Disappearing ozone: reality, or another hoax?

Carol Shaffer Cleary and Carol White evaluate the environmentalist claim that the ozone layer is vanishing, and compare this to Carl Sagan's 'nuclear winter' hoax.

On March 9, Dr. Susan Solomon, of the National Oceanic and Atmospheric Administration, gave testimony before the House Subcommittee on Health and the Environment, on the dangerously high level of chlorine dioxide found over Antarctica—an estimated level 20 to 50 times higher than expected. She attributed the rise to the pollution of the atmosphere by chlorofluorocarbons. As she admitted to the congressmen hearing her testimony, there are many questions, yet to be resolved, of how the polar climate affects chemical reactions, yet to be resolved.

Despite the fact that she admitted that it is still premature to conclude on the basis of her findings, that these molecules, popularly known as freons, were the cause of ozone loss in Antarctica, her testimony was used as the basis of a scare article in the next day's *New York Times* "Science" section. Environmentalists claim that freons have led to significant global decreases in the protective ozone layer in the upper atmosphere. Ozone, a colorless gas, guards life from excessive exposure to ultraviolet radiation.

While Dr. F. Sherwood Rowland, a chemist who first in the 1970s predicted destruction of the Earth's ozone layer by freons, was quite unequivocal in interpreting the Antarctica results, other scientists, mainly industry representatives, disagreed. Dr. Rowland himself admitted that there is still a large range of uncertainty built into the mathematical models which are being used to predict ozone loss.

Lee M. Thomas, administrator of the Environmental Protection Agency, said at the hearing that he feels the evidence to be so strong—even without the data on Antarctica—that there should be a freeze and phase-out of chlorofluorocarbons (CFCs).

The United States already bars their use in aerosol sprays, and has introduced an international protocol which would freeze production to current levels, banning their use entirely within 10-15 years.

Both France and Britain oppose this. Because of pressure from U.S. environmentalists, U.S. and Soviet officials, at a January 1987 meeting in Moscow, discussed possible means of banning or limiting chlorofluorocarbons. We would tend to agree with Yuri Z. Izrael, chairman of the Soviet State Committee for Hydrometeorology and Control of the Natural Environment, who said that the Soviet government did not think there was adequate evidence to warrant limitations on CFCs.

CFCs are a crucial chemical component of industrialized economies, used as an aerosol propellant, as a refrigerant, and as a solvent. The more industrialized an economy is, the greater its use of CFCs. United Nations Environmental Program advocates have been pushing the claim that CFCs catalytically destroy ozone in the upper atmosphere at very rapid rates, to get the United States and U.S.S.R. to mutually police the globe, dictating reduced rates of industrial development to all nations on the basis of this and similar environmentalist issues.

But while United Nations Environmental Program advocates negotiate, scientists have just discovered the "Catch-22" about the hypothesis that the CFCs destroy ozone.

What are the facts?

Data from NASA's Solar Backscatter Ultraviolet instrument (SBUV), which has been in operation since 1979 in the 40-50 kilometer altitude range above Earth, indicate that starting in 1982, the upper atmosphere (40-50 km) has brightened by 5% in three years. The assumption is made that such

brightening is due to a lessening of the protective ozone layer above Earth. According to the model used it would have lessened by 10% in those three years.

A 10% lessening in the protective ozone layer would be catastrophic; in fact it is four to five times greater than the rate of lessening of ozone predicted by the models of CFC destruction of ozone. Unless we are willing to accept such a Chicken Little point of view, we are led to question the model which is being used.

Either the model and the hypothesis are virtually worthless, and science really doesn't understand anything about the catalytic destruction of ozone by CFCs in the upper atmosphere, or science has no way of accurately measuring ozone, and no idea of what the rate of destruction of ozone is, assuming that such destruction exists.

The role of volcanos

A group of scientists at the University of Colorado Laboratory for Atmospheric and Space Physics has come to the conclusion that the problem is that the modelers overlooked the role of volcanic particles. This has resulted in attributing the reported observations to a decrease of ozone, when this many not really be the case.

Since 1982, the SBUV instrument "has been seeing an atmospheric brightening that may be explained by sunlight scattered by aerosols. This brightening is currently being attributed to a large, global decrease in upper stratospheric ozone," researcher Todd Clancy explained. In 1981-82 there were two major volcanic aerosol imputs into the upper stratosphere; one was a mystery cloud in late 1981, of undetermined volcanic origin, and the other the huge El Chichón explosion, which put more volcanic aerosols into the upper stratosphere than any volcano in the last 100 years. "We're still seeing the effects of El Chichón nearly three years after it erupted in 1982," Clancy said.

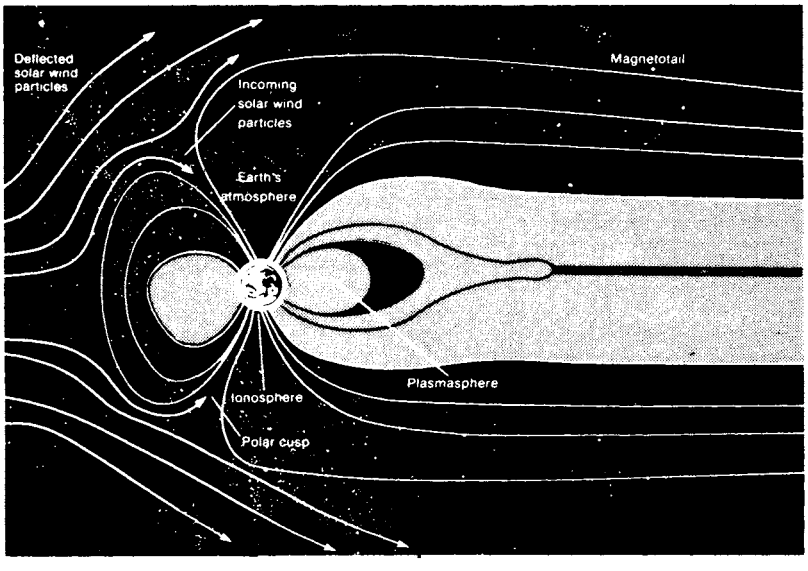
Data from the Solar Mesosphere Explorer satellite, launched in 1981, confirms that a large amount of sulfuric acid droplets was volcanically injected into the upper stratosphere in 1982, and they are still up there, in the 30-50 kilometer range, in a fine haze which is still growing. Sulfuric acid emits thermal radiation which confuses the backscatter ultraviolet equipment by generating additional atmospheric brightness.

The University of Colorado team is currently trying to sort through the Solar Mesosphere Explorer satellite data, to try to determine how much of the observed brightening of the upper atmosphere is due to volcanically injected sulfuric acid haze, and how much might be due to an actual thinning of the protective ozone layer. While this question may be exceedingly difficult to resolve, it is very important, since most scientists will not debate that CFCs can catalytically destroy ozone, but the real question is, do they do so on a level that affects the Earth's ozone level, or is man's intervention, putting CFC in the atmosphere, still very trivial in scale relative to natural processes affecting the atmosphere and climate, such as major storms, volcanos, and fluctuations in solar activity affecting Earth? (See **Figure 1**.)

The Antarctic ozone hole

A separate, but possibly related occurrence, is the mysterious transient thinning of the ozone layer above Antarctica each spring. This has been seized on by environmentalists as proof that CFCs rapidly destroy global ozone in the upper atmosphere. The media picked up this cry with the enthusi-

FIGURE 1
The solar wind and Earth's atmosphere



Ionized, or corpuscular radiation, the so-called solar wind, comes into the Earth's environment by spiraling down along magnetic field lines that converge on the Earth over the North and South Pole. The environmentalists claim that ozone is disappearing from the Earth's atmosphere at an alarming rate and that the transient "ozone hole" over the South Pole is dangerous.

asm of a science-fiction writer whose fantasy has come true.

The ozone hole that ate the Earth started as a media hit when DuPont, a major global manufacturer of CFCs, called for limitations on production of CFCs. This DuPont announcement occurred just one business day before Antarctic scientists officially released their vague, unquantified results in October 1986.

A small scientific team had gone on a much-publicized trip to Antarctica, to make various experimental measurements, during the Antarctic spring. Their purpose was to further probe the causes of the ozone hole. Was this another example of CFC destruction of the ozone layer?

While the media campaign which followed appeared to prove that the ozone hole will soon devour the whole Earth, like most such campaigns, this did not have much relationship to scientific truth. In fact, scientific circles have been quietly battling over competing hypotheses which claim to give other causal explanations for the transient thinning of ozone over Antarctica.

One of the most interesting hypotheses has been presented by Linwood Callis and Murali Natarajan, who work at NASA's Langley Research Center in Hampton, Virginia. They published two papers, one in the Sept. 20, 1986 issue of the *Journal of Geophysical Research* and another in the Oct. 13, 1986 issue of *Nature*, releasing extensive satellite data, which supported the hypothesis that it was the 1979-80 solar cycle which led to the build-up of odd nitrogen compounds. They contend that it is these which catalytically destroyed ozone over the pole.

The solar cycle

The sun's cycle of solar storms is commonly measured by sunspot activity. The apparent 11-year sunspot cycle is actually a 22-year cycle, with the magnetic field reversing after each 11 years. The strength of the maximum period of sunspot activity within the cycle itself varies. The peak of solar cycle number 21, which occurred in 1979, was the second-strongest peak in solar disturbances in 250 years (**Figure 2**).

The 1979-80 period was one of the most intense periods of solar activity in centuries. The build-up of odd nitrogen compounds it triggered is just finally beginning to dissipate three to four years later. Ionized particles, also called corpuscular radiation, from such periods of intense solar activity, spiral down along the Earth's magnetic field lines, creating vortical plasma filaments at the poles.

During periods of high solar activity, this corpuscular radiation interacts with the thermosphere (90-130 kilometers above the Earth), producing more than double the amount of odd nitrogen compounds normally produced by cosmic radiation. Odd nitrogen compounds include a whole family of chemical species: NO, NO^2, NO^3, HNO^4, N^2O^5, etc.

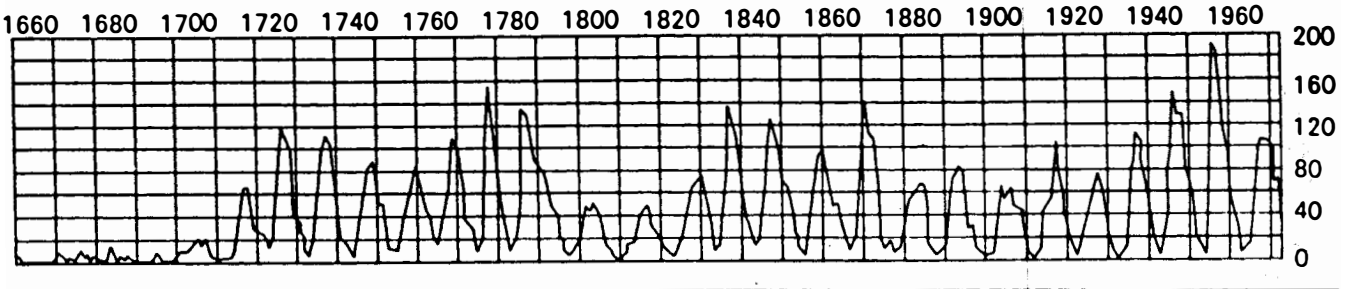
The long polar night vortex, which by convection sweeps cold air down in a vortical motion over Antarctica, during its dark winter, sucks the increase in odd nitrogen compounds down from the thermosphere into the upper stratosphere. As the sun comes up during Antarctica's spring, N^2O^5 photodissociates into NO^2, which catalytically destroys ozone, until the final warming breaks up the cold winter night polar vortex, cutting off the source of odd nitrogen compounds. Then the ozone hole disappears until the next Antarctic spring.

Preliminary analysis of the latest 1986 satellite data indicates that the South Pole ozone hole was significantly less pronounced in the Antarctic spring in 1986 than it was in 1985, and that mid-latitude ozone levels have recovered by about 3% from previous levels of depletion. This is what would be expected if odd nitrogen compounds were catalytically destroying ozone as a consequence of variations in the sun's activity.

Right now, most scientists are still suspending final judgment on whether Callis is right, that the sun's intense activity generated a temporarily enlarged Antarctic ozone hole, or

FIGURE 2

The sunspot cycle



The Sun's cycle of solar storms is commonly measured by sunspot activity. The apparent 11-year sunspot cycle discernable in the figure is actually a 22-year cycle, with the magnetic field reversing after each 11 years. The strength of the maximum period of sunspot activity within the cycle itself varies. The peak of the solar cycle that occurred in 1979 was the second strongest peak in solar disturbances in 250 years.

whether the environmentalists are right, that CFCs generated the large Antarctic ozone hole as part of a continuing global destruction of ozone. An answer will have to wait at least until additional satellite data come in at the end of 1987. If the hole continues to decrease, and mid-latitude ozone levels continue to recover, then the scientific world would favor Callis's hypothesis; but if the hole gets larger, and mid-latitude ozone levels begin to drop again, then scientists will conclude that the CFC model is basically correct, and 1986 is a transient fluctuation in a larger trend.

The polar night vortex also exists over the North Pole, but nearby orthographic features—bumps, like mountain ranges—allow more transient aerodynamic patterns to move the vortex over the North Pole around and even split it up, so that surrounding warmer ozone-rich, odd nitrogen compound-poor air is frequently mixed in. For this reason, the long dark winter at the North Pole is much warmer than at the South Pole, and no spring ozone hole is found over the North Pole. (See **Figure 3**.)

While science patiently waits to discover the actual cause of the much-publicized Antarctic ozone hole, United Nations Environmental Program advocates are trying to negotiate a policy of CFC use that closely follows that laid out in a recent World Resources Institute study to ban or drastically limit use of chlorofluorocarbons.

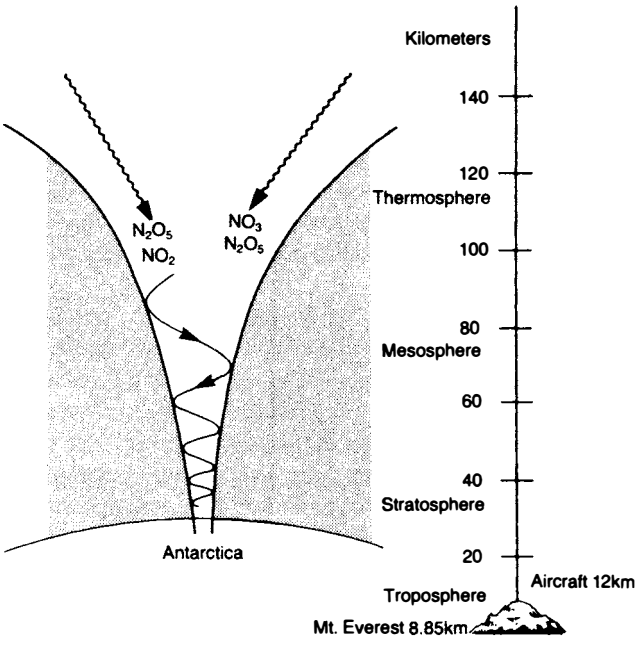
The implications for the economy

This would mean major redesign of all equipment using CFCs, mainly refrigerants. It would affect numerous food processing and chemical industry uses of refrigeration, and even thousands of industrial processes employing CFCs as solvents, refrigerants, or aerosol propellants—even the air conditioning seals and valves of automobiles.

One obvious way to reduce dependence upon CFCs in the area of food processing, would be the widespread introduction of food irradiation for the preservation of food and a certain amount of insect control. The lessons of the Carter administration must not be overlooked in a rush to institute controls. It is no exaggeration to attribute some of the backwardness of American industry, compared to that of Japan for example, to the misapplication of capital investment to the retrofitting of industry in order to cut down on air pollution.

The Carter administration made utilities put expensive and inefficient scrubbers on smokestacks, while using every political means to destroy the more efficient and less polluting nuclear industry. In fact, under the spurious justification of an energy emergency, conversion to coal use was mandated. The situation was similar, in industry at large. In steel production, funds were diverted from investment in the development of plasma furnace and associated technologies such as the Jordan process, which could have cleaned up the coal pollution 100%, and made fertilizer as a by-product at the same time.

FIGURE 3
The South Pole in winter



During winter, corpuscular radiation spirals down along the magnetic field lines that converge over the South Pole, generating odd nitrogen compounds in the upper part of the Earth's atmophere: the thermosphere and mesosphere. The stable polar night wind vortex that forms in the winter sucks these odd nitrogen compounds from the thermosphere and mesosphere down into the stratosphere, where they partially destroy the protective layer of ozone.
The polar night vortex also exists over the North Pole, but nearby topological features—bumps, like mountain ranges—allow more transient aerodynamic patterns to move the vortex over the North Pole and even split it up, frequently mixing in surrounding warmer ozone-rich air that is poor in odd nitrogen compounds. For this reason, the long dark winter at the North Pole is much warmer than at the South Pole—and no spring ozone hole appears there.

Let us assume for the moment, that the CFCs are indeed depleting the Earth's ozone layer. There is another entirely different approach to the problem which this poses, than that of restructuring industry. Can we develop a means of recreating the ozone layer?

To pose this question is by no means fanciful. It is precisely the kind of problem which must be solved if we are to make planets such as Mars habitable by man. Perhaps the atmosphere of Mars will never (or not within the century) be breathable by man, but we can expect to be able to raise the pressure of the Martian atmosphere from the present 1% of Earth's atmosphere to somewhere nearer the proportion of Mars' gravitational field to that of Earth—38%. We will also wish to replicate the way in which the ozone layer provides a

radiation shield on Earth.

Nuclear winter, or is it summer?

The questions being raised about the ozone level are occurring against a continuing background of "concern" about a general greenhouse effect, said to come from an increase in carbon dioxide and other gases in the upper atmosphere—again by-products of our industrial society. One of the egregious problems in all of these predictions is the fact that the models upon which they are based are flawed, by the current inability of scientists to adequately model weather flows. An ironic side commentary on this involves the "nuclear winter" hoax.

In the fall of 1983, Carl Sagan, a longtime pro-Soviet activist in the "peace movement" and otherwise science publicist and professor at Cornell University, led a coalition of environmentalists who warned that the aftermath of a nuclear war might be the extinction of the human species, due to the abrupt severe temperature drop which would occur. They predicted as much as a 40ß centigrade drop in temperatures.

Sagan's predictions assumed a 5,000-megaton nuclear exchange. This would create a cloud of dust and smoke which would encircle the Earth for one to two weeks, shielding the Earth from solar radiation.

In the Dec. 6, 1983 issue of *EIR,* Robert Gallagher, Beth Moore, and Ned Rosinsky published an attack on this scenario, deeming it an unscientific fraud. In particular they criticized the fact that Sagan depended upon a one-dimensional radiative convection model. What they said then, is as true today—even the best weather models fall short because they are unable to represent non-linear processes. (The model used by Sagan, however, was the epitome of bad weather models.)

The whole question was raised again at a meeting of the American Association for the Advancement of Science held in Chicago on Feb. 16. At that time, S. Fred Singer of George Mason University predicted that a global nuclear exchange would result in heating rather than cooling the Earth's atmosphere. His idea—that a smoke blanket would trap heat given off by the Earth—was not generally accepted, but more to the point, Carl Sagan was denounced for fraudulently misrepresenting his weather model, in order to score political points for the nuclear freeze movement. The same oversimplistic methodological error occurs among those scientists who predict dire consequences from running an industrial economy. Is this not conveniently coherent with the point of view of the environmentalist movement?

The Sagan story

Two scientists from the University of Colorado, in Boulder, employed a computer model designed at the National Center for Atmospheric Research (NCAR). According to their findings, a nuclear exchange would at most briefly introduce autumn-like weather in summer. Some areas might experience a quick freeze, but human life (and food production) would not be threatened with extinction. Their findings were reported upon in the 1986 issue of *Foreign Affairs,* and more recently in the Jan. 16, 1987 issue of *Science* magazine. They were also presented to the American Association for the Advancement of Science in February.

Sagan faced with their results, contends that there is "nothing new" which could make him alter his original description of nuclear winter. He justifies this deliberate disregard for truth by the "higher truth" of his political convictions. His pro-Soviet bias is so obvious that it has caused a falling out between him and his collaborators in the nuclear freeze movment, such as George Rathjens, a professor of political science at MIT. Rathjens is quoted in *Science* magazine as asking the question: "Is this another case of Lysenkoism?" He concludes that it is, and asserts that the original nuclear winter model is "the greatest fraud we've seen in a long time."

The nuclear winter case a paradigm

As long as scientific prediction rests upon a computer study, rather than experimental results, it is inherently flawed by the hereditary assumptions embedded in the model. This in our view is precisely the problem with the modeling now being done to account for the reduction in the ozone layer. It is plausible, but plausibility is not sufficient grounds for the sweeping restrictions being proposed for the use of CFCs.

Russell Seitz, a fellow at Harvard's Center for International Affairs, recently attacked Sagan for cynically presenting doctored results to support his conclusions. He has published articles in a Washington, D.C. quarterly, *National Interest,* and in the *Wall Street Journal,* in which he charged that the nuclear winter fraud was hatched "within the inner circle of the world's disarmament activists," as a way of terrifying the public.

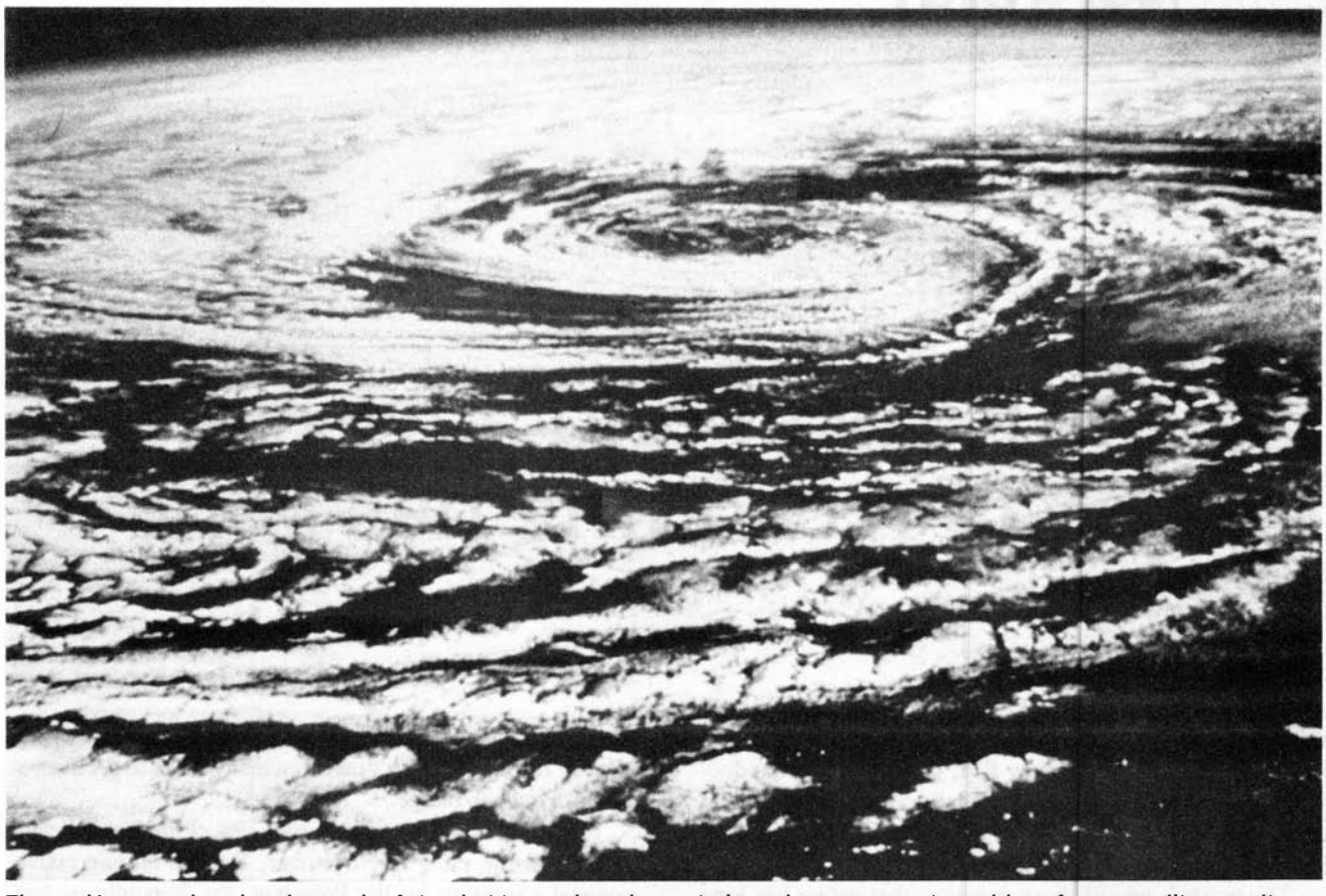
The model

Questions of weather modeling are most relevant to assessing the validity of modeling the spread of particulates through the atmosphere.

Obviously, the nuclear winter model is heavily dependent upon what scenario for a nuclear exchange between the United States and the U.S.S.R. is accepted. Unlike some of his critics, we would not quibble with Sagan on this point. If such a tragic war occurs, it will not be limited in scope.

Science magazine originally supported the Sagan hypothesis (we would assume for reasons not unconnected with their political support of the disarmament cause); however in their Jan. 16 review they raise a number of critical points worth quoting:

> For quite a few variables in the nuclear winter equation, choosing a "high" or "low" value can make the difference between a black or a rosy outcome. . . . Some nautral events are described by assumptions as



The earth's atmosphere has thousands of singularities, such as the vortical weather structure pictured here from a satellite—nonlinear processes which Sagan's "nuclear winter" weather model never took into consideration.

arbitrary as the bombing scenarios. Furthermore, several pose the same dilemma: Choosing one value wipes out nuclear winter, and choosing another makes it real. Nor is it clear that a midrange between the extremes is in any sense "better" than a high or low value.

Consider how land and atmospheric heat are treated. No experiment can mimic the smoke and turbulence rising from 100 burning cities. Sagan and Turco think it best to assume the atmosphere would behave very differently from what we now experience. Turco says a smoky atmosphere would become "decoupled" from the Earth's surface, with unpredictable results. No model based upon a peaceful environment can give an adequate picture of this. Schneider says this view overstates the effect of smoke cloud, which would not be uniform, but patchy.

On the other side, one of Sagan's collaborators, R.P. Turco, criticizes the above-mentioned Schneider study because it assumes a uniform mixing rate for the smoke, instead of a uniform density. In the original *EIR* study, both such approaches were criticized as violating the actual hydrodynamic quality of weather flows, which are governed by vortical action rather than homogeneity, and in which it is the existence of singularities which are key. As *EIR* wrote in 1983:

Let us assume now, for the sake of investigating Sagan's other assumptions, that somehow 225 million tons of smoke particles get up into the troposphere and stratosphere from firestorms ignited by nuclear blasts. Sagan assumes that within one to two weeks this material will distribute itself uniformly around the globe, or at least around the Northern Hemisphere. This is a completely arbitrary assumption.

Such a blanket at tropospheric or stratospheric altitudes would set up a tremendous temperature gradient between the layers of the atmosphere above and below. This in itself would tend to tear the dust-smoke cover apart. It is preposterous to assume that such a cover could remain intact, absorbing energy from the sun, and not begin to exhibit nonlinear collective particle effects that would form structures between which sunlight would pass to the Earth, thereby permitting photosynthesis and some warming.