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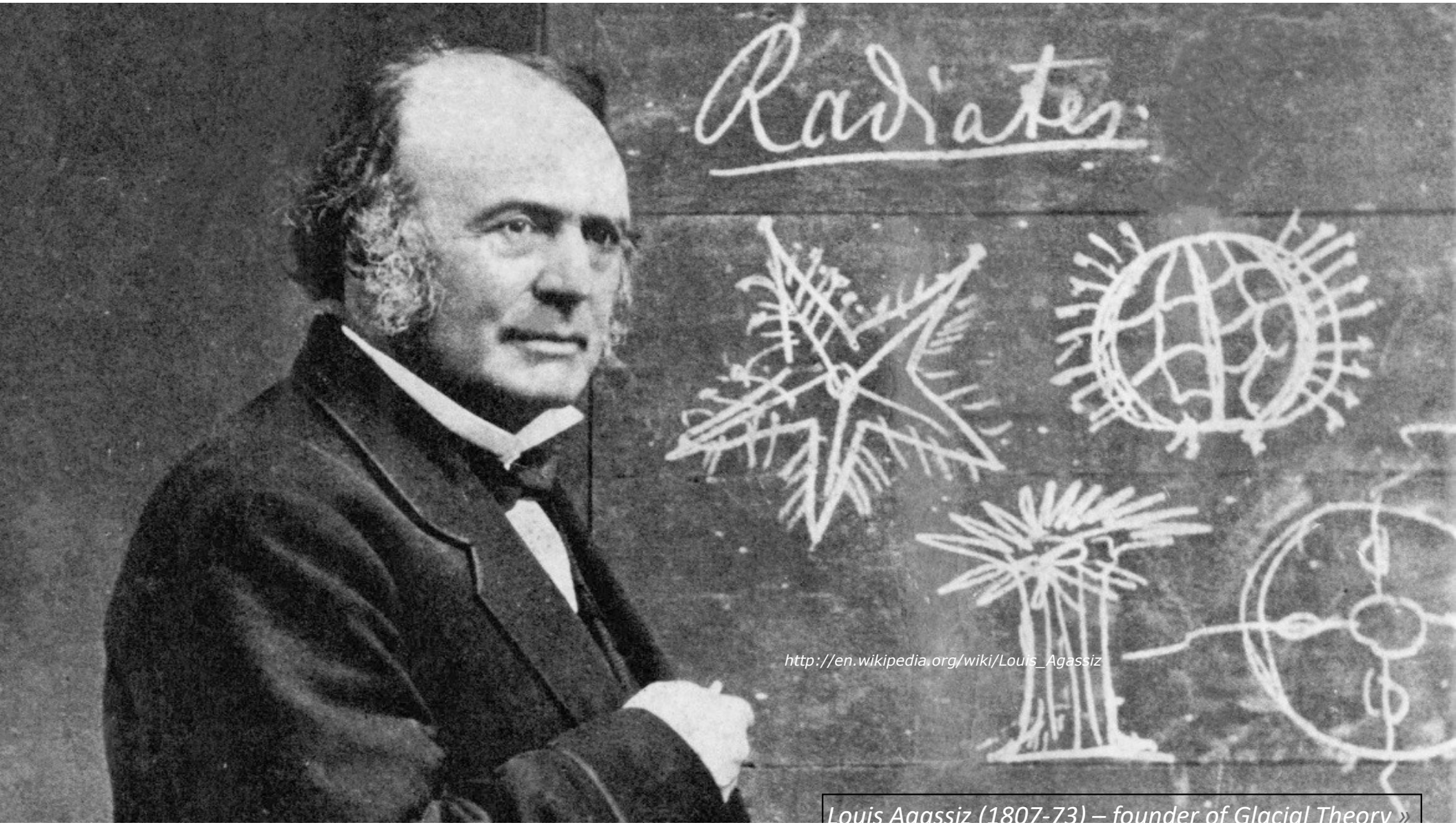
Climate change

the science, the impacts, the urgency

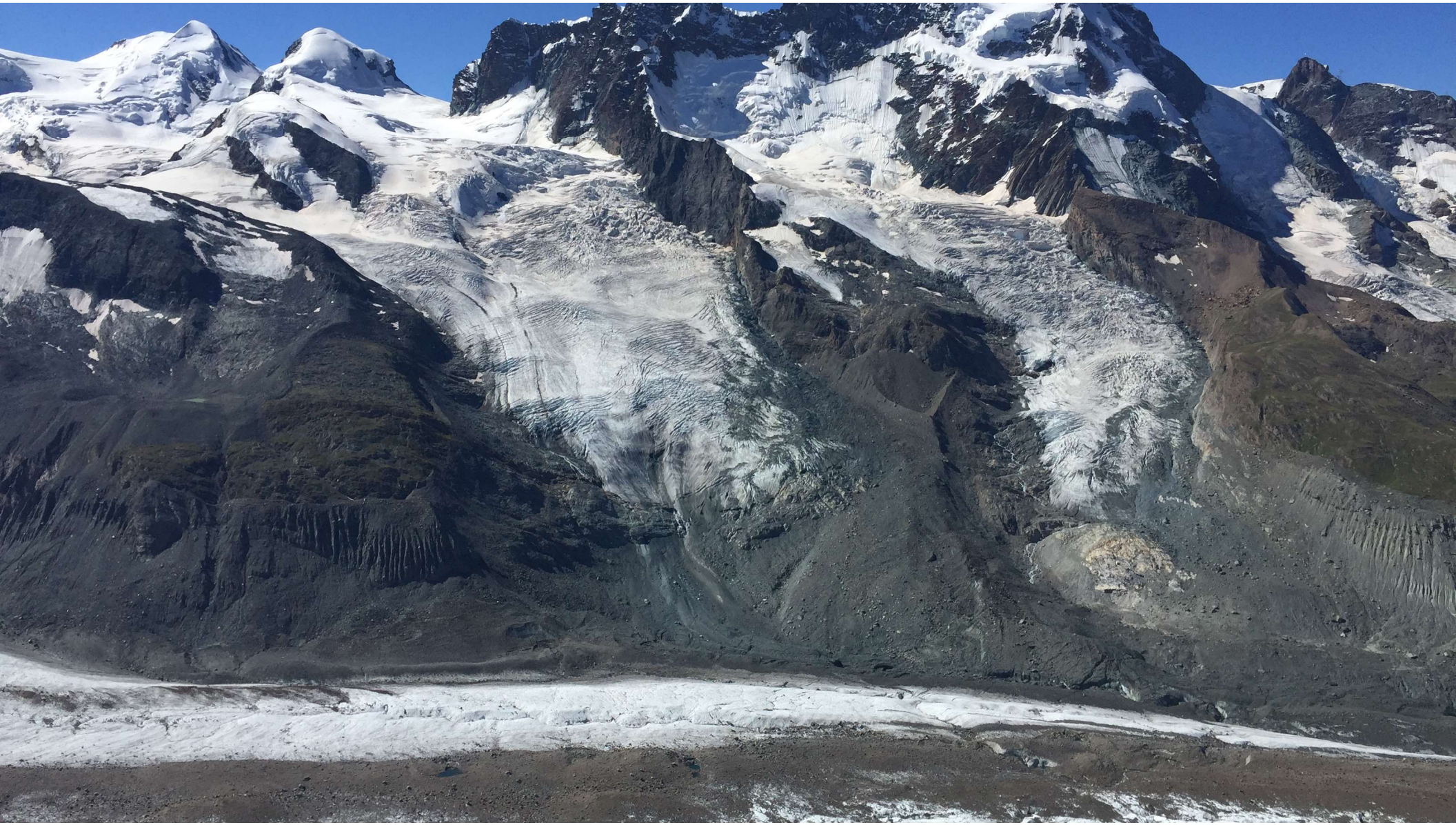
Martin Siegert

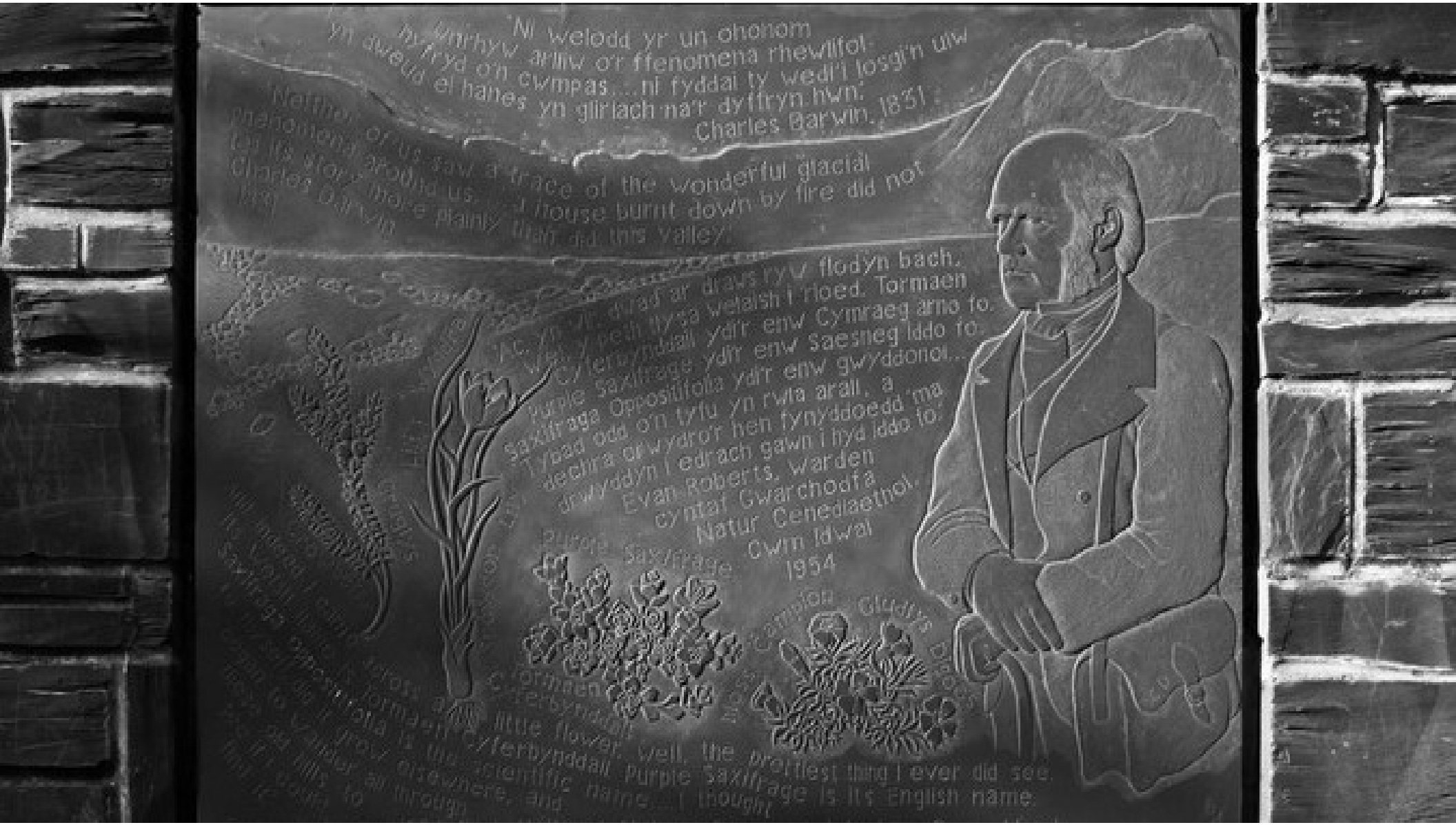
Grantham Institute
Climate Change and the Environment



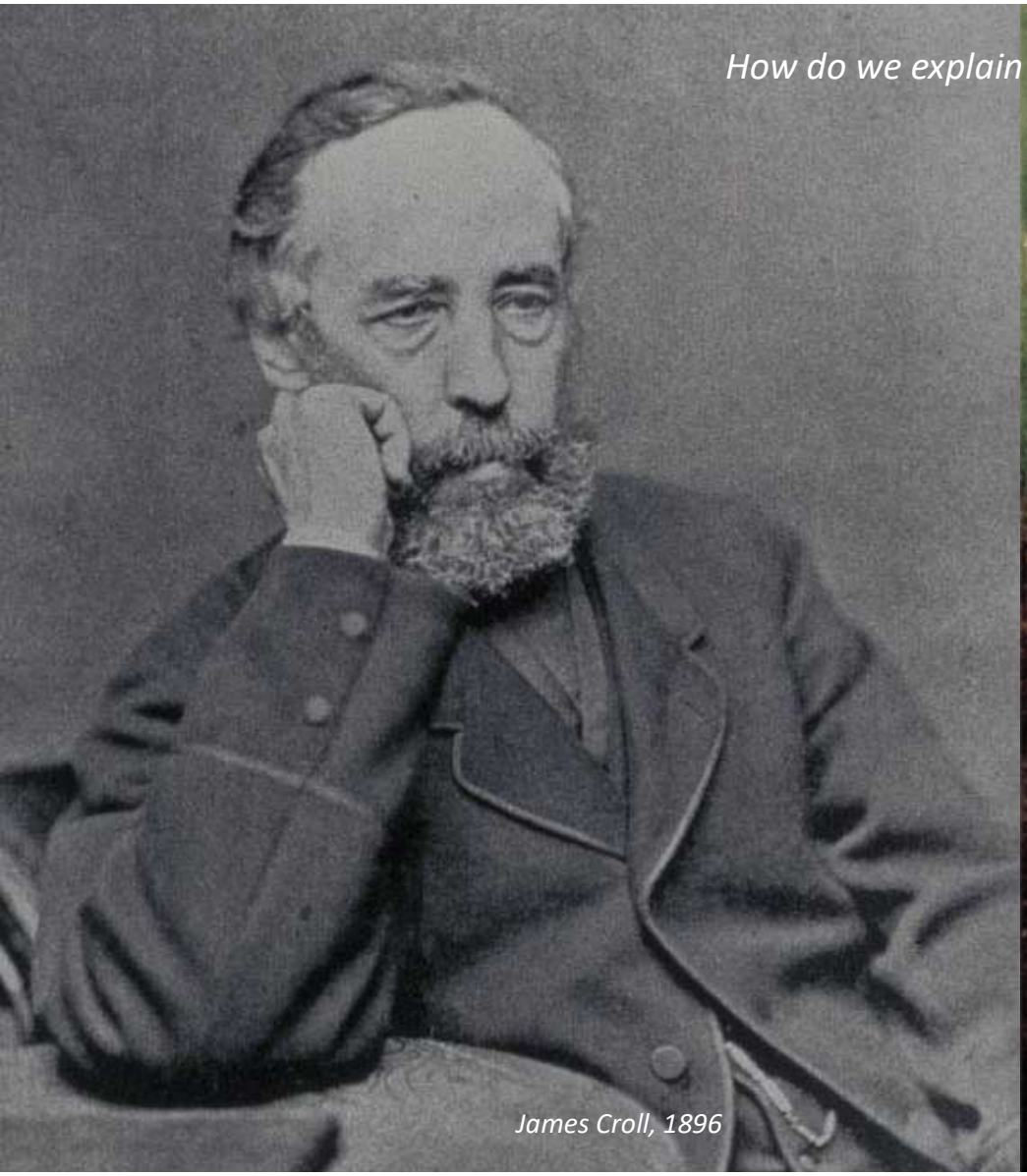
Louis Agassiz (1807-73) – founder of Glacial Theory »

Kummakivi Balancing Rock – Finland

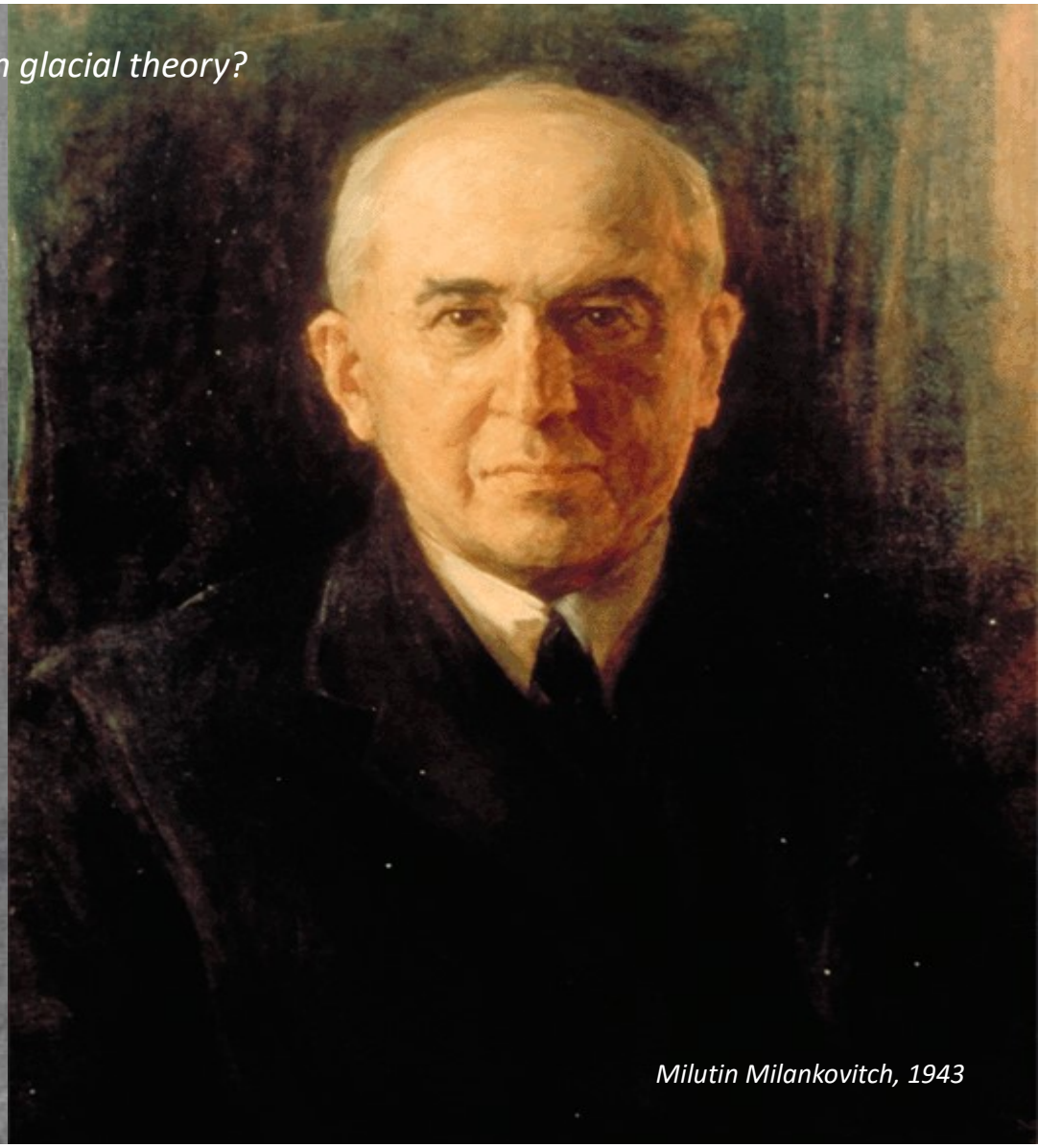



Ni welodd yr un ohonom
byth fwrhyw arlliw o'r ffenomena rhewlifol
yn dweud el hanes yn glirlach na'r dyffryn hwn.
Charles Darwin, 1831
Purple Saxifrage
Cwm Idwal
1954

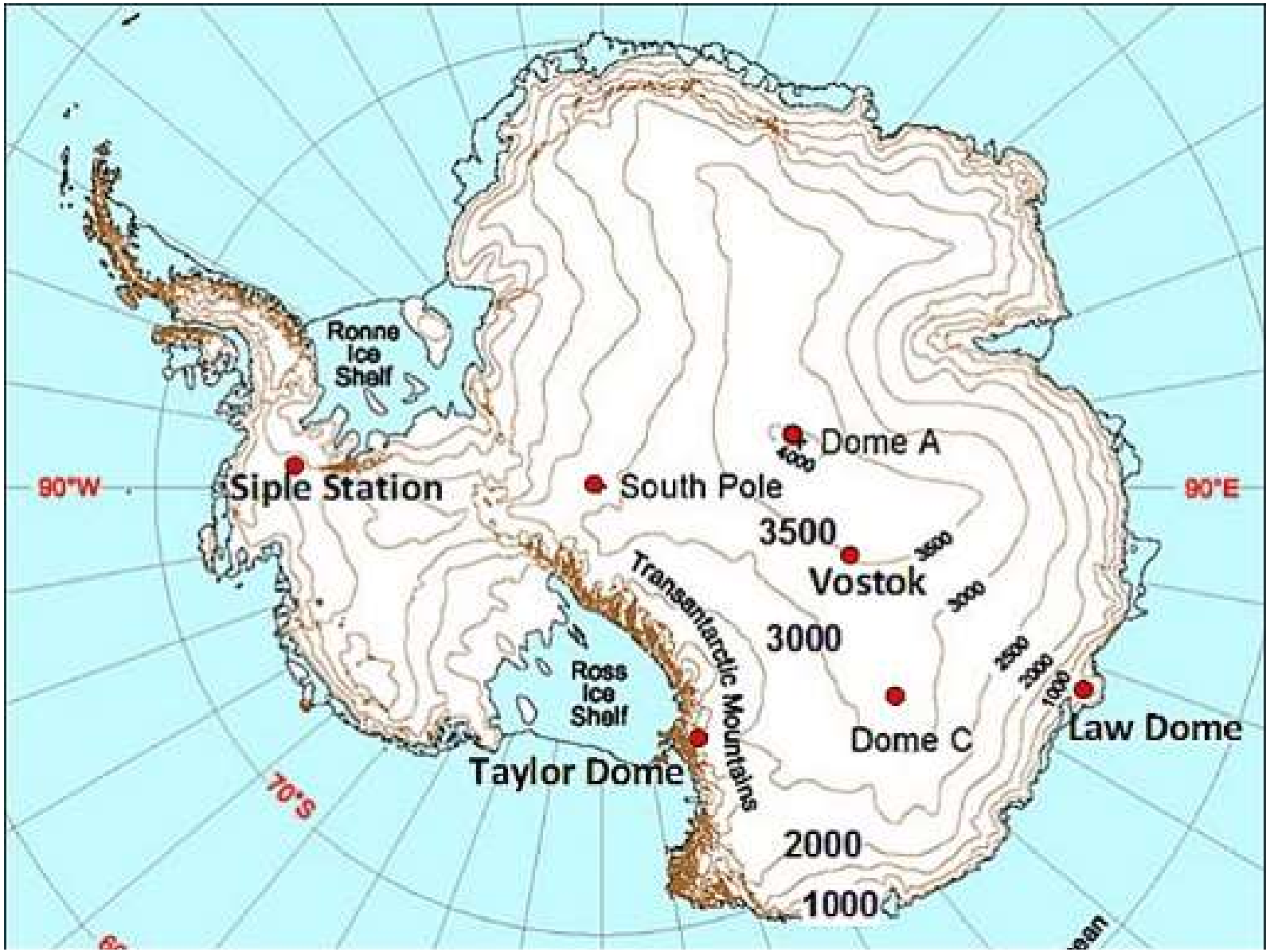
How do we explain glacial theory?

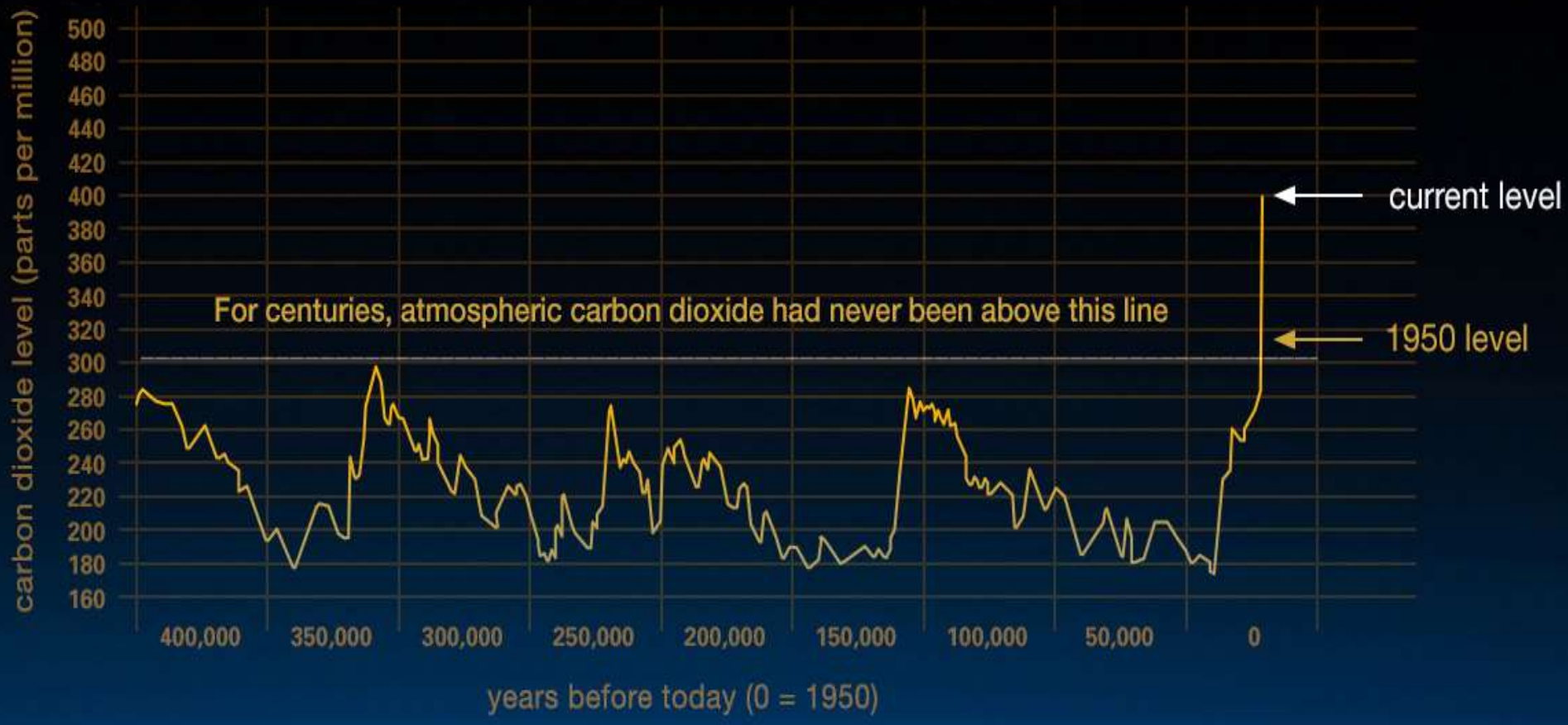


James Croll, 1896

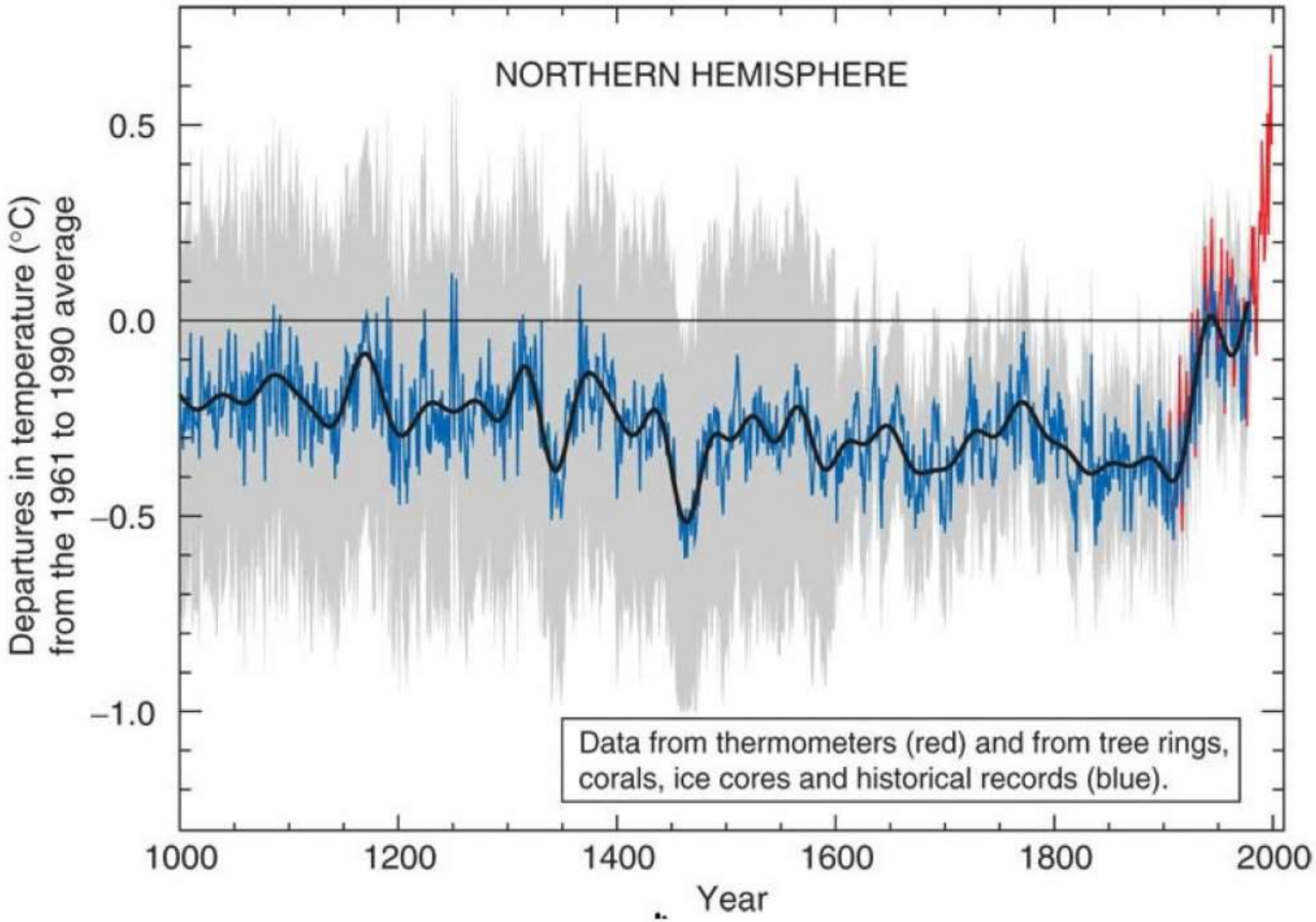


Milutin Milankovitch, 1943

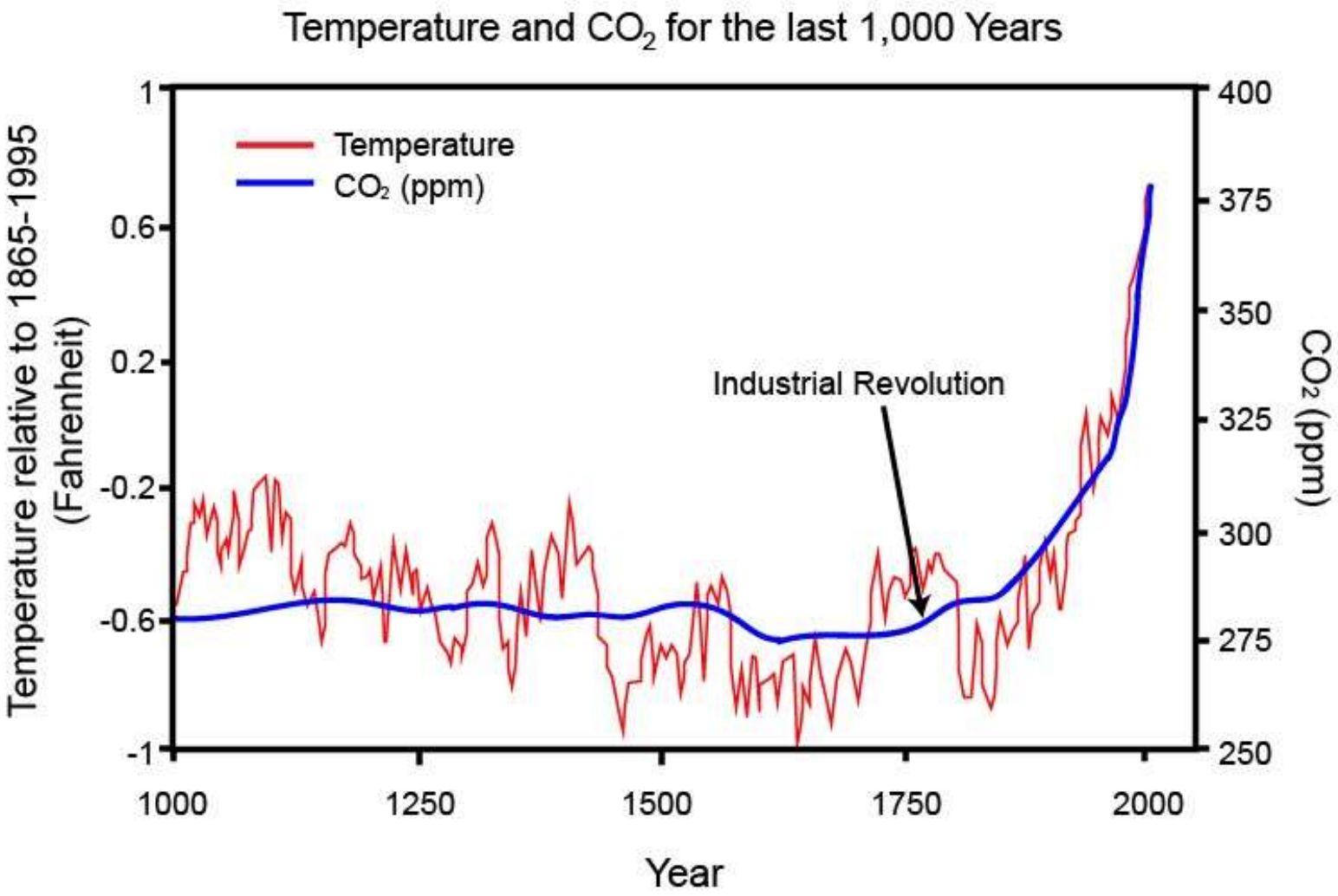

Ronne
Ice
Shelf
Dome A
4000
90°W
Siple Station
South Pole
90°E
3500
3500
Vostok
3000
Transantarctic Mountains
Ross
Ice
Shelf
3000
2500
2000
1000
Dome C
Law Dome
Taylor Dome
70°S
2000
1000



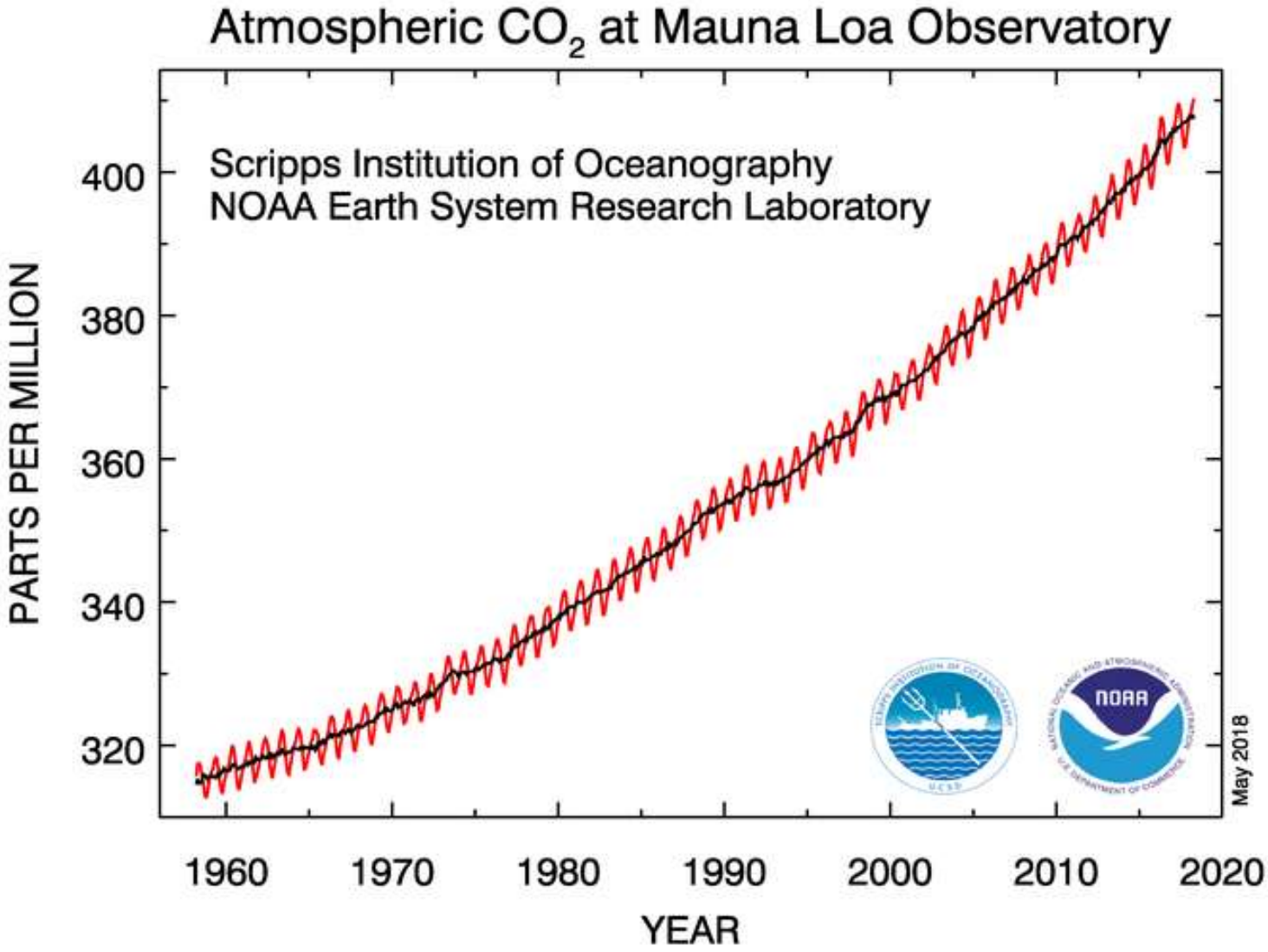
https://climate.nasa.gov/news/2535/satellite-data-confirm-annual-carbon-dioxide-minimum-above-400-ppm/

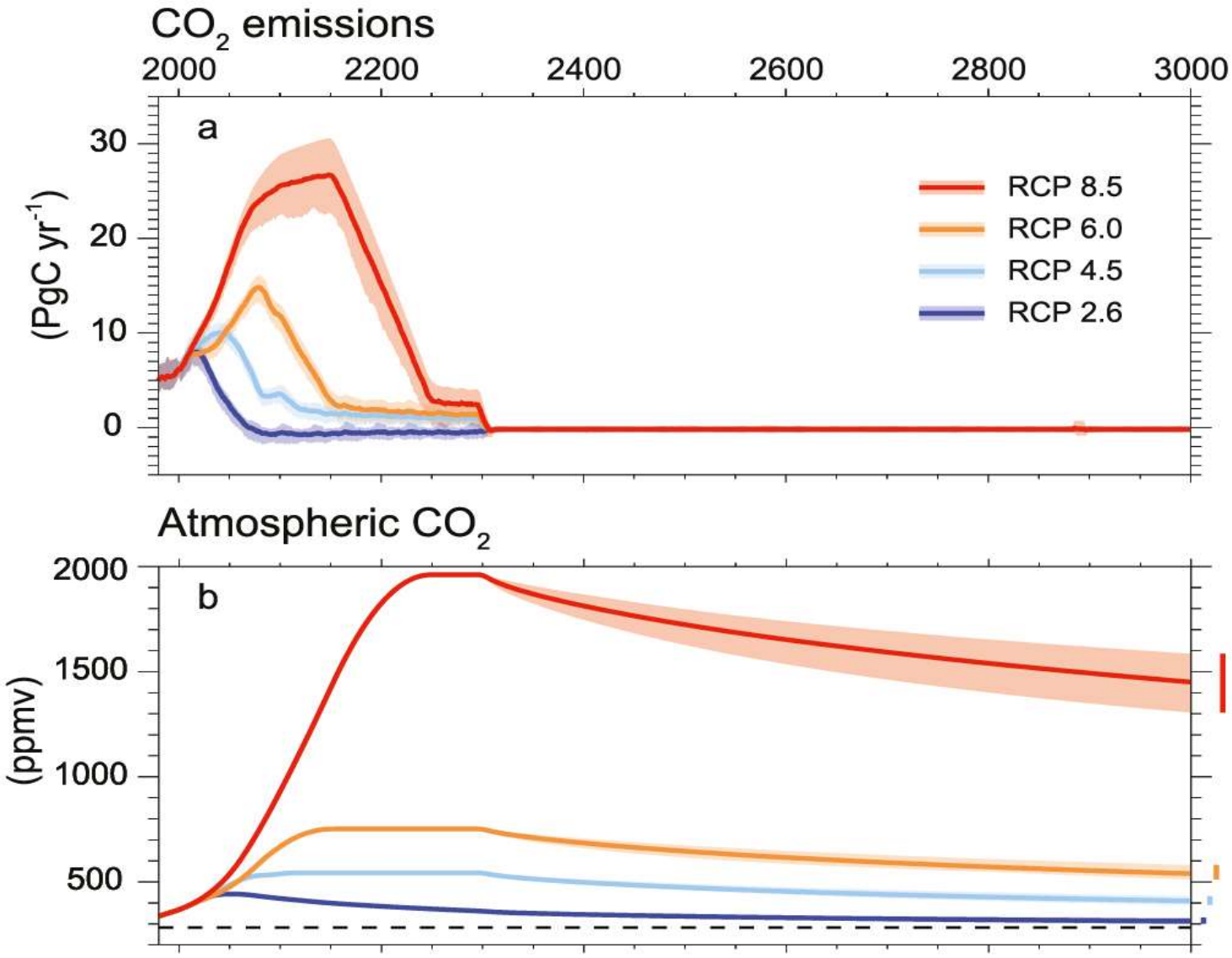


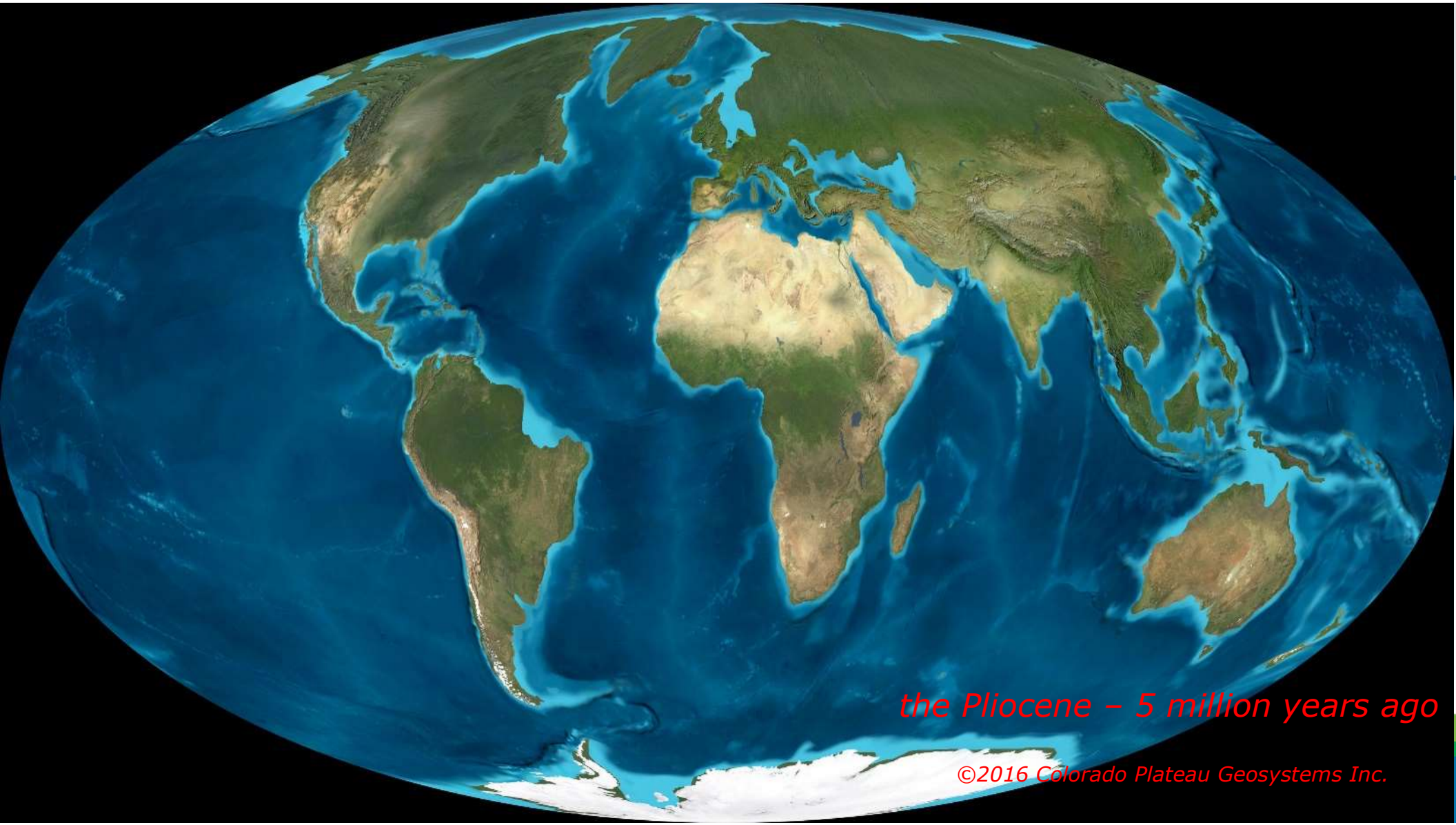
http://www.climatecentral.org/news/temperature-plateau-is-likely-due-to-warming-of-deep-oceans-16280

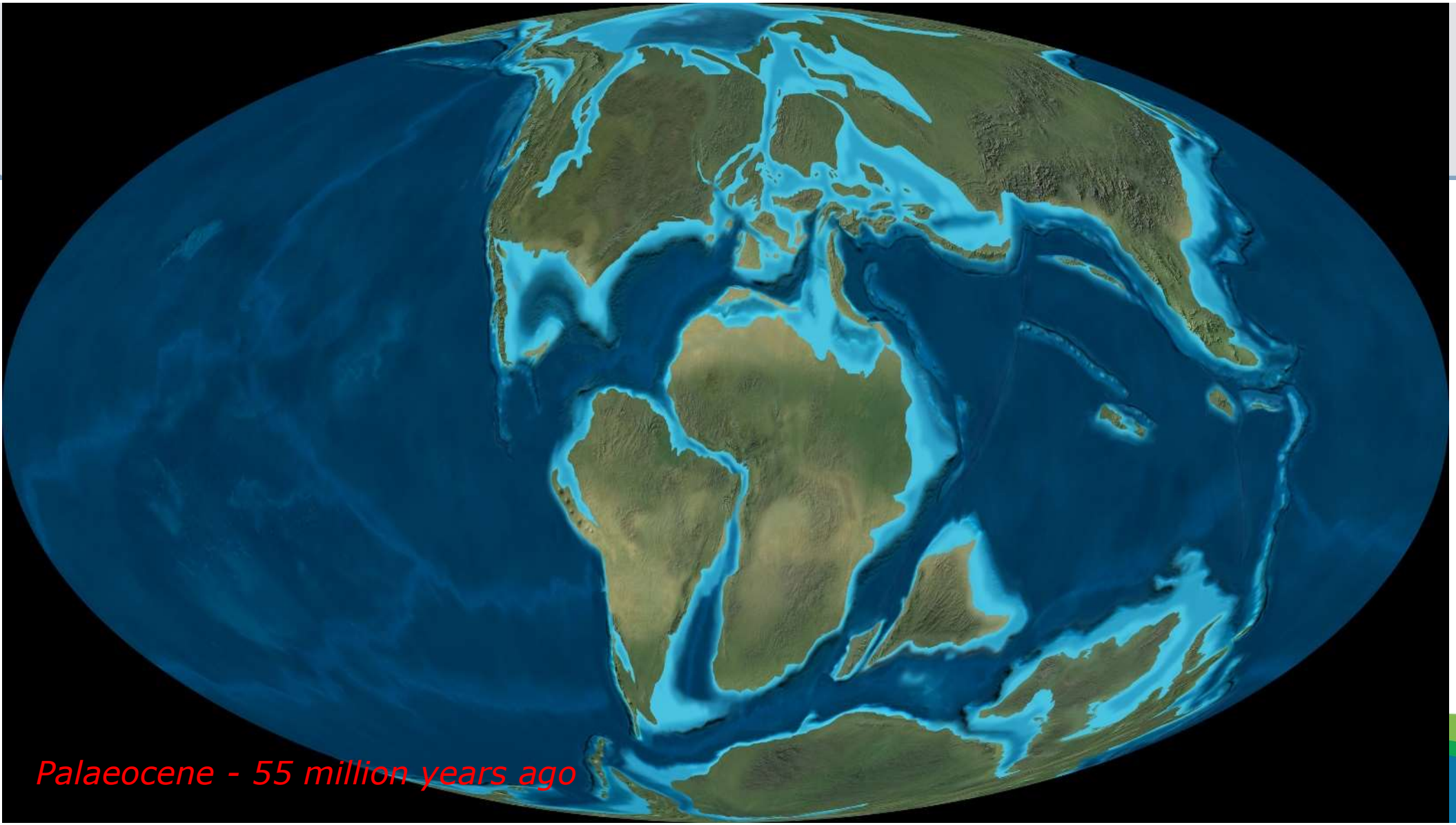


https://timescavengers.blog/climate-change/co2-past-present-future/


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
2020
YEAR
May 2018


CO2 emissions
2000
2200
2400
2600
2800
3000
a
30
20
10
0
(PgC yr-1)
RCP 8.5
RCP 6.0
RCP 4.5
RCP 2.6
Atmospheric CO2
b
2000
1500
1000
500
(ppmv)


the Pliocene – 5 million years ago
©2016 Colorado Plateau Geosystems Inc.


Palaeocene - 55 million years ago

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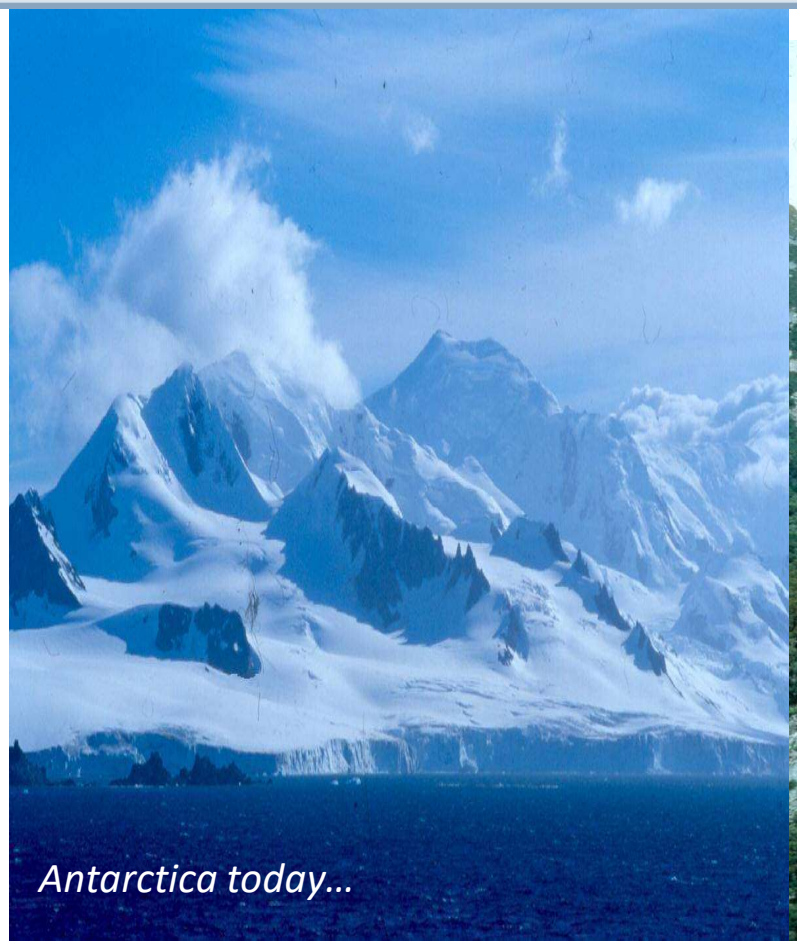
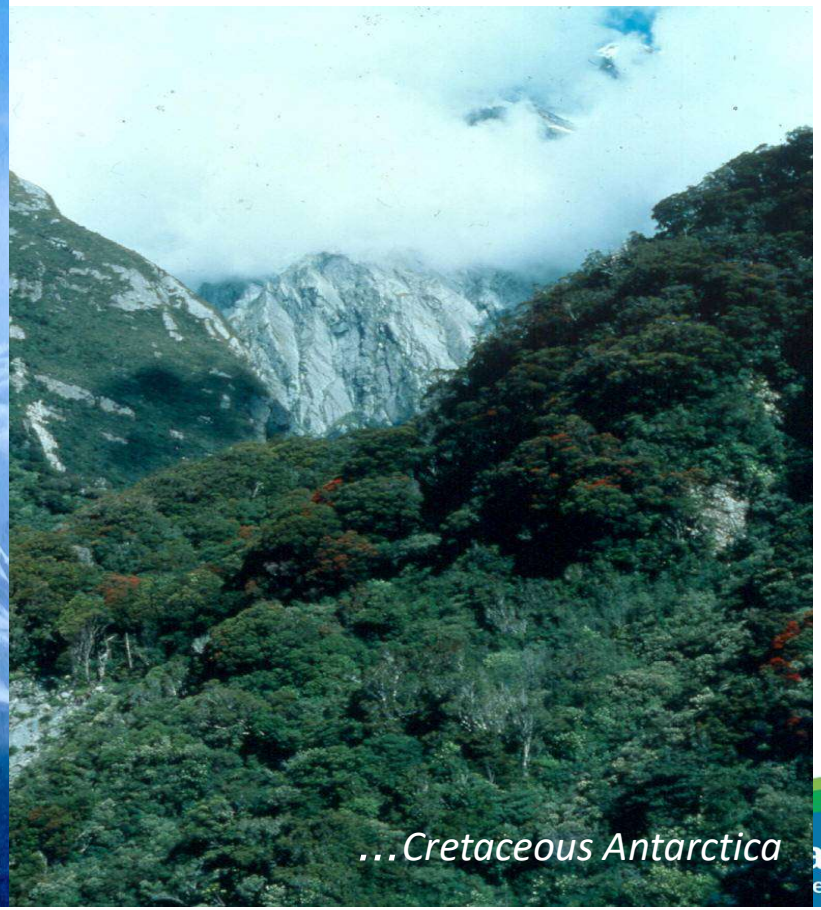


Antarctica today…



…Cretaceous Antarctica

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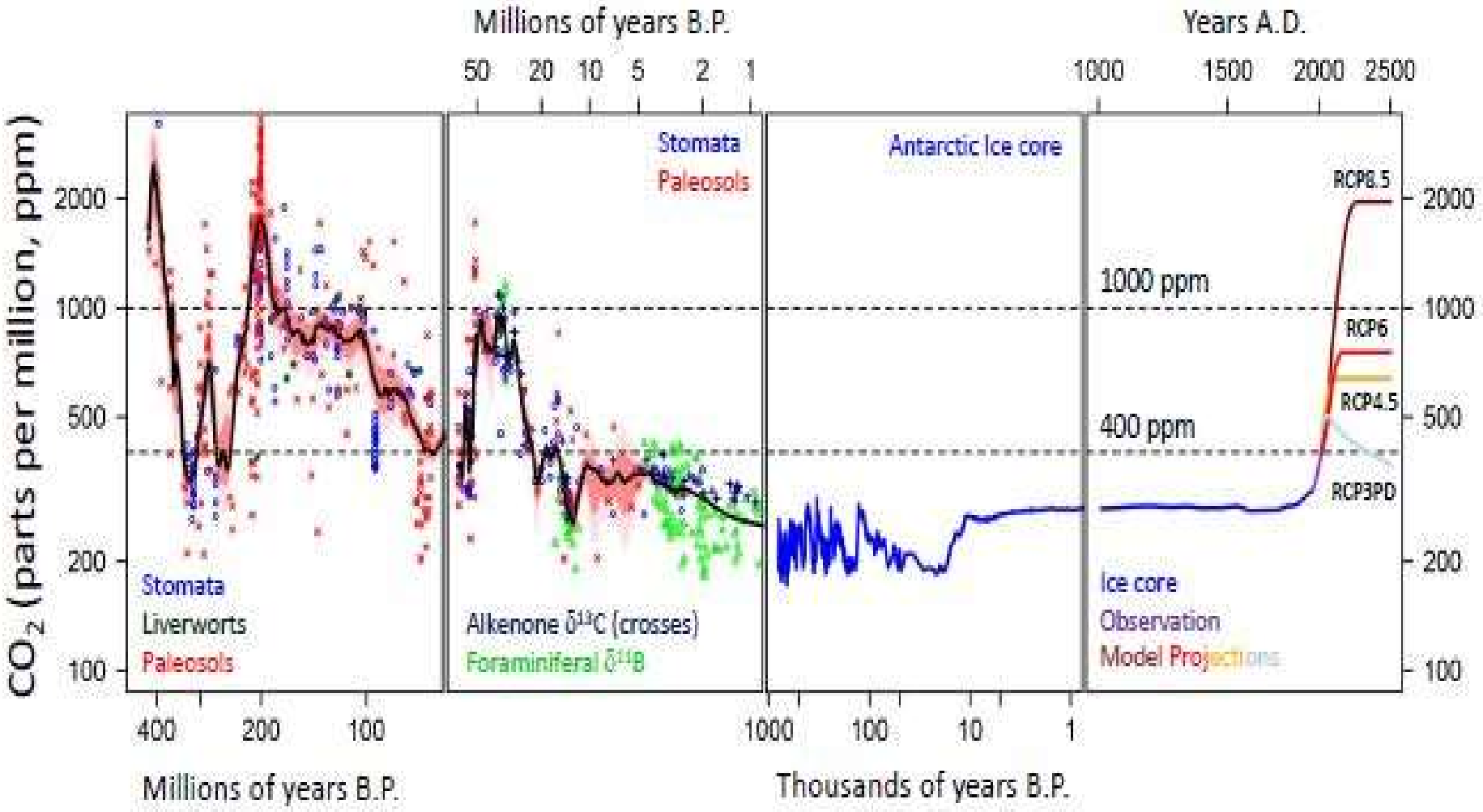
Slide 22

JS3 Do you have an Antarctic image that doesn't look stretched?
James Spencer, 18/06/2018



Foster et al. 2017

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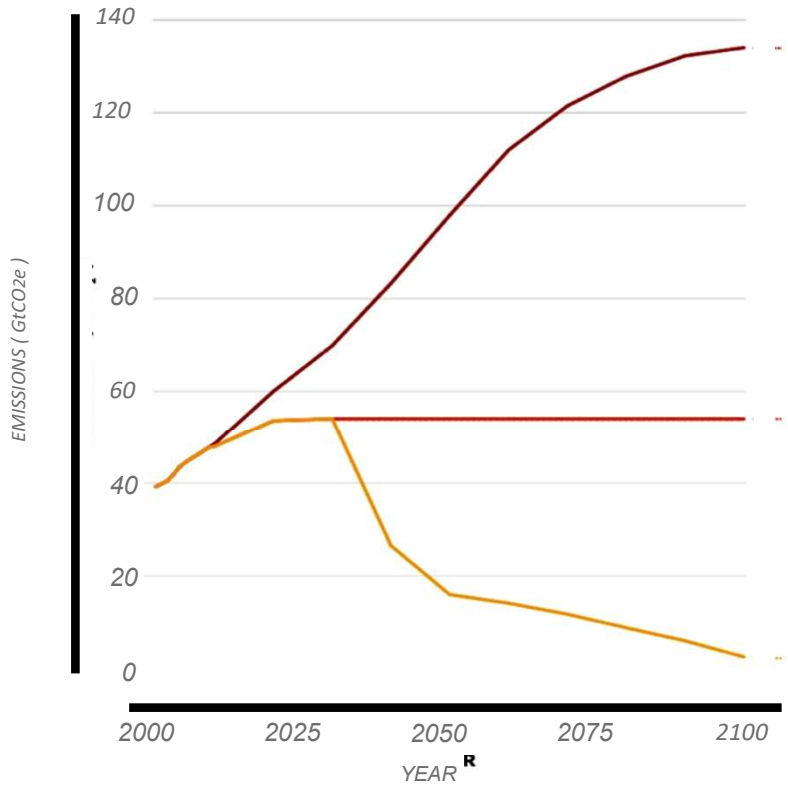
AVOID 2
Can we avoid dangerous climate change?



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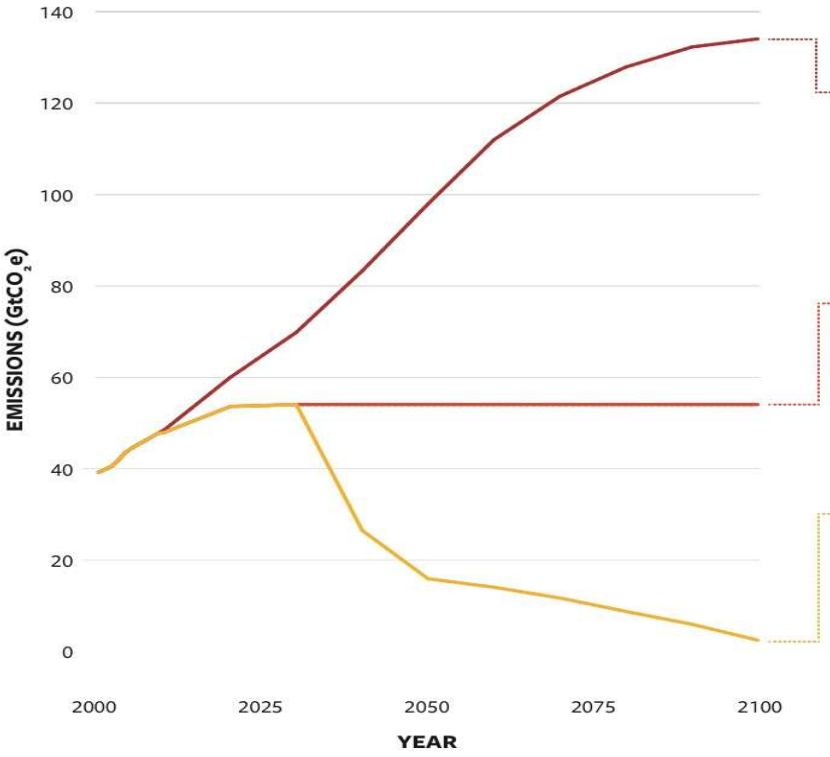
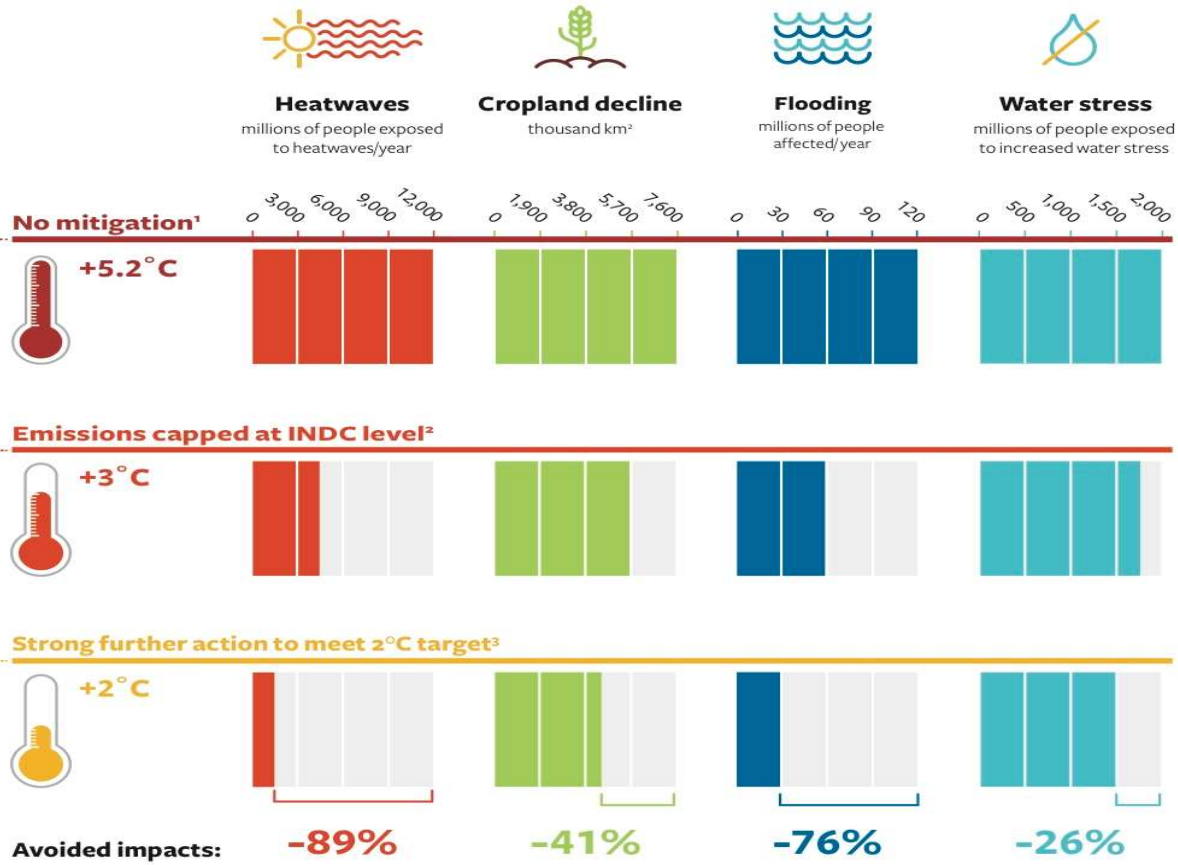
AVOIDING THE IMPACTS OF DANGEROUS CLIMATE CHANGE

With sustained effort up to and beyond 2030, the Paris pledges will limit the severity of key impacts on people and society.



SELECTED GLOBAL CLIMATE IMPACTS IN 2100[4]



Footnotes: The scenarios used are:
1. No mitigation: RCP8.5
2. Emissions capped at INDC level: INDC pledges to 2030 and no backtracking
3. Strong further action to meet 2°C target: INDC pledges to 2030, with further large reductions in greenhouse gas emissions to meet 2°C by 2100
4. Relative to a scenario with no climate change

The temperatures displayed here represent median values for each scenario. Water stress and cropland availability will also be affected by land use decisions e.g. concerning biofuels.

For more information, please visit www.avoid.uk.net/indcs/moreinfo

AVOID 2
Can we avoid dangerous climate change?

WHAT WILL IT TAKE TO ACHIEVE 2°C?

Delaying action to 2030 will increase the costs of decarbonisation.
It will also mean we will need to introduce new technologies more quickly.

HOW MUCH WILL DECARBONISATION COST?

Mitigation costs as share of global GDP over the 21st century[1]

GLOBAL ACTION BY 2020 — **1.7%** GLOBAL GDP

GLOBAL ACTION BY 2030 — **2.2%** GLOBAL GDP

HOW FAST WILL WE NEED TO DECARBONISE?

Modelled rate of decarbonisation required (%/year)[2,3]

4% fastest known sustained annual rate of decarbonisation[5]

HOW FAST WILL WE NEED TO DEPLOY KEY TECHNOLOGIES?

Deployment rates (up to ... GW/year)[2,3,4]

WAITING UNTIL 2030...

...will cost 30% more[6]

...means decarbonising two to three times as fast as if we start in 2020

...means deploying key low-carbon technologies at rates far greater than 50 GW/year: as fast as coal use increased at the start of the 21st century

2000–2010 average annual deployment rates (GW/year)

1. Using one illustrative model that fits IPCC range
2. Using a range across three models
3. Rate is for the decade following start of action
4. Deployment rates are average annual rates over the decade following the start of mitigation action
5. Maximum average annual decline over a decade, Sweden 1973–1983
6. Delaying the deployment of key technologies would further increase mitigation costs

For further information, please visit www.avoid.uk.net/feasibility/moreinfo

AVOID 2 — Can we avoid dangerous climate change?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