

Climate system trend will result in 5°C to 6°C global temperature increase in decade or two



“It is vital that we slash greenhouse gas emissions”

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“Our climate system is presently undergoing preliminary stages of abrupt climate change. If allowed to continue, the planet climate system is quite capable of undergoing an average global temperature increase of 5°C to 6°C over a decade or two. Precedence for changes at such a large rate can be found at numerous times in the paleo-records. From my chair, I conclude that it is vital that we slash greenhouse gas emissions and undergo a crash program of climate engineering to cool the Arctic region and keep the methane in place in the permafrost and ocean sediments.” —Paul Beckwith

Paul teaches climatology/meteorology and does PhD research on ‘Abrupt climate change in the past and present’ at the University of Ottawa. To read his climate system summary click on the following linked title. Or read below a slightly restructured reposting.

**[Where we are – A climate system summary](#) by Paul Beckwith, [Arctic News](#),
October 3, 2014**

Air — The presence of GHGs (greenhouse gases) in the atmosphere is vital to sustain life on our planet. These GHGs trap heat and keep the global average surface temperature of the planet at about 15°C, versus a chilly -18°C, which would be our temperature without the GHGs.

We have changed the chemistry of the atmosphere, specifically of the concentrations of the GHGs.

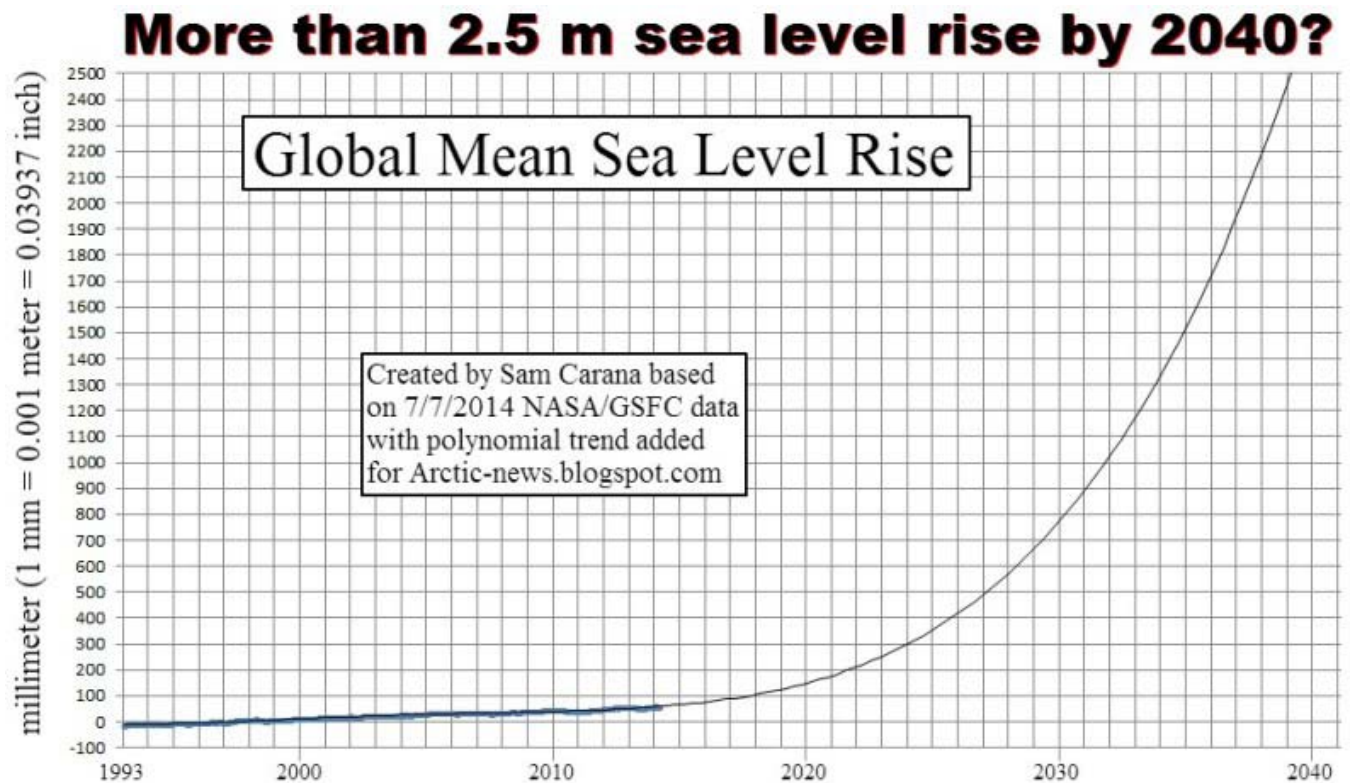
- **Concentrations of carbon dioxide have increased about 40%** since the start of the industrial revolution (from a tight range between 180 to 280 ppm [parts per million] over at least the last million years) to 400 ppm.
- **Concentrations of methane have increased by more than 2.5x** since the start of the industrial revolution (from a tight range of 350 to 700 ppb) [parts per billion] to over 1800 ppb.
- **The additional heat trapped has warmed our planet by over 0.8°C over the last century, with most of that rise (0.6°C) occurring in the last 3 or 4 decades.**

Oceans – Over 90% of the heat trapped on the surface of the planet is increasing the temperature of the ocean water.

- **The increased levels of carbon dioxide** in the atmosphere acidify the rainfall, and have increased the acidity of the oceans by about 40% in the last 3 to 4 decades (pH of the open ocean has dropped from 8.2 down to 8.05 on the logarithmic scale).
- **An increased drop to a pH of 7.8** will prevent calcium based shells from forming, and threaten the entire food chain of the ocean.

Changes in ocean currents, and vertical temperature profiles are leading to more stratification and less overturning which is required to transport nutrients to the surface for phytoplankton to thrive.

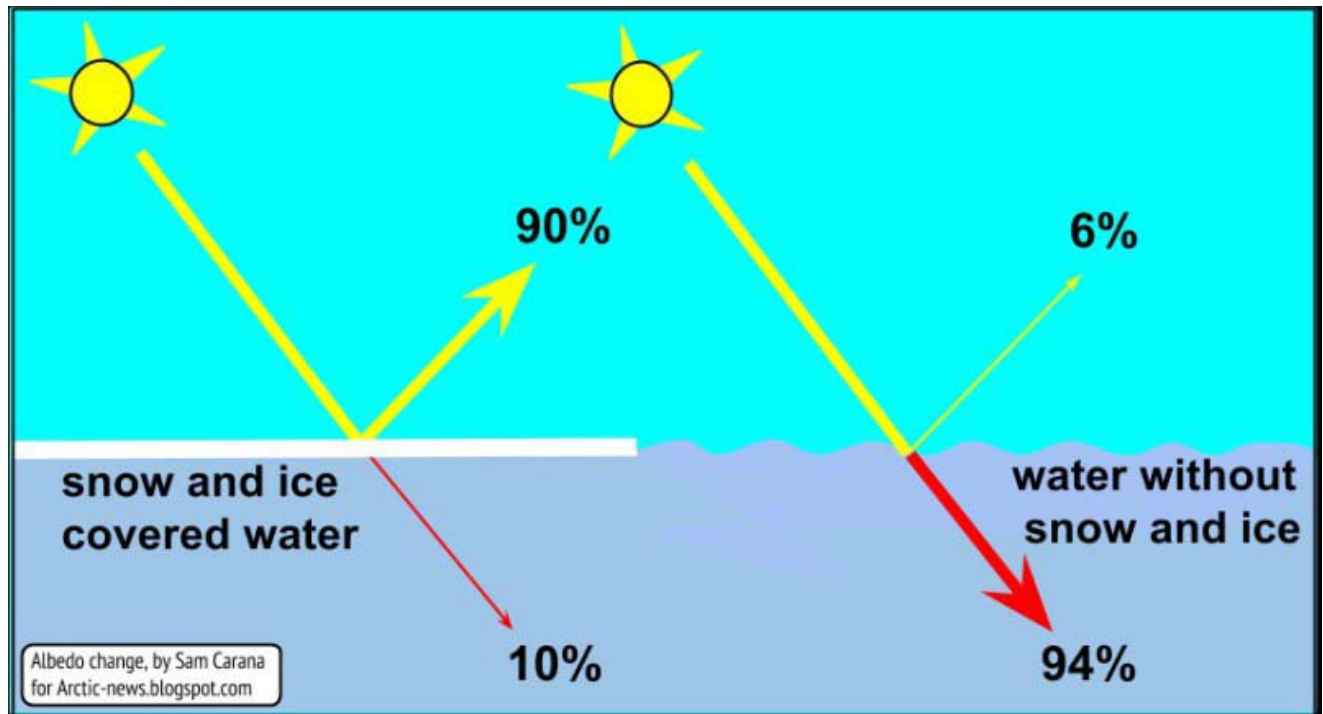
- **Global sea levels are presently rising at a rate of 3.4 mm per year**, compared to a rate of about 2 mm per year a few decades ago.
- **Melt rates on Greenland have doubled in the last 4 to 5 years**, and
- **melt rates on the Antarctica Peninsula have increased even faster.** Based on the last several decades, melt rates have had a doubling period of around 7 years or so.
- **If this trend continues, we can expect a sea level rise approaching 7 meters by 2070.**



From: [More than 2.5 m sea level rise by 2040](#)

Land – Higher global average temperatures have increased the amount of water vapor in the atmosphere by about 4% over the last several decades, and around 6% since the start of the industrial revolution. Changes in heat distribution with latitude from uneven heating with latitude has slowed the jet streams and caused them to become wavier and fractured, and has changed the statistics of weather. **We now have higher frequencies, intensities, and longer duration extreme weather events and also a change in location of where these events occur.**

Feedback loops — The sensitivity of the climate system to increased levels of GHG appears to be much higher than previously expected due to many powerful reinforcing feedbacks.



From: [Arctic Warming due to Snow and Ice Demise](#)

Arctic temperature amplification from exponentially declining sea ice and spring snow cover are the strongest feedbacks in our climate system today.

- **The average albedo (reflectivity) of the Arctic region** has decreased from 52% to a present day value of 48% over 3 or 4 decades.
- **The increased absorption of energy in the Arctic** has increased the temperature at high latitudes at rates up to 6 to 8x the global average temperature change.
- **The reduced temperature difference between the Arctic and equator** has reduced the west to east speed of the jet streams causing them to slow and become wavier and more fractured, and directly causing a large change in the statistics of our global weather.

Methane gas emissions have been rapidly rising in the Arctic region from the terrestrial permafrost and the continental shelf marine sediments, most notably on the ESAS (Eastern Siberia Arctic Shelf). **The extremely potent ability of methane to warm the planet (global warming potential GWP is >150, 86, and 34 times for methane relative to carbon dioxide on a few year, several decade, and century timescale, respectively) makes increased emissions an extremely dangerous risk to our well-being on the planet.**

My overall assessment

Our climate system is presently undergoing preliminary stages of [abrupt climate change](#). If allowed to continue, the planet climate system is quite capable of undergoing an average

global temperature increase of 5°C to 6°C over a decade or two. Precedence for changes at such a large rate can be found at numerous times in the paleo-records. From my chair, I conclude that it is vital that we slash greenhouse gas emissions and undergo a crash program of climate engineering to cool the Arctic region and keep the methane in place in the permafrost and ocean sediments.



[Paul Beckwith](#) is part-time professor with the laboratory for paleoclimatology and climatology, department of geography, University of Ottawa. Paul teaches climatology/meteorology and does PhD research on 'Abrupt climate change in the past and present'. Paul holds an M.Sc. in laser physics and a B.Eng. in engineering physics and reached the rank of chess master in a previous life. [Click here](#) to view Paul's earlier posts at the Arctic-news blog.

SEE ALSO

- [What's wrong with the weather?](#) Arctic News, July 2, 2014 — What's happening is that temperatures in the Arctic are even rising faster than they are at the Equator. The falling temperature difference between the two is deforming the Jet Stream and slowing the speed at which the Jet Stream is circumnavigating the globe.
- [Arctic News: Polar jet stream appears hugely deformed](#) — Arctic News, December 20, 2012 — This is very worrying, as this is only one out of many feedbacks that come with accelerated warming in the Arctic. There are at least ten such feedbacks, as depicted in the diagram below, from the earlier post [Diagram of Doom](#).