

A Revision of Future Climate Change Trends

By [Dr. Andrew Glikson](#)

Global Research, January 29, 2019

Theme: [Environment](#)

In-depth Report: [Climate Change](#)

Abstract

As the Earth continues to heat, paleoclimate evidence suggests transient reversals will result in accentuating the temperature polarities, leading to increase in the intensity and frequency of extreme weather events. Pleistocene paleoclimate records indicate interglacial temperature peaks have been consistently succeeded by transient stadial freeze events, such as the Younger Dryas and the 8.5 kyr-old Laurentide ice melt, attributed to cold ice melt water flow from the polar ice sheets into the North Atlantic Ocean. The paleoclimate evidence raises questions regarding the mostly linear to curved future climate model trajectories proposed for the 21st century and beyond, not marked by tipping points. However, early stages of a stadial event are manifest by a weakening of the North Atlantic overturning circulation and the build-up of a large pool of cold water south and east of Greenland and along the fringes of Western Antarctica. Comparisons with climates of the early Holocene Warm Period and the Eemian interglacial when global temperatures were about +1°C higher than late Holocene levels. The probability of a future stadial event bears major implications for modern and future climate change trends, including transient cooling of continental regions fringing the Atlantic Ocean, an increase in temperature polarities between polar and tropical zones across the globe, and thereby an increase in storminess, which need to be taken into account in planning global warming adaptation efforts.

Introduction

Reports of the International Panel of Climate Change (IPCC[1]), based on thousands of peer reviewed science papers and reports, offer a confident documentation of past and present processes in the atmosphere[2], including future model projections (Figure 1). When it comes to estimates of future ice melt and sea level change rates, however, these models contain a number of significant departures from observations based on the paleoclimate evidence, from current observations and from likely future projections. This includes departures in terms of climate change feedbacks from land and water, ice melt rates, temperature trajectories, sea level rise rates, methane release rates, the role of fires, and observed onset of transient stadial (freeze) events[3]. Early stages of stadial event/s are manifest by the build-up of a large pool of cold water in the North Atlantic Ocean south of Greenland and along the fringes of the Antarctic continent (Figure 2).

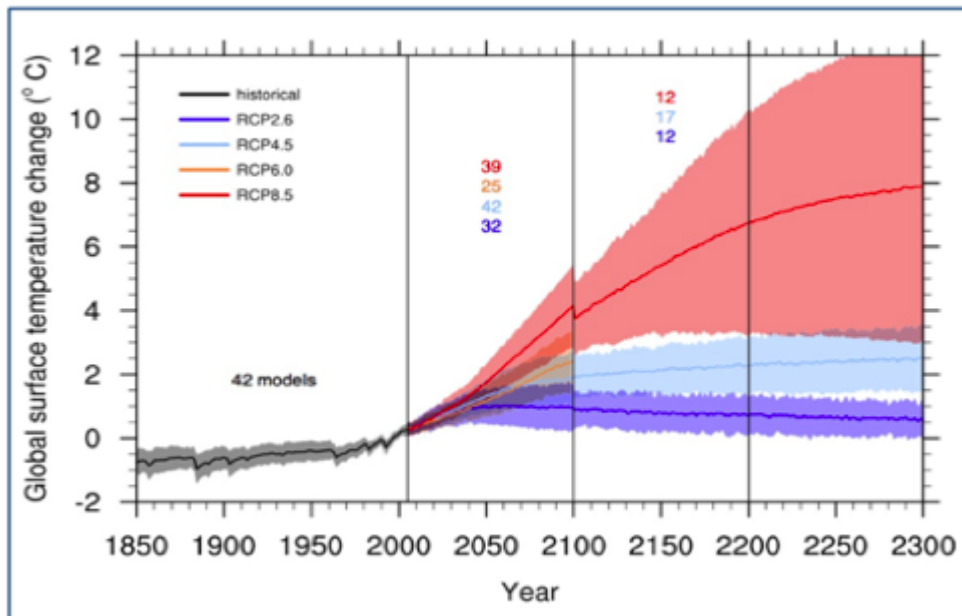


Figure 1. Time series of global annual mean surface air temperature anomalies relative to 1986–2005 from CMIP5 (Coupled Model Inter-comparison Project) concentration-driven experiments. Projections are shown for each RCP for the multi model mean (solid lines) and the 5–95% range (± 1.64 standard deviation) across the distribution of individual models (shading).[4]

Hansen et al. (2016) (Figure 2) used paleoclimate data and modern observations to estimate the effects of ice melt water from Greenland and Antarctica, showing cold low-density meltwater tend to cap increasingly warm subsurface ocean water, affecting an increase ice shelf melting, accelerating ice sheet mass loss (Figure 3) and slowing of deep water formation (Figure 4). Ice mass loss would raise sea level by several meters in an exponential rather than linear response, with doubling time of ice loss of 10, 20 or 40 years yielding multi-meter sea level rise in about 50, 100 or 200 years.

Linear to curved temperature trends portrayed by the IPCC to the year 2300 (Figure 1) are rare in the Pleistocene paleo-climate record, which abrupt include warming and cooling variations during both glacial (Dansgaard-Oeschger cycles; Ganopolski and Rahmstorf 2001[5]; Camille and Born, 2019[6]) and interglacial (Cortese et al. 2007[7]) periods. Hansen et al.'s (2016) model includes sharp drops in temperature, reflecting stadial freezing events in the Atlantic Ocean and the sub-Antarctic Ocean and their surrounds, reaching -2°C over several decades (Figure 5).

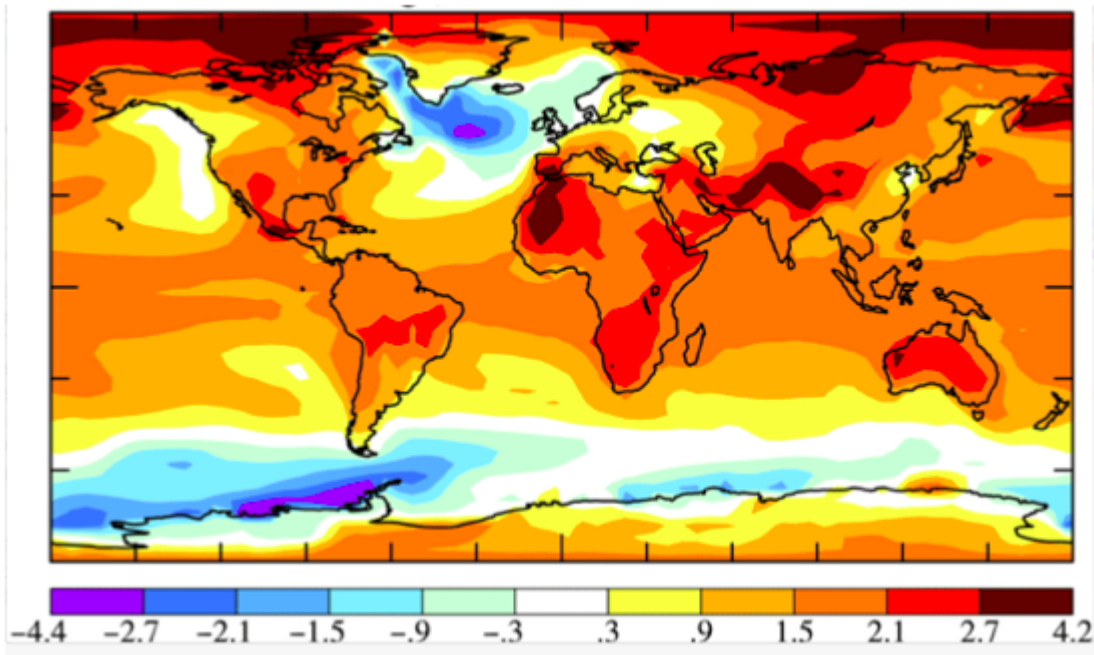


Figure 2. 2055-2100 surface-air temperature to +1.19°C above 1880-1920 (AIB model modified forcing, ice melt to 1 meter) (Hansen et al. 2016)[8]

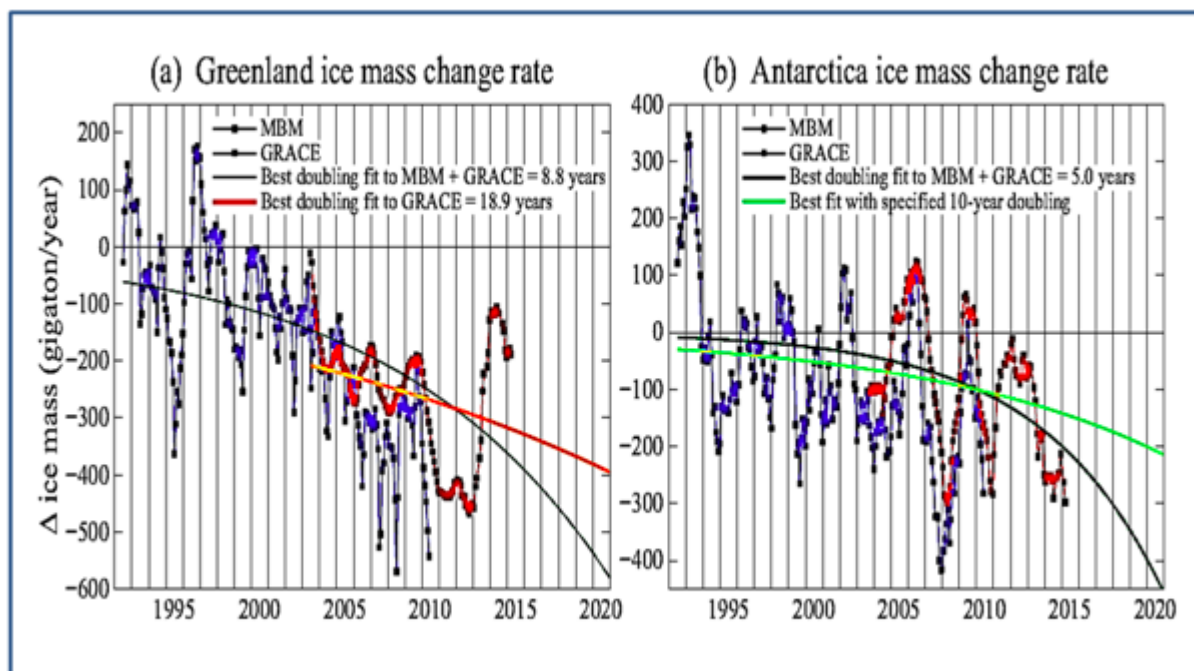


Figure 3. Greenland and Antarctic ice mass change. GRACE data are extension of Velicogna et al. (2014)[9]gravity data. MBM (mass budget method) data are from Rignot et al. (2011)[10].Red curves are gravity data for Greenland and Antarctica only; small Arctic ice caps and ice shelf melt add to freshwater input.[11]

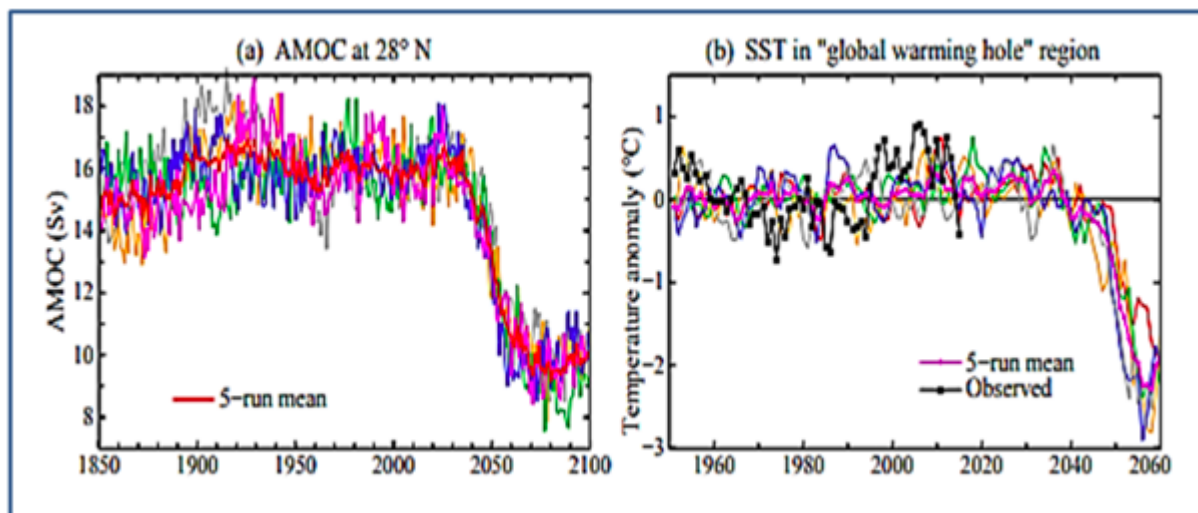


Figure 4. AMOC (Sverdrup[12]) at 28° N in simulations (i.e., including freshwater injection of 720 Gt year⁻¹ in 2011 around Antarctica, increasing with a 10-year doubling time, and half that amount around Greenland). (b) SST (°C) in the North Atlantic region (44–60° N, 10–50° W).

Temperature and sea level rise relations during the Eemian interglacial[13] about 115-130 kyr ago, when temperatures were about +1°C or higher than during the late stage of the Holocene, and sea levels were +6 to +9 m higher than at present, offer an analogy for present developments. During the Eemian overall cooling of the North Atlantic Ocean and parts of the West Antarctic fringe ocean due to ice melt led to increased temperature polarities and to storminess[14], underpinning the danger of global temperature rise to +1.5°C. Accelerating ice melt and nonlinear sea level rise would reach several meters over a timescale of 50-150 years (Hansen et al. 2016)

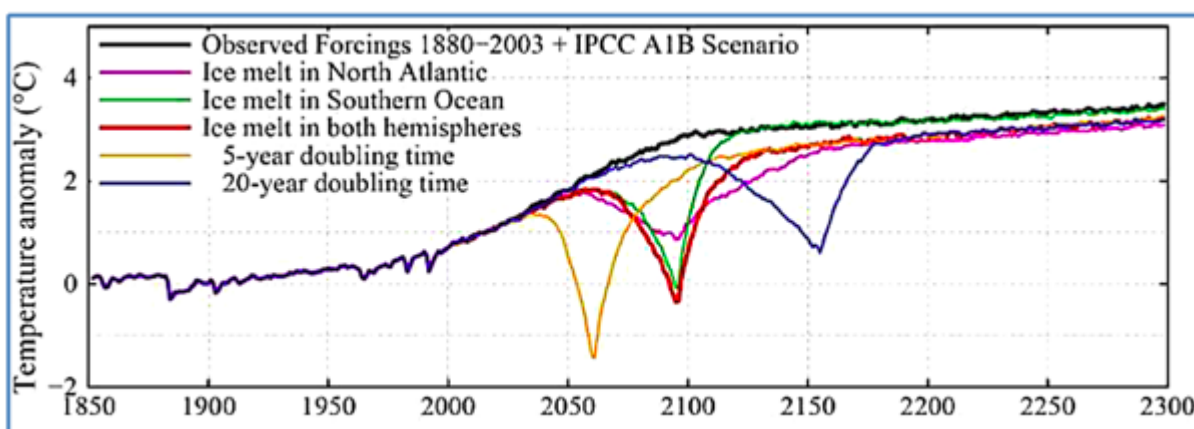


Figure 5. Global surface-air temperature to the year 2300 in the North Atlantic and Southern Oceans, including stadial freeze events as a function of Greenland and Antarctic ice melt doubling time

Portents of collapse of the Atlantic Meridional Ocean Circulation (AMOC)

The development of large cold water pools south and east of Greenland (Rahmstorf et al. 2015[15]) and at the fringe of West Antarctica (Figures 1 and 5) signify early stages in the development of a stadial, consistent with the decline in the Atlantic Meridional Ocean Circulation (AMOC) (Figure 4). These projections differ markedly from linear model trends (Figure 1). IPCC models mainly assume long term ice melt[16], stating “For the 21st century,

we expect that surface mass balance changes will dominate the volume response of both ice sheets (Greenland and Antarctica). A key question is whether ice-dynamical mechanisms could operate which would enhance ice discharge sufficiently to have an appreciable additional effect on sea level rise"[17]The IPCC conclusion is difficult to reconcile with studies by Rignot et al. (2011) reporting that in 2006 the Greenland and Antarctic ice sheets experienced a combined mass loss of 475 ± 158 Gt/yr, equivalent to 1.3 ± 0.4 mm/yr sea level rise."[18]. For the Antarctic ice sheet the IEMB team (2017) states the sheet lost $2,720 \pm 1,390$ billion tonnes of ice between 1992 and 2017, which corresponds to an increase in mean sea level of 7.6 ± 3.9 millimeter[19]

A non-linear climate warming trend, including stadial freeze events, bears significant implications for planning future adaptation efforts, including preparations for transient deep freeze events in parts of Western Europe and eastern North America, for periods lasting several decades (Figure 5) and coastal defenses against enhanced storminess arising from increased temperature contrasts between the cooled regions and warm tropical latitudes.

Imminent climate risks

Climate model projections for the 21st to 23rd centuries need to take paleoclimate evidence more fully into account, including the transient stadial effects of ice melt water flow into the oceans and amplifying feedbacks of global warming from land and oceans. Radiative forcing[20], increasing with concentration of atmospheric greenhouse gases and rising by about 0.04 Watt/m²/year over the last 50 years[21], totaled by more than 2 Watt/m², equivalent to $\sim 3.0^\circ\text{C}$ ($\sim 1.5^\circ\text{C}$ per W/m²)[22]. The rise of mean global temperatures to date by 0.9°C since 1880[23]therefore represents lag effect, pointing to potential temperature rise by approximately two degrees Celsius. A further rise in global temperatures would be enhanced by amplifying feedbacks from land and oceans, including exposure of water surfaces following sea ice melting, reduction of CO₂ concentration in water, release of methane and fires. Climate change trajectories would be highly irregular as a result of stadial events affected by flow of ice melt water into the oceans. Whereas similar temperature fluctuations and stadial events occurred during past interglacial periods (Cortese et al. 2007[24]; Figure 6), when temperature fluctuations were close to $\sim 1^\circ\text{C}$, further rises in temperature in future would enhance the intensity and frequency of extreme weather events, entering uncharted territory unlike any recorded during the Pleistocene, rendering large parts of the continents uninhabitable.

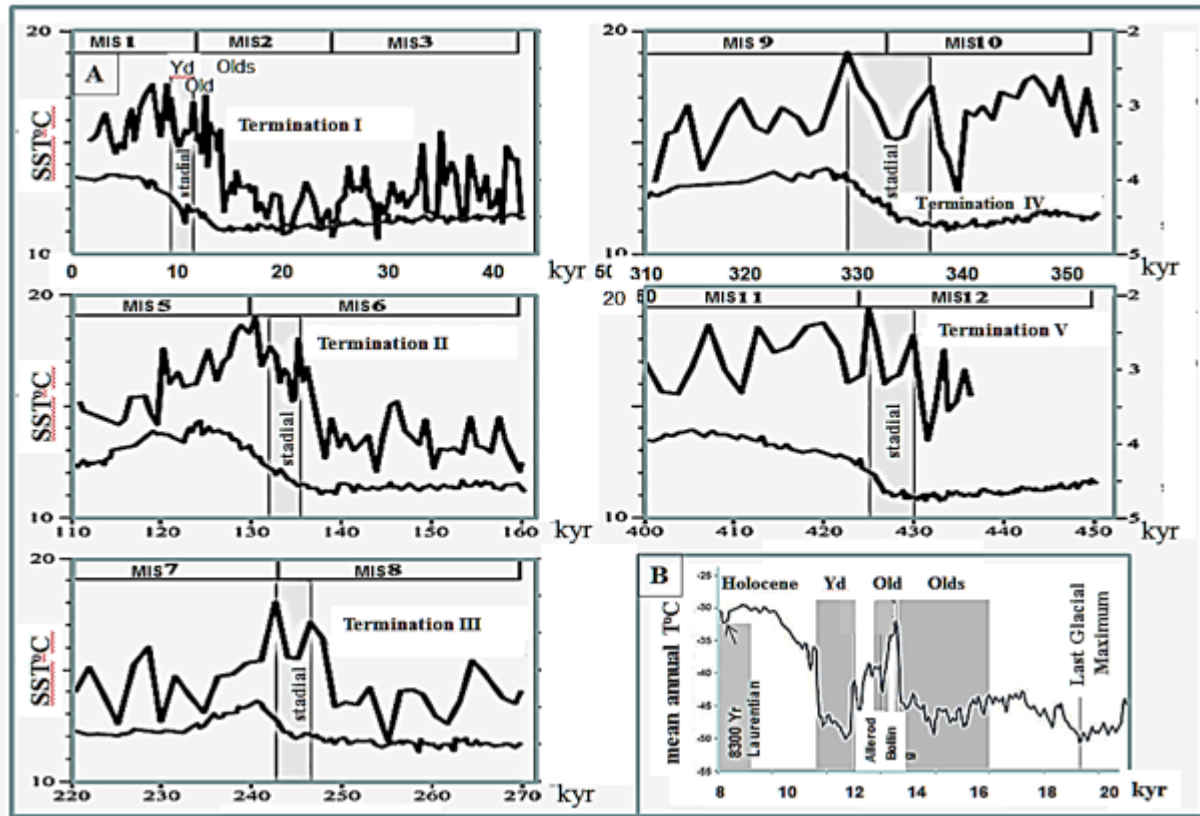


Figure 6. A. Evolution of sea surface temperatures in 5 glacial-interglacial transitions recorded in ODP 1089 at the sub-Antarctic Atlantic Ocean. Lower grey lines – $\delta^{18}\text{O}$ measured on *Cibicidoides* plankton; Black lines – sea surface temperature. Marine isotope stage numbers are indicated on top of diagrams. Note the stadial temperature drop events following interglacial peak temperatures, analogous to the Younger Dryas preceding the onset of the Holocene (Cortese et al. 2007[25]). B. Mean temperatures for the late Pleistocene and early Holocene.

*

Note to readers: please click the share buttons above. Forward this article to your email lists. Crosspost on your blog site, internet forums. etc.

Dr Andrew Glikson, Earth and Paleo-climate science, Australia National University (ANU) School of Anthropology and Archaeology, ANU Planetary Science Institute, ANU Climate Change Institute, Honorary Associate Professor, Geothermal Energy Centre of Excellence, University of Queensland. He is a frequent contributor to Global Research.

Notes

[1] <https://www.ipcc.ch/sr15/>

[2] https://www.climatecouncil.org.au/resources/limiting-temperature-rise/?gclid=EAlaQobChMl-Wq7-KM4AIVVQ4rCh0WSQ69EAAAYASAAEgLhp_D_BwE

[3] <https://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf>

[4] <https://johncarlosbaez.wordpress.com/2014/04/16/what-does-the-new-ipcc-report-say-about-climate->

[change-part-6/](#)

[5] <https://www.ncbi.nlm.nih.gov/pubmed/11196631>

[6] <https://www.sciencedirect.com/science/article/pii/S0277379118305705>

[7] <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007PA001457>

[8] <https://www.atmos-chem-phys.net/16/3761/2016/>

[9] <https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2014GL061052>

[10] <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2011GL046583>

[11] <https://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf>

[12] Sverdrup:Unit of flow - 1 Sv equal to 1,000,000 cubic metres per second

[13] <https://www.britannica.com/science/Eemian-Interglacial-Stage>

[14] http://moraymo.us/wp-content/uploads/2018/03/Rovereetal_PNAS_2017.pdf;
<https://www.clim-past.net/3/181/2007/cp-3-181-2007.pdf>

[15] <https://www.nature.com/articles/nclimate2554>

[16] https://motherboard.vice.com/en_us/article/43e8yp/the-uns-devastating-climate-change-report-was-too-optimistic

[17] <https://archive.ipcc.ch/ipccreports/tar/wg1/416.htm>

[18] <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011GL046583>

[19] https://www.nature.com/articles/s41586-018-0179-y.epdf?referrer_access_token=S5Y_R-7foKDe_0LTC1ePHNRgN0jAjWel9jnR3ZoTv0PBKEqWHTwARlrR4OxoHfD5WZGh-A0FX8FPbkdWIZLYWSZXdrY6PsBEIhQw8kfzqY8CzRUyWao-gOmRIMtURwKL_LY17cUVdlgmtWLaRk_EWhFIlOjdJyawITzjhU3y8fPcoosWQQMgEN2fv3kQx_S8JT4BLn4bheLaGZaYfD6j64pzwLO1V5h5TxsI6j4qUimPnWHm2Ax0DoQjYvfEgChVqY1nI8d3M_kRuObyJedPw%3D%3D&tracking_referrer=www.abc.net.au

[20] Radiative forcing - the difference between incoming radiation and radiation reflected back to space

[21] http://www.columbia.edu/~jeh1/mailings/2018/20181206_Nutshell.pdf

[22] <https://arxiv.org/abs/0804.1126>

[23] <https://climate.nasa.gov/vital-signs/global-temperature/>

[24] <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007PA001457>

[25] <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007PA001457>

The original source of this article is Global Research

[Comment on Global Research Articles on our Facebook page](#)

[Become a Member of Global Research](#)

Articles by: **[Dr. Andrew Glikson](#)**

Disclaimer: The contents of this article are of sole responsibility of the author(s). The Centre for Research on Globalization will not be responsible for any inaccurate or incorrect statement in this article. The Centre of Research on Globalization grants permission to cross-post Global Research articles on community internet sites as long the source and copyright are acknowledged together with a hyperlink to the original Global Research article. For publication of Global Research articles in print or other forms including commercial internet sites, contact: publications@globalresearch.ca

www.globalresearch.ca contains copyrighted material the use of which has not always been specifically authorized by the copyright owner. We are making such material available to our readers under the provisions of "fair use" in an effort to advance a better understanding of political, economic and social issues. The material on this site is distributed without profit to those who have expressed a prior interest in receiving it for research and educational purposes. If you wish to use copyrighted material for purposes other than "fair use" you must request permission from the copyright owner.

For media inquiries: publications@globalresearch.ca