



Press Release

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## Tropical Indo-Pacific Climate Shifts to a More El Niño-like State

The Walker circulation determines much of the tropical Indo-Pacific climate and has global impact as seen in the floods and droughts spawned by the El Niño-Southern Oscillation. Meteorological observations over the last 60 years show this atmospheric circulation has slowed: the trade winds have weakened and rainfall has shifted eastward toward the central Pacific.

The immediate cause of this slowdown has puzzled climate scientists. They could not reproduce it in their atmospheric models, questioning the ability of climate models to simulate gradual climate change.

A breakthrough is now reported in a study spearheaded by Hiroki Tokinaga, associate researcher at the International Pacific Research Center, University of Hawaii at Manoa, and published in the November 15, 2012, issue of *Nature*.

At the root of the models' failure, Tokinaga suspected, was the lack of precise sea surface temperature data used to drive the models. Slight differences in this temperature across the tropical Indo-Pacific Ocean can greatly affect wind and rainfall.

Over the 60-year period the methods used to measure ocean temperature have evolved enormously. Until satellites came along in the 1980s, such measures were taken by ships. This makes it difficult to have one continuous, unbiased record that goes back for so long.

Tokinaga, who is an expert in understanding old, archived data sets and at correcting their biases, found two measures that have been taken by ships over the whole period: the bucket technique, in which the temperature is taken of sea water scooped up in a bucket lowered from a ship, and night time marine air temperature.

"Removing observational biases from the measurements was still challenging, but we saw that these quite different ways of measuring sea surface temperature turned out to agree very well over the 60-year span from 1950 – 2009, and were supported by subsurface ocean temperature observations," explains Tokinaga. "To our surprise both measures showed that the surface temperature across the Indo-Pacific did not rise evenly with global warming, but that the east-west temperature contrast has actually decreased by 0.3-0.4°C, similar to what happens during an El Niño."

Using this unbiased, reconstructed surface temperature data set in four widely used atmospheric models, the scientists were able to reproduce quite closely the observed patterns of climate change seen over the 60-year period in the tropical Indo-Pacific and the slowdown of the Walker circulation.

"Our experiments show that the main driver of the change in the Walker circulation is the gradual change that has taken place in the surface temperature pattern toward a more El Niño-like state. We don't have enough data yet to say to what degree the slowdown over the last 60 years is due to a rise in man-made greenhouse gases or to natural cycles in the climate," explains Tokinaga.



Tropical convection.  
Image courtesy Y. Kashino, RIGC/JAMSTEC.

"Short-term fluctuations in the strength of the Walker circulation happen every few years: during La Niña the circulation strengthens, during El Niño it weakens," says co-author Shang-Ping Xie, meteorology professor at the International Pacific Research Center. "The Walker circulation affects tropical convection, and the global impacts of a temporary slowdown during an El Niño are well known, resulting in extreme floods or droughts in North America and other regions of the world. How the gradual slowdown observed in this study impacts global climate still needs to be investigated."

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The International Pacific Research Center (IPRC) of the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaii at Manoa, is a climate research center founded to gain greater understanding of the climate system and the nature and causes of climate variation in the Asia-Pacific region and how global climate changes may affect the region. Established under the "U.S.-Japan Common Agenda for Cooperation in Global Perspective" in October 1997, the IPRC is a collaborative effort between agencies in Japan and the United States.