Winter storms in North Atlantic follow the solar cycle

A tiny, 11-year cycle in the sun's radiation appears to exert a strong influence on the paths of winter storms in the North Atlantic near Great Britain, reports an atmospheric scientist from the National Science Foundation. This finding, to be announced in the May GEOPHYSICAL RESEARCH LETTERS, exemplifies a renewed interest in seeking links between the solar cycle and earthly weather – a field that has traditionally engendered skepticism and even scorn.

Atmospheric scientist Brian A. Tinsley reexamined a ten-year-old statistical analysis of the relationship between storm tracks in the North Atlantic and the solar cycle. This earlier study found that during a maximum in the solar cycle – when the total solar output of energy is highest – the average storm track was 2.5° south of the average tracks during a sunspot minimum. However, according to Tinsley's new analysis, the storm tracks during maximum and minimum differ on average by over 6°, or over 400 miles.

"In fact, this is a very strong pattern," says Tinsley.

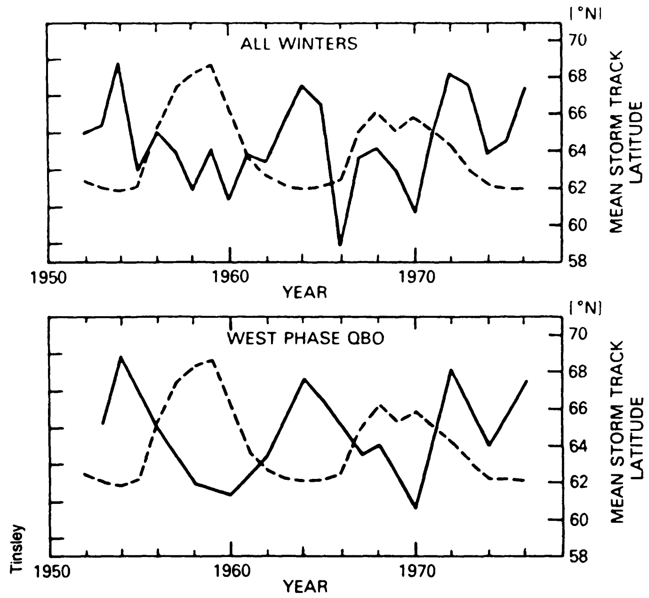
For his reanalysis, Tinsley borrowed a concept recently developed by Karin Labitzke of the Free University in Berlin along with Harry van Loon of the National Center for Atmospheric Research in Boulder Colo. (SN: 12/19 & 26/87, p.388). These researchers found last year that stratospheric winds over the tropics seem to be an important element in the relationship between the solar cycle and weather.

These tropical winds reverse their direction in a 26-month cycle called the Quasi-biennial Oscillation (QBO). Labitzke and van Loon found that when they looked only at years from the west phase of the QBO, a strong correlation emerged between the solar cycle and atmospheric temperatures and pressures. Years from the east phase of the QBO showed a similar but less pronounced pattern.

Tinsley extended this method to the record of storm tracks. He found a strong link between the solar cycle and average storm latitude during years of westerly winds, but none during the opposite years.

Most scientists historically have dismissed associations between earth's weather and the solar cycle – a term which also describes a waxing and waning in the number of sunspots and the emissions of ultraviolet rays and x-rays. "There have been good grounds for skepticism," says Tinsley. "But I do think that good papers have been neglected because of the presence of sloppy ones." The work by Labitzke and van Loon revitalized the field, he says.

A number of researchers are now starting to reexamine meteorological records with this new method of grouping years according to the QBO, although most scientists continue to reserve judgment on the meanings of these statistical correlations. No one has been able to explain how large processes on the earth can respond to small energy changes in the solar output. "It's like the flea on the tail of the dog, wagging the dog," says climatologist Eugene Rasmusson of the University of Maryland in College Park.



Apparent relationship between solar cycle (dashed line) and storm tracks (solid) emerges during years of the west phase of QBO.

Lacking a physical mechanism to link the solar cycle to weather, scientists like Tinsley must rely on statistics to make the association. But the record for the QBO only goes back to 1952, which encompasses only 3½ rounds of the solar cycle – a relatively small number in statistics. Scientists will be watching the QBO and the weather trends closely as the solar cycle again builds to a maximum expected sometime in late 1989 or 1990.

– R. Monastersky

The high-pressure world of Uranus

Experiments involving intense shock waves generated by a metal plate slamming into a liquid-filled container are providing important clues about the interior of the distant, large planet Uranus. These experiments shed light on the origin of the planet's magnetic field, one of the more startling discoveries made when Voyager 2 flew past Uranus in 1986 (SN: 7/5/86, p.4).

Data from Voyager 2 indicate that the planet's magnetic field is sharply tilted – as if the planet contains a bar magnet that points not along the planet's axis of rotation but toward a spot just 30° from its equator. Moreover, the magnetic field at Uranus' surface can be as much as twice that found on earth. These observations suggest the magnetic field is caused, not by an iron core, which would be too deep and too small to create such a field, but by large-scale movements of electrically conducting fluid in the middle reaches of the planet's interior.

To test this idea, William J. Nellis and his colleagues at the Lawrence Livermore (Calif.) National Laboratory recently conducted a series of laboratory experiments using shock waves to produce the extreme temperature and pressure conditions likely to be found in the interior of Uranus. They experimented on materials thought to make up the planet – ammonia and methane "ices" – and on a special, blended, hydrogen-rich liquid, called "synthetic Uranus," consisting of water, ammonia and isopropyl alcohol.

The experimental results, reported in the May 6 SCIENCE, suggest that strong shock waves cause the materials to break apart into electrically charged fragments, or ions. At certain temperatures and pressures, the electrical conductivity of the dissociated material becomes large enough to account for the existence of a planetary magnetic field.

"Although there is still a question about the details of the chemical composition," Nellis says, "we do have a handle on the conductivity of the material that's there because [the conductivity] seems only weakly dependent on the exact chemical composition."

The results also show that materials deep within the planet are likely to be stiff and dense. There, the pressures and temperatures are high enough to break down the molecules and ions into individual atoms of oxygen, hydrogen, nitrogen and carbon. These extremely light elements end up being packed into a small space, becoming hard materials resistant to further pressure increases. In fact, the conditions may be right for producing the diamond phase of carbon and equivalent phases of oxygen, nitrogen and perhaps hydrogen. *– I. Peterson*