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.

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.

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 northern 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 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.

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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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