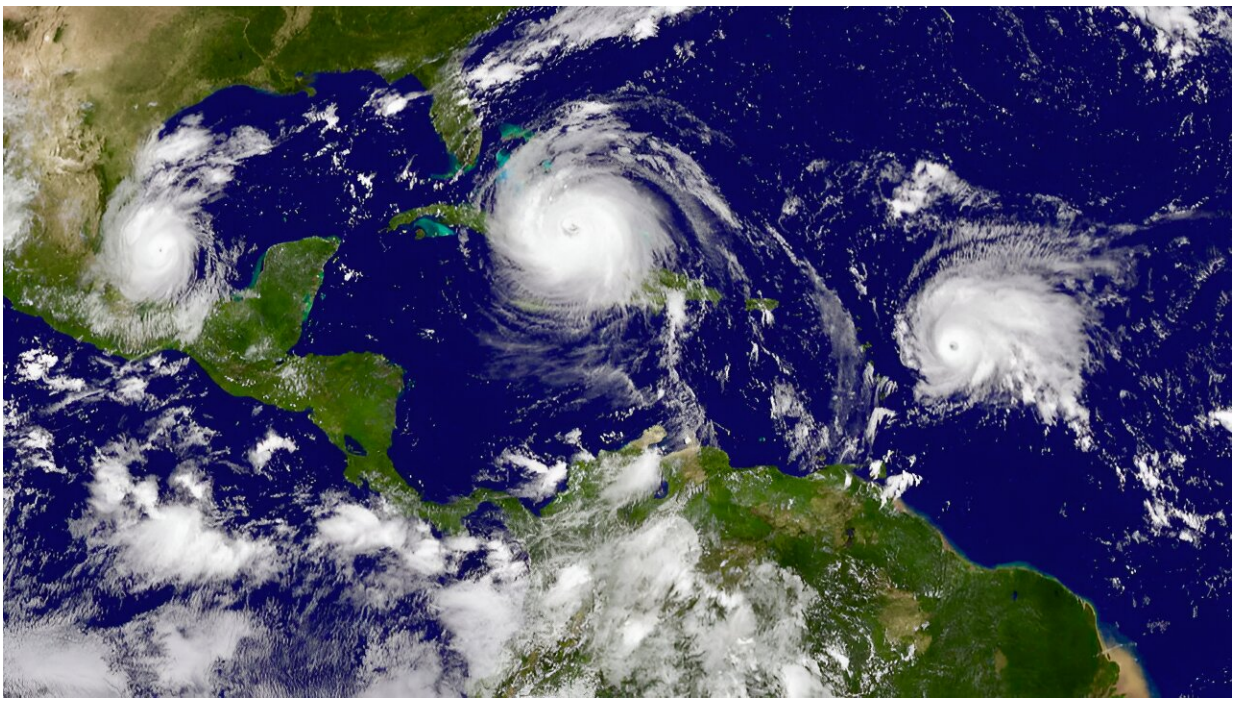
Human emissions shown to drive changes in North Atlantic ocean temperatures, West African rainfall and hurricanes

September 13 2023



Continuous reduction in human-induced aerosol emissions around the Atlantic, along with ongoing and future warming due to greenhouse gases, suggest there will likely not be a return to the quiet period in hurricane activity in the Atlantic in the decades of the mid-century,. Credit: NOAA

A new climate study led by scientists at the University Miami Rosenstiel

School of Marine, Atmospheric, and Earth Science found that temperature fluctuations in the tropical Atlantic Ocean temperature are largely driven by human-induced aerosol emissions, impacting rainfall in West Africa's Sahel region and hurricane formation in the Atlantic.

The findings, published in the journal *Nature*, comes in a year when several hurricanes, including Hurricane Idalia, formed within days of each other over the tropical Atlantic.

"Our findings suggest the waxing and waning in Atlantic ocean temperature, hurricanes, and Sahel rainfall are largely driven by human-induced emissions," said the study's lead author Chengfei He, a postdoctoral researcher at the Rosenstiel School, "The novel results are hidden in the noise and can only be revealed by new techniques."

The researchers used a grand ensemble simulation technique that took the average of more than 400 climate model simulations from climate centers worldwide. Like noise-canceling headphones, the technique showed the climate changes resulting from external forcings—a force on the climate system that mainly comes from human activities and volcanic eruptions.

"For a long time, changes in the West African rainfall and Atlantic hurricanes were believed to be driven by natural cycles within the climate system, such as the Atlantic Meridional Overturning Circulation," said study co-author Amy Clement, a professor of atmospheric sciences at the Rosenstiel School. "Now we have found that the forced climate changes in our model simulations closely match the real-world observations seen in the tropical Atlantic."

The results from these simulations suggest that suppressed Atlantic hurricane activity and a drier Sahel in the decades following World War II were mostly driven by human-caused aerosol emissions. West Africa's

Sahel region stretches south of the Saharan desert from the Atlantic to the Red Sea.

This culminated in drought in the early 1980s with food shortages and diseases resulted in over hundreds of thousands of lives lost from West Africa to Ethiopia. The reduction in aerosol emissions after the 1980s resulted in more Atlantic hurricanes and more Sahel rainfall. The results also showed similarities in sea surface temperature, hurricane activity, and Sahel rainfall that closely matches what scientists observe in the tropical Atlantic.

The researchers also note that there are many factors that influence the activity in hurricane season, and also that storms can and will occur even if the overall activity of a hurricane season is low.

"Due to the continuous reduction in human-induced aerosol emissions around the Atlantic, along with ongoing and future warming due to greenhouse gases, we suggest there will not likely be a return to the quiet period in hurricane activity in the Atlantic in the decades of the mid-century," said He.

More information: Chengfei He, Tropical Atlantic multidecadal variability is dominated by external forcing, *Nature* (2023). DOI: 10.1038/s41586-023-06489-4.
www.nature.com/articles/s41586-023-06489-4

Provided by Rosenstiel School of Marine, Atmospheric, and Earth Science

https://phys.org/news/2023-09-human-emissions-shown-north-atlantic.html