

Human-induced warming to date and implications for outstanding carbon budgets for 1.5°C

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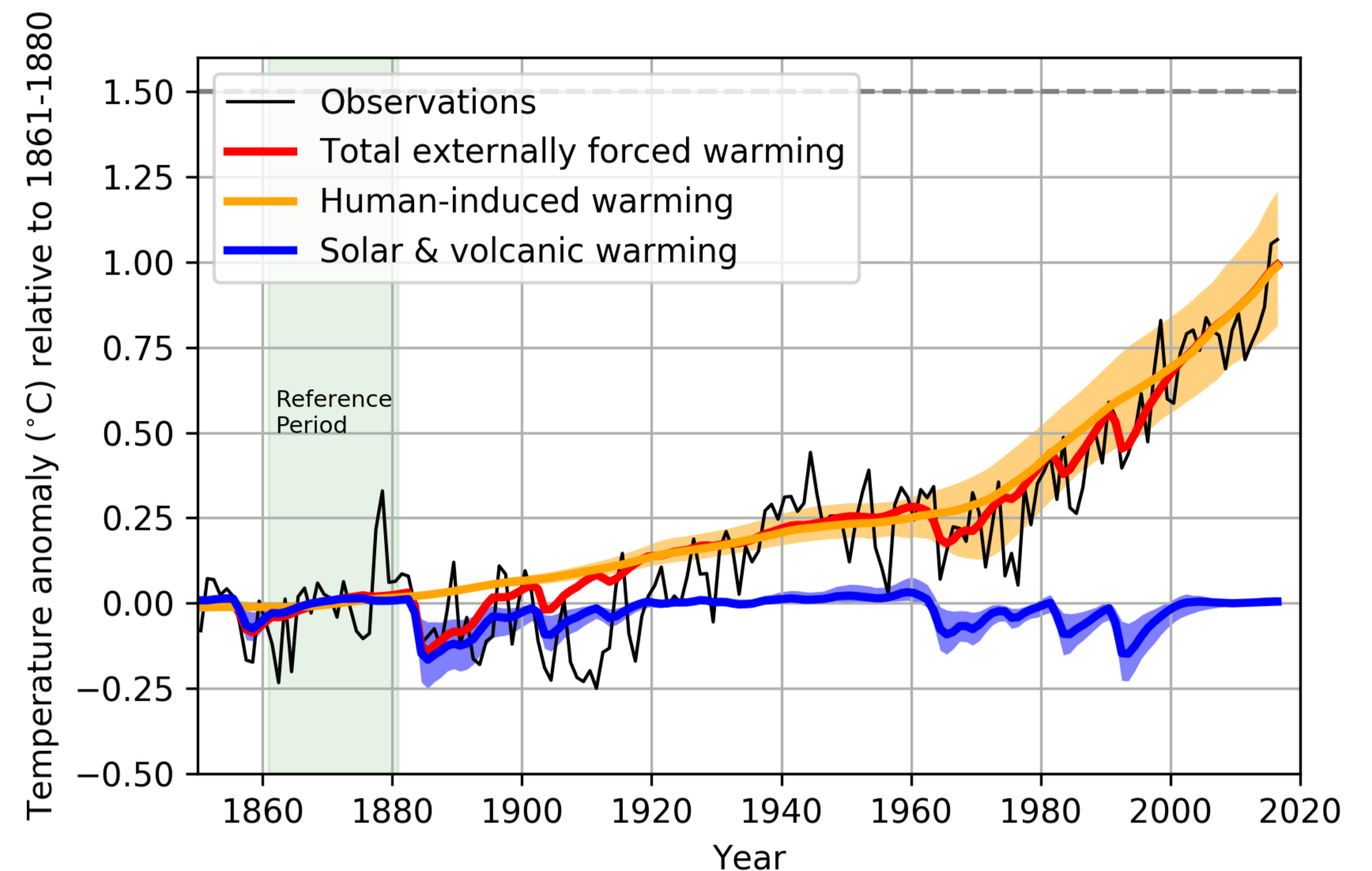
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Summary

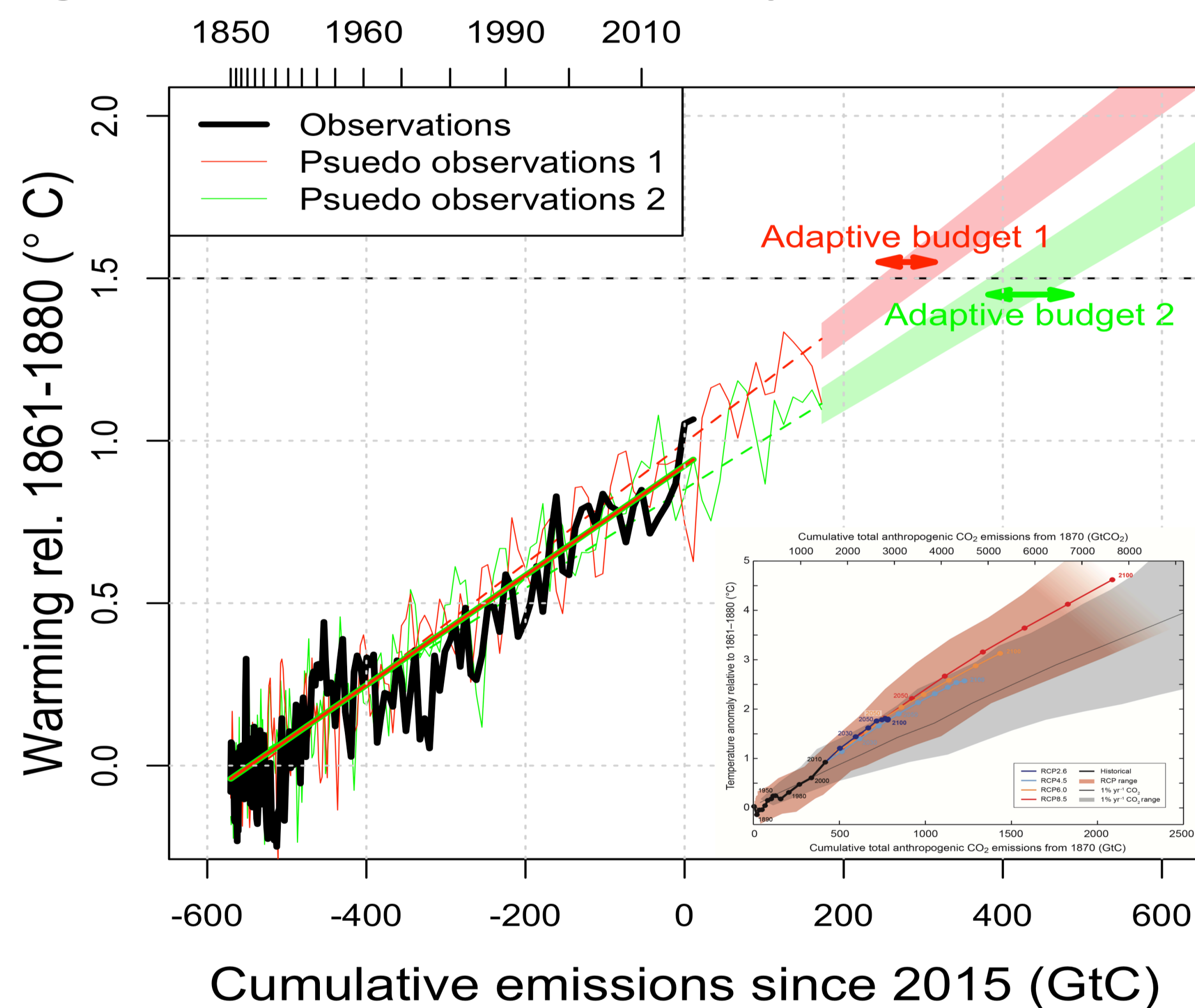
Article 14 of the Paris Agreement stated that the “global stocktake” assessing progress towards the long-term goals of the Paris Agreement should be informed “by the best available science”. An adaptive approach, where the level of global mitigation ambition required to achieve the Agreement’s long-term warming goals is regularly reassessed in light of contemporary estimates of human-induced warming, can be a powerful framing for achieving the required ratcheting of future mitigation ambition

Present-day human-induced warming can be assessed using simple climate modelling tools

- Up-to-date estimates of anthropogenic and natural radiative forcing can be used to calculate contributions of natural and human factors to present-day warming
- The magnitude of human-induced warming is determined using observations of global temperature and not exclusively from climate model output
- Estimates indicate that nearly all of present-day warming is due to human influence, and is currently about 1°C
- This index of anthropogenic warming can be continually updated without the need for computationally intensive modelling tools
- An accurate assessment of the present state of the climate system will be an essential element of the global stocktake process and is provided at globalwarmingindex.org



Mitigation ambition will need to respond to future warming to ensure success in meeting a temperature goal



- Limiting global mean warming to the long-term temperature goals of the Paris Agreement requires *cumulative* carbon dioxide emissions to be limited, but uncertainty remains about the size of the remaining budget
- Estimates of the remaining budget are likely to be updated based on observed climate change
- Climate responses that have been statistically indistinguishable in the past (e.g. black, green and red lines over left hand side of figure) will become more distinguishable in the future and should be reflected in assessments of required mitigation ambition
- The global stocktake offers the perfect opportunity to use regularly updated assessments of human-induced warming to revise estimates of the scale of global mitigation ambition required to achieve the goals of the Paris Agreement

- Limiting warming to 1.5 or 2°C requires global net emissions of CO₂ to be brought to zero by the time human-induced warming reaches these thresholds
- Despite variations between the time-profiles of annual CO₂ emissions in cost-optimal scenarios that limit warming to less than 2°C (blue lines), all such scenarios show an approximately linear reduction (as a percentage of business-as-usual emissions) per 0.1°C increase in human-induced warming (panel b)
- Global CO₂ emissions must fall by on average 20% (10%) per 0.1°C increase in human-induced warming from now on to limit warming to 1.5°C (2°C)
- Indexing specific mitigation policies against human-induced warming could help ensure mitigation policies are robust to climate response uncertainty (Otto et al., *Nature Climate Change* [2015])

