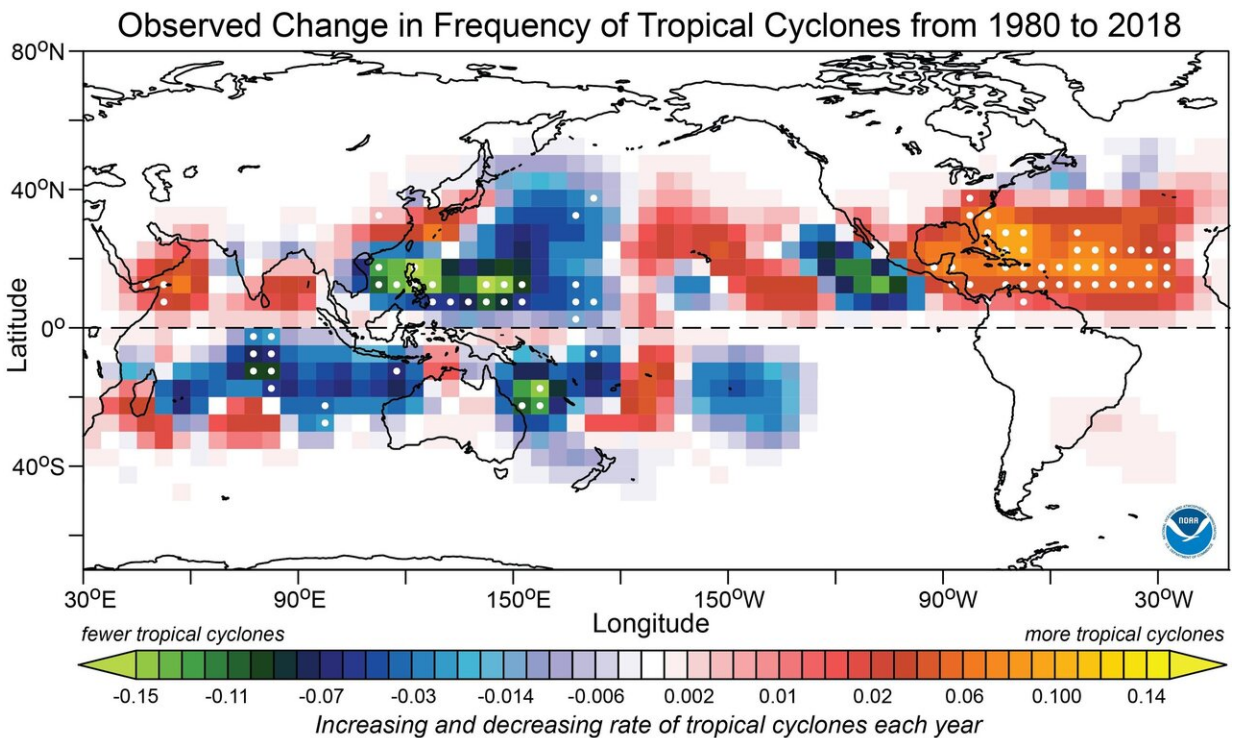


Climate change has been influencing where tropical cyclones rage: study

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This graphic depicts the global pattern of where the frequency of tropical cyclones has increased and where it has decreased around the world from 1980 to 2018. New NOAA research shows that while the global annual average number of tropical cyclones has remained at 86, climate change has influenced the location of where tropical cyclones have become more frequent, or less frequent.

This graphic depicts the global pattern of where the frequency of tropical cyclones has increased and where is has decreased from 1980 to 2018. New NOAA research shows that while the annual average number of tropical cyclones has remained at 86, climate change has influenced where the frequency of tropical cyclones have increased, decreased. Credit: NOAA

While the global average number of tropical cyclones each year has not budged from 86 over the last four decades, climate change has been influencing the locations of where these deadly storms occur, according to new NOAA-led research published in *Proceedings of the National Academy of Sciences*.

New research indicates that the number of [tropical cyclones](#) has been rising since 1980 in the North Atlantic and Central Pacific, while storms have been declining in the western Pacific and in the southern Indian Ocean.

"We show for the first time that this observed geographic pattern cannot be explained only by natural variability," said Hiroyuki Murakami, a climate researcher at NOAA's Geophysical Fluid Dynamics Laboratory and lead author.

Murakami used climate models to determine that [greenhouse gases](#), manmade aerosols including particulate pollution, and [volcanic eruptions](#) were influencing where tropical cyclones were hitting.

3 forces influence where storms are hitting

Greenhouse gases are warming the upper atmosphere and the ocean. This combines to create a more stable atmosphere with less chance that convection of air currents will help spawn and build up tropical cyclones.

Particulate pollution and other aerosols help create clouds and reflect sunlight away from the earth, causing cooling, Murakami said. The decline in [particulate pollution](#) due to pollution control measures may increase the warming of the ocean by allowing more sunlight to be absorbed by the ocean.

Diminishing manmade aerosols is one of the reasons for the active

tropical cyclones in the North Atlantic over the last 40 years, Murakami said. However, toward the end of this century, tropical cyclones in the North Atlantic are projected to decrease due to the "calming" effect of greenhouse gases.

Volcanic eruptions have also altered the location of where tropical cyclones have occurred, according to the research. For example, the major eruptions in El Chichón in Mexico in 1982 and Pinatubo in the Philippines in 1991 caused the atmosphere of the northern hemisphere to cool, which shifted tropical cyclone activity southward for a few years. Ocean warming has resumed since 2000, leading to increased tropical cyclone activity in the northern hemisphere.

Looking ahead: Scientists predict fewer tropical cyclones by 2100 but likely more severe

Climate models project decreases in tropical cyclones toward the end of the 21st century from the annual average of 86 to about 69 worldwide, according to the new study. Declines are projected in most regions except in the Central Pacific Ocean, including Hawaii, where tropical cyclone activity is expected to increase.

Despite a projected decline in tropical cyclones by 2100, many of these cyclones will be significantly more severe. Why? Rising [sea surface temperatures](#) fuel the intensity and destructiveness of tropical storms.

"We hope this research provides information to help decision-makers understand the forces driving tropical cyclone patterns and make plans accordingly to protect lives and infrastructure," Murakami said.

More information: Hiroyuki Murakami et al., "Detected climatic change in global distribution of tropical cyclones," *PNAS* (2020).

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