New Antarctic ice discovery aids future climate predictions

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A team of British climate scientists comparing today's environment with the warm period before the last ice age has discovered a 65 percent reduction of Antarctic sea ice around 128,000 years ago.

Reporting today in the journal *Nature Communications* scientists describe how by reconstructing the Earth's climate history through analysis of Antarctic ice cores they can determine what environmental conditions were like during ice ages and past warm periods.

This study focussed on sea ice conditions during the most recent warm period – known as the last interglacial – when global temperatures were similar to today.

Sea ice in the Arctic and around Antarctica regulates climate as, in summer vast areas of whiteness reflect heat from the sun back into the atmosphere, whilst in winter, sea ice prevents heat from escaping from the warm ocean to the air.

Current climate models forecast a reduction in Antarctic sea ice of up to about 60 percent by the end of the next century. Finding a 65 percent reduction in the climate record during a time when global climate conditions were similar to the present day is especially relevant.

The research team from British Antarctic Survey (BAS) and from the Universities of Bristol, Reading, Leeds and Cambridge studied data from ice cores drilled on the East Antarctic Ice Sheet.

A climate model was then used in the analysis of these data. The ice core data and climate model simulations were combined using advanced statistical techniques to determine the state of Antarctic sea ice 128,000 years ago.

Lead author Max Holloway of British Antarctic Survey explains: "We know that the Earth's climate is changing and that climate models predict a warmer world. What we are not yet sure about is the precise magnitude of future change or the timeline.

"This is where looking into the past can help. We used a number of analytical techniques to quantify change in sea ice extent around Antarctica during this important past warm period.

"We were expecting to see a relationship between warm temperatures around 128,000 years ago and a past collapse of the West Antarctic Ice Sheet.

"Surprisingly, we found that a major retreat of Antarctic sea ice is a more likely explanation. Our analysis suggests that a collapse of the West Antarctic Ice Sheet occurred later during the last interglacial.

"Something that our team will be looking at in more detail through another collaborative UK-US project."

Co-author, Professor Paul Valdes of the School of Geographical Sciences at the University of Bristol, said: "These results change our ideas about how the Antarctic responded in the past and will help us improve our understanding of likely future changes."

Today researchers observe differences between sea ice changes at both poles. This is largely due to different geography – the Arctic being a frozen sea surrounded by land and the Antarctic being a frozen landmass surrounded by sea. Whilst a rapid sea ice retreat has been recorded in the Arctic in recent decades, sea ice extent around some parts of the Antarctic have grown. Understanding the similarities and differences between hemispheres has been the subject of intense study by the international polar research community.

Research group leader, Dr Louise Sime, of BAS, said: "The current rapid retreat of sea ice in the Arctic Sea is of critical importance to Arctic ecosystems and global climate.

"By uncovering, for the first time, a huge retreat around Antarctica we have established that sea ice in the Southern Hemisphere is also susceptible to major climate changes. This discovery will help us

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understand whether similar sea ice retreat events are likely in a future high-CO2 world.

"Although Arctic sea ice has diminished during the past 30 years, little change has been observed around Antarctica. This discovery in the ice core record of a massive loss of sea ice provides evidence that Antarctic sea ice can also undergo similar major reductions. This may give vital clues to what might happen by the end of the next century."

This research was funded through a NERC PhD studentship. The BAS team's research on the last interglacial will be continued through NSFGEO-NERC project NE/P009271/1.

Paper:

'Antarctic last interglacial isotope peak in response to sea ice retreat not ice-sheet collapse' by Max D. Holloway, Louise C. Sime, Joy S. Singarayer, Julia C. Tindall, Pete Bunch & Paul J. Valdes is published this week in *Nature Communications*. DOI: 10.1038/ncomms12293

Further information

British Antarctic Survey (BAS), an institute of the Natural Environment Research Council (NERC), delivers and enables world-leading interdisciplinary research in the Polar Regions. Its skilled science and support staff based in Cambridge, Antarctica and the Arctic, work together to deliver research that uses the Polar Regions to advance our understanding of Earth as a sustainable planet. Through its extensive logistic capability and know-how BAS facilitates access for the British and international science community to the UK polar research operation. Numerous national and international collaborations, combined with an excellent infrastructure help sustain a world leading position for the UK in Antarctic affairs. For more information visit www.bas.ac.uk

An interglacial is a period of global warmth and reduced ice sheets that occurs between two glacial periods (or ice ages). Glacial periods, in contrast, are characterised by global cold and large ice sheets. The cold glacials typically last for around 100,000 years, whilst the warm interglacials are much shorter, may last between about 5,000 and 15,000 years. Our current interglacial (the Holocene) started about 11,000 years ago.

The last interglacial, 130,000 to 116,000 years ago, is particularly special because the climate was very similar to that today; global temperatures were 1-2 °C warmer than today but Polar Regions were substantially warmer and sea levels were 6-9 meters higher than present. Therefore, understanding the last interglacial could help us better predict likely polar change over the coming centuries.

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