

The Tropics Play A More Active Role Than Was Thought In Controlling The Earth's Climate

Researchers from the Universitat Autònoma de Barcelona and Durham University (UK) have discovered that a million years ago, global climate changes occurred due to changes in tropical circulation in the Pacific similar to those caused by El Niño today. Changes in atmospheric circulation caused variations in heat fluxes and moisture transport, triggering a large expansion of the polar ice sheets and a reorganisation of the Earth's climate.

The discovery, published in *Geology*, shows that local climate changes in the tropics can create more global climate changes, and emphasises the hypothesis that the tropics play a more active role than was thought in controlling the Earth's climate.

The planet enters and leaves glacial periods approximately every 100,000 years. However, a million years ago these cycles lasted only 40,000 years. Scientists have reconstructed the chain of climatic events that brought about a change in the frequency of glacial periods and that occurred alongside changes in sea temperatures in the Pacific Ocean and alongside significant changes to tropical climates.

The researchers have worked mainly with data obtained from the remains of marine organisms that have accumulated over time in the tropical Pacific. These fossil records show that approximately 1.2 million years ago, the difference in sea temperatures between the East and West Pacific began changing gradually over the course of 400,000 years.

In the equatorial regions surrounding Central America, the sea cooled; while around Indonesia, sea temperatures barely changed. This caused changes in atmospheric circulation, creating what is now known as the Walker circulation.

According to the researchers, these changes to tropical atmospheric circulation caused a change in heat fluxes and moisture transport to the polar regions. This brought about an increase in snowfall, enabling the ice sheets, particularly in the northern hemisphere, to expand and change in the frequency of glacial periods from 40,000 to 100,000 years.

Until now this expansion was thought to have been influenced only by the ice sheets themselves and by the ocean currents and the atmospheric circulation at high altitude in the northern hemisphere, as well as by CO₂ levels in the atmosphere.

"Our results show that local climatic changes in the tropics can produce global changes," stated Antoni Rosell of the UAB, one of the authors of the research. "We are seeing that the tropics play a more active role than was thought in controlling the Earth's climate".

The two researchers, Antoni Rosell, a researcher of the Catalan Institute for Research and Advanced Studies (ICREA) for the UAB Institute of Environmental Science and Technology, and Erin L. McClymont, of Durham University (UK), currently at the University of Bristol, have published these results in *Geology*, the most important scientific journal in this field.

The uneven rhythm of the Earth's cooling process

The Earth has been passing through a cooling period for several million years. The process is not one of

gradual, continuous cooling, but rather one of sporadic stops and starts. Professor Rosell's previous article, published in Nature, looked at one of these transitions. This transition was significant because it resulted in the cooling of large parts of the northern hemisphere, especially North America.

The latest article looks at another one of these transitions, this time in the more recent past and on a global scale. This transition is very important in climatology, as it coincides with a change in the frequency of glacial periods, the reasons for which are not fully understood. Although it was a change in the North Pacific that caused the northern hemisphere permafrost 2.7 million years ago, in the more recent case 1 million years ago, the origin of the permafrost was at the tropics.

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