Variable southeast summer rainfall linked to climate change

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A doubling of abnormally wet or dry summer weather in the southeastern United States in recent decades has come from an intensification of the summertime North Atlantic Subtropical High (NASH), or "Bermuda High."

And that intensification appears to be coming from global warming, according to a new analysis by a Duke University-led team of climate scientists.

The NASH is an area of high pressure that forms each summer near Bermuda, where its powerful surface center helps steer Atlantic hurricanes and plays a major role in shaping weather in the eastern United States, Western Europe and northwestern Africa.

By analyzing six decades of U.S. and European weather and climate data , the team found that the center of the NASH intensified by 0.9 geopotential meters a decade on average from 1948 to 2007. (Geopotential meters are used to measure how high above sea level a pressure system extends; the greater the height, the greater the intensity.)

The team's analysis found that as the NASH intensified, its area grew, bringing the high's weather-making western ridge closer to the continental United States by 1.22 longitudinal degrees a decade.

"This is not a natural variation like El Nino," says lead author Wenhong Li, assistant professor of earth and ocean sciences at Duke University's

Nicholas School of the Environment. "We thoroughly investigated possible natural causes, including the Atlantic Multivariate Oscillation (AMO) and Pacific Decadal Oscillation (PDO), which may affect highs, but found no links.

"Our analysis strongly suggests that the changes in the NASH are mainly due to anthropogenic warming," she says.

An early online edition of the study, published in the *Journal of Climate*, is available at the American Meteorological Society's website at http://journals.ametsoc.org/doi/pdf/10.1175/2010JCLI3829.1.

As the NASH intensified and migrated westward, Li's team's analysis found that its north-south movement also was enhanced from 1978 to 2007, a period when the frequency of extreme summer rainfall variability in the Southeast more than doubled over the previous 30 years. From 1978 to 2007, six summers were abnormally wet, while five were abnormally dry. Those 11 summers – defined in this study as the months of June, July and August – had total seasonal precipitation anomalies greater than one standard deviation from the mean.

To forecast future trends in the NASH's intensity, the team used climate models developed for use by the Intergovernmental Panel on Climate Change's Fourth Assessment Report in 2007. The models – known as Coupled Model Intercomparison Project Phase 3 (CMIP3) models – predict the NASH will continue to intensify and expand as concentrations of carbon dioxide and other greenhouse gases increase in Earth's atmosphere in coming decades.

"This intensification will further increase the likelihood of extreme summer precipitation variability – periods of drought or deluge – in southeastern states in coming decades," Li says.

If the NASH 's western ridge jogs a little to the north as it expands, the likelihood increases for more extreme dry weather in the Southeast that summer, she explains. If the NASH wobbles a little to the south, extreme wet weather becomes more likely.

Provided by Duke University