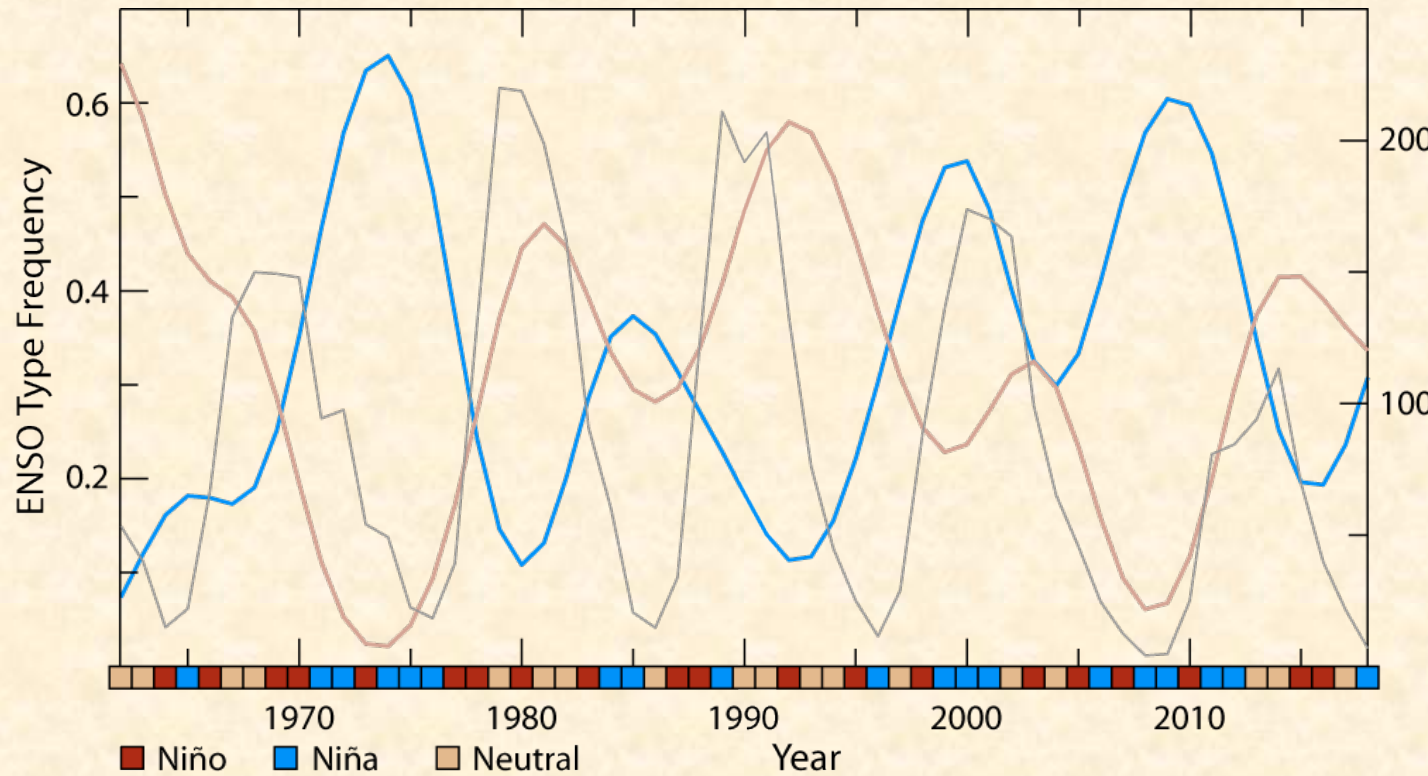
# Oceanic oscillations strongly affect climate



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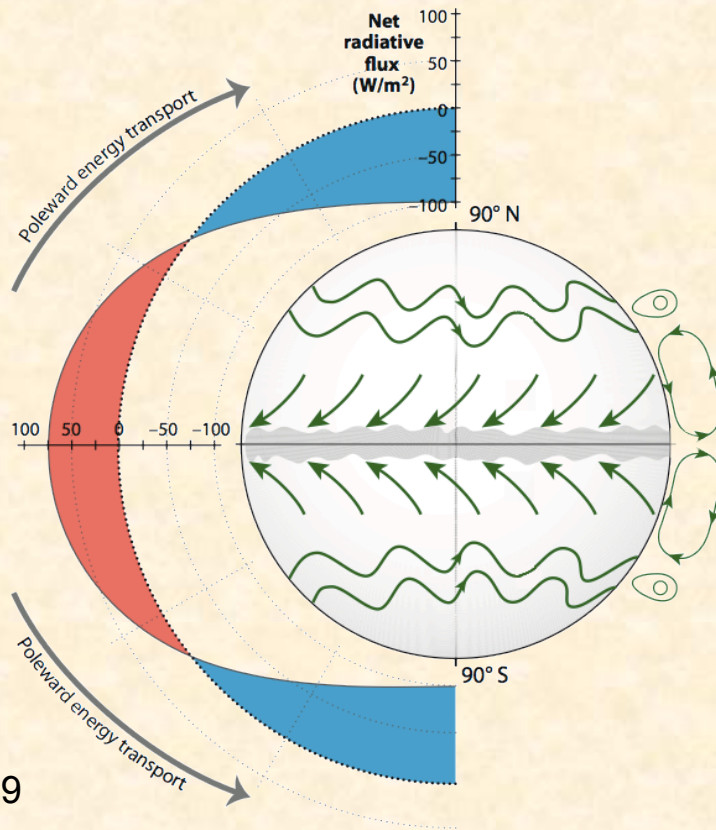
They reflect the intensity of poleward heat transport

# El Niño is a heat-pump that extracts energy from the tropics

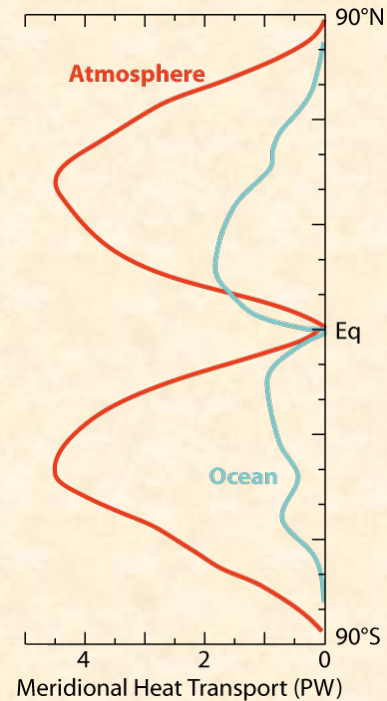


modulated by solar activity

# Poleward (meridional) transport of energy



Chiang 2009

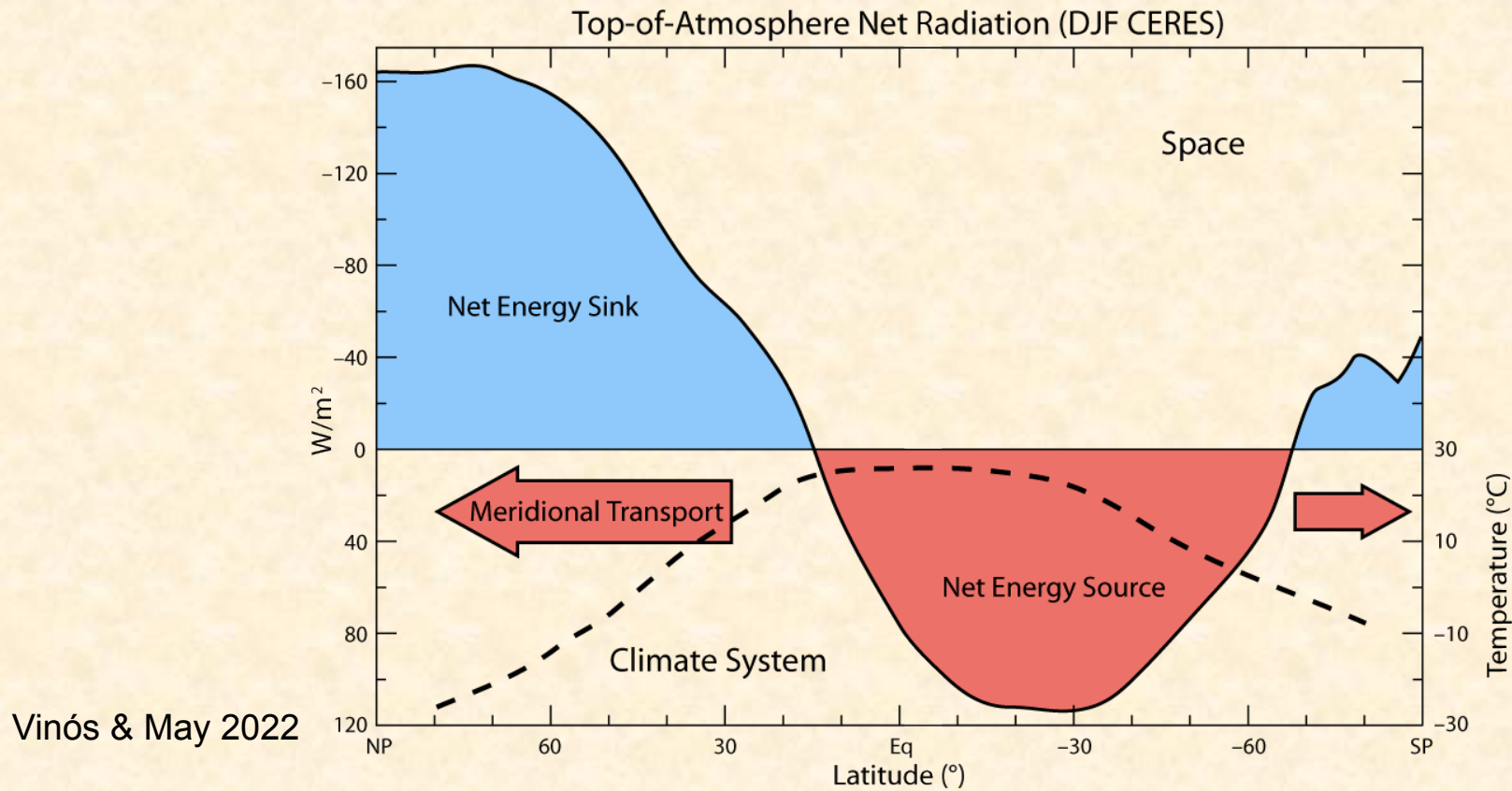


*"The atmospheric heat transport on Earth from the Equator to the poles is largely carried out by the mid-latitude storms. However, there is no satisfactory theory to describe this fundamental feature of the Earth's climate."* Leon Barry, George C. Craig & John Thuburn (2002)

Vinós & May 2022

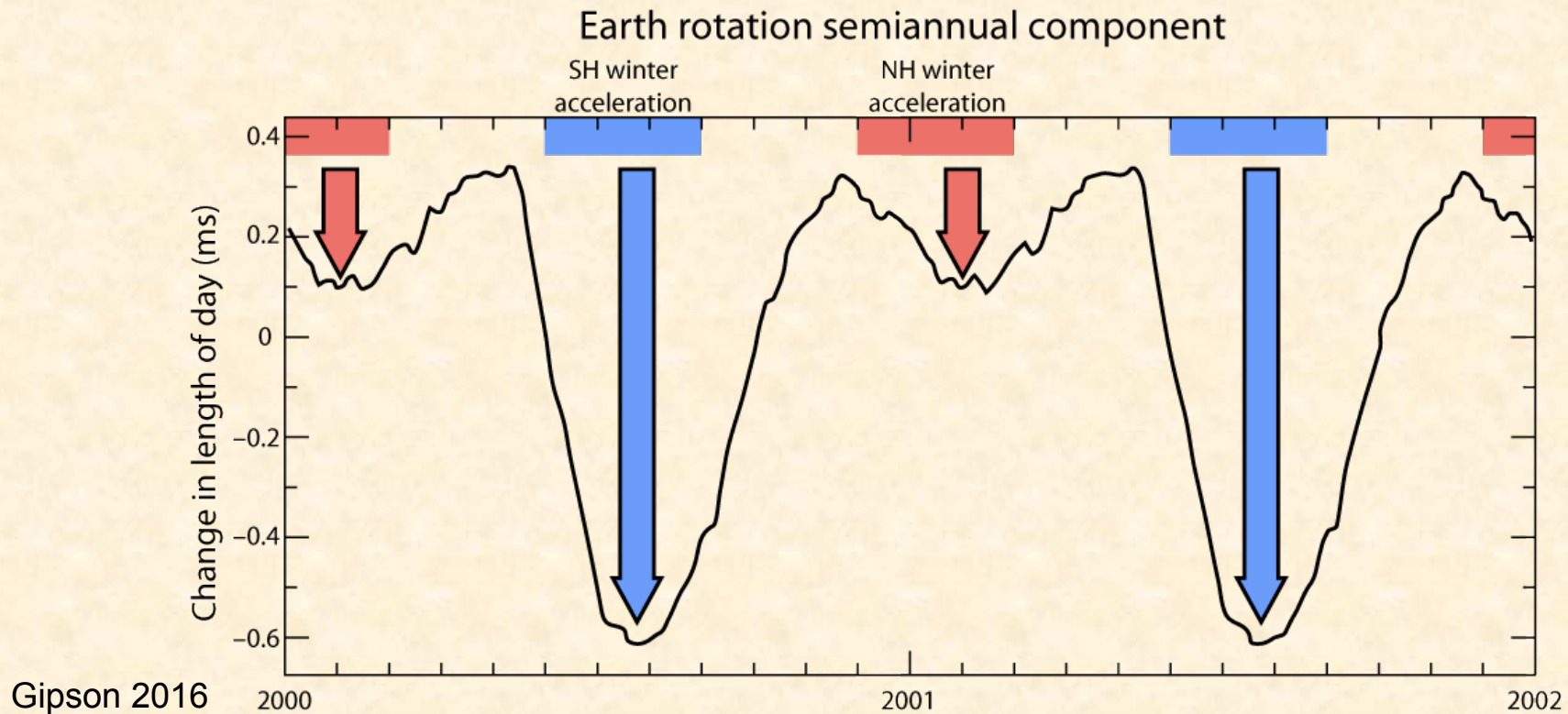
is the most important feature of the climate system

# Heat transport is more intense during winter



and atmospheric circulation increases in winter

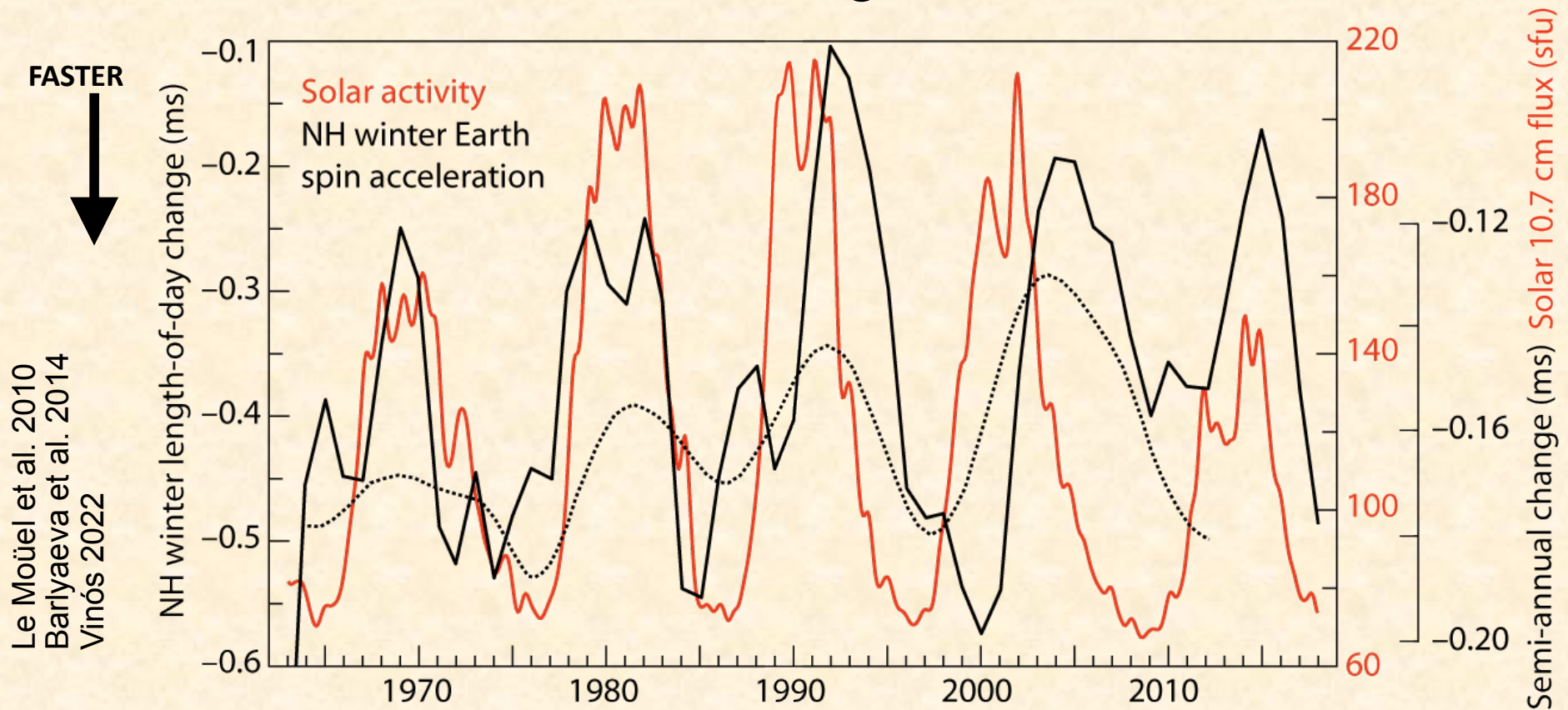
# Winter heat transport causes the Earth to spin faster



and the days become a fraction of a millisecond shorter



# Earth's winter rotation change is solar modulated



the Earth rotates *faster* when solar activity is low



# Searching for Natural Climate Change

## I. The IPCC Answer

- All anthropogenic, mostly greenhouse gases

## II. What the Past Tells Us About Natural Climate Change

- Climate change does not correlate to CO<sub>2</sub> changes
- Lots of abrupt climate events when GHGs did not change significantly
- Several of those events correlate with solar activity changes

## III. What Science Tells Us About Natural Climate Change

- Oceanic oscillations strongly affect climate and reflect meridional transport
- El Niño is a part of the transport system modulated by solar activity
- Winter atmospheric circulation is also modulated by solar activity

## IV. The Winter Gatekeeper Hypothesis

- Natural climate change is essentially a change in the transport of energy

# The Winter Gatekeeper Hypothesis

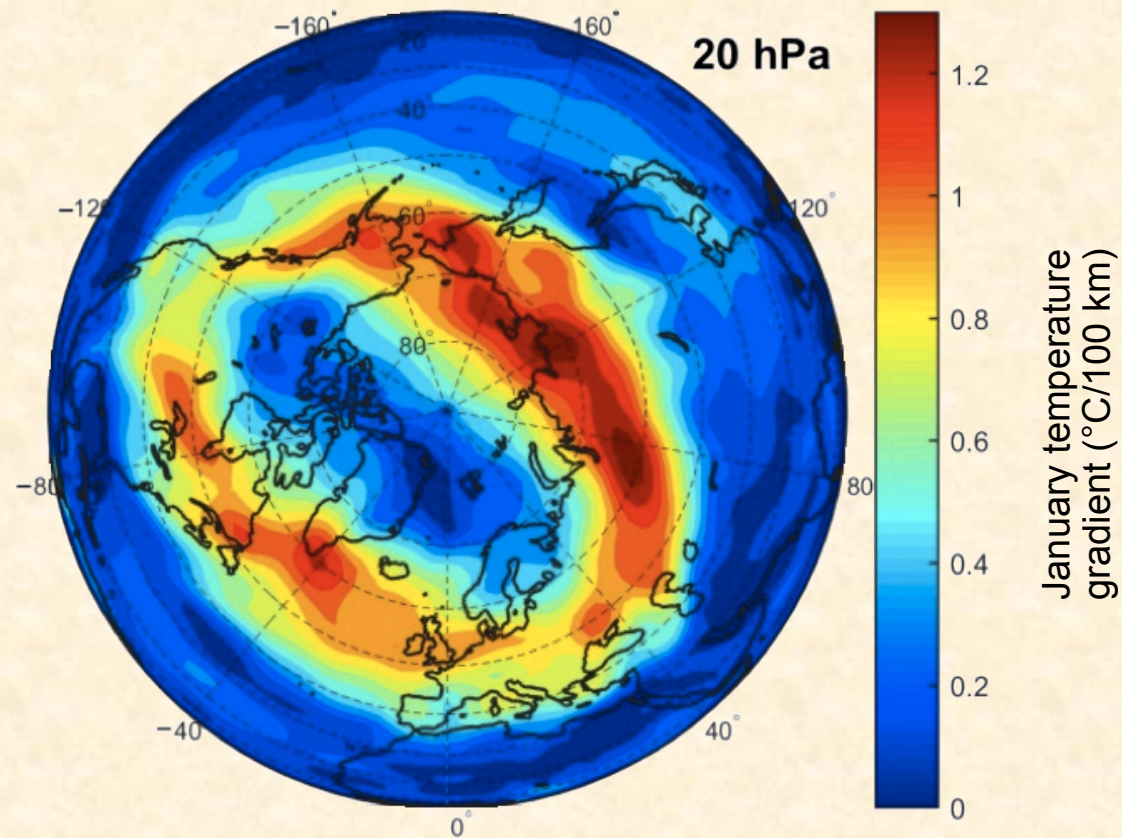
*The main natural climate change mechanism at all timescales is a persistent change in the amount of energy transported to the winter poles. At different timescales, different factors affect this meridional transport.*

*The polar vortex acts as an energy barrier for the winter pole. Its strength regulates how much energy is lost every winter at the poles.*

*On centennial timescales, solar activity is the main factor regulating meridional transport, through its effect on polar vortex strength and winter atmospheric circulation. Solar activity acts through stratospheric ozone, altering the planetary wave flux that controls polar vortex strength. Thus the Sun acts on climate as a winter gatekeeper.*

*Persistently low solar activity causes increased energy loss by the planet, northern mid-latitudes cooling, and Arctic warming. Persistently high solar activity has the opposite effect.*

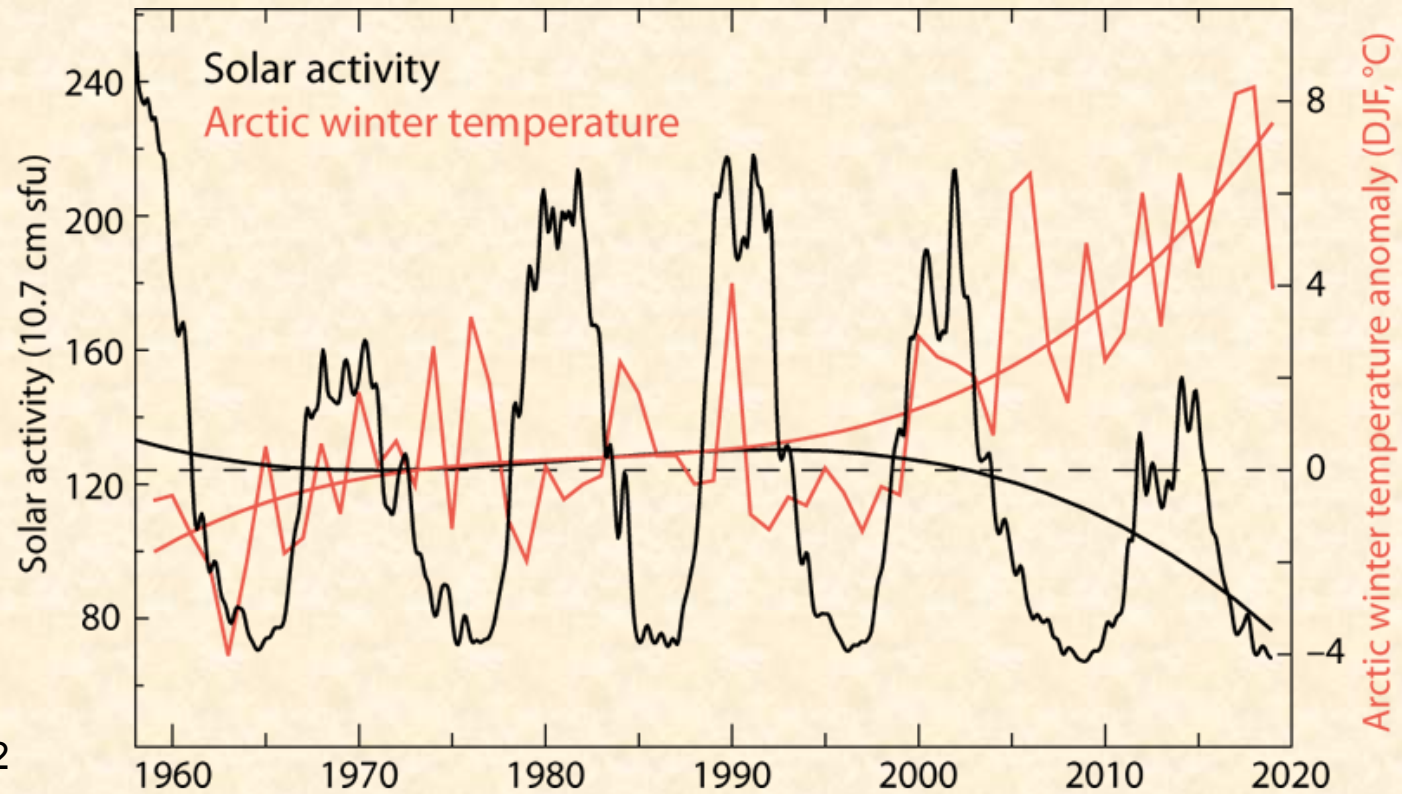
# The winter gatekeeper



Veretenenko 2022  
Stratospheric Polar Vortex as  
an Important Link between  
the Lower Atmosphere  
Circulation and Solar Activity

Polar vortex winds act as a temperature barrier

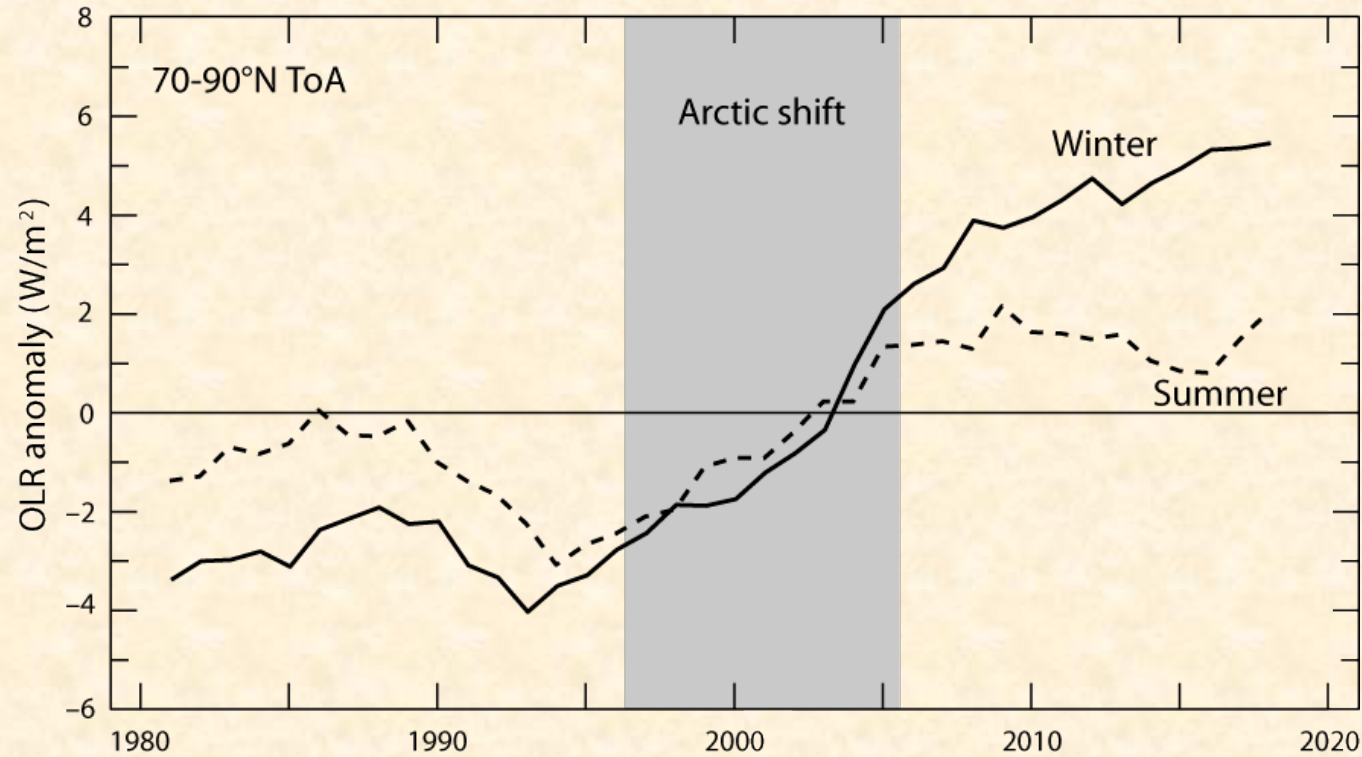
# Solar activity negatively correlates



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with Arctic winter temperature

# Low solar activity and Arctic warming



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result in more outgoing energy



# Solar activity-Arctic temperature anti-correlation

## Modern solar maximum forced late twentieth century Greenland cooling

T. Kobashi<sup>1,2,3</sup>, J. E. Box<sup>4</sup>, B. M. Vinther<sup>5</sup>, K. Goto-Azuma<sup>3,6</sup>, T. Blunier<sup>5</sup>, J. W. C. White<sup>7</sup>, T. Nakaegawa<sup>8</sup>, and C. S. Andresen<sup>4</sup>

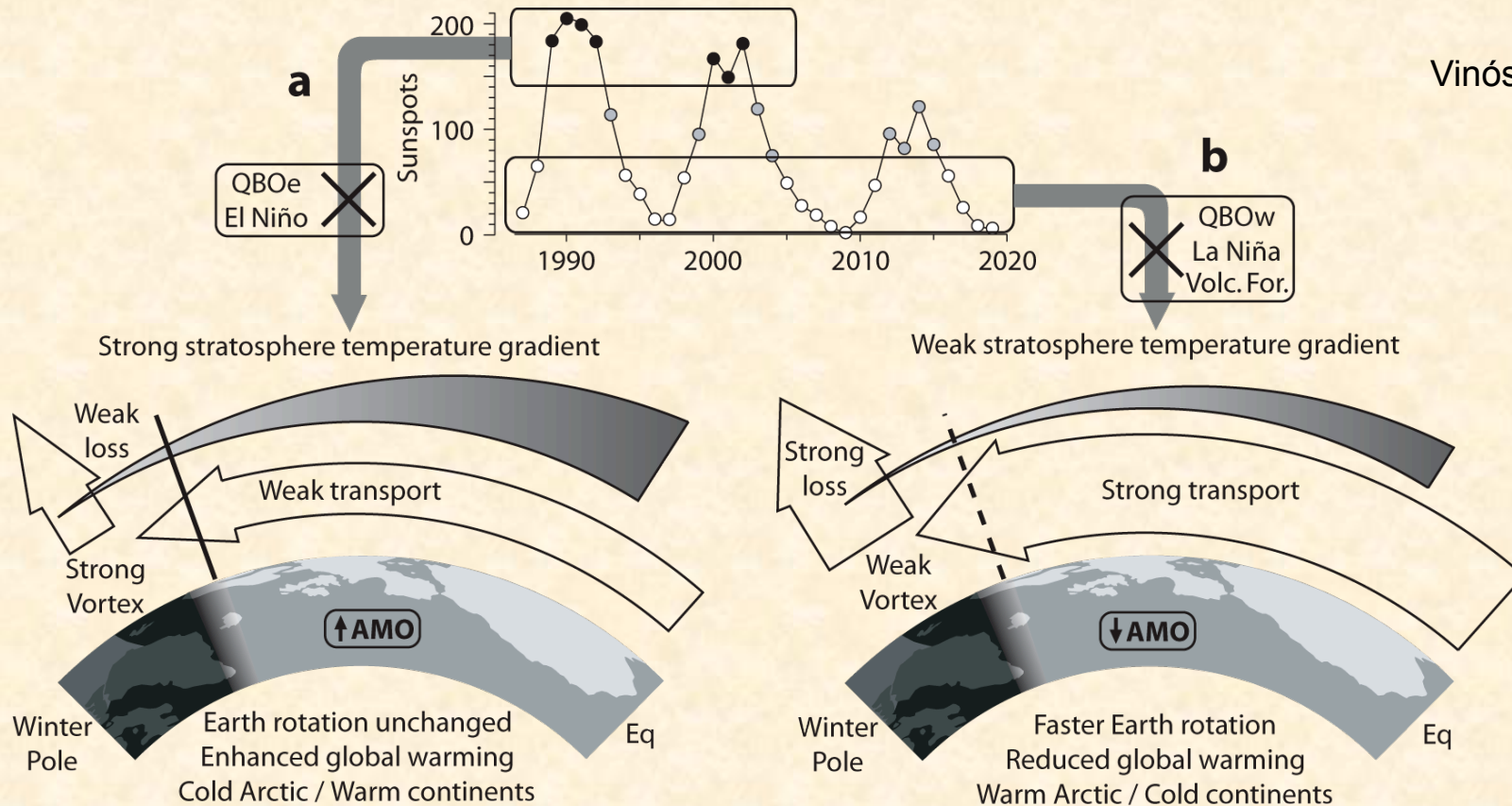
*“robust Greenland temperature records over the past 2100 years ... show that this cold anomaly was part of a recursive pattern of antiphase Greenland temperature responses to solar variability with a possible multidecadal lag.”*

Kobashi et al. 2015

goes back at least 2100 years

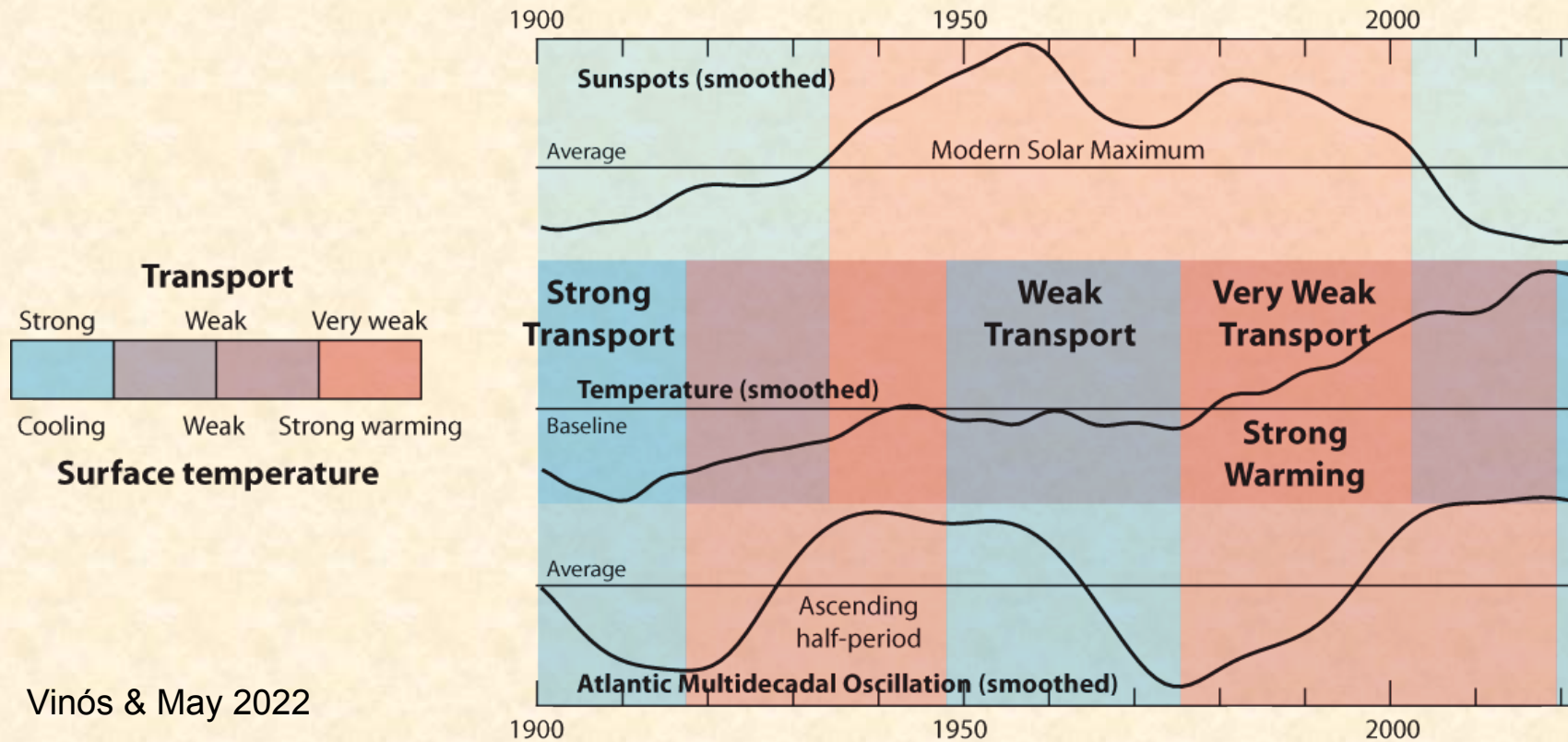
# The Winter Gatekeeper Hypothesis

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# Weak meridional transport over the 20<sup>th</sup> century



Vinós & May 2022

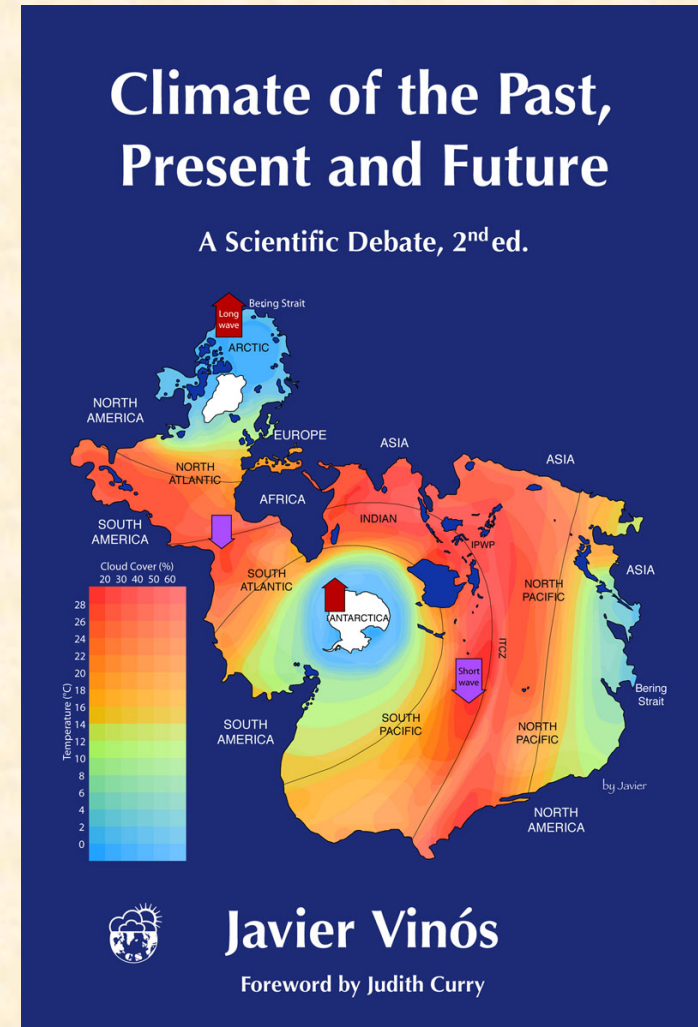
has resulted in *strong* 20<sup>th</sup> century natural warming

# Projections

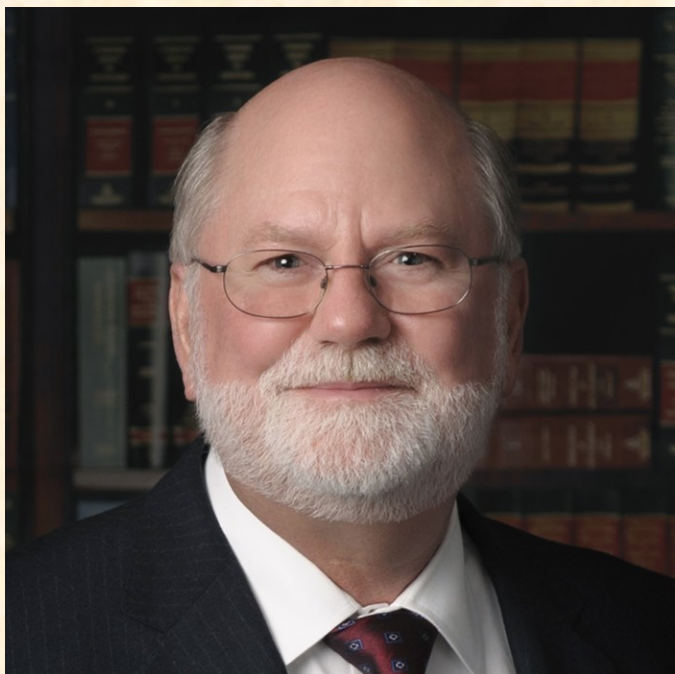
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- Little warming or slight cooling until 2035
- Less warming in the 21<sup>st</sup> than in the 20<sup>th</sup> century
- When solar activity becomes high there should be Arctic cooling and Arctic sea ice growth

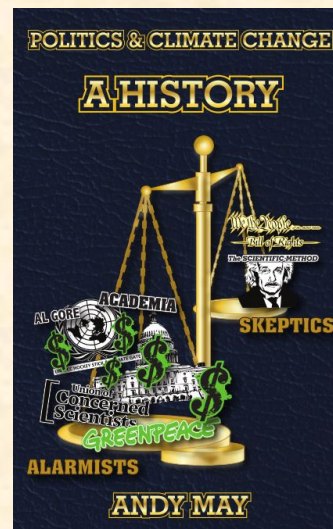
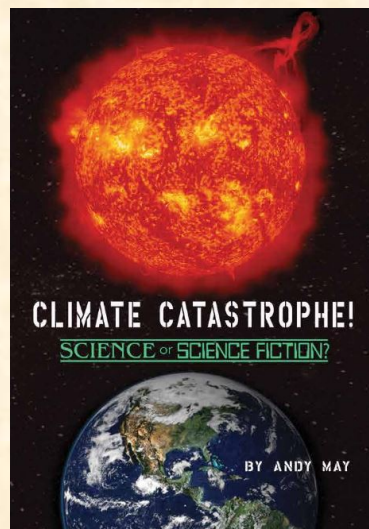
Future book:



# Andy May



<https://andymaypetrophysicist.com/>



## Acknowledgements:

- Judith Curry & Peter Webster
- Willie Soon
- Anthony Watts & WUWT people