Sailors, beware! The notoriously fierce weather below Cape Horn turns out to be part of a regular pattern.

METEOROLOGY

Southern Hemisphere Storms Pulsate To a 25-Day Beat, New Papers Show

Roaring Forties, Furious Fifties, Shrieking Sixties—the sailors' terms for the stormy latitudes of the Southern Ocean suggest that the winds and waves there are relentless. In fact, their fury ebbs and surges. This week on page 641 of *Science*, researchers report that the storm belt in the Southern Hemisphere throbs powerfully with a 20- to 30-day beat, the manifestation of a pulsating flow of heat from the tropics to high latitudes.

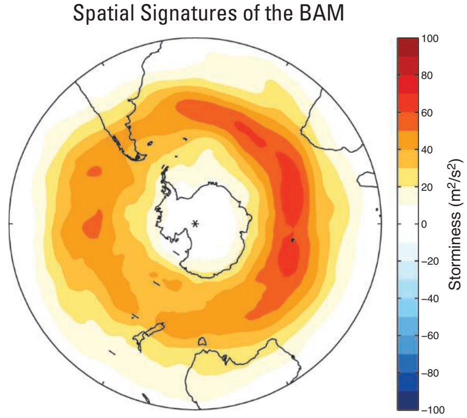
The discovery caps a lengthy search for mid-latitude oscillations in the atmosphere, which meteorologists have long theorized. It also offers a new tool for understanding the workings of the southern atmosphere as well as a glimmer of hope for better long-range forecasting there. "There will be a tremendous amount of interest in this paper," says meteorologist Dennis Hartmann of the University of Washington, Seattle. The ups and downs of Southern Hemisphere weather "will be a hot topic," he says.

Atmospheric oscillations are common in the tropics, where scientists have identified an alphabet soup of roughly rhythmic changes in the atmosphere and sometimes in the ocean: the MJO; the QBO; and ENSO, or El Niño. Around 1950, meteorologists predicted that another oscillation—a so-called index cycle—should be at work in the mid-latitude atmosphere of the Northern Hemisphere, influencing the weather for much of the world's population. The idea was based on the way the atmosphere moves heat from tropical latitudes, where solar heating is greatest, to polar latitudes. The theorists proposed that feedbacks in the system would cause mid-latitude storminess to vary more or less rhythmically over several weeks.

No one has ever found any such variability in the Northern Hemisphere, but meteorologists David Thompson of Colorado State University (CSU), Fort Collins, and Jonathan Woodworth, now at DEIF Inc. in Loveland, Colorado, gave it a try in the south. In the 1950s, weather observations in the Southern Hemisphere were too spotty to consider looking for the index cycle there, but since about 1980, satellites have filled in the observational holes.

As they report in a paper in press in the *Journal of the Atmospheric Sciences*, Thompson and Woodworth succeeded in finding a 20- to 30-day oscillation in storminess around the Southern Hemisphere over the past 30 years. Technically, the storminess cycle is called the baroclinic annular mode, or BAM, pronounced the way it looks. As Thompson and Elizabeth Barnes of CSU go on to show in the *Science* paper, the BAM shows up in changes in the storms' kinetic energy, the amount of heat they transport, and the amount of precipitation they release. "The whole thing is pulsating with remarkable regularity," Thompson says of the southern mid-latitude atmosphere that stretches across a wide swath from far southern South America, South Africa, and Australia to the shores of Antarctica. In the north, the corresponding latitude band would span the contiguous United States and most of Canada.

Spatial Signatures of the BAM



Wild waves. Storminess in the Southern Ocean follows a 20- to 30-day cycle, new analyses reveal.

Thompson and Barnes also show what makes the BAM tick. When they ran four different computer models, all of them—from a simple two-equation program to a sophisticated atmospheric simulation—produced a BAM. The key ingredient was a two-way feedback between the uneven heating of the hemisphere, with heat tending to build up at lower latitudes, and a time lag for storms to grow in response to that heat buildup and relieve it by moving heat toward the pole. As long as it takes storms a few days to grow and start moving substantial amounts of heat, the researchers found, the hemisphere's storminess will throb. The results suggest that any other Earth-like planet that rotates and gets disproportionate heat near its equator ought to have a BAM in its atmosphere, Thompson says.

On reading the *Science* paper, meteorologist Steven Feldstein of Pennsylvania State University, University Park, wondered, "Why didn't I look at this?" He finds both the detection of the oscillation and the suggested mechanism for generating it persuasive. "It's a great first step," he says. "It has potential implications for other processes and even for forecasting. It will be interesting to see where it leads."

Back to the Northern Hemisphere might be one place the work could lead, but so far no luck. Thompson and Barnes have looked at a far higher quality observational record in the north than was available in the 1950s or even the 1980s, but they still find no sign of an oscillation. Possibly, the temperature contrasts in the north between the expansive colder continents and warmer oceans are too strong for a northern BAM. But Thompson and Barnes may not be the only ones continuing the search.

–RICHARD A. KERR

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