top story Goddard Space Flight Center

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NEW METHOD GREATLY IMPROVES U.S. SEASONAL FORECASTS

Image 1

A new technique could raise the bar for predicting seasonal precipitation by 10 to 20 percent for all seasons in the United States, a NASA-funded study finds.

The new method looks at changes in sea surface temperatures in various ocean basins, and then weighs their individual impacts on regional climate to greatly increase predictability of precipitation during all seasons. Changes in sea surface temperatures strongly influence atmospheric winds, climate and weather.

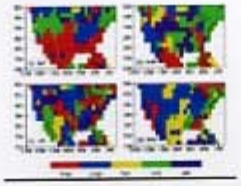

Image 2

"The paper presents results applied to the U.S. continent, where we show that the potential predictability can be raised 10 to 20 percent above traditional methods," said William Lau, a senior researcher at NASA's Goddard Space Flight Center, and lead author of the paper. "The scheme can be applied to other regions as well. It raises the bar for seasonal and inter-annual climate forecasts."

The paper will be presented on January 15 at the American Meteorology Society meeting in Orlando, Fla. The study will also be published in an upcoming issue of the journal Geophysical Research Letters.

Currently, scientists rely on climate patterns derived from global sea surface temperatures to forecast precipitation for the U.S. winter. For example, rising warm moist air creates tropical storms during El Niño years, a period of above average temperatures in the waters in the central and eastern tropical Pacific. These storms interact with the jet stream, causing it to steer southward during U.S. winters. The altered jet stream directs more storms and rain over the west coast and the

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Image One: Ocean Basins That Affect U.S. Climate

Caption: Changes in sea surface temperatures strongly influence atmospheric winds, climate and weather. The new technique takes a closer look at climate impacts from specific ocean basins, including the tropical Pacific, the north Pacific, the tropical Atlantic, the north Atlantic, and the Indian Ocean. Lau and his colleagues evaluated the individual influences of each ocean basin on the climate of U.S. regions during each season. Credit: NASA/Goddard Space Flight Center

Image Two: Effects of Sea Surface Temperatures from Various Ocean Basins on Seasonal Regional Climate in the United States.

Caption: This graphic shows how each ocean basin individually influences the climate of U.S. regions during each season. The colors indicate the most

southern states.

When climatologists use global sea surface temperatures to forecast U.S. winter precipitation, the temperature of the tropical Pacific is the dominant force, and smaller signals, like impacts from temperature changes in other ocean basins, get drowned out.

While the tropical Pacific largely dictates fall and winter precipitation levels, the strength of that signal falls off by spring through the summer. This phenomenon is called the 'spring-summer predictability barrier,' and nobody knows what causes it. For that reason, summer climate predictions are very difficult to make.

The new technique takes a closer look at climate impacts from specific ocean basins, including the tropical Pacific, the north Pacific, the tropical Atlantic, the north Atlantic, and the Indian Ocean. Lau and his colleagues evaluated the individual influences of each ocean basin on the climate of U.S. regions during each season.

Since the tropical Pacific is the most dominant force in the winter, Lau's results for the winter were similar to the traditional forecasts that use global sea surface temperatures. In the winter, the tropical Pacific had the strongest influence on the southern states, spanning the southwest, Mexico, the Gulf Coast, the southeast and eastern seaboard. The northern Pacific had the strongest influence in the Ohio Valley and the northwest, while the north Atlantic seemed to control the northeastern seaboard, northern California, Idaho and Montana.

In the spring, the effects of the tropical Pacific wane and the northern Atlantic begins to impact the northeast and the East Coast.

In the summer, the study finds a strong correlation between northern Pacific sea surface temperatures and the climate of the region that stretches from the Gulf coast of Texas to the northern Great Plains and the Midwest.

The study used 49 years of global climate data. Actual regional U.S. precipitation amounts were ordered into three categories-above normal, normal and below normal. To test their forecasts, Lau and his colleagues made predictions for each of the 49 years after building up their computer model with data from the remaining 48 years of observations. When the forecast and the actual observations matched, the forecast was called a

important influence from the corresponding ocean basins. For example, the red region is most influenced by the Tropical Pacific. The seasons are marked as follows: (a) Winter: December, January, and February; (b) Spring: March, April, May; (c) Summer: June, July, August; and (d) Fall: September, October, November. Credit: NASA/Goddard Space Flight Center

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For all regions, regardless of the time of year, there was a 10 to 20 percent increase in accuracy compared to traditional methods. The increases were most notable during the spring and summer, greatly reducing the spring predictability barrier.

Though the method has yet to be used on a real-time forecast, it raises the bar for seasonal precipitation prediction, Lau said.

"We hope to develop this into a bonafide forecast scheme to be used for regional climate predictions," Lau said.

EDITOR'S NOTE: This presentation, session J1.20, will be given on Tuesday, January 15 at 4:00 PM at the 82nd Annual Meeting of the American Meteorological Society at the Orange County Convention Center, Orlando, Fla.

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