Climate & Earth Systems | Jan 20, 2026 | 9 min read | By Bryan White

Accelerating Feedback Loops as we Approach the Planetary Tipping Point (1.5C)

Environment * Climate Change * Ethics

Introduction: The Threshold of a New Climatic Era

As the calendar turned to January 2026, the global scientific community and policymakers found themselves navigating a landscape that had fundamentally shifted from early 21st-century warnings to the visceral reality of a planet in flux. Climatological data finalized in early 2026 confirmed that Earth experienced its third consecutive year of exceptional warmth in 2025, solidifying a multi-year period -- extended further through 2026 as Copernicus C3S tracked 2026 among the warmest years on record -- where the global average temperature persistently approached or exceeded the 1.5 degrees Celsius threshold above pre-industrial levels.[1][31] While the Paris Agreement's guardrails are defined by multi-decadal averages rather than single years, the physical breach of this limit signals that humanity has entered the "Overshoot Era."

The narrative of 2026 is one of profound dichotomy. On the physical front, the signals are unambiguous and accelerating. The atmosphere holds more heat than at any point in human history, driven by record concentrations of greenhouse gases that reached 425.7 parts per million in 2025.[2] This energy imbalance is manifesting in cascading tipping points: the destabilization of Antarctic ice shelves, the emergence of a "hypertropical" drought regime in the Amazon, and the most extensive coral bleaching event ever recorded -- which NOAA confirmed in June 2026 had likely concluded after the 2025-2026 austral summer, having impacted ~84% of global reef areas across 83 countries and territories.[23] Yet the human response has fractured. In January 2026, the United States initiated a formal withdrawal from the United Nations Framework Convention on Climate Change (UNFCCC),[3] standing in stark contrast to Asia, where China and India simultaneously reduced coal generation while expanding renewable capacity at a record scale.[4] This report synthesizes the underlying physical mechanisms, feedback loops, and radiative forcing dynamics driving the 2026 climate crisis.

Planetary Temperature Dynamics and Atmospheric Physics

Final datasets from NOAA, NASA, Berkeley Earth, and Copernicus (C3S) confirm that 2025 was the third-warmest year on record, statistically tied with 2023 behind 2024.[1][6] Berkeley Earth estimates the 2025 global mean anomaly at 1.44 deg C (+/-0.09 deg C) above the 1850-1900 baseline,[7] while Copernicus places it at 1.47 deg C.[8] Subsequent Copernicus tracking in 2026 shows the four-year 2023-2026 global mean anomaly tracking at or above 1.5 deg C, confirming a new thermal baseline in the Anthropocene even after the dissipation of the 2023-2024 El Ni o event.[31]

| Agency | | Rank | | Anomaly vs 1850-1900 | | Key Observation | | Source |

| NOAA / NASA | | 3rd / Tied 2nd | | ~1.19 deg C (vs 1951-1980) | | Ocean heat content at record high. | | [5][6] |

| Copernicus (C3S) | | 3rd Warmest | | +1.47 deg C | | 0.13 deg C cooler than 2024 peak; 2023-2026 4-yr mean 1.5 deg C. | | [8][31] |

| Berkeley Earth | | 2nd (Land) | | +1.44 deg C (Global) / +2.03 deg C (Land) | | 3rd consecutive year land exceeded +2.0 deg C. | | [7] |

Because water has a higher specific heat capacity than soil or rock, terrestrial surfaces heat far more rapidly than the oceans, reaching +2.03 deg C in 2025.[7] This warming is driven by a positive imbalance in Earth's energy budget -- the difference between absorbed solar radiation and outgoing thermal emission.[9] Primary forcing stems from carbon dioxide (CO_2) at 425.7 ppm (+52% over pre-industrial levels), compounded by saturating oceanic and terrestrial carbon sinks.[2][10]

While some researchers hypothesized that International Maritime Organization (IMO) 2020 sulfur regulations triggered an aerosols "termination shock" (~0.5 W/m) pushing climate sensitivity toward 4.5 deg C,[11] late-2025 cloud microphysics modeling showed marine cloud brightening saturates, limiting the IMO 2020 warming effect to ~0.03 deg C.[12] Similarly, multi-model analyses of the 2022 Hunga Tonga eruption demonstrated that sulfate aerosol scattering offset stratospheric water vapor, yielding a net neutral-to-cooling effect (-0.05 K) over 2022-2025.[13][14]

The Cryosphere in Crisis: Mechanisms of Collapse

In the polar regions, Antarctic sea ice extent plummeted to its second-lowest level on record in 2025, while global glacier mass loss reached ~408 +/- 132 Gt in hydrological year 2025 (~1.1 mm sea-level equivalent).[5][16] In the Amundsen Sea, upwelling warm deep water melts sea ice from below, exposing dark ocean water and accelerating warming via the ice-albedo feedback.[15] On the Antarctic ice sheet, Interferometric Synthetic Aperture Radar (InSAR) and subglacial robotics at the Thwaites Glacier ("Doomsday Glacier") revealed vigorous basal melting across a kilometers-wide grounding zone.[16] Twice-daily tides lift the ice sheet ("tidal pumping"), drawing warm, high-pressure seawater inland to scrub basal ice and threatening >3 meters of sea-level rise -- prompting 2026 evaluations of geoengineered "Seabed Curtains."[16][17] Concurrently, meltwater from the Greenland ice sheet is diluting North Atlantic salinity, threatening the thermohaline circulation (AMOC). New 2025 high-resolution models project a 37% (intermediate emissions) to 70% (high emissions) probability of post-2100 AMOC collapse.[18][19][20]

Ecological Collapse and Biological Tipping Points

Following historic 2023-2024 droughts, the Amazon basin began transitioning toward a "hypertropical" regime in 2025.[20][21] Under extreme heat and elevated vapor pressure deficit, rainforest trees close their stomata to prevent xylem embolism, halting transpiration. Without evaporative cooling and moisture recycling ("flying rivers"), local air temperatures spike and clouds vanish. Climate change made the recent Amazon meteorological drought 10 times more likely and agricultural drought 30 times more likely, pushing the southeastern basin toward a carbon source.[21][22]

Simultaneously, the Fourth Global Coral Bleaching Event impacted ~84% of global reef areas across 83 countries and territories before thermal stress abated in mid-2026.[20][23]

| Earth System | | 2026 Status | | Primary Physical Mechanism | | Projected System Impact | | Source |

| AMOC | | High Risk | | Freshwater dilution of N. Atlantic deep-water sinking. | | 37%-70% collapse risk post-2100; monsoon disruption. | | [18][19] |

| Amazon Basin | | Critical | | Stomatal shutdown; failure of transpiration recycling. | | Hypertropical shift; transition from C-sink to C-source. | | [21][22] |

| West Antarctic Ice | | Active Retreat | | Subglacial tidal pumping at Thwaites grounding zone. | | Marine ice sheet instability; >3m sea-level potential. | | [16][17] |

| Global Coral Reefs | | Severe Post-Event Stress | | Sustained thermal stress expelling zooxanthellae. | | ~84% of global reefs bleached across 83 nations/territories (2023-2026). | | [20][23] |

The Energy Transition and Geopolitical Fracture

In 2025, coal-fired power generation fell simultaneously in both China (-1.6%) and India (-3.0%) for the first time in 52 years.[4][24] China installed over 300 GW of solar and 100 GW of wind capacity in a single year -- ten times US utility solar additions -- allowing non-fossil growth to outpace electricity demand.[4][24] Conversely, US federal policy rollbacks and offshore wind moratoriums between November 2024 and January 2026 stalled or canceled 324 clean energy projects across 47 states, erasing $53.05 billion in investment and 165,531 jobs.[25][26][27]

| Metric | | China / Asia | | United States | | Strategic Context | | Source |

| 2025 Solar Added | | >300 GW (China) | | ~30 GW (Utility) | | China added ~10x US utility solar capacity. | | [4] |

| Coal Trend | | -1.6% (China) / -3.0% (India) | | Policy Support | | Historic Sino-Indian coal peak vs. US stagnation. | | [4][24] |

| US Contraction | | Supply Chain Dominance | | -$53.05B / 165,531 Jobs | | 324 projects stalled (Texas -$6.78B; Mass. -$8.61B). | | [26][27] |

On January 7, 2026, the United States formally initiated withdrawal from the UNFCCC, the Paris Agreement, and the Intergovernmental Panel on Climate Change (IPCC), while halting Green Climate Fund payments and triggering a scientific exodus at NOAA.[3][28][29] At COP30 in Bel m, Brazil (November 2025), the EU, China, and the Global South passed the "Bel m Package" and "Mutir o" decision -- establishing a Just Transition Mechanism, a Forest Roadmap, and a $1.3 trillion annual finance target by 2035.[30]

Conclusion: Navigating the Overshoot Era

With terrestrial warming exceeding 2.0 deg C and CO2 surpassing 425 ppm, non-linear physical feedbacks -- from subglacial tidal pumping at Thwaites to stomatal shutdown

in the Amazon -- are outpacing incremental diplomacy. While structural coal decline in China and India proves renewable economics can bend emissions at scale, US diplomatic withdrawal fractures global mitigation, demanding urgent investment in earth observation and biome adaptation across the Anthropocene.

Updates... (Nov 24, 2026): Replaced bot-gated Reference #2 (globalcarbonbudget.org) with the peer-reviewed Global Carbon Budget 2025 Earth System Science Data DOI (Friedlingstein et al., May 13, 2026), corrected the Science Media Centre publication date in Reference #11 from 2024 to Feb 4, 2025, added verified exact publication dates to References #6, #10, #13, #23, and #29, and normalized the bibliography heading to References. (Prior Nov 21, 2026 update incorporated Copernicus 2026 tracking, NOAA's June 2026 Fourth Global Coral Bleaching Event closure, and 2025 glacier loss metrics.)

References

* [1] Copernicus Climate Change Service (2026). 5 charts to discover the Global Climate Highlights 2025 report. -- https://climate.copernicus.eu/5-charts-discover-global-climate-highlights-2025-report

* [2] Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., et al. (2026, May 13). Global Carbon Budget 2025. Earth System Science Data, 18(5), 3211-3288. -- https://doi.org/10.5194/essd-18-3211-2026

* [3] Carbon Brief (2026, Jan 9). Q&A: What Trump's US exit from UNFCCC and IPCC could mean for climate action. -- https://www.carbonbrief.org/qa-what-trumps-us-exit-from-unfccc-and-ipcc-could-mean-for-climate-action/

* [4] Eco-Business / Carbon Brief (2026, Jan 14). Analysis: Coal power drops in China and India for first time in 52 years after clean-energy records. -- https://www.eco-business.com/news/analysis-coal-power-drops-in-china-and-india-for-first-time-in-52-years-after-clean-energy-reco

* [5] NOAA NCEI (2026, Jan 13). Assessing the Global Temperature and Precipitation Analysis in 2025. -- https://www.ncei.noaa.gov/news/global-climate-202513

* [6] NASA (2026, Jan 14). NASA Releases Global Temperature Data. -- https://www.nasa.gov/news-release/nasa-releases-global-temperature-data/

* [7] Berkeley Earth (2026, Jan 14). Global Temperature Report for 2025. -- https://berkeleyearth.org/global-temperature-report-for-2025/

* [8] ECMWF (2026, Jan 14). 2025 was the third-warmest year on record, Copernicus data show. -- https://www.ecmwf.int/en/about/media-centre/news/2025/2025-third-warmest-year

* [9] Myhre, G., Hodnebrog, ., Loeb, N., & Forster, P. M. (2025, Jun 12). Observed trend in Earth energy imbalance may provide a constraint for low climate sensitivity models. Science. -- https://doi.org/10.1126/science.adt0647

* [10] CSIRO (2025, Nov 13). Global carbon dioxide emissions from fossil fuels rise in 2025. -- https://www.csiro.au/en/news/All/News/2025/November/Global-Carbon-Budget-2025

* [11] Science Media Centre (2025, Feb 4). Expert reaction to study looking at shipping aerosol emissions, ocean surface temperatures and rate of global warming.

--
https://www.sciencemediacentre.org/expert-reaction-to-study-looking-at-shipping-aerosol-emissions-ocean-surface-temperatures-and

* [12] Watson-Parris, D., Wilcox, L. J., Stjern, C. W., Allen, R. J., Persad, G., Bollasina, M. A., Ekman, A. M. L., Iles, C. E., Joshi, M., Lund, M. T., McCoy, D., Westervelt, D. M., Williams, A. I. L., & Samset, B. H. (2025, Apr 23). Surface temperature effects of recent reductions in shipping SO2 emissions are within internal variability. Atmospheric Chemistry and Physics, 25, 4443-4460. -- https://doi.org/10.5194/acp-25-4443-2025

* [13] NOAA CSL (2025, Dec 18). International Report Unveils the Global Atmospheric Impacts of the 2022 Hunga Volcano Eruption. -- https://csl.noaa.gov/news/2025/436_1218.html

* [14] EGUsphere (2025, Sep 5). Multi-model analysis of the radiative impacts of the 2022 Hunga eruption indicates a significant cooling contribution from the volcanic plume. -- https://egusphere.copernicus.org/preprints/2025/egusphere-2025-3769/

* [15] Frew, R. C., et al. (2019, Sep). Sea Ice-Ocean Feedbacks in the Antarctic Shelf Seas. Journal of Physical Oceanography, 49(9). -- https://doi.org/10.1175/jpo-d-18-0229.1

* [16] World Glacier Monitoring Service (2026). Global Glacier Mass Change in 2025 (408 +/- 132 Gt Net Loss). -- https://wgms.ch/ncc_glaciers_in_2025/

* [17] Mongabay (2025, Sep 24). Scientists weigh giant sea curtain to shield 'Doomsday Glacier' from melting. -- https://news.mongabay.com/2025/09/scientists-weigh-giant-sea-curtain-to-shield-doomsday-glacier-from-melting/

* [18] PIK Potsdam (2025). Possible North Atlantic overturning circulation shutdown after 2100 in high-emission future. -- https://www.pik-potsdam.de/en/news/latest-news/possible-north-atlantic-overturning-circulation-shutdown-after-2100-in-high-emiss

* [19] The Guardian (2025, Aug 28). Collapse of critical Atlantic current is no longer low-likelihood, study finds. -- https://www.theguardian.com/environment/2025/aug/28/collapse-critical-atlantic-current-amoc-no-longer-low-likelihood-study

* [20] Global Systems Institute, University of Exeter (2025, Oct 3). Global Tipping Points Report 2025. -- https://global-tipping-points.org/lana-download/global-tipping-points-report-2025-full-report/

* [21] UC Berkeley News (2025, Dec 10). A new 'hypertropical' climate is emerging in the Amazon. -- https://news.berkeley.edu/2025/12/10/a-new-hypertropical-climate-is-emerging-in-the-amazon/

* [22] World Weather Attribution (2024). Climate change, not El Ni o, main driver of exceptional drought in highly vulnerable Amazon River Basin. -- https://www.worldweatherattribution.org/climate-change-not-el-nino-main-driver-of-exceptional-drought-in-highly-vulnerable-amaz

* [23] NOAA NESDIS (2026, Jun 2). World's Fourth Mass Coral Bleaching Event Likely Ended in 2025/2026. -- https://www.nesdis.noaa.gov/news/worlds-fourth-mass-coral-bleaching-event-likely-ended-2025

* [24] CleanTechnica (2026, Jan 14). Coal-Powered Thermal Generation Declines In China & India, But Surges In US. --

https://cleantechnica.com/2026/01/14/coal-powered-thermal-generation-declines-in-china-india-but-surges-in-us/

* [25] E2 (2025, Apr 17). $8 Billion and 16 New Clean Energy Projects Abandoned in First 3 Months of 2025. -- https://e2.org/releases/march-clean-economy-works-update/

* [26] Climate Power (2025). December Energy Crisis Snapshot. -- https://climatepower.us/wp-content/uploads/2025/12/EMBARGO-December-Energy-Crisis-Snapshot-RES-2025_11-1.pdf

* [27] Office of Sen. Elizabeth Warren (2026, Jan 13). New Warren-Markey Report Details Impacts of Clean Energy Rollbacks on Massachusetts. -- https://www.warren.senate.gov/newsroom/press-releases/new-warren-markey-report-details-impacts-of-trump-admins-clean-energy-

* [28] The White House (2026, Jan 7). Withdrawing the United States from International Organizations, Conventions, and Treaties. -- https://www.whitehouse.gov/presidential-actions/2026/01/withdrawing-the-united-states-from-international-organizations-conventio

* [29] U.S. Department of the Treasury (2026, Jan 8). Treasury Announces the United States' Immediate Withdrawal from the Green Climate Fund. -- https://home.treasury.gov/news/press-releases/sb0352

* [30] Carbon Brief (2025, Nov 23). COP30: Key outcomes agreed at the UN climate talks in Bel m. -- https://www.carbonbrief.org/cop30-key-outcomes-agreed-at-the-un-climate-talks-in-belem/

* [31] Copernicus Climate Change Service (2026). 2026 and 4-year global temperature average on track to exceed 1.5 deg C above pre-industrial levels. -- https://climate.copernicus.eu/2026-and-4-year-global-temperature-average-track-exceed-15degc-above-pre-industrial-levels