Assessing the Climate Threat

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We live on a planet with a climate characterized by delayed response and amplifying feedbacks.
Antarctic Dome C temperature for past 800 ky from Jouzel et al. relative to mean of the last 10 ky and Dome C CO$_2$ amount from Luthi et al. (kyBP = kiloyears before present).


Polar ice cores have long provided precise knowledge of global paleo CO$_2$ variations.

Recent independent studies of Tierney et al. and Seltzer et al. provide accurate evaluation of Last Glacial Maximum (LGM) temperature.
1. Peak LGM (21-18 kyBP) cooling = 7.0 ± 1°C (2σ, 95% confidence)

2. LGM surface albedo forcing = 3.5 ± 1.0 W/m² (2σ)

3. LGM Greenhouse gas forcing = 2.25 ± 0.225 W/m² (2σ)

Climate Sensitivity = 7.0/(3.5+2.25) = 1.2 ± 0.3°C per W/m² (2σ)

= 4.8 ± 1.2°C for 2×CO₂ (2σ)

Excludes IPCC best estimate (3°C for 2×CO₂) at 3σ (99.7% confidence)
GHG climate forcing in past 20 ky with vertical scale expanded for the past 10 ky on the right. GHG amounts are from Schilt et al. and formulae for forcing are in Supporting Material.
Global mean surface temperature change over the past 24 ky, from Fig. 2 of Osman et al. (2021).
Total sulfate (parts per trillion by volume) and percentage of total sulfate provided by shipping in simulations of Jin et al. prior to IMO regulations on sulfur content of fuels.
North Atlantic is (20-60°N, 0-60°W) and North Pacific is (20-60°N, 120-220°W).

Data source: http://ceres.larc.nasa.gov/order_data.php
Global absorbed solar radiation (W/m²) relative to mean of the first 120 months of CERES data
12-month running-mean of Earth’s energy imbalance based on CERES satellite data for EEI change normalized to 0.71 W/m² mean for July 2005 - June 2015 from in situ data.
Global temperature relative to 1880-1920. Edges of the predicted post-2010 accelerated warming rate (see text) are 0.36 and 0.27°C per decade.
Continental configuration 56 MyBP. Continental shelves (light blue) were underwater as little water was locked in ice. The Indian plate was moving north at about 15 cm per year. A sea floor rift opened in North Atlantic at 56 MyBP as Greenland pulled away from Europe.

Global deep ocean $\delta^{18}$O. Black line: high resolution Westerhold et al. (2020) data.

Lower left: velocity of Indian tectonic plate.

EECO = Early Eocene Climatic Optimum; Oi-1 = transition to glaciated Antarctica
Cenozoic surface temperature estimated from deep ocean oxygen isotope data of Westerhold et al. Red data is $0.6 \times$ Antarctic Dome C temperature.
Implied CO$_2$ history for ECS = 1.2°C per W/m$^2$ (black); red & green for ECS = 1.0 and 1.4°C per W/m$^2$ are 1 My smoothed.
Forcing required to yield Cenozoic temperature for today’s solar irradiance, compared with human-made GHG forcing in 2022.
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Annual growth of climate forcing by GHGs. MPTG and OTG are Montreal Protocol and Other Trace Gases. RCP2.6 scenario is designed to keep global warming < 2C.
Global energy consumption and CO₂ emissions (Hefner et al. and Energy Institute)
Fossil fuel CO$_2$ emissions from mature and emerging economies. China is counted in emerging economies.
Cumulative per capita national fossil fuel emissions
Carbon intensity (carbon emissions per unit energy use) of several nations and the world. Mtoe = megatons of oil equivalent
Fundamental Required Actions

1. Rising Price (Fee) on Carbon
   - All Funds to Public (combating wealth disparities)
   - Border Duties (to make carbon fee near-global)

2. East-West Cooperation
   - Present focus on military hegemony increases inflation
   - Cooperate to make modern nuclear cheaper than gas

3. Actions to Restore Cooler Climate
   - 1.5°C limit long dead; 2°C is on deathbed
   - Initiate Preparations to Restore Energy Balance
Equal Rights and Opportunity: The Platform

1. No funding from special interests
   Individual donations only, max = $100?/year

2. Party control of who/whether to run
   Avoid being spoiler if ranked voting not available

3. Advocate ranked voting
   Begin pushing for this immediately

4. Carbon fee & 100% dividend
   Eventually supplemented by energy fee

5. Renew civilian control over war-making
   Congress should uphold its Constitutional duty