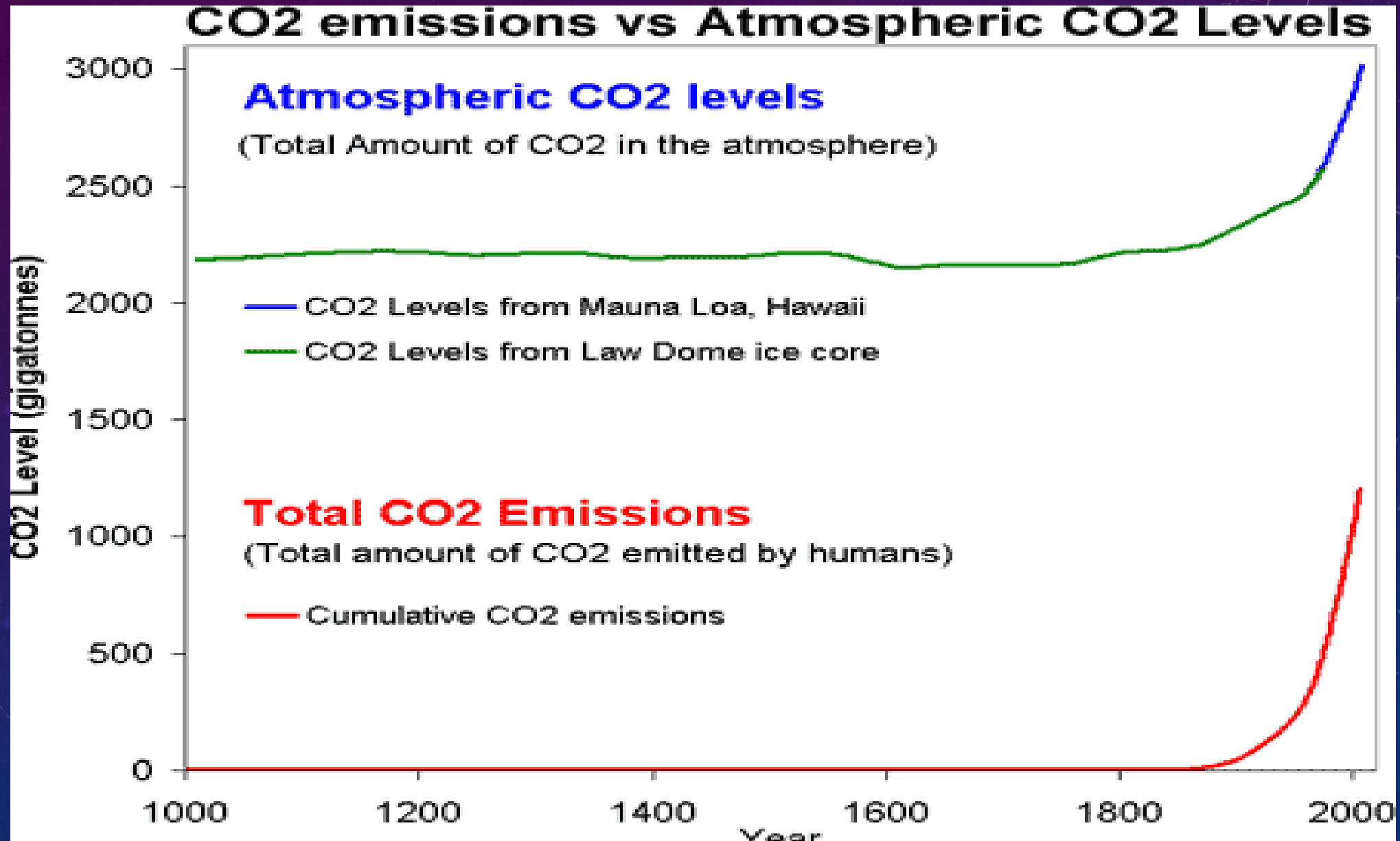


# CLIMATE CHANGE AND THE WIDER DILEMMA: DISTILLED TO THE ESSENTIALS

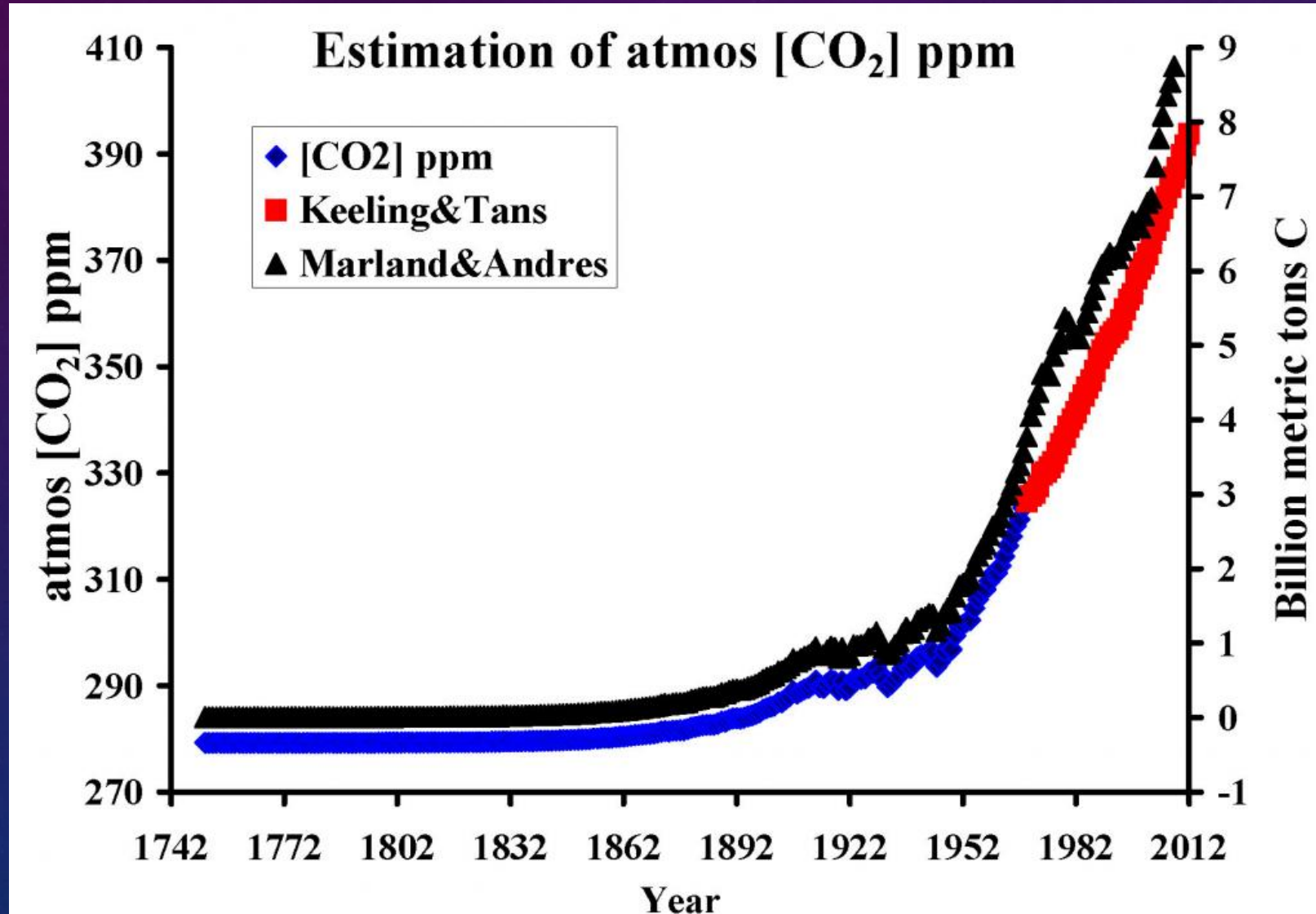


DR. RICHARD NOLTHENIUS  
CABRILLO COLLEGE ASTRONOMY

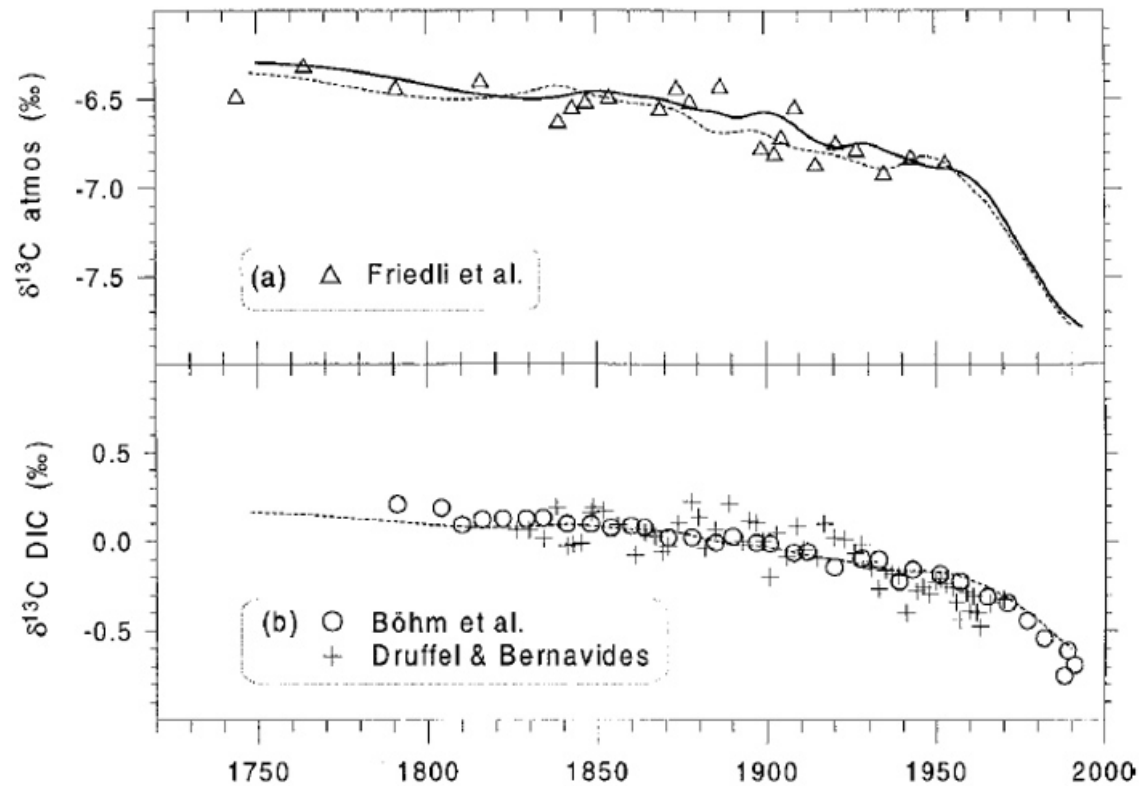
# POINT #1: IT'S REAL, IT'S HUMANS



# ATMOSPHERIC CO<sub>2</sub> AND DOCUMENTED EMISSION RATES FROM HUMAN ACTIVITIES – THEY RISE TOGETHER

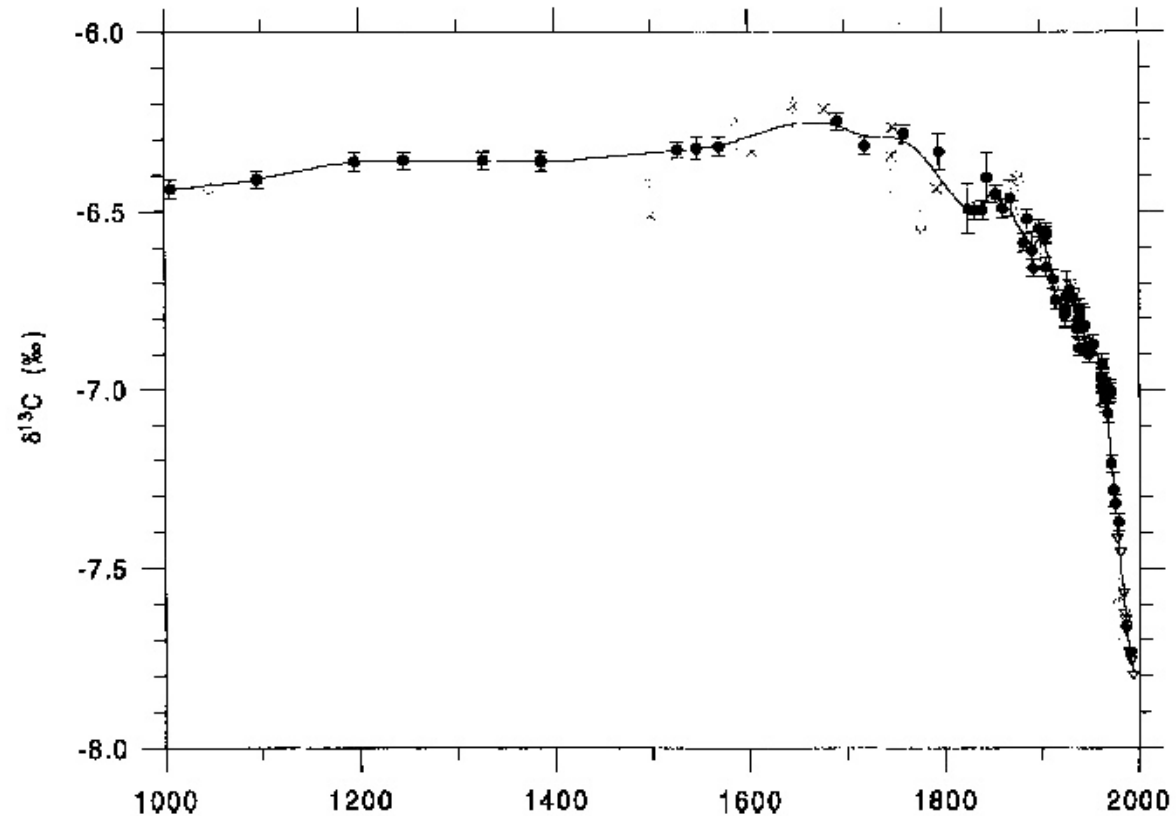


FOSSIL FUEL CARBON IS ENHANCED IN  $C_{12}$  VS.  $C_{13}$ . THIS TREND SHOWS OUR ATMOSPHERIC CO<sub>2</sub> RISE IS DUE TO PHOTOSYNTHETIC (FOSSIL FUEL SOURCED) CARBON, WHICH IS ENRICHED IN  $C_{12}$



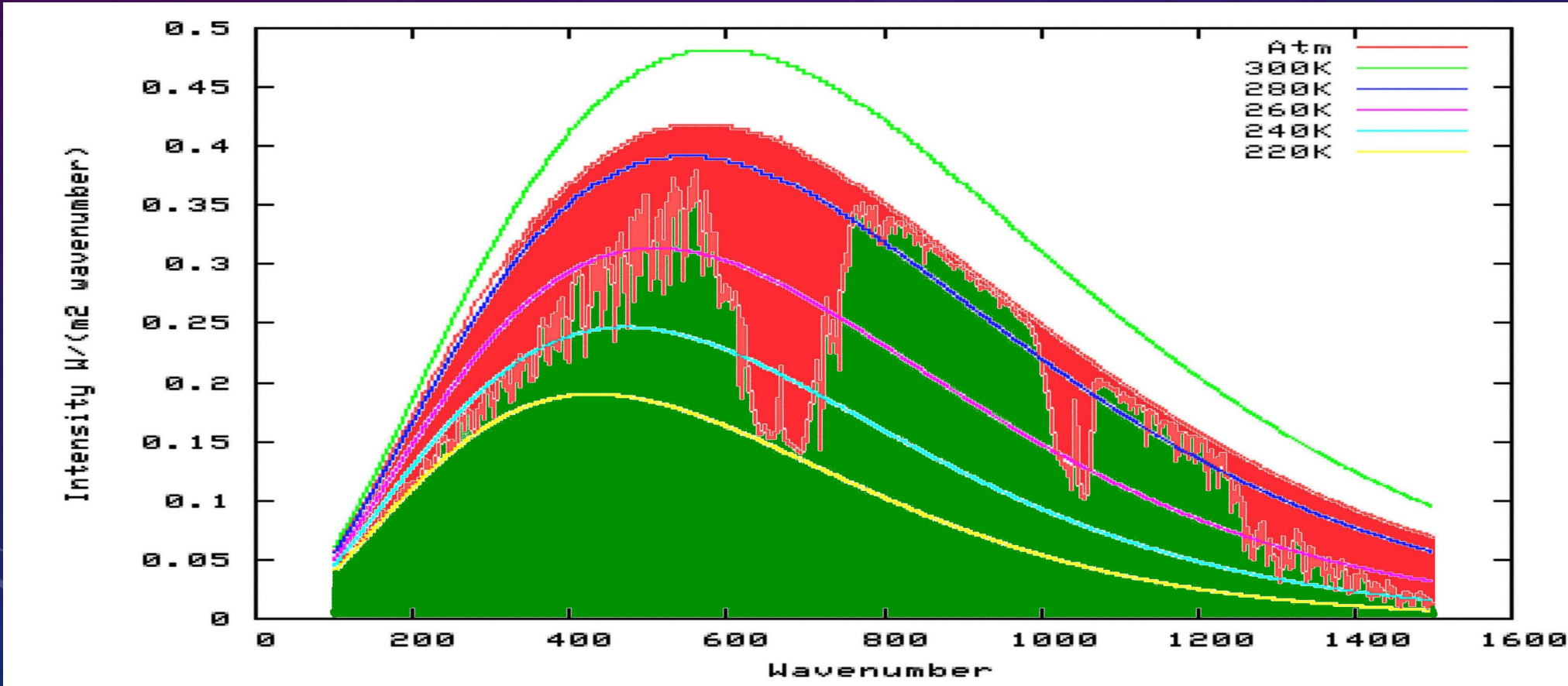
*Fig. 10.* Comparisons with other published records. (1) The ice core  $\delta^{13}\text{C}$  data of Friedli et al. (1986, triangles) are compared to the Law Dome ice cores and firn using the spline of Figs. 8, 9 (solid line), and to model troposphere  $\delta^{13}\text{C}$  derived from the Law Dome CO<sub>2</sub> record (dashed line, Trudinger et al., this volume). (2) The proxy DIC  $\delta^{13}\text{C}$  data of Böhm et al., 1996 (circles, +4.674) and Druffel and Bernavides, 1986 (crosses, -0.193) are compared to the model mixed layer DIC (dashed line, +2.294) from the same model run used in (a). The numbers in brackets above are values, averaged over the 1820–1940 period, used to normalise each record to zero over this period to aid comparison of the temporal behaviour.

OBVIOUS WHEN SEEN OVER THE PAST 1,000 YEARS. DRAMATIC RELEASE OF 50~100 MILLION YEARS OF LONG SEQUESTERED, FOSSIL SUNLIGHT STORED AS ORGANIC  $C_{12}$ -ENRICHED CARBON, LOWERING THE  $C_{13}$  FRACTION

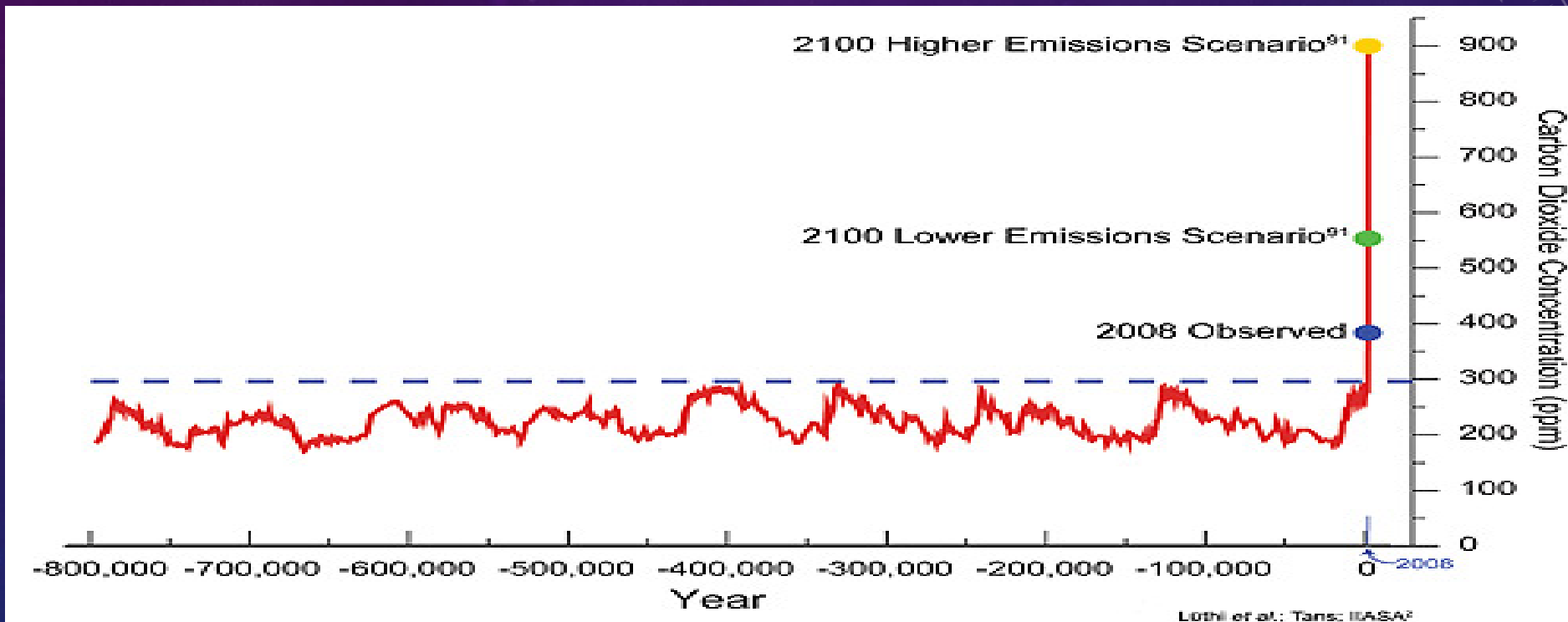


**Fig. 9.** The complete record of  $CO_2$  and  $\delta^{13}C$  from the Law Dome ice cores and firn. The smoothing spline is weighted by the statistical error in, and density of, data; effective smoothing is 25 years after 1800 AD and  $\sim 130$  years before 1800 AD. (Light grey symbols are rejected points from the section “Summary of data selections and corrections” and are included here only to provide a perspective on the selection processes. Crosses indicate ethanol contaminated samples, open circles are other rejections).

POINT #2: WHY DOES THIS CO2 CAUSE TEMPERATURE CHANGE? BECAUSE CO2 (AND ALL NON-DIATOMIC MOLECULES) ABSORBS AND SCATTERS THE OUTGOING INFRARED HEAT RADIATION THE EARTH MUST SEND BACK OUT TO SPACE IF WE ARE TO MINIMIZE TEMPERATURE RISE



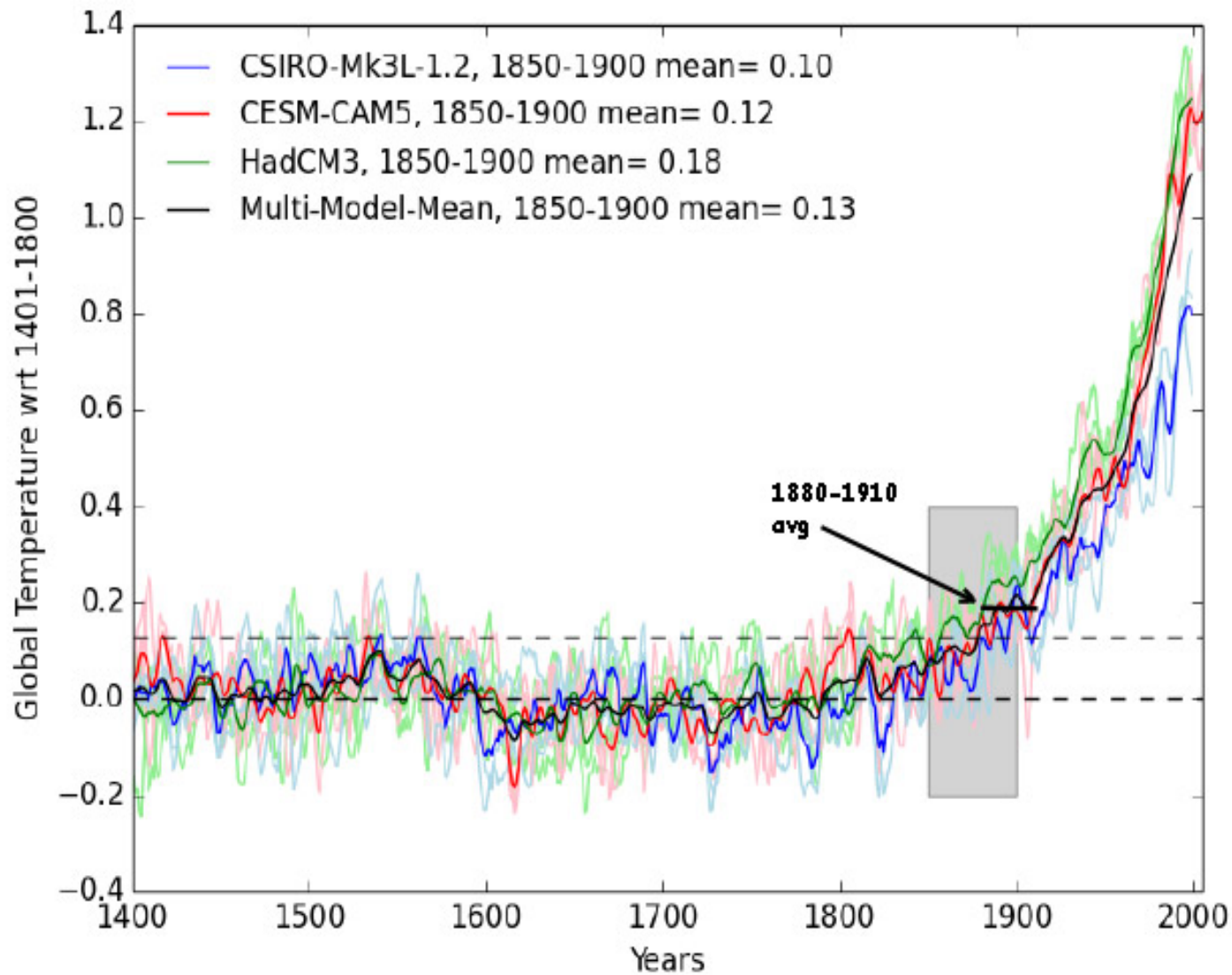
ATMOSPHERIC CO<sub>2</sub> IS RISING AT RATES NEVER SEEN IN EARTH HISTORY.  
EXTINCTIONS HAPPEN WHEN CHANGE IS TOO FAST FOR SPECIES' SLOW  
MULTI-GENERATIONAL GENETIC CHANGES TO ADAPT TO.



Analysis of air bubbles trapped in an Antarctic ice core extending back 800,000 years documents the Earth's changing carbon dioxide concentration. Over this long period, natural factors have caused the atmospheric carbon dioxide concentration to vary within a range of about 170 to 300 parts per million (ppm). Temperature-related data make clear that these variations have played a central role in determining the global climate. As a result of human activities, the present carbon dioxide concentration of about 385 ppm is about 30 percent above its highest level over at least the last 800,000 years. In the absence of strong control measures, emissions projected for this century would result in the carbon dioxide concentration increasing to a level that is roughly 2 to 3 times the highest level occurring over the glacial-interglacial era that spans the last 800,000 or more years.

# POINT #3: NATURE DEMANDS WE MEASURE OUR TEMPERATURE CHANGE TO CLIMATE FROM THE PRE-INDUSTRIAL BASELINE IF WE ARE TO PROPERLY JUDGE CLIMATE SENSITIVITY TO CO2 AND THE CONSEQUENCES

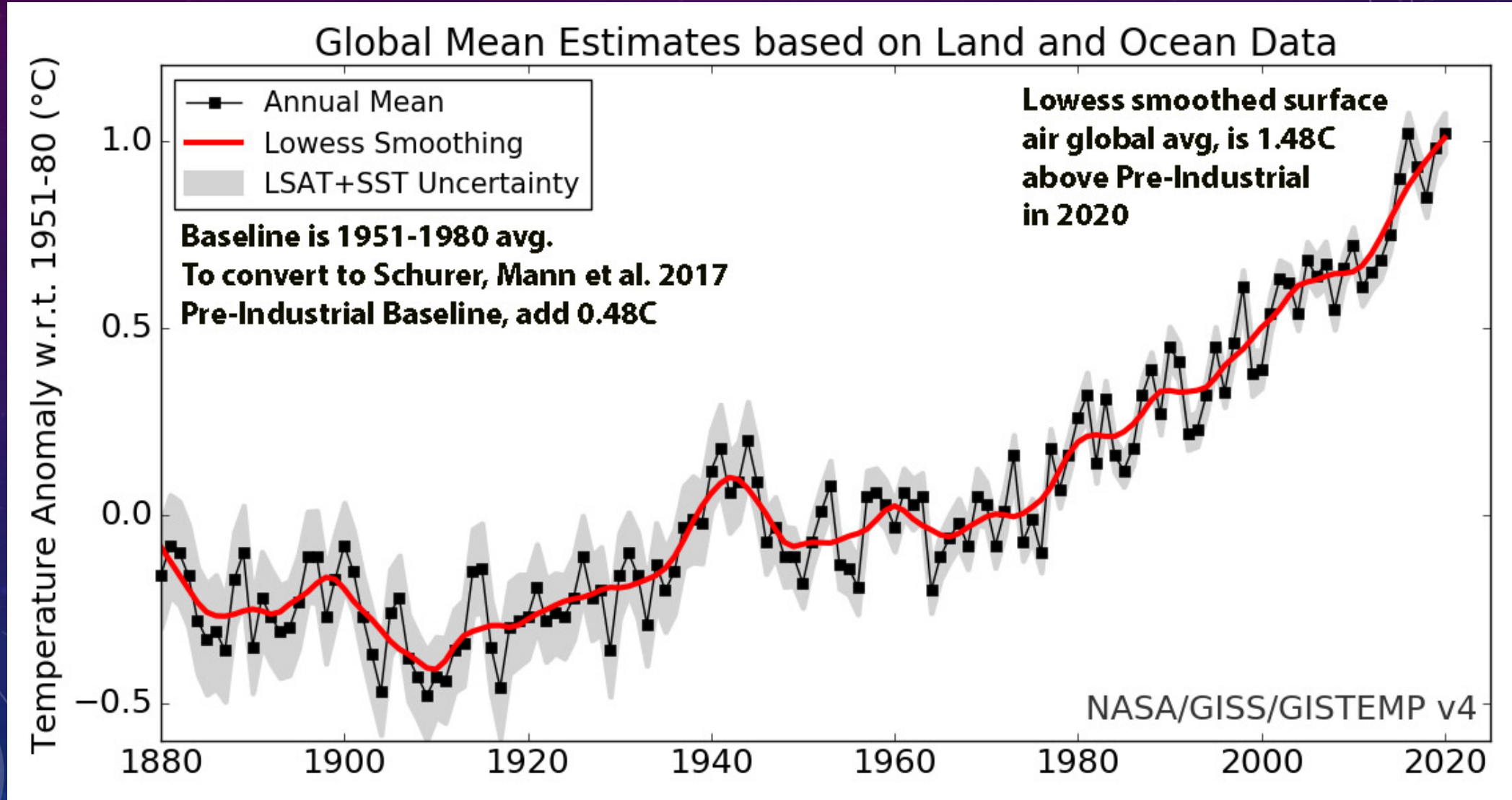
- The best temperature data is from the GISS database: (GISS=Goddard Institute for Space Sciences). Unfortunately, GISS decided to use the 1951-1980 average as their zero point temperature baseline in their constantly updated graph. And uncritical media and even many who should know better, continue to simply read the number off their graphs without noticing it is not referenced to the Pre-Industrial Baseline.
- This media mis-representation serves the political purpose of having the public believe that the Paris 1.5C and 2C targets can still be reached within the ruling political / economic paradigm. Scientists know those targets are impossible. Lately, it's gotten worse...



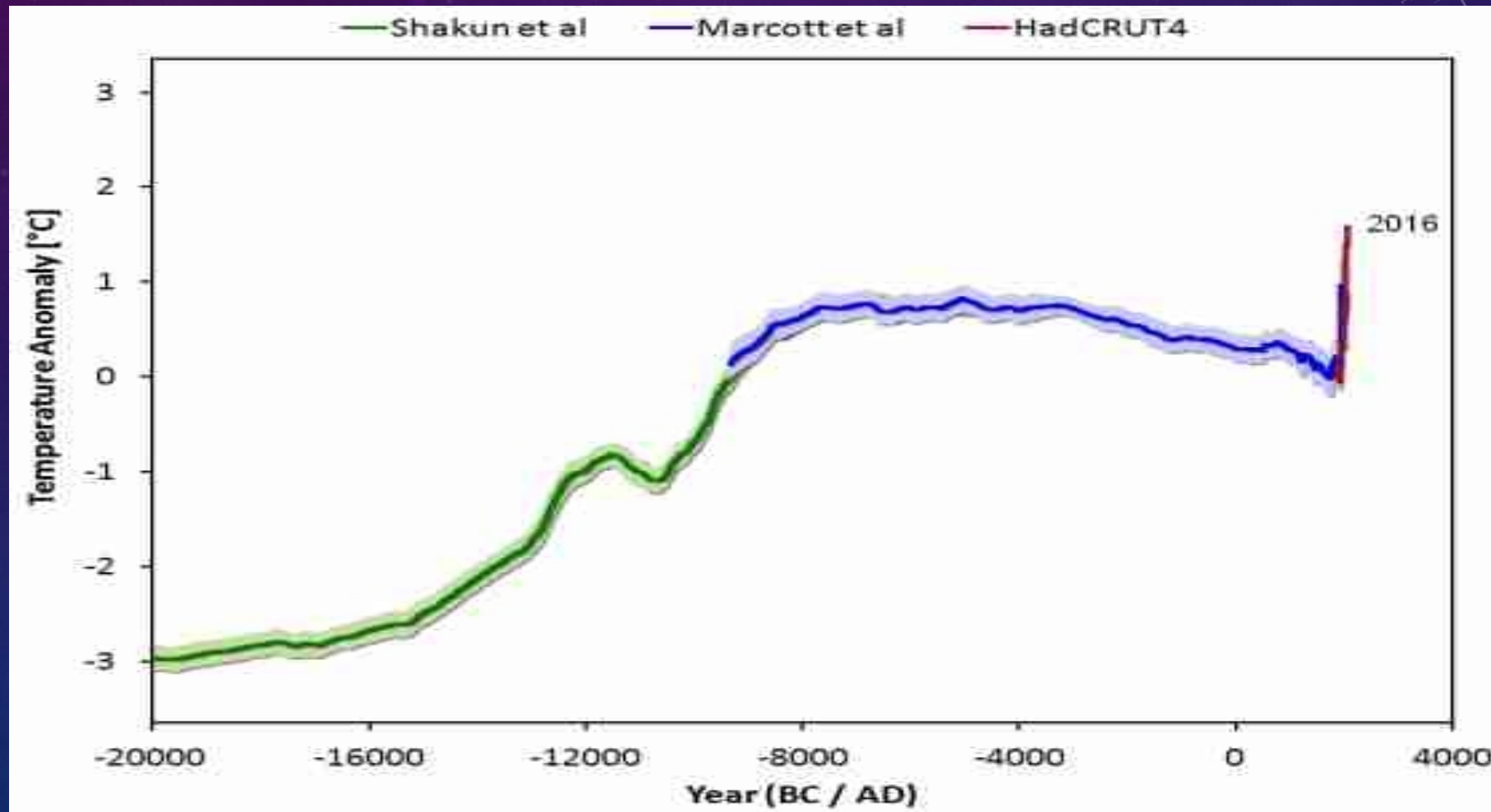
**Fig S1- Temperature response to Greenhouse Gas forcing** Global mean temperature for three models, smoothed by a 5-year running mean, details given in table S1. Bold coloured lines model means, light coloured lines individual ensemble members. Black line multi-model mean. 1851-1900 highlighted by grey box. Mean for this period shown in legend for the different models and multi-model mean for this period is highlighted by a horizontal dashed line.

For the old IPCC reports that too many still want to quote – the conventional “pre-industrial” baseline was the 1880-1910 average. This was not pre-industrial. CO2 emissions were already 10% of today’s in 1900. Michael Mann’s team addressed this in 2017. Note in 2000 we were already +1.2C above, and in 2020 at +1.5C above. Please, my students - disregard the rosy reportings of what the temperature anomaly is today. In 2023, we’re already at +1.6C above true pre-industrial baseline.

GLOBAL AVERAGE SURFACE TEMPERATURE SINCE 1880. MUST ADD  
+0.48C TO THESE POINTS TO BASE THEM RELATIVE TO SCHURER, MANN *et al.*  
(2017) PROPER PRE-INDUSTRIAL BASELINE. WE'RE AT +1.60C IN 2023.



THE PAST 20,000 YEARS. THE HOLOCENE (BLUE) PERIOD OF STABLE TEMPERATURES IS WHAT ALLOWED HOMO SAPIENS TO CLIMB OUT OF THE CAVES AND BUILD OUR CIVILIZATION – FROM STABLE COASTLINES, STABLE RAINFALL PATTERNS, STABLE, SAFE INFRASTRUCTURE SUPPORT SYSTEMS. THAT IS NOW ENDING. TEMPERATURE RISING AT UNPRECEDENTED RATES OF 0.2C PER DECADE



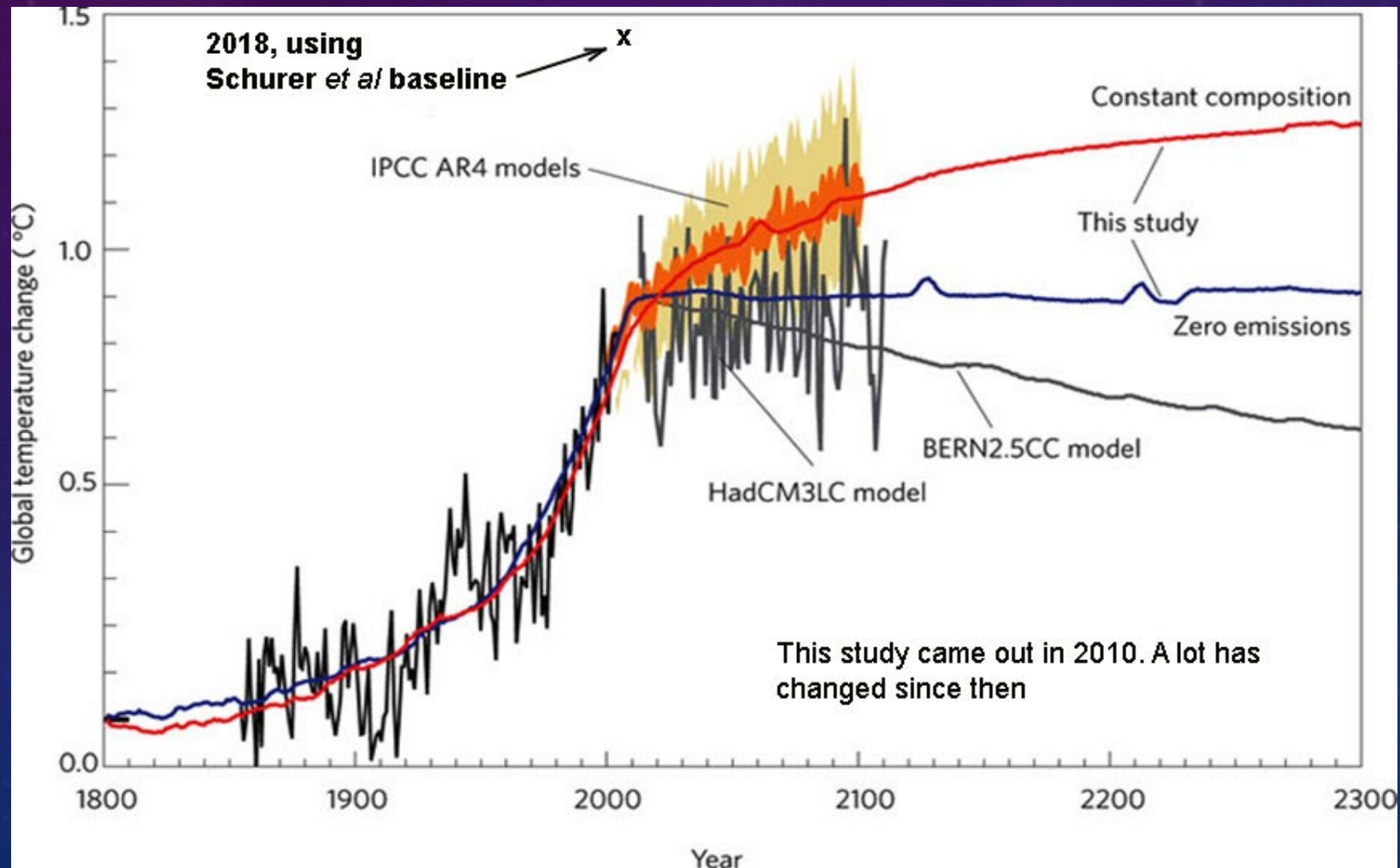
POINT #4: IF WE JUST STOP EMITTING CO<sub>2</sub>, WON'T  
THE EARTH HEAL?

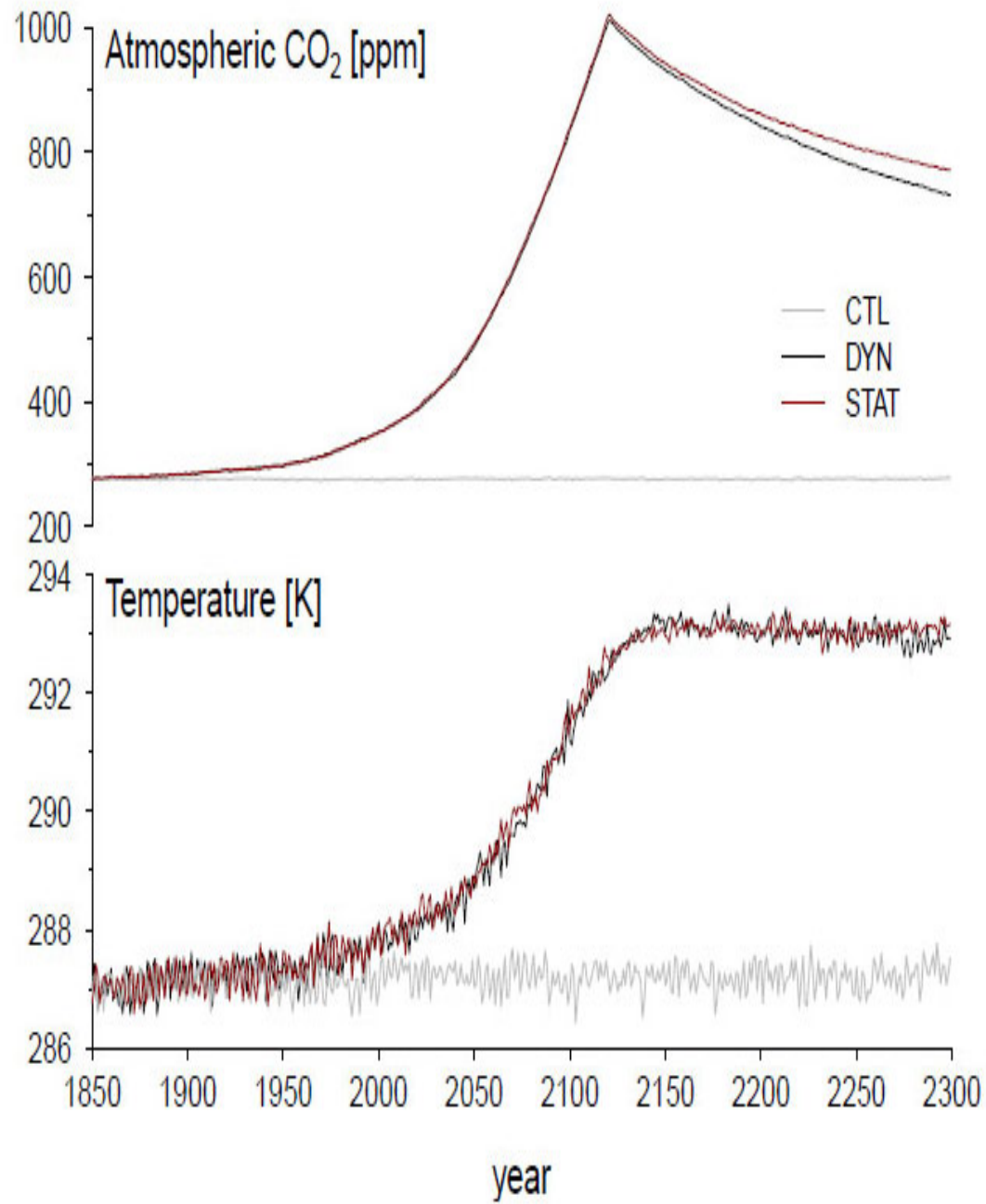
**NO.** CLIMATE CHANGE IS NOT LIKE SOME OTHER  
ENVIRONMENTAL DAMAGES...

# WHY NOT? IF ATMOSPHERIC CO<sub>2</sub> COULD GO DOWN, WHY WOULDN'T TEMPERATURES GO DOWN TOO?

- First: Because the climate is being “forced”, and just like a thick iron skillet suddenly put on a hot stove is being forced, yet warms slowly. It takes time to come up to final equilibrium temperature. Big systems take longer. We will continue to warm for many decades, regardless of how much we (realistically) lower our direct emissions. Only harsh geo-engineering to block sunlight in addition to ending direct emissions, might halt that rise.
- We have not yet manifested the temperature rise “in the pipeline” that will come even if there were no more CO<sub>2</sub> forcing. Our radiative imbalance is most recently estimated at over +1.6 w/m<sup>2</sup>, far above the earlier trend of about +0.6 w/m<sup>2</sup>
- Second: The ocean has absorbed 93% of our GHG heating, and that vast heat capacitance - 700 times larger than the atmosphere - will prevent a lower CO<sub>2</sub> atmosphere from cooling. That excess heat from the ocean will just return in large part to the atmosphere.

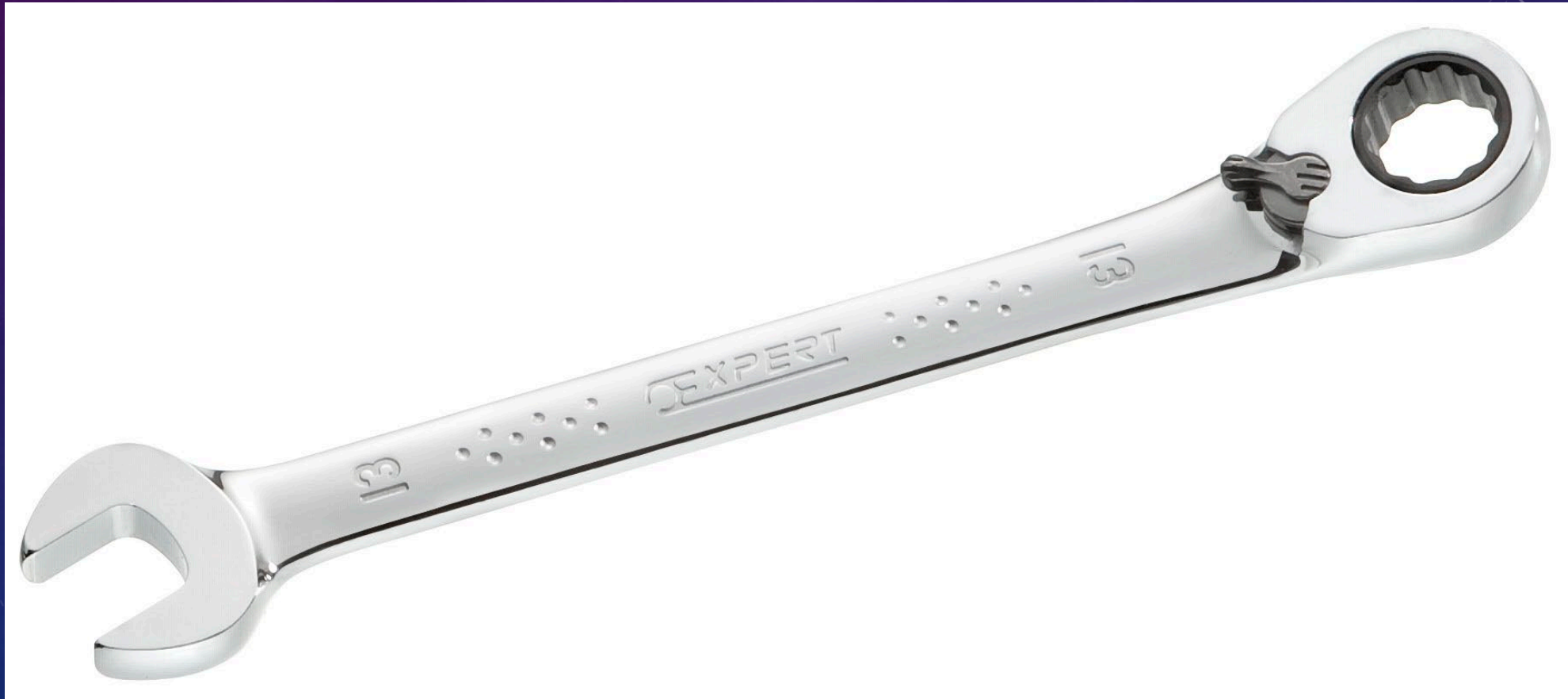
SO EVEN AT ZERO EMISSIONS – BOTH DIRECT HUMAN CO<sub>2</sub> EMISSIONS AND EVEN INDIRECT HUMAN CAUSED CO<sub>2</sub> EMISSIONS FROM NATURAL SOURCES – STILL, TEMPERATURES DO NOT GO BACK DOWN. NOT FOR 10'S OF THOUSANDS OF YEARS (MATTHEWS AND WEAVER 2010).



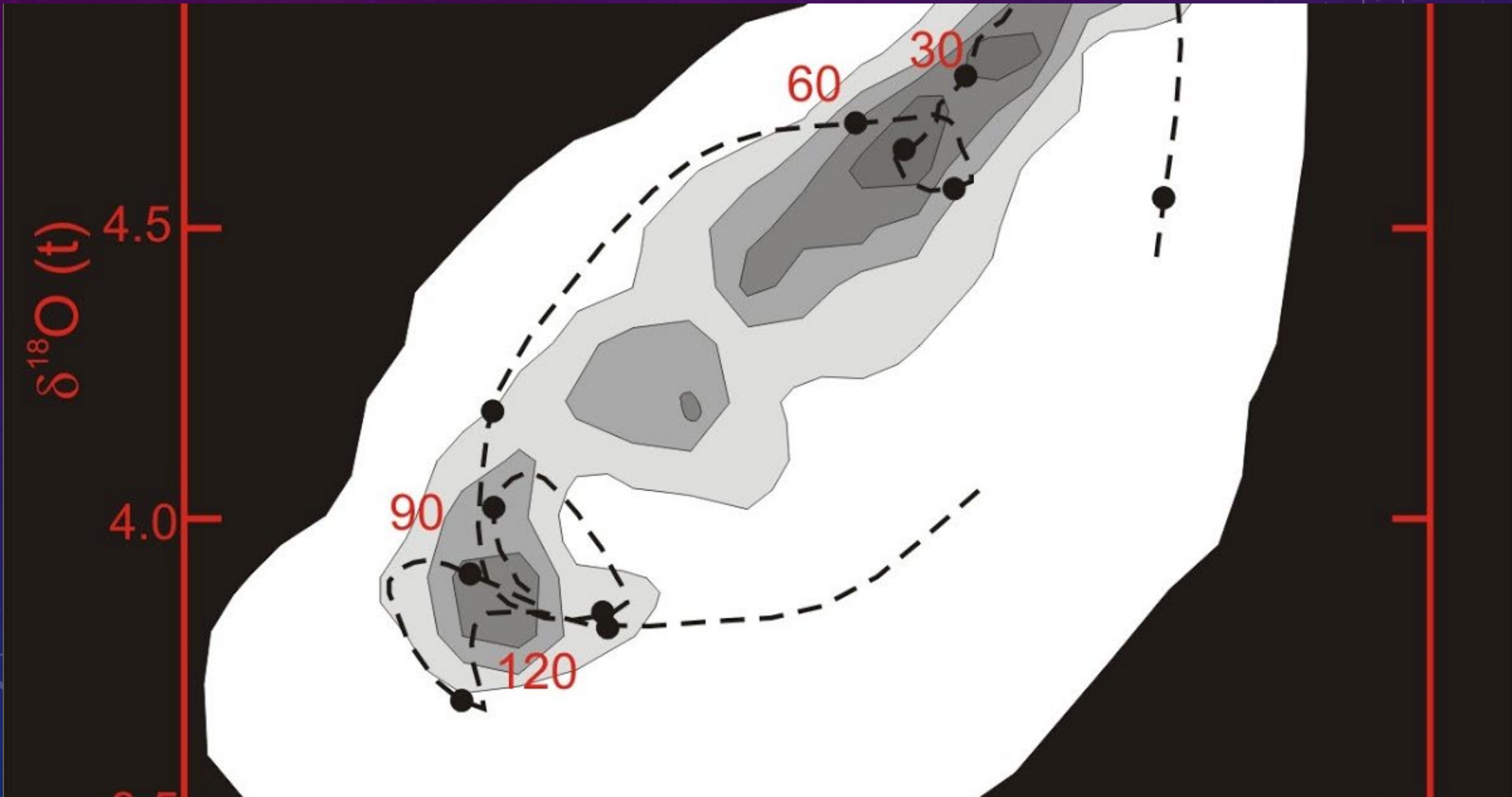


SOLOMON *et al.* (2009) FIRST SHOWED THIS. LATER STUDIES CONFIRM. HERE, FROM PORT *et al.* (2012): EVEN WITH PLANTS AND TREES TOO OPTIMISTICALLY ASSUMED TO TAKE UP MORE EXCESS CO<sub>2</sub>, STILL, TEMPERATURES DO NOT GO BACK DOWN AFTER INDUSTRIAL CO<sub>2</sub> EMISSIONS SHUT DOWN (HERE ASSUMED IN THE YEAR 2120)

TEMPERATURE IS A RATCHET: IT ONLY GOES UP, OR STAYS THE SAME. IT DOES NOT GO BACK DOWN UNLESS FORCED ARTIFICIALLY THROUGH MASSIVE, DANGEROUS, HIGHLY EXPENSIVE GLOBAL GEO-ENGINEERING SCHEMES



COMPLEX DYNAMICAL SYSTEMS HAVE COMPLEX SYSTEM “SURFACES IN PHASE SPACE”. PERTURB THE SYSTEM ENOUGH, AND IT TRANSITIONS TO AN ENTIRELY NEW PLACE OF SEMI-STABILITY



# HOW DOES THIS HAPPEN?

- Through “amplifying feedbacks”... (a “vicious cycle”, in every day language)
- Climate change forces something to change in such a direction that that forcing makes climate change worse, causing an even stronger forcing, resulting in climate change forcing being worse still – an amplifying feedback.

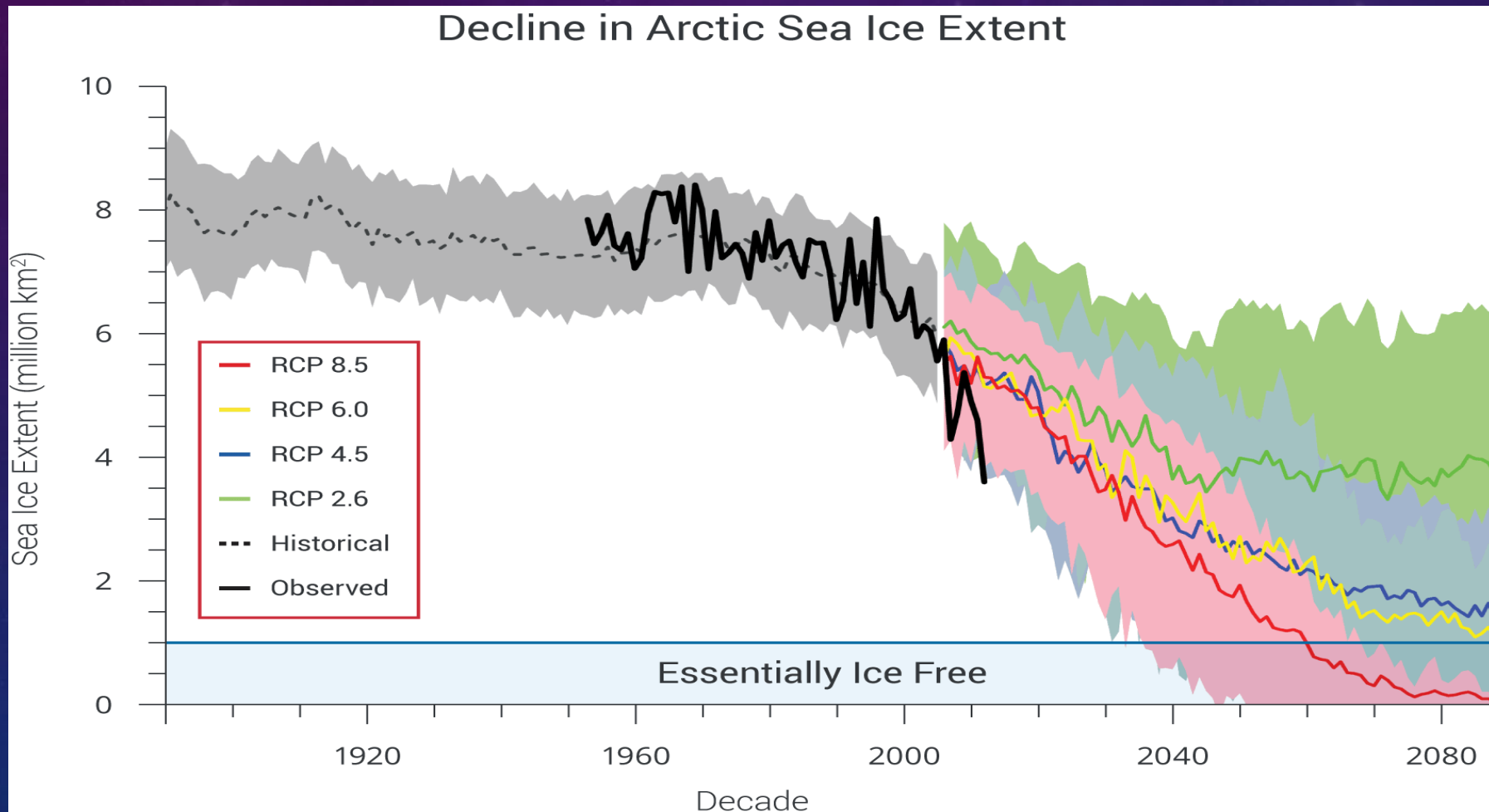
# THE STRONGEST AMPLIFYING CLIMATE FEEDBACK IS FROM WATER VAPOR

- Hotter air will hold more water vapor before it saturates and rains out.
- But H<sub>2</sub>O is itself a Greenhouse Gas
- So rising humidity means more Greenhouse Effect, means hotter, means still higher humidity, means even stronger Greenhouse Effect, means hotter temperatures and forcing even higher humidity, and this saturation limit is itself exponential with temperature, adding to the effect...

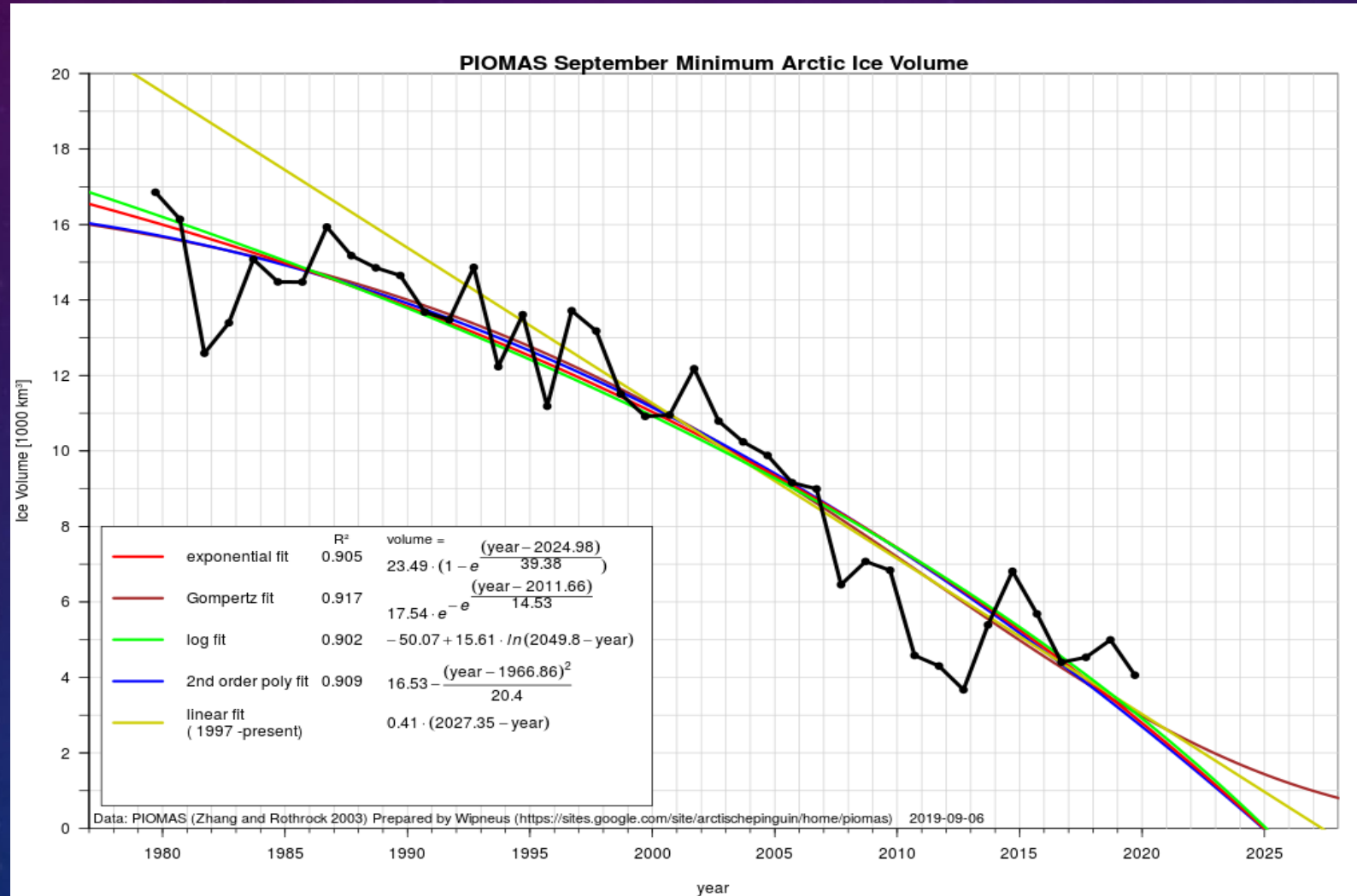
# EVEN JUST A +1C RISE IN TEMPERATURE ALLOWS AIR TO HOLD FULLY 7% MORE WATER VAPOR

- That's a 22 to 1 amplification factor! 22x !
- This humidity effect doubles the temperature rise that CO2 alone would cause.
- The next time a climate denialist tries to tell you it's water vapor, not our CO2 that's the problem – you tell them that it is our CO2 which is controlling water vapor in our atmosphere - because CO2, unlike water, does not rain out.

AN EASIER FEEDBACK ILLUSTRATES THE POINT. ARCTIC OCEAN ICE IS RAPIDLY DISAPPEARING, LEADING TO DARK OCEAN ABSORBING 90% OF SUNLIGHT INSTEAD OF ICE REFLECTING BACK TO SPACE 90% OF SUNLIGHT. BUT THAT WARMS THE ARCTIC MORE, LEADING TO FASTER MELT AND MORE DARK OPEN OCEAN... OBSERVED REALITY IS WORSE THAN THE WORST IPCC MODELS.



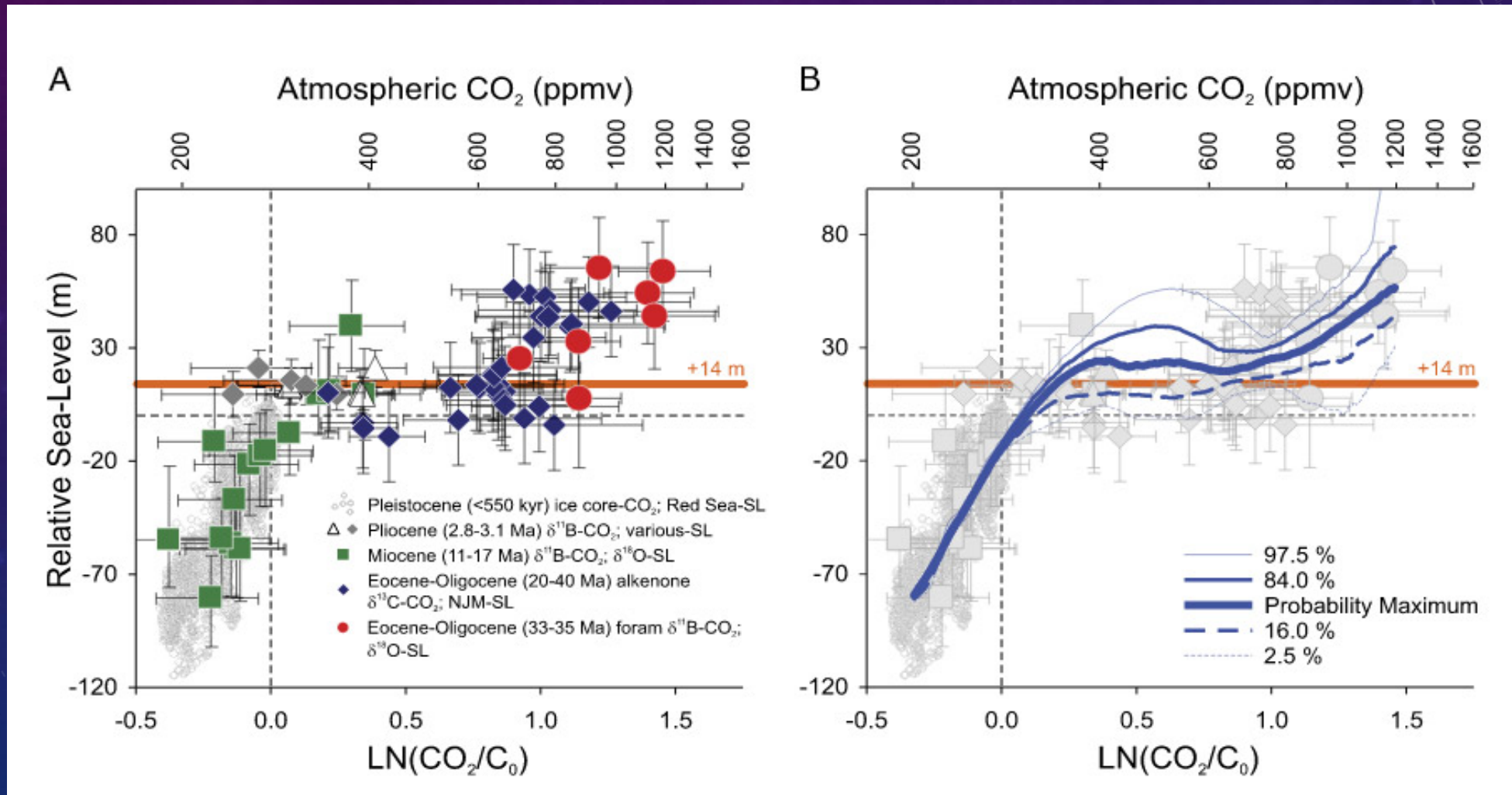
# THE ARCTIC OCEAN IS ONLY A FEW YEARS AWAY FROM LOSING ALL OF ITS SUMMER ICE. THIS DRIVES ARCTIC OCEAN AND PERMAFROST TEMPERATURE RISE...



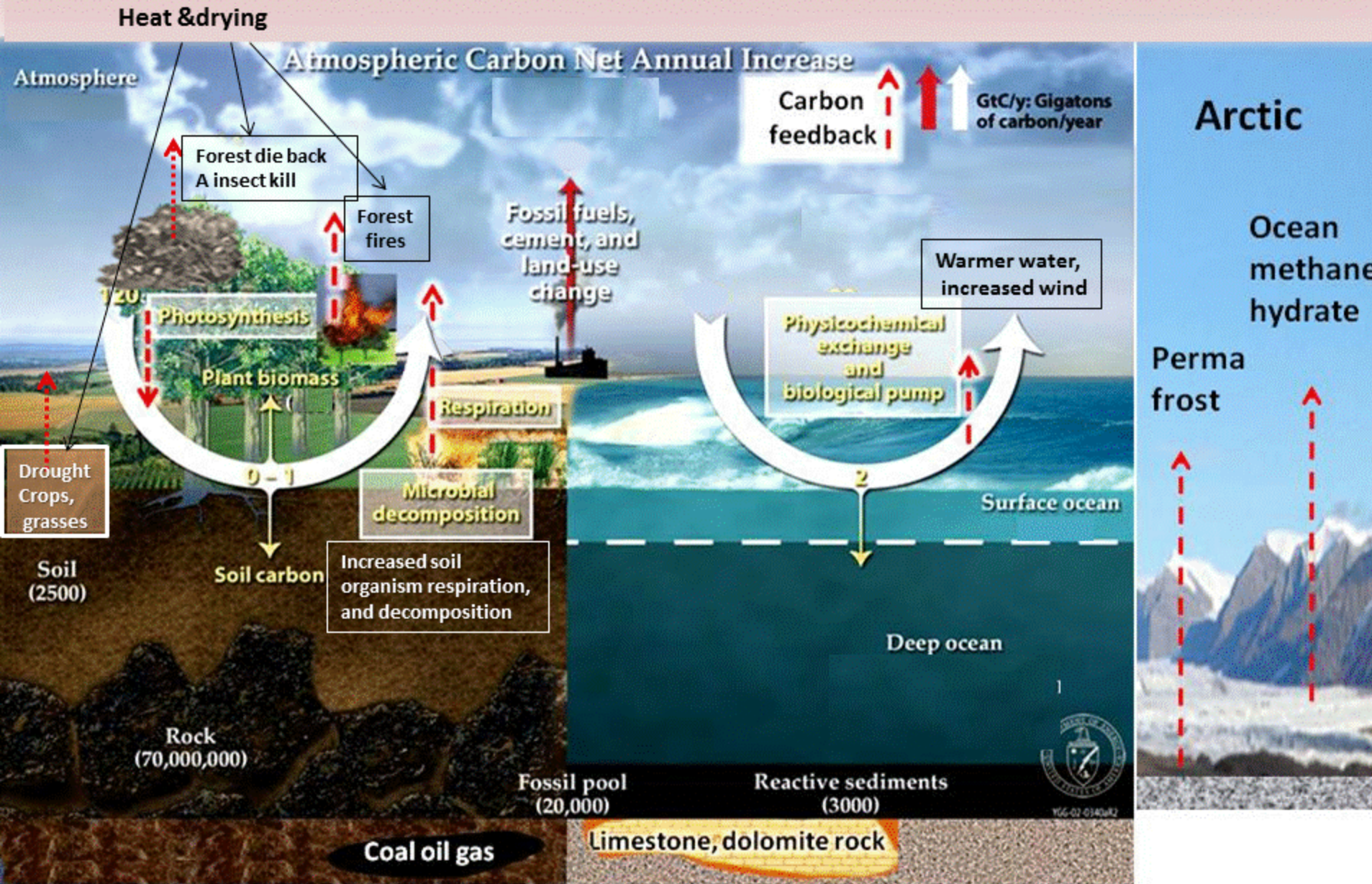
# HOW HIGH WILL SEA LEVEL RISE?

FOSTER & ROHLING 2013 - PALEO CLIMATE SHOWS THAT 400 PPM CO<sub>2</sub> LEADS TO FINAL SEA LEVEL RISE OF ~24M

(80 FT) ABOVE TODAY'S, AND CONCLUDE "OUR RESULTS IMPLY THAT TO AVOID SIGNIFICANTLY ELEVATED SEA LEVEL IN THE LONG TERM, ATMOSPHERIC CO<sub>2</sub> SHOULD BE REDUCED TO LEVELS SIMILAR TO THOSE OF PRE-INDUSTRIAL TIMES." THAT MEANS REDUCING IT FROM TODAY'S 425PPM BACK TO ~280 PPM. 350.ORG NEEDS A RE-NAME!



# Climate system sources of +ve (bad) carbon feedbacks caused by global warming

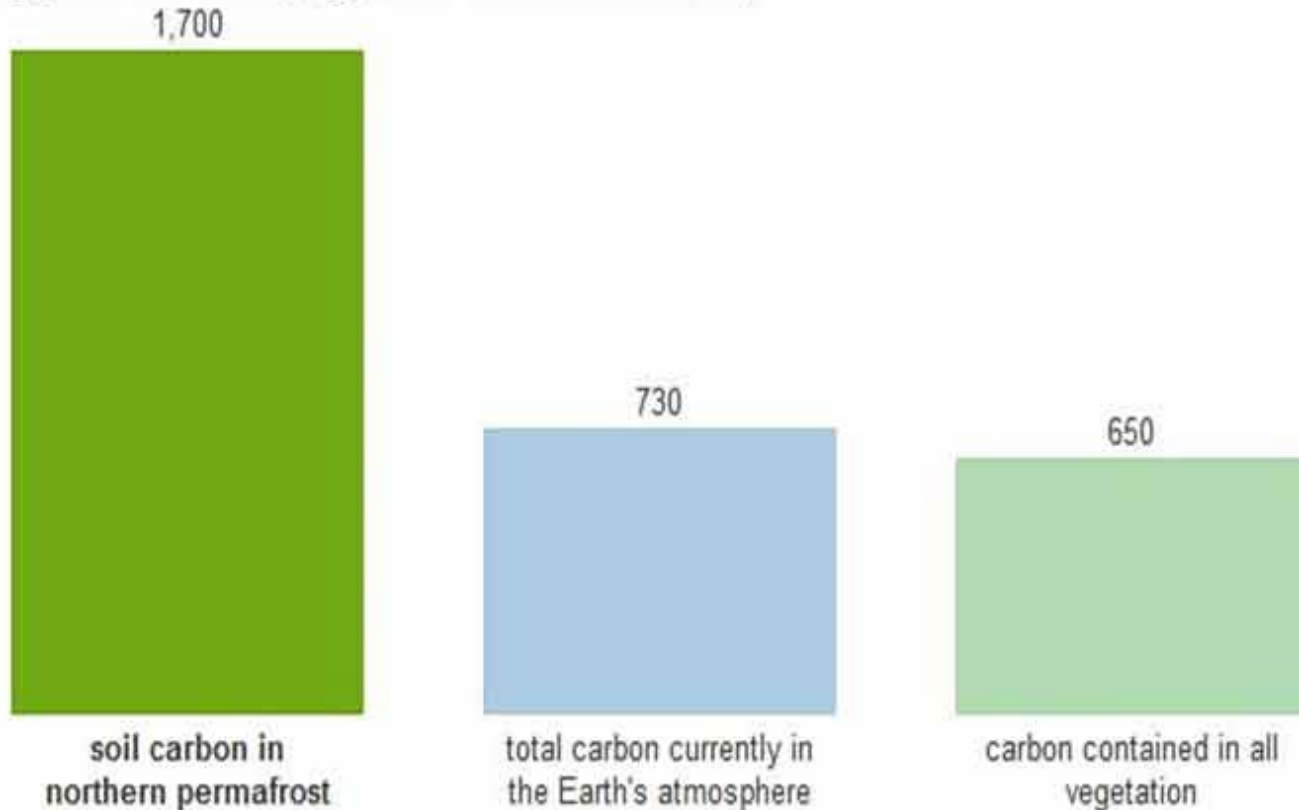


HERE ARE JUST SOME OF THE AMPLIFYING FEEDBACKS...

# AS THE FUTURE UNFOLDS – INDIRECT HUMAN-CAUSED CARBON EMISSIONS MAY COME TO DOMINATE TOTAL EMISSIONS

## The massive store of carbon in Arctic permafrost

In gigatons of carbon (a gigaton is a billion metric tons).



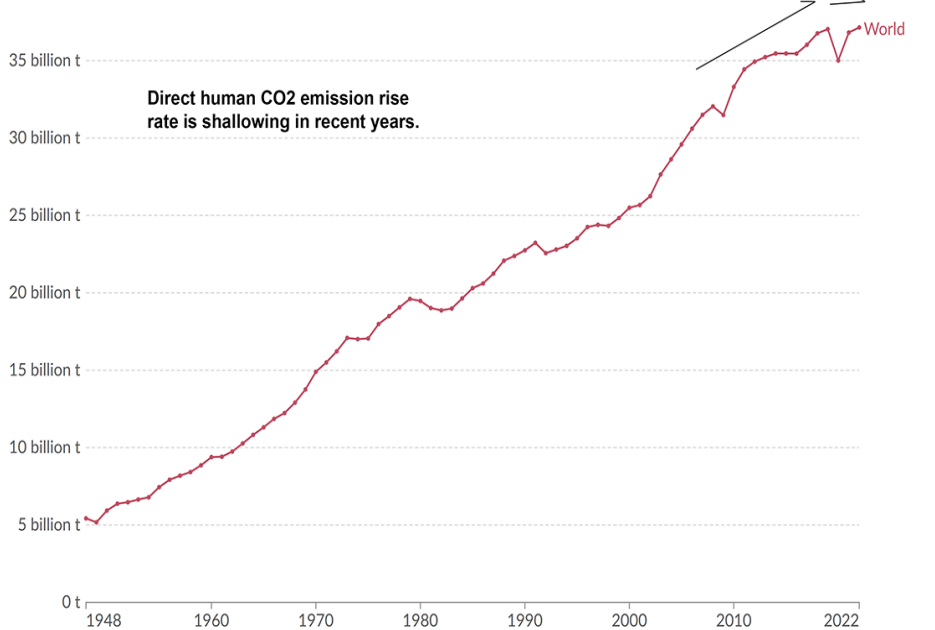
Source: [National Academy of Sciences, 2013](#)

The Washington Post

# GROWING EVIDENCE THAT ATMOSPHERIC CO2 CONCENTRATION IS NOW RISING SIGNIFICANTLY FASTER THAN DIRECT HUMAN CO2 EMISSIONS. ARE INDIRECT ANTHRO EMISSIONS TAKING OVER, AND AS NORMAL LAND/OCEAN CAPTURE DROPS?

## Annual CO<sub>2</sub> emissions

Carbon dioxide (CO<sub>2</sub>) emissions from fossil fuels and industry<sup>1</sup>. Land-use change is not included.



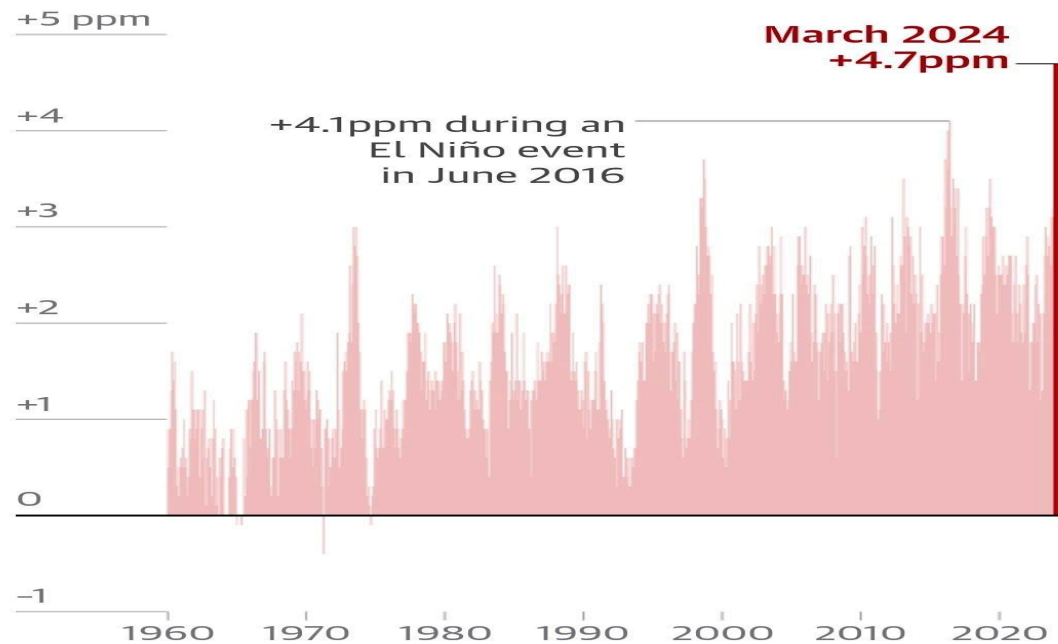
Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO<sub>2</sub>) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO<sub>2</sub> includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

## A record annual increase in the amount of atmospheric CO<sub>2</sub>

Monthly year-over-year change measured in parts per million at the Mauna Loa observatory



Guardian graphic. Source: Dr. Xin Lan, NOAA/GML and Dr. Ralph Keeling, Scripps Institution of Oceanography

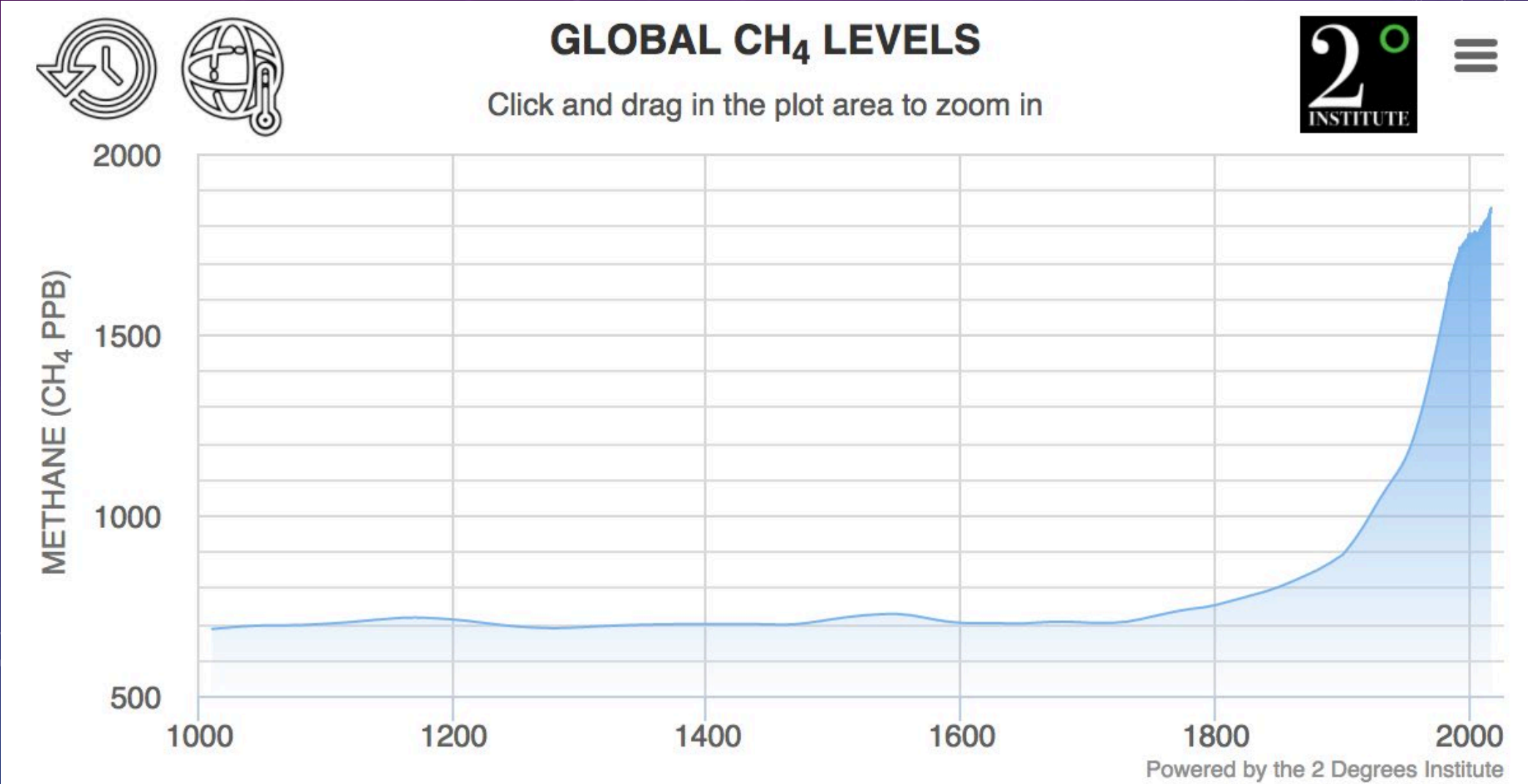


A POWERFUL FEEDBACK  
JUST BEGINNING NOW -  
MELTING PERMAFROST  
CREATES THERMOKARST  
THAW PONDS, CUTTING OFF  
PREVIOUSLY FROZEN  
CARBON FROM  
ATMOSPHERIC OXYGEN,  
STIMULATING ANAEROBIC  
MICROBES TO CONSUME  
THE CARBON AND PRODUCE  
METHANE INSTEAD OF CO<sub>2</sub>.

# THIS IS NOT GOOD

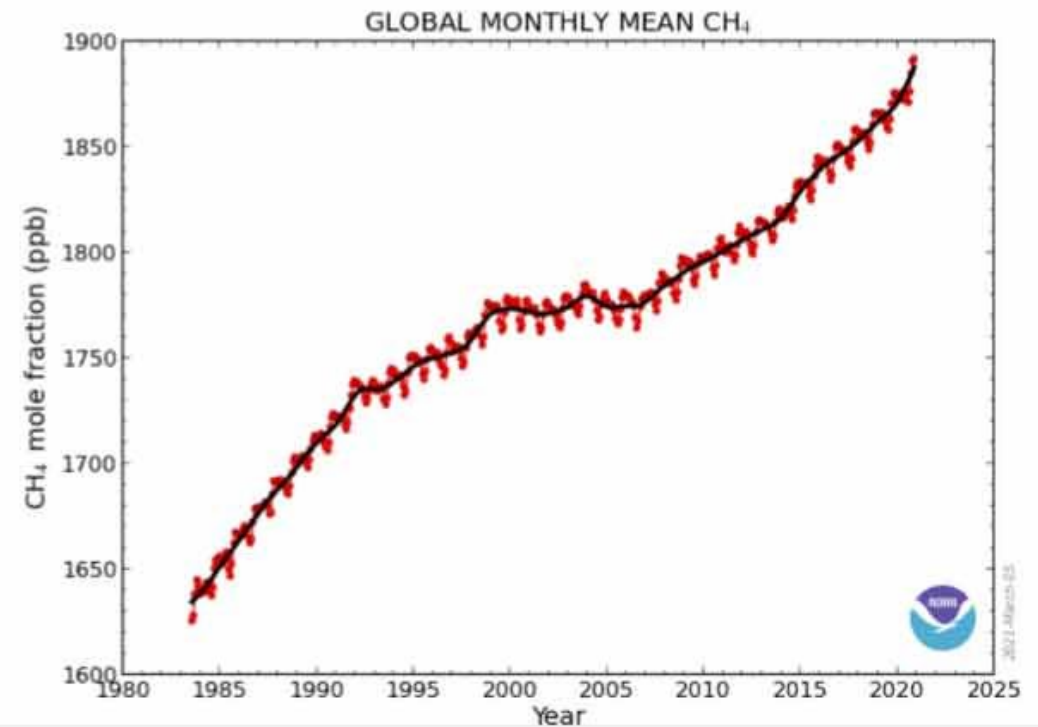
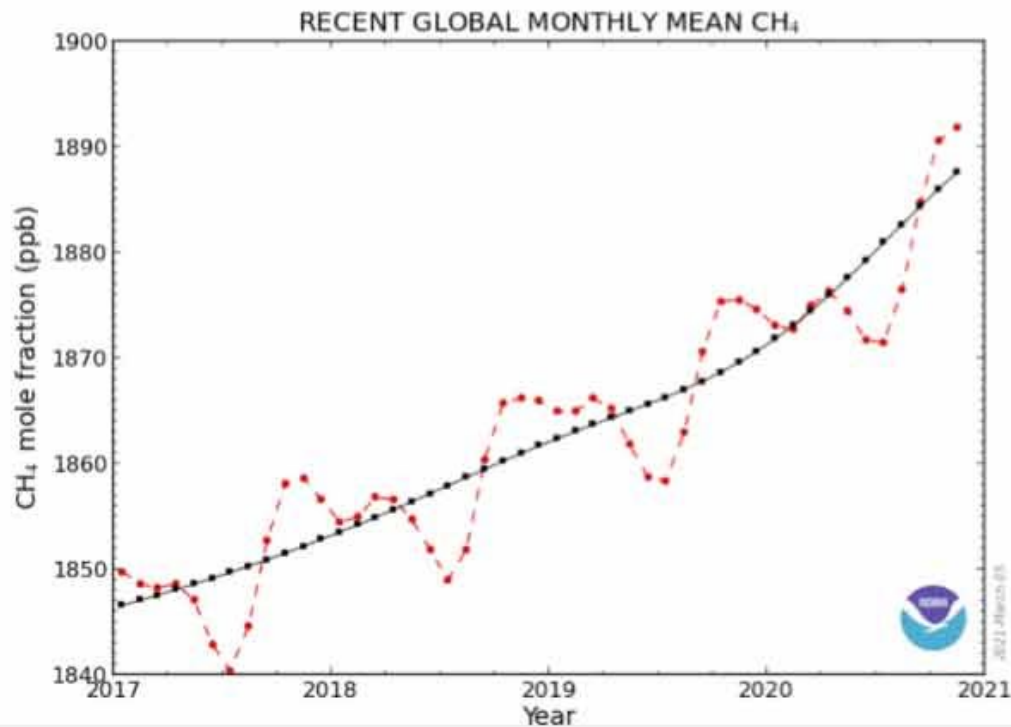
- Methane absorbs Earth outgoing IR radiation 100x more, pound for pound, than CO<sub>2</sub> does, at time of emission.
- Its “Global Warming Potential GWP” is 100 (100x of CO<sub>2</sub>).
- The good news is that methane oxidizes once it’s in the atmosphere, with a half-life of 8-12 years depending on whether it is in the tropics (faster), or in the Arctic (slower).
- But the bad news is....

WE'RE CAUSING THE EMISSION OF METHANE AT RATES FAR FASTER THAN IT CAN DECAY. IT'S RISING EVEN FASTER THAN CO2, ALMOST TRIPLED SINCE PRE-INDUSTRIAL DAYS. SO FAR, ARCTIC METHANE EMISSIONS ARE SMALL, BUT RISING FAST.



HERE'S JUST THE PAST 39 YEARS. SOURCES: LIVESTOCK, TROPICAL WETLANDS, OTHER AGRICULTURAL SOURCES, RESERVOIRS, "FUGITIVE EMISSIONS" FROM GAS PIPELINES ... AND ARCTIC THAW IS RISING VERY RAPIDLY. ALL CONTRIBUTING TO RAPIDLY ACCELERATING GLOBAL METHANE CONCENTRATIONS.

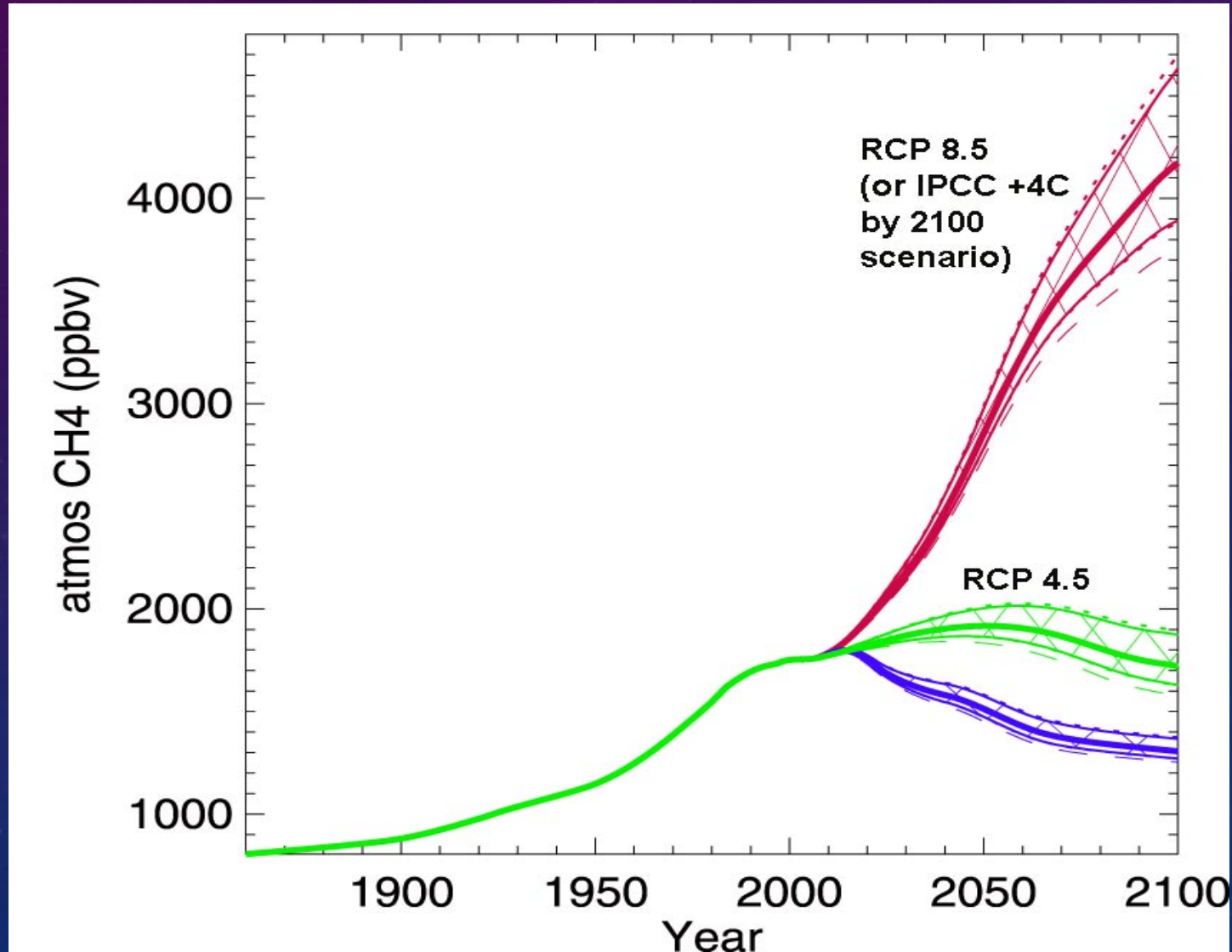
**November 2020: 1891.9 ppb**  
**November 2019: 1875.6 ppb**  
*Last updated: March 05, 2021*



# TO EMPHASIZE: THESE RAPID EMISSIONS ARE HAPPENING AT TODAY'S TEMPERATURES

- Yet we saw that even if, impossibly, we could end all direct **and indirect** human CO2 emissions, that temperatures would NOT GO BACK DOWN, but instead merely stay at today's level.
- Therefore, these indirect emissions from thawing permafrost, dying forests, warming soils... WOULD CONTINUE
- Clearly, this is a contradiction of the assumption that ending direct emissions would be our salvation.

# WE REMAIN ON THE MOST PESSIMISTIC SCENARIO TREND FOR METHANE CONCENTRATIONS IN OUR ATMOSPHERE





# ECS = “EQUILIBRIUM CLIMATE SENSITIVITY”

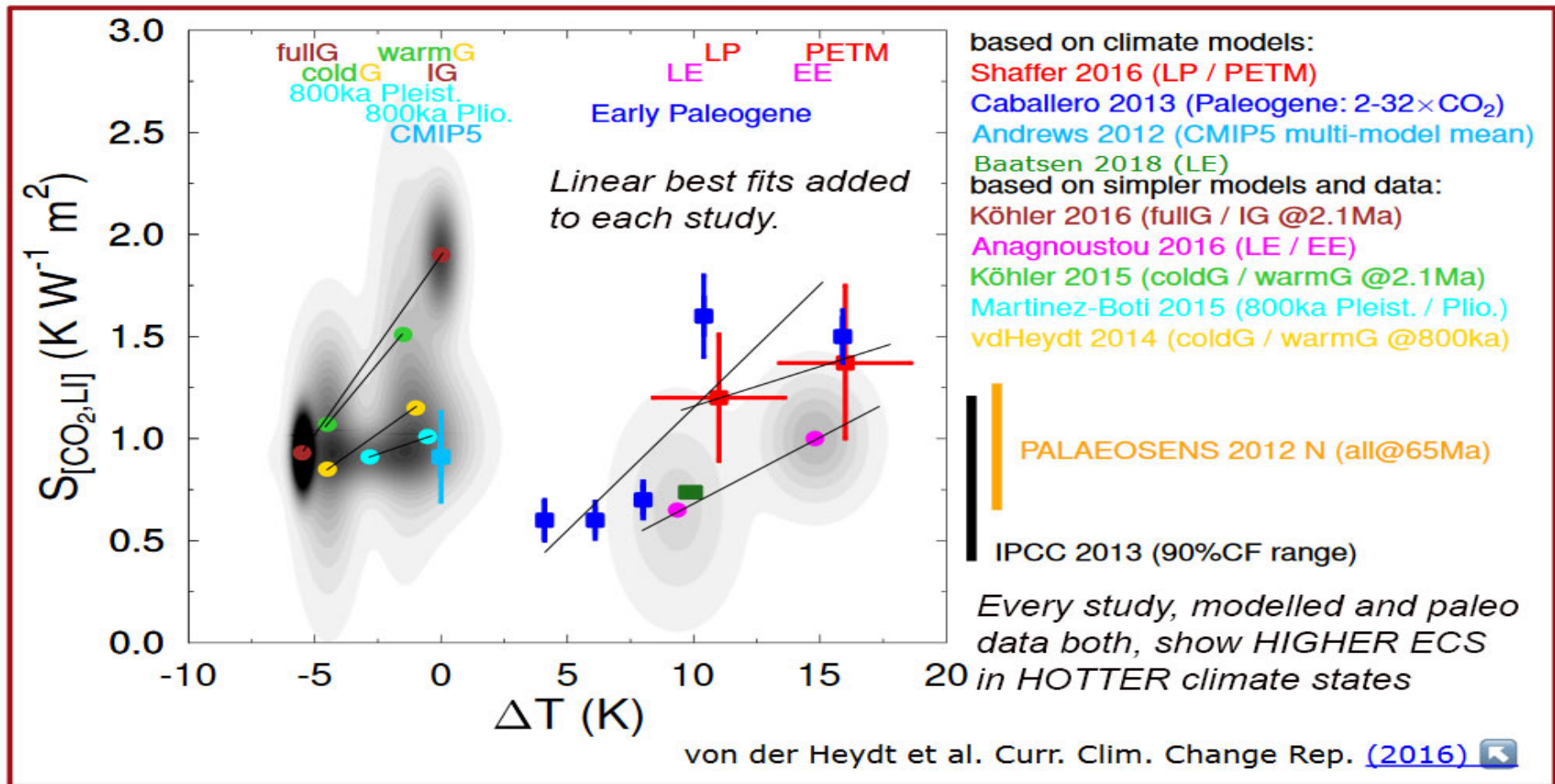
- A convenient number to summarize the sensitivity of global average temperature to global atmospheric CO2 level.
- How defined? Take CO2 levels before human interference: 280 ppm. Double that to 560ppm. Now watch temperatures go up and wait till the fast climate feedbacks have pretty much played out, and ask what the new temperature is. That temperature change is called ECS.
- Unfortunately, temperatures don't REALLY come to “equilibrium”, the slower feedbacks like ice sheet melt and others, continue to raise temperature to about twice as high as ECS alone, over many centuries to thousands of years.
- But relatively short term (a century or two), ECS is meant to be the expectation of what temperatures will come to if we double pre-industrial CO2 concentrations to 560ppm and stop it right there.
- Where are we today? In 2020, we're at 418 ppm. In 2022, we're at 422 ppm.
- We are half way to doubling pre-industrial CO2 today.

# IS ECS REALLY A CONSTANT AS TEMPERATURES RISE, AS WAS USUALLY ASSUMED?

- If the Earth were a simple perfect CO<sub>2</sub> dominated system w/o non-CO<sub>2</sub> feedbacks, then the radiation transport physics says: yes – pretty much a constant because of the “band saturation effect”.
- But in the real world? **NO.**
- Non-CO<sub>2</sub> dependent heat forcing that is forced by CO<sub>2</sub>, and non-linear feedbacks mean that ECS itself actually goes up as temperatures rise. The evidence is very strong... see the next slide.

ALL PALEO STUDIES SHOW ECS IS HIGHER WITHIN HOTTER BACKGROUND CLIMATE STATES. THIS SUMMARY GRAPH FROM THE REVIEW BY VON DER HEYDT (2016) SHOWS ALL BEST-FIT LINEAR TRENDS SLOPE UPWARD: HOTTER CLIMATES HAVE HIGHER ECS VALUES

## State dependent ECS from palaeoclimate data and models



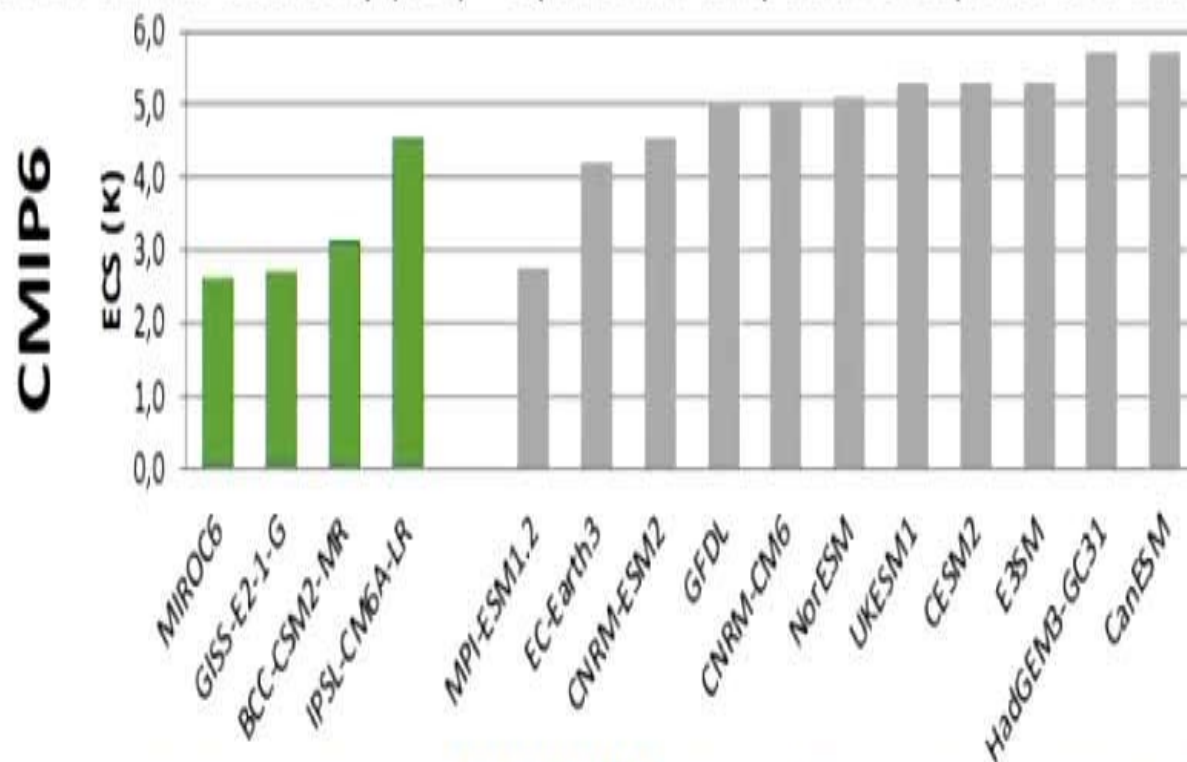
# Many CMIP6 models are warmer



FRIEDRICH *et al.* 2016, AND INDEPENDENTLY, NOW, THE LATEST AND MOST DETAILED SUPER COMPUTER LARGE SCALE CLIMATE MODELS – THE CMIP6 MODELS – DONE BY THE MAJOR MODELLING CENTERS AROUND THE WORLD, SHOW  $ECS = 4.9C$ .

THIS IS HIGHER THAN EARLIER, MORE PRIMITIVE MODELS FROM THE CMIP PROJECTS AND OLD IPCC

Equilibrium climate sensitivity (ECS) = equilibrium temperature response to a doubling of CO<sub>2</sub>



Dr Veronika Eyring's [presentation](#) at the CMIP6 workshop, March 2019

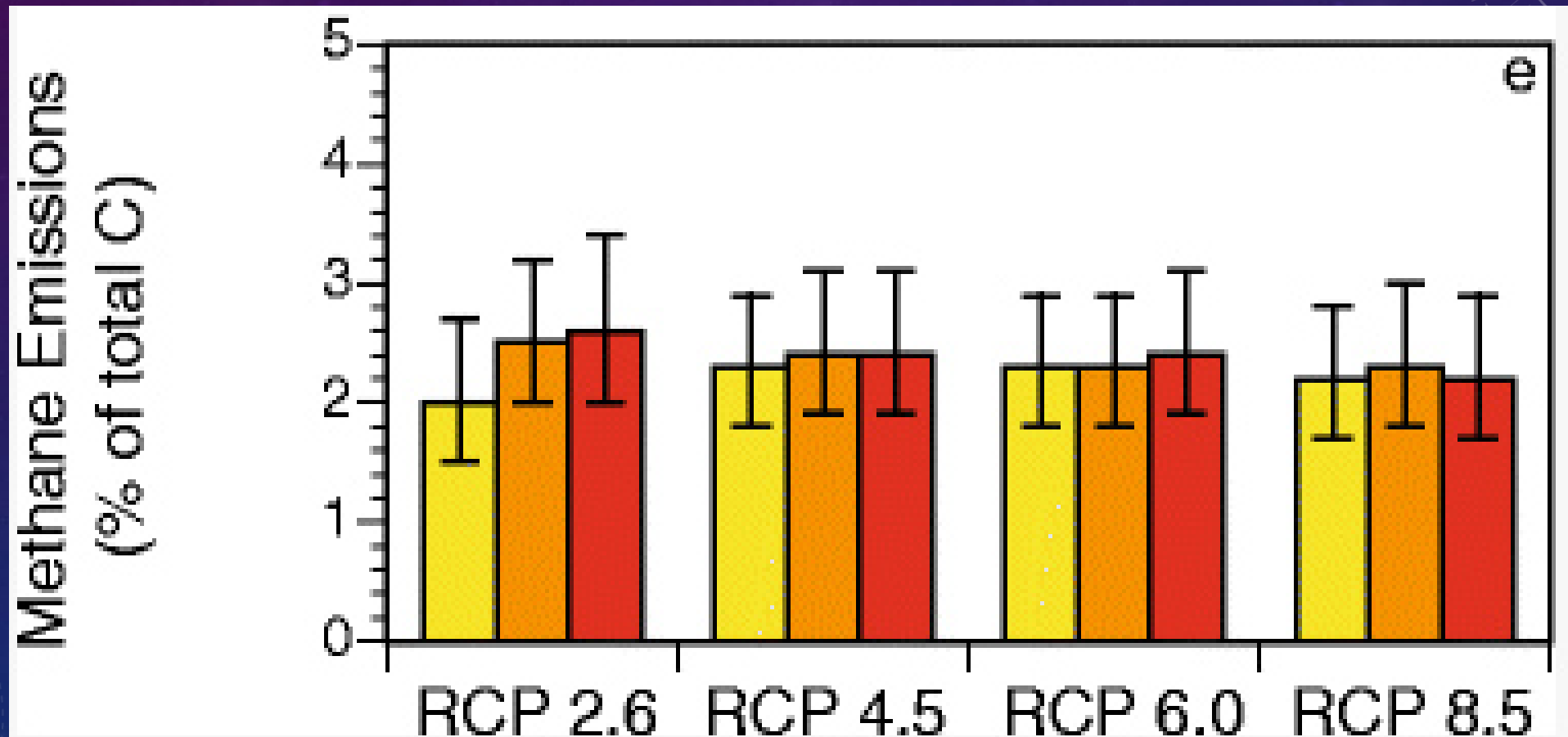
# IF ECS IS REALLY +5C PER CO2 DOUBLING, THIS DRAMATICALLY AFFECTS PERMAFROST THAW AND ITS AMPLIFYING FEEDBACK, AND WE'RE IN REAL TROUBLE

- MacDougall *et al.* ([2012](#)) studied how global atmospheric CO2 concentrations would evolve under a scenario where we stay on our present emissions course until 2050, and then instantly end all human fossil fuel burning.
- The results are striking.
- Worse; the U. Vic. Climate Model he used assumed (for simplification) that all permafrost carbon emerges as CO2, none as methane.

WE KNOW THIS IS NOT CORRECT - SOME CARBON WILL EMERGE AS METHANE. U. ALASKA'S DR. KATY WALTER- ANTHONY HAS LED THIS OBSERVATIONAL RESEARCH, AND NOW SHOWING WE'VE SIGNIFICANTLY UNDERESTIMATED THIS CONTRIBUTION.



SHUUR *et al.* 2013, SURVEYING DOZENS OF PERMAFROST EXPERTS, FIND A CONSENSUS THAT 2.3% OF THE PERMAFROST'S EMERGING CARBON TO BE IN THE FORM OF METHANE - REGARDLESS OF HUMAN EMISSION SCENARIO. (BAR COLORS ARE FOR YEAR 2040, 2100, 2300) BUT NOW, YEARS LATER, THIS LOOKS SIGNIFICANTLY UNDERESTIMATED.



# I CANNOT FIND A FULL GLOBAL CLIMATE MODEL SIMULATION WHICH INCLUDES ALL OF THIS LATEST KNOWLEDGE OF PERMAFROST THAW, METHANE AND NEW FEEDBACKS WITH EXPLICIT ECS

- So I've made an estimate of how [MacDougall's](#) atmospheric CO<sub>2</sub>e curves would change when methane is included.
- These estimates include
  - the high GWP of methane, and the oxidation decay effect
  - the fact the "active layer" is 40% thinner than his first simulations assumed, speeding conduction to the base of the active layer, where permafrost now thaws and begins the process of emission.
  - there is 2x the methane emission we'd thought because there continues (surprisingly) to be emissions all winter ([Zona et al. 2016](#)), despite freezing at the surface.
  - and, that the methane and other non-CO<sub>2</sub> GHG GWP's had been under-calculated by neglecting short-wavelength spectrum effects ([Etminan et al. 2016](#))
- -- they do not include more recent work by Walter-Anthony showing dramatically higher methane when thermo-karst lakes are included (MacDougall did not include these either) – [Walter-Anthony 2019](#)
- My black curves (later) should only be taken as rough estimates and not taken too literally. Uncertainties remain large and a full coupled climate modelling is needed (but still uncertain with today's wide range of thaw emission findings. Here, it's not "worst case", but instead, if anything, too optimistic in the physics.

ALSO, MODELS DON'T EXPLICITLY CONSIDER THE GROWING NEW  
DISCOVERIES OF SIBERIAN METHANE EXPLOSION CRATERS: PINGOS MELTING  
AND FILLING WITH DEEP METHANE, THEN EXPLODING AND LEAVING LARGE CRATERS.

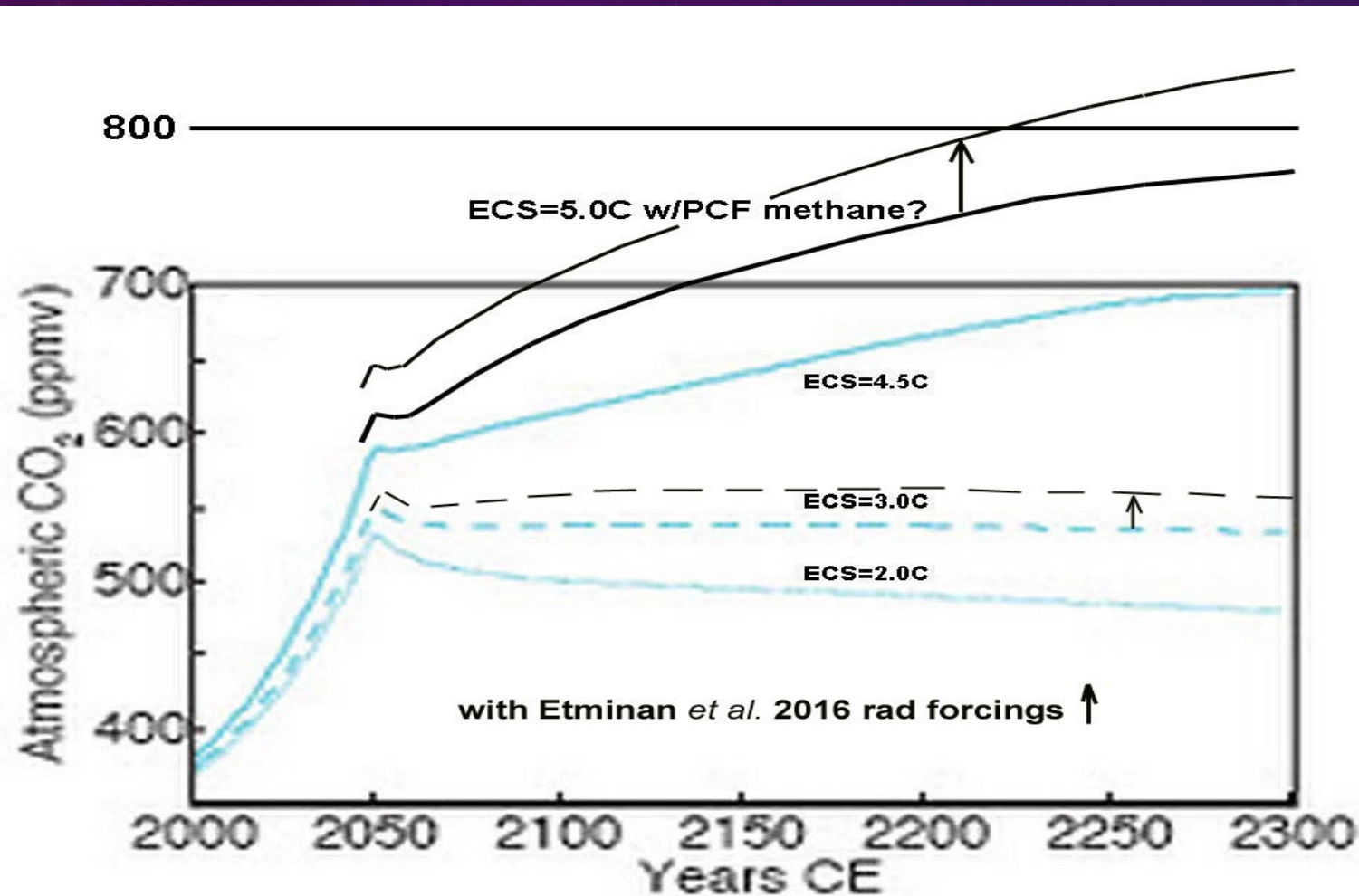


# AS OF 2017, SCIENTISTS ARE DISCOVERING...



- ...Over 7,000 new domes filled with methane and “are ready to explode”, in the Yamal and Gydan Peninsulas alone. Methane explosion craters continue in 2017

MACDOUGALL *et al.* CO<sub>2</sub> CURVES IN BLUE, MY ESTIMATED CO<sub>2</sub>e FROM NEGLECTED METHANE, AS DESCRIBED, IN BLACK. PERMAFROST THAW AND HIGH ECS, LEAD TO DEVASTATING RISING CO<sub>2</sub>e LEVELS... EVEN WHEN HUMANS CUT TO ZERO ALL FOSSIL FUEL USE AFTER 2050



Shutdown in 2050

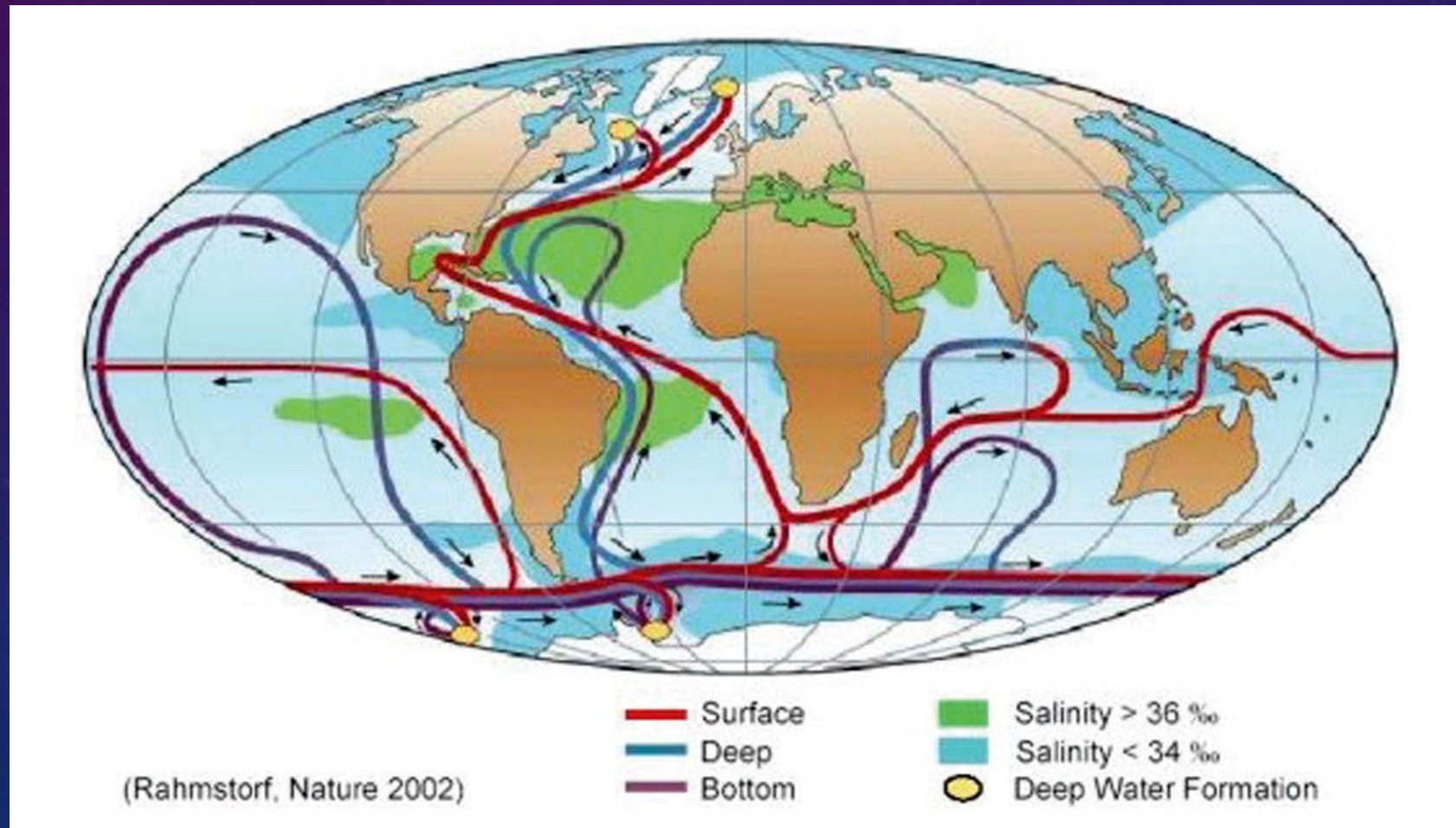
# NEWER WORK COMPLICATES THIS PICTURE...

- ... on the one hand, there is a rapid loss of carbon initially, but then the remaining carbon that in 2013 was thought to be lost quickly, instead is lost much more slowly.
- But then again, the 2.3% as methane may be as high as 10%, according to Katy Walter-Anthony's studies of thermokarst ponds and other sources.
- Some believe that the Friedrich *et al.* (2016) determination of ECS=4.9C for past interglacials includes slower acting effects that should not be part of a true Charney ECS determination, so that his ECS (if using Charney definition) is too high.
- But cloud feedbacks were not considered at all, and happen quick and clearly an amplifier, raising ECS.
- Permafrost carbon loss observations need to be more precise and cover much more area. The permafrost regions are highly complex and can't be modelled as simple systems of only a few category types.
- I will say, though, that ECS work that globally determines the temperature rise from past observations, of course has ALL the physics that Nature has, and should be taken seriously. More so than current models which leave out important processes. I'll continue to weight the Friedrich *et al.* and observationally determined ECS values over simplified theoretical model values.

# OTHER CONSEQUENCES: SHUT DOWN OF THE GLOBAL OCEAN CIRCULATION. HOW COULD THAT HAPPEN?

- As Greenland melts, it dumps fresh water - which is lower density and floats over the denser, warmer saltwater - over a wide area around Greenland, preventing the warmer seawater underneath from releasing its heat. It stays warmer, more buoyant and so, can't penetrate the thermocline and descend.
- Thus we make a “clog in the pipe” of the global ocean thermohaline circulation.
- We already see this happening (next slides), as the best studied portion – Atlantic: the AMOC – has slowed significantly, and, on current pace, comparing to the Eemian Interglacial shutdown, has a high likelihood of shutting down again in the next century, or sooner.

# GLOBAL OCEAN CIRCULATION: DEEP WATER FORMS ONLY AT 4 PLACES ON EARTH: TWO ARE OFF GREENLAND, AND TWO STRADDLING THE PALMER PENINSULA IN ANTARCTICA (YELLOW DOTS)

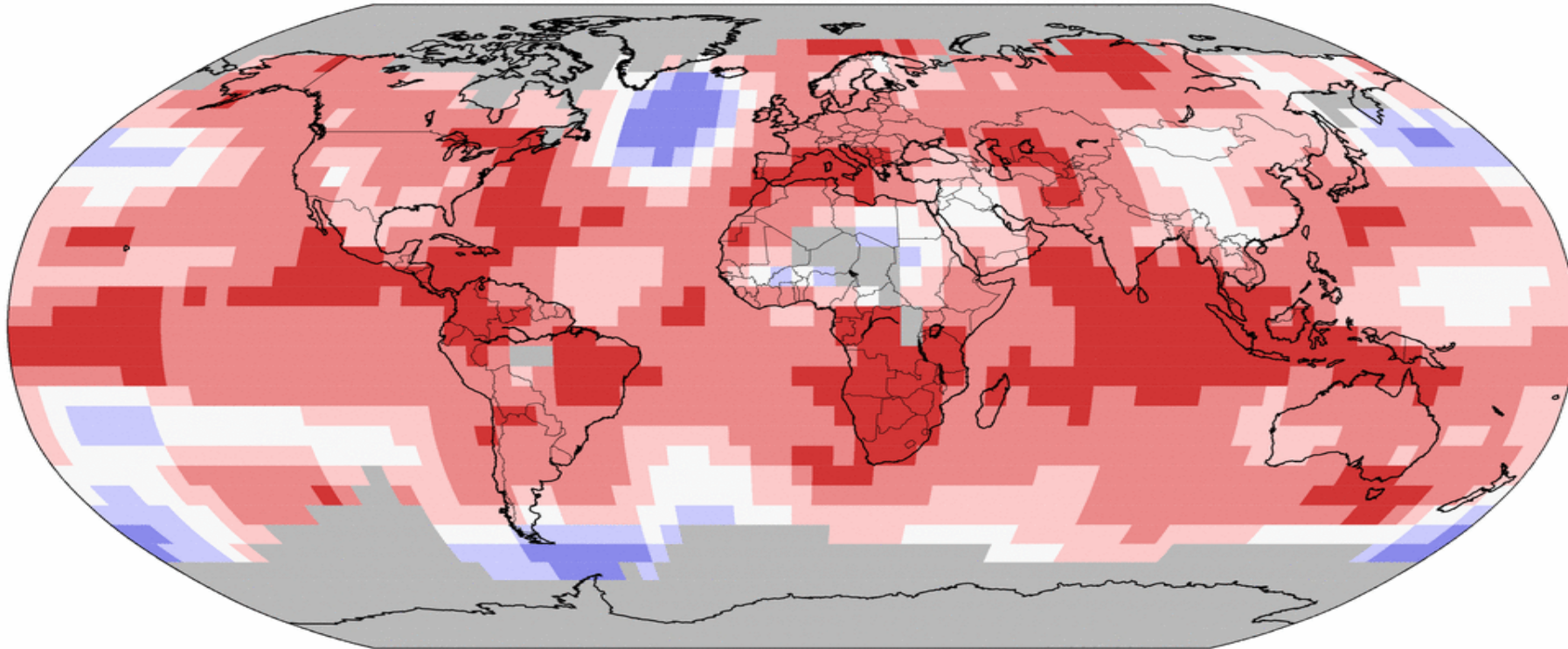


OBSERVED DATA. COLD PATCH (BLUE) OFF GREENLAND, AND STRADDLING THE ANTARCTIC PENINSULA – COLD CAP OF LOW DENSITY FRESH WATER IS NOW INHIBITING DEEP WATER FORMATION. THE RESULTING INTENSE TEMPERATURE DIFFERENCE BETWEEN COLDER GREENLAND WATERS AND STAGNANT HOT EQUATORIAL WATERS DRIVES “SUPERSTORMS”

## Land & Ocean Temperature Percentiles Dec 2015–Feb 2016

NOAA's National Centers for Environmental Information

Data Source: GHCN-M version 3.3.0 & ERSST version 4.0.0



  
Record  
Coldest

  
Much  
Cooler than  
Average

  
Cooler than  
Average

  
Near  
Average

  
Warmer than  
Average

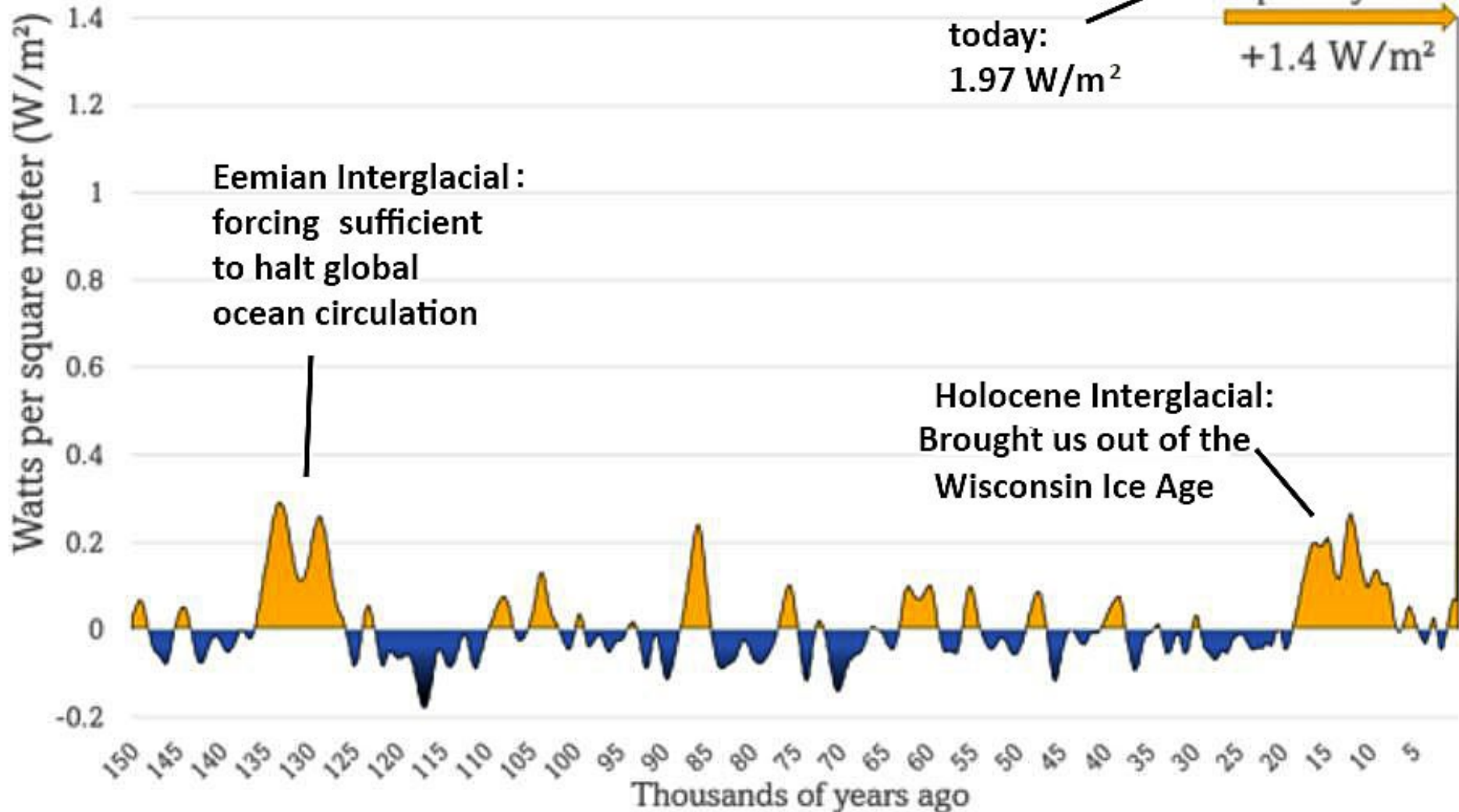
  
Much  
Warmer than  
Average

  
Record  
Warmest



# Earth's Energy Imbalance

Watts per square meter at 510,000,000,000,000 m<sup>2</sup>



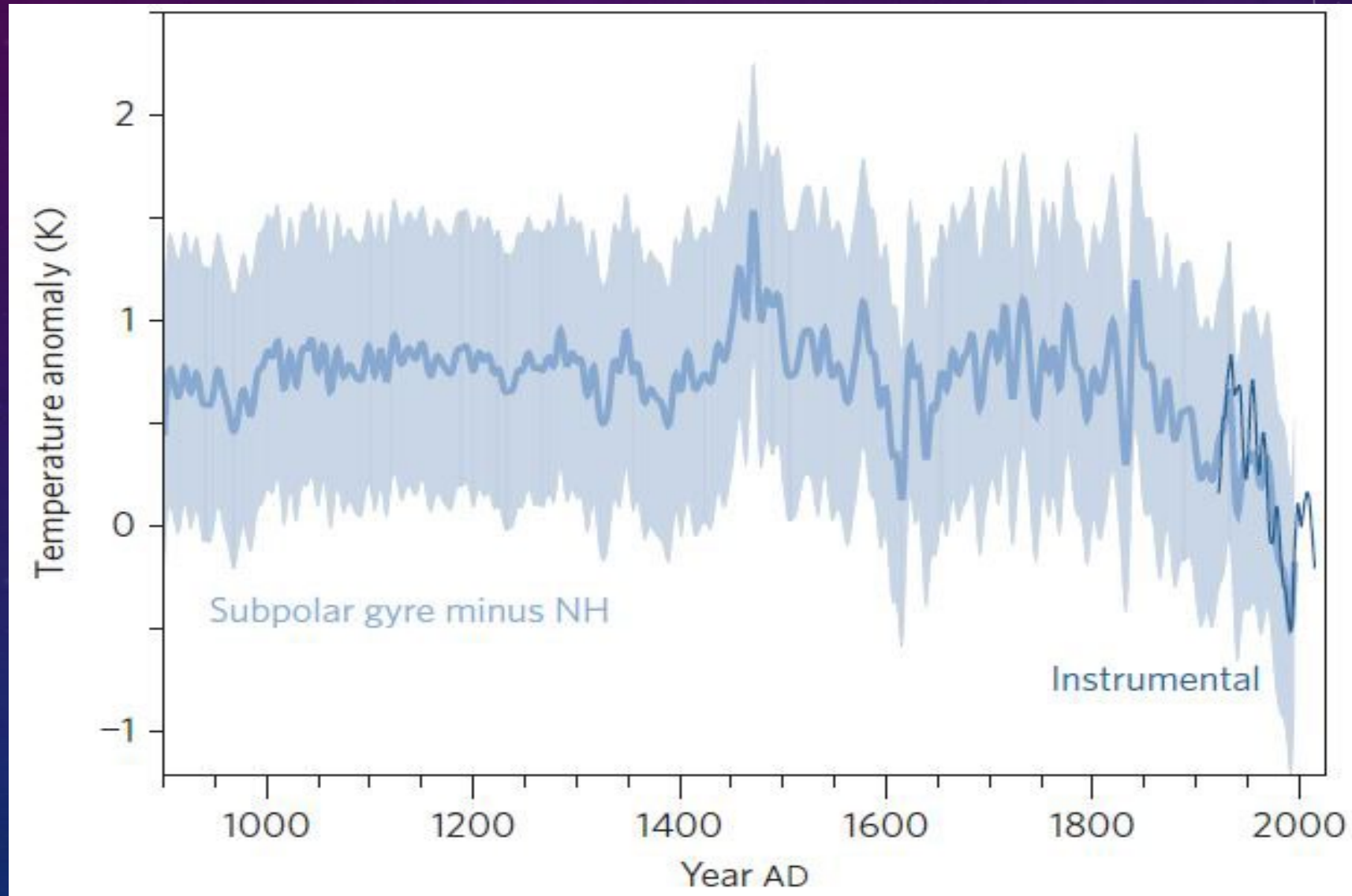
Eemian Interglacial:  
forcing sufficient  
to halt global  
ocean circulation

Holocene Interglacial:  
Brought us out of the  
Wisconsin Ice Age

0.2 W/m<sup>2</sup> energy imbalance, held for thousands of years, shut down the Eemian Interglacial's ocean. We have zoomed far past that level.

For how long?  
Certainly, if held,  
the ocean will  
shut down, and go  
stagnant.

TIME SERIES OF THE TEMPERATURE DIFFERENCE BETWEEN THE SUBPOLAR NORTH ATLANTIC AND THE ENTIRE NORTHERN HEMISPHERE, WHICH IS INTERPRETED AS AN INDICATOR OF THE STRENGTH OF THE ATLANTIC CIRCULATION. FROM RAHMSTORF *ET AL.* 2014, SEE [HERE](#) . WE SEE THE AMOC IS ALREADY WEAKENING.



THESE ~2,000 TON BOULDERS WERE TOSSED UP ONTO RIDGE LINES FROM THE SHALLOW OCEAN OFFSHORE DURING THE EEMIAN INTERGLACIAL IN THE BAHAMAS BY SUPER-STORMS, POWERED BY THE SAME *AMOC* SHUTDOWN WE MAY BE INITIATING WITH OUR FOSSIL FUEL BURNING. CAPTION BELOW INCLUDES “CHEVRON RIDGES” ... (NEXT SLIDE)



**Fig. 1.** Two boulders (#1 and #2 of Hearty, 1997) on coastal ridge of North Eleuthera Island, Bahamas. Scale: person in both photos = 1.6 m. Estimated weight of largest boulder (#1, on left) is ~ 2300 tons.

Enormous boulders tossed onto an older Pleistocene landscape (Hearty, 1997; Hearty et al., 1998; Hearty and Neumann, 2001) provide a metric of powerful waves at the end of stage 5e. Giant displaced boulders (Fig. 1) were deposited in north Eleuthera, Bahamas near chevron ridges and runup deposits (Hearty, 1997).

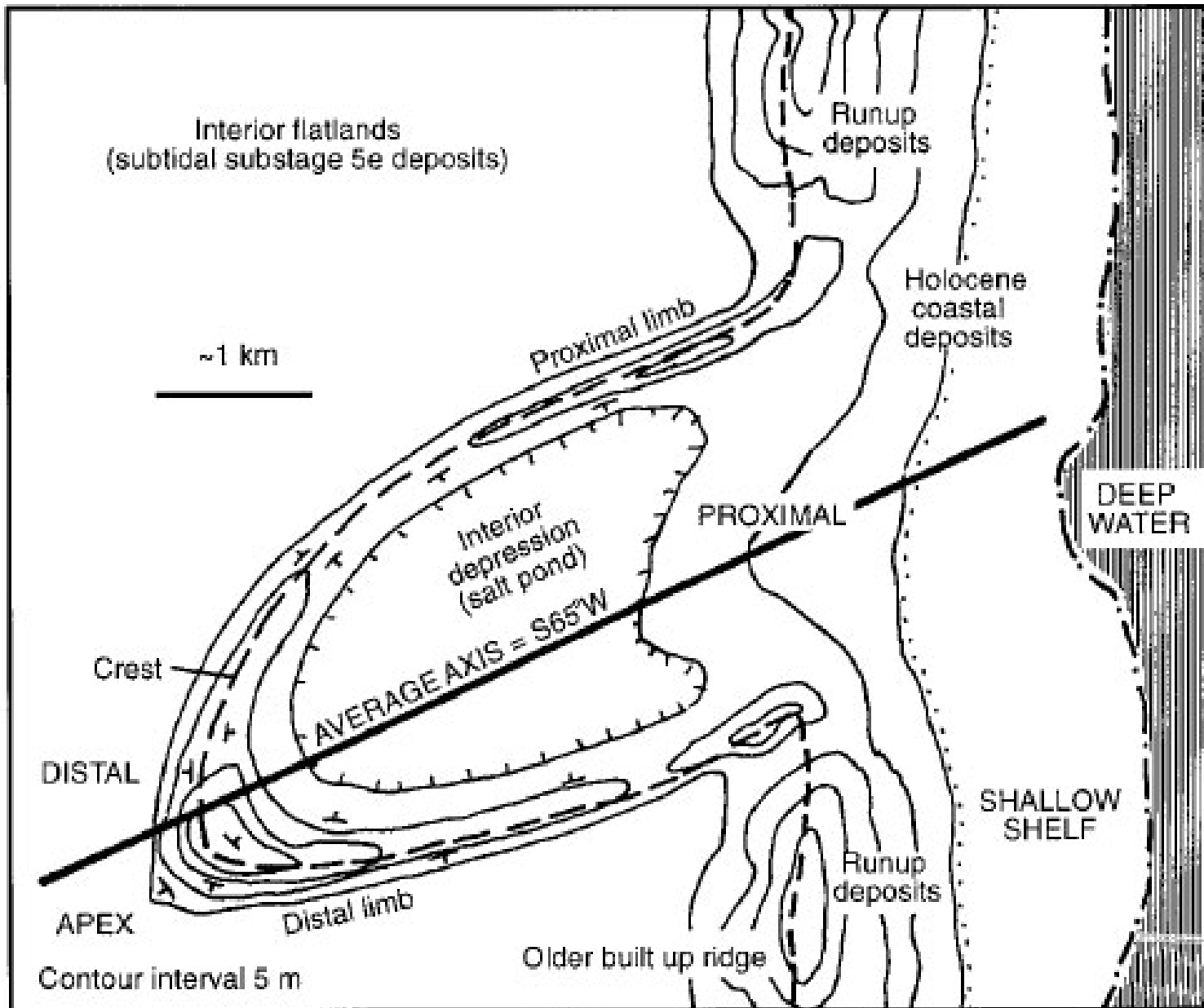
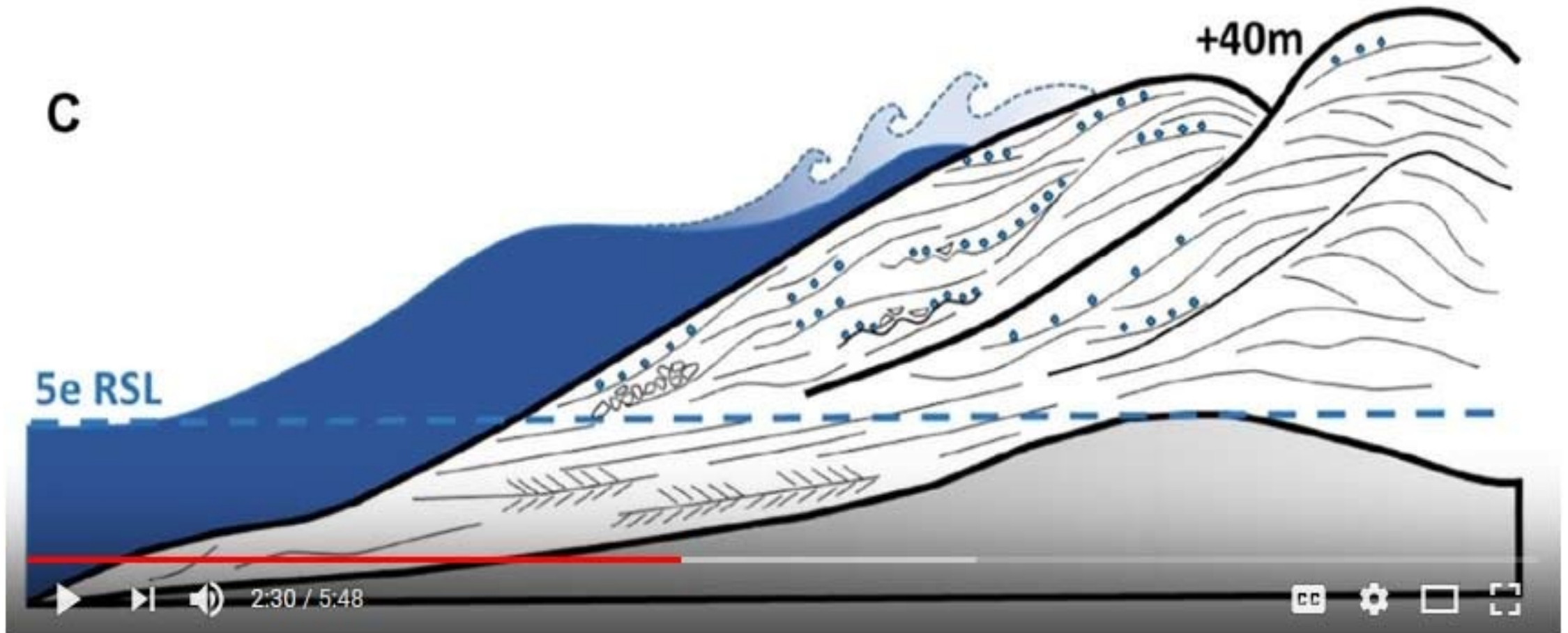


FIG. 1. Schematic map of chevron beach ridge.

GIANT SUPER STORM WAVES OF THE EEMIAN INTERGLACIAL CREATED CHEVRON DEPOSITS 50 FT HIGH AND 2 MILES LONG, WHEN WASHING BACK TO SEA. THESE ARE ALL ALONG THE SHORELINES OF THE BAHAMAS. SOME RUN-UP DEPOSITS ARE AS HIGH AS 43M, REQUIRING WAVES NEARLY ~200 FT IN HEIGHT TO CREATE THEM.

THIS IS WORK BY [HANSEN ET AL. 2016](#), ON WHICH I GAVE A [PUBLIC TALK](#) BACK IN 2016.

HERE IS A [6 MIN VIDEO](#) ON SUPERSTORMS FROM HANSEN *et al.* ([2016](#)), FROM YALE CLIMATE CONNECTIONS



Climate, Sea Level, and Superstorms

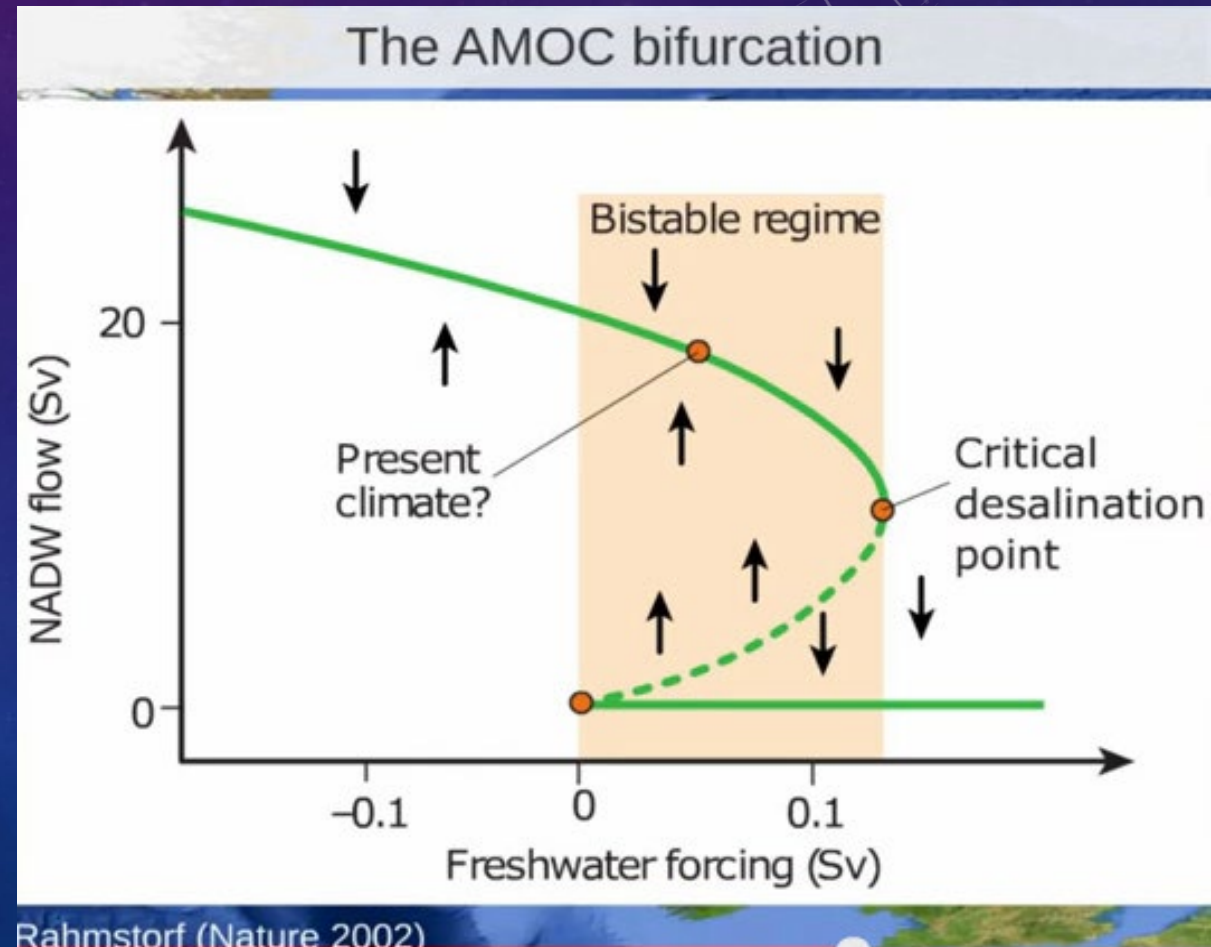
REMEMBER THE WAVES IN THE MOVIE *"INTERSTELLAR"*? THEY WERE SAME HEIGHT AT THE EEMIAN SUPERSTORM WAVES.

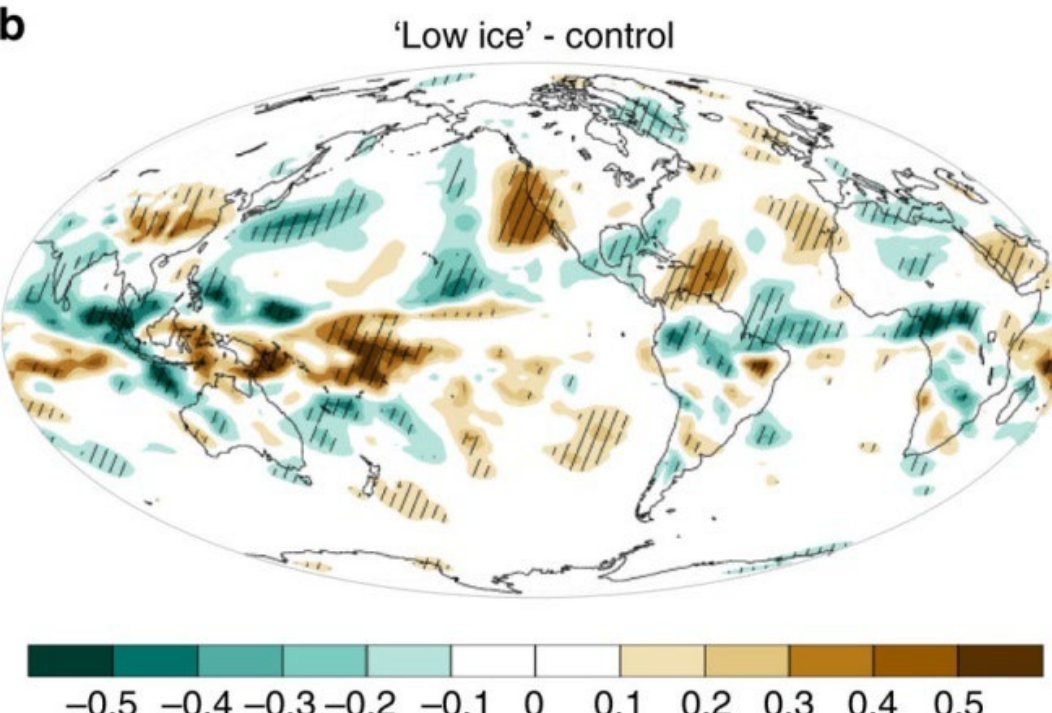
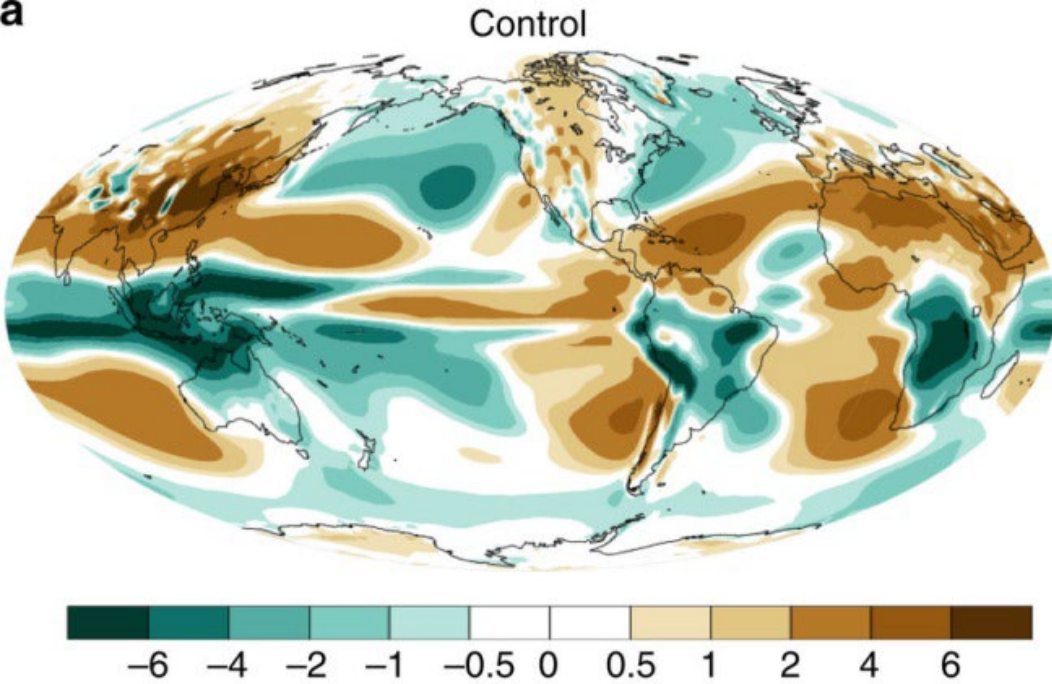


VIA 9GAG.COM

# HOW CLOSE ARE WE TO THIS SITUATION? RAHMSTORFF (2002) SHOWS THE SYSTEM STABILITY TRAJECTORY FOR THE AMOC (ATLANTIC MERIDIONAL OVERTURNING CIRCULATION) – THE BEST STUDIED SEGMENT OF THE GLOBAL OCEAN CIRCULATION

We're already in a salinity regime where there are two stable solutions, one being total shutdown. If melt increases and salinity declines further, a critical desalination point is reached and the current shuts down. Then, only drastic re-salinization (re-freezing Greenland) can push it all the way back to a point where the current can resume, and that would take centuries even if temperatures dropped immediately, according to James Hansen.





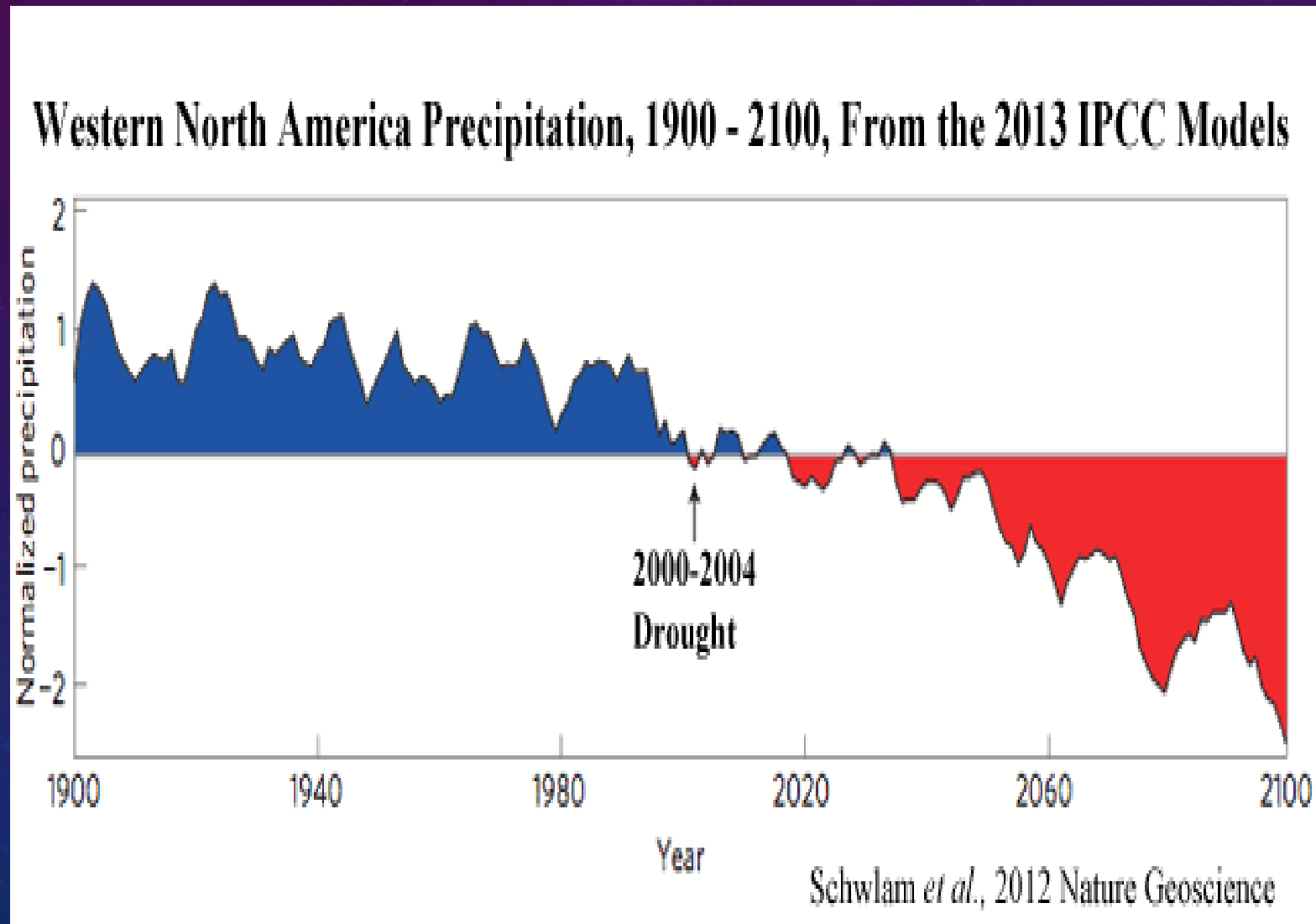
WHAT ABOUT CALIFORNIA'S FUTURE?

CVIJANOVIC ET AL. (2017) CONFIRM THE LINK BETWEEN THE LOSS OF ARCTIC OCEAN ICE AND SEVERE DROUGHT IN CALIFORNIA

NOTE THAT CALIFORNIA IS THE WORST CONTINENTAL LAND ON EARTH FOR FUTURE DROUGHT (BOTTOM).

AS THE POLAR CELL WEAKENS AND TROPICAL WARMING RISES, THE DESERT BAND AT  $\sim +30$  LATITUDE, IS MIGRATING NORTHWARD 3X FASTER THAN CLIMATE MODELS PREDICTED, INCLUDING MORE OF CALIFORNIA

EVEN IN THE OVER-OPTIMISTIC IPCC PREDICTIONS – WESTERN U.S. DROUGHTS ARE JUST GETTING STARTED. [SCHWLAM \*et al.\* 2012](#).



# SO WHAT DO WE DO?

Perhaps you're thinking – let's just re-double our efforts at energy efficiency.

Policy people and pro-Neoclassical economic people constantly promote this.

**Alas, that does not work. Not for energy, not for climate.**

# IT'S THAT EASY!

80s

PICK UP YOUR LITTER AND SAVE THE EARTH!

90s

RECYCLE AND YOU CAN SAVE THE EARTH!

'00s

REDUCE YOUR CARBON FOOTPRINT AND YOU CAN SAVE THE EARTH!

'10s

COMPLETELY RESTRUCTURE GLOBAL ECONOMIC SYSTEMS AND YOU MAY BE ABLE TO SAVE A REMNANT OF HUMANITY!

@Tommy Siegel

SORRY... IT'S  
*NOT* THAT EASY.

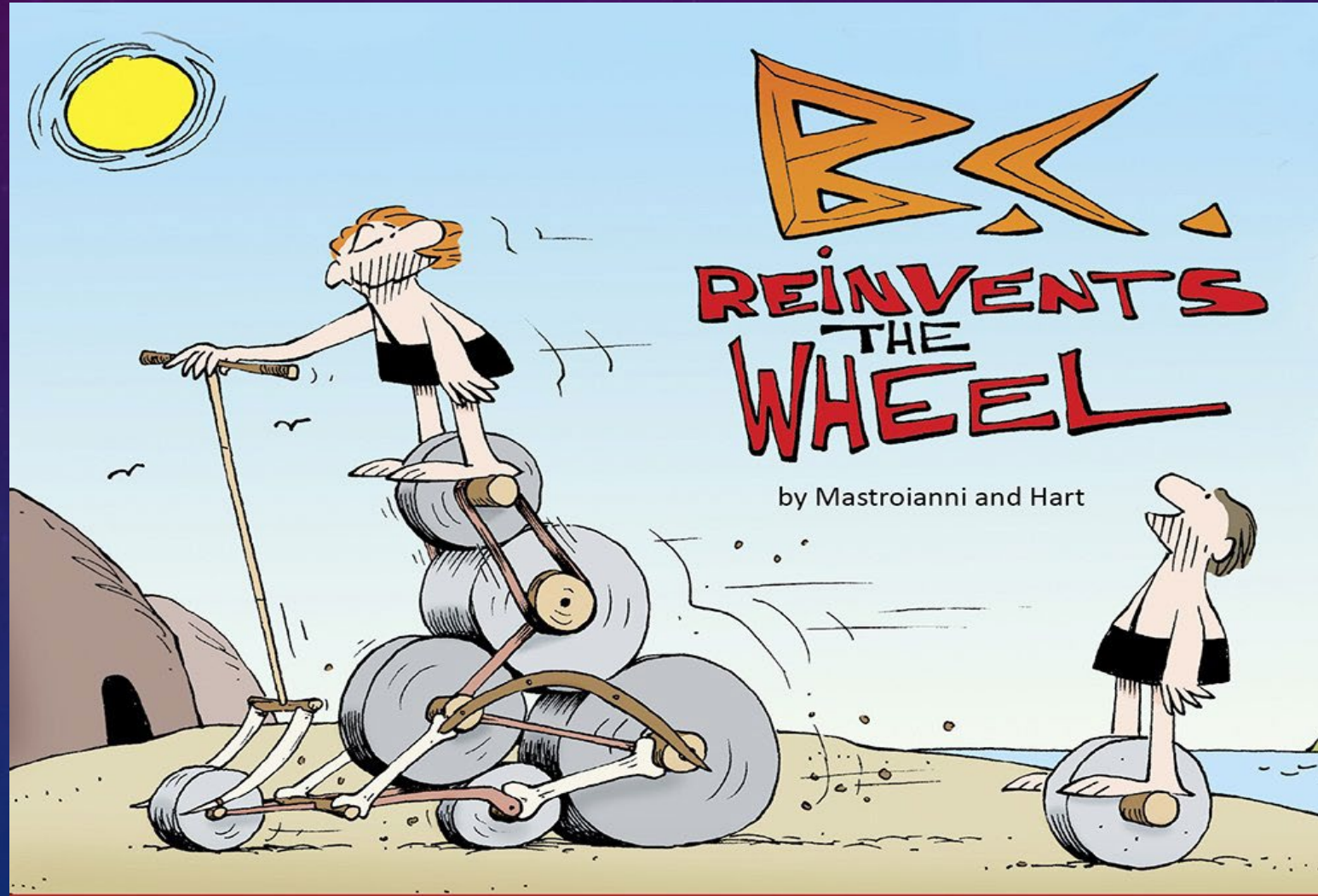
# JEVONS' PARADOX

- Original Jevons' Paradox: William Stanley Jevons pointed out in the 1860's that improving the efficiency of steam engines would not result in lower coal use, but in fact lead to greater coal use. He was correct.
- Economists who do not want to face the implications on a finite planet, will narrowly interpret Jevons' Paradox to apply to only the item who's efficiency is being improved, and thereby claim Jevons' Paradox is not true, instead there's only a small "rebound".
- Classic example: double the miles per gallon efficiency of your car, and they claim you won't then drive twice as miles and thereby eliminate the energy savings. True! You'll probably drive only a little more, but not a lot.
- But this misses the key truth...

# THE KEY INSTEAD IS: GENERALIZED JEVONS' PARADOX

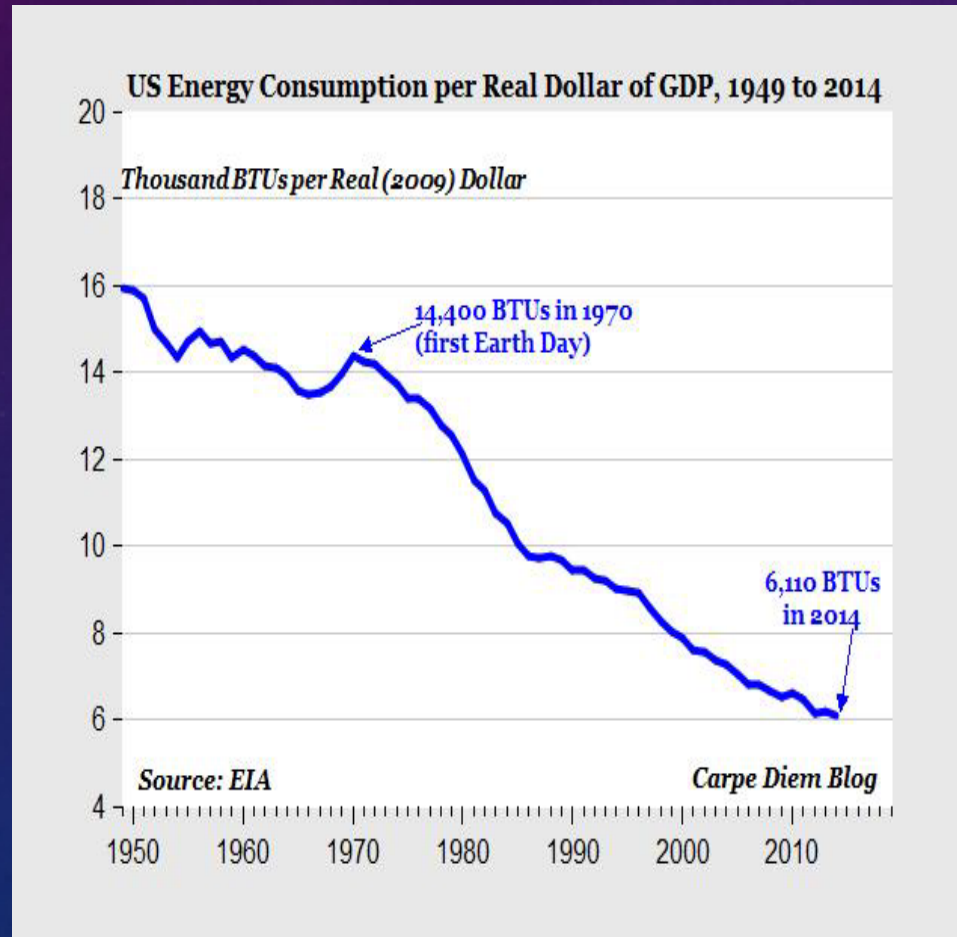
- I've given the name "**Generalized Jevons' Paradox**" to the fact that improved efficiencies lead to *savings*, and those savings historically have been - and always will be - *spent*. And spending forces new energy consumption to support the creations the work paid for. And more - greater savings leads to the expanded ability and realization of growing civilization faster.
- Result: Civilization consumes MORE energy, not less, as energy efficiency improves. And remember, climate only cares about the TOTAL energy consumed on this finite planet, not per capita.

WE'VE BEEN CONTINUALLY AND DRAMATICALLY INCREASING ENERGY EFFICIENCY EVER SINCE THE INVENTION OF THE WHEEL. WE'RE "OPTIMAL FORAGERS", AS ARE ALL OTHER ANIMALS, SEEKING TO LOWER OUR ENERGY SPENT PER UNIT OF ECONOMIC UTILITY GAINED.

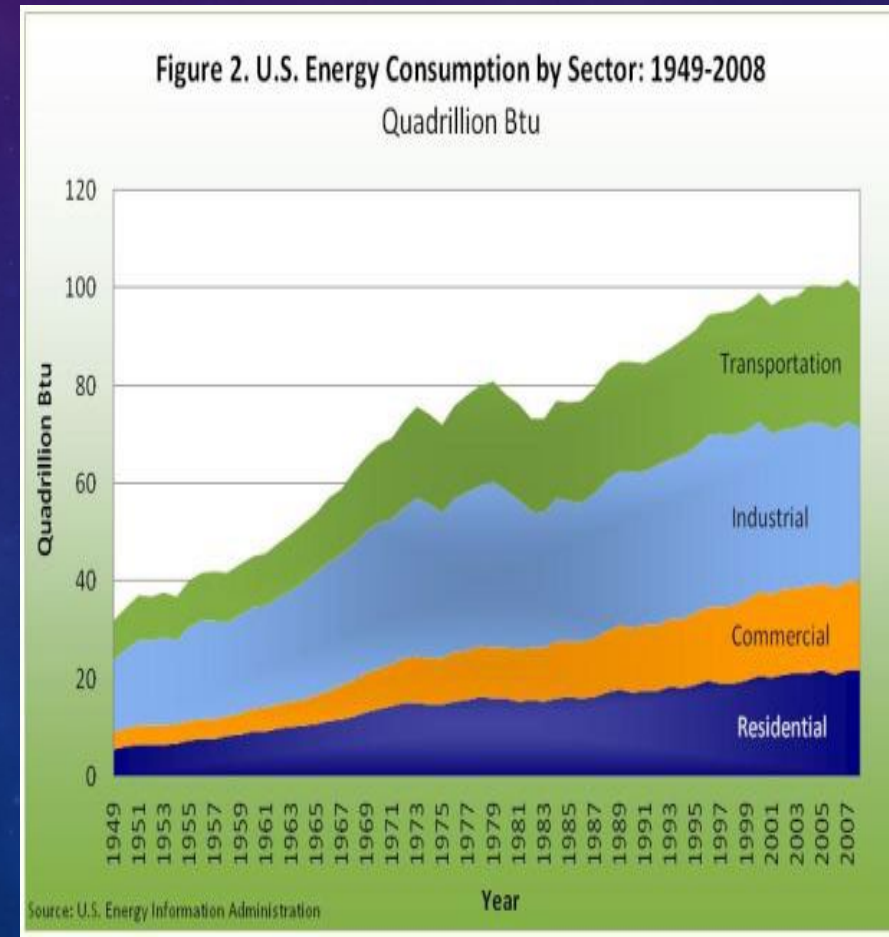


# U.S. ENERGY EFFICIENCY SINCE 1950...

Spectacular 62% increase in energy efficiency! (except during oil-shock recessions of '70-'74). Has it lowered our consumption?...



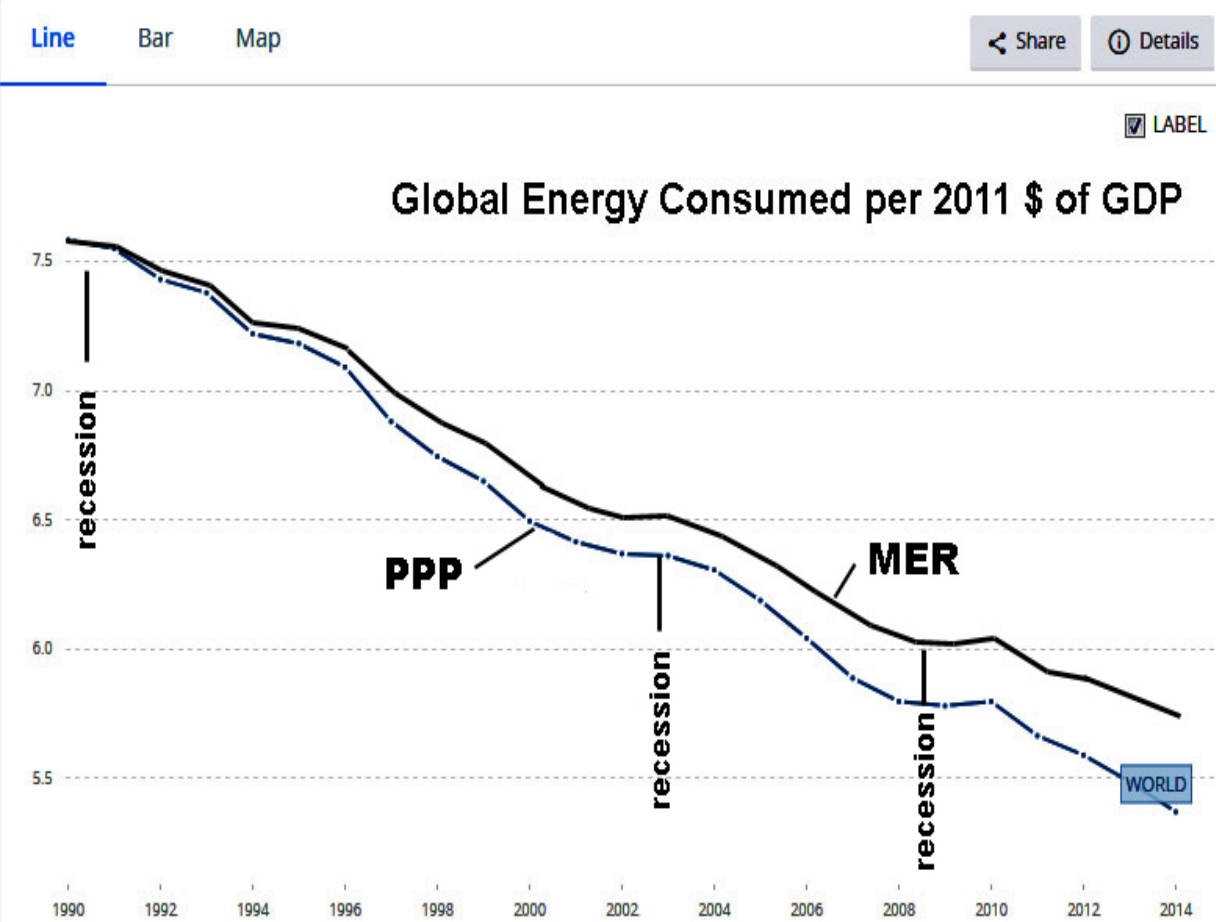
Quite the contrary! Energy consumption is up 300%, even given our off-shoring of much of our manufacturing to China



# Energy intensity level of primary energy (MJ/\$2011 PPP GDP)

World Bank, Sustainable Energy for All ( SE4ALL ) database from the SE4ALL Global Tracking Framework led jointly by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program.

License: [Open](#)

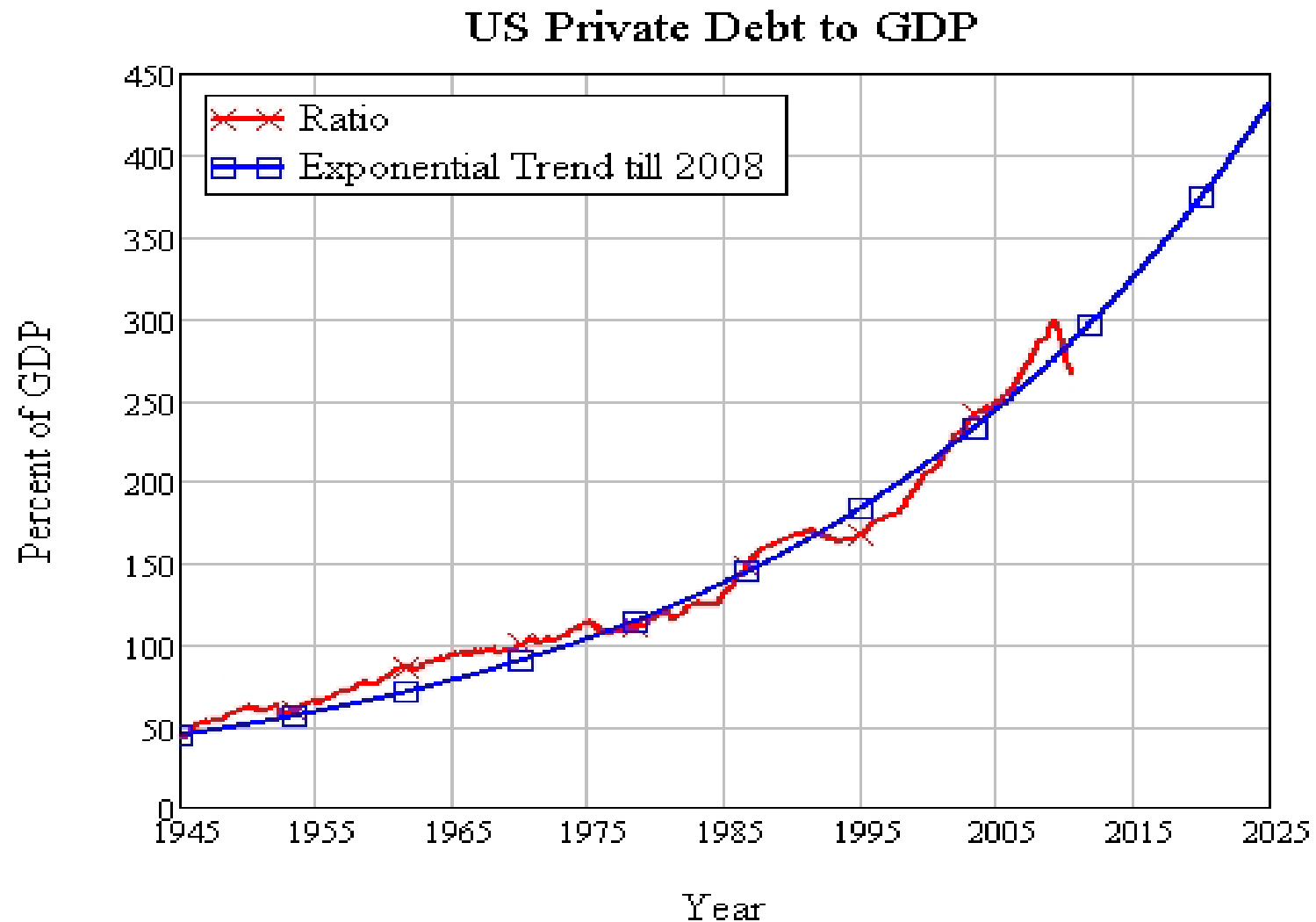


GLOBAL PRIMARY ENERGY EFFICIENCY IN PRODUCING GDP. THE CONSISTENCY OF THE SLOPE OF THIS CURVE ARGUES THAT WE HAVE ALWAYS PURSUED ENERGY EFFICIENCY WITH AS MUCH VIGOR AS PROFITS CAN JUSTIFY. THAT'S NO SURPRISE SINCE IT'S A "WIN/WIN" FOR EVERY POLITICAL CAMP. THE KEY IS – "AS MUCH VIGOR AS PROFITS CAN JUSTIFY" ...

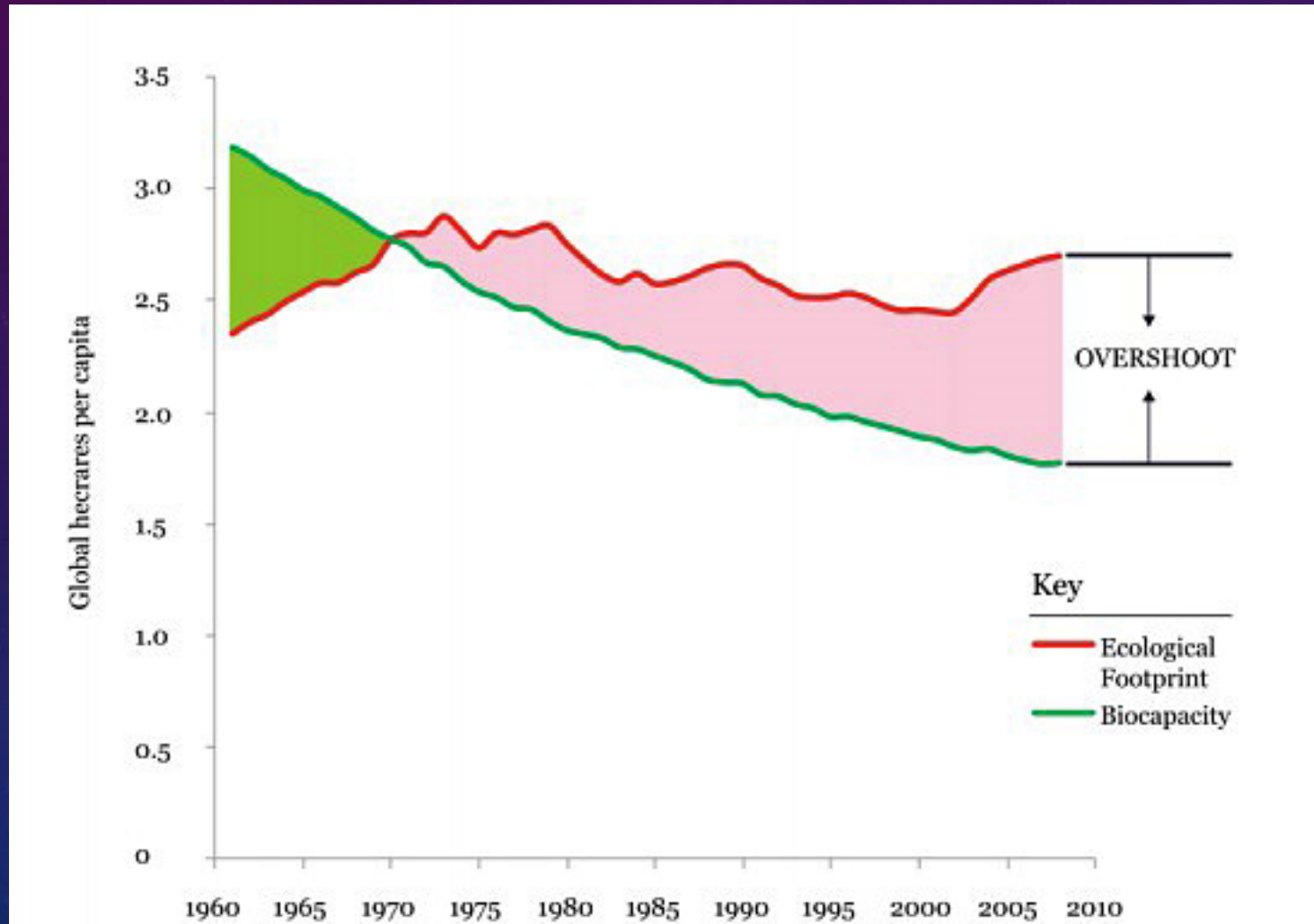
# THE POWER/WEALTH RELATION

- Related to Generalized Jevons' Paradox is an observational discovery by Tim Garrett (U. Utah) of a relationship that I call "The Garrett Relation"
- ***"The Rate of Consumption of Primary Energy at any time, is directly proportional to the sum of all past global Real GDP"***
- I have reformulated this slightly by doing additional investigating. Instead of "GDP", instead substitute "Total Spending" where "spending" includes barter and the "shadow economy" not monetized. And Real GDP should be corrected from nominal national GDPs using market exchange rate accounting, and should be corrected for inflation using the original dGDP methodology, not the politically motivated understated inflation commonly published. The true inflation rate is quantified by the "Shadow Stats" methodology or the MIT School of Business' "Billion Prices Project" (see my Presentation K43: Civilization as a Thermodynamic System)

WORSE. WE DO MORE THAN SPEND THOSE EFFICIENCY GAINS. WE BORROW FROM FUTURE GENERATIONS, SADDLING THEM WITH NEW DEBT. U.S. PRIVATE DEBT IS NOW OVER 350% OF GDP, EXPONENTIALLY INCREASING.



HUMANS ARE USING OVER 1.7 EARTH'S WORTH OF NATURE'S CAPACITY FOR RENEWABILITY. THIS WILL END BADLY. WE'RE EATING THROUGH OUR NATURAL RESOURCES "SEED CORN"



# SO WHAT DO WE DO?

- More than stop our growth, we must undo the damage we've done.
- It's not enough to just walk away from the planet we've trashed and apologize to the Earth. We must fix our mess. We must pull back out the CO<sub>2</sub> we added, and do it quickly.
- Climate tipping points are near or are being crossed right now.
- The public needs to know the un-sugar-coated truth contained in the science journals. To that end...

# ACTION #1: IPCC SCIENTISTS SHOULD DIVORCE THEMSELVES FROM THEIR U.N. HANDLERS

- Continue to issue periodic reports, including the Summary to Policy Makers, but change the rules so...
- --- that only ~90% of scientists need agree on language for it to be approved.
- --- that policy people have no say in the content of these reports, only the scientists.
- --- Let policy people react to the science however they will, but do not force the scientists to put their name on documents redacted, manipulated, and re-worded against their better judgment. Science is not to be “negotiated” for political purposes.

# ON COMING CLIMATE CHANGE...

*“...Scientists were not telling the whole truth. Because they were discouraged from telling the whole story, even explicitly told not to do so.” (page 4)*

- James Hansen, 2019

# I HAVE RESPECT FOR (MOST OF) THE IPCC SCIENTISTS' WORK IN QUALITY JOURNALS...

- ...but I have little respect for the U.N. overlords who censor and manipulate the official document releases from the scientists.
- These U.N. people's stated goals - choose IPCC members with a "*range of views*" and then insist on 100% agreement from all IPCC policy, volunteers, and scientists to every word in all publications.
- They thus insure veto-power granted to the small minority of industry-sponsored "scientists", together with the larger number of political representatives whose goals are not scientific openness, not truth-telling, but preservation of the economic paradigm that employs them and brought this tragedy. Thus, we get only the most bland and unthreatening pronouncements.
- And worse – the scientists' name and imprimatur is then on the documents which actually violate the faithful observance of good science.

# THE POLITICAL MANIPULATION OF THE IPCC

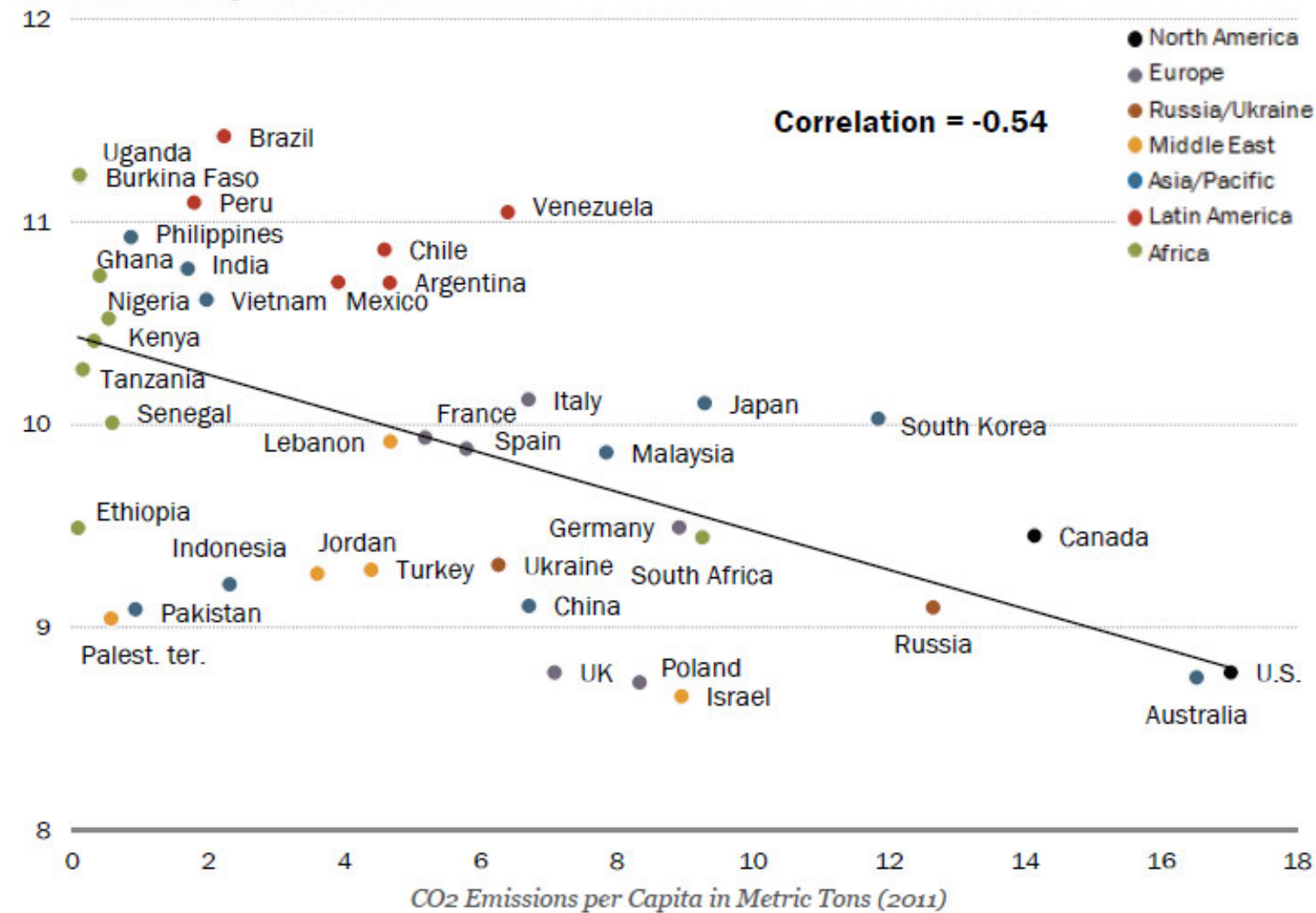
- More and more scientists are complaining that the latest report, as well as earlier ones, have a “vast blind spot” on the role of the fossil fuel and right-wing sponsored misinformation campaigns.
- *“This is an important barrier to climate action, but it is never addressed,” said Professor Robert Brulle of Drexel University, who has published research on the funding and influence of climate science denial efforts.*
- *“A large existing literature on this was ignored by the IPCC,” he added.*

# THE IPCC: SCIENTISTS WERE TOLD THE IPCC WAS THE MEANS FOR CLIMATE SCIENTISTS TO INFLUENCE PUBLIC POLICY

- But in operation (and intent?), by encapsulating the scientists within the UN mandated rules for “consensus” with policy overlords (the UN is dominated by the most powerful carbon emitters and pro-economic growth countries on Earth – next slide), the IPCC instead acts as a mechanism to muzzle and neutralize the science.
- And much worse - it puts the names of the scientists on these documents which are massaged to be unthreatening to the economic growth paradigm that rules the politics of U.N. countries.
- This badly neuters the message of science - Real science; science contained in the peer-reviewed journal studies many of these scientists authored.

# High CO<sub>2</sub> Emitters Are Less Intensely Concerned about Climate Change

Global climate change concern scale\*



\* Concern about global climate change is measured using a three-item index ranging from 3-12, with 12 representing the most concerned about climate change. Respondents were coded as 4 if they believe climate change is a very serious problem; if they think climate change is harming people now; and if they say they are very concerned that climate change will harm them personally at some point in their lifetime. The mean score for each country is used in this analysis. (See [Appendix](#) for more details.)

Source: Spring 2015 Global Attitudes survey. Q32, Q41 & Q42. Data for CO<sub>2</sub> emissions per capita from World Bank Data Bank, accessed August 5, 2015.

THE HIGHEST PER  
CAPITA CARBON  
EMITTING COUNTRIES  
ARE ALSO THE  
COUNTRIES MOST IN  
CLIMATE DENIAL, AND  
MOST INVOLVED IN  
MANIPULATING THE  
IPCC SCIENCE ([STOKES  
et al. 2015](#))

# THE PUBLIC AND PRESS LOVE TO READ ABOUT MESSY, LOUD DIVORCES! LET'S GIVE THEM ONE!

- I advocate that the IPCC Scientists to go to the media and make a blunt announcement that they are fed up with the political meddling and censorship of good science that happens by the political / economic people in the IPCC.
- And they are hereby divorcing themselves from the U.N. and the IPCC.
- They will continue to assemble their collective science and issue both the large scale documents and also a “Summary for Policy Makers” as usual, but on their own. Written ONLY by the scientists.
- And further, that they will demand only ~95% consensus from the scientists, and thus refuse to give veto-power to a minority who's motives may be sullied by political, financial, or corporate agendas

# SO WHAT DO WE DO?

- *We cannot know what to do, until we know what we aspire to”*
  - Dr. Nate Hagens. Energy expert and systems thinker for the human dilemma in its widest meaning.

# THE MOST SPIRITUALLY (IN A HUMANIST, NOT SUPERNATURAL, SENSE), INTELLECTUALLY, AND EMOTIONALLY EVOLVED AMONG US, HAVE SHOWN US...

- ...That happiness is not to be found by submitting to being a hamster in the consumption cage run by the profit-motivated manipulators of your hormones.
- ...That the best and most meaningful things in life include:
  - -- Appreciating and welcoming the other life on this planet. Not merely as a food “resource”, nor a competitor to be beaten.
  - -- Living on a planet of abundance, and in simplicity enough to enjoy your personal growth in knowledge, values, benevolent companionship. That does require a certain level of technological wealth, but not status-driven avarice.
  - -- Mastering new knowledge and skills and creating a better world for all future generations.
- This, for me, is what *Homo Sapiens* at their best would be aspiring to.

# ALL EFFECTIVE CLIMATE STRATEGIES WILL HAVE ONE OR BOTH OF THE GOALS BELOW:

- #1. Lower the heating of the Earth by the sun (“sunshade” category)
- #2. Raise the ability of Earth to radiate its heat back out to outer space (lower Greenhouse Gas concentrations is the only way to accomplish this)

# AND ALL SAFE GEO-ENGINEERING CLIMATE TECHNOLOGY SOLUTIONS SHOULD SATISFY THE TWO CRITERIA BELOW:

- #1: No Hysteresis. Technologies must take the Earth System back from its current dangerous state, to its safe climate state with as little hysteresis as possible. You do not go off into profit-hungry schemes that veer the Earth into completely novel directions whose dangers are ignored and/or not understood!
- #2: Leave the Earth's surface, where ~all life must live, in as pristine a state for all species as possible. So - no growing a U.S. sized area with weeds to burn and capture their carbon (impoverishing soil). No spreading iron across the open oceans (=>domoic acid; toxic, doesn't sequester carbon), no ideas which massively change rainfall patterns. No massive use of white paint. No clear-cutting of boreal forests to raise albedo, etc.

# HOW TO GET THERE? FIRST: THE EASY STUFF. WHAT WOULD STABILIZE CLIMATE TO A STATE CLOSE TO WHAT CURRENT SPECIES EVOLVED IN HARMONY WITH?

- #1: GeoEngineering a stop-gap to halt further temperature rise. It looks extremely unlikely we'll lower CO<sub>2</sub> fast enough. So...Perhaps stratospheric CaCO<sub>3</sub> aerosols, wind-driven pumps operated on the Arctic Ocean to re-ice it in winter, thick enough to prevent melt during the following summer (Desch 2017).
- #2: Massive capture and underground sequestration of CO<sub>2</sub> from existing fossil fuel power plants. (VERY expensive!)
- #3: Massive deployment of DAC (direct air capture) of CO<sub>2</sub> (*e.g.* Climeworks) and pumping underground permanently into salt domes and other geologically stable formations, or basalt formations for slow chemical fixing into CaCO<sub>3</sub>. (VERY expensive!)
- #4: Transform energy systems to run mostly on molten salt thorium breeder reactors (MSR, LFTR), which are safe and have a virtually inexhaustible supply of fuel, and have a tiny footprint on Nature. Solar PV and wind in already-developed areas as “peaker” supplies. After all, virtually all species need sunlight, but only one can use thorium. Let's use it and leave space and sunlight to our fellow life travelers. New EIA studies suggest we may also be able to use high grade geothermal power for always-on reliable power with low footprint on Nature. Let's hope so.

## 2017: THE FIRST COMMERCIAL AIR CAPTURE CO<sub>2</sub> INSTALLATION...



...by Climeworks, Inc. in Switzerland. Very small scale, and CO<sub>2</sub> is sold for fertilizer, not sequestered. In the next 10 years, their very ambitious goal is build 250,000 of these air capture plants by the mid 2020's. If they succeed, that would capture 1% of our current emissions. **(As of late '22, they have only 18)**. Estimate \$400/ton CO<sub>2</sub> to capture and \$20 to sequester, except feasibility of climate-scale sequestration is highly speculative at present.

**How expensive is \$420/ton? To remove enough CO<sub>2</sub> to bring global concentration down to 350 ppm, would cost \$26,000 for every man, woman, and child on the planet.**

NOW THE HARD PART: *HOMO SAPIENS*. *THE GENETIC DRIVES THAT MADE US A SUCCESS ARE NOW KILLING THE PLANET. AND US.*

- The deeper I delve into climate change science, the more clear that it's merely a symptom of a deeper problem that may be unsolvable, and that mere techno stuff won't overcome.
- Natural Selection breeds species to grow, dominate the competing species for resources, and leave more offspring. This is mediated through hormones and brain chemistry; the brain's reward and desire systems.
- But Nature never bred us for a time when we had over-dominated the planet. These growth compulsions are now killing us.

# IN THE DARWINIAN COMPETITION FOR RESOURCES, IT MAY FEEL TRAGIC IF YOUR SPECIES LOSES...

- For most species, though, there is still the comfort of knowing the rest of the world will go on pretty much the same without you.
- But for a species as powerful, as dominant, as *Homo Sapiens*; the real tragedy is not when you lose, it's instead when you WIN.
- Because on a finite planet, your addictions to eternal material and status-seeking growth, will carry you far beyond what the Earth can support, and then ecosystems collapse. Your victory is hollow, because by your very win , you lose all that's worthwhile, and your species then follows the others to a grim future, or extinction.

# WE HAVE ARRIVED AT THAT TIPPING POINT IN HUMAN EVOLUTION. NOW. TODAY.

- Nature's gift to us – our overpowering mind's ability to out-compete all species for resources, worked well for 6,000 generations, as long as the Earth was not “full” of us.
- But it never bred us for the moment, now, to push back from the dwindling feast on the table. Yet that is what we must do, or face the destruction of perhaps the only intelligently inhabited planet in the Galaxy. Instead, our urges compel us to compete that much more desperately against our fellow humans, and other species.

# OUR SHORT-TERM ADDICTIONS DRIVE US TOWARDS DESTRUCTION

- Consider: a recent poll showed that 70% of Americans agree climate change is real and a concern and will likely hurt their families.
- And yet – that same fraction of 70% - refuse to vote to spend even \$10 a month to do anything about it. And 40% would refuse to pay even \$1 per month.

# WILL WE SOMEHOW OVERCOME OUR VERY NATURE, AND CHANGE?

- I'm skeptical. Most people do not change.
- They cling to their dogmatic attachments. Only when they "hit bottom", exhausted by the continual denial of their dysfunctions, do they find the courage to change, or else fail survival.
- So instead, I agree with James Hansen – if it's to happen, it will have to be by the youth of today. My (Boomer) generation is who got us INTO this, and refuse to do anything meaningful about it.

# SO WHAT DO WE DO?

- It may yet be possible to turn things around, even with only a minority of dedicated activists.
- Some studies indicate that as little as 3.5% of a population needs to get fully on board and insistent on change (if that change is genuinely good), for a “tipping point” in cultural change to begin.
- I have thought about this issue for 14 years. My best idea remains the same...

# I OFFER THIS: OCCUPY D.C. FOR CLIMATE

- If climate activists, rather than celebrating inconsequential meetings with their congressman, instead got educated using climate science resources such as I and others have assembled, and then canvassed the country to get ~100,000 – 500,000 people who would commit to going to Washington D.C. for a different kind of demonstration...
- With images stirring public conscience, the power of media attention can be instantaneous. Witness the [Standing Rock Nation standing up to Big Oil](#)
- We either deal with climate change, or little else really matters

# OCCUPY DC' FOR CLIMATE: GOAL WOULD BE...

- To nonviolently, peacefully, but with determination, prevent “business as usual” from continuing...
- To march on the Capitol and White House and walk past those who would stand in their way.
- It would not be merely a weekend feel-good march.
- **It would be to OCCUPY the City, slowing its political “business as usual” to a halt, until congressional leadership publicly spoke to the assembled press and the People with a commitment to pass the legislative demands outlined in my “K44 Strategies: Policy”.**

# THE MOST IMPORTANT LEGISLATIVE DEMAND

- A 28<sup>th</sup> Amendment to the Constitution: *“Congress shall pass no law which violates the life, liberty, and pursuit of humane happiness by future generations, when such violation involves the destruction of the Planetary Commons given by Nature to all: Healthy oceans, climate, the great forests, ice caps, and the atmosphere. These commons shall be left in a stable state suitable for the great ecosystems of the planet which evolved within it.”*
- (this is your instructor’s wording. Open, of course, to fine-tune.)

# ANOTHER LEGISLATIVE DEMAND: TAX ALL NON-RENEWABLE MATERIALS AT THEIR SOURCE

- A Hansen-style tax on well-head carbon, copper, etc. Not an emissions tax, but a source tax on any material pulled from the ground or imported across our national boundary. The goal is to de-motivate the MINING. Because once out of the ground, it'll (carbon) will end up mostly in the atmosphere, is the reality.
- Only this, has hope of forcing us off Fossil Fuels. Emission taxes are what the fossil fuel industry favors, because they understand how vital and price-inelastic energy is. It has historically only motivated more profits and more domination by the major oil companies, while being “sold” as a “solution”. It is NOT ([Donnelly 2018](#)). And it makes the poorest suffer the worst costs.
- To “sell” this politically has usually included that the tax be given to all citizens to spend as they please. Alas, this sacrifices some of the pro-climate, pro-environment effect...

# DR. NATE HAGENS OBSERVES...

- *“To distribute carbon fees as dividends to the poor as a combinatory climate mitigation and wealth inequality tool, risks a large (carbon) backfire.*
- *The lowest 2 quintiles of our society spend 100% of their income. The top 5% spend only 7% of their income (RN: the rest going into inflating asset prices, or what is usually called “investments”).*
- *In a world with depleting oil fields (not 1 year view but 10 year view), a carbon fee with the money going to the poor quickly rebounds as a large ‘call’ on more oil/gas consumption as we are taking abstract wealth (digits in bank) and having them become an immediate call on natural resources”*

# CAN WE DO IT?

- It is not in our nature to make such personal sacrifices for the sake of the world's distant future. For our individual families, or tribe? ... maybe. But not for the world. Only a tiny few are on board for that.
- Instead, civilization has a long history of empowering, or tolerating the empowerment of the most amoral and ruthless of psychopathological people into government and the high places in Industry ([Brooks et al. 2016](#)). We let them make the laws we all must live by. And this trend has been worsening, in parallel with climate.
- I'm afraid my honest judgment remains – probably not. High profile scientists like Kevin Anderson, Tim Garrett, and others agree. (But **PLEASE prove me wrong!**)

# STILL, CAN WE DO IT?

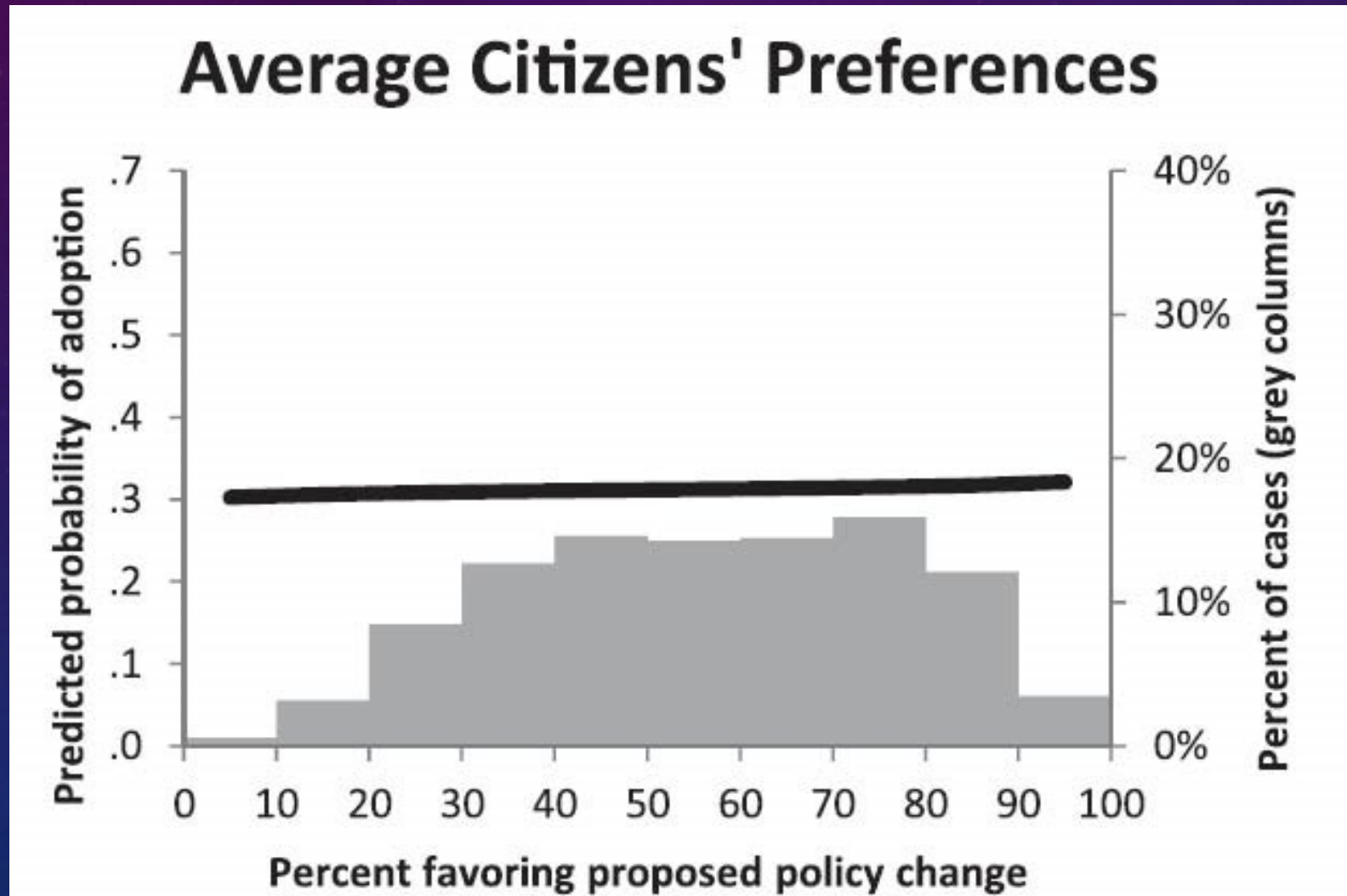
## LET'S START WITH THE EASY PART... VOTE!

- It takes very little time, and compared to everything else, it's extremely easy.
- You might be tempted to think, after what I'll show you soon, that voting is pointless.
- But refusing to vote, out of pure disgust, is a key reason we had the most disastrous election imaginable in 2016.
- No matter how bad things are getting, we may find, in the words of "Star Wars" Han Solo - "It's Worse!" if you let the worst candidates win through your negligence. I vote. You should too.

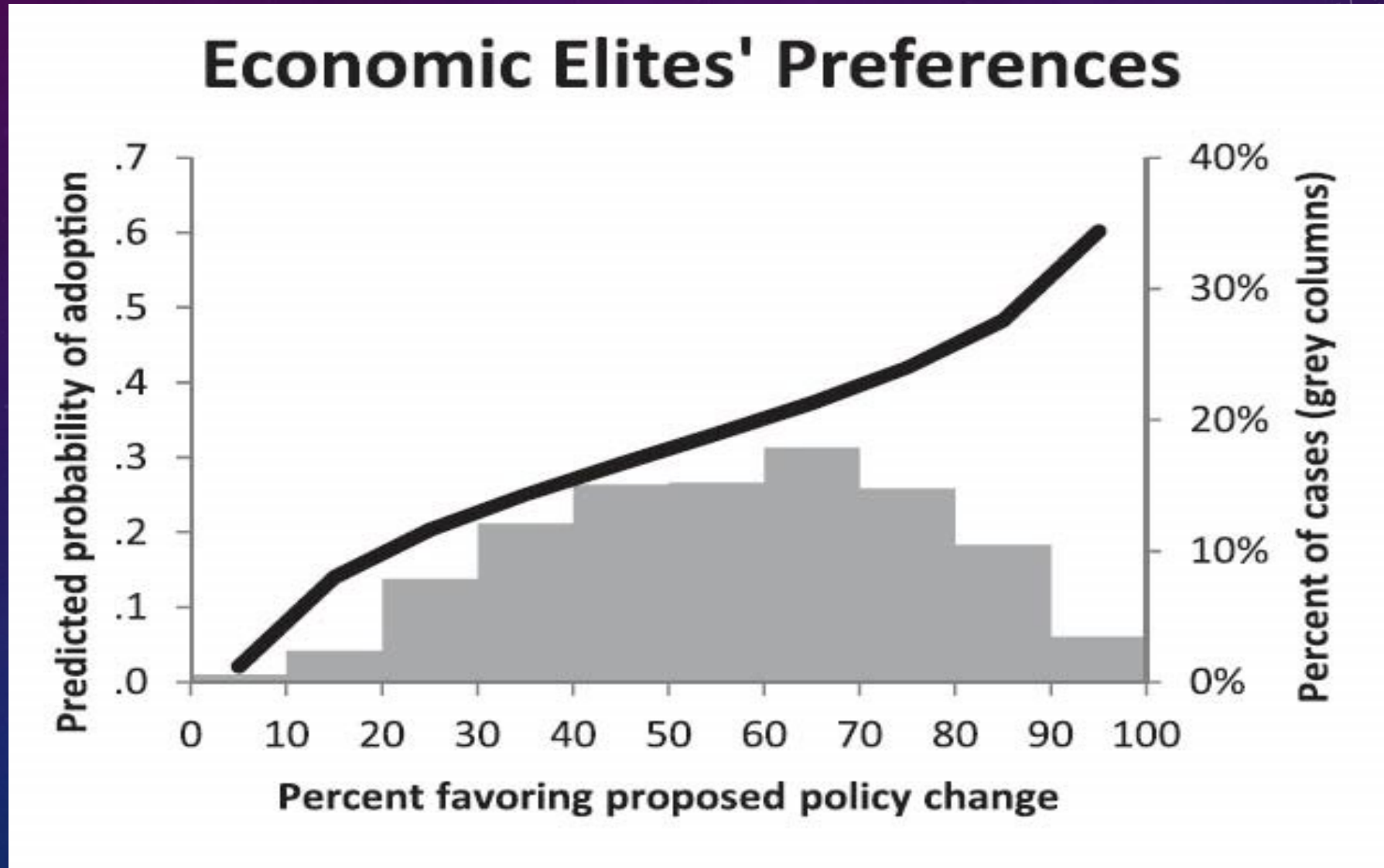
# BEYOND VOTING: HOW TO BRING ABOUT THESE POLICIES?

- The hard evidence proves it is certainly not by politely asking “please”, hat-in-hand, of our law-makers once they’re in office...
- Princeton and Northwestern University researchers ([Gilens and Page 2014](#)) studied the key variables of the 1,779 policy issues contained in all congressional legislation bills with the needed data for their study; all such bills between 1981 and 2002 (most of these years the Democrats held a majority in Congress, where bills originate), and found that the desires of the average citizen had a zero (“miniscule, statistically insignificant”) correlation with what legislation was actually enacted.
- **ZERO CORRELATION.**

REGARDLESS OF WHETHER AVERAGE CITIZENS HATED OR LOVED A POLICY PROPOSAL, THEIR INFLUENCE HAD ZERO CORRELATION (FLAT LINE) WITH WHETHER THE POLICY WAS ENACTED (GILENS AND PAGE 2014). THIS IS ARGUABLY THE MOST IMPORTANT GRAPH IN THE ENTIRE FIELD OF POLITICAL SCIENCE.



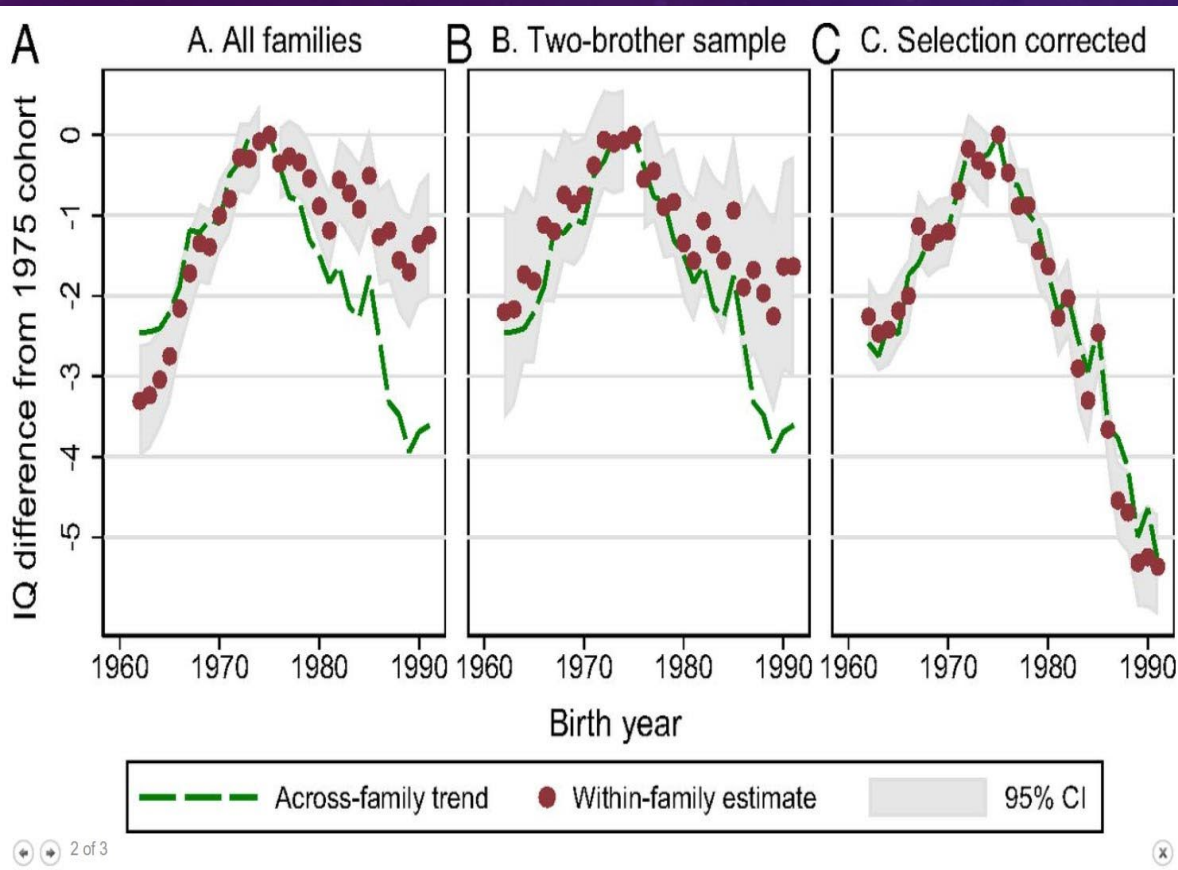
BUT THE INFLUENCE OF ECONOMIC ELITES CORRELATED ALMOST PERFECTLY (CORRELATION COEFF = 0.78) WITH WHAT WAS ENACTED. (PERFECT=1.00)



WE MAY REQUIRE OUR GENTLE, AND NOW GROWN UP, 1970'S "FLOWER CHILDREN" PROGRESSIVES TO GET A BIT MORE INSISTENT. GRETA THUNBERG'S GENERATION IS QUITE JUSTIFIABLY ANGRY THAT IT INDEED SEEMS THEY WILL HAVE TO DO IT ALL THEMSELVES.



# CAN THEY DO IT? I PRAY THEY CAN



- I'm encouraged by Hansen's "Our Children's Trust" effort, and Greta Thunberg.
- But intelligence scores for younger and younger people (born after 1975) are lower and lower ([Bratsberg et al. 2018](#)). Cause: "Environmental effects", not genetics. That leaves a wide range of hypotheses open, from declining education to greater exposure to toxins in early years, to distractability through rampant capitalist diversions, etc.

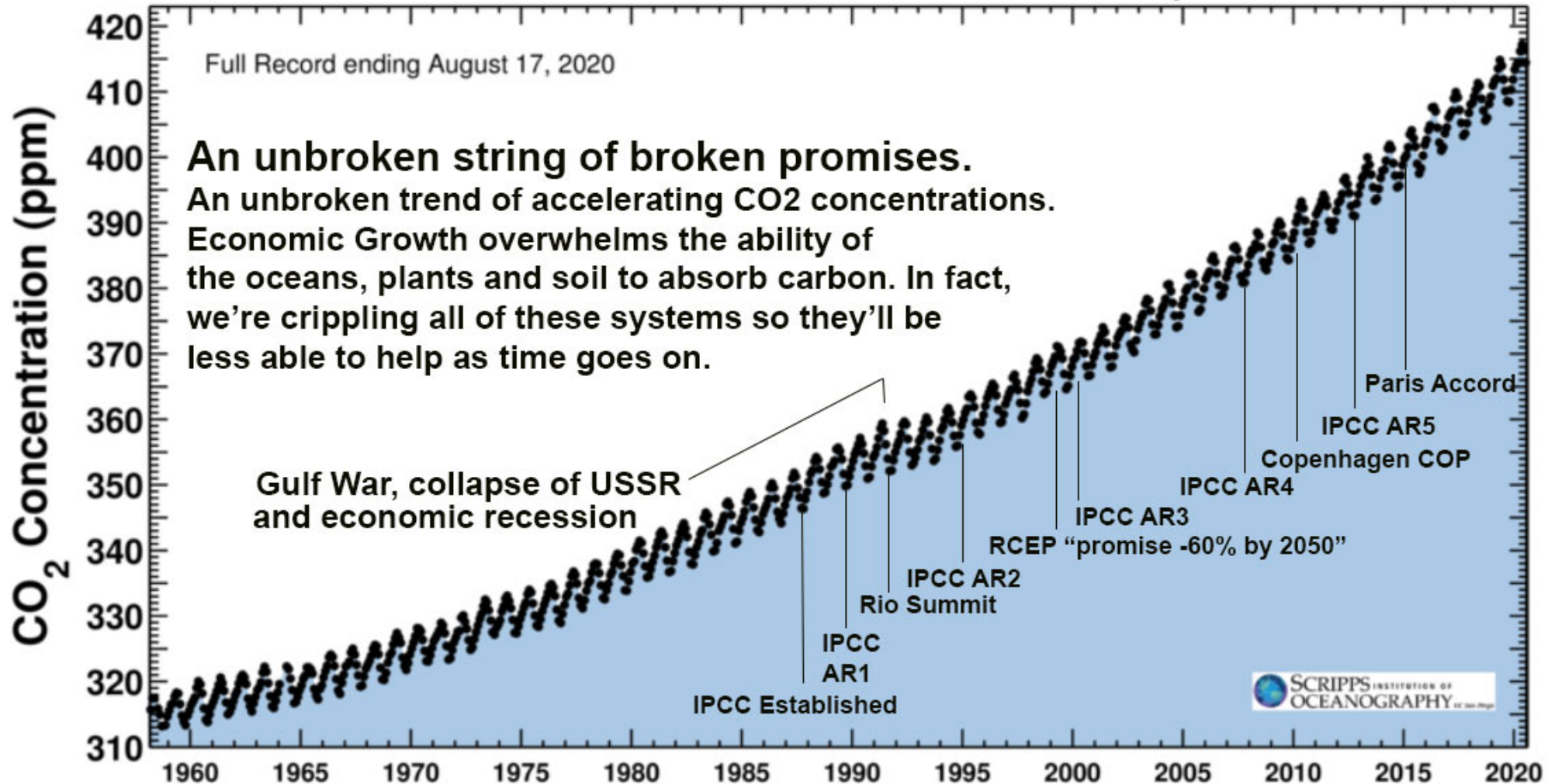
# A NEW "OCCUPY DC FOR CLIMATE" ... WHY THIS JUST MIGHT WORK...

- History shows that nearly all politicians do what is in their own personal financial and re-election interests.
- So individually they will very rarely stand up against their own Party and its fund-raising machinery. Things have to go off-scale lunatic before they'll even consider this.
- This is a key reason why individual meetings with individual congress people has gotten us nowhere.

# AN UNBROKEN STRING OF BROKEN PROMISES...

August 17, 2020

## Carbon dioxide concentration at Mauna Loa Observatory



# BUT WHEN 100,000 TO A MILLION DETERMINED CITIZENS ARE STANDING OUTSIDE THE CAPITOL...

- ...demanding (peacefully of course) that ALL of Congress enact the revolutionary legislation required – together they just might decide it actually IS in their best interest to listen and obey the average citizens this time.
- They also just might have somewhere still buried inside, a soul that is longing to do the right thing, but has been too scared.
- Let's give that soul an easier opportunity to take charge, together, with other Congress people.
- But it is also true that the U.S. today contributes only 13% of global CO2 emissions. Such determined political action must be global, and especially in Asia.

# TECHNOLOGICAL SOLUTIONS? NOT AS EASY AS YOU'VE BEEN TOLD...

- As just one example...
- Natural gas has been touted as a “bridge fuel” to replace coal.
- But the first effect of replacing all coal with natural gas power plants will be a sharp INCREASE in global temperatures, after which temperatures will still climb.
- Why? Because the aerosols from burning coal COOL the ground beneath them. And they help seed low clouds which also cool climate.
- That doesn't mean we should keep coal fired power plants, it's illustrating how we've dug a very deep hole for ourselves and we will have to dig it even deeper just to try to climb out, if that's even possible.

# AS ANOTHER EXAMPLE: THE ENVIRONMENTAL COST OF SOLAR PV

- Merely to keep our global annual CO<sub>2</sub> emission rate constant, at about 40 billion tons per year, and still keep global growth at its historical 2% per year, will require the equivalent of **11 square miles of solar panels (which is about 20 square miles of solar farm area) be constructed EVERY DAY.**
- That is taking away the habitat and the sunlight needed by all the other life we share this planet with.
- I'd instead advocate against utility-scale solar and argue for modern molten salt thorium breeder reactors, which have vastly less nuclear waste, and which only needs waste storage for a much tinier amount, and only for few centuries instead of 100,000 years, and power plants which takes up only 1% of the landscape that solar PV does. No other species can use thorium. Let other life have the sunlight and the wind and the natural ecosystems.

# TECHNOLOGICAL SOLUTIONS?: I HOPE IT DOESN'T COME TO THIS. (SEE MY [K45: STRATEGIES – TECHNOLOGY FOR BETTER](#))

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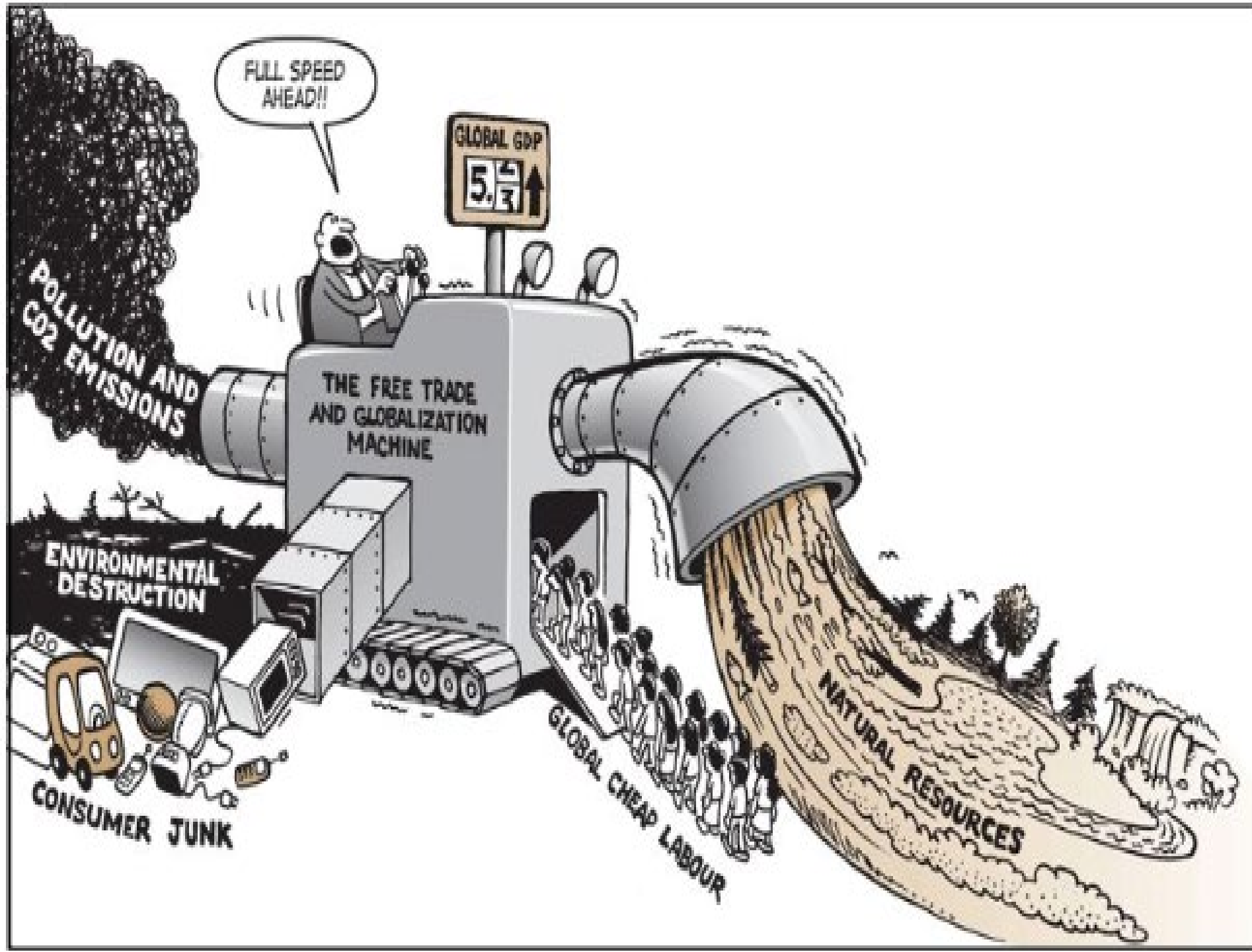
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FULL SPEED  
AHEAD?  
OR SHOULD  
WE RE-  
CONSIDER?



***“YES, THE PLANET GOT DESTROYED. BUT FOR A BEAUTIFUL MOMENT IN TIME WE CREATED A LOT OF VALUE FOR SHAREHOLDERS”***

*“Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders.”*

# NO FATE?



NO FATE!

THE FUTURE'S NOT SET  
THERE IS NO FATE  
BUT WHAT WE MAKE