EARTH SCIENCES

On the death of the atmosphere

The topic has a considerable touch of the macabre. It is, after all, the ultimate doomsday: The day the sun stops shining. Not for just the few minutes of a solar eclipse—terrifying enough to primitive peoples—but forever. The end.

Fortunately, that day is some 5 billion years off. But the question of what would happen on earth if the sun suddenly swtiched off, in addition to its intrinsic interest, raises some interesting scientific questions.

The earth's atmosphere, for instance, is a very intricate mechanism that is far from being fully understood. One way to understand a complex system is to make an artificial change in the conditions and observe the response. We can hardly do that with our atmosphere, however; it's the only one we've got. The alternative is to use numerical simulations using a computer and a general circulation model of the atmosphere.

Using these techniques, B.G. Hunt of the Australian Numerical Meteorology Research Center in Melbourne has "stopped" the sun. In his calm, but chilling, words, "This experiment was intended to investigate the response of the atmosphere to a sudden and complete termination of the incoming solar radiation." His report on the experiment, in the July 20 JOURNAL OF GEOPHYSICAL RESEARCH, is titled, appropriately enough, "On the Death of the Atmosphere."

The results show that the atmosphere is surprisingly resilient. The decay time of the model atmosphere greatly exceeded crude estimates in the literature. Even after 50 days, 30 to 40 percent of the zonal components of the available potential energy and kinetic energy remained. Amazingly, the basic structure of the troposphere (the lower five miles of the atmosphere) persisted even after 50 days. The model still had a jet stream and meaningful vertical and latitudinal temperature gradients. The overall distribution of the atmosphere's meridional (north-south) velocities remained the same after 50 days, showing that the atmosphere retains a "memory" of the previous heat-caused pressure differences.

Hunt was surprised and impressed. "This 'resilience' of the model, if applicable to the actual atmosphere, is encouraging, since it emphasizes that the atmosphere is not easily disturbed from its basic state, and this has obvious climatic implications." It suggests, for example, that external forcing, such as from a large volcanic eruption, would not be expected to produce a permanent effect on the atmosphere. It also hints that large climatic changes may be caused by subtle modifications in the existing atmospheric system rather than major, dramatic changes to the system.

The roving cloud of Mt. St. Augustine

At 6:30 in the evening on Jan. 25, 1976, Aden B. Meinel and Marjorie P. Meinel of the University of Arizona's Optical Sciences Center observed a cloud of unusual coloring and structure passing over Tucson. The cloud appeared in a perfectly blue sky from the northwest and drifted rapidly southeast. By sunset, according to the Meinels, the entire sky west of the zenith at Tucson was filled with curiously bluish-gray clouds lying in long windrows parallel to the direction of flow. The sight continued for two hours until darkness came.

It has now been confirmed that what they saw was the cloud of ash from a major eruption of the Mt. St. Augustine volcano in Alaska, 3,500 miles to the northwest, two days earlier.

As roving volcanic clouds go, this one was distinguished by its relatively low altitude, about 6 kilometers instead of the usual height of about 19 kilometers. The Meinels and Glenn E. Shaw of the University of Alaska's Geophysical Institute describe their observations of the cloud in the July 30 SCIENCE.

SPACE SCIENCES

ATS-6 works its way home

The sixth Applications Technology satellite, ATS-6, has started its four-month homeward orbital journey to the western hemisphere, following completion of a year-long educational television experiment for the government of India. Even the trip home will be busy, however, as the satellite takes part in direct-broadcast experiments with a host of other countries, in a cooperative agreement between NASA and the U.S. Agency for International Development.

By the end of this month, experiments will have been conducted with Thailand, Pakistan, Bangladesh, the United Arab Emirates, Oman, Jordan, Kenya, Yemen, Morocco (including a separate demonstration for the Conference of Applied Science and Technology in the Arab World), Libya and Sudan. An additional 15 countries in Africa, the Caribbean and Central and South America have been invited to participate in a second group of similar demonstrations, tentatively scheduled to begin in late September.

The satellite's huge antenna and high power output enable it to broadcast to an individual television receiver equipped with a portable antenna and frequency converter, but without the need for a costly ground station, thus making it applicable to developing countries.

Satellite on a string

A satellite that would hang suspended by a cable from the space shuttle to "troll" through the atmosphere is being studied by researchers at NASA's Marshall Space Flight Center in Huntsville, Ala. The tethered probe could allow extended observations at altitudes where sounding rockets soar too briefly, and where even conventional orbiting satellites have short lifetimes due to atmospheric drag.

The satellite would hang as far as 100 kilometers below the shuttle after being deployed from the shuttle's cargo bay, to dangle in regions from 80 to 120 kilometers above the surface of the earth. The Marshall group maintains that such a technique would offer improved accuracy in magnetic-field and gravity surveys, as well as temperature and aerodynamics studies. The Smithsonian Astrophysical Observatory is aiding NASA in studying the dynamics of the tether system.

The first tethered satellite mission, primarily just to verify the concept, could take place as early as 1980, possibly within a year of the space shuttle's first orbital flight in the summer of 1979.

Another weather-eye aloft

The latest of the National Oceanic and Atmospheric Administration's orbiting weather-watchers, the ITOS-H satellite, was launched July 29 into a pole-crossing, circular path. Instrumented to provide visible and infrared images of cloud cover, snow, ice and the sea-surface, it will also compile atmospheric moisture and temperature profiles. The probe was launched in place of a previously scheduled satellite in the series, designated ITOS-E2, because it contains an improved temperature-profile radiometer.

Oblique-wing robot plane flies

A remotely controlled test version of a proposed aircraft that would swing one wing forward and the other back to angles up to 45° (SN: 7/10/76, p. 25) made its first test flight Aug. 6 at the NASA Dryden Flight Research Center in California's Mojave Desert, though an autopilot problem limited the wing-swing to 15°.