Computer model helps explain Jupiter's cloud bands

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Look closely at a giant planet like Jupiter and you can actually see a powerful system of winds at work. University of Alberta physicist Dr. Moritz Heimpel and his research team have created a new 3-D computer model to describe how the winds that form the distinctive bands on that planet's atmosphere are powered by forces from within the planet. The research is published in the current issue of *Nature*.

Jupiter's winds are different from those on Earth - they continually circle the planet, and have changed very little in the 300 years that scientists have studied them. In Jupiter's equatorial region, the massive east-west winds reach speeds upwards of 540 kilometres per hour, twice as fast as winds generated by strong hurricanes on Earth. At higher latitudes, the wind pattern switches to alternating jets that race around the planet.

Heimpel has always been interested in planetary dynamics, especially in the Earth's core, and how it generates a magnetic field. Although we cannot directly see what is going on in the Earth's core, we can look to the big planets like Jupiter and Saturn where a telescope will reveal fluid dynamics in the atmosphere.

"We have images from space missions that show fluid motion in incredible detail," said Heimpel. "The giant planets provide a natural laboratory for the fluid dynamics of other planetary bodies."

Heimpel's work offers clues as to why the winds are so constant and what generates them.

On a small scale, an example of fluid dynamics takes place in a creek with little whirls of current. The research team-made up of Johannes Wicht from the Max Planck Institute for Solar System Research in Germany and Jonathan Aurnou at the University of California, Los Angeles-had to scale that small example up to planetary size. The key, said Heimpel, was using a good computer system and a better code as well as a scaling theory for planetary turbulence.

The model is the first to show that high latitude jet streams come from deep convection.

"The issue of how deep these fast winds penetrate has always been an unresolved question," said Heimpel. "Some groups have argued that the winds are shallow and powered by the sun, and others have maintained that the winds are deep and powered by the internal heat of Jupiter itself. Our model gives strong evidence of a deep origin of Jupiter's winds."

The planet's radius is more than 11 times the radius of Earth and a tremendous amount of heat comes from the interior, which may help explain why these winds have been so stable for centuries.

Heimpel hopes the research may start to provide answers about the flow in the liquid outer core of the Earth, as well as for zonal currents in the Earth's oceans.

Soruce: University of Alberta

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