

Press Release

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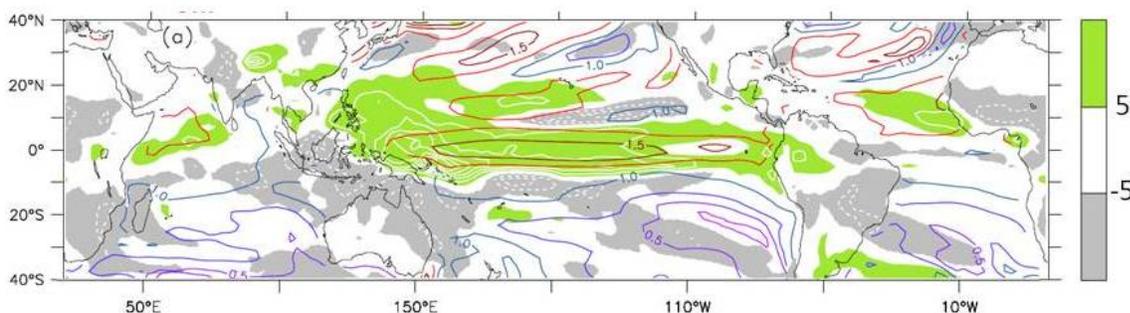
Going After Regional Climate Patterns of Global Warming

Climate models project that the global average temperature will rise about 1°C by the middle of the century, if we continue with business as usual and emit greenhouse gases as we have been. The global average, though, does not tell us anything about what will happen to regional climates, for example rainfall in the western United States or in paradisaical islands like Hawaii. A study published in the *Journal of Climate* this month is breaking ground on such regional climate forecasts.

Analyzing global model warming projections in models used by the Intergovernmental Panel on Climate Change, a team of scientists headed by meteorologist Shang-Ping Xie at the International Pacific Research Center, University of Hawaii, finds that ocean temperature *patterns* in the tropics and subtropics will change in ways that will lead to significant changes in rainfall patterns.

Scientists have mostly assumed that the surfaces of Earth's oceans will warm rather evenly in the tropics. This assumption has led to "wetter-gets-wetter" and "drier-gets-drier" regional rainfall projections. Xie's team has gathered evidence that, although ocean surface temperatures can be expected to increase mostly everywhere by the middle of the century, the increase may differ by up to 1.5°C depending upon the region.

"Compared to the mean projected rise of 1°C, such differences are fairly large and can have a pronounced impact on tropical and subtropical climate by altering atmospheric heating patterns and therefore rainfall," explains Xie. "Our results broadly indicate that regions of peak sea surface temperature will get wetter, and those relatively cool will get drier."



Patterns of sea surface temperature warming and precipitation change in 2050 as compared with 2000. Annual mean precipitation change is shown in green/gray shade and white contours in mm/month. Precipitation tends to increase over regions with ocean warming above the tropical mean (contours of warm colors in °C), and to decrease where ocean warming is below the tropical mean (contours of cool colors).

Two patterns stand out. First, the maximum temperature rise in the Pacific is along a broad band at the equator. Already today the equatorial Pacific sets the rhythm of a global climate oscillation as shown by the worldwide impact of El Niño. This broad band of peak temperature on the equator changes the atmospheric heating in the models. By anchoring a rainband similar to that during an El Niño, it influences climate around the world through atmospheric teleconnections.

a second ocean warming pattern with major impact on rainfall noted by Xie and his colleagues occurs in the Indian Ocean and would affect the lives of billions of people. Overlaid on Indian Ocean warming for part of the year is what scientists call the Indian Ocean Dipole that occasionally occurs today once every decade or so. Thus, the models show that warming in the western Indian Ocean is amplified, reaching 1.5°C, while the eastern Indian Ocean it is dampened to around 0.5°C.

“Should this pattern come about,” Xie predicts, “it can be expected to dramatically shift rainfall over eastern Africa, India, and Southeast Asia. Droughts could then beset Indonesia and Australia, whereas regions of India and regions of Africa bordering the Arabian Sea could get more rain than today.”

Paper Information: Xie, S.-P., C. Deser, G.A. Vecchi, J. Ma, H. Teng, and A.T. Wittenberg, 2010: Global warming pattern formation: Sea surface temperature and rainfall. *J. Climate*, **23**, 966–986.

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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 Hawai'i at Mānoa, 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.