SUDDEN WARMINGS

Surprise Answer in the Lab

Sudden warmings are the most drastic large scale phenomena the atmosphere undergoes. Although they occur at high levels, they are apparently connected with surface weather, often resulting in a condition known as blocking that switches the worldwide circulation pattern to very much north-south rather than the more usual east-west. In the United States, this pattern often results in severe cold waves dipping far down into the South.

Until now, the cause of these warmings had been attributed by some to the streams of sun particles loosed by solar flares (SNL: 2/27/54).

But the atmosphere itself contains enough energy to account for the sudden warmings, without any input from streams of extra particles, researchers now find.

Confirming evidence that the high atmosphere can undergo temperature changes as great as 50 degrees C. comes from a computer programmed to make experimental forecasts of circumpolar air flow patterns at nine levels, from the surface to 20 kilometers.

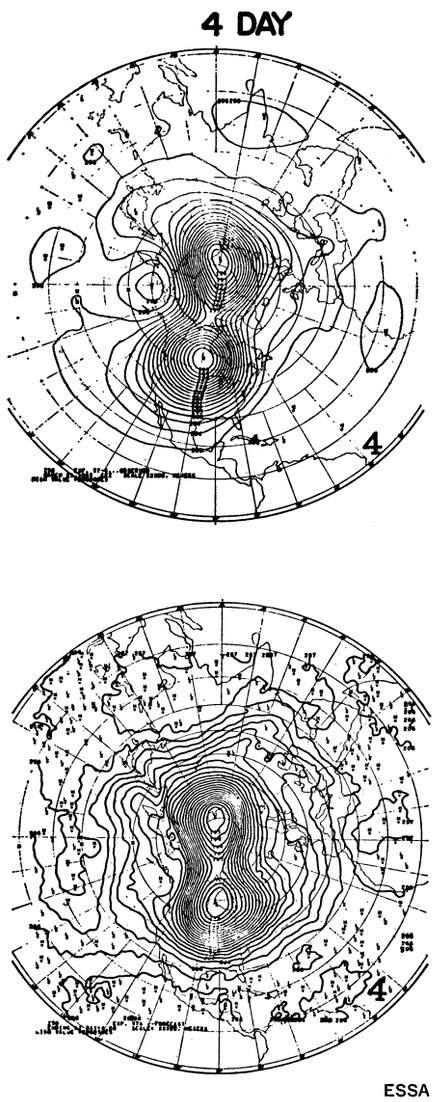
As far as meteorologists know, there have been six such sudden warmings, the first in 1952. Others probably occurred previously but only scattered soundings were then being taken at the extremely high altitudes where they are detected. All those studied occurred between mid-January and early March.

The self-contained nature of the sudden warmings was first found while using a computer at ESSA's Geophysical Fluid Dynamics Laboratory in Washington. It is programmed to predict what meteorologists call the general circulation, the planet-wide pattern of atmospheric motion averaged over a period of time, usually a month, season or year. Although the computer program contains such factors as heat transfer and atmospheric condensation, it does not include any imput for a sudden flow of solar energy from a corpuscular stream.

Nevertheless, a sudden warming was predicted by the computer. These calculations were then checked by the same computer, using a different set of equations that predict the circumpolar air flow patterns. Although the pattern is circular at the start, within a few days it becomes elongated and eventually becomes so unstable that it divides in two.

The two computer calculations show that no outside influence is required to account for sudden warmings and, therefore, that the model of the atmosphere being used to make experimental forecasts of the general circulation actually reflects physical reality even for previously puzzling events.

Dr. Kikuro Miyakoda of the Laboratory believes that the energy for the warming comes from the instability that causes the breakdown of the polar night vortex, which is a large-scale cyclonic circulation at high altitudes centered over the polar regions.



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Patterns, actual (top) and computed.

THE ELECTRIC MIND

Short Reactions Stay Unconscious

From the way humans behave, it is clear they have some kind of unconscious mental processes. A man can drive without making conscious traffic decisions, or shut out a conversation and still nod his head at the proper time; he can react according to experiences long forgotten, and even perhaps perceive things that are below his threshold of sensation.

From the way the brain behaves, it is now apparent that these unconscious processes do have a neurological basis.

According to work done at the University of California Medical Center in San Francisco, an unfelt sensation can nevertheless provoke a brain response. Moreover, the response is different from those that follow sensations that are actually felt.

Dr. Benjamin Libet, a physiologist who led the San Francisco team, says the evidence may help provide a physical basis for both subliminal perception and the unconscious thought processes.

In eight years Dr. Libet, with neurosurgeon Bertram Feinstein, experimented on more than 100 persons undergoing brain surgery for Parkinson's disease and cerebral palsy. Since the skulls had to be open and the patients unanesthetized for surgery, Dr. Libet was able to work directly with the sensory cortex to pick up signals sent from skin nerves.

Most of the patients were very willing to cooperate, to his surprise. He simply asked each patient to give him a half hour or so before surgery for the experiment, explaining that it was harmless, although of no help in the ailment.

Once the patient had agreed, Dr. Libet placed a flat plate a few centimeters long over the sensory cortex and matched it with a metal disk on the corresponding nerve area of the skin. Both plates had electrical contact points so that impulses could be sent either way.

Dr. Libet then tested the patient to find his threshold for sensory perception. Although the threshold varies widely among individuals, most patients could not feel an impulse below the one milliampere range. Yet their brains would react with a short, highly localized responses.

On the other hand, when the sensation was felt, this first primary response was followed by a series of complicated waves, says Dr. Libet. Instead of being localized in the sensory cortex, these afterwaves extended beyond to other brain areas and lasted half a second or longer.

Dr. Libet theorizes that conscious experience requires a minimum of at least half a second of brain activity. At shorter durations, the experience will most likely be unconscious, he says.

Dr. Libet's theory is backed further by the action of the brain under direct stimulation. A single, quite strong electrical impulse shot directly into the sensory cortex elicited no sensation in the patient, says Dr. Libet. But repeated impulses at low levels did.

The single impulse could be as much as 20 times stronger and still the patient would say he didn't feel anything, even while his brain was showing a large primary reaction.

The patient, however, did show some reaction to the single impulse—his muscle twitched. In other words, direct