# Study reveals seasonal patterns of tropical rainfall changes from global warming

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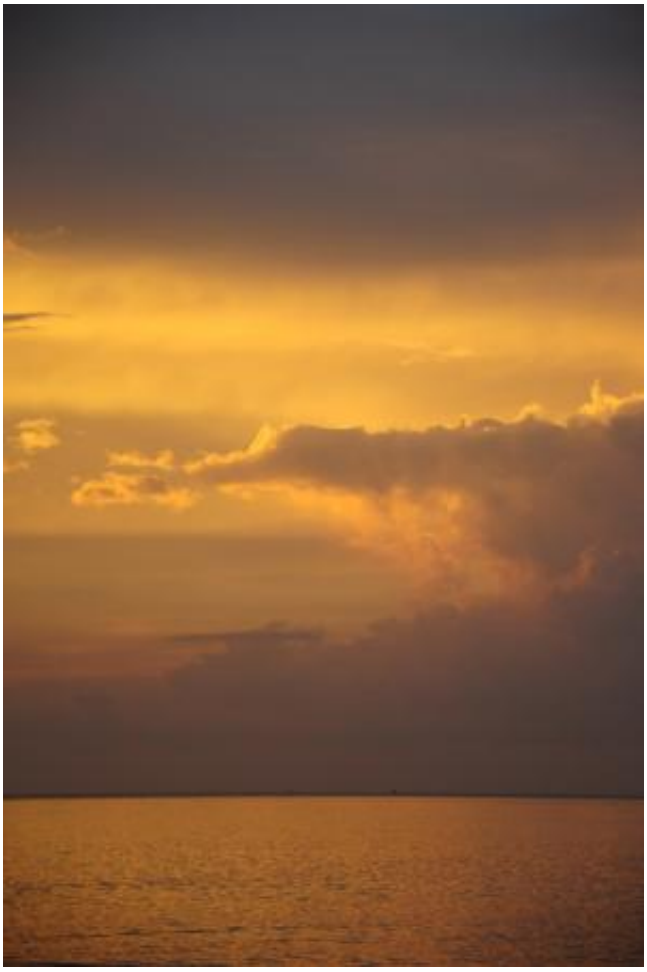

Rain clouds form over the tropical ocean. Credit: Ping Huang

Projections of rainfall changes from global warming have been very uncertain because scientists could not determine how two different

mechanisms will impact rainfall. The two mechanisms turn out to complement each other and together shape the spatial distribution of seasonal rainfall in the tropics, according to the study of a group of Chinese and Hawaii scientists that is published in the April 14, 2013, online issue of *Nature Geoscience*.

The one mechanism, called "wet-gets-wetter," predicts that rainfall should increase in regions that already have much rain, with a tendency for dry regions to get dryer. The second mechanism, called the "warmer-gets-wetter," predicts rainfall should increase in regions where sea surface temperature rises above the tropical average warming.

The team of scientists compared current rainfall in the tropics with future rainfall projections from simulations of 18 cutting-edge climate models forced with a likely scenario of atmospheric greenhouse gas concentrations. They found that rainfall in the models increases more in regions that currently are already wet and decreases slightly in currently dry regions, supporting the wet-gets-wetter mechanism. But they also found evidence for the warmer-gets-wetter mechanism in that the higher the surface temperature in a region, the more the rainfall. By merging the impact from the two mechanisms, they noted that they could account for nearly 80 percent of the variations in the models' projected rainfall changes from global warming.

The complementary action of the two mechanisms is because the pattern of ocean warming induces more convection and rainfall near the Equator , where the temperature warming peaks, and subsidence and drying further away from the Equator, reflecting the warmer-gets-wetter view. But as this band of increased rain marches back and forth across the Equator with the Sun, it causes seasonal rainfall anomalies that follow the wet-gets-wetter pattern.

The wet-gets-wetter mechanism contributes more to the projected

seasonal rainfall changes, whereas the warmer-gets-warmer mechanism more to the mean annual rainfall changes.

"Because our present observations of seasonal rainfall are much more reliable than the future sea surface temperatures, we can trust the models' projections of seasonal mean rainfall for regional patterns more than their annual mean projections," says co-author Shang-Ping Xie, meteorology professor at the International Pacific Research Center, University of Hawaii at Manoa and Roger Revelle Professor at Scripps Institution of Oceanography, University of California at San Diego. "This is good news for monsoon regions where rainfall by definition is seasonal and limited to a short rainy season. Many highly populated countries under monsoon influences already face water shortages."

**More information:** Ping Huang, Shang-Ping Xie, Kaiming Hu, Gang Huang, & Ronghui Huang: Patterns of the seasonal response of tropical rainfall to global warming. *Nature Geoscience*, AOP April 14, 2013, dx.doi.org/10.1038/NGEO1792

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