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SCIENTISTS SEE FIRST SIGNS OF LONG-TERM CHANGES IN TROPICAL RAINFALL

WASHINGTON - NASA scientists have detected the first signs that tropical rainfall is on the rise, using the longest and most complete data record available.

The international scientific community assembled a 27-year global record of rainfall from satellite and ground-based instruments. The researchers found the rainiest years between 1979 and 2005 occurred primarily after 2001. The wettest year was 2005, followed by 2004, 2003, 2002 and 1998. The study appeared in the August 1 issue of the American Meteorological Society's *Journal of Climate*. The rainfall increase was concentrated over tropical oceans, with a slight decline over land.

"When we look at the whole planet over almost three decades, the total amount of rain falling has changed very little. But in the tropics, where nearly two-thirds of all rain falls, there has been an increase of 5 percent," said lead author Guojun Gu, a research scientist at NASA's Goddard Space Flight Center in Greenbelt, Md.

Climate scientists predict that a warming trend in Earth's atmosphere and surface temperatures would produce an accelerated recycling of water between land, sea and air. Warmer temperatures increase the evaporation of water from the ocean and land and allow air to hold more moisture. Eventually, clouds form that produce rain and snow.

"A warming climate is the most plausible cause of this observed trend in tropical rainfall," said co-author Robert F. Adler, senior scientist at Goddard's Laboratory for Atmospheres. Adler and Gu are now working on a detailed study of the relationship between surface temperatures and rainfall patterns to investigate the possible link further.

Obtaining a global view of our planet's rainfall patterns is a challenge. Only since the satellite era have regular estimates of rainfall over oceans been available to supplement the long-term, but land-limited record from rain gauges. Recently, the many different land- and

space-based data have been merged into a global record: the Global Precipitation Climatology Project, organized under the World Climate Research Program.

Using this global record, the scientists identified a small upward trend in overall tropical rainfall since 1979. To assess whether this pattern was a long-term trend rather than natural year-to-year variability, they removed the effects of the two natural phenomena that change rainfall: the El Niño-Southern Oscillation and large volcanic eruptions.

El Niño is a cyclical warming of the ocean waters in the central and eastern tropical Pacific that generally occurs every three to seven years and alters weather patterns worldwide. Volcanoes that loft debris into the upper troposphere and stratosphere create globe-circling bands of aerosol particles that slow the formation of precipitation by increasing the number of small cloud drops and temporarily shielding the planet from sunlight. The result lowers surface temperatures and evaporation that fuels rainfall. Two such eruptions - El Chicon in Mexico and Mount Pinatubo in the Philippines - occurred during the 27-year period.

The scientists found that during El Niño years, total tropical rainfall did not change significantly, but more rain fell over oceans than usual. During the two years following each volcanic eruption, overall tropical rainfall was reduced by about 5 percent. With these effects removed from the rainfall record, the long-term trend appears more clearly in the rainfall data both over land and over the ocean.

According to Adler, evidence for the rainfall trend is holding as more data come in. The latest numbers for 2006 show another record-high year for tropical rainfall, tying 2005 as the rainiest year. Adler's research group at NASA produces the Global Precipitation Climatology Project's monthly rainfall updates.

"The next step toward firmly establishing this initial indication of a long-term tropical rainfall trend is to continue to lengthen and improve our data record," said Adler, who is project scientist of the Tropical Rainfall Measuring Mission (TRMM), a joint effort between NASA and the Japan Aerospace Exploration Agency. The satellite's three primary instruments are providing the most detailed view of rainfall ever provided from space. Since 1997, Adler's group has been incorporating the mission's rainfall data into the global rainfall record.

NASA plans to extend the success of monitoring rainfall over the tropics to the entire globe with the Global Precipitation Measurement mission, scheduled for launch in 2013. This international project will measure both rain and snow around the world.

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http://www.nasa.gov/centers/goddard/news/topstory/2007/rainfall_increase.html

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