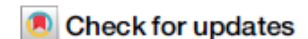


Warming of +1.5 °C is too high for polar ice sheets



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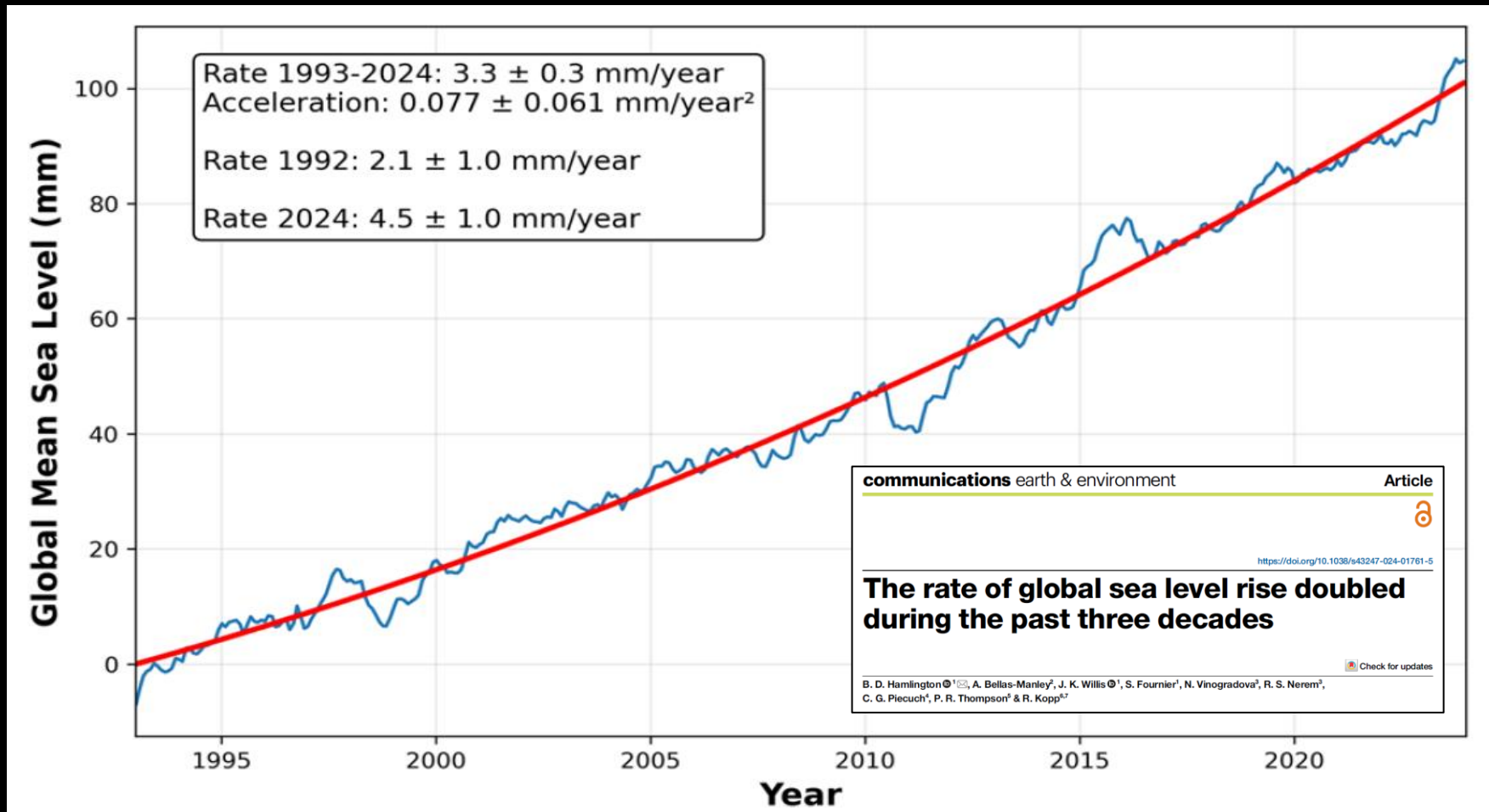


Full Paper



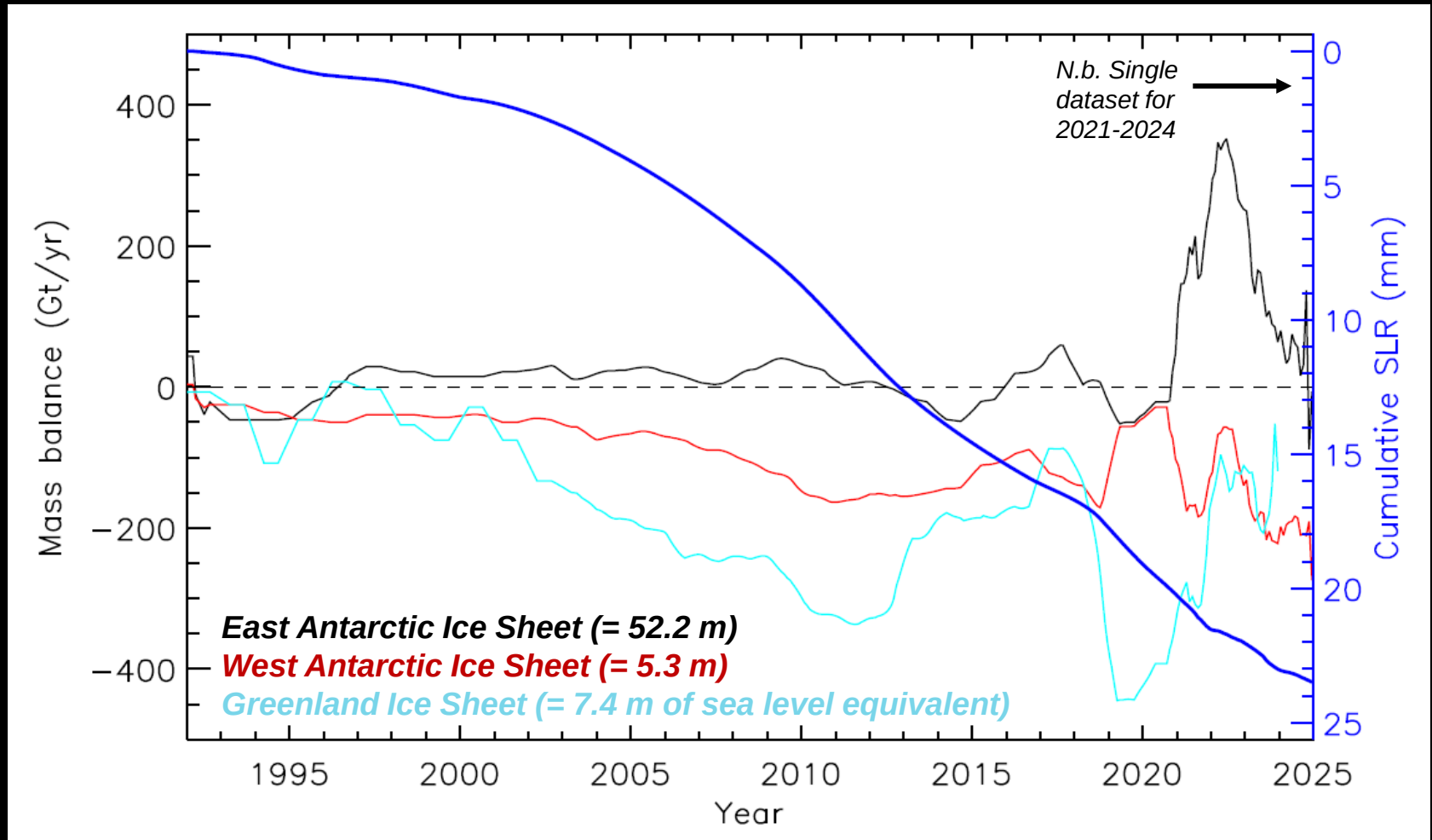
KEY MESSAGE

- **Conclusion:** limiting warming to +1.5 °C is essential, but it will *not* slow sea-level rise from melting ice sheets, which store 65 m of sea level equivalent
- Even under current warming (+1.2 °C), sea level rise is accelerating
- If current rate of acceleration continues, we could see 1 cm per year by 2100



1. CURRENT OBSERVATIONS OF ICE MASS LOSS

- Ice sheet contributions to sea level have quadrupled since the 1990s, adding almost 25 mm to global mean sea level
- Currently losing around 370 billion tonnes of ice per year



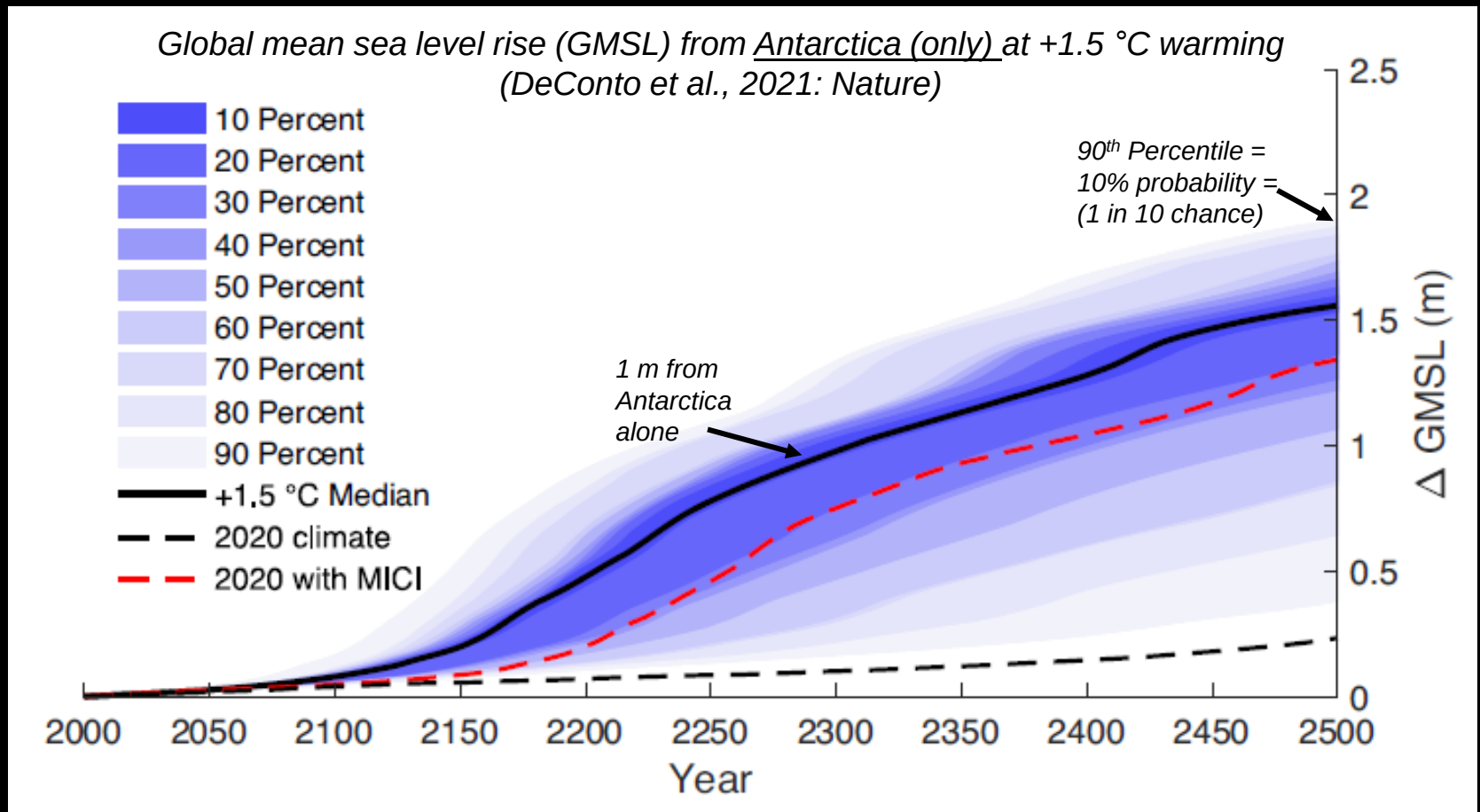
2. SEA LEVEL DURING PAST WARM PERIODS

- We should expect several metres of sea level rise over the coming centuries
- 2-9 m is locked in over millennial time-scales, but recent work shows things are happening more quickly than previously thought
- Remember: current temps = +1.2 °C and current CO₂ levels = 420 ppm

		Marine Isotope Stage 5e (~129-116 ka)	Marine Isotope Stage 11 (~400 ka)	Mid-Pliocene Warm Period (3.3-2.9 Ma)
Forcing (peak values)	CO ₂	287 ppm	286 ppm	350 to 450 ppm
	Global mean temp. anomaly ² 'Arctic' temp. anomaly ³ 'Antarctic' temp. anomaly ³	1 °C 4 to 8 °C 4 to 5 °C	1 to 2? °C 4 to 10 °C 2 to 3 °C	2 to 5 °C 4 to 11 °C ? °C
Greenland	Ice sheet response	Central portion of ice sheet largely intact; southern GrIS deglaciated	NW and southern GrIS deglaciated; complete deglaciation possible	partial to complete deglaciation
	GMSL contribution (SLE)	Estimates range from 1 to >5 m	Estimates include: >1.4 m, 4.5 to 6 m; 6.1 (3.9 to 7) m	up to 7.4 m
Antarctica	Ice sheet response	WAIS retreat, some EAIS retreat possible	EAIS retreat & increased runoff indicated	retreat in WAIS and EAIS
	GMSL contribution (SLE)	debated, up to 5 m (or higher if EAIS contributed)	uncertain; up to 3-4 m	possibly 13-17 m
Peak GMSL		2-9 m above present	6-13 m above present	10-20 above present
Interpretation		GMSL exceeded present (H), a portion of the GrIS retreated (H), AIS contributed to GMSL rise (M)	GMSL exceeded present (M-H); GrIS smaller than present (H); majority of the GrIS melted (M-H); AIS smaller than present (M)	GrIS smaller than present (H); AIS smaller than present (H)

3. FUTURE PROJECTIONS

- Most computer simulations (projections) show that +1.5 °C will not slow sea-level rise
- Growing number of studies show that even current warming (+1.2 °C) is sufficient to trigger collapse that is irreversible on human timescales



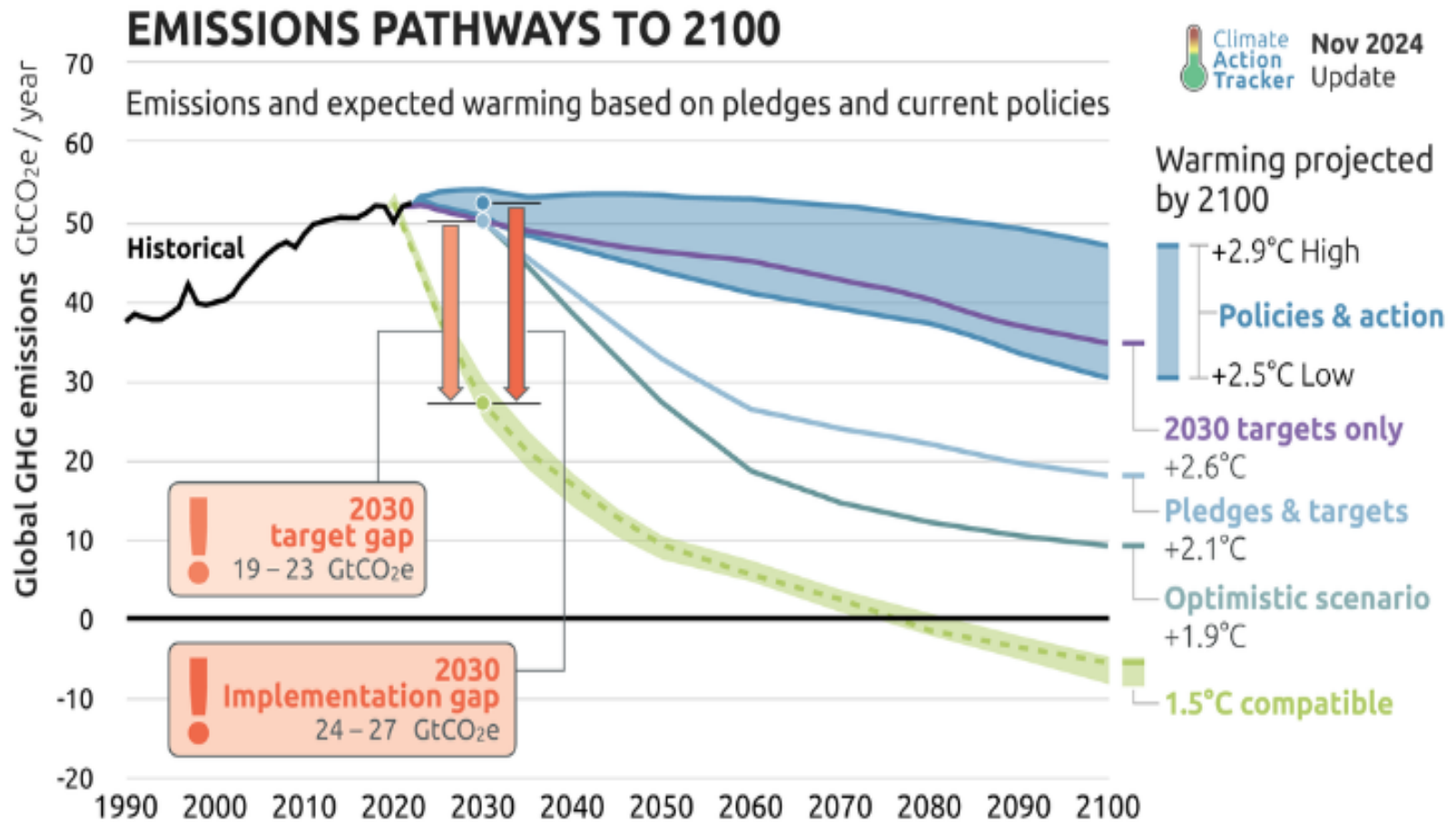
CONCLUSIONS

- 1. Limiting warming to +1.5 °C is essential – but the best-case scenario is that sea-level rise is slow and steady, e.g. <10 mm per year**
- 2. Ice sheets are losing mass at +1.2 °C and sea-level rise is accelerating to rates that would be very challenging to adapt to (>10 mm per year) within the life-time of our young people**
- 3. Every fraction of a degree *really, really matters* for ice sheets**
- 4. To slow sea-level rise from ice sheets to a manageable level requires a long-term temperature goal that is close to +1.0 °C or possibly lower**
- 5. The sooner we slow and stop the warming, the easier it will be to return to safe levels**

EXTRA SLIDES

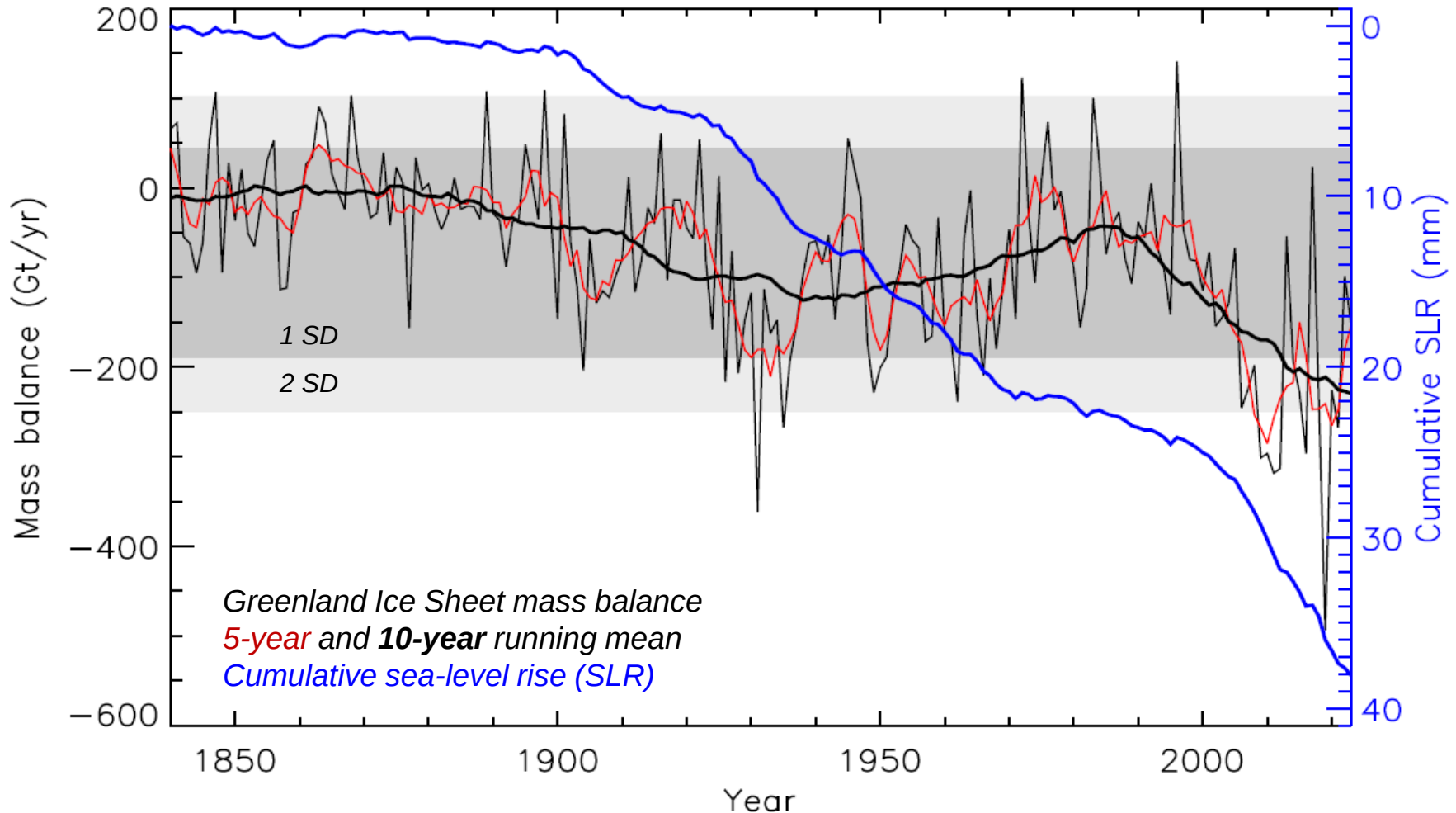
CONTEXT:

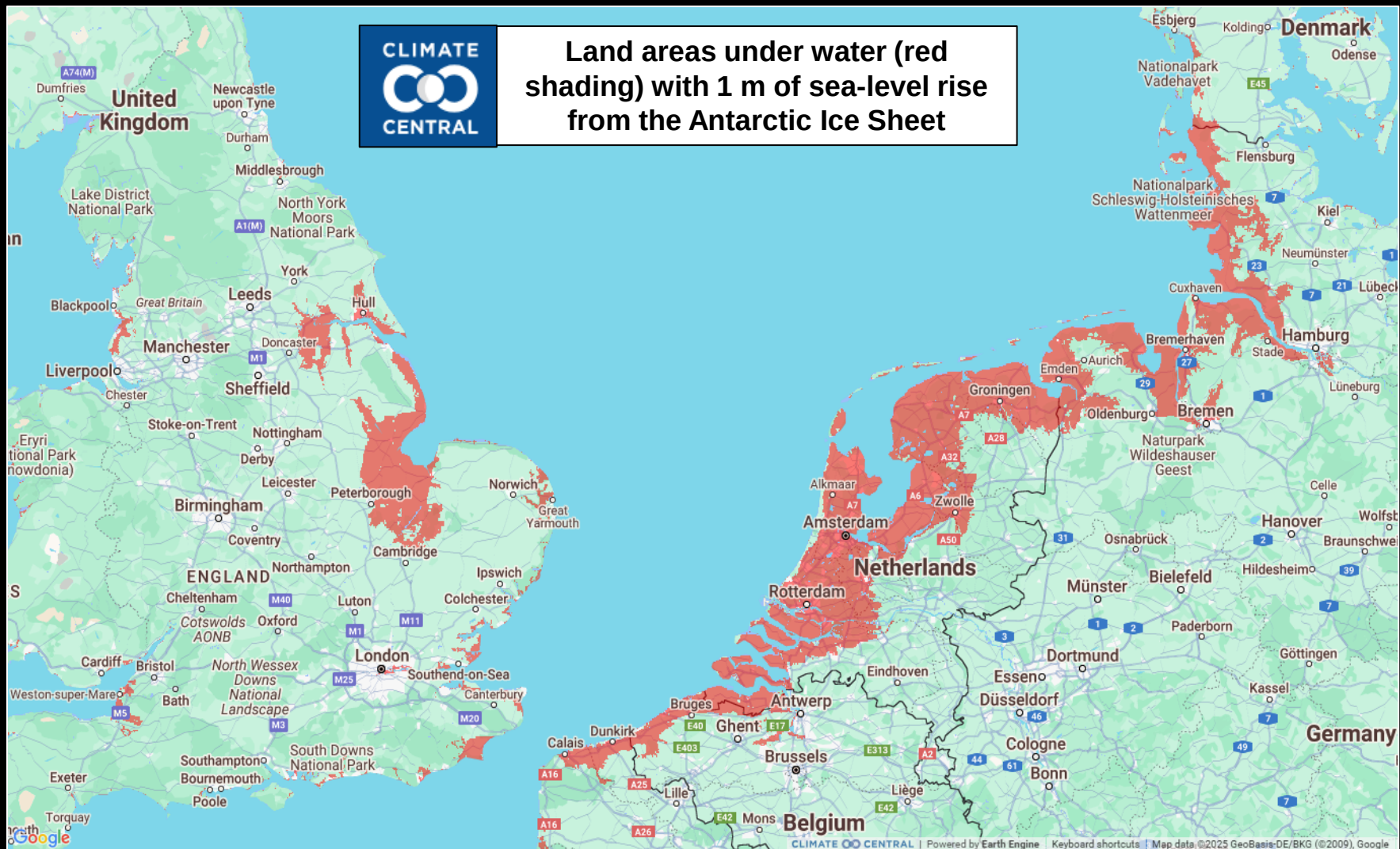
- Currently at +1.2 °C and heading for +2.5 °C to +2.9 °C (current policies)
- Limiting warming to +1.5 °C requires rapid, deep emissions reductions



1. CURRENT OBSERVATIONS OF ICE MASS LOSS

- Rate of ice sheet loss appears to be accelerating, even under current warming levels of +1.2 °C, especially in Greenland (*below*)





Map produced using Climate Central's online 'Coastal Risk Screening Tool': <https://coastal.climatecentral.org/>

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