of such factors as ozone amount, latitude, and weather variables. The calculations suggest that DNA-damaging wavelengths of UV light were 81 percent stronger and sunburn-producing wavelengths were 44 percent stronger in New Zealand, they report in the Sept. 10 NATURE. The researchers say they had not expected such a large hemispheric difference.

Ozone measurements for the two regions indicate that the air over the New Zealand station had roughly 15 percent less ozone than did air over the German station. Instruments carried by balloons reveal two separate causes underlying that difference. In the troposphere, or lower atmosphere, Germany has much higher levels of ozone pollution; this accounts for about half the total ozone difference between the two sites. The rest stems from inequities in the stratosphere, where Germany also has greater concentrations of ozone.

To explain the stratospheric discrepancy, Seckmeyer notes that New Zealand lies close to Antarctica, where vast amounts of ozone are destroyed each September during the formation of the ozone hole. Indeed, ozone levels in Antarctica are currently dropping at a record rate, suggesting that this year's ozone hole will be particularly severe. When the hole breaks up during October and November, pockets of ozone-depleted air drift northward and mix with air over New Zealand and other regions in the southern hemisphere.

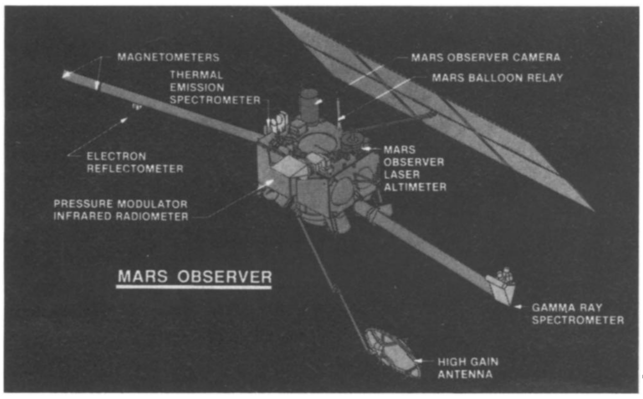
The same chemicals that cause the ozone hole also eat away at the global ozone layer. But so far, increases in tropospheric ozone pollution at the German site have largely offset the stratospheric loss there, the researchers say.

UV levels in Germany and other industrialized countries might actually be lower today than they were in preindustrial times, says Sasha Madronich of the National Center for Atmospheric Research in Boulder, Colo. Aside from considerable tropospheric ozone pollution, these regions also suffer from sulfuric acid haze, another factor that filters out UV light, says Madronich.

In a recent study, Madronich and colleagues calculate that the haze factor alone should have reduced UV levels by 5 to 18 percent in rural parts of industrialized countries (SN: 1/4/92, p.5). As nations begin to reduce air pollution, the cleaner skies will combine with stratospheric ozone loss, permitting more ultraviolet radiation to reach the surface, Madronich says. *—R. Monastersky*

Mars Observer: Return to the Red Planet

Global dust storms, boulder-strewn terrain, a landscape scarred by ancient channels — these images of Mars were made familiar by the spacecraft that flew past, orbited, or landed on the planet in the 1960s and 1970s. Yet explorers such as the Mariner fleet of spacecraft and the 1976 Viking missions mapped in detail only 15 percent of the surface of Mars, the most Earth-like body in the solar system.



NASA

Mars Observer and its instruments

Now, for the first time in 17 years, a U.S. craft will again journey to the Red Planet. Scheduled for launch Sept. 25, the Mars Observer comes equipped with an arsenal of seven scientific instruments that emphasize geology and climate studies over biology. The Observer "will map parts of Mars better than we have mapped parts of Earth," says program scientist Bevan M. French at NASA headquarters in Washington, D.C.

Intended to pave the way for future human and robotic explorations of Mars, the $511 million craft will reach the planet next August. For at least one Martian year (687 Earth days), it will circle the planet every 118 minutes in a polar orbit 378 kilometers above the surface. And in so doing, the craft will gather information about the composition, volcanic activity, and atmosphere of Mars that has eluded planetary scientists for decades, French adds.

For example, one of the craft's detectors may settle the debate over whether Mars has a magnetic field. Even a weak field would indicate that the planet still has a partially liquid core, an apparent prerequisite for generating magnetic activity, French says. In addition to hunting for an active field, the mission's magnetometer/electron reflectometer will search for remnants of an extinct field. If Martian rocks retain some residual magnetism from an ancient field, that magnetism may reverse the path of solar-wind electrons heading toward the planet.

Two instruments will attempt to unveil the chemical composition of the Martian surface. A gamma ray spectrometer will measure radiation emitted by the nuclei of atoms, identifying the elements contained in soil and rocks. Another detector, the thermal emission spectrometer, will examine infrared emissions from the surface to determine its mineral content and the layering of ice and dust. This spectrometer can also detect infrared radiation emitted during the dust storms that sometimes engulf the planet.

The craft will take the sharpest pictures ever recorded from a Martian orbit. Two pairs of fish-eye lenses will offer 140-degree views of the planet, resolving horizon features as small as 2 kilometers across and indicating changes in weather patterns. Using another set of optics, the camera system will also take narrow, ultra-sharp pictures of the Martian surface with a resolution better than 3 meters across. Because of the huge amounts of data involved, scientists will take high-resolution images sparingly, homing in on ice caps, volcanos, and channels.

Bouncing infrared laser light off the planet, the craft will determine the heights of volcanos, highlands, and other surface features to within a few meters. Such measurements can help scientists map the planet's gravitational field. Radio signals beamed from the craft to Earth will also probe Martian gravity. When the craft passes by a portion of the planet that has a relatively higher mass density, it will speed up slightly, shifting the frequency of the radio signal received on Earth.

By sending radio signals through the atmosphere, scientists also can determine the electron density and temperature of different layers. Another device, the pressure modulator infrared radiometer, will examine the atmosphere below the craft and off to the horizon. This detector will measure temperature, the composition of Martian clouds, pressure, water vapor, and dust concentrations.

If, as expected, the craft lasts longer than its three-year design lifetime, it may play a unique role as the main communications link between Earth and the next explorer to visit Mars. A Russian craft known as Mars 1994, scheduled for launch in two years, will release several surface probes as it enters its Martian orbit in 1995. Mars Observer would relay signals from those probes back to Earth. *—R. Cowen*