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Global Warming and Tropical Cyclones: a Vicious Cycle?

Emily Sohn, Discovery News

May 14, 2009 -- [Global warming](#) can change [storm patterns](#). In turn, storms might help fuel global warming.

A new study suggests that tropical cyclones shoot water high into the atmosphere. The result may be a small but significant contribution to [the greenhouse effect](#).

"The bottom line is that tropical cyclones can't be counted out" as players in global climate change, said lead author David Romps, of Harvard University. "It's not something to lose sleep over. But there's a possibility for some type of feedback."

For decades, scientists have been puzzled by two atmospheric mysteries: There is less water vapor in the upper atmosphere than there theoretically should be, said Columbia University atmospheric scientist Timothy Hall. Yet, there is more than there used to be.



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Both phenomena are related to the way temperature changes from one level of the atmosphere to the next. In the troposphere, which goes from the ground up to about nine miles, air gets colder as you go higher.

In the stratosphere, which begins where the troposphere ends, the opposite happens: Air gets warmer with rising altitude. The boundary between the troposphere and the stratosphere, called the tropopause, is where temperatures are coldest.

Clouds and the water they contain -- which are colder and heavier than the surrounding air -- tend to stay the troposphere because the relatively warm and light air in the stratosphere pushes them downwards.

What's more, the tropopause is so cold that any water vapor that gets there falls out as ice before it can reach the stratosphere. Both of these effects keep the stratosphere dry.

Still, the stratosphere is even drier than experts suspect it should be. At the same time, scientists have measured a 50 percent rise in water vapor in the stratosphere over the last 50 years.

To explain the trend, some researchers have speculated that powerful tropical cyclones might be increasingly punching through the tropopause and spewing water vapor high into the atmosphere. The stratosphere is warm enough to trap the moisture, according to some theories. Circulation patterns would then carry the vapor from the tropics to the poles.

"There's all this evidence that a changing climate could change the intensity or frequency of tropical cyclones," Romps said. "We were thinking about what impact tropical cyclones could have on climate."

To test the theory, Romps and colleague Zhiming Kuang looked at 23 years worth of satellite data to measure cloud temperature in cyclones and other storms. Temperature readings told them how high the clouds were.

The maps they produced, published in *Geophysical Research Letters*, showed that tropical cyclones account for 15 percent of the water vapor that shoots into the stratosphere and 30 percent of water vapor that shoots the highest -- about 1.5 kilometers (nearly a mile) above the troposphere.

"This is not just academic," Hall said. "Water vapor is a greenhouse gas. So, changing water vapor does have global warming potential, and it is significant."

Still, Hall said, increases in stratospheric water vapor make a much smaller contribution to warming than do [carbon dioxide emissions](#). In that sense, the new work adds a small piece of the puzzle to our understanding of the forces behind climate change.

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