INTERNATIONAL PACIFIC RESEARCH CENTER

IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I at MĀNOA

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Study Shows Natural Climate Swings Contribute More than Global Warming to Increased Monsoon Rainfall

The 3-layered cloud structure in a developing Madden-Julian Oscillation photographed during the Indian Ocean DYNAMO field experiments In November 2011. Credit Owen Shieh.

Monsoon rainfall in the Northern Hemisphere impacts about 60% of the World population in Southeast Asia, West Africa and North America. Given the possible impacts of global warming, solid predictions of monsoon rainfall for the next decades are important for infrastructure planning and sustainable economic development. Such predictions, however, are very complex because they require not only pinning down how manmade greenhouse gas emissions will impact the monsoons and monsoon rainfall, but also a knowledge of natural long-term climate swings, about which little is known so far.

To tackle this problem an international team of scientists around Meteorology Professor Bin Wang at the International Pacific Research Center, University of Hawaii at Manoa, examined climate data to see what happened in the Northern Hemisphere during the last three decades, a time during which the global-mean surface-air temperature rose by about 0.4°C. Current theory predicts that the Northern Hemisphere summer monsoon circulation should weaken under anthropogenic global warming.

Wang and his colleagues, however, found that over the past 30 years, the summer monsoon circulation, as well as the Hadley and the Walker circulations, have all substantially intensified. This intensification has resulted in significantly greater global summer monsoon rainfall in the Northern Hemisphere than predicted from greenhouse-gas-induced warming alone: namely a 9.5% increase, compared to the anthropogenic predicted contribution of 2.6% per degree of global warming.

Most of the recent intensification is attributable to a cooling of the eastern Pacific that began in 1998. This cooling is the result of natural long-term swings in ocean surface temperatures, particularly swings in the Interdecadal Pacific Oscillation or mega-El Niño-Southern Oscillation, which has lately been in a mega-La Niña or cool phase. Another natural climate swing, called the Atlantic Multidecadal Oscillation, also contributes to the intensification of monsoon rainfall.

“These natural swings in the climate system must be understood in order to make realistic predictions of monsoon rainfall and of other climate features in the coming decades,” says Wang. “We must be able to determine the relative contributions of greenhouse-gas emissions and of long-term natural swings to future climate change.”

Citation:

Bin Wang, Jian Liu, Hyung-Jin Kim, Peter J. Webster, So-Young Yim, and Baoqiang Xiang: Northern Hemisphere summer monsoon intensified by mega-El Niño/southern oscillation and Atlantic multidecadal oscillation. *PNAS 2013; published ahead of print March 18, 2013, doi:10.1073/pnas.1219405110.*

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The International Pacific Research Center (IPRC) of the School of Ocean and Earth Science and Technology (SOEST), 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.