

Stay Below Tipping Points

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TIPPING POINTS – ICE IS ALREADY IN THE DANGER ZONE TODAY

Glacier/ice sheet melt & associated SLR will be locked-in when we reach various temperature tipping points

Antarctica was thought to be a bastion of ice that will not melt & contribute materially to SLR within this century. We were wrong. The rate of ice loss in Greenland today is 5x that of 20 years ago while Antarctica's contribution to SLR is 6x than 30 years ago. Every year, [more grim news emerge](#) adding to accelerating & rapid multi-metre SLR fears. **Widespread ice shelf melting by 2100 is now unavoidable for West Antarctica, which could lead to the collapse of the West Antarctic Ice Sheet (3-5m SLR).** Moreover, portions of the East Antarctic Ice Sheet, long thought to be stable, are now starting to behave like the unstable West Antarctic Ice Sheet as per a consensus paper. **At today's temperatures, we are likely to have locked in 6-9m of SLR – whether 2-3m of this occurs sooner (by 2100) or later (2200 onwards) depends on if we can limit warming to 1.5°C – it's up to us!**



State of the Cryosphere 2024 - Lost Ice, Global Damage

International Cryosphere Climate Initiative (ICCI)

"A compelling number of new studies, taking into account ice dynamics, paleo-climate records from Earth's past & recent observations of ice sheet behavior point to thresholds for both Greenland and parts of Antarctica well below 2.2°C. Many ice sheet scientists now believe that **exceeding even 1.5°C will be sufficient to melt large parts of Greenland & West Antarctica, & potentially vulnerable portions of East Antarctica**; generating inexorable sea-level rise that exceeds 10m in the coming centuries, even if air temperatures are later decreased."



"...extensive West Antarctic ice shelf melting, including in regions crucial for maintaining ice sheet stability, is now inevitable, even with very low emissions. This means that the opportunity to preserve much of the West Antarctic Ice Sheet, with its potential 5m of sea-level rise, has probably passed. Its loss can be slowed, but not prevented entirely."

State of the Cryosphere 2023



"For regions like the Hindu Kush Himalaya, frankly even 1.5°C is too high."

State of the Cryosphere 2023

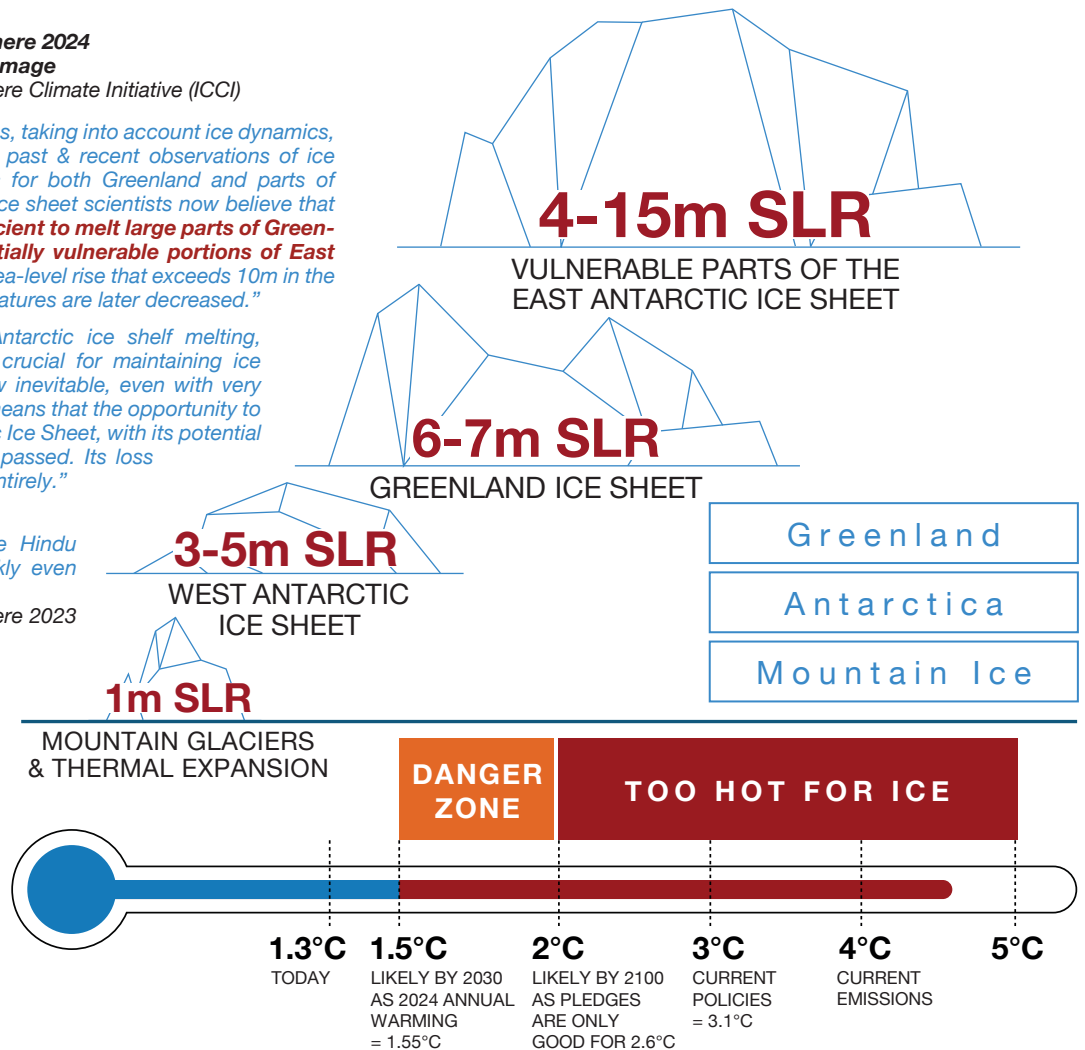
"Severe and potentially permanent changes to the water cycle, due to loss of snowpack and ice run-off during the warm summer growing season, will impact food, energy & water security."

State of the Cryosphere 2024



Surging Seas in a warming world UN, 2024

"every additional 0.1°C of temporary overshoot above 1.5°C – even if temperatures later decrease – increases the risk of triggering such tipping points"



ACCELERATES WARMING Permafrost thaw & committed emissions

We face significant challenges with greenhouse gas emissions from Arctic permafrost thaw, which has not been fully included in the carbon budget. As our world warms, permafrost (frozen ground) in polar and tundra regions begin to melt, releasing methane, one of the most potent greenhouse gases. This in turn heats the world even more, releasing more methane. We expected permafrost thaw to happen sometime in the future but it is happening now. Get on top of this now... it's bad!

[Permafrost](#)


ACCELERATES WARMING Loss of sea ice & albedo effect

Sea ice reflects solar energy back to space. This albedo effect keeps our planet cool but accelerated ocean warming has meant that sea ice has now dropped to "mind-blowing" low levels. Less sea ice means that less energy is reflected but the darker sea waters now exposed to sunlight will absorb more heat, further accelerating ice melt in the polar regions. Sea ice also helps protect ice sheets from ocean warming so their loss will escalate rising seas. See the extent of losses now ...

[Sea Ice](#)

Source: CWR; Otsuka et al. (2023), Earth System Science Data (15); Rignot et al. (2019), PNAS (116); Naughten et al. (2023), Nature Climate Change (12); Stokes et al. (2022), Nature (608); ICCI State of the Cryosphere 2023 & 2024; ICCI report "Threshold and Closing Windows" (2015); Bochow et al. (2023), Nature (622); UN (2024) Surging Seas in a warming world; Möller et al. (2024), Nature Communications (15); WMO State of Climate 2024; WMO; UNEP Emissions Gap Report 2024; IPCC AR6 WG3 (2022).

Note: The global warming thresholds above are based on 10-year averages and not annual warming which for 2024 has reached 1.55°C, compared to 1.45°C in 2023 and 1.15°C in 2022.

Reality Check! Multi-metre SLR & seas rising 3-4m within a century has happened before!

Actual SLR in the past...



REALITY CHECK

Temperatures were 2°C-3°C warmer than the pre-industrial period during the Pliocene, some 3 million years ago, when CO₂ concentrations were ~400ppm. We breached these levels back in 2015. In May 2023, CO₂ levels officially reached 424ppm – this is 50% above pre-industrial levels, the highest in at least 3 million years. Levels have only risen since – it was ~427ppm in June 2024. SLR during the Pliocene reached as high as 25m.

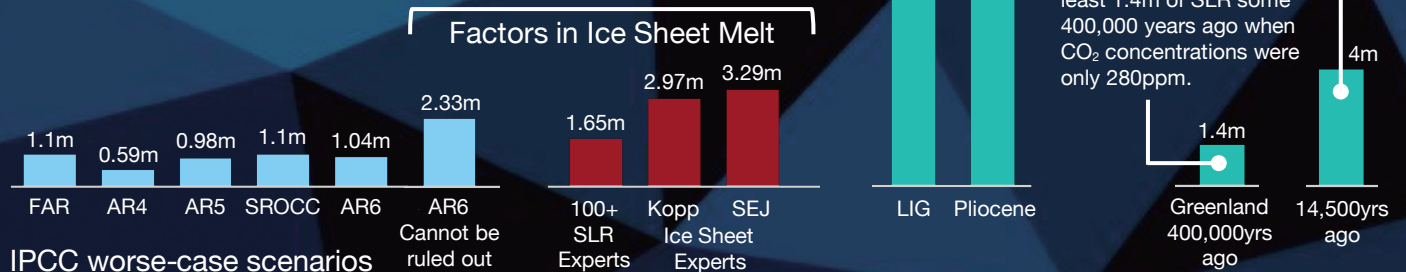


REALITY CHECK

Temperatures were 0.5°C-1°C warmer than the pre-industrial period during the Last Interglacial Period (LIG), some 130,000–115,000 years ago, when seas were 6-9m higher than today.

SLR Projections by 2100...

SLR Levels



Pam Pearson
Director & Founder
(ICCI)

“...drawing from Earth’s past, there have been periods when sea levels rose between 3-4m per century (the last time, about 14,500 years ago) ... But the really serious issue is that those past rapid increases in sea levels were taking place in a world that was not warming nearly as fast as ours today.”



2023 Research Paper

One section of the Greenland Ice Sheet alone contributed to at least 1.4m of SLR some 400,000 years ago when CO₂ concentrations were only 280ppm.

Don’t overshoot! Ice tipping points trigger runaway melt & irreversible SLR

The IPCC notes that if we stopped emitting, “it is virtually certain that global mean sea level will continue to rise over the 21st century”. As rising seas once triggered is irreversible, we must be careful not to overshoot 1.5°C, let alone 2°C. **We are not safe ... even current warming of 1.2°C today is enough to trigger irreversible future ice loss, but if we exceed 1.8°C, even temporarily, West Antarctica & Greenland will both cross irreversible melting thresholds.** The harsh reality is that annual warming soared to 1.55°C for 2024. Unless current climate policies are improved, we’ll almost certainly (97% chance) blow past the 1.8°C threshold to 2°C by 2100.

The situation is dire. Recent polar research & observations have shown us that we have 1) overestimated the resiliency of the cryosphere to warming and 2) under-estimated SLR projections. It’s time to wake up! Get updated to adapt wisely. And don’t forget ... **SLR does NOT rise in a linear manner. Abrupt jumps in SLR can occur due to abrupt ice melt due to ice sheet collapse.** So, it’s best to avoid breaching temperature thresholds in the first place. How fast seas will rise depends on our actions today – we must cut fossil fuel emissions now not later – this decade rather than the next.

We’re at 1.3°C today! Drastic cuts needed by 2030 for 1.5°C...

With carbon concentrations hovering around 420ppm, we could well be locking in Pliocene SLR levels of over 20m unless we cut emissions drastically sooner rather than later. Time is of the essence, the window to limit warming in a meaningful way closes by 2030. Ice scientists were already alarmed with “insane” warming in 2023 – at 1.45°C warmer than the pre-industrial period, it was the hottest year ever, yet in 2024 we’ve broke even more records. But it’s not just surface temperatures that are soaring, our [oceans are also heating up](#) at extraordinary rates, way faster than we expected – this is more bad news for our polar marine ice sheets/shelves.

Global heating has accelerated so much that we’re already at 1.3°C of warming today according to the WMO. There is still time, but not much, to slow down rising seas – we’ve 5 years left to deliver drastic cuts by 2030. There is no “or else” as there is no negotiating with ice – [so choose wisely](#).

Source: CWR; ICCI State of the Cryosphere 2023; NOAA; Rovere et al. (2014), *Earth & Planetary Science Letters* (387); Naish et al. (2009), *Nature* (458); IPCC reports (2007-2021); Horton et al. (2020), *npj Climate & Atmospheric Sci.*; Kopp et al. (2017), *Earth’s Future* (5); Bamber et al. (2019), *PNAS* (116); Christ et al. (2023), *Science* (381); Park et al. (2023), *Nat. Commun* (14); WMO; UNEP Emissions Gap Report 2024; IPCC AR6 WG3 (2022).



Pam Pearson
Director & Founder
International Cryosphere
Climate Initiative (ICCI)

“we cannot negotiate with ice ... Thinking we can turn back the clock in 2040 or 2050 or 2060 without causing extensive global loss and damage is a fantasy; and we need to face physical reality”

Current Path

Adapt Wisely



The World Meteorological Organization (WMO)
10 January 2025

“...confirms 2024 is the warmest year on record at ~1.55°C above pre-industrial level ... The past 10 years have all been in the Top 10, in an extraordinary streak of record-breaking temperatures.”

Deep Cuts

Ocean Warming