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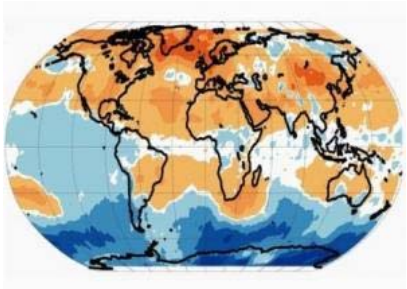
Science News

Faster Atmospheric Warming In Subtropics Pushes Jet Streams Toward Poles

ScienceDaily (May 26, 2006) — The atmosphere is warming faster in subtropical areas, around 30 degrees north and south latitude, than it is elsewhere, University of Washington-led research shows. But scientists examining more than 25 years of satellite data also found that each hemisphere's jet stream has moved toward the pole by about 1 degree of latitude, or 70 miles.



This map shows areas of particularly strong lower atmosphere warming in yellow, orange and red. Enhanced warming of subtropical regions north and south of the equator indicates the expansion of the tropics. The map also shows pronounced atmospheric warming in the Arctic. (Credit: Qiang Fu)

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That could widen the tropics and expand some of the world's driest regions, they say.

"It is direct observational evidence of atmospheric circulation changes seen from satellites," said Qiang Fu, a University of Washington associate professor of atmospheric sciences and lead author of a paper detailing the findings in the May 26 edition of the journal Science.

Co-author John M. Wallace, a UW atmospheric sciences professor, said it is not clear yet whether the movement of the jet streams is key evidence for global warming or just an anomaly. He said more work is needed to understand precisely why the jet streams are moving, but he added that if the movement continues the long-term impact on rainfall could be serious.

"The jet streams mark the edge of the tropics, so if they are moving poleward that means the tropics are getting wider," Wallace said. "If they move another 2 to 3 degrees poleward in this century, very dry areas such as the Sahara Desert could nudge farther toward the pole, perhaps by a few hundred miles."

The researchers analyzed satellite temperature data collected from 1979 through 2005 and found the troposphere was warming faster in a band around 30 degrees north latitude -- which crosses the southern United States, southern China and north Africa -- and around 30 degrees south latitude -- which crosses southern Australia, South Africa and southern South America. The troposphere is the layer from the Earth's surface to about 7.5 miles in altitude, the part of the atmosphere in which most weather occurs.

While a poleward shift of jet streams is a strongly supported prediction by computer models of 21st century climate, the models also show the fastest warming will occur in the tropical upper troposphere. Instead, the research found that warming was actually a bit faster at 30 degrees latitude in both hemispheres than over the equator. The enhanced warming at 30 degrees latitude has helped to reshape the atmosphere's pressure surfaces in a way that pushed the jet streams toward the poles, Fu said. The position of the jet streams -- the band of strongest westerly winds aloft -- is important because it determines the northern and southern limits of the major wet and dry belts on the surface.

Other authors of the paper are Celeste Johanson, a UW atmospheric sciences research assistant and graduate student, and Thomas Reichler, an assistant professor of meteorology at the University of Utah. The work was supported by grants from the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration.

The scientists examined measurements from devices called

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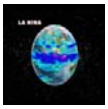

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Fu and colleagues previously analyzed these measurements to show that the troposphere actually is warming as much as the Earth's surface, a key piece of evidence to demonstrate that the Earth is warming faster than can be accounted for by natural processes.

The new research suggests that faster subtropical warming of the troposphere, which moves the jet streams, also could shift mid-latitude storm tracks poleward, Wallace said. That could reduce winter precipitation in regions such as southern Europe, including the Alps, and southern Australia.

Fu noted the research also appears to show that enhanced warming in the troposphere corresponds closely with enhanced cooling in a higher atmospheric layer called the stratosphere, which extends from about 7.5 miles in altitude to about 31 miles.

"It's a very intriguing problem, why the increase in tropospheric temperatures and the decrease in stratospheric temperatures in the subtropical region happens in tandem, almost exactly," he said.

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