THE ECONOMICS OF CLIMATE DAMAGE: A CRITIQUE OF WILLIAM NORDHAUS AND NEOCLASSICAL ECONOMICS IN LIGHT OF 21ST CENTURY CLIMATE SCIENCE

PART 3

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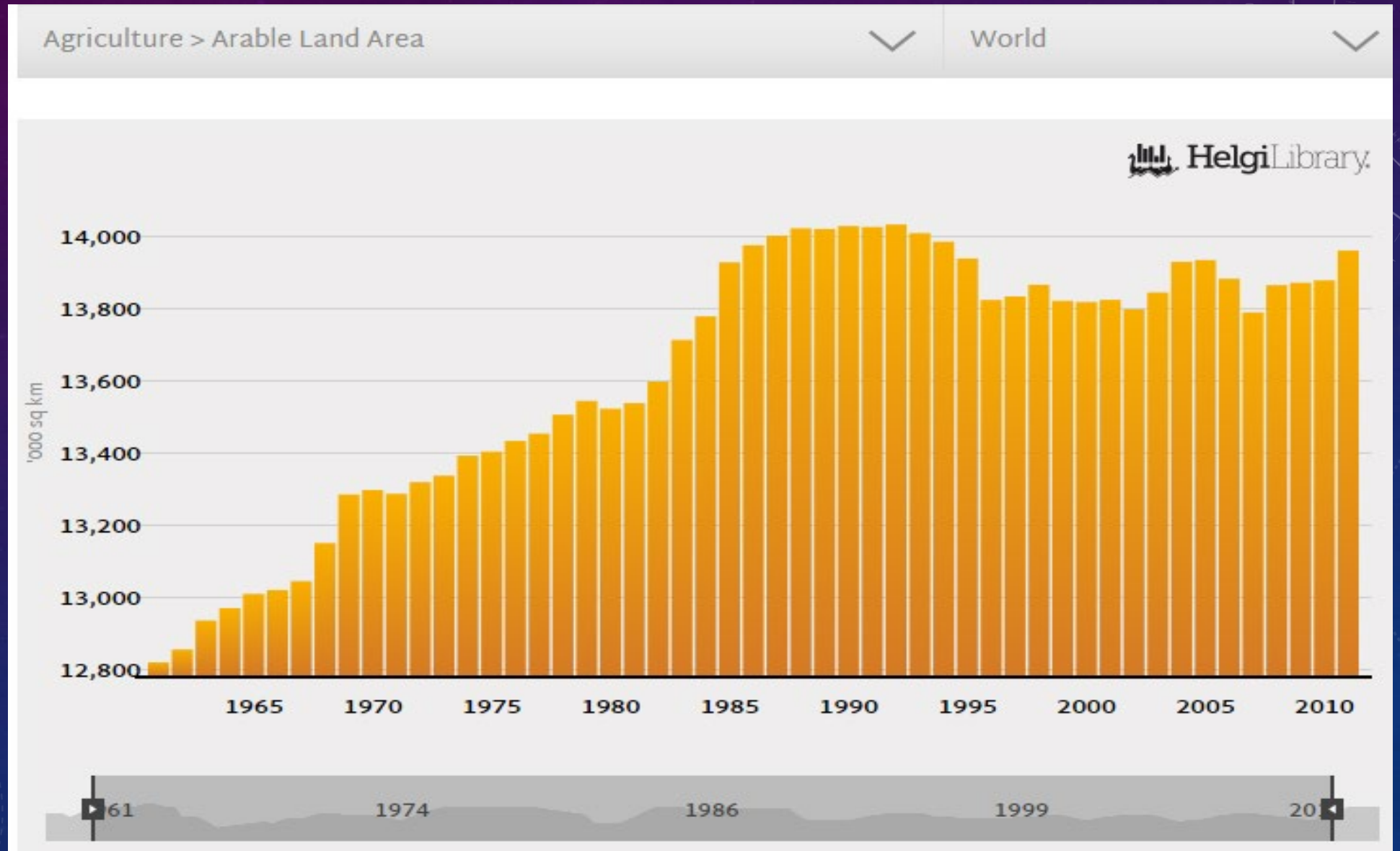
TO REMIND YOU, FROM PART 2'S FINAL SLIDE: AS TEMPERATURES RISE… CAN WE "GMO" CLIMATE-TOUGHER STAPLE CROPS?

- We've had some success engineering more drought-tolerant plants.
- **But biology is extremely temperature dependent, and despite 30 years of major efforts, there has been no success at breeding heat-tolerant staple crops (1:04:50 into this talk by atmospheric scientist Dr. David Battisti in 2016**).
- And elevated CO2, far from being "good for plants", is robbing food crops of vital nutrients (**Myers *et al*. 2014).**

TOPSOIL LOSS THREATENS THE END OF FARMING IN THE 21ST CENTURY (*e.g.* DELONG AND STILLERMAN 2020)

- Existing arable land topsoil is being washed away at a rate estimated at 1% per year, from *e.g.* large-scale disc'ing of land. Why? Saves labor, saving costs, but robs soil of organic holds. Profits now. The future is someone else's problem, is how we operate.
- Modern Ag also releases N_2O (a powerful greenhouse gas) from massive use of nitrogen fertilizers - minimize costs *vs.* labor-intensive organic methods. The "Green Revolution"? NOx emissions cost corporations nothing; they're externalized onto us. So they do it. Cost rules the decisions, as always.
- Topsoil creation from hard subsoil and rock: rate is only ~1 cm per 1,000 yrs by natural forces, (but even that assumes healthy plant cover). With commercial agriculture techniques farming might survive for only another ~60 years.

TOTAL AREA OF ARABLE LAND HAS PLATEAUED. WHILE DEPTH OF TOPSOIL CONTINUES TO THIN DUE TO EROSION. 90% OF ALL GLOBAL ARABLE LAND HAS ALREADY BEEN PUT TO HUMAN USE.



FAMINE TRIGGERED EXODUS AND WARS: THE MOST LIKELY FIRST-TO-GO, IN OUR “HOUSE OF CARDS”…
AN INCREASINGLY FRAGILE CIVILIZATION UNDER CLIMATE STRESS

Fig. 6 The warming surface waters of the Gulf of Mexico feed increasing moisture to the low-level jet that delivers water to the central United States in summer, intensifying the convective power of storms that inject water vapor deep into the stratosphere, entering the anti-cyclonic gyre that sequesters the injected mixture of water and radical precursors allowing time for the catalytic loss of ozone.

Another mechanism for climate –induced mass extinctions… A newly recognized ozone destruction feedback loop – (Anderson and Clapp 2018)…

FROM ANDERSON AND CLAPP (2018) IN QUOTES

- *"The term 'Global Warming' does not capture the imperative for what is actually occurring to the climate structure. Increases in the global mean temperature (to which global warming refers) of 1 °C in the last few decades carries little imperative. Individuals have little concern…"* But heat flow is very large. 93% of our GHG-induced heating has been deposited into the oceans. This is extremely powerful on climate.
- *"What matters, in fact, is the net flow of heat into subsystems of the climate structure. This inflow of heat leads to irreversible changes in those subsystems that in turn trigger feedbacks that contribute to the instability of the overall climate structure."*
- **Neoclassical economists' insistence that temperature is all that concerns economic activity, shows doggedly denialist naivete'.**

HOTTER CLIMATE -> STRONGER CONVECTION OF MICROBIAL BROMINE AND OCEAN CHLORINE INTO THE STRATOSPHERE (ANDERSON *et al.* (2012)) AND ANDERSON AND CLAPP (2018), THREATENING THE OZONE LAYER. ESPECIALLY OVER THE U.S.

- Now, Marshall *et al.* (2020) find strong evidence that the 2nd of the 5 great Mass Extinctions – the Devonian – was caused by UV-induced killing of land and shallow sea plants and animals through warming-induced ozone destruction.

SHARE

RESEARCH ARTICLE

Recent global decline of CO_2 fertilization effects on vegetation photosynthesis

Songhan Wang[1,2], Yongguang Zhang[1,2,3,*], Weimin Ju[1,2], Jing M. Chen[1,4], Philippe Ciais[5], Alessandro Ces...
+ See all authors and affiliations

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DOI: 10.1126/science.abb7772

Article | Figures & Data | Info & Metrics | eLetters | PDF

A decline in the carbon fertilization effect

One source of uncertainty in climate science is how the carbon fertilization effect (CFE) will contribute to mitigation of anthropogenic climate change. Wang *et al.* explored the temporal dynamics of CFE on vegetation photosynthesis at the global scale. There has been a decline over recent decades in the contribution of CFE to vegetation photosynthesis, perhaps owing to the limiting effects of plant nutrients such as nitrogen and phosphorus. This declining trend has not been adequately accounted for in carbon cycle models. CFE thus has limitations for long-term mitigation of climate change, and future warming might currently be underestimated.

Science, this issue p. 1295

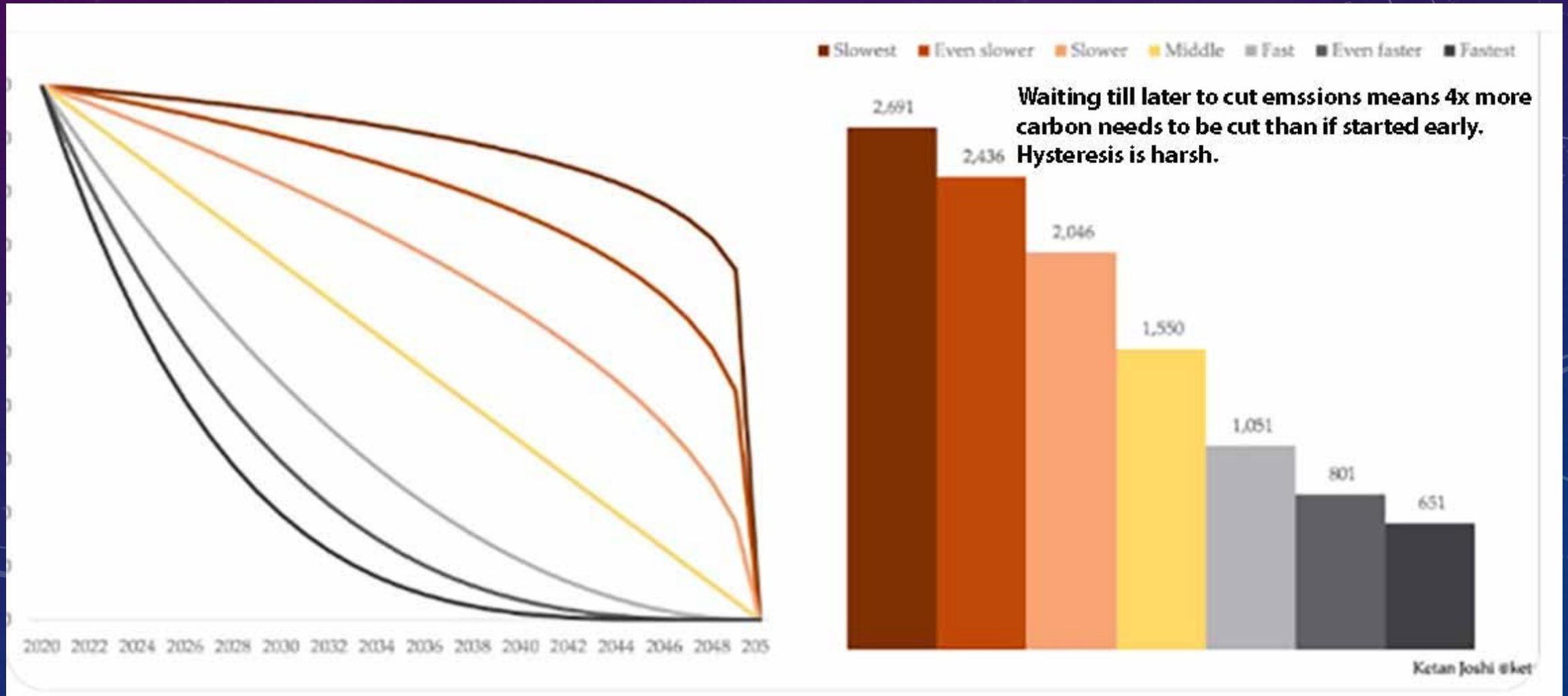
Key Result: 43% decline in Carbon Fertilization Effect since 1980

AND… CLIMATE MODELS HAD RELIED ON THE **“CARBON FERTILIZATION EFFECT” (CFE)** TO BOOST PHOTOSYNTHESIS AND MODERATE HOW MUCH CO2 WE HAVE TO CUT.

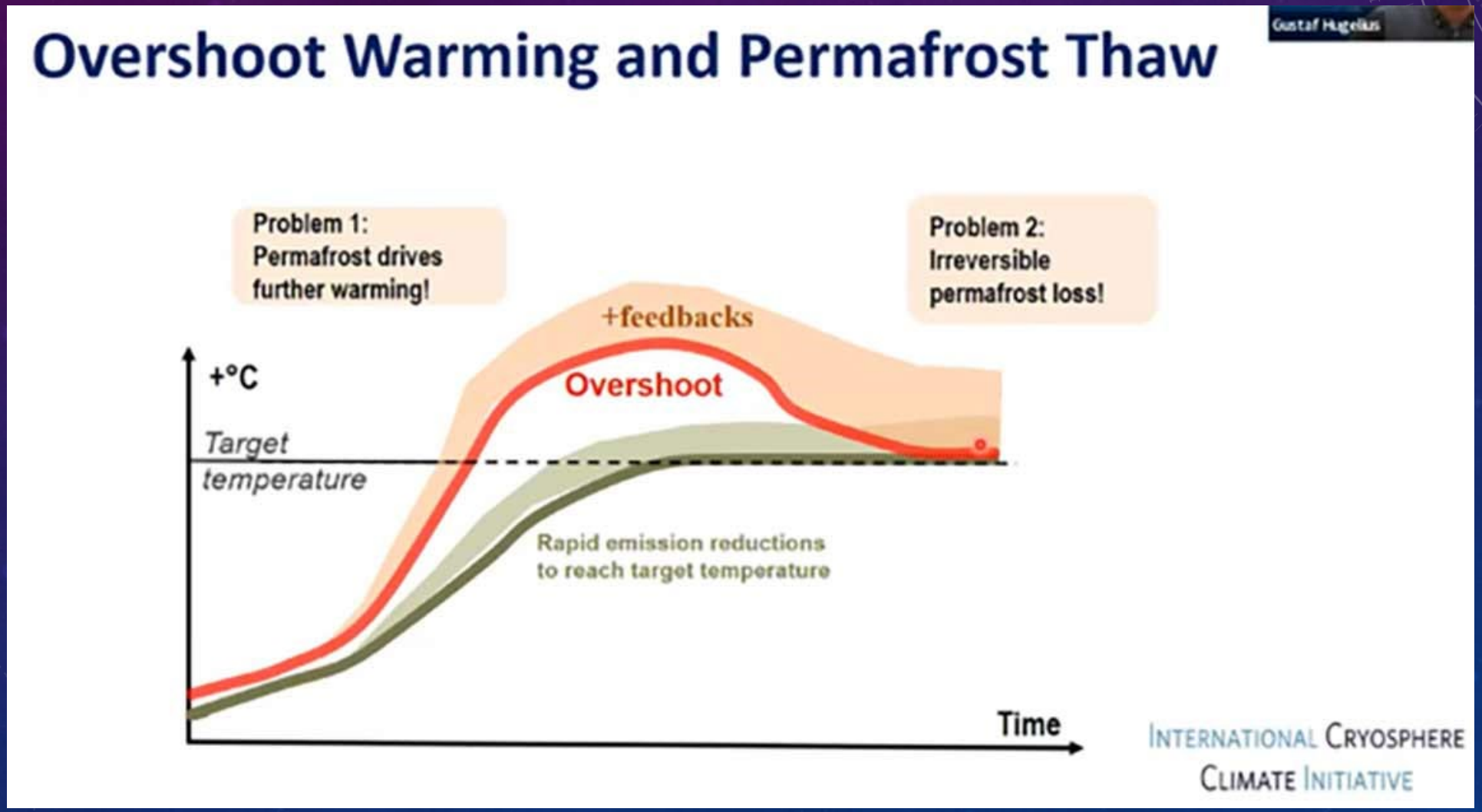
THIS OPTIMISM WAS MIS-PLACED…

43% DECLINE IN THE CFE SINCE 1980, AND IS NOT INCLUDED IN ANY IPCC MODELLING (WANG *et al.* 2020. BUT (SANG *et al.* 2021) COMMENT THAT THE DECLINE’S CAUSE CANNOT YET BE ROBUSTLY ATTRIBUTED), SO STILL WORK TO DO HERE.

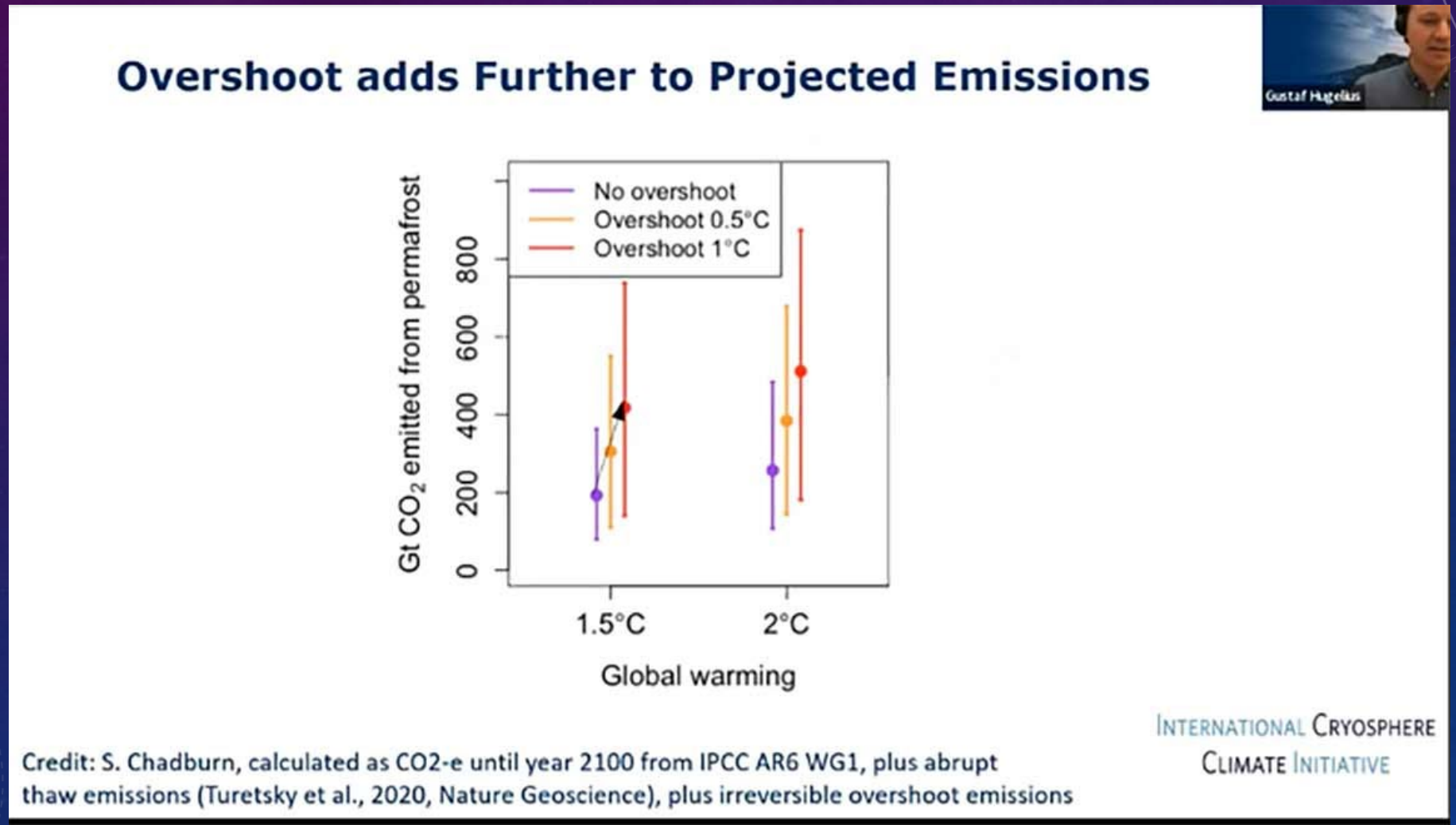
NORDHAUS' **DICE** AND FOLLOWERS: *CONTINUE WEALTH PURSUIT; ONLY IF WE REACH +4C DOES COST/BENEFIT ACTION PENCIL OUT.* BUT HYSTERESIS IS A HARSH LOAN SHARK. WAITING TILL 2050 AND THEN MAKING STEEP CARBON CUTS ALL AT ONCE, REQUIRES ~4X MORE CARBON CUT THAN DOING IT EARLY.



PERMAFROST THAW ALSO SHOWS STRONG HYSTERESIS. IT'S ANOTHER EXAMPLE EMPHASIZING HOW DANGEROUSLY WRONG IS THE ECONOMISTS' ASSUMPTION WE CAN PUT OFF CARBON REMOVAL AND INSTEAD FORCE OUR CHILDREN TO DEAL WITH IT. GRUBB *et al.* (2021) SHOW THIS IS ESPECIALLY TRUE OF NORDHAUS' "**DICE**" MODEL, WHICH FAILS TO INCLUDE NON-LINEAR DYNAMICS REALISM, AND THEREBY GROSSLY UNDERESTIMATES THE REQUIRED SIZE OF INITIAL CLIMATE ABATEMENT.



OVERSHOOT BY +1C AND FIX LATER? NO. HYSTERESIS THEN DOUBLES PERMAFROST CO2 EMISSIONS, VIA THE ABRUPT THAW OF ARCTIC PERMAFROST AND ITS IRREVERSIBILITY (TURETSKY *et al.* 2020). NOT INCLUDED BUT SHOULD BE; FASTER RISING METHANE.

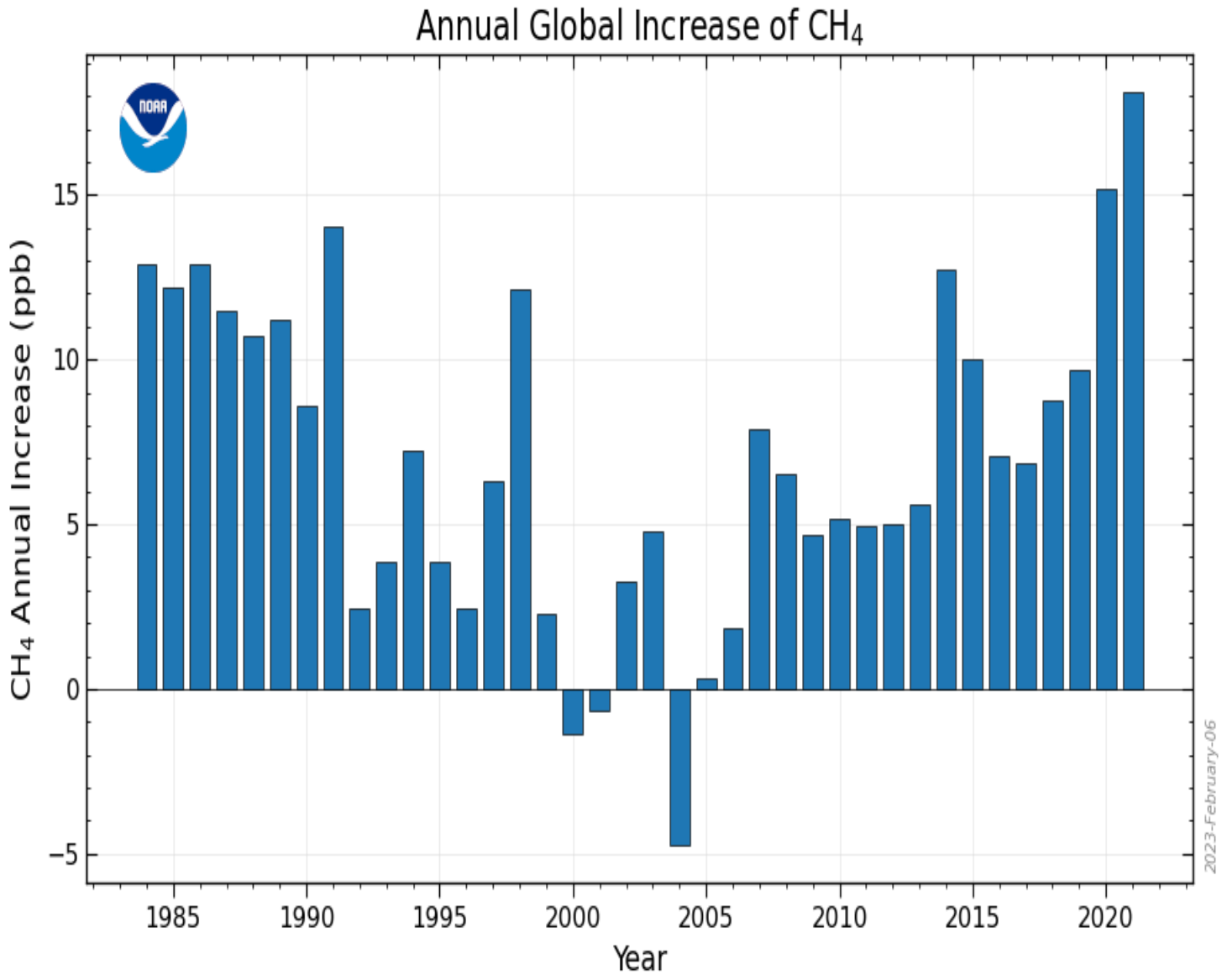


WORSE – THE IPCC AR6 ASSUMPTION OF CLIMATE SENSITIVITY TO METHANE ($0.02\,W\,m^{-2}\,°C^{-1}$) IS NOW SEEN TO BE UNDERESTIMATED BY A FACTOR OF 4

- By including the oscillations in methane emissions from *e.g.* permafrost thaw, ocean emissions, *etc.* and the loss of hydroxyl radical OH- concentrations (which is the mechanism for atmospheric methane destruction), new research (Cheng and Redfern 2022) which includes hysteresis finds…
- *"Incorporating the interannually increasing C_{CH4} via negative feedbacks gives historical methane-climate feedback sensitivity ≈ 0.08 W m^{-2} °C^{-1}, much higher than the IPCC AR6 estimate."*
- *"To summarize, due to nonlinearly lagged responses from positive methane-climate feedback via oscillating positive-negative feedbacks, the mean value of net methane-climate feedback sensitivity reported in the IPCC AR6 is likely underestimated."*

YET WORSE: SPIKING METHANE DISCOVERED DUE TO REDUCING FOSSIL FUEL BURNING

- Spiking atmospheric methane in ‘20’s pandemic recession, and continuing to ‘21’s new record, despite slight reduction in fossil fuel (FF) direct methane emissions. Why?...
- Wetlands CH4 increases and recession-induced drop in fossil fuel burning (Allen 2022) are equally the culprits Peng *et al*. 2021.
- NOx accounts for 85% of methane destruction, but NOx is primarily produced by FF burning, and also modern agriculture.
- Peng *et al*. find a **mere 20% reduction in NOx increases the rate of atmospheric methane production - *by 100%***. This presents a highly dangerous “Catch 22”.

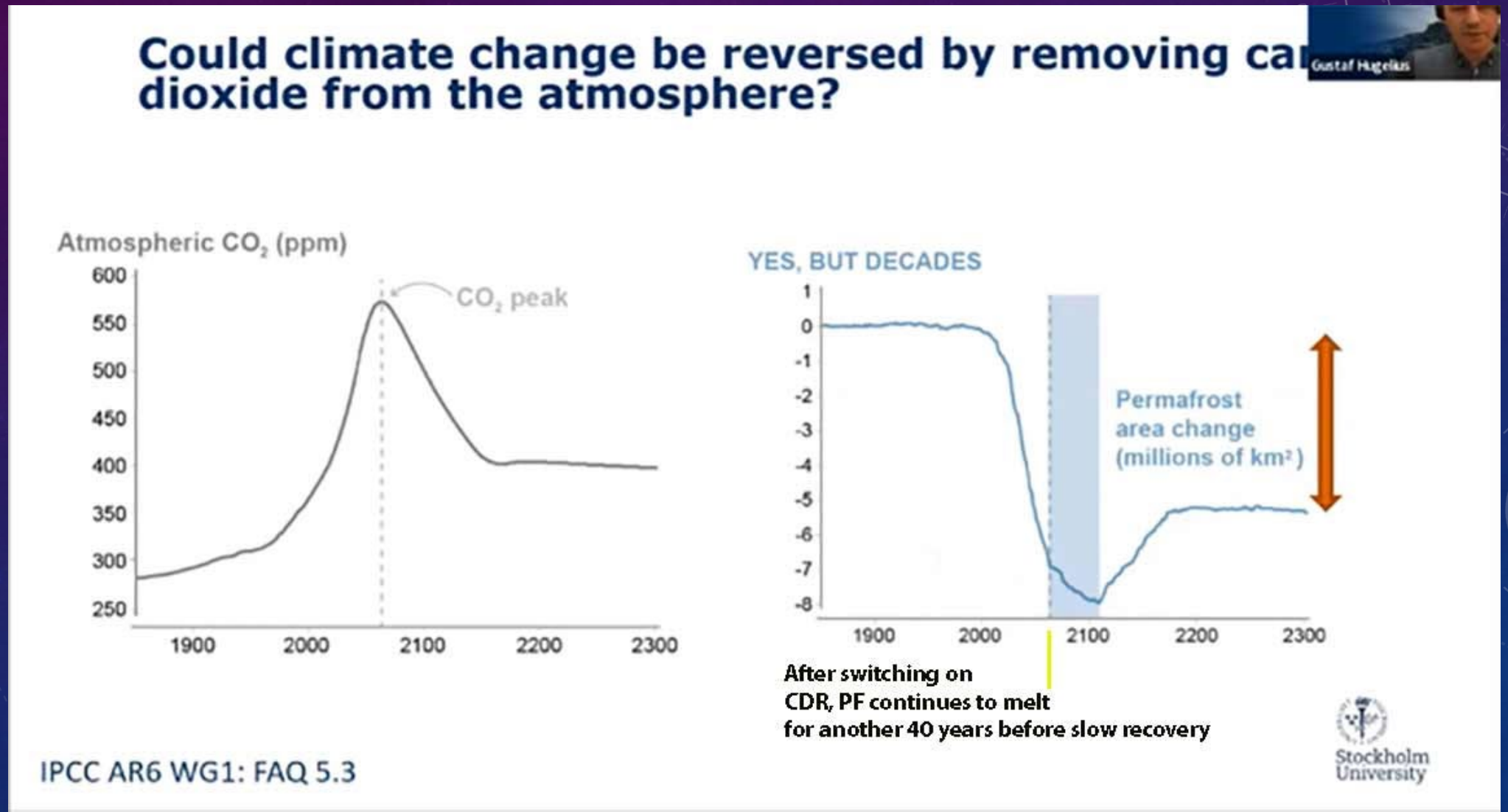


ANNUAL RATE OF CHANGE OF ATMOSPHERIC METHANE CONCENTRATIONS:

RISING RAPIDLY EVEN DURING THE PANDEMIC. ARGUES INDUSTRIAL EMISSIONS NOT THE CULPRIT.

ATMOSPHERIC METHANE RISING 1.05%/YR *vs.* CO2 RISING ONLY 0.60 %/YR: THIS, DESPITE OXIDATIVE DESTRUCTION.

CLIMATE IS MASSIVE, SO RESPONSE IS SLOW: EVEN AFTER STRONG CO2 REMOVAL (CDR), PERMAFROST (PF) THAW REVERSAL TAKES MANY DECADES TO BEGIN, AND THEN MAKES ONLY A PARTIAL RECOVERY.



NOTE THE CONTRADICTION – NOT MENTIONED HERE BUT DEAD CERTAIN IN THE LOGIC…

- The idea of a “Carbon budget” which was introduced in prior IPCC AR’s, rests on the notion that it doesn’t matter WHEN you add or remove the carbon only that it is added or removed (so kick the can; our kids’ll deal with it).
- The existence of hysteresis, as admitted here in the IPCC AR6’s section within the segment most directly written by the scientists, makes a mockery of any “Carbon Budget”.
- **Carbon Debts have a loan-shark level of “interest” attached to them:**
- There IS no “Carbon Budget” for safety. Please explain this to your can-kicking neighbors and other faculty!

EXTINCTION RATES ARE ACCELERATING SINCE FOSSIL FUEL AND CAPITALISM ARRIVED

- Current extinction rate is ~1000 times higher than the normal background (Pimm *et al.* 2014 behind paywall, but described here).
- Habitat destruction; *e.g. u*tility scale solar farms on virgin land, in coastal marine ecologies, increasing off-shore wind farms, and pollution especially by hormone-mimic plastics…
- The plastics industry successfully lobbied to prevent necessity to safety test any plastics not intended to be in contact with food.

IT MAY WELL BE WORSE… THE "COMPOST BOMB INSTABILITY"

- This is an instability discovered by Jenkinson (1991) and explored by **Luke and Cox 2011** (behind paywall), **Wieczorek *et al.* (2010)** and **Clark *et al.* 2020**.
- This instability is triggered when Arctic peat is heated from above at a rate that exceeds the ability of thawing peat's microbe digestion exothermic heat can conduct upward.
- Since this microbe activity is sensitively stronger at higher temperature, it sets off the "Compost Bomb".
- **The instability is triggered if Arctic surface temperatures rise at a rate faster than 0.088C per year.**

FROM THE LUKE AND COX (2011) ABSTRACT…

- *"…we have shown here that there is a general class of dynamical systems, including the climate-carbon cycle model (1.1)–(1.3), which define a dangerous **rate** rather than a dangerous **level** per se. We suspect that such rate-dependent tipping points are much more common in the climate system than is typically assumed, and suggest that deriving the associated critical rates of global warming, as we have done here for the 'compost-bomb instability', would provide valuable guidance for climate change policy."*

PROCEEDINGS OF THE ROYAL SOCIETY A

Proc. R. Soc. A (2011) **467**, 1243–1269
doi:10.1098/rspa.2010.0485
Published online 24 November 2010

Excitability in ramped systems: the compost-bomb instability

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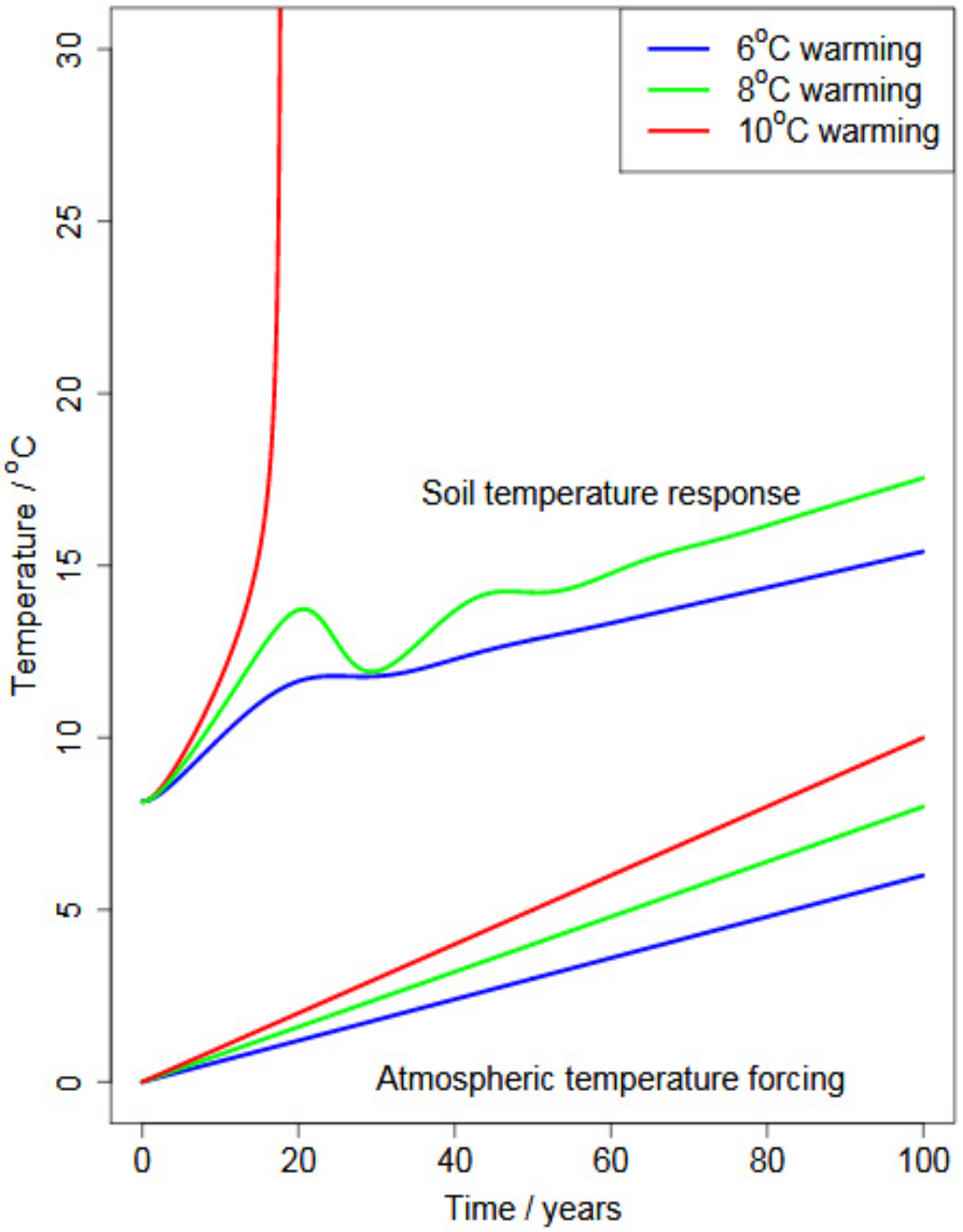
The paper studies a novel excitability type where a large excitable response appears when a system's parameter is varied gradually, or ramped, above some critical rate. This occurs even though there is a (unique) stable quiescent state for any fixed setting of the ramped parameter. We give a necessary and a sufficient condition for the existence of a critical ramping rate in a general class of slow–fast systems with folded slow (critical) manifold. Additionally, we derive an analytical condition for the critical rate by relating the excitability threshold to a canard trajectory through a folded saddle singularity. The general framework is used to explain a potential climate tipping point termed the 'compost-bomb instability'—an explosive release of soil carbon from peatlands into the atmosphere occurs above some critical rate of global warming even though there is a unique asymptotically stable soil carbon equilibrium for any fixed atmospheric temperature.

Keywords: excitability; singular perturbation theory; climate tipping points; soil carbon; folded saddle; non-autonomous systems

WARMING CONDITIONS CAUSE SOIL MICROBES TO ACCELERATE EXOTHERMIC CARBON DIGESTION, WITH ACCOMPANYING ESCAPE TO THE ATMOSPHERE

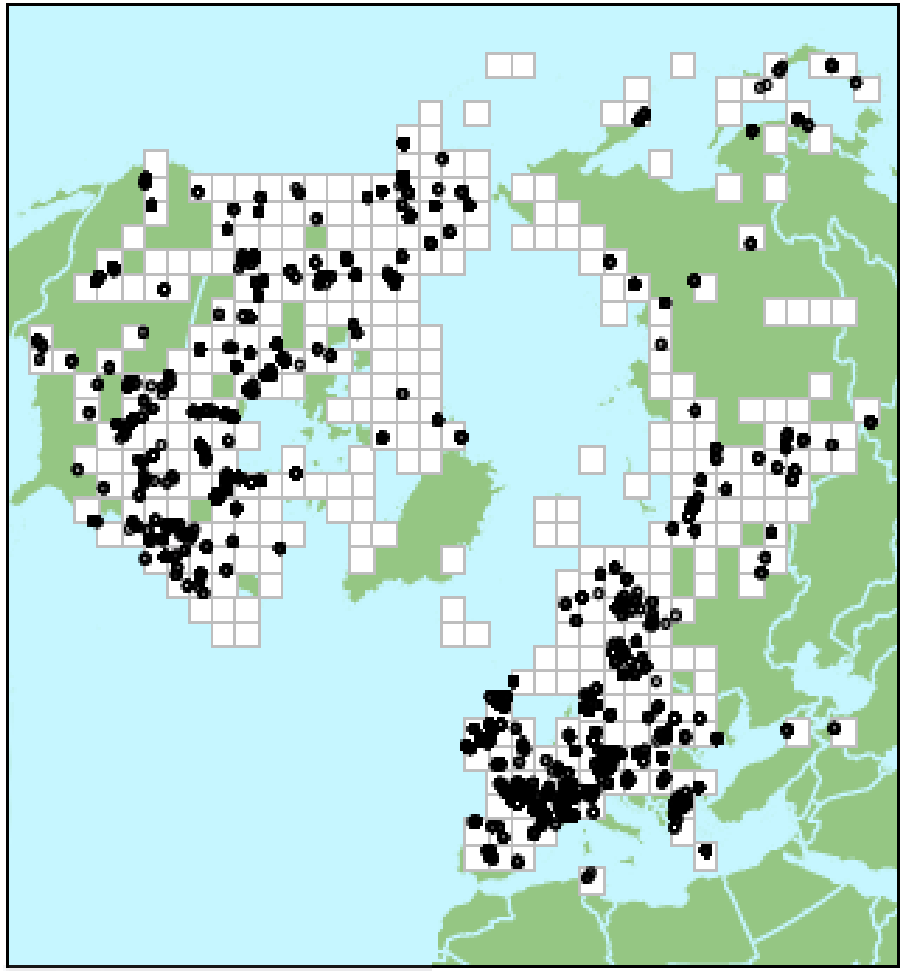
- If this heat does not escape fast enough, then run-away combustion and CO2 release happens catastrophically.
- **Luke and Cox (2011)** find that for the vast peat areas of the Earth, including in the Arctic, **the critical warming rate is 0.088C per year.**
- Warming rates faster than this trigger the **"Compost Bomb Instability"**, with extraordinarily bad consequences.



When the surface atmospheric temperature rise rate exceeds 0.088C per year, then within 15 years, soil carbon in buried peat ignites, setting off the "Compost Bomb" and "explosive" carbon release to the atmosphere.

New more detailed work confirms here: Clark *et al.* (2020).

SO, HOW MUCH PEAT CARBON IS THERE?

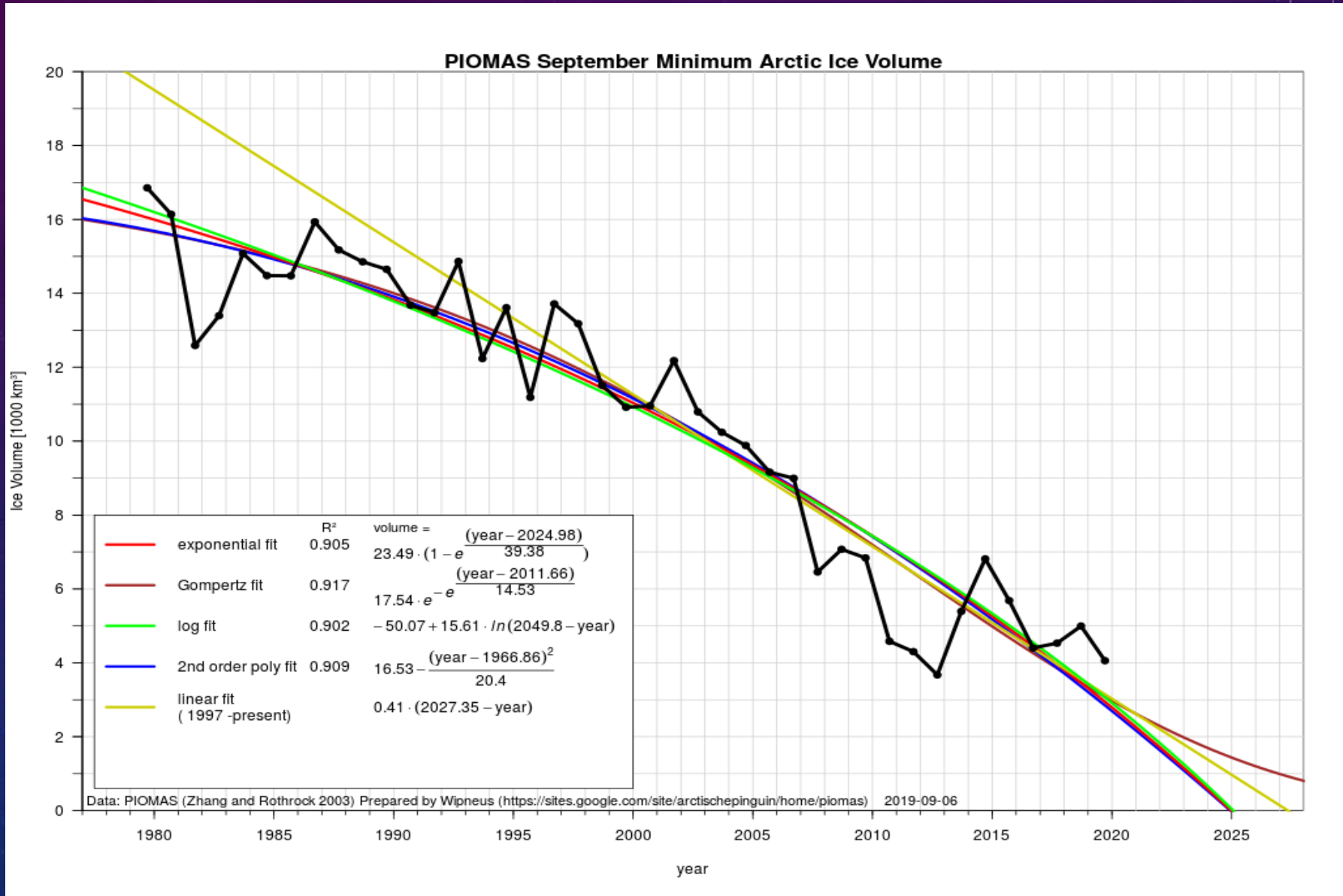


New in 2019 – twice as much as we had assumed.

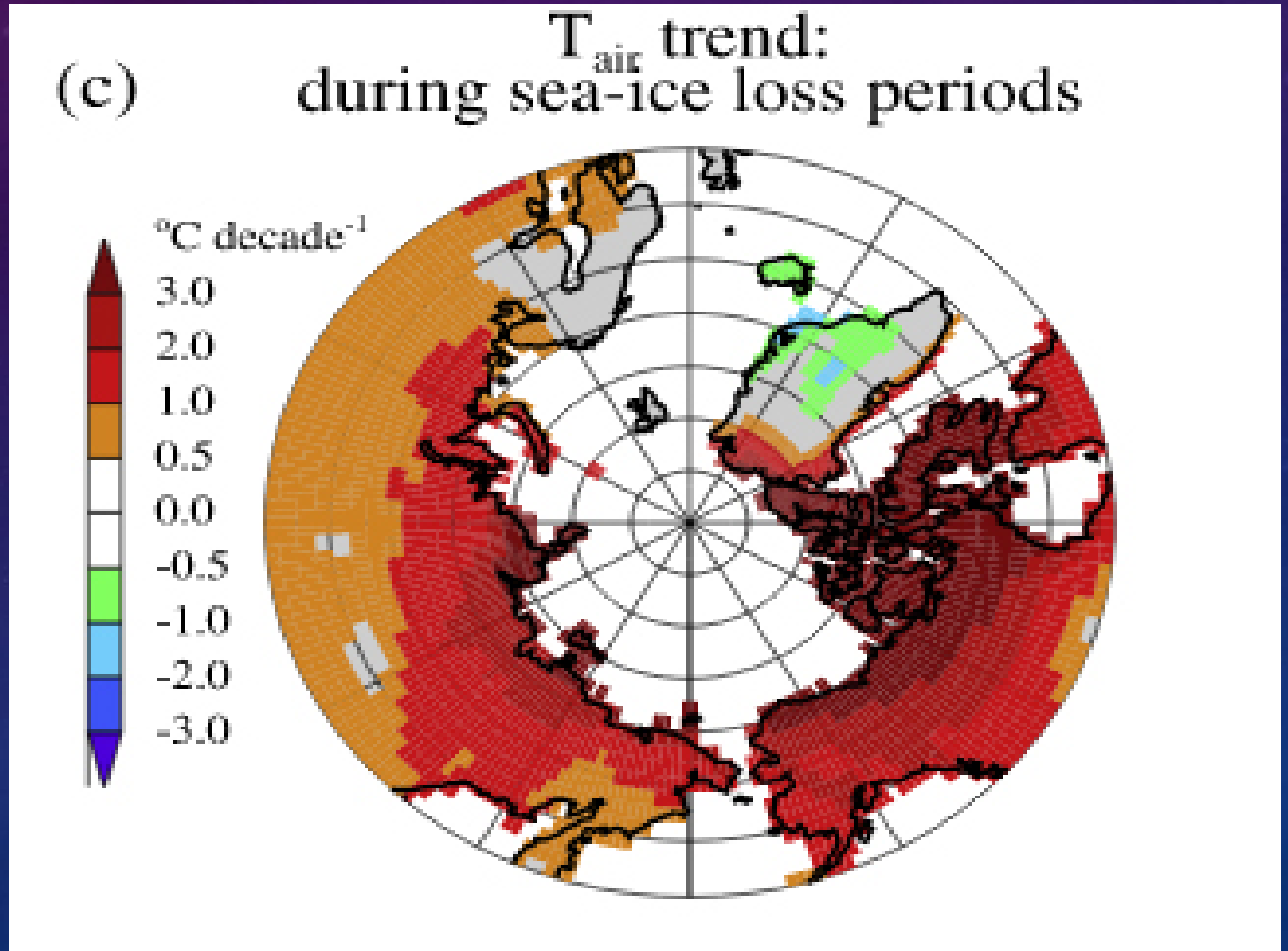
Northern peatlands alone: over 1 trillion tonnes, 2 times the total of all carbon humans have directly dumped into the atmosphere (**Nichols and Peteet 2019**, discussed **here**).

How is this triggered?...

TRIGGERED BY THE LOSS OF THE ARCTIC OCEAN ICE CAP. WE ARE ON TREND TO LOSE ALL SUMMER ICE BY 2030.



WITH LOSS OF ALL SEA ICE, TEMPERATURES IN THE PERMAFROST RISE FROM +1C TO +3C PER DECADE, AND HIGHER (LAWRENCE *et al.* 2008). +1C/DECADE EXCEEDS THE "COMPOST BOMB INSTABILITY" LIMIT OF .88C/DECADE. THE PERMAFROST BEGINS SERIOUS THAW ABOVE +1.5C (VAKS *et al.* 2013 AND HIS LATER QUALIFICATIONS). EXISTING CLIMATE FORCING "IN THE PIPELINE" WILL TAKE US WELL BEYOND +1.5C, SHORT OF MASSIVE IMMEDIATE SUN-SHADE GEO-ENGINEERING.



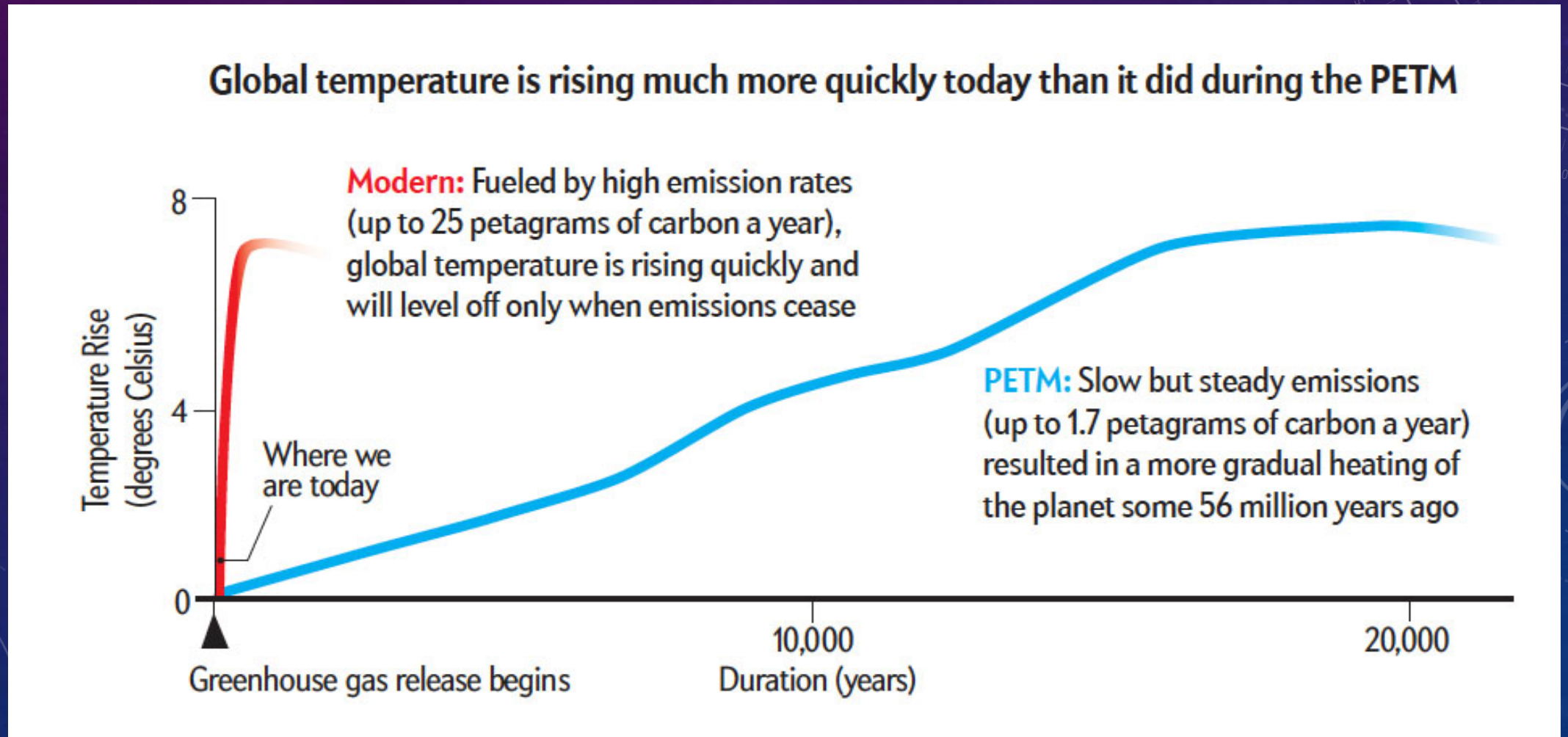
DON'T PANIC (YET)! … A HOPEFUL CAVEAT…

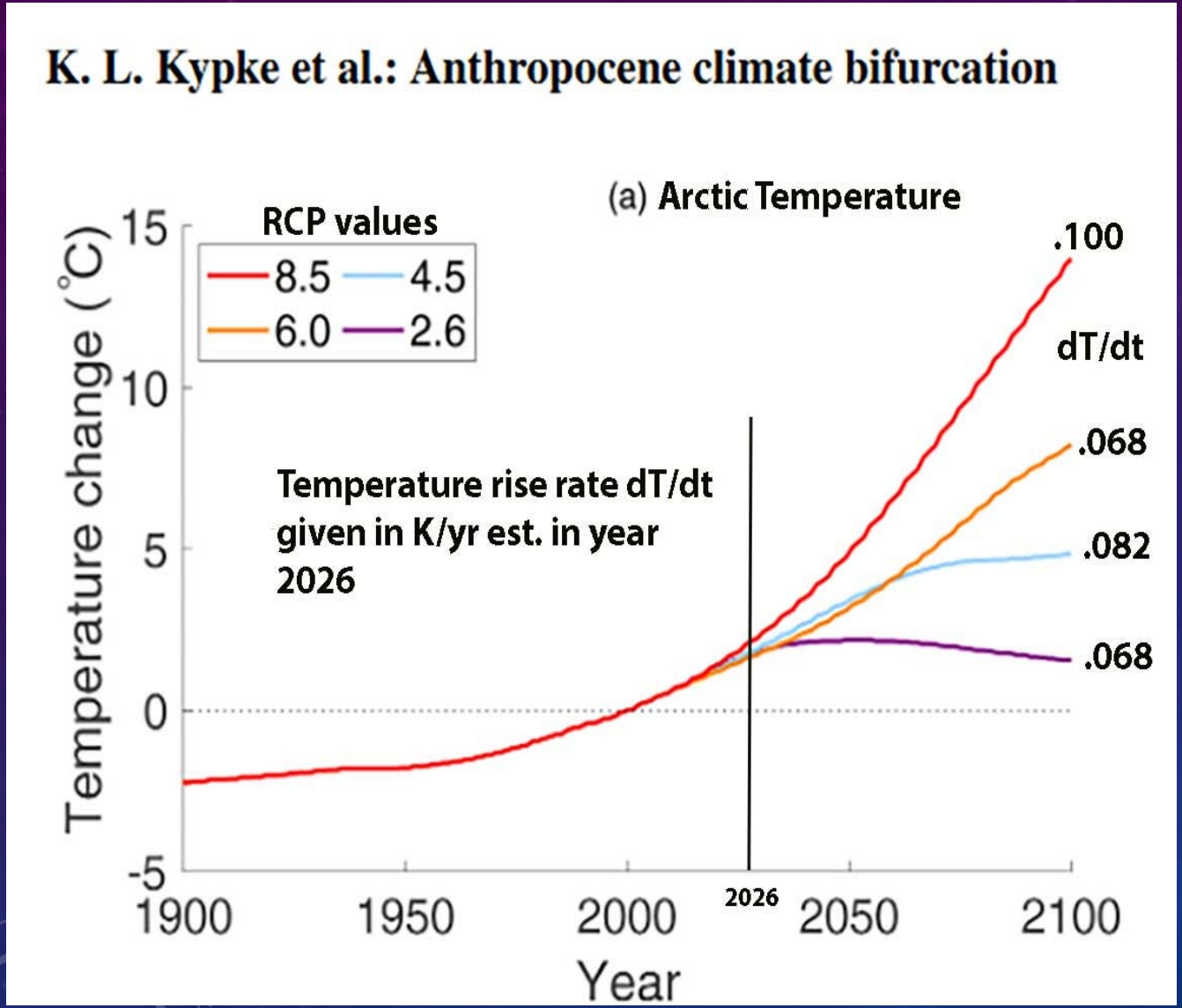
- This work used a 1-dimensional model of the permafrost. Meaning, they assume uniform thermal properties across area (x and y), and only depth (z) variations are modeled.
- But the real world permafrost has logs, taliks, stream sides, rocks, and other non-uniformities. These may provide alternate and easier paths for some heat to escape at an alternate rate.
- This means that the conclusions above might only apply to large uniform peat bogs and not to all peat areas.

NEW STUDIES SHOW ANTARCTICA IS ALSO THAWING MUCH FASTER THAN IPCC MODELS PREDICTED

- *“Most scientists had once thought this ice sheet was largely invulnerable to climate change, but not any more.”*
- *https://theconversation.com/the-worlds-biggest-ice-sheet-is-more-vulnerable-to-global-warming-than-scientists-previously-thought-187500*
- *“We found Antarctica’s ice shelves have lost twice as much mass as previous studies suggested. ”*
- *https://theconversation.com/ice-shelves-hold-back…*

SUCH ARCTIC RISE RATES ARE POSSIBLE, ESPECIALLY GIVEN THE CROWTHER *et al.* 2016 STUDIES SHOWING SOIL CARBON LOSS AS HIGH AS 17% THAT OF HUMAN EMISSIONS. THE RATE AT WHICH WE ARE FORCING CLIMATE IS UNPRECEDENTED IN EARTH HISTORY : 40-100X FASTER THAN EVEN THE PALEOCENE-EOCENE THERMAL MAXIMUM OF 56 MILLION YEARS AGO (CUI *et al.* 2011), FOR WHICH THIS INSTABILITY IS A SUSPECTED CAUSE.

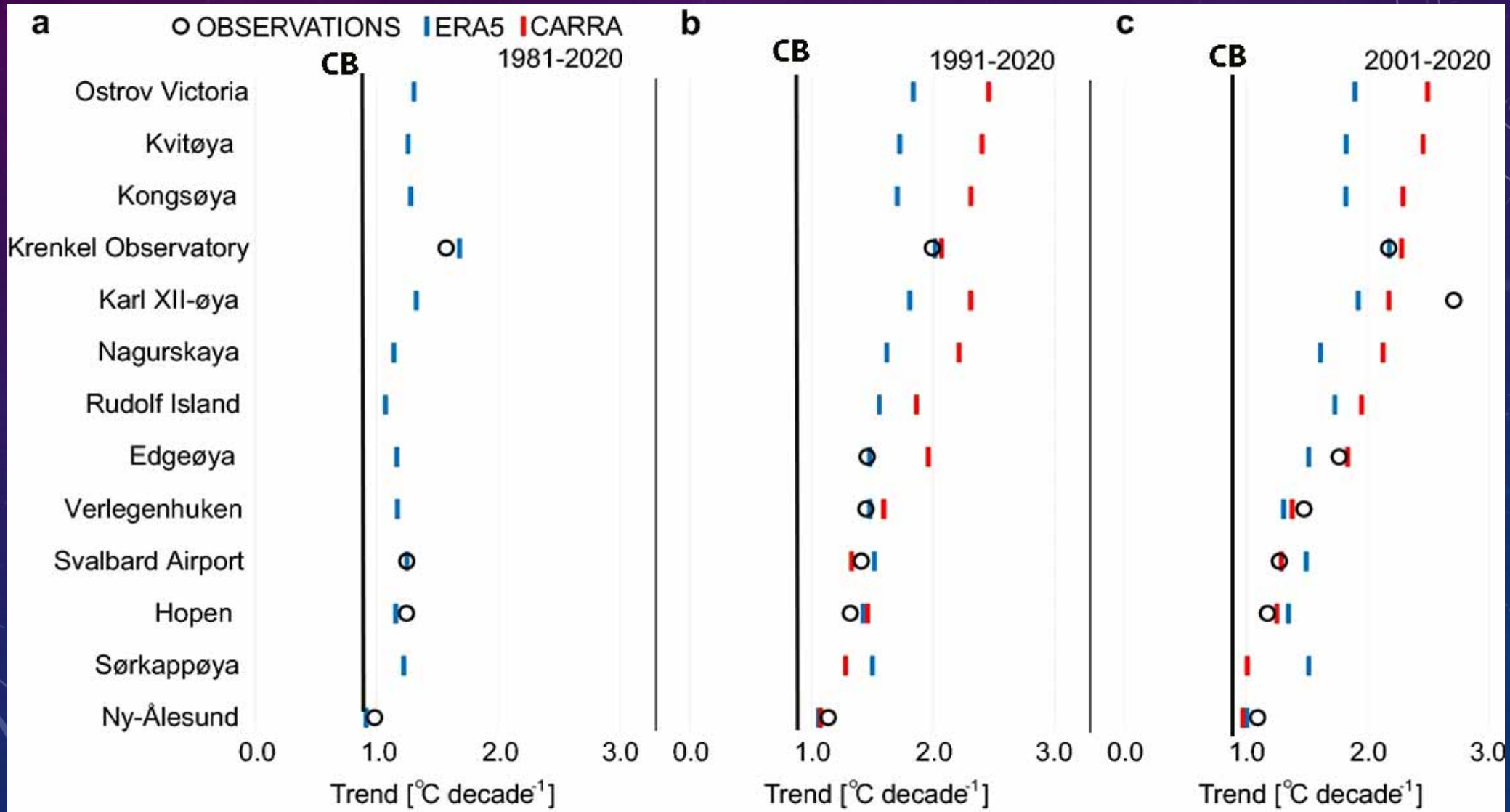




Our current Arctic temperature trend is at ,or above, the **"Compost Bomb Instability"** trigger (reference rates on right side of graph are for year 2026, my choice). Kypke *et al.* 2020 use an energy balance equilibrium climate model, calibrated against current and paleo data, to project beyond.

And, a new research report says a 3-5C temperature rise in the Arctic is "locked in" by 2050. Implies >0.1C/year rise rate as well. (Now look at the **UN policy people's** political pushback on the scientists.)

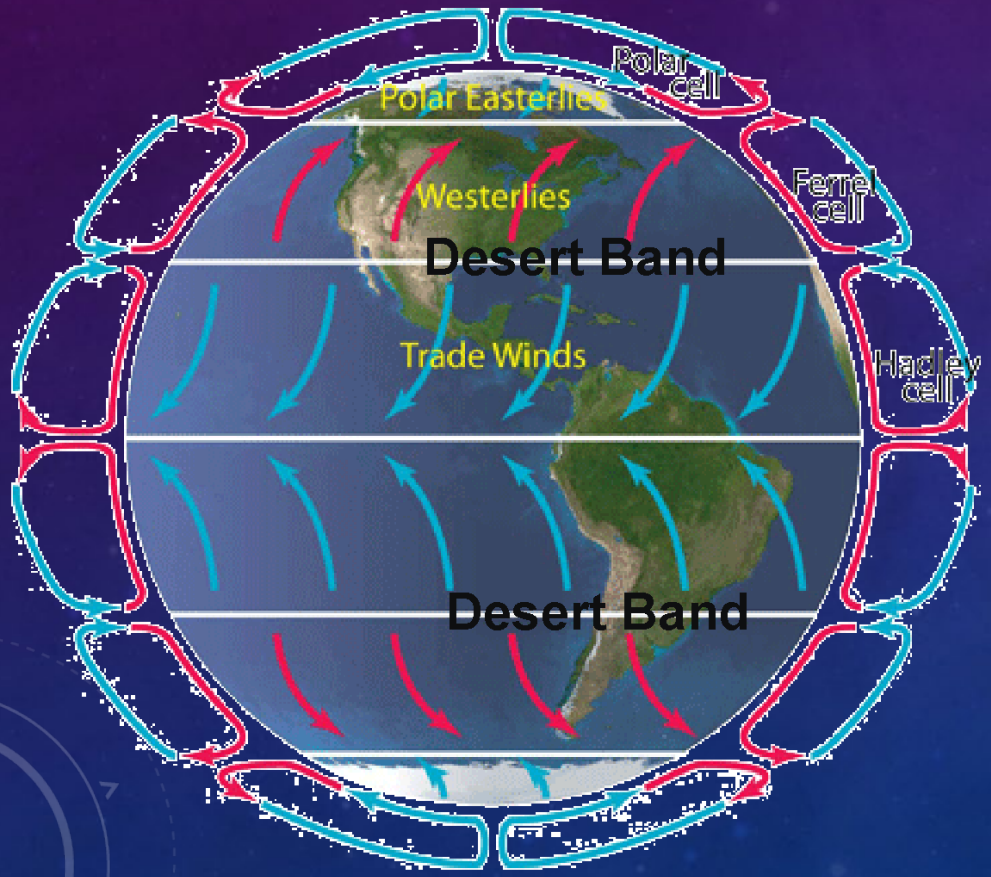
CURRENT OBSERVATIONS: (ISAKSEN *et al.* 2022) TEMPERATURE RISE RATE IN NORTHERN SCANDINAVIA LOCATIONS. ALL EXCEED THE COMPOST BOMB INSTABILITY LIMIT OF 0.88C/DECADE (VERTICAL BLACK LINES "CB")

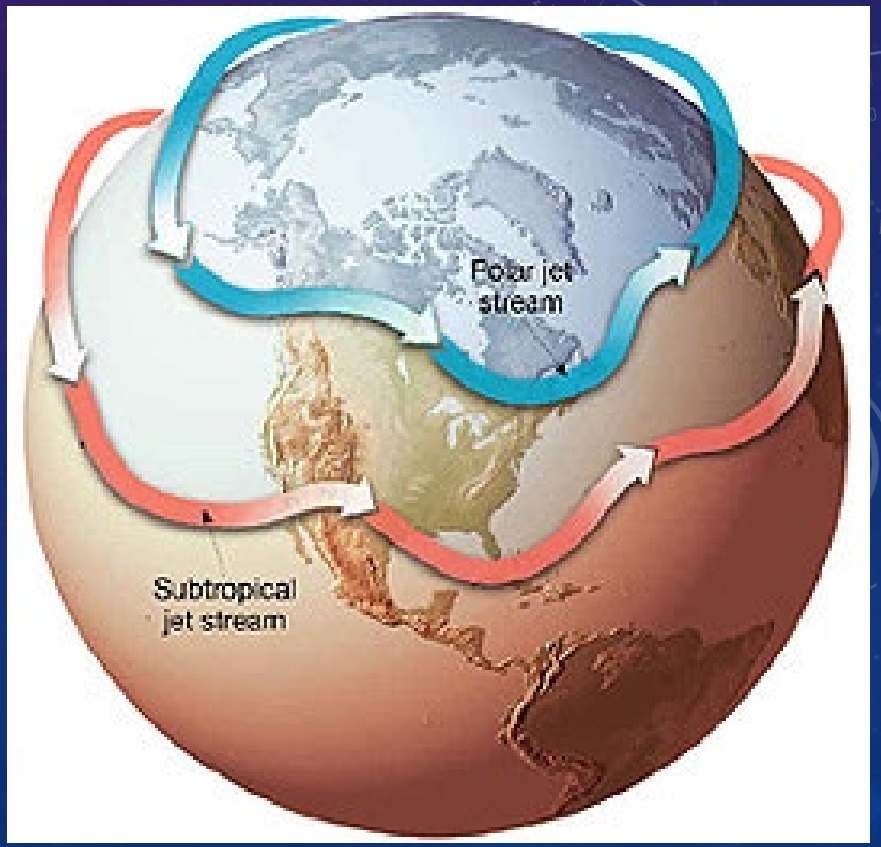


BEYOND THE COMPOST BOMB INSTABILITY, KYPKE *et al.* 2020'S WORK SHOWS A NEW CLIMATE TIPPING POINT WHICH COULD BE THE MOST CATASTROPHIC YET

- The implications are serious, I believe this Kypke *et al.* work needs careful follow up. While the model used is a simple "Energy Balance Model (EBM)", it is carefully tuned with parameters from current and paleo data, and remember….
- There were crocodiles in 74F ocean water at the Arctic Ocean in the Eocene, at CO2 levels not much higher than today, and continental positions and ocean currents very similar to today's.
- A hot jungle climate in the Arctic - How can that be? So please don't be so quick to dismiss the results just because an EBM model is less sophisticated than a full 3D coupled ocean/atmosphere model.

IF WE CONTINUE ON THE RCP=8.5 EMISSIONS PATH (COMBINED DIRECT HUMAN FF BURNING TOGETHER WITH OUR INDIRECT-INDUCED EMISSIONS)… KYPKE *et al* FIND OUR ATMOSPHERE'S 3-CELL STRUCTURE (BELOW) COULD TIP TO A 1-CELL STRUCTURE. THIS PRODUCES **AN ENTIRELY DIFFERENT PLANET. MUCH MORE UNIFORM CLIMATE EVERYWHERE, NO JET STREAMS, AND INTOLERABLY HOT.**





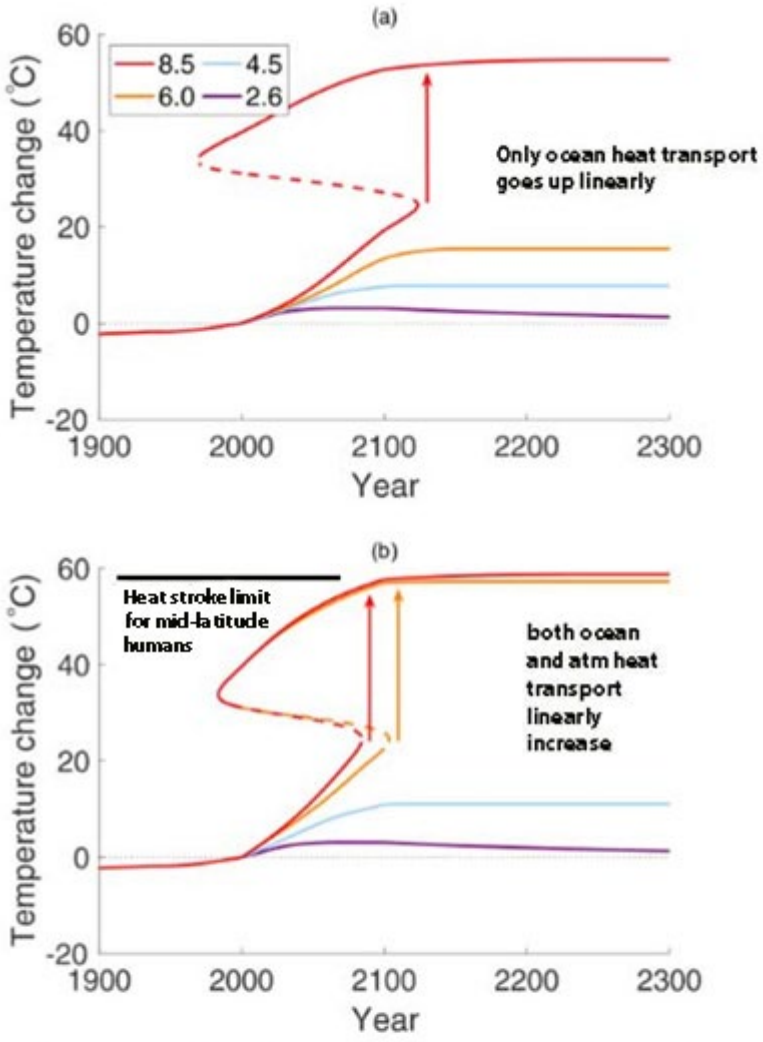


Figure 7. Arctic surface temperature change projected to year 2300 (relative to year 2000 temperature of −28.90 °C), with linearly increasing ocean heat transport F_O, interpolating the data in Koenigk and Brodeau (2014); see Table 2. **(a)** With constant $F_A = 104$, the jump in temperature for RCP 8.5 now occurs nearly 40 years earlier than for the case of constant F_O shown in Fig. 6. **(b)** The same as **(a)** except that in addition to increasing F_O the atmosphere heat transport F_A also increases, as in Yang et al. (2016), linearly from 104 to 129 W m^{-2}. Now upward transitions occur on *both* RCP 8.5 and 6.0, as indicated by the arrows.

Fig 7 from Kypke *et al*. 2020. I've inserted (black) the T_{WB} limit at which young healthy mid-latitude adults succumb to heat stroke (Vecellio *et al.* 2010): Graph is Arctic (not global) temperature relative to current avg T= -29C. Average annual T=+29C means that there will be frequent extended periods of T_{WB} > 30C, exceeding the Vecellio *et al*. limits for human survivability for mid-latitude subjects. Thus, if, as used in their lower graph, ocean and atmosphere heat transport rates rise along with CO2 (see their supporting ref's), then both RCP=8.5 and even RCP=6.0 IPCC emissions paths lead to **an Arctic that could be too hot for humans to survive, and hotter elsewhere. But, see caveats on next slides…**

On our current path of RCP 8.5 this occurs as soon as 2080-2100. **How?** Did their EBM model imply an impossibly high ECS? **No**… Kypke *et al.*'s models were tuned with paleo data; they find **their model's behavior corresponds to an ECS=4.38C**, which is well motivated within our likely proper ECS for the future, as we showed earlier in Part 1 and Part 2 of these talks.

OTHER RESEARCH: SIMPLER MODELS TEND TO SHOW "BIFURCATIONS" MORE CLEANLY AND OFTEN THAN COMPLEX MODELS, WHERE ENERGY IN/OUT OF LOCAL AREAS WITH INERTIA OCCURS.

- Yet, I worry that this EBM model only takes us to the logical destination more efficiently than the real world will… but the destination is the same.
- Here's the referee report and response from Kypke *et al.* 2020
- See Bathiany *et al.*, 2016
- Also, see the introduction in Eisenman (2012).

KYPKE *et al.* CLEARED REFEREE AND EDITOR SCRUTINY, AND SHOULD BE ON THE TABLE FOR OUR FUTURE.

- Here's the referee report and response from Kypke *et al.* 2020
- See Bathiany *et al.*, 2016
- Also, see the introduction to Eisenman (2012).

THE OLDER THEORETICAL HEAT STRESS LIMIT FOR HUMANS IS INCORRECT, AND ACTUAL PHYSIOLOGICAL MEASUREMENTS SHOW EVEN FOR YOUNG, HEALTHY MID-LATITUDE ADULTS. IT IS NOT **AT T_{WB}=35C BUT AT ~30.5C** (VECELLIO *et al.* 2010). THE EFFECTS FROM EXPOSURE AT THIS WET-BULB TEMPERATURE FOR ~HOURS… ARE (using their delicate wording) "UNCOMPENSATABLE"

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RESEARCH ARTICLE

Evaluating the 35°C wet-bulb temperature adaptability threshold for young, healthy subjects (PSU HEAT Project)

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Abstract

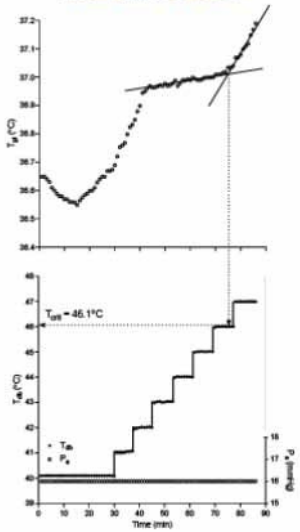
A wet-bulb temperature of 35°C has been theorized to be the limit to human adaptability to extreme heat, a growing concern in the face of continued and predicted accelerated climate change. Although this theorized threshold is based in physiological principles, it has not been tested using empirical data. This study examined the critical wet-bulb temperature ($T_{wb,crit}$) at which heat stress becomes uncompensable in young, healthy adults performing tasks at modest metabolic rates mimicking basic activities of daily life. Across six experimentally determined environmental limits, no subject's $T_{wb,crit}$ reached the 35°C limit and all means were significantly lower than the theoretical 35°C threshold. Mean $T_{wb,crit}$ values were relatively constant across 36°C –40°C humid environments and averaged 30.55 ± 0.98°C but progressively decreased (higher deviation from 35°C) in hotter, dry ambient environments. $T_{wb,crit}$ was significantly associated with mean skin temperature (and a faster warming rate of the skin) due to larger increases in dry heat gain in the hot-dry environments. As sweat rates did not significantly differ among experimental environments, evaporative cooling was outpaced by dry heat gain in hot-dry conditions, causing larger deviations from the theoretical 35°C adaptability threshold. In summary, a wet-bulb temperature threshold cannot be applied to human adaptability across all climatic conditions and where appropriate (high humidity), that threshold is well below 35°C.

NEW & NOTEWORTHY This study is the first to use empirical physiological observations to examine the well-publicized theoretical 35°C wet-bulb temperature limit for human to extreme environments. We find that uncompensable heat stress in humid environments occurs in young, healthy adults at wet-bulb temperatures significantly lower than 35°C. In addition, uncompensable heat stress occurs at widely different wet-bulb temperatures as a function of ambient vapor pressure.

climate change; environmental limits; global warming; human heat stress; thermoregulation

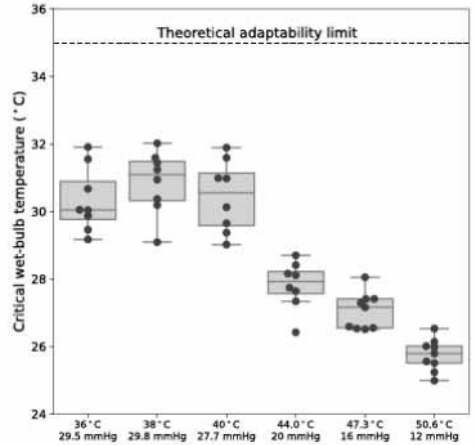
Evaluating the 35°C wet-bulb temperature adaptability threshold for young, healthy subjects (PSU HEAT Project)

METHODS



Representative tracing of chamber and subject data.

OUTCOME



Critical wet-bulb temperature values for the study's six experimental protocols.

CONCLUSION: Critical wet-bulb temperatures in both hot-dry and warm-humid environments all are significantly less than the literature's theorized 35°C threshold for human adaptability to extreme heat.

A CAVEAT: NY TIMES JOURNALIST DAVID WALLACE-WELLS POINTS OUT (JULY 2022) IMPORTANT NEW DATA ON HUMAN SURVIVABILITY LIMITS FOR HEAT STRESS…

- After my Presentation was made, in July 2022 this relevant article from Wallace-Wells was published.
- Recent heat waves in India brought the nominal reported wet-bulb temperature to slightly above the Vecellio *et al.* limits. Yet, the death toll was far smaller than the Vecellio study would suggest.

WHY? EACH OF THESE POINTS BELOW ARE LIKELY RESPONSIBLE IN PART…

- **1.** Most important perhaps, acclimatization of tropical residents to higher temperatures. The Vecellio *et al.,* Raymond *et al*., and other studies looked at healthy young people from the mid-latitudes, without the selection effects and acclimatization that tropical residents likely are subject to. Therefore, these studies need to be repeated in the tropics - likely the threshold temperature will be higher.
- **2.** On the other hand…The nominal wet-bulb temperature given for a date or period can be erroneously calculated, in that, in general, rising day time temperature usually go with lowering humidity during that day, so that using a day-value of max temperature and day value max humidity at a different moment, can give a misleadingly high wet-bulb temperature.
- **3.** Cause of death in the case of heat stroke is notoriously poorly accounted. Heat stress will make one far more vulnerable to frailties and point-of-failures which are then listed as cause on the autopsy report.

EVEN WITH THIS CAVEAT, THE KYPKE *et al.* WORK SUGGESTS WE MIGHT CONCEIVABLY END MUCH OF MAMMALIAN LIFE ON EARTH ON OUR CURRENT COURSE, WITHIN A CENTURY OR MORE.

- Fully coupled ocean / atmosphere climate models will show certain buffering in reaching energy equilibrium, which these EBM models likely do not – they enforce energy balance at each time step in each vertical cell array.
- I've not found how this affects the reliability of the EBM results. Could it mean only that their critical temperatures are reached more quickly than in the real world, but they would be reached just the same, given a little more time? With so many fully coupled ocean/atm models so expensive to run on giant super computer arrays, they are often only run to year 2100. Is this relevant to why this tipping point is not more recognized?
- Could human life then be restricted to higher elevation cooler mountainous regions?
- I've not seen this issue (our 3-cell structure transition to 1-cell structure) addressed or even mentioned in other climate modelling. Yet the Eocene data is there for all to see.
- Given these catastrophic consequences, and given that existing fully-coupled sophisticated models cannot explain why the Eocene was +13C hotter than today, yet at CO2 levels not much higher than today - this Kypke *et al.* work should not be dismissed out of hand just because it is simpler than 3D fully coupled models.

HERE IS THE KYPKE *et al*. 2020 ABSTRACT, IN FULL

- *"Abstract. This article presents the results of a bifurcation analysis of a simple energy balance model (EBM) for the future climate of the Earth. The main focus is on the following question: can the nonlinear processes intrinsic to atmospheric physics, including natural positive feedback mechanisms, cause a mathematical bifurcation of the climate state, as a consequence of continued anthropogenic forcing by rising greenhouse gas emissions? Our analysis shows that such a bifurcation could cause an abrupt change to a drastically different climate state in the EBM, which is warmer and more equable than any climate existing on Earth since the Pliocene epoch. In previous papers, with this EBM adapted to paleoclimate conditions, it was shown to exhibit saddle-node and cusp bifurcations, as well as hysteresis. The EBM was validated by the agreement of its predicted bifurcations with the abrupt climate changes that are known to have occurred in the paleoclimate record, in the Antarctic at the Eocene–Oligocene transition (EOT) and in the Arctic at the Pliocene–Paleocene transition (PPT). In this paper, the EBM is adapted to fit Anthropocene climate conditions, with emphasis on the Arctic and Antarctic climates. The four Representative Concentration Pathways (RCP) considered by the IPCC (Intergovernmental Panel on Climate Change) are used to model future CO2 concentrations, corresponding to different scenarios of anthropogenic activity. In addition, the EBM investigates four naturally occurring nonlinear feedback processes which magnify the warming that would be caused by anthropogenic CO2 emissions alone. These four feedback mechanisms are ice–albedo feedback, water vapour feedback, ocean heat transport feedback, and atmospheric heat transport feedback. The EBM predicts that a bifurcation resulting in a catastrophic climate change, to a pre-Pliocene-like climate state, will occur in coming centuries for an RCP with unabated anthropogenic forcing, amplified by these positive feedbacks. However, the EBM also predicts that appropriate reductions in carbon emissions may limit climate change to a more tolerable continuation of what is observed today. The globally averaged version of this EBM has an equilibrium climate sensitivity (ECS) of 4.34 K, near the high end of the likely range reported by the IPCC."*

FROM THE CONCLUSIONS OF KYPKE *et al.* 2020…

- *"This EBM (Energy Balance Model) for the Anthropocene Arctic predicts that a bi-furcation (here, a transition to a 1-cell atmosphere) will occur, leading to catastrophic warming of the Arctic if CO2 emissions continue to increase along RCP 8.5 without mitigation.*
- *This is true in the model even if ocean and atmosphere heat transport remain unchanged*
- *The amplifying effects of (rising) ocean and atmosphere heat transport can make this abrupt climate change become even more dramatic and occur even earlier.*
- *Water vapour feedback further intensifies global warming."* (RN: The well-verified Clausius-Clapyron relation insures the water vapor feedback will indeed continue to occur)

JUST A WEEK AFTER THIS PRESENTATION WAS GIVEN AT UC SANTA CRUZ, A FOLLOW UP STUDY BY KYPKE *et al.* (2022) WAS PUBLISHED, USING AN IMPROVED REPRESENTATION OF THE ATMOSPHERE.

- Kypke *et al.* (2022) *"Instead of using a slab to represent a uniform atmosphere with absorption properties similar to the real atmosphere, here we use the Schwarzschild two-stream equations to model absorption in the atmosphere explicitly as a function of altitude (Pierre-Humbert, 2010, p. 191)."*
- Like in their 2020 study, the tipping point to a 1-cell structure with a hot Arctic still occurs, under similar scenarios and timing.
- After the tipping point, on RCP 8.5 happening near year 2100; Arctic temperatures rise linearly and reach near 40C (104F) by year 2200.

THE TIPPING POINT TO A HOT ARCTIC HAPPENS FOR THE RCP=8.5 EMISSIONS TRACK. REMEMBER, CO2 CAN COME FROM ANY SOURCE; HUMAN FF BURNING, OR INDIRECTLY FROM ARCTIC THAW, FOREST DIE-OFF, SOIL CARBON LOSS, ETC.

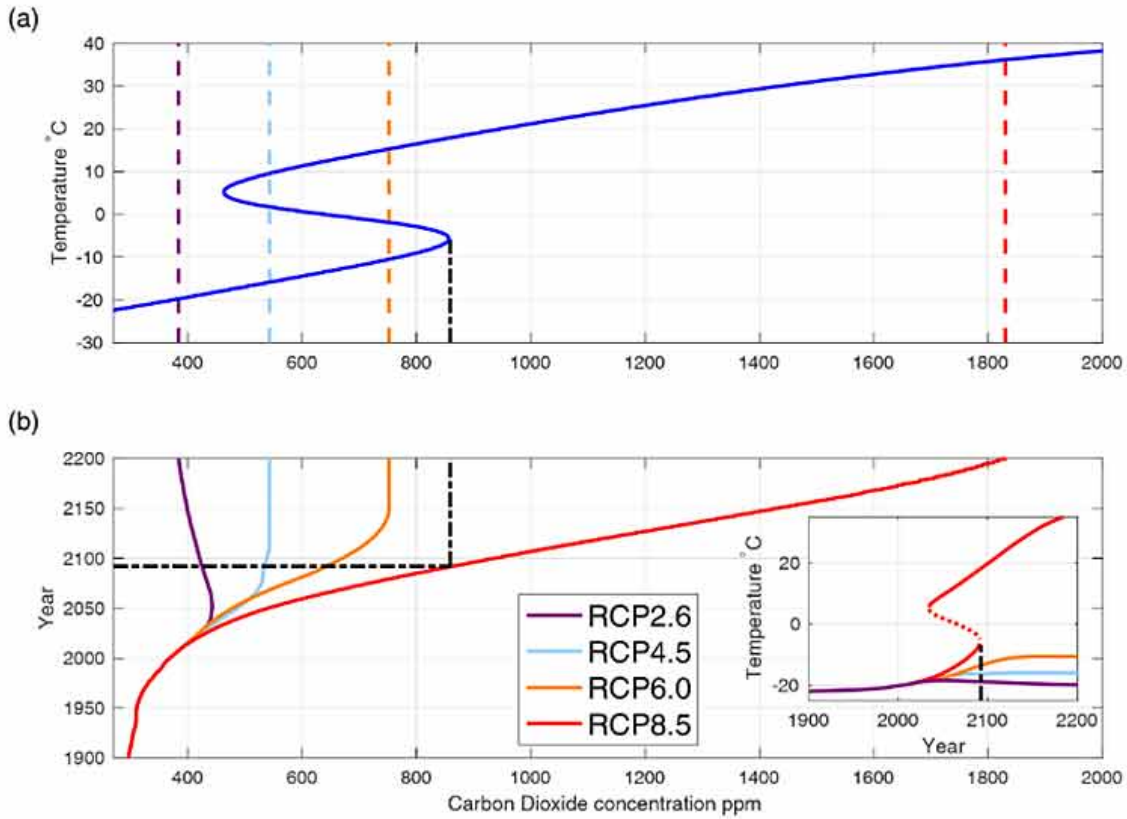
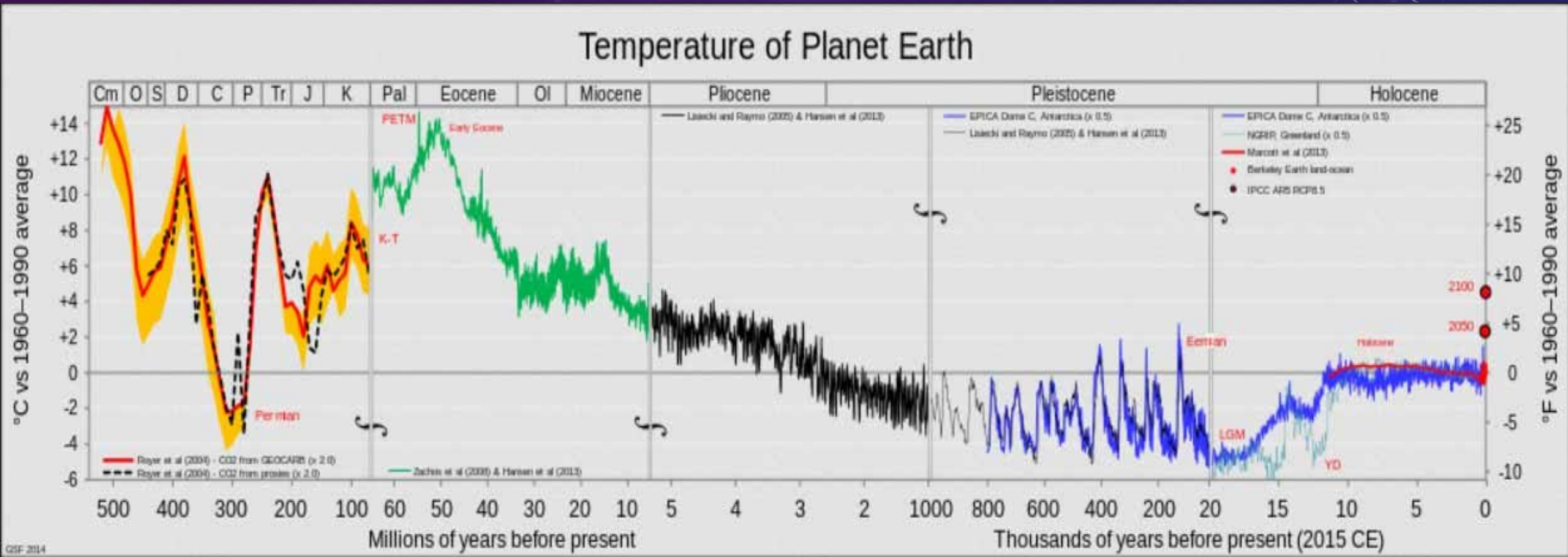


Figure 4. (a) Model surface temperature as a function of CO_2 concentration, μ. (b) CO_2 concentration levels for RCPs 2.6, 4.5, 6.0, and 8.5 (left to right). The dashed lines in panel (a) correspond to the CO_2 concentration levels for the four RCPs in the year 2200. The dashed-dotted line extends from the bifurcation point in panel (a) to RCP8.5 in the lower panel, indicating the bifurcation occurs in approximately the year 2100 for this scenario. The inset shows the predicted surface temperature as a function of the year for the four RCPs.

IS THIS DIRE PREDICTION REALLY POSSIBLE? IS IT CONSISTENT WITH OTHER EVIDENCE? THE PALEOCENE / EOCENE PERIOD 56 MILLION YEARS AGO MAY HOLD CLUES

- The PETM (Paleocene – Eocene Thermal Maximum) we talked about earlier here, and investigated by UCSC's own James Zachos, discussed here.
- This was Earth at its hottest since the Age of the Dinosaurs.
- Why so hot? That's puzzled climatologists until recently…

FROM O^{18}/O^{16} PROXY, THE TEMPERATURE IN THE EOCENE GLOBALLY WAS **~13C HIGHER** THAN THE HOLOCENE, AND THERE WAS NO ICE ON EARTH. CROCODILES SUITED TO TROPICAL SWAMPS ROAMED THE ARCTIC'S ELLSEMERE ISLAND (fossil evidence *e.g.* EBERLE 2007)

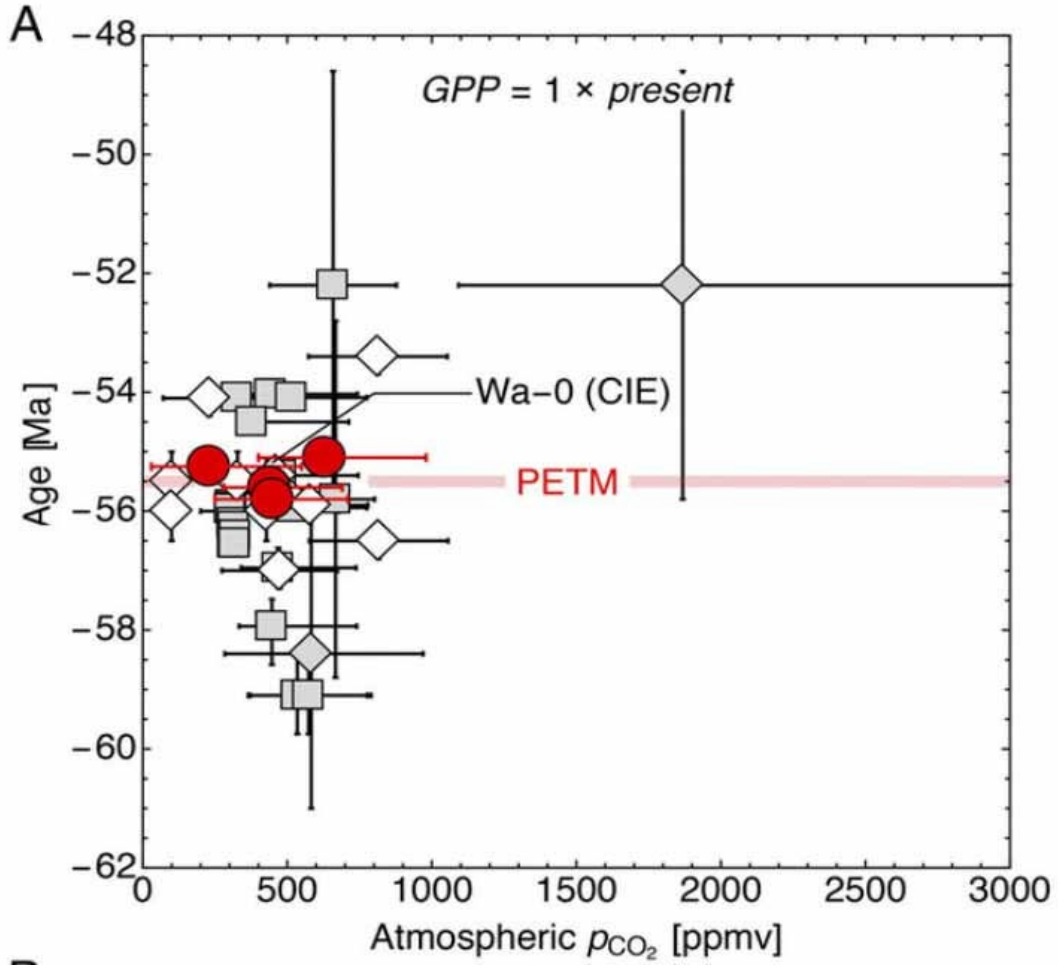


Inuit Johnny Issaluk holds a recent photo of a South Carolina swamp. That's what his home, near the Arctic Circle on Baffin Island, would have looked like 56 million years ago, when summer water temperatures at the North Pole hit 74°F.

A HOT JUNGLE ARCTIC…

A SLIDE BORROWED FROM THIS PRESENTATION

YET EOCENE CO2 LEVELS WERE ONLY ~500-600 ppm (GEHLER *et al*. 2016). HOW TO GET SUCH HIGH TEMPERATURES WITH CO2 LEVELS LESS THAN 50% HIGHER THAN TODAY'S 420 ppm? CONVENTIONAL CLIMATE MODELS FAIL (PRESS RELEASE, NCAR). COULD THIS NO-ICE WORLD HAVE MADE THE TRANSITION TO A 1-CELL ATMOSPHERE? ARE THE MARINE LOW CLOUD LOSSES MORE THAN WE HAVE ASSUMED, EVEN AT CO2 NOT MUCH HIGHER THAN TODAY? COULD **ECS** BE ~5C AND NOT THE ~3C THAT THE IPCC ASSUMED? OR ALL OF THE ABOVE?



Figure

Caption

Fig. 2. Existing proxy data for pCO 2 between 50 and 60 Ma adapted from the compilation of Beerling and Royer (35), compared with pCO 2 estimates from Δ 17 O of Ectocion bioapatite (red circles, this study). pCO 2 has been calculated for (A) modern global GPP conditions and (B) GPP 2.3 times the modern value, as proposed by Berner (71). White diamonds, paleosols; gray squares, leaf stomata; white squares, marine phytoplankton; gray diamonds, liverworts. pCO 2 results here are the first to our knowledge to come unquestionably from the PETM interval. Note that pCO 2 results for the PETM here are not elevated but consistent with earlier and later pCO 2 values reported by Beerling and Royer (35).

WE KNOW THAT MAMMALS DID EXIST DURING THE EOCENE. DOES THIS CONTRADICT THE HEAT STRESS LIMIT?

- No. There were very few mammal species then, and they were all tiny. Mice-like.
- Tiny means they have larger surface area–to–metabolic volume ratios. They could therefore dissipate their heat more easily than larger animals can.

WORSE: SOLAR HEATING WAS LOWER DURING THE EOCENE THAN TODAY

- Well-understood stellar physics shows the incoming solar luminosity is higher now by about 5.5 watts/m^2 compared to the PETM 56 Mya. So; given it was already crocodile-swamp hot in the Arctic back 56 Mya, how much hotter would the equivalent CO2 situation then be today, due to a more luminous sun alone? This adds alarm. I've not seen this solar luminosity issue mentioned in any of these papers. Is this knowledge too ensconsed just among astronomers?
- For comparison, the Earth's radiative imbalance on the RCP 8.5 emissions track that we, so far, continue following, is +8.5 watts/m^2 in year 2100, and this corresponds to a temperature rise on Earth of +4C to +6C from pre-industrial levels, as we saw.

KYPKE *et al.*'S RESULT, THEN, IF ACCURATE, IS TRULY APOCALYPTIC. IS IT REASONABLE? DOES IT FIT WITH WHAT WE KNOW? CONSIDER…

- It's not clear that Kypke *et al.*'s model indirectly includes the Compost Bomb instability, nor the new data on low cloud loss which came out at the same time (Schneider). Their findings might even be on the optimistic side. But let's consider…
- From Kypke *et al.*'s Figure 7 (see earlier slide), note the temperature rise prior to the transition to a 1-cell atmosphere is ~0.35C/year. This is 4 times faster than the "Compost Bomb Instability" limit.
- That would suggest most Arctic peat carbon might enter the atmosphere. Recall we showed there's more than twice as much carbon in the permafrost as in the entire atmosphere. Consider: Adding twice the existing CO2 to our atmosphere would take it to ~1300 ppm. If, as is likely, significant amounts enter as methane, that's worse.
- Schneider *et al*. (2019) have found that at a CO2 level of 1200-1600 ppm, climate-cooling marine low clouds (which cover 20% of sub tropical oceans) disappear entirely from Earth, raising global temperature by an additional +8C on top of what was existing prior to the transition to this low cloud loss.

HOW DOES THE 3-CELL-TO-1-CELL MECHANISM WORK?

- With Arctic Amplification reducing the temperature gradient from equator to pole so severely, the thermally driven kinetic force on airmasses drops, and the winds from the equator northward lose speed, therefore reducing the Coriolis Force on those winds.
- Yet it is the Coriolis right-ward deflection of northward winds that causes the latitude edge of the Hadley Cell to form and imposes our 3-cell structure today.
- Similarly with the weakening of the Polar Cell
- **…to the point that the in-between Ferrel Cell disappears and the Polar and Hadley Cells merge to become one.**
- This enforces a much more uniform global temperature to take hold from equator to pole, and the jet stream boundaries disappear. Note that the jet streams guide frontal system rain.
- **This, on today's already solar luminosity-induced +5.5 watts/m^2 hotter planet *vs*. the Eocene, could plausibly raise Arctic temperatures to 29C-30C, which is right at the upper limit that mid-latitude humans today can survive. Even minor heat waves would be enough to kill. Human and most mammalian life on Earth might be restricted to cooler island ecology higher mountains.**

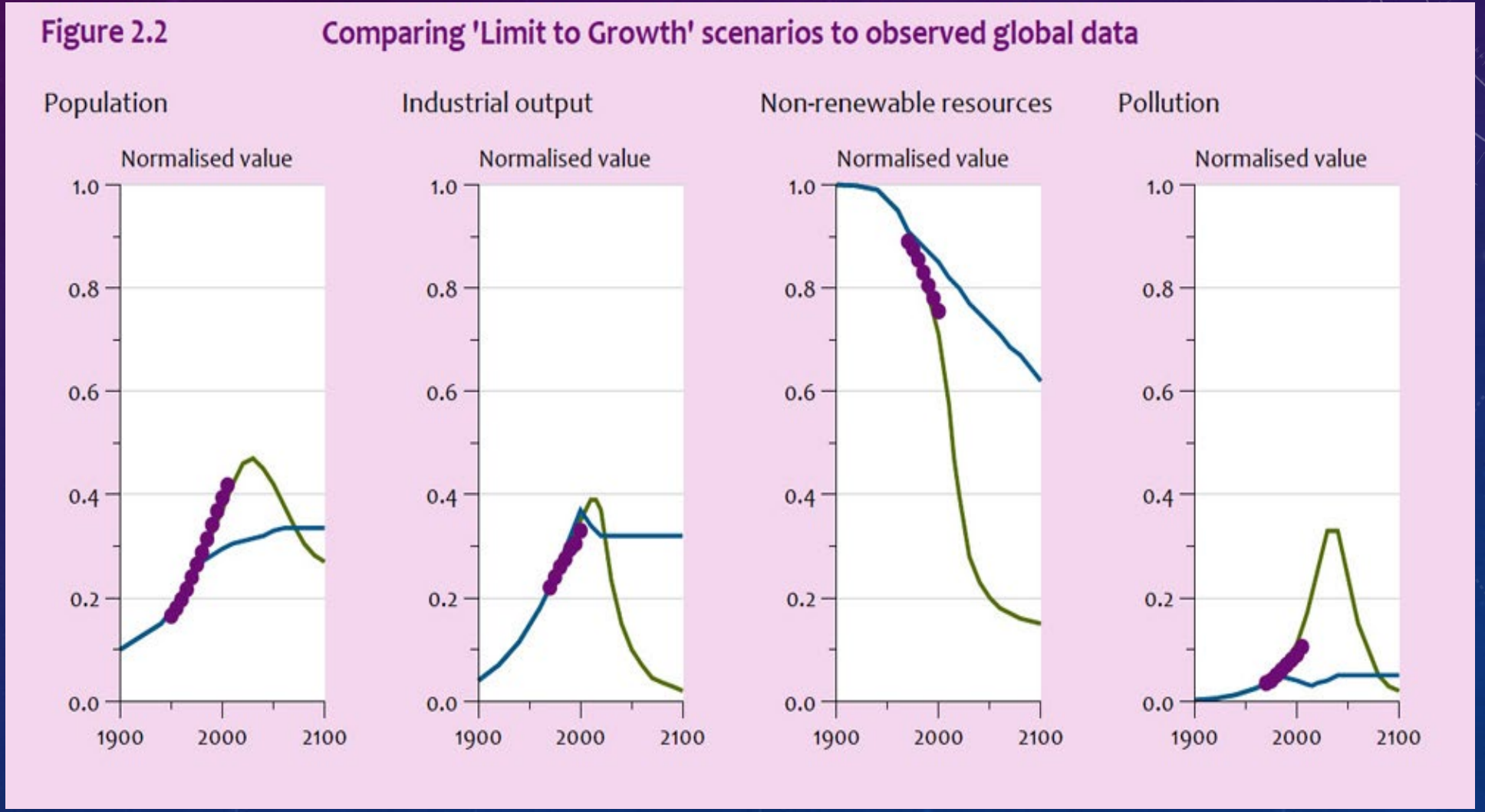
THE SIXTH GREAT MASS EXTINCTION

- Barnosky *et al.* (2011) finds that ¾ of all animal species could be extinct within 300 years.
- The Human Enterprise is the cause – climate change, microplastics, habitat destruction, direct killing, ocean acidification…
- How long after this mass extinction would it take for biodiversity to recover? Much longer than you might think. Scientists find that in each of the past 5 mass extinctions, it took roughly 10 million years before biodiversity rose back to comparable levels.

THE REASON IS THAT NOT ONLY ARE ECOLOGICAL NICHES COMPROMISED, BUT ENTIRE ECOSYSTEMS DISAPPEAR

- Therefore, species cannot evolve into existing niches because the niches themselves are destroyed, and evolution will first require entirely new niches to be created, which is a much slower process (Lowry *et al*. 2019)
- Natural selection involving minor modifications to fill an existing niche can proceed faster, but mass extinctions are entirely different.
- There is a natural "speed limit" that applies, and this is true even for species with fast life cycles, such as foraminifera (above).
- The post-extinction world will be entirely different than the pre-extinction world, paleo experience shows. And with life being such a profound shaper of even the geology and atmospheric chemistry of the Earth, it becomes very difficult to see what place, if any, that humans would occupy in such a world. Just like "American Exceptionalism", we will see that "human exceptionalism" has deep flaws. Grandiosity has its costs.

POPULATION, INDUSTRIAL OUTPUT, NON-RENEWABLE RESOURCES, AND POLLUTION ALL REMAIN ON "OVERSHOOT-AND-CRASH" TRAJECTORIES (VAN VUUREN *et al.* 2009 click 'export' for pdf)



ECONOMIC "*GROWTH UBER ALLES*": SHARP INCREASES IN SATELLITE ROCKET LAUNCHES SET TO BECOME A NEW CAUSE OF STRATOSPHERIC OZONE DESTRUCTION (SOURCE)

- *"The problem is that there are now plans to launch about 55,000 satellites," Boley said. "Starlink second generation could consist of up to 30,000 satellites, then you have Starnet, which is China's response to Starlink, Amazon's Kuiper, and OneWeb... That could lead to unprecedented changes to the Earth's upper atmosphere."*
- *Mega-constellation operators, inspired by the consumer technology model, expect fast development of new satellites and frequent replacement, thus the high amount of satellites expected to be burning in the atmosphere on a daily basis.*
- *"Humans are exceptionally good at underestimating our ability to change the environment," said Boley.*

BEFORE WE VEER AGAIN INTO ECONOMISTS' REACTIONS, I SHOULD EXPLAIN MORE CLEARLY…

- My criticisms focus more centrally on Neoclassical economics not because I think it is the absolute worst school of economic theory (there are worse out there, probably), but because it has become the mainstream, the dominant and therefore most relevant, paradigm.
- And, because it is Neoclassicals who have intruded most obviously into climate policy economics - with disastrous consequences - the Neoclassicals are the biggest danger to our future.
- However, I do accept that some Neoclassical additions to classical economics: marginalism, mathematical quantification, the notion of utility… are on the whole, an improvement, at least in some contexts.

SO. GIVEN THE RADICAL DIFFERENCE BETWEEN CLIMATE SCIENTISTS' DIRE ASSESSMENTS AND NORDHAUS' TRIVIAL DAMAGE FUNCTIONS: DID NORDHAUS DECIDE TO BRING IN CLIMATE SCIENTISTS TO HELP UPDATE HIS MODELLING?

- In fact, he did the exact opposite.
- *"Given this extreme divergence of opinion between economists and scientists, one might expect that Nordhaus's next survey would examine the reasons for it. In fact, the opposite applied: his methodology excluded non-economists entirely" (Keen 2021).*

THEY (NORDHAUS AND HIS NEOCLASSICAL ECONOMIST COLLEAGUES) DID NOT SEARCH A COMPARABLE SCIENCE DATABASE, SUCH AS PROQUEST SCIENCE JOURNALS…

- *"…where the (his) same too-broad search string (on January 11th 2021) returned 60,315 peer-reviewed full-text articles, and a narrower search string "damage AND climate AND GDP" returned a manageable 2,721 hits.*
- ***There is therefore no significant science-based content in the papers** that generated the 'data' on which IPCC economists concluded that 'the impact of climate change will be small relative to the impacts of other drivers' (Arent et al., 2014a, p. 662). All of the pairs of numbers in Figure 2 were generated by economists, and all but one predict an extremely small impact on GDP from global warming" (Keen 2021)*

NEOCLASSICAL ECONOMISTS CONTROL THE IPCC ECONOMICS PROCESS – THIS HAS BEEN DISASTROUS TO THE STATED PURPOSE OF THE IPCC, FOR 32 YEARS NOW (below, KEEN 2021).

But the main weaknesses with the IPCC's methodology are firstly that, in economics, it exclusively selects Neoclassical economists, and secondly, because there is no built-in review of one discipline's findings by another, the conclusions of these Neoclassical economists about the dangers of climate change are reviewed only by other Neoclassical economists. The economic sections of IPCC reports are therefore unchallenged by other disciplines who also contribute to the IPCC's reports.

FACING DIRE AND IRREVERSIBLE CONSEQUENCES TO OUR FUTURE: ARE NEOCLASSICAL ECONOMISTS FIT FOR THE JOB? WHAT, IF ANY, IS THEIR MORAL COMPASS?

- One's moral compass must include the value of future life.
- This is a value mindset, as we showed, that they do not possess. Neoclassical economists are unsuited to be in the policy decision process.
- But, they **have** intruded themselves into, and **are**... in the decision process…
- Employed by the wealthiest and most powerful policy makers on Earth; in industry and government.
- So consider…

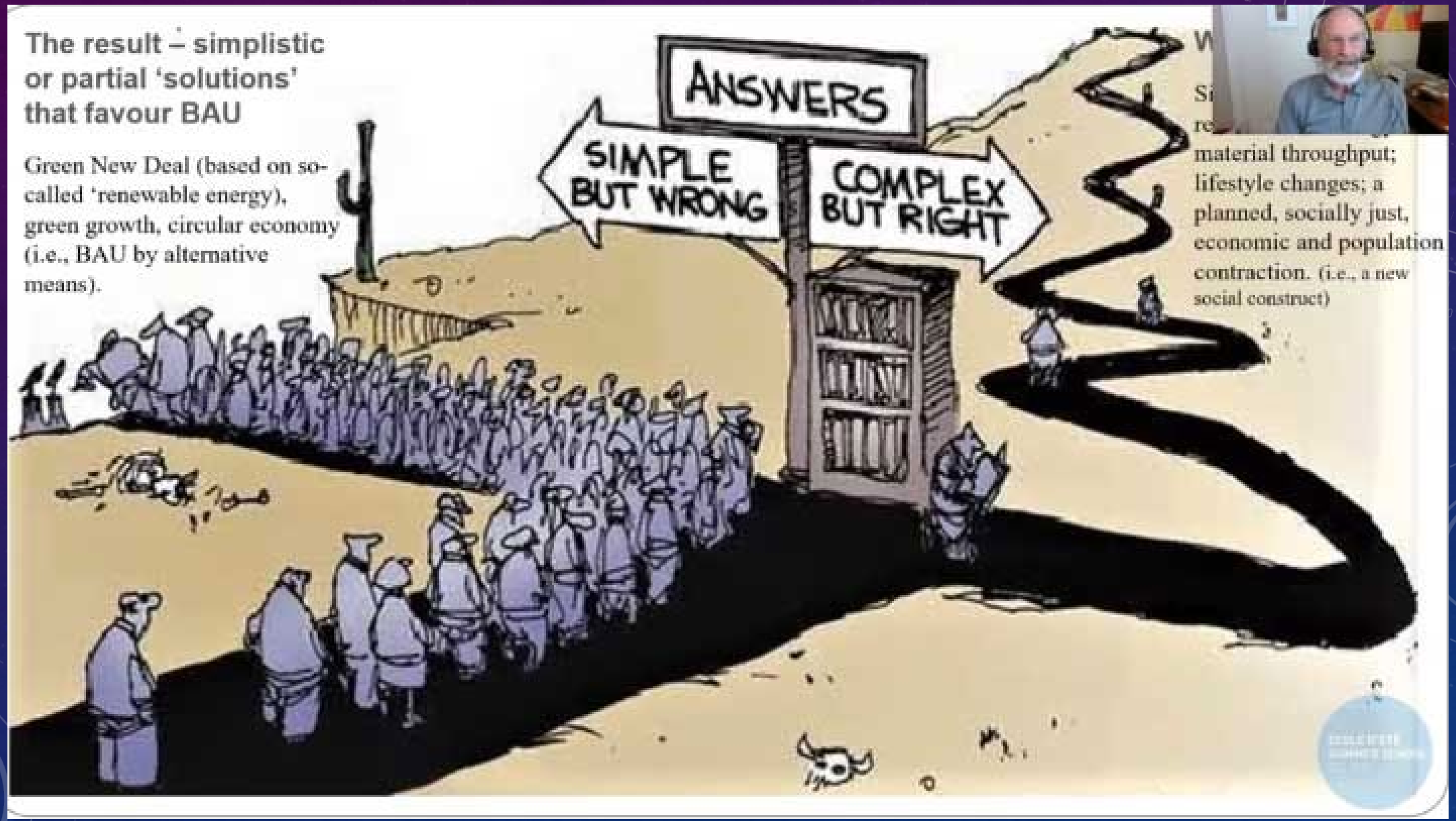
POLITICAL AND CORPORATE POLICY PEOPLE, AIDED BY TEAMS OF THEIR HIRED ECONOMISTS… HOW IS IT THAT SUCH DIRE AND HORRIFIC CLIMATE CONSEQUENCES CAN MEAN SO LITTLE TO THEM?

- Let’s examine that now…
- The nature and ethics of the Neoclassical economist…

*"MILTON FRIEDMAN CLAIMED THAT A THEORY SHOULD BE JUDGED BY ITS ABILITY TO **PREDICT**. THE COMPLEXITY OF THE MODEL OR **REALISM OF THE ASSUMPTIONS**, IS NOT A STANDARD TO JUDGE A THEORY." (SOURCE: CFI)*

- An incredible statement, from someone else that the Swedish Central Bank awarded a "Nobel"(*sic*) Prize to.
- Well sure – if we divorce from reality, and cut loose entirely from the essence of good science (which is Realism), I suppose you could find some things to feel warm about among some Neoclassical economists pronouncements, if it suits your ideology.

FROM A TALK BY ECOLOGICAL ECONOMIST WILLIAM REES



AND YET - NEOCLASSICAL ECONOMISTS ALSO HAVE A DISMAL RECORD OF MAKING CORRECT PREDICTIONS

- Consider - even the iconic early 20th century Libertarian economist…
- *…"Friedrich Hayek made an astonishing admission. Not only were economists unsure about their predictions, he noted, but their tendency to present their findings with the certainty of the language of science was misleading and 'may have deplorable effects'." (Guardian 2017)*
- *And, this devastating critique of the iconic Milton Friedman's anti-scientific ideology by economist George Blackford (2017 and here)*

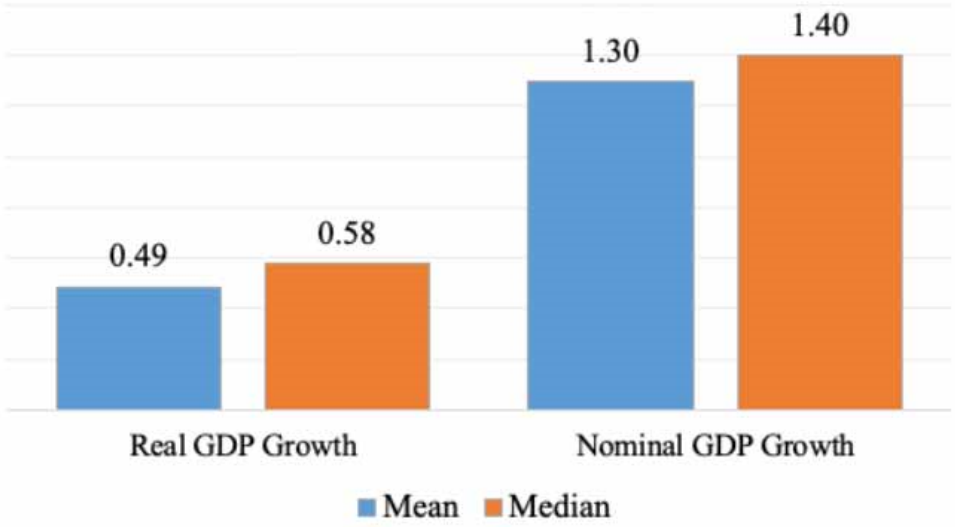
"It is difficult to get a man to understand something, when his salary depends upon his not understanding it."

—**Upton Sinclair**

ROSY PROJECTIONS ARE DESIRED BY THE PATRONS OF ECONOMISTS. IS THIS BIASING THEIR ACADEMIC PREDICTIONS? BELOW IS FOR THE JAPANESE ECONOMY… (MORIKAWA 2020)

Figure 1 shows the means and medians of forecast errors. Forecasts by the researchers in economics have an optimistic bias, similar to the findings for the forecasts by the government agencies. Even after removing the two years affected by the Global Crisis to calculate annual growth rates, a non-negligible upward bias remains: about 0.5-0.6 percentage points for real GDP growth and about 1.3-1.4 percentage points for nominal GDP growth.

Figure 1 Means and medians of forecast errors

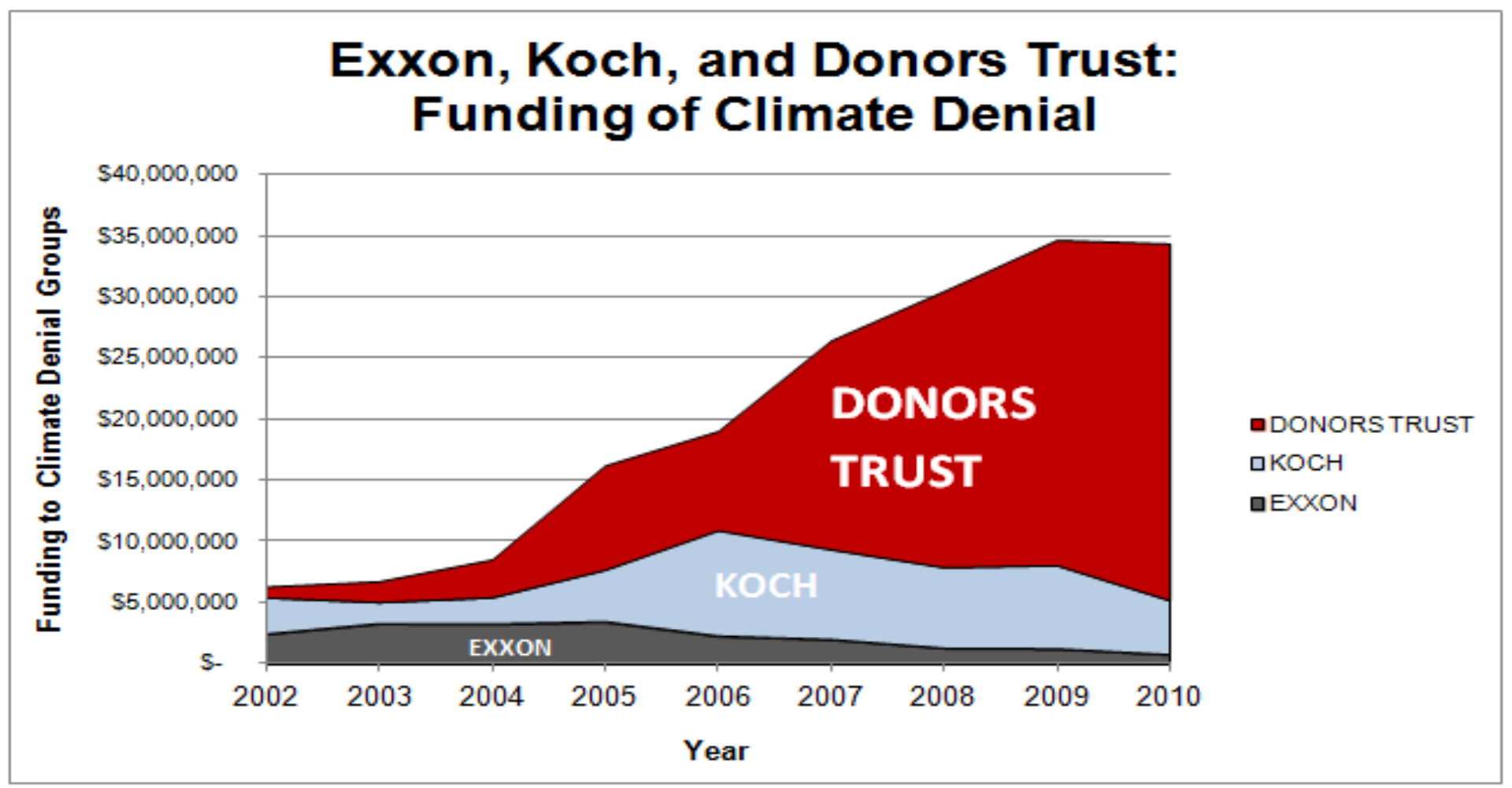


- At left: Prediction *vs* actuality.
- Real and nominal GDP growth predictions are significantly over-estimated by mainstream economists.
- ~0.5% overestimate of a typical 2% actual real GDP growth. That's a 25% error!

EXXON-MOBIL'S OWN SCIENTISTS WERE DOING GOOD CLIMATE SCIENCE AND ADVISING CORPORATE HEADQUARTERS OF THE "CATASTROPHIC" (THEIR WORDS) CONSEQUENCES OF THEIR BUSINESS AS EARLY AS THE 1970'S

- Corporate headquarters' reaction? They dismantled their own climate science funding effort and instead created and/or funded retribution squads attacking climate scientists, sometimes threatening their families, and promoting climate science lies. Examples; **fund "Doubt is our Product"** purveyors, the **"climategate" fabrications**, and vastly more than I can link here.
- While Exxon-Mobil's PR person **claims** they don't fund climate denial groups now, observe the evasive and manipulative wording in the interview linked above.
- In fact, all the major oil companies knew the catastrophic consequences of their business.

SINCE 2000, MONEY TO FUND CLIMATE DENIAL GROUPS IS BEING INCREASINGLY LAUNDERED THROUGH THE ANONYMITY OF DONOR'S TRUST. SEE LINKS TO UNDERSTAND WHY THE RED CURVE ROSE, WHILE TAKING DIRECT, NAMED RESPONSIBILITY FOR THEIR DONATIONS DECLINED



PSYCHOPATHS IN THE CORPORATE CEO OFFICES

- This study (Brooks *et al.* 2016), finds 21% of Corporate CEO's fit the diagnostic criteria as **psychopaths. (APS 2016)**
- **This is the same fraction as found in prisons.**
- **By the same criteria, in the general population, the rate is only 1%**
- Lead author and forensic psychologist Nathan Brooks notes: *"For psychopaths, it [corporate success] is a game (6 min Vox on CNN's political journalism as sport), and they don't mind if they violate morals. It is about … having dominance over others."*
- *This is the result of the systemic motivation structure which we have devised and implemented. What does this say about us?*

CONTRARY TO NEOCLASSICAL THEORY - PAYING PEOPLE TO BE MORAL ACTUALLY REDUCES THEIR MORAL BEHAVIOR…

- "Motivation Crowding"
- Studies show when you pay people to do what they otherwise feel is a morally or socially proper thing to do, you rob them of the experience of moral motivation, and turn their actions into a monetary maximization exercise.
- But since the most profound internal joys come from honorable actions and behavior, you scramble their moral experience and lower their self-regard, which only further accentuates bad behavior.
- **Climate Example:** Paying tropical countries to NOT cut down their rain forests, worked for only a short time – and after the moral honoring of Nature was usurped by money, we saw renewed de-forestation at unprecedented rates. Morally compromised people, then behave immorally.

UNIV. OF VERMONT ECOLOGICAL ECONOMIST JOSHUA FARLEY GIVES A LIVELY INTERVIEW WITH MANY INSIGHTS ON THE FATAL FLAWS OF CAPITALIST MARKETS AND NEO-CLASSICAL ECONOMISTS…

- Common Sense *vs.* Economics (podcast)
- Example: The Minister of Finance for Malaysia, couldn't wait to chop down his rainforest because the forest grew at only 2-3%/year but if he converted the trees into money, he could grow it at 7-10% per year in the equity markets.
- And so, that's exactly what Malaysia (and Brazil, Africa…) are doing.

WITH FOREST ECOLOGIES TODAY HAVING THEIR GROWTH RATES CRIPPLED FURTHER, THROUGH RISING DROUGHT AND HEAT…

- … what does this imply about the rate at which more countries will decide that it is in their financial interest to cut down the trees to make Ikea furniture yet faster, before they die and decay instead?
- Another amplifying climate feedback towards a different and more sterile Earth.

Does Studying Economics Breed Greed?

Even thinking about economics can make us less compassionate.

Posted October 22, 2013

In 1776, Adam Smith famously wrote: "It is not from the benevolence of the butcher, the brewer, or the baker, that we can expect our dinner, but from their regard to their own interest."

Economists have run with this insight for hundreds of years, and some experts think they've run a bit too far. Robert Frank, an economist at Cornell, believes that his profession is squashing cooperation and generosity. And he believes he has the evidence to prove it. Consider these data points:

(LEFT: GRANT 2013) ECONOMIC MODELS ARE DEEPLY CONNECTED TO THE IDEOLOGY, POLITICS, AND ETHICAL GROUNDING OF THE ECONOMIC MODELERS. THEIR UTILITY FUNCTIONS REFLECT THIS.

THEREFORE: SHOULD WE REALLY BE RELYING ON THESE ECONOMISTS TO GUIDE OUR TREATMENT OF FUTURE LIFE?

Less charitable giving: In the US, economics professors gave less money to charity than professors in other fields—including history, philosophy, education, psychology, sociology, anthropology, literature, physics, chemistry, and biology. More than twice as many economics professors gave *zero dollars to charity* than professors from the other fields.

More deception for personal gain: Economics students in Germany were more likely than students from other majors to recommend an overpriced plumber when they were paid to do it.

Greater acceptance of greed: Economics majors and students who had taken at least three economics courses were more likely than their peers to rate greed as "generally good," "correct," and "moral."

Less concern for fairness: Students were given $10 and had to make a proposal about how to divide the money with a peer. If the peer accepted, they had a deal, but if the peer declined, both sides got nothing. On average, economics students proposed to keep 13% more money for themselves than students from other majors.

WHETHER BY LEARNED BEHAVIOR, OR SELF-SELECTION FOR THIS PROFESSION, TRADITIONAL ECONOMISTS EXHIBIT HEIGHTENED PSYCHOPATHOLOGIES. SAMPLE AT LEFT FROM GRANT 2013.

EMBEDDED LINKS ARE BELOW

FRANK *et al.* 1993

FRANK and SCHULZE 2000

WANG *et al.* 2013

CARTER and IRONS 1991

MANY MORE INSIGHTS ARE IN THE ARTICLE.

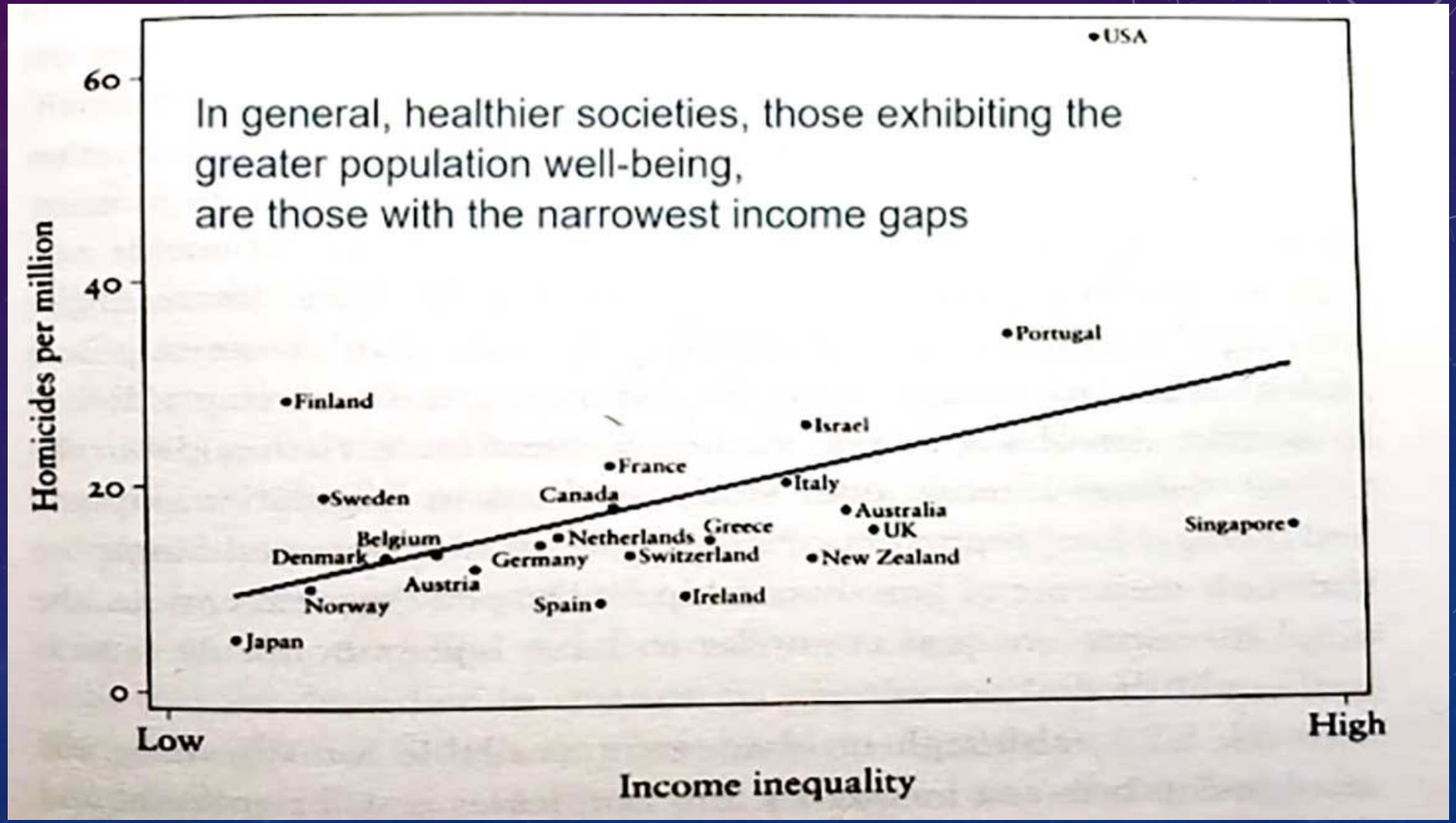
AS AN ECONOMICS PhD STUDENT, FARLEY'S ADVISOR CAUGHT HIM READING AN ECOLOGY BOOK ON AMAZONIA – SUBJECT OF HIS THESIS WORK

- Thesis advisor asked *"Why are you reading THAT?"*. Farley: *"I'm solving a problem and I understand I'm to use whatever tools and methods I need to accomplish that".*
- His advisor responded: *"No. You're here to learn a set of tools and methods that you will apply to ANY problem".*
- Rather amazing, no? Almost no U.S. universities offer degrees in ecological economics; not surprising given this insular culture.

ECONOMISTS ARE THE MOST INSULAR AND NON-INTERDISCIPLINARY OF THE SOCIAL SCIENCES – AND PROUD OF IT (FARLEY, CITING FOURCADE *et al.* 2015)

- Fourcade *et al.* 2015, from the sociology viewpoint, did a fascinating study "The Superiority of Economists" (title was intended to be taken tongue-in-cheek).
- *"You are only supposed to follow certain rules. If you don't follow certain rules, you are not an economist. So that means you should derive the way people behave from strict maximization theory"* (quote from an academic economist, cited from Fourcade *et al.* 2015)
- I can attest personally, that economists fight against anyone not a True Believer who attempts to publish anything related to economics, especially if it takes physics and climate science seriously while doing so. I'm not alone in this frustrating experience.
- We ask: Are insular, turf-guarding, dogmatic people well-suited to solving the Human Dilemma that we now face in the 21st Century?

NEOCLASSICAL ECONOMISTS' POLICY IMPLICATIONS CLAIM TO BE MAXIMIZING UTILITY. BY INCREASING INEQUALITY, **THEY DO THE OPPOSITE**: HERE, HOMICIDES *vs.* INCOME INEQUALITY – A STRONG CORRELATION



WE NEED THEM FOCUSED.

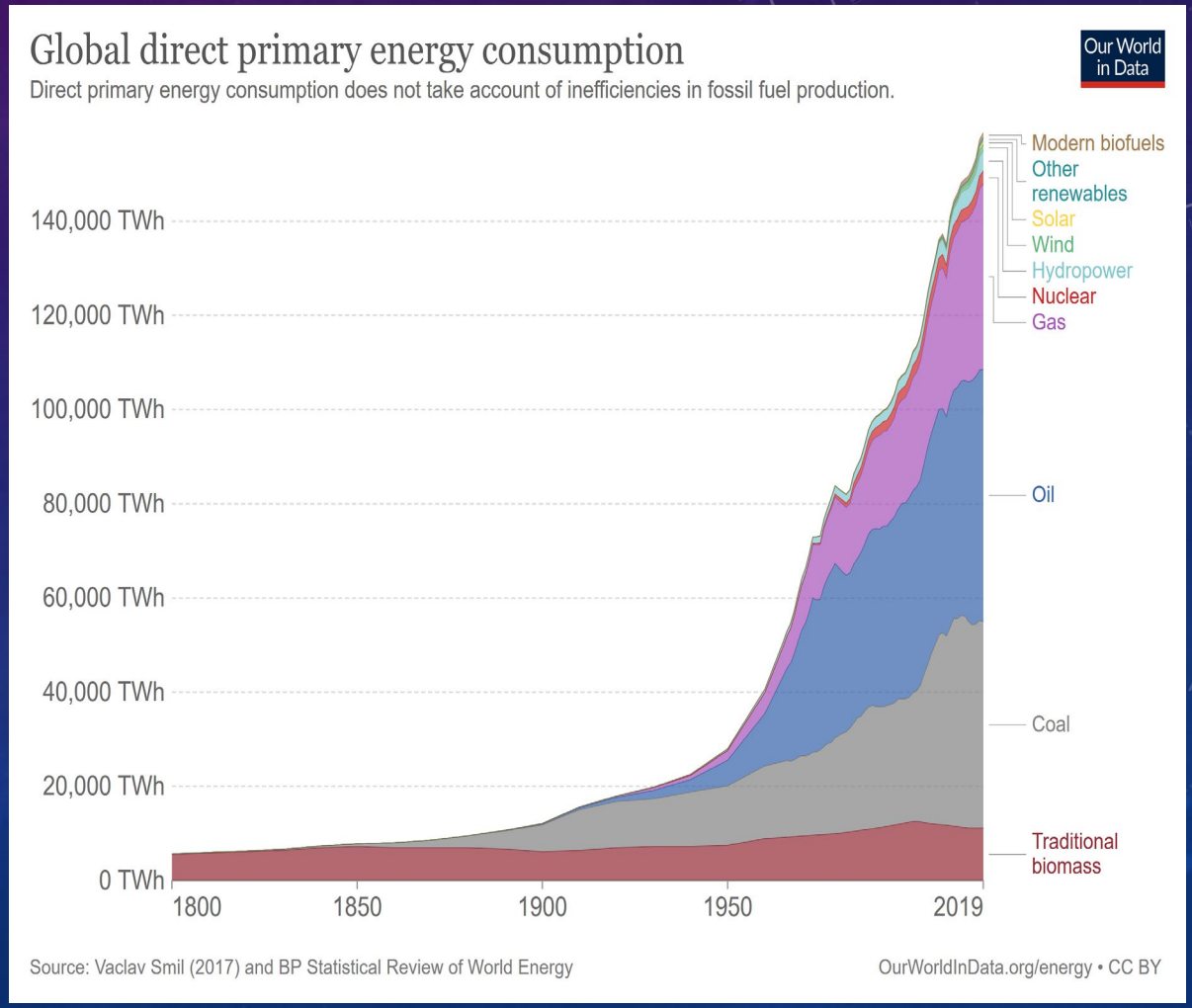
NEOCLASSICAL ECONOMISTS ARE NOT PROPERLY FOCUSED.

POPULATION CONTROL? THE SHORT-TERM THINKING OF CONVENTIONAL ECONOMISTS IS ULTIMATELY TRAGIC

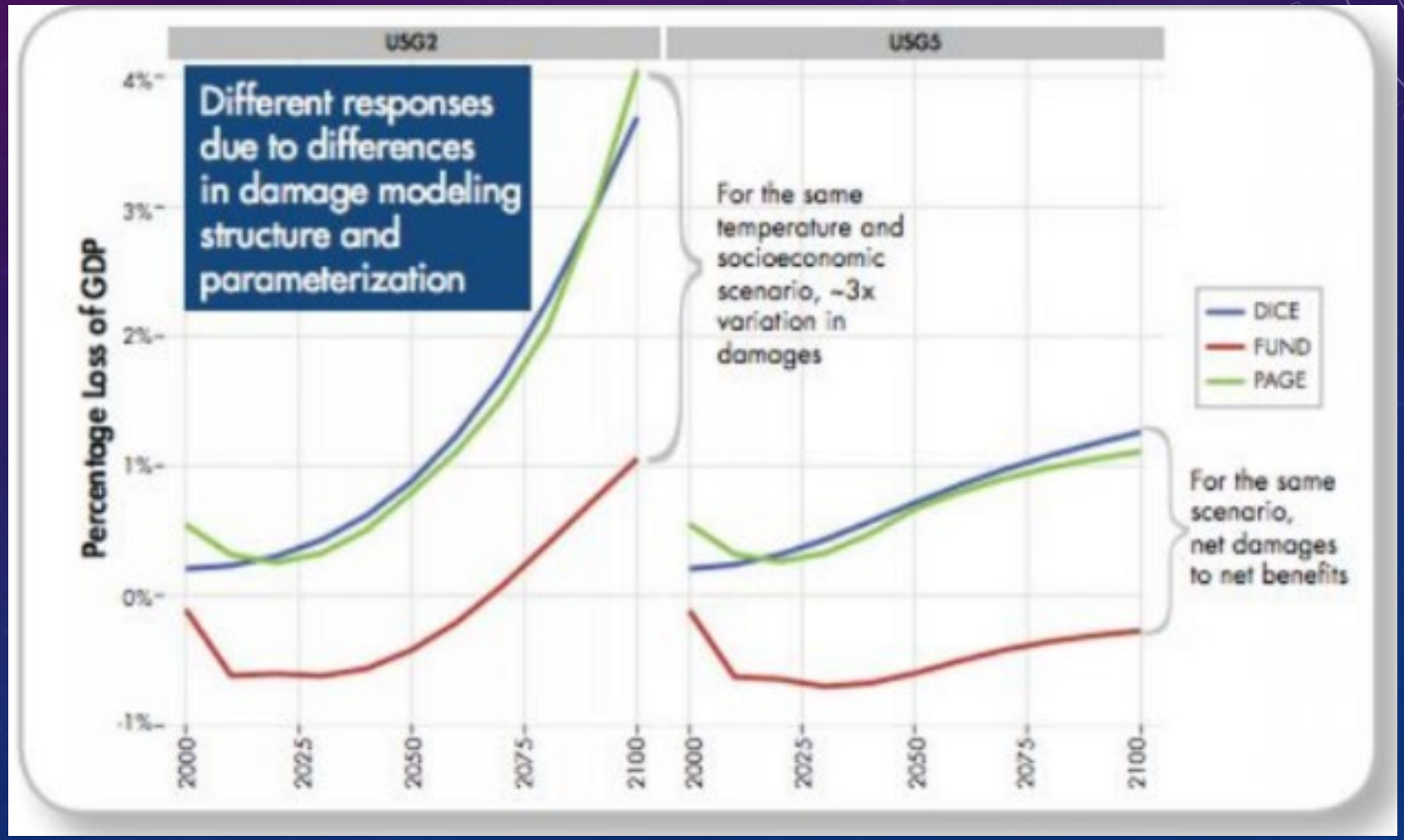
- **Example:** New births are, in fact, environmentally "forward costed".
- The consumption-induced environmental degradation which new additional population causes, is spread over the next ~75 years.
- The today cost of a current birth is minor by comparison. So, how wise and how ethical is discounting future welfare?
- Starvation could be the result, yet the increased spending causes perverse motivation in the context of capitalist values.
- It is famine in the 21st century which many scientists find is most likely to lead to the bloodiest of civilization's breakdowns.

ANOTHER PRICING FAILURE: FOSSIL FUEL ENERGY IS CLEARLY PRICED FROM THE (STILL SMALL) COST OF EXTRACTION AND COMPETITIVE PROFIT MARGINS, NOT ITS TRUE (LARGE) VALUE.

- This incentivizes the most rapid exploitation achievable for the fastest near-term profit growth. But a $100 barrel of oil produces the energy equivalent of ~25,000 hours of manual labor, or ~$500,000 at ~minimum wages for that worker. **No wonder we burn it like there's no tomorrow. It's "free"!** (and at this rate, there may in fact **be** no tomorrow).
- This behavior contrasts sharply with the claimed nature of Neoclassicals *"They further believe that the price of a product is not dependent upon its cost of production but rather on its "perceived value".* (Kaushik 2021 "What is Neoclassical Economics?")



OTHER NEOCLASSIC DAMAGE FUNCTIONS – ARE **AS ABSURD OR EVEN MORE SO** THAN NORDHAUS' "DICE". SHOULD WE WASTE TIME WE DON'T HAVE, IN TRYING TO PATCH THEM? REJECT THEM ALTOGETHER. IT IS NOT "NOBEL" PRIZE-WORTHY TO PORT COST/BENEFIT MICRO-DISCOUNT EQUATIONS INTO CLIMATE CHANGE AND LONG TERM GLOBAL SUSTAINABILITY WHEN TIPPING POINTS EXIST. IT IS AMAZINGLY STUPID AND DANGEROUS.



TOWARDS A MORE REALISTIC DAMAGE ASSESSMENT… LET'S COUNT THE WAYS:

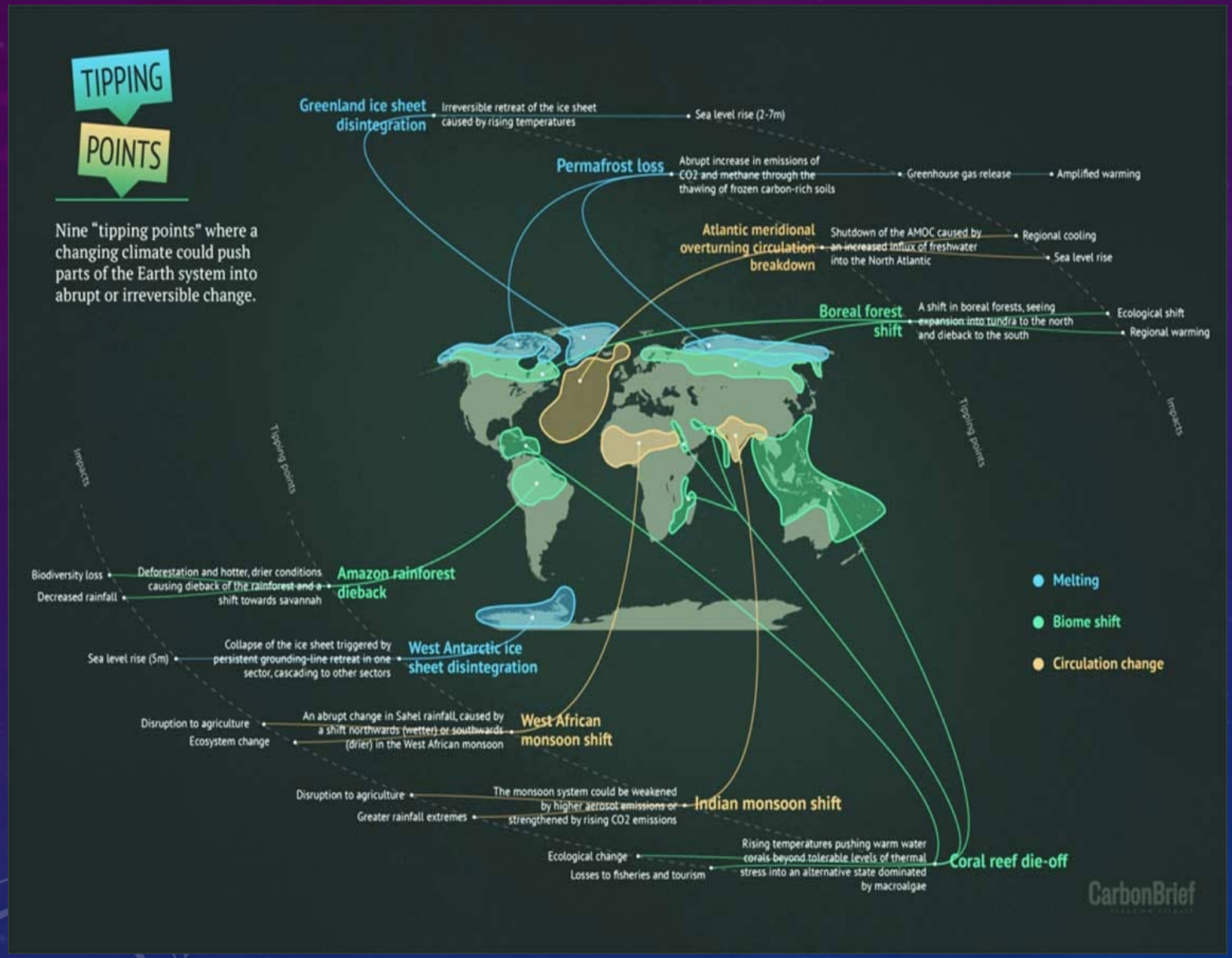
- Must include: the value of biodiversity, including the fat tailed distribution of ecological costs we only imperfectly understand today.
- We are subjects of Nature, not Nature's master. We're learning that fact the hard way.

MUST INCLUDE: THE VALUE THAT FUTURE PEOPLE PUT ON THEIR OWN PRESENT (WHICH IS OUR FUTURE); THEIR SELF-VALUE! THEY WILL CERTAINLY **NOT** DISCOUNT THEIR PRESENT VALUE TO THEMSELVES. NORDHAUS AND OTHER NEO-CLASSICALS ONLY CARE *"WHAT ARE FUTURE GENERATIONS WORTH **TO ME**? NOW, TODAY, **TO ME?**"* (AND, THAT, TOO, IS DONE POORLY).

- Therefore – Apply zero discount rate to future Utility.
- Future generations don't get to vote on what climate and what Earth we leave them with.
- We must therefore act to be their protectors, not the object of our looting.

MUST INCLUDE: THE UTILITY VALUE OF OUR GENUINE SELF-RESPECT. SELF RESPECT IS ESSENTIAL TO MOTIVATE OUR DRIVE TO BE INDUSTRIOUS AND TO PRODUCE VALUE

- Our actual self-respect (*vs.* delusional posturing) is damaged by endorsing the discounting away of the future damages we're causing, merely for our own immediate gratifications.
- Psychologists have demonstrated (*e.g.* Branden 1981) that self respect is essential for motivation. It is so powerful, we feel driven to fake it if we don't possess it honestly.
- Delusion will get harder and harder to maintain as denied reality of the 21st century intrudes. Our brains were designed to do non-contradictory identification and integration. Self-sabotaging of that design feature requires continuous ENERGY to combat our Nature.
- **Maintaining self-delusions requires real, caloric, biological ENERGY, and as delusions pile on, gets more and more exhausting to maintain (see Nolthenius). This can end tragically.**



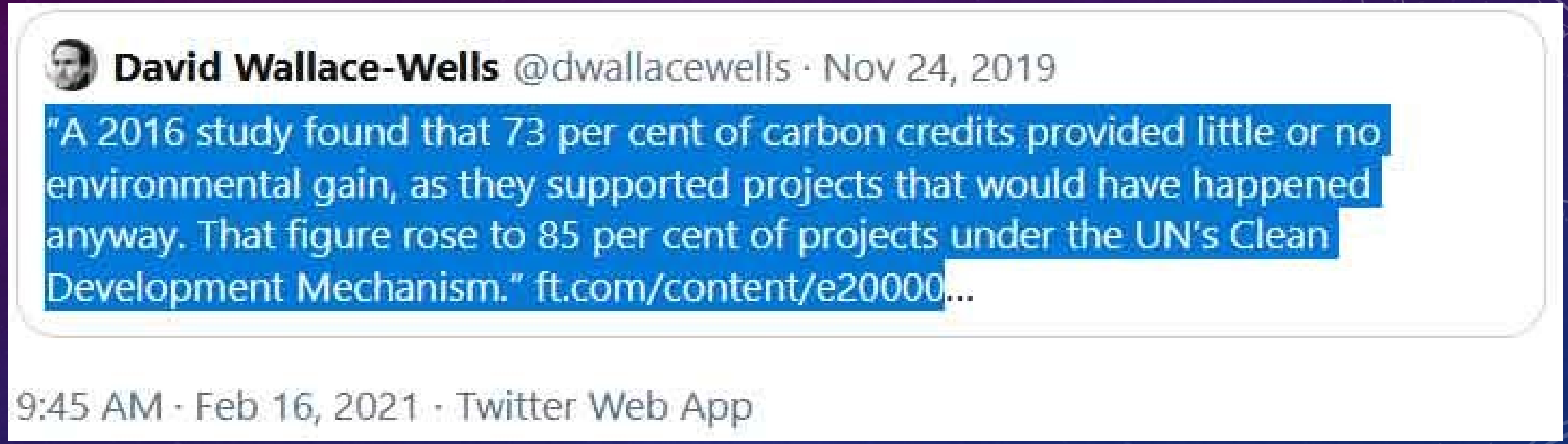
MUST INCLUDE: TIPPING POINTS IN THE CLIMATE SYSTEM.

CANNOT ACCOMPLISH WITH NORDHAUS *et al.* SIMPLE LINEAR, ADDITIVE, AND BADLY UNDERESTIMATED DAMAGE MODELLING.

CONSEQUENCES WILL LAST FOR MILLENNIA. EXTINCTIONS; FOREVER. PAST MASS EXTINCTIONS DID NOT RECOVER TO PREVIOUS BIODIVERSITY LEVELS UNTIL 10'S OF ***MILLIONS*** OF YEARS LATER.

WITH PROPER ZERO DISCOUNTING – IT SAYS **"YOU CANNOT GO THERE!"**

CARBON OFFSETS? NO. ANOTHER FOX-GUARDING-HEN-HOUSE SCANDAL, ESPECIALLY WHEN FACING THE DEADLY CONSEQUENCES WHICH SCIENCE SHOWS. (A PARABLE)



*"Solely in terms of temperature I suggest offsets are likely to be **worse** than doing nothing" – Climatologist Kevin Anderson (source)*

START FROM ABSOLUTE PHYSICS…

- … not “flexible” ethics
- Define the consequences and set absolute priorities from climate and sustainability physics, and let current comforts and financial gains take the back seat later; with whatever we can afford.
- Protect the future. All else is should be secondary.

INTERNALIZING CLIMATE DAMAGE: BANKRUPTCY OF THE FOSSIL FUEL INDUSTRY, EVEN USING THE CYNICALLY HIGH 3% STANDARD DISCOUNT RATE ON FUTURE WELFARE?

- Hope *et al.* (2015) finds that –assuming $105/ton CO2 rising 2.3%/yr - **internalizing climate costs** would **end** the fossil fuel business, as all profits would disappear for all years and all companies studied.
- Unfortunately, **innovation** has improved Big Oil profitability (fracking, horizontal drilling, pressure insertion to revive old wells, steam injection to lower viscosity, etc…)
- I recently heard Exxon can profitably operate at crude oil prices of ~$55/barrel, *vs.* 2022's ~$100/barrel, albeit with the current oil subsidies and externalized pollution damages off-loaded onto the rest of us.

FROM HOPE *et al.* 2011

- *"In almost all cases, it shows that fossil fuel companies are costing society more than they contribute in profits, even those producing lower carbon fuels. There is already concern amongst policy makers about direct subsidies for fossil fuels (IEA 2011). The analysis in this paper suggests the subsidy is actually much greater than perceived.*
- *This is most extreme in the case of coal where the companies we analyzed imposed economic costs on society that were 2 to 9 times their total revenue.*
- *Even with the most generous interpretation of economic value created by a company (considering jobs, taxes, royalties, supply chain purchases, indirect employment etc) their net economic contribution to society is negative, in some cases dramatically so."*

FLAW: OPTIMIZING GDP WITHIN A SYSTEM OF INCREASINGLY SCARCE ESSENTIAL GOODS INCENTIVIZES MORE SCARCITY, NOT LESS

- Why? Because essential goods are price-inelastic. Meaning, their price goes up FASTER than their availability goes down. Example: a 10% drop in availability might mean a 40% rise in prices.
- But GDP rises as (price) x (sales volume). So GDP rises with higher scarcity.
- Neoclassical models say they maximize “utility”, but no;in their actual practice, utility is just GDP.
- Therefore, the policies which proceed from such models ACCENTUATE inequality, ACCENTUATE more rapid depletion of natural resources and food.
- This is the exact opposite of helping present and future total welfare of Earth’s life and civilization, the supposed goal of good economics.

Figure 2 **Distribution of Wealth in the US, 1917–2015**

Source: BofA Merrill Lynch, Emmanuel Saez & Gabriel Zucman

SINCE RONALD REAGAN, THERE HAS BEEN A MASSIVE TRANSFER OF WEALTH FROM THE BOTTOM 90% TO THE TOP 0.1%, ALONG WITH THE POLITICAL POWER THAT WEALTH BUYS

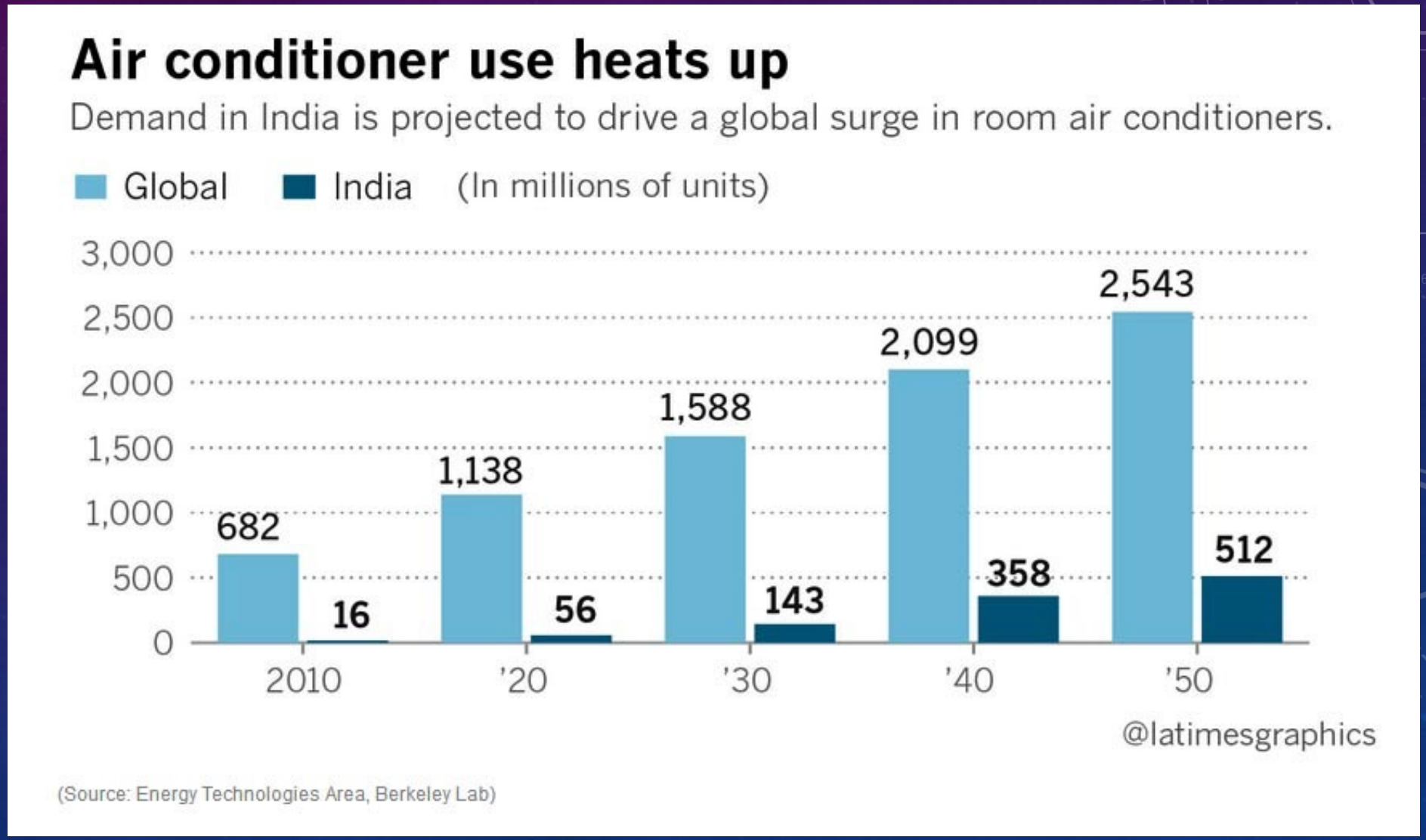
FLAW: NEOCLASSICAL ECONOMICS' "UTILITY" HAS LITTLE TO DO WITH ACTUAL HUMAN WELFARE

- Maximizing "utility" actually, in Neoclassical practice (as in Nordhaus' figures) is to their mind, maximizing GDP.
- The Neoclassic price mechanism is deeply flawed in allocating values. Farley (described here) shows that increasing the price of food results in more food to those who least need it and most waste it – because that's what maximizes GDP.
- Yet Farley describes (40 min in) that our markets allocate essential resources to those who need it least. This will become far more pervasive as crop failures and social fraying of networks increases.

FLAW: NEOCLASSICAL ECONOMISTS CONSIDER THE ENVIRONMENT AS A "LUXURY GOOD"

- As a luxury good, its value is considered very price-elastic. Non-essential. Optional. The environment's value is mainly as a pretty view or nice vacation spot.
- The environment is considered a small part of the Great Human System which in their minds is their Neoclassical Economics. The truth is opposite. Economics is a small, "wholly owned subsidiary of the environment."
- Mass extinctions happen. Ecology scientists find evidence we're in one right now, with plummeting biodiversity. We are not above Nature, we are subjects to Nature.

GLOBAL AIR CONDITIONING RISING 3.3%/YR, MUCH FASTER THAN GLOBAL GDP (~2%). NEO-CLASSIC ECONOMISTS WHICH SEEK TO MAXIMIZE SPENDING WILL PRESUMABLY CELEBRATE, SEEING A STEEPER POSITIVE SLOPE OF GDP. BUT IS IT REAL UTILITY?…



FLAW: REPAIR OF CLIMATE DAMAGES - REAL GDP? OR PURE INFLATION? BE SURE YOU GET IT RIGHT…

- Imagine a static no-growth civilization, but now insert a new economic activity: Continuously hiring delinquent youths to fill their ruck-sacks with rocks, and throw those rocks through every window they can find.
- We generate spending (GDP) for labor (the kids, window manufacturers), and for new capital (the replacement windows).
- In the end, the civilization has no more actual welfare than before this enterprise, and the money to fund all this spending must be created by the banking system supported by Fed policies (as now), only to get us back to where we were: zero true gain. **This is pure inflationary spending. There is no growth in real GDP. In fact, there is *less* wealth, when you include opportunity costs.**
- **Repairing climate damage is similar. Counting that spending as GDP to be maximized, is sheer madness!**

IF THE MADNESS OF NEOCLASSICAL ECONOMICS APPLIED TO CLIMATE CHANGE IS STILL NOT OBVIOUS TO SOME, HERE'S A PARABLE:

- Start with a revolver. One bullet. I suggest to a passer-by: *"Hey, bud, let's play Russian Roulette… whaddya say?"* This passer-by happens to be reasonable and sane, and responds: *"That's NUTS! Put the gun DOWN!"*
- But another passer-by happens to be a Neoclassical economist. He's uncertain. I continue: "Sure, there's a risk you could die, but the odds are that you won't - it's only 1 bullet, and it would be an exciting exercise, no?".
- He responds: *"Well, there's that; a non-zero benefit to what you say. And additionally, I sure wouldn't die of boredom, therefore. But now there's damage costs too, though…"*
- *He continues… "Hmmm. How many chambers in the revolver? 4? 6? 8? If it's 8, that'll improve my odds over a 6-shooter by… (calculate, calculate, calculate…) 33.3333% ☺"*
- *"Hmmmm. Well, I might lose my future, but heck; I was going to discount it away by 3%/year anyway, so it's not THAT big a loss as you might at first think. Yeah, yeah… let me make a utility function! I love 'em! Then I can do some DiffEq's and stroke my physics envy, and maximize!"*
- **Should we play Russian Roulette with Earth's future, and is there only 1 bullet in the climate disaster chambers?**

SUMMARIZING THE FATAL FLAWS OF NORDHAUS / NEOCLASSICAL CLIMATE ECONOMISTS' MODELLING

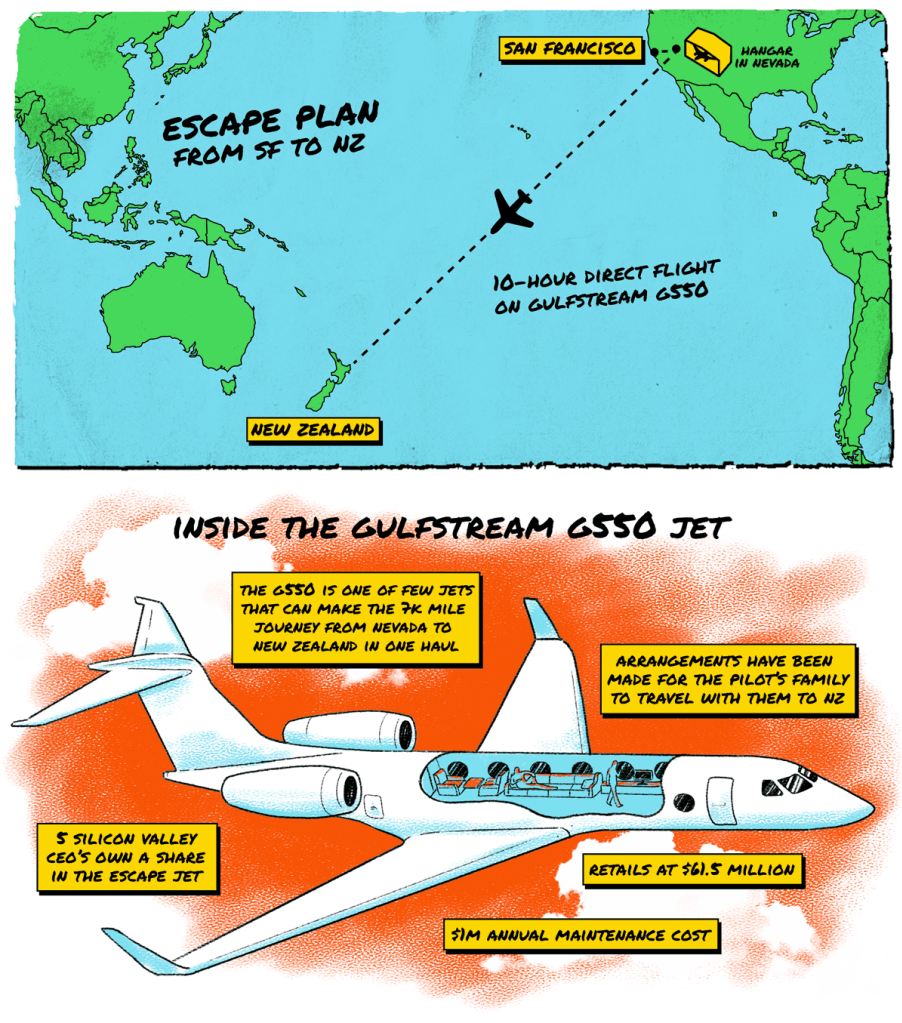
- Gives zero value to future generations' valuation of their own lives. This alone is fatal to any claims of validity.
- Has no appreciation of the non-linear feedbacks which control both climate, and civilization's political and support networks.
- They apply a welfare discount rate to our future. But unlike individuals, civilization itself has no "death date" to justify discounting. With zero discount, cost/benefit formulae blow up and become meaningless, especially when uncertainties still exist
- In my assembling the relevant economic data, I've never seen confidence limits or error bars (as good science demands) given on economists' numbers. What does that say about them?
- They have no mechanism for proper accounting of climate tipping points. Damage functions blow up even more catastrophically, if included. Tipping points are real, and we're at or beyond some of them right now.

- They assume local temperature *vs.* local income is what determines climate change effect on GDP, giving no appreciation for climate change rate as the vector of damage, nor of the non-local effects of temperature and change from globally traded goods/services.
- They put trivial value on the environment which supports us. Assumes we can optimally substitute for whatever Nature has trouble providing us. Created capital, they assume, can always substitute for Natural Capital. This is transparently false. The fragile environment which supports us is NOT substitutable.
- Cost/benefit and mini/max formalisms may have some value in limited business decision-making in appropriate contexts, but it is completely and dangerously the wrong framework to apply for global climate change on a now-unstable finite planet with a long future. Any damage function will blow up and become meaningless to purpose.

ZERO WELFARE DISCOUNT RATE + LONG TERM CRIPPLING OF EARTH SYSTEMS -> NEOCLASSICAL MODELLING BREAKS DOWN COMPLETELY

- A proper ethical welfare discount rate: is zero, or negative.
- Reject DICE, FUND, PAGE, RICE and the rest of Neoclassical economic climate modelling.
- Given the science assessment of high risk catastrophic consequences lasting for tens to hundreds of millennia, their optimization ideology completely breaks down because the actual damage function will actually race towards 100%.

DO THE SUPER-RICH AND THE MAINSTREAM ECONOMISTS WHO SERVE THEM, REALLY BELIEVE WHAT THEY WRITE?



- It's perhaps telling, that so many Silicon Valley billionaires are "prepping" for the End Times, building their luxury bunkers in cooler climate New Zealand.
- Should we be re-assured, that at least the Best and the Brightest, the "meritocracy elite" according to *Laissez Faire* Capitalism, and who are served so well by our mainstream political/economic paradigm, are going to at least survive longer than you and I - the not-so-Elite?
- Reminds me of Dr. Strangelove.
- In case you're thinking of escaping to New Zealand. Too late. No longer accepting immigration.

INSTEAD: ASK THE SCIENTISTS AND ENGINEERS (AND PSYCHO-THERAPISTS?) WHAT ACTIONS ACHIEVE A STRICT GOAL OF CLIMATE STABILITY COOLER THAN TODAY (TO HALT INDIRECT EMISSIONS AND ZERO-OUT "IN THE PIPELINE" RADIATIVE IMBALANCE).

- …as we work out the sanest way towards Civilization degrowth (see Civilization as a Thermodynamic System, a later talk, for why) in order to permit long term Earth sustainability.
- Only then consider how to insure payment of the costs.
- Why? Because physics and thermodynamics laws are NON-NEGOTIABLE.
- Ecological economists who understand climate can play a part.
- But Neoclassical economists have dominated policy politics, yet continue to demonstrate that they cannot be entrusted with our future. Exclude them.

ECONOMIC GAME THEORY FINDS – CLIMATE NEGOTIATIONS WILL CONTINUE TO FAIL…

- **…finds this study** applying **Game Theory** and **Nash equilbria** (remember, "A **Beautiful** Mind"?)
- When given climate negotiation-mimic'ing realistic rules and choices, including a realistic amount of uncertainty as to when we hit the tipping points leading to climate catastrophe and doom for all, then competitive **negotiators will still choose to risk catastrophe rather than contribute to insure full funding.**
- Why? Competitive advantage. Negotiators valued being the RELATIVE $winner even higher than they valued the survival of a sane future.
- In a system of competitive players within a global competitive atmosphere, this is **MAD**. **M**utual **A**ssured **D**estruction is the result.
- Read the details **here**

CAPITALISM – IDOLIZED IN THE U.S. - BUT THE PRACTITIONERS HAVE DOCUMENTED PSYCHOPATHIC TRAITS…

"Capitalism is the extraordinary belief that the nastiest of men for the nastiest of motives will somehow work for the benefit of all."

John Maynard Keynes

WHILE IT MAY SEEM CORPORATIONS ARE COMPLETELY CORRUPT (BELOW), IT'S NOT ENTIRELY TRUE…

Independent Science Shows Harmful Effects from BPA, while Industry Science Shows None

A recently-published review of scientific studies shows that, in the last 7 years (through November 2005), 151 studies on the low-dose effects of BPA have been published.(37) None of the 12 studies funded by the chemical industry reported adverse effects at low levels, whereas 128 of 139 government-funded studies found adverse effects. These many studies were conducted in academic laboratories in the U.S. and abroad. Even the 12 industry-funded studies have flaws, however. Of the industry studies, two had their positive controls fail—an indication that the entire experiment had failed, not that BPA had not caused an adverse health effect.

	Adverse health effect	*No effect*
Plastics Industry funded	*0*	*12*
Government funded	*128*	*11*

Another industry study concluded BPA caused no adverse effect, but an independent analysis of the experiment's data by scientists convened by the National Toxicology Program of the U.S. Department of Health & Human Services concluded that in fact there was an adverse effect. Industry scientists had misreported their own results. The chemical industry relies on an incomplete review of scientific studies by an effort funded by the American Plastics Council at the Harvard Center for Risk Analysis. The panel funded by the American Plastics Council only considered 19 studies in concluding in 2004 that the weight of the evidence for low-dose effects of BPA was weak.(38) As of November 2005, there were 151 published studies on the low-dose effects of BPA.

CAPITALISM *PER SE*, IS NOT IMMORAL, IT IS AMORAL

- Immorality is the perverse pleasure taken in flaunting actions and behavior which violate valid moral codes.
- Amoral actions are actions which take no recognition of morality; it doesn't enter the equation. The actions may be moral, or not.
- The single-minded goal of capitalism is to accrue money to the capitalist and the corporation that he acts for, and it is very efficient at doing this. We write this mandate into the corporate charters.

A GOOD ANALOGY FOR CAPITALISM

EFFICIENT, GOAL ORIENTED, AMORAL, AND RELENTLESS.

BUT IT ISN'T THAT PRO-CAPITALISTS WANT TO DESTROY THE EARTH; ANY MORE THAN "THE TERMINATOR" ENJOYED DESTROYING THIS TRUCK. **THE TRUCK JUST GOT IN THE WAY.**

SIMILARLY, **THE EARTH JUST GOT IN THE WAY**... **OF THE CAPITALISTS.**

And so…

…this is the human dilemma we have made, with the help of Natural Selection's evolution of our genetic traits, and the leaders we empower (or tolerate), and the economists they employ.

(Thank you, to my Astro 7 student Amanda F. for this great artwork)

THE 4TH PRESENTATION TO COME…

- Exploring Civilization as a Thermodynamic System, and how it limits realistic options.
- Policy failures, prediction failures…. And
- Alternate strategies.