Scientist studies climate record embedded in Antarctic ice

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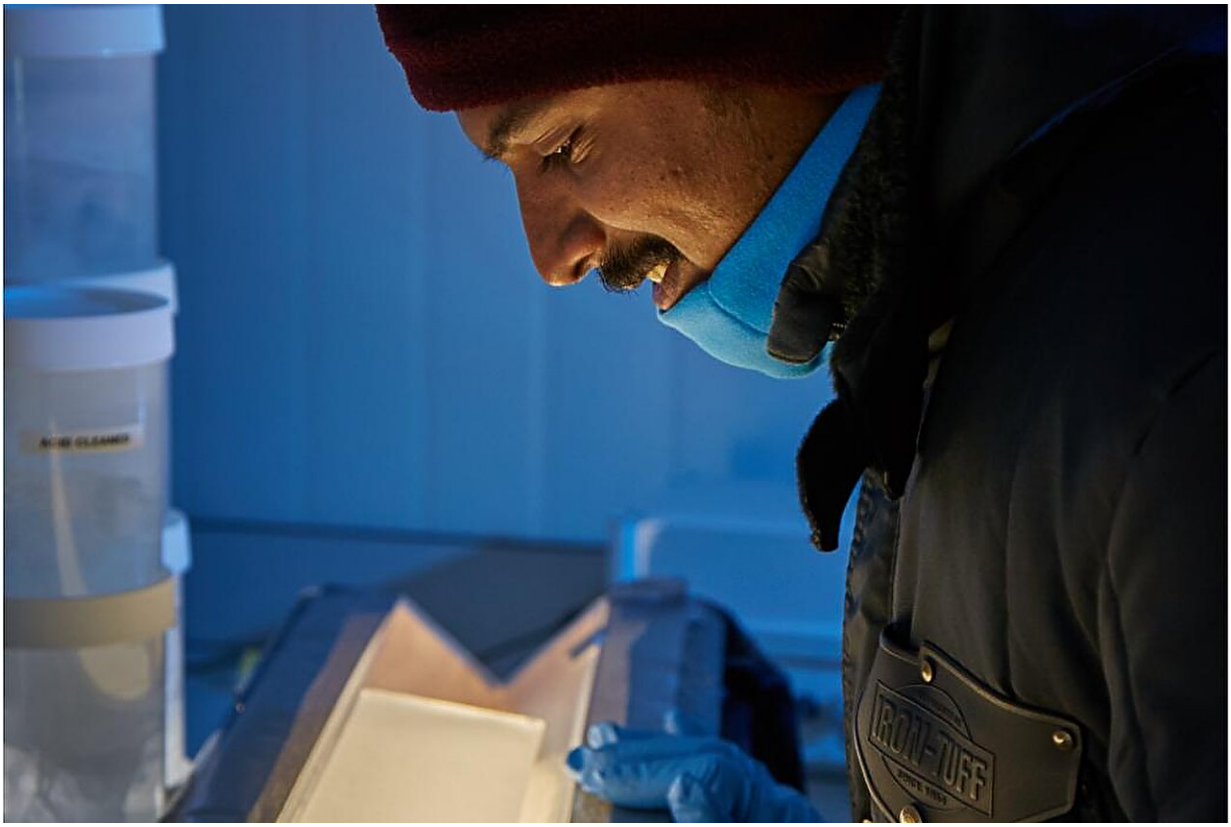

University of Canterbury Postdoctoral Fellow Dr Abhijith Ulayottil Venugopal is studying a 764-metre ice core that preserves more than 80,000 years of global climate data. Credit: GNS Science / Victoria University of Wellington / Roosevelt Island Climate Evolution (RICE) Project

A Canterbury climate modeler is part of an international team studying a

764-meter ice core that preserves more than 80,000 years of global climate data.

Dr. Abhijith Ulayottil Venugopal, a Postdoctoral Fellow from the School of Physical and Chemical Sciences at Te Whare Wānanga o Waitaha | University of Canterbury (UC), carried out his research as part of the Roosevelt Island Climate Evolution (RICE) project, a nine-nation collaborative science venture led by New Zealand.

The RICE project aims to investigate the stability of the Ross Ice Shelf and the West Antarctic Ice Sheet in a warming climate, and to better understand implications for global sea level change.

To enable this research, a deep ice core was extracted from Roosevelt Island in the Ross Dependency between 2011 and 2013 in field operations supported by Antarctica New Zealand and the US Antarctic Programme (USAP). Scientists hope the resulting data will improve the models used to project future climate change and assist understanding of the thresholds beyond which irreversible change will occur.

Dr. Venugopal's research focuses on the impact of Westerly wind patterns on the Southern Ocean as this affects the release of CO_2 from deep ocean currents. The study, "Antarctic evidence for an abrupt northward shift of the Southern Hemisphere westerlies at 32ka BP," a collaboration with colleagues from New Zealand (GNS Science and VUW), United States, Germany and Denmark, has been published in the journal *Nature Communications*.

"By studying the ice core, we see that when the Westerly wind belt shifted, it changes the way ocean currents move. This can alter the amount of carbon dioxide brought to the surface to be released into the atmosphere, which has a global impact," he says.

Roosevelt Island is a "grounded ice dome" formed when fallen snow creates layers of ice over millennia. These layers provide a highly accurate record of the temperature, dust composition, and gas concentrations present in the atmosphere during specific time periods.

Dr. Venugopal says the samples extracted from the Island provide an unparalleled archive of the planet's atmospheric and climatic history.

"The benefit of the ice core is that it gives a continuous record of temperature, sea-ice changes, and wind patterns, all from the same sample. By studying the changes in the ice over time we can see that, in the past, the climate system has approached thresholds at which change occurs very rapidly."

The study identified, for the first time, an abrupt equatorward shift in the position of the Westerlies 32,000 years ago during the last ice age. This research is part of the broader international scientific community's effort to look at past time intervals for clues on the behavior of important climate drivers, such as the Southern Hemisphere Westerlies.

The findings suggest that when such climatic thresholds are reached the atmospheric response can be rapid, taking place over a human timescale. As the future behavior of Westerly winds will be highly influenced by levels of greenhouse gas emissions this research will help to anticipate potential consequences, both regionally and globally.

Dr. Giuseppe Cortese, a co-author on the study from GNS Science, says shifts in the position and strength of this wind system are also observed in response to current warming trends. "These shifts have important consequences for the global climate system and have an impact on New Zealand. They affect the currents that transport heat around the ocean, and influence regional temperature, precipitation and storms over New Zealand."

RICE Chief Scientist, Professor Nancy Bertler from Te Herenga Waka—Victoria University of Wellington (VUW) and GNS Science, notes that this important study is particularly timely as Antarctica is experiencing remarkable and concerning extreme climate events that have the potential for cascading impacts with global consequences which are not yet captured or predicted by models. "Dr. Venugopal's findings provide critical insights that help improve models and future projections."

From 2–8 October, Christchurch's Days of Ice festival will celebrate Antarctic exploration and scientific investigation and highlight the unique connection that Ōtautahi—one of the world's five Antarctic Gateway cities—has with the frozen continent.

Dr. Venugopal believes such initiatives are important opportunities to communicate science to a broader audience. His own interest in science communication led to him translate the documentary Thin Ice: The Inside Story of Climate Science, adding subtitles enabling it to screen in his home country, India.

"The students there are only familiar with tropical climate, so this can help them get a better understanding of how Antarctica affects the global climate," he says.

More information: Abhijith U. Venugopal et al, Antarctic evidence for an abrupt northward shift of the Southern Hemisphere westerlies at 32 ka BP, *Nature Communications* (2023). DOI: 10.1038/s41467-023-40951-1

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