External forcing causes multidecadal covariability in Southern Atlantic and Indian oceans

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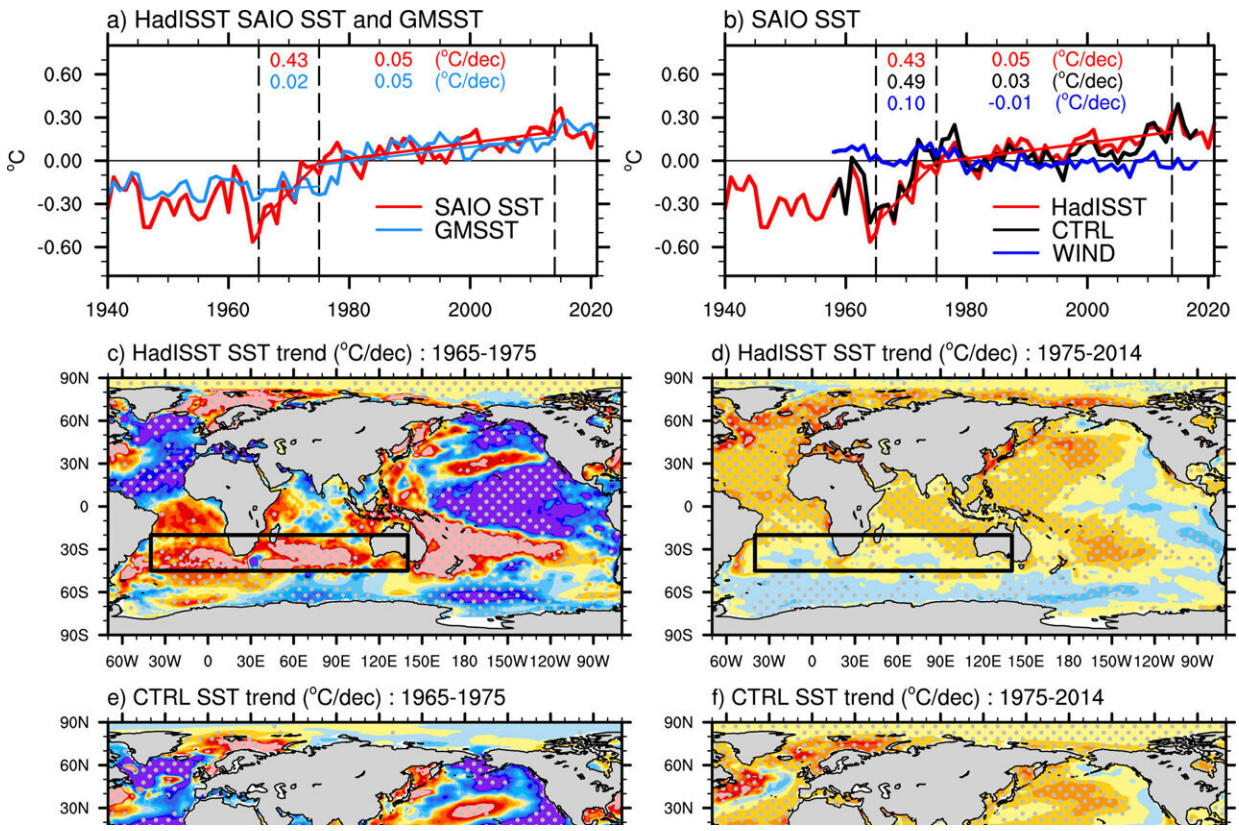

(a) Time series of the southern Atlantic and Indian Oceans (SAIOs) sea surface temperature (SST) and global-mean SST, derived from Hadley Center SST (HadISST) data. (b) Time series of the SAIO SST from HadISST data and control (CTRL) and wind-forced (WIND) runs of LICOM3. The linear trends of SST for the 1965–1975 and 1975–2014 periods are shown in (a and b). (c, e, and g) Linear trends of SST for the period of 1965–1975 from (c) HadISST, (e)

CTRL, and (g) WIND. The black boxes denote the SAIO region. Stippling indicates exceeding 90% confidence level based on the Student's t test (d, f, and h) Same as (c, e, and g), but for the period of 1975–2014. Credit: *Geophysical Research Letters* (2023). DOI: 10.1029/2022GL101735

Sea surface temperatures (SSTs) in the southern Atlantic and Indian Oceans (SAIOs) show prominent multidecadal variations, with notable impacts on rainfalls over southern-hemisphere continents. However, the origins of these variations remain unclear.

Recently, a research team led by Prof. Wang Fan from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS), with collaborators from the Institute of Atmospheric Physics and South China Sea Institute of Oceanology of CAS, has revealed the origins of synchronous SST variations in the southern Atlantic and Indian Oceans since the 1960s.

The study was published in *Geophysical Research Letters* on Feb. 17.

While previous studies overall stressed internal climate variability, this study suggests essential effects of external drivers such as volcanic eruptions and Antarctic ozone depletion on the changes in the SST warming rate of the SAIO since the 1960s.

The researchers investigated multidecadal SST variations in the SAIO by synthesizing observational data sets and climate model (CMIP6) simulations, focusing on the two period of the decade-long warming surge (0.43 °C/decade) during 1965–1975 and the stalled warming pace (0.05 °C/decade) since the late 1970s.

The 1965–1975 warming was preconditioned by an abrupt cooling in

1963 caused by the eruption of Mount Agung, and led to a decade surge due to the following recovery of radiative heating. Since the late 1970s, the increasing greenhouse gases and the Antarctic ozone depletion enhanced westerly winds and turbulent heat flux (THF) release in the SAIO, which led to a slowdown of SST warming.

"The Interdecadal Pacific Variability (IPV) can also modulate the SAIO SST through atmospheric teleconnections, but the role of internal variability is overall secondary," said Gao Xing, first author of the study.

"Our findings are helpful for understanding the mechanisms of the SST variability in the vast southern Atlantic-Indian Ocean, and will contribute to the assessment and improvement of climate models," said Dr. Li Yuanlong, corresponding author of the study.

More information: Xing Gao et al, Origins of Multidecadal SST Variations in the Southern Atlantic and Indian Oceans Since the 1960s, *Geophysical Research Letters* (2023). DOI: 10.1029/2022GL101735

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