Climate change impact on Gulf Stream will have severe consequences for weather in Europe and North America

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Human-induced climate change has caused a substantial reduction in the Gulf Stream's rate of flow, according to a new study by a team of scientists from Ireland, Britain and Germany published in the journal *Nature Geoscience* (Caesar et al, 25 February 2021). Furthermore, the researchers predict that should this trend continue, which is likely under current conditions, the degradation of the Gulf Stream will reach a "tipping point" beyond which the change will become irreversible, producing major, negative impacts to weather patterns along the North Atlantic coasts of Europe and North America. The results of this study support previous modeling that predicted the slowing that has now been documented.

The North Atlantic Gulf Stream, also known as the Atlantic Meridional Overturning Circulation (AMOC), begins near Florida, flows northward along the east coast of North America, then swings eastward toward Europe, subsequently diverging into a number of separate currents. It is one of the world's major ocean currents which have a major influence on global climate. In particular, the Gulf Stream acts as a moderating influence on the weather patterns of eastern North America and western Europe. Without it, weather patterns in these areas would be more extreme, including a greater range of temperatures and precipitation, and a marked increase in severe storms, possibly deflecting winter storm tracks over Europe. It would also accelerate sea level rise in both areas.

The moderating effect of the Gulf Stream on weather patterns along the northern hemisphere's Atlantic coasts is caused by the huge amount of warm water—more than 5.2 billion gallons (20 million cubic meters) per second—it pumps into the North Atlantic, counteracting the colder water from the Arctic region to the north.

The researchers predict that the tipping point could be reached by the year 2100, beyond which the Gulf Stream would be substantially degraded or halted altogether. Once that happens, the change would likely be irreversible, regardless of any efforts to moderate climate change.

Although the recording of precise measurements began only in 2004, the researchers were able to use 11 proxy indicators to reconstruct key characteristics of the Gulf Stream back about 2,000 years. These include atmospheric temperature records, Atlantic silt data from underwater sediment cores, deep-sea coral population records, tree rings and ice cores. These data allowed for estimations of the Gulf Stream's water temperature and rate of flow. For example, different coral species prefer specific temperature environments. Changes in coral populations thus indicate shifts in water temperature over time. And the greater the rate of water flow the larger the sediment particles that can be moved by the current. The data collected, representing a variety of sources and taken from dispersed locations were, nevertheless, found to present a broadly consistent pattern.

Similar research has been done for years. A work on the impact of climate change on the Gulf Stream was published in 2007, when Zickfield et. al. noted that, if current warming trends continue, there is a 40 percent chance of a "collapse" of the ocean current by 2100.

The sensitivity of the Gulf Stream's rate of flow to global warming is indicated by two changes identified by the study. The first was a small reduction prompted by the end of the Little Ice Age, a period of natural global cooling which lasted from approximately 1300 to 1850. The second was much more significant. Beginning in the mid-20th century, as anthropogenic (human-caused) global warming accelerated, the rate of flow began a precipitous decrease, which has now reached 15 percent

below the previous level. It is now at its lowest in over a millennium.

The historic pattern of flow of the Gulf Stream is driven by what is called deep convection. Warm and salty water moves from the south to the north where it cools down and thus gets denser. When it is heavy enough the water sinks to deeper ocean layers and flows back to the south. Global warming disturbs this mechanism: Increased rainfall and enhanced melting of the Greenland ice sheet add fresh water to the surface ocean. This reduces the salinity and thus the density of the water, inhibiting the sinking and thus weakening the flow of the Gulf Stream.

A warmer climate increases rainfall and accelerates the rate of glacial melting, most significantly in this case the Greenland ice sheet. Separate research has demonstrated that melting of the Greenland ice sheet is 14 percent more rapid now than it was between 1985 and 1999.

The researchers project that at the current rate, assuming no significant reduction in the pace of global warming, the Gulf Stream could slow another 45 percent by the end of the century, at or near a critical tipping point of no return.

The consequences of disruption of the Gulf Stream are one more indication of the truly catastrophic effects of uncontrolled climate change. So far, the meagre efforts toward slowing the rate of global warming have been woefully inadequate, amounting to little more than lip service.

As with the lack of effective response to the COVID-19 pandemic, this criminal pattern is the direct result of the maniacal and myopic drive of capitalism to maximize profits, no matter what the cost, even if it means rendering the earth unlivable. One need only look at our near neighbor, the planet Venus, an extreme and unlivable hothouse, to see what’s in store unless the working class takes control and rapidly implements the measures needed to halt climate change.