Harbingers of increased Atlantic hurricane activity identified

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This is a NASA close-up of Hurricane Isabel taken from the International Space Station. Credit: NASA

Reconstructions of past hurricane activity in the Atlantic Ocean indicate that the most active hurricane period in the past was during the "Medieval Climate Anomaly" about a thousand years ago when climate conditions created a "perfect storm" of La Niña-like conditions combined with warm tropical Atlantic waters.

"La Niña conditions are favorable for hurricanes because they lead to less wind shear in the tropical Atlantic," said Michael E. Mann, professor of meteorology, Penn State. When combined with warm tropical Atlantic ocean temperatures, a requirement for hurricanes to form, conditions become ideal for high levels of activity."

During an El Niño, the more familiar half of the El Niño Southern Oscillation (ENSO), there is more wind shear in the Caribbean and fewer hurricanes. The low Atlantic hurricane activity so far during this current season is likely related to the mitigating effects of an emerging El Niño event.

"Hurricane activity since the mid-1990s is the highest in the historical record, but that only goes back a little more than a century and is most accurate since the advent of air travel and satellites in recent decades," said Mann. "It is therefore difficult to assess if the recent increase in hurricane activity is in fact unusual."

Mann, working with Jonathan D. Woodruff, assistant professor of geosciences, University of Massachusetts; Jeffrey P. Donnelly, associate scientist, Woods Hole Oceanographic Institution, and Zhihua Zhang, postdoctoral assistant, Penn State, reconstructed the past 1,500 years of hurricanes using two independent methods. They report their results in today's (Aug. 13) issue of *Nature*.

One estimate of hurricane numbers is based on sediment deposited during landfall hurricanes. The researchers looked for coastal areas where water breached the normal boundaries of the beaches and overwashed into protected basins. Samples from Puerto Rico, the U.S. Gulf coast, the Southern U.S. coast, the mid-Atlantic coast and the southeastern New England coast were radiocarbon dated and combined to form a history of landfall hurricanes.

This is a birds eye view of hurricane Katrina approaching the Gulf coast. Credit: NASA

The other method used a previously developed statistical model for predicting hurricane activity based on climate variables. They applied the model to paleoclimate reconstructions of tropical Atlantic sea surface temperature, the history of ENSO and another climate pattern called the North Atlantic Oscillation (NAO), which is related to the year-to-year fluctuations of the jet stream. Warm waters are necessary for hurricane development, ENSO influences the wind shear and the NAO controls the path of storms, determining whether or not they encounter favorable conditions for development.

The researchers compared the results of both hurricane estimates, taking into account that the sediment measurements only record landfall hurricanes, but that the relationship between landfall hurricanes and storms that form and dissipate without ever hitting land can be estimated.

Both hurricane reconstructions indicate similar overall patterns and both

indicate a high period of hurricane activity during the Medieval Climate Anomaly around AD 900 to 1100.

"We are at levels now that are about as high as anything we have seen in the past 1,000 years," said Mann.

The two estimates of hurricane numbers do not match identically. The researchers note that they do not know the exact force of a storm that will breach the beach area and deposit sediments. They are also aware that the relationship between landfalling hurricanes and those that remain at sea is not uniform through all time periods. However, they believe that key features like the medieval peak and subsequent lull are real and help to validate our current understanding of the factors governing long-term changes in Atlantic hurricane activity.

One thing the estimates show is that long periods of warm Atlantic ocean conditions produce greater Atlantic hurricane activity.

"It seems that the paleodata support the contention that greenhouse warming may increase the frequency of Atlantic tropical storms," said Mann. "It may not be just that the storms are stronger, but that there are there may be more of them as well."

Source: Pennsylvania State University (news : web)