Global Warming Is Expected to Raise Hurricane Intensity

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Global warming is likely to produce a significant increase in the intensity and rainfall of hurricanes in coming decades, according to the most comprehensive computer analysis done so far.

By the 2080's, seas warmed by rising atmospheric concentrations of heat-trapping greenhouse gases could cause a typical hurricane to intensify about an extra half step on the five-step scale of destructive power, says the study, done on supercomputers at the Commerce Department's Geophysical Fluid Dynamics Laboratory in Princeton, N.J. And rainfall up to 60 miles from the core would be nearly 20 percent more intense.

Other computer modeling efforts have also predicted that hurricanes will grow stronger and wetter as a result of global warming. But this study is particularly significant, independent experts said, because it used half a dozen computer simulations of global climate, devised by separate groups at institutions around the world. The long-term trends it identifies are independent of the normal lulls and surges in hurricane activity that have been on display in recent decades.

The study was published online on Tuesday by The Journal of Climate and can be found at www.gfdl.noaa.gov/reference/bibliography/2004/tk0401.pdf.

The new study of hurricanes and warming "is by far and away the most comprehensive effort" to assess the question using powerful computer simulations, said Dr. Kerry A. Emanuel, a hurricane expert at the Massachusetts Institute of Technology who has seen the paper but did not work on it. About the link between the warming of tropical oceans and storm intensity, he said, "This clinches the issue."

Dr. Emanuel and the study's authors cautioned that it was too soon to know whether hurricanes would form more or less frequently in a warmer world. Even as seas warm, for example, accelerating high-level winds can shred the towering cloud formations of a tropical storm.

But the authors said that even if the number of storms simply stayed the same, the increased intensity would substantially increase their potential for destruction.

Experts also said that rising sea levels caused by global warming would lead to more flooding

from hurricanes - a point underlined at the United Nations this week by leaders of several small island nations, who pleaded for more attention to the potential for devastation from tidal surges.

The new study used four climate centers' mathematical approximations of the physics by which ocean heat fuels tropical storms.

With almost every combination of greenhouse-warmed oceans and atmosphere and formulas for storm dynamics, the results were the same: more powerful storms and more rainfall, said Robert Tuleya, one of the paper's two authors. He is a hurricane expert who recently retired after 31 years at the fluid dynamics laboratory and teaches at Old Dominion University in Norfolk, Va. The other author was Dr. Thomas R. Knutson of the Princeton laboratory.

Altogether, the researchers spawned around 1,300 virtual hurricanes using a more powerful version of the same supercomputer simulations that generates Commerce Department forecasts of the tracks and behavior of real hurricanes.

Dr. James B. Elsner, a hurricane expert at Florida State University who was among the first to predict the recent surge in Atlantic storm activity, said the new study was a significant step in examining the impacts of a warmer future.

But like Dr. Emanuel, he also emphasized that the extraordinary complexity of the oceans and atmosphere made any scientific progress "baby steps toward a final answer."

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