UV Network News

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This and past issues available online at http://www.srrb.noaa.gov/UV/

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W*elcome!* to *UV Network News*, a newsletter for those involved with the UV-monitoring network operated by the U.S. Environmental Protection Agency (EPA), the University of Georgia's (UGA) National UV Monitoring Center (NUVMC), 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/UGA and other monitoring sites.

About the EPA/UGA UV network:

EPA, UGA, 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…

PRIMENet Meeting Reminder

4th Annual PRIMENet Meeting,
Shenandoah National Park,
November 7-9, 2000.
Additional info available from Kathy Tonnessen (406) 243-4449.

More upcoming meeting info: http://www.srrb.noaa.gov/UV/.

How Altitude Affects UV

The amount of UV varies with altitude — essentially, the higher you go, the higher the UV levels. Why? UV is scattered by clouds, water vapor, and air molecules in our atmosphere, and quite simply, there is more atmosphere down low. More air molecules present mean more scattering of UV radiation. Hence, at lower altitudes where the air is thicker, UV is scattered significantly.

Radiation that has been scattered out of the direct beam is referred to as diffuse radiation. Diffuse visible radiation is what makes the sky appear blue. The following diagram shows UV radiation being scattered out of the direct beam. Notice that the diffuse radiation is scattered in

all directions. This scattering greatly affects the exposure of persons, plants, and animals on the ground and means that trees and other canopies can not provide complete shielding from diffuse UV.

Researchers have studied the shaded versus unshaded exposure for various canopies to determine their effectiveness at shielding UV. These canopies can include crop types (e.g. Grant 1991) or canopies designed to shelter humans, such as a beach umbrella or a veranda (Moise and Aynsley 1999).

The limits on effectiveness at blocking UV stem from the transmission qualities of the shading material as well as from the amount of overhang available to screen out diffuse UV. A beach umbrella, for example, offers very little protection from harmful UV rays.

Other scientists have examined UV levels in the shade of a tree and find greater exposure levels than would be expected based on visual cues (Gao et al. 2000). That is, while the amount of visual radiation may be greatly reduced by the tree canopy, UV—and particularly UVB—levels can remain much higher than expected. The results show that UV in the shade is 40 to 60% of the UV on a sunlit surface in the open. Directly under the crown of the tree, the UV is less than 30% of the amount on a sunlit surface in the open, but is still not zero.

At higher altitudes, there are fewer molecules to scatter UV. The direct beam is therefore stronger but the diffuse UV is much less. At higher altitudes then, plants and animals (and people!) taking cover under a tree or other canopy may be able to screen out a larger portion of the total UV dose than they could at sea level. This total (direct + diffuse) UV dose has important implications for all life, including ecosystems and people, on the ground.

References:

Gao, W., et al. UV waveband solar irradiance in different vegetation canopies: measurements and modeling, UV Impacts Workshop, 2000.

Grant, R.H. Ultraviolet and photosynthetically active bands: plane surface irradiance at corn canopy base, Agron J, 83(2):391-396, 1991.

Moise, A.F. and R. Aynsley. Ambient ultraviolet radiation levels in public shade settings, Int J Biometeorol, 43(3):128-138, 1999.

Improving the EPA/UGA Brewer Network Data

In a follow-up to last month's article on EPA/UGA PRIMENet UV data presented in Japan, this month we include two abstracts by Jeff Sabburg and colleagues at the University of Georgia. Dr. Sabburg's work involves correcting the Brewer UV and total ozone observations to improve the overall accuracy and usefulness of the data. The problems, especially those relating to cosine issues, are difficult and require complex solutions. For additional information, contact Dr. Sabburg at sabburg@hal.physast.uga.edu.

Corrected Ozone and erythemal ultraviolet radiation data from the US EPA/UGA Brewer Network

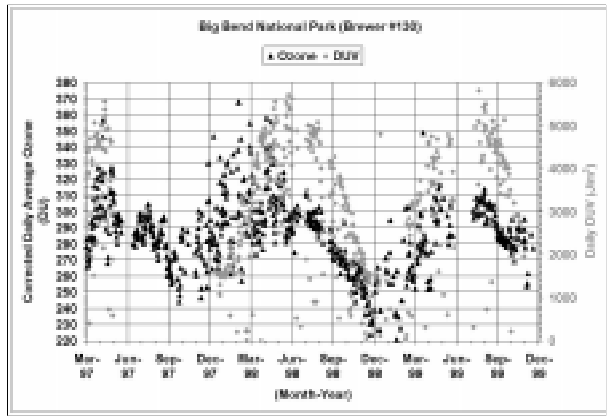
J. SABBURG, R.S. MELTZER, and J. RIVES,
NUVMC, University of Georgia, USA.

This paper discusses an alternative method for correcting total column ozone values when comparison to a traveling standard instrument is not available. The corrections, necessary due to instrument changes, have been determined by monitoring drift and step changes in the R5 and R6 ratios during the operating history of a number of Brewer spectrophotometers (ranging from one to six years' operation).

An inter-comparison with available TOM's ozone data is used as a crosscheck to assess the correction methodology. Abnormal changes in SO_2 levels are also monitored. The ozone corrections are envisaged to improve the absolute accuracy of the ozone values from ± 10 % to ± 3 %.

This corrected ozone data is presented, along with erythemally weighted ultraviolet radiation data, for a selection of the 21 Brewers owned by the U.S. Environmental Protection Agency (USEPA) and operated and maintained by the National UV Monitoring Center (NUVMC).

It is expected that the wider ozone community will use this corrected ozone data set for studies of radiative effects, spatial and temporal trend analyses across the U.S.A.



Corrected daily average ozone data and daily DUV doses for Brewer #130 at Big Bend National Park (29.3ºN, 103.2ºW).

Cosine corrections for ultraviolet radiation data from the US EPA/UGA Brewer Network

J. SABBURG and R.S. MELTZER
NUVMC, University of Georgia, USA.

This paper discusses the cosine corrections that have been determined for 21 Brewer spectrophotometers owned by the U.S. Environmental Protection Agency and operated and maintained by the National UV Monitoring Center (NUVMC). The methodology involves measuring the cosine response of each Brewer in the NUVMC laboratory using a standard 1000 W lamp. The Direct / Global irradiance ratio is used in finding the total cosine correction using a semi-empirical, clear-sky, UV model. An isotropic, diffuse, skylight distribution is assumed. It is found that the absolute error due to the nonideal angular response of UV irradiance of the Brewers in the network ranges from 3 to 24 %. This range applies for an aerosol optical depth equal to one and a total column ozone amount equal to 300 DU. The correction is also dependent on wavelength, solar zenith angle and the cosine response for each Brewer.

UV Resources Available

UV Network News is one of only many forums designed to disseminate information related to UV monitoring and research, particularly at the national parks.

The UV Radiation Resouces page (http://www.srrb.noaa.gov/UV/resources.html) contains archived issues of this newsletter, as well as electronic copies of various UV effects brochures developed for the national parks.   The site also contains a slide presentation offering an overview of UV radiation and the need for monitoring. The presentation has been used to educate audiences from middle school teachers to college faculty about UV research and its importance.

One of our present goals is to develop a one-page summary of UV radiation and sun safety for distribution not only at PRIMENet sites, but at all national parks and monuments. The project involves the collaboration of the World Health Organization (WHO) and the Environmental Protection Agency's SunWise program. The final text will be translated into four languages for dissemination to parks' visitors.

We appreciate your interest in UV radiation and its effects on the planet, and welcome your suggestions for additional materials or topics that may interest you.   Thanks for reading!

See the Sunwise Stampede!

The San Diego State University Foundation has developed a sun safety program targeting zoo visitors, especially children. You can view the stampede at http://www.foundation.sdsu.edu/sunwisestampede.

Changes in season; changes in UV

The end of summer brings autumn to the Northern Hemisphere, and with it, changes in the amount of ultraviolet radiation reaching the surface.

The changing sun angle, combined with fewer hours of daylight, results in lower doses of UV radiation for much of the Northern Hemisphere mid-latitudes. In addition, most ecosystems have reached a point in their life spans where they are least susceptible to damage from UV. Trees are no longer budding, and marine organisms are no longer spawning, to name a couple examples.

In the Southern Hemisphere, however, the picture is quite different. September begins the Southern Hemisphere spring, and with it the now-expected anthropogenic decrease in ozone amounts. This spring the ozone hole is bigger than ever — 28.3 million square kilometers (11 million square miles) — more than three times the size of the entire United States. Because it is spring and time for new growth, organisms in the southern hemisphere are especially sensitive to any increases in UV. Measurements have shown that even under normal ozone levels, UV in the southern hemisphere summer can be greater than that in the northern hemisphere. The difference is due to a higher number of cloud-free days in the Southern Hemisphere coupled with the fact that the southern latitudes experience their summer at the time when the earth is closest to the sun.

For more information on the Antarctic ozone hole and daily updates of global ozone levels, visit the TOMS web page at http://toms.gsfc.nasa.gov.

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- Any comments or contributions are welcome. -