UV Network News

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Welcome! to *UV Network News*, a newsletter for those involved with the UV-monitoring network operated by the U.S. Environmental Protection Agency (EPA) and the National Park Service (NPS). UV Network News is distributed monthly to provide up-to-date information on UV radiation and effects and on measurement efforts at EPA/NPS and other monitoring sites.

About the EPA/NPS UV network:

EPA and NPS operate a network of Brewer spectrophotometers at locations throughout the U.S. Fourteen of the monitoring sites are located in national parks in conjunction with PRIMENet (Park Research and Intensive Monitoring of Ecosystems Network) measurement efforts. An additional seven sites are located in urban areas. Together, these sites comprise the largest spectral-UV network in the world.

The network data are used for a variety of scientific studies including assessments of the effects of UV on frog populations and other ecosystems, verification of the NOAA/EPA UV Index for predicting human exposure levels, and for monitoring changes to the global environment. The data are available to interested parties via the following web sites:

EPA's Ultraviolet Monitoring Program, UV-Net
http://www.epa.gov/uvnet/

The National UV Monitoring Center home page
http://oz.physast.uga.edu/

The National Park Service PRIMENet page
http://www2.nature.nps.gov/ard/prime/index.htm

In this issue...

News for June

UV radiation listed as a carcinogen...The National Toxicology Program of the National Institute of Environmental Health Sciences (NIEHS) has listed solar UV radiation and exposure to sunlamps and sunbeds as a known or reasonably anticipated Human Carcinogen. The Report of Carcinogens (9th edition) is available from the NIEHS at ehis.niehs.nih.gov.

Upcoming Brewer meeting....Sixth WMO/GAW Brewer Users Group Meeting, Tokyo, Japan, July 10-12, 2000. See http://www.srrb.noaa.gov/UV/meetings.html for additional info and notices of other future UV meetings.

Remember, we are always looking for ideas and contributions. Please contact Betsy or Amy and we'll work on getting your information in print. (betsy@srrb.noaa.gov, 303 497-6653; amy@srrb.noaa.gov, 303 497-6417).

UV reaching the surface peaks in early summer

The amount of ultraviolet radiation reaching the earth's northern midlatitudes reaches a peak in late June and early July. The sun is at its northernmost location on the summer solstice, which occurs on June 20, 9:48 p.m. EDT. While the days are longer and the sun's rays more direct, the amount of ozone in stratosphere is typically decreasing at this time due to natural variablity. The combination of the more direct sunlight and lower ozone makes June and July particularly crucial months in terms of UV exposure.

Figure 1 illustrates the seasonal cycle of ozone over Theodore Roosevelt National Park in North Dakota. The data were taken by NASA's Total Ozone Mapping Spectrometer (TOMS) and show that ozone values begin to decrease naturally in the late springtime and early summer. Because ozone is a powerful absorber of UV radiation, the maximum UV amounts do not occur right at the solstice, but instead are shifted by one or two weeks. Figure 2 shows the seasonal cycle of UV radiation at the park. Although clouds, pollution, and other factors can cause UV amounts to vary greatly, the peak UV exposure is seen to occur around the end of June or beginning of July.

The peak in radiation levels in June and July comes at a time when many organisms in the biosphere are most vulnerable. Late spring is a prime breeding time for amphibians, the embryos of which can be damaged by UV. Likewise, plants and trees are often still budding or opening new leaves at this time. The young leaves and shoots on plants can be more sensitive than older shoots to UV exposure. Human skin is also more sensitive in youth, with infants and children at particular risk from exposure to UV. Older skin has been found to be more senstive to sun exposure in the early summer than later in the season when protective pigments help shield cells from UV.

For further information:
The National Aeronautics and Space Administration TOMS Ozone page, http://toms.gsfc.nasa.gov/

The National Park Service's PRIMENet program, http://www2.nature.nps.gov/ard/prime/index.htm

The World Ozone and Ultraviolet Radiation Data Centre, http://www.tor.ec.gc.ca/woudc/

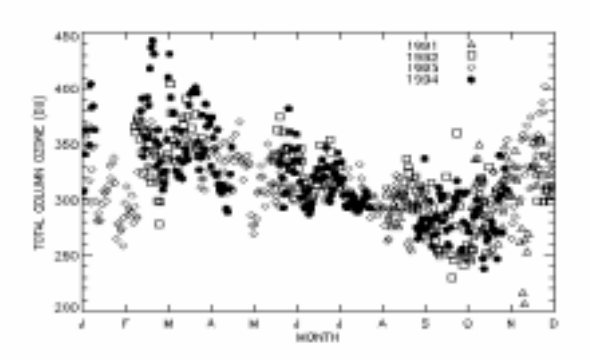

Figure 1. Seasonal cycle of total column ozone (1991-1994) over Theodore Roosevelt National Park from the Total Ozone Mapping Spectrometer (TOMS), provided by NASA.

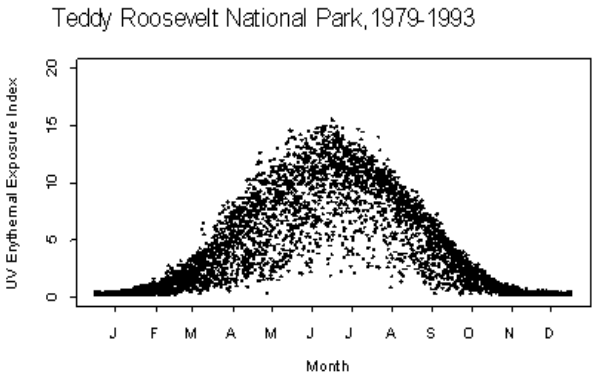

Figure 2. Seasonal cycle of UV radation at Theodore Roosevelt National Park in North Dakota. Data from the Total Ozone Mapping Spectrometer (TOMS), provided by NASA.

Measuring Your Personal Dose of UV

UV radiation can be measured very simply using hand-held meters that are currently manufactured by several companies. Personal UV meters are easy to use. Simply point the sensing portion of the meter toward the sun and read the highest digital number on the screen. The meter must be held correctly to body position to receive appropriate readings.

UV dose measurements, along with the UV Index available from the National Weather Service, allow you to assess your personal sun exposure. Guidelines for keeping yourself and your family sun-safe are available from http://www.epa.gov/sunwise. Remember, though, that every person is different, and a variety of factors, including age, skin type, and medication, can dramatically affect an individual's sun sensitivity.

Most of the meters are calibrated to provide accurate measurements, but over time the values may drift. These difficulties, as well as a number of other issues including spectral and angular responsivity, make the meters generally unsuitable for scientific purposes. The meters do, however, allow individuals to learn a lot about UV through some simple experiments of their own. Some questions to answer using a personal meter include:

- Are certain fabrics better than others at blocking UV?
- Are wet fabrics more transparent to UV?
- How much UV do your sunglasses block?
- Can UV penetrate window glass?

There are several types of products available to alert people to dangerous levels of UV exposure. Some of the products and the companies that manufacture them are described below.

UV Intensity card by Matcor Global Products Inc., http://www.matcor.ca/, (800) 260-5325.
Wallet-sized UV cards that respond to ultraviolet radiation.

UV Monitors by Orbital Sciences Corporation, Tempe, AZ, (602) 814-6800.
Watch-like devices that can be clipped on or worn around the neck. Shows the UV Index and calculates cumulative UV exposure.

UV Meter by SUNSOR, INC., http://ourworld.compuserve.com/homepages/sunsor/, (800) 492-9815.
UV meters that measure the sun's intensity on a scale (0 to 120) that compares to one of five skin-type Exposure Guide cards. These meters have long been used by schools and museums to educate the public about UV.

SafeSun precision UV meter by Optix Tech Inc., http://www.safesun.com/, (888) 327-6641.
Several meters showing UV Index readings and the UV dose for the time of day. Useful for determining maximum sun exposure time.

UV Meters by SolarTech Enterprises, LLC., http://www.solarmeter.com/, (800) 798-3311.
Several models of digital UV meters as well as wallet-sized cards to obtain real-time estimates of the UV Index.

Using the Brewer spectrophotometer to measure UV

The Environmental Protection Agency and the National Park Service operate Brewer spectrophotometers at 21 sites throughout the United States. The instruments measure incoming solar radiaton by scanning the 290-363 nm spectral range in 0.5-nm increments. The Brewer operates at ground-level and is fully automated to provide near-simultaneous observations of UV spectra. The results can be used to estimate total column ozone, sulfur dioxide, and nitrogen dioxide.

Brewer instruments have been in operation since the early 1980s and have been used to study changes in the amount of UV reaching the surface. Determining trends in UV has not been an easy venture. Attempts to analyze ground-based data for trends have faced problems with record length, calibrations, and quality control. As shown in the figure below, satellite instruments suffer similar challenges related to data soundness. The figure shows that the many of the TOMS estimates fall in a range 12-27 percent higher than collocated ground-based observations.

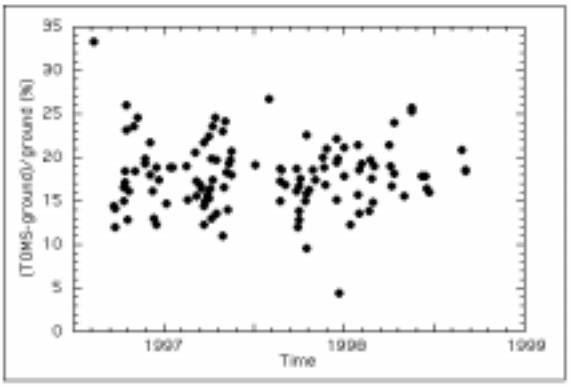

Figure. Percent differences between erythemally weighted UVB flux at the surface as estimated by the Total Ozone Mapping Spectrometer (TOMS) and ground-based measurements at Goodwin Creek, Mississippi, for totally clear-sky periods. The measured UVB flux is averaged over one-hour periods centered on the satellite overpass time.

The TOMS data record establishes a nice climatology of monthly erythemal UV values for 1978-1993. However, measurements of the day-to-day variations in UV require the temporal coverage provided by ground-based instruments. As an example, Figure 2 on page 2 shows the seasonal cycle of the UV Index at Theodore Roosevelt National Park as obtained from TOMS. The plot represents 15 years of daily averaged data; the spread of the data points illustrates the magnitude of the day-to-day and year-to-year variations of UV.

These variations can be better understood through use of the ground-based Brewer data. Work is currently in progress comparing the PRIMENet Brewer data with TOMS UV estimates and using the Brewer data to derive a climatology of UV levels at the various measurement sites. Understanding the UV levels reaching the surface is an important piece of the puzzle concerning the effects of stratospheric ozone depletion. Consistency in these measurements and their calibrations will help determine whether, and to what extent, the stratospheric ozone layer will recover in the next decades.

For more information:

Brewer instruments: http://www.sci-tec.com/product/ozone/brewer.htm.

The Brewer network: http://www.epa.gov/uvnet/.

NASA TOMS page: http://toms.gsfc.nasa.gov.

UV Network News is a monthly newsletter for persons involved in UV monitoring and research. The newsletter is produced by the Cooperative Institute for Research in Environmental Sciences at the University of Colorado and the Surface Radiation Research Branch of NOAA's Air Resouces Laboratory. Support is provided by the National Park Service and PRIMENet. Editor: Amy Stevermer, amy@srrb.noaa.gov; Supervising Editor: Betsy Weatherhead, betsy@srrb.noaa.gov.

- Any comments or contributions are welcome. -