How Feedback Loops Are Driving Runaway Climate Change

Midnight sun shines over the Arctic Ocean with drifting ice floes, north of the Arctic Circle in Nordaustlandet, Svalbard / Spitsbergen, Norway.Arterra / UIG via Getty Images

By Dahr Jamail, Truthout, Published October 1, 2018

If you think this summer has been intense as far as record warm temperatures, wildfires, drought, and flooding events around the Northern Hemisphere, you haven't seen anything yet — unless you happen to live in the Arctic.

According to the US National Oceanic and Atmospheric Administration (NOAA), air temperatures there are increasing at an "unprecedented rate" — twice as fast as they are around the rest of the globe. NOAA's 2017 Arctic Report Card states unequivocally that the Arctic "shows no sign of returning to reliably frozen region of recent past decades."

The Executive Summary of the report also adds, "Arctic paleo-reconstructions, which extend back millions of years, indicate that the magnitude and pace of the 21st century sea-ice decline and surface ocean warming is unprecedented in at least the last 1,500 years and likely much longer."

A recent report from National Geographic revealed that some of the ground in the Arctic is

no longer freezing, even during the winter. Along with causing other problems, this will become yet another feedback loop in the Arctic, causing yet more greenhouse gasses to be released from permafrost than are already being released and impacting the entire planet.

The simplest explanation for a positive climate feedback loop is this: The more something happens, the more it happens. One of the most well-known examples is the melting of sea ice in the Arctic during the summer, which is accelerating. As greater amounts of Arctic summer sea ice melt away, less sunlight is reflected back into space. Hence, more light is absorbed into the ocean, which warms it and causes more ice to melt, and on and on.

Dr. Ira Leifer is an academic researcher who specializes in bubble-related oceanographic processes (such as subsea bubble plumes emanating from the ocean floor**)**, satellite remote sensing, and air pollution. Working closely with NASA on some of his projects, Leifer uses the agency's satellite data to study methane in the Arctic and its role in climate disruption.

One of his concerns about a feedback loop already at play in the Arctic is how the heating of that region is already being amplified by ocean currents that transport warmer, more southerly waters northwards into Arctic seabed waters where it can affect methane deposits in submerged permafrost and sub-seabed methane hydrates.

"The release of this methane contributes powerfully to overall warming – methane is a very potent greenhouse gas, which actually has a bigger effect [on] the atmosphere's radiative balance than carbon dioxide on decadal timescales," Dr. Leifer told Truthout.

Although climate is generally thought to occur on century timescales, human timescales and ecological adaptation timescales are measured in decades instead of centuries, and this is now how many climate processes are being monitored given the rapidity of human-forced planetary warming.

Dr. Peter Wadhams is a world-renowned expert who has been studying Arctic sea ice for decades.

His prognosis for the Arctic sea ice is grim: He says it is in its "death spiral."

"Multi-year ice is now much less than 10 percent of the area of the ice cover; it was 60 percent or more before 2000," Dr. Wadhams told Truthout. "[Sea ice] extent in summer is down to 50 percent of its value in the 1980s."

Dr. Wadhams, who is also the President of the International Association for the Physical Sciences of the Ocean (IAPSO), noted that this primary feedback loop is much further along than most of us realize.

"I see the summer sea ice disappearing by the early 2020s," Wadhams said. He noted that the change of albedo (a measure of reflection of solar radiation) due to the loss of sea ice and snowline retreat across the Arctic "is sufficient to add 50 percent to the warming effect of CO2 emissions alone."

Alarmingly, on August 21, Arctic scientists told The Guardian that the oldest and strongest sea ice in the Arctic had broken up for the first time in recorded history. One of them described the event as "scary," in part because it occurred off the north coast of Greenland, which is normally frozen year-round. The region has long been believed to be "the last ice area": It was thought, at least until now, to be the final place that would hold out against the melting impacts from an increasingly warmer planet.

Abrupt Acceleration

Temperatures are rising most strongly in the Arctic, with some areas already showing an increase of as much as 5.7 degrees Celsius (10.26 degrees Fahrenheit).

Dr. Michael MacCracken, Chief Scientist for Climate Change Programs with the Climate

Institute in Washington, DC, explained to Truthout how, now that the Arctic is warmer, the temperature gradient between the tropics and the traditionally cold Arctic is reduced.

With a reduced gradient, the movement of warmth from low to high latitudes is slowed. As Earth rotates, this leads to a wavier jet stream that can carry low latitude warmth up to Alaska and elsewhere in the Arctic, and the southward reach of cold air in the Arctic to lower latitudes. This explains why New Orleans, for example, has recently experienced unusual freezing winter weather.

"In addition, the waves in the jet stream that result are shifting to the east less rapidly, which means the unusual weather patterns that are more frequently occurring are moving eastward less rapidly," Dr. MacCracken explained. "So both wet and dry periods are lasting longer, contributing to both excessively wet (e.g., flooding) and excessively dry (e.g., wildfire) conditions."

Dr. Wadhams is concerned about this as well.

"The jet stream effect is because Arctic air is warming faster than tropical air, so the temperature difference is decreasing," he explained. "This reduces the driving force on the jet stream, so it then meanders, which brings hot air to the higher latitudes (and cold air to some low latitudes)."

Summer weather patterns are now increasingly likely to become stalled out over places like North America, portions of Asia, and Europe, according to a recent climate study that showed how a warming Arctic is causing heatwaves in other places to become more intense and persistent due to a slowing of the jet stream.

Dr. Leifer warned that as these processes continue and the Arctic continues to heat up faster than the tropics, the pole-equator temperature difference that controls our weather and causes three major weather circulation "cells" — tropical, mid-latitude, and arctic — will merge into a single weather cell. A similar merging of weather cells occurred during the time of the dinosaurs.

"The jet stream, which controls seasonal storms in the midlatitudes, is a result of these three cells, and would disappear in a single weather cell planet, dramatically altering rain patterns and almost certainly heralding an ecosystem catastrophe," Leifer explained. "The plants that underlie the food chain would be replaced by others that the local animals (insects to apex predators) could not utilize — in short, an abrupt acceleration of the current *Great Anthropocene Extinction* event."

The diminishment of the jet stream also contributes to another potentially catastrophic feedback loop within the Arctic seabed: Changes to the jet stream are causing longer and more intense heat waves to occur across the Arctic, which of course causes the Arctic Ocean to warm further.

Kevin Lister, an associate with the Climate Restoration Foundation in Washington, DC, co-authored a paper with Dr. MacCracken for the United Nations that addressed the crisis in the Arctic, among other climate disruption-related issues.

Unlike the most commonly accepted idea that global temperatures should not be allowed to increase by more than 1.5°C, Lister told Truthout that the planet reaching 1.5°C above baseline "is fundamentally dangerous and that the rate of change we are seeing today means we will not even be able to stop the temperature at this level."

Lister said this conclusion was reached, in part, due to initial observations from Dr. Wadhams regarding how the loss of sea ice was amplifying rates of change in the Arctic.

Lister told Truthout that "methane emissions [in the Arctic] are already a severe risk," and that he and Dr. MacCracken's UN paper shows that once

temperatures started rising they would be largely unstoppable due to the interacting nature of the feedback mechanisms.

"Thus, one feedback mechanism, such as sea ice melting, can trigger another, such as methane releases, which then accelerates the first in a tightening spiral," he explained. "In reality, there are many critical feedback mechanisms and the interlocking effects between them means that the climate is far more unstable and irreversible than we are led to believe, and the climate's change is likely to follow a super exponential progression once the temperature rises above a certain level."

Dr. Leifer, who has been studying Arctic methane for years, shares the same concern.

"There is the potential for seabed methane deposits off Greenland to be destabilized by the input of warm melt water and also heat transport," he said, in addition to having pointed out that this process has been occurring in other areas around the Arctic for many years.

As I have written in the past, we are currently facing the very real possibility of a major methane release in the Arctic. Such a release would be a catastrophe for the global climate — and the survival of humans and other species.

Could a Dire Situation Lead to a "War for Survival"?

Lister and Dr. MacCracken both believe that the global focus on a maximum allowable temperature increase target of 1.5°C above baseline is both dangerous and unachievable. Most media and governmental attention has centered on keeping the Earth from warming 2°C over pre-industrial revolution baseline temperatures, and ideally limiting warming to 1.5°C. This is based on a politically agreed upon goal set forth during the 2015 Paris Climate talks, which were nonbinding.

"It reflects the way that intergovernmental climate change policy has been managed which has been to arbitrarily set a temperature target, which was firstly 2°C and then latterly 1.5°C, and then to see if economic and political policy can deliver an appropriate carbon budget," Lister explained. "This is clearly not a rational way to develop climate change policy."

Lister and Dr. MacCracken both believe that, in an ideal world, the process would be the other way round; governments would decide a safe temperature rise based on the best science and then set an appropriate climate change policy. But this is not the world we live in.

Mark Serreze, the director of the US National Snow and Ice Data Center at the University of Colorado, Boulder, recently pointed out how the Arctic climate system has entered uncharted territory, so that even computer models are "no longer providing a reliable guide to the future."

Dr. Leifer said that even if we prepare for the inevitable sea level rise from Greenland melting alone, accelerated melting there is "very bad," as it reduces the time to implement plans. However, he noted, most countries are not in preparation mode to begin with.

"For example, a forward-looking society would encourage relocation through, say, tax incentives and disincentives from, say, most of Florida, to higher ground — even purely on a hurricane insurance basis," he said. "Sadly, forward-looking is incompatible with our political system's biannual money festival, aka elections. Still, very few other countries are doing better — excepting some northern European countries, like Holland — despite differences."

The impacts of climate disruption aren't waiting for our preparations, or lack thereof. Dr. Leifer believes that, sooner or later, the sea levels will rise dramatically.

Once this happens, he believes coastal cities will have to be abandoned due to sea level rise and increasingly destructive hurricanes. He believes that the sooner that departure happens, the less

destruction and loss of human lives we will experience.

Dr. Leifer also expressed concern about the changes to the Atlantic Meridional Overturning Circulation (AMOC), which is currently weakening and already at its weakest in at least the last 1,600 years.

Dr. MacCracken told Truthout that his greatest concern about Arctic feedback loops is that of the melting of the plateau of the Greenland Ice Sheet. He explained that the meltwater and warmth at the surface is penetrating down into the ice sheet, softening it enough that the glacial ice has started flowing outward, and as this happens, the surface of the ice sinks to lower altitudes.

This kicks in a feedback loop that ultimately causes warming to accelerate, which causes the ice to flow faster, which further accelerates the melting.

"The ice making up the Greenland Ice Sheet holds about the equivalent of 6-7 meters (~20 feet) of global sea level rise, and glaciological evidence makes clear that an order of approximately half of that melted during the last interglacial about 125,000 years ago, contributing significantly to the 4-8 meter rise in sea level at that time," Dr. MacCracken said.

He pointed out that this rise was caused by a 1°C temperature increase, similar to the temperature increase Earth is experiencing right now (1.16°C above baseline).

"At that time, the atmospheric CO2 concentration was near 300 ppm and the warming was due to differences in the Earth's orbit around the Sun; today, the orbital parameters are less favorable to significant warming, but the CO2 concentration is a good bit higher and growing," Dr. MacCracken said. "And its warming influence acts all year long, making it not surprising that the loss of mass of ice from the Greenland Ice Sheet is going up rapidly with a stronger and stronger influence on sea level around the world."

The rapidly melting Greenland Ice Sheet is precisely what is causing the AMOC to slow.

Moreover, an Arctic that is continuing to warm could lead to the failure of the Gulf Current, Dr. Leifer said.

"The resultant deep freeze that would hit Europe would destroy European agriculture and likely lead to a massive war for survival," he warned.