

of vegetation produces nitric oxide and other gases that get converted in the atmosphere into nitric acid and organic acids. Crutzen adds that researchers don't really know how the acidic precipitation and high ozone levels affect tropical ecosystems. Future research must address this question, he says.

Levine says scientists expect pollution from fires in tropical regions to worsen as the rapidly growing population places greater stress on the surrounding environment.

- New studies highlight the importance of carbon monoxide emissions from fires. Carbon monoxide tends to lower the concentration of hydroxyl radicals, so-called "detergent" molecules that clean the atmosphere by reacting with pollutants. The reduction in hydroxyl concentrations also contributes indirectly to the greenhouse effect by lengthening the tropospheric life spans of ozone and methane, another greenhouse gas.

From test fires, Crutzen estimates that biomass burning contributes about half the carbon monoxide present in the atmosphere; other recent studies suggest it contributes about one-fourth the carbon monoxide. Scientists have estimated that the carbon monoxide level itself has been growing at about 1 percent per year.

- Until the past few years, researchers studying biomass burning focused on fires associated with the clearing of tropical rain forests. But recent findings have revealed the importance of two other practices that appear to burn as much material as land-clearing fires: the worldwide burning of agricultural waste left over after harvest, and the annual burning of grasslands in Africa, South America, Australia and elsewhere to improve grazing.

Scientists at the meeting also discussed the importance of cooking/heating fires in heavily populated regions of Asia, and a huge boreal forest fire in 1987 in China and the Soviet Union. Satellite measurements indicate the 1987 blaze may have been the single largest fire in the last 500 to 1,000 years, says Levine.

As a result of the recent findings, researchers have boosted their estimates of the amount of biomass burned by fires each year. Only a few years ago, Crutzen says, experts thought biomass fires burned about 2.5 billion tons of carbon annually; now they are speaking in a range of 3 billion to 4 billion tons each year.

Using current estimates of biomass burning, two research groups calculate that fires and the process of deforestation contribute about 15 percent of the warming expected from the buildup in greenhouse gases. This means policies attempting to slow global warming will have to limit biomass burning, insists Daniel Lashof of the Natural Resources Defense Council in Washington, D.C.

— R. Monastersky

Satellites find no global warming in 1980s

Satellite measurements indicate Earth's lower atmosphere has not warmed over the last decade. But because these data span such a short period, they cannot settle the question of whether increasing levels of greenhouse gases have started to raise global temperatures.

"I certainly wouldn't say we've proven there isn't a global warming [underway]," says Roy W. Spencer of NASA's Marshall Space Flight Center in Huntsville, Ala., who analyzed the atmospheric measurements with John R. Christy of the University of Alabama in Huntsville.

The satellite instruments measure the temperature of the atmosphere's lower 10 kilometers by absorbing microwave radiation emitted by oxygen molecules. Between 1979 and 1988, the instruments recorded strong upswings and downswings in average global temperature, each lasting several months, but showed no general warming trend, the researchers report in the March 30 *SCIENCE*.

Concern over global warming stems in part from measurements taken at land stations and on ships, which indicate Earth's average surface temperature has risen by 0.5° since the late 1800s. The surface record differs slightly from the satellite data, showing a subtle rise since 1979. However, most of the surface warm-

ing occurred before 1979.

The surface record has come under fire in recent years from critics who contend that it fails to represent true global temperatures for two important reasons: The network does not sufficiently cover vast regions of the remote oceans, and urban heat from developing cities may artificially boost temperatures at land stations.

In contrast, the satellite sensors survey the entire lower atmosphere, and city warmth does not skew their readings. The sensors thus provide a powerful tool for monitoring future global temperatures, and could detect a global warming sooner than surface measurements, Spencer and Christy say. They plan to use satellite measurements to test the reliability of computer climate models that predict a 1.5°C to 4.5°C warming by the middle of the next century.

Spencer says the disagreement between satellite and surface data for the 1980s does not necessarily mean one source is wrong. Satellite measurements encompass a thick region of the lower atmosphere, he explains, and over a time span as brief as a decade, Earth's surface and its lower atmosphere might follow different temperature trends.

— R. Monastersky

'Vaccine' spurs immune attack on melanoma

Researchers this week reported some "dramatic" improvements among patients with widespread melanoma who received vaccination-like injections to spur the immune system to attack this particularly lethal form of skin cancer.

Malcolm S. Mitchell and his colleagues at the University of Southern California at Los Angeles formulated the experimental treatment using cultured, fragmented human melanoma cells. While it cannot prevent cancer, they say the vaccine seems to prod the immune system's killer T-cells to destroy existing tumors. Preliminary tests in 12 people had suggested the vaccine slowed melanoma progression (SN: 10/24/87, p.267).

Now Mitchell reports some striking results among a group of 79 people whose melanoma had spread beyond the initial skin site to distant body parts, although the primary skin tumors had been surgically removed. Each participant received weekly injections for four weeks, followed by another injection in the sixth week and monthly booster shots for those showing a treatment response.

The researchers found that 18 of the 79 patients (23 percent) had tumors that shrank to half their original size or completely vanished for at least a month. Five of the 18 survived two years or more, with one patient still living nearly four years

after treatment.

Mitchell, who described the new results at an American Cancer Society science writers' seminar in Daytona Beach, Fla., says this is a significant survival advantage; most people with widely disseminated melanoma who receive conventional treatment die within a year after doctors detect tumor spread. Only 30 to 40 percent of melanoma patients benefit from standard chemotherapy, and among these the reprieve is often brief, adds John Laszlo of the American Cancer Society. In all, melanoma kills about 6,300 people in the United States each year.

Mitchell says the experimental vaccine caused swelling at the injection site but no other adverse reactions. In contrast, he notes, standard chemotherapy often causes severe side effects.

One unexpected result of Mitchell's trial: An 83-year-old man with melanoma in the skin lining the back of the eye showed "remarkable" tumor shrinkage and vision improvement. Such tumors usually grow inexorably and resist chemotherapy, leaving surgical removal of the eye as the only remedy, Mitchell says. He and his colleagues now plan to give the vaccine to 30 people with melanoma of the eye to see whether it can halt tumor growth and preserve eyesight.

— K.A. Fackelmann