



The National Park Service

Natural Resource Information Division

Fact Sheet 98-03
August 1998

Measuring Ultraviolet Radiation in National Park System Units

By Kathy Tonnessen

Background

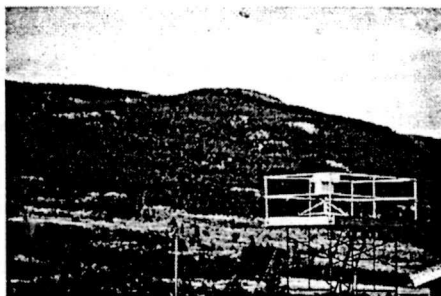
In September 1996, the National Park Service and the U.S. Environmental Protection Agency (EPA) signed an interagency agreement to cooperate on a program of long-term monitoring of environmental stressors in National Park System (NPS) units¹ and research the effects of the stresses on ecosystems. Fourteen NPS units are included in the *Demonstration Intensive Site Project* (DISPro): Acadia, Big Bend, Canyonlands, Everglades, Denali, Glacier, Great Smoky Mountains, Hawaii Volcanoes, Olympic, Rocky Mountain, Sequoia-Kings Canyon, Shenandoah, Theodore Roosevelt, and Virgin Islands national parks. These parks are representative of major ecosystem types and were chosen because of their status as Class-1² air quality parks.

In these parks, the National Park Service is sponsoring the monitoring of air quality including ozone, wet and dry deposition, visibility, and meteorology. EPA added UV-B monitors in these parks to determine changes in irradiance that may be

affecting human health and ecosystem processes.

Why Monitor UV?

In 1985 the scientific community discovered the stratospheric ozone hole over the Antarctic through which more damaging UV-B reach the surface of the earth. Ozone thinning has been detected throughout the globe, and seasonal depressions in this protective shield are most severe at the poles. Stratospheric ozone depletion is the result of anthropogenic air pollutants known as chlorofluorocarbons (CFCs), which cause catalytic reactions in the stratosphere that destroy ozone molecules. In 1987, the major polluting nations signed the *Montreal Protocol on Substances that Deplete the Ozone Layer*, which called for phasing out such chemicals as freon, a particularly harmful CFC.



Ultraviolet radiation monitor in Glacier National Park, Montana.

Because of the long lifetimes of CFCs in the upper atmosphere, scientists are not certain when the ozone

thinning will be reversed. The actual exposure of humans and ecosystems to this form of solar radiation must be determined to understand which systems are being damaged. To chart the changes from the CFC control programs, researchers must also monitor the seasonal variability in both the UV-B reaching the surface and in the total column ozone that exists to filter out UV.

Effects of UV-B on biological systems include:

- an increase in human skin cancers and cataracts
- damage to phytoplankton and reduction in growth of fish, molluscs, and crustaceans
- damage to DNA and photosynthesis in plants
- possible effects on animals including benthic invertebrates and amphibians.

UV Monitoring

Each of the fourteen DISPro sites will be equipped with a Brewer spectrophotometer, an instrument designed to measure different wavelengths of light, and the focus will be on the ultraviolet spectra (UV-B radiation is in the 300-320 nm range of light). These instruments track the sun as they monitor the variation in solar irradiance throughout the day. They also record other data such as total column ozone and ambient concentration of gases. These data are then used to calculate the dose of UV at the surface of the Earth.

¹ National parks and other entities of the National Park Service such as national monuments, national rivers, wild and scenic riverways, national scenic trails, and others are called *units* and collectively constitute the *National Park System*.

² A classification established by the U.S. Congress to implement the prevention of significant deterioration of air quality in specific areas, including national parks larger than 24.3 km² (6000 acres).

Because of the influence of sun angle, clouds, and other forms of air pollution, the seasonal variation in UV-B detected at the surface is large. Therefore, it will take many years of monitoring to detect trends in the incidence of UV-B.

The fourteen NPS units complement a larger Brewer network in the United States that includes eight monitors located in cities. These monitoring devices have also been deployed in Canada and on other continents to allow global assessment of the status of the stratospheric ozone layer.

Partnerships

The two major contributors to this long-term research and monitoring program are the Natural Resource Program Center

of the National Park Service and the Office of Research and Development of EPA. In DISPro sites, the two agencies are cooperating with researchers from other organizations, including the Biological Resources Division of the U.S. Geological Survey, the USDA Forest Service, and universities to conduct the effects research needed to tie atmospheric stressors to ecosystem responses. They are also working with the National Oceanic and Atmospheric Administration and the U.S. Department of Agriculture to develop quality-assurance methods and to compare UV instruments.

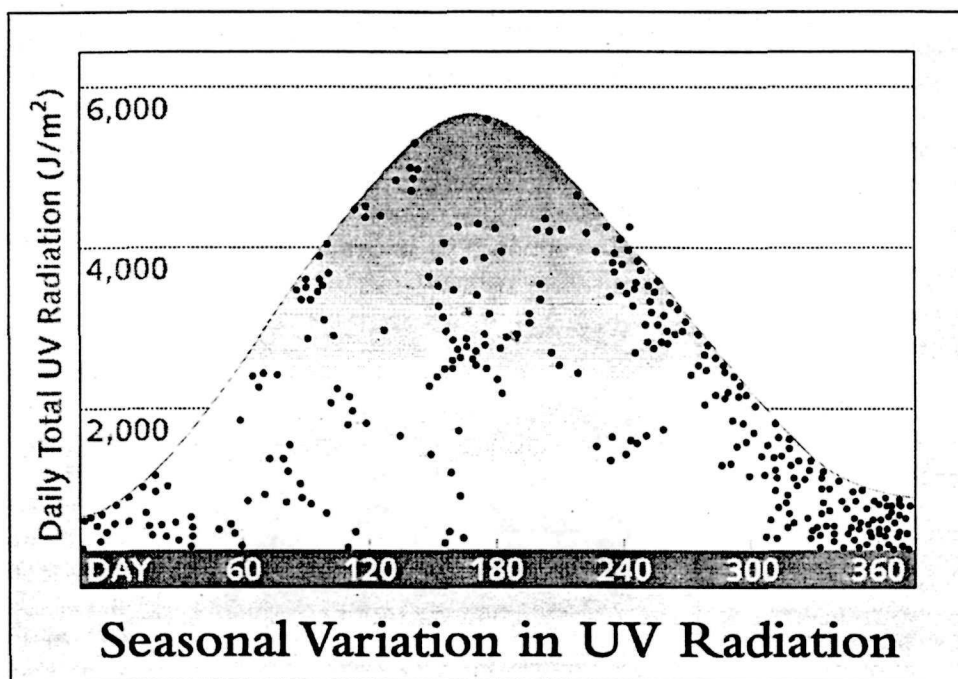
Program Status

By the end of Fiscal Year 1998, all 14 UV-B monitors will be operating in NPS units. This cooperative

monitoring program will be complemented by process-level ecological research on the effects of UV on arid-land terrestrial processes and amphibian populations. A new interagency agreement to maintain the UV-B monitoring, air quality monitoring, and effects research will be in place as of 1 October 1998. The annual DISPro meeting of park staff, researchers, and EPA liaisons will be held in November.

For further information contact:

Dr. Kathy Tonnessen
Air Resources Division
National Park Service
P.O. Box 25287
Denver, Colorado 80225
Telephone: (303) 969-2738
e-mail: kathy_tonnessen@nps.gov



Seasonal variation in UV radiation in Great Smoky Mountains National Park, Tennessee and North Carolina, 1997.