Study reveals co-evolution of Indian Summer Monsoon and Antarctic Intermediate Water

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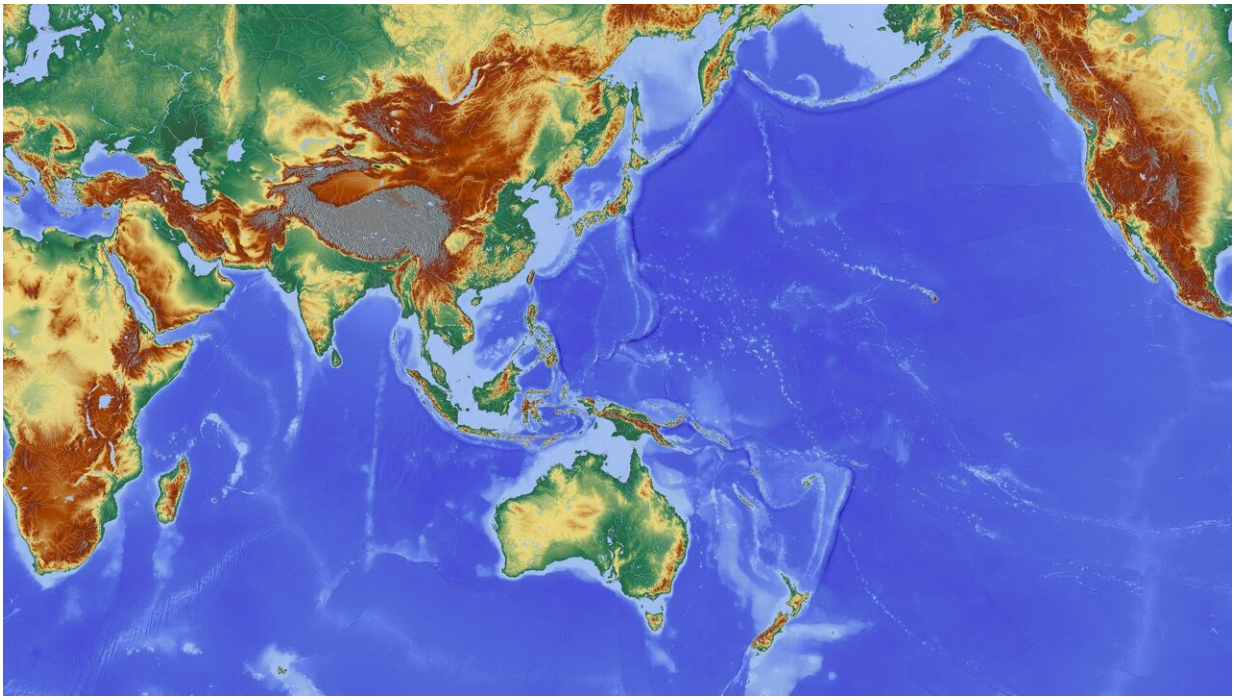

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The Last Deglacial (~19 ka BP ~ 11.5 ka BP) is the period of transition from the last major ice age to the warm period in the evolution of Earth's climate.

The study of its climate evolution mechanism can help to better understand the transition mechanism of the Earth's climate from cold to

warm and provide a reference to cope with the current global warming.

Recently, a research team led by Prof. Wan Shiming from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) reported a foraminiferal neodymium (Nd) isotopic record spanning the past 17,000 years with an unprecedented resolution of 200 years. This record used a mid-water marine core from the northern Indian Ocean to compare the differing interhemispheric relationships between the Indian Summer Monsoon and Antarctic Intermediate Water (AAIW).

The study was published in *Geophysical Research Letters* on Oct. 31.

"A difficult problem in the study of climate evolution during the Last Deglacial is to decipher the interaction mechanisms between the atmospheric and oceanic climate systems," said Prof. Wan.

The variability of this Nd isotopic record reflected the relative changes in continental weathering input driven by Indian Summer Monsoon precipitation and the strength of the Antarctic Intermediate Water mass of southern hemisphere origin. Through quantitative end-member decomposition of this Nd isotope record, the researchers investigated the interaction history of the Northern Hemisphere monsoon system (atmospheric circulation) and the Southern Hemisphere sourced AAIW (ocean circulation) on the millennial timescale.

They found that the weakening of the Indian Summer Monsoon during the millennial cold intervals coincides with the enhancement of the northward advection of AAIW, and the two varied inversely, while during the warm intervals between 10,000 and 8,000 years ago, the enhancement of monsoon activity was accompanied by a continuous strong AAIW inflow, and the two varied in the same direction.

To verify the above findings, the researchers further summarized the

AAIW evolution records tracked globally using multiple indicators and came to a relatively consistent conclusion.

The shift from inverse to synchronous changes in the strength of the Indian Summer Monsoon and the AAIW may have responded to changes in the North Atlantic glacial meltwater and the southern hemisphere westerly wind belt, and played a key role in the cold-to-warm climate mode shift.

"We find different evolution relationships between Indian Summer Monsoon and AAIW during the Last Deglacial and the Early Holocene. This result predicts a possible simultaneous enhancement of the Indian summer wind and the Antarctic mid-water mass in the context of global warming," said Yu Zhaojie, first and corresponding author of the study.

More information: Zhaojie Yu et al, Millennial Variability in Intermediate Ocean Circulation and Indian Monsoonal Weathering Inputs During the Last Deglaciation and Holocene, *Geophysical Research Letters* (2022). DOI: 10.1029/2022GL100003

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