

经验交流

云对太阳紫外辐射的影响

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摘要 云对到达地面的太阳紫外辐射有着重要的影响, 根据在香港综合观测站 1 年的观测资料, 利用相关分析, 得到了计算云天条件下太阳紫外总辐射的一种经验公式, 计算结果比较令人满意。对阴天太阳紫外总辐射的减弱作了简单的分析。

关键词 云, 太阳紫外辐射, 云量。

长期过量的紫外线照射, 可以对地球上的生物及人类产生极大的危害, 如 DNA 的损伤、免疫抑制、红斑病、皮肤癌等。云对到达地面的太阳紫外辐射有着重要的影响, 这种影响随云量、云状、云高、云的类型的不同而不同。

1 研究现状

1.1 观测与研究结果

根据 M. Ityas 4 年的观测, 云天条件下的太阳紫外总辐射, 在云量为 83% 时, 减弱为晴天(无云)条件下相应值的 50%; 云量为 100% 时, 减弱为晴天(无云)条件下相应值的 45%^[1]。M. Blumthaler 的测量结果为, 云量为 10 时的太阳紫外 A 波段辐射为晴天(云量为 0)条件下相应值的 55%—65%^[2]。

太阳紫外 A 波段辐射占太阳总辐射的比值随云量的增加而增大^[2]。

1.2 计算云天条件下太阳紫外总辐射的经验公式^[1]

M. Ityas 利用 10 年对云量, 4 年对太阳紫外总辐射的观测资料, 得到了云量与太阳紫外总辐射($\lambda=295-390\text{nm}$)的经验公式:

$$F_s/F_0 = 1 - 0.056C \quad (1)$$

式中, F_s 为地面紫外总辐射曝辐射量, F_0 为晴天(无云)时地面紫外总辐射曝辐射量, C 为天空云量。(1)式的计算结果表明, 对每年的观测数据来说, 82.4% 的云天资料中, 计算的太阳紫外总辐

射值符合得很好, 一般计算值大于观测值的 7%, 但计算值不能反映出观测值的一些波动, 有时二者还呈现相反的变化趋势。

2 最新进展

2.1 观测概述

为了研究太阳紫外辐射的变化特征, 笔者于 1990 年 1 月 1 日起, 在北京东南 70km 处的香港综合观测站进行了对太阳紫外辐射的正常观测。辐射表头为国产 TBQ-4-1 型, 紫外波段范围为 270—400nm, 记录仪为国产 RYJ-2 型日射记录仪, 整套仪器的日常观测全部是自动的, 且每日都有云量、云状、日照、天气情况等记录。每日观测均按一定观测规范进行, 观测时间为从日出到日落。当太阳辐射照度大于某一数值后, 该仪器可自动记录日照时数, 并自动进行日累计。

2.2 有云情况下太阳紫外总辐射的计算方法

利用 1990 年(12 个月)晴天(云量 $N \leq 2$)和阴天(云量 $N \geq 8$)的资料, 来分析阴天条件下云对到达地面的太阳紫外总辐射的影响。为了避免云量记录受人的主观因素的影响, 采用日照时数(S)而不采用云量(N)来计算云对到达地面太阳紫外总辐射的影响。用相关分析的方法, 得到如下形式的经验公式:

$$\eta = A_1 S + A_0 \quad (2)$$

式中, $\eta = Q_{\text{阴}}/Q_{\text{晴}}$, $Q_{\text{阴}}$ 、 $Q_{\text{晴}}$ 分别为阴天和晴天太阳紫外总辐射曝辐射量的月平均日总量, A_1 、 A_0 均为常数。经 F 检验, η 与 S 在置信度 $\alpha=0.01$ 的水平上高度相关, 其 F 检验值为 $F=31.679$, (2) 式的相关系数为 $R=0.872$, 标准差为 $\sigma=0.029$ 。

利用公式(2)计算了 1990 年 12 个月阴天条件下到达地面的太阳紫外总辐射曝辐射量的月平均日总量, 计算结果见表 1, 表 1 中同时给出计算值与观测值的相对偏差(δ)及比值 η 。

表 1 阴天地面太阳紫外总辐射月平均日总量(MJ/m²)

月份	$Q_{\text{观}}$	$Q_{\text{计}}$	$\delta(\%)$	$\eta(\%)$
1	0.51	0.54	7.15	51.01
2	0.67	0.71	5.75	52.89
3	0.80	0.72	-10.15	59.27
4	0.86	0.82	-4.70	61.65
5	0.88	0.90	3.29	56.76
6	1.02	1.01	-0.71	61.82
7	0.84	0.87	4.35	50.76
8	0.66	0.67	2.28	44.16
9	0.71	0.69	-2.5	49.17
10	0.77	0.76	-1.62	56.76
11	0.48	0.47	-2.01	50.23
12	0.41	0.42	2.16	48.95
$\bar{\delta}$			3.89	
$\bar{\eta}$				53.62

从表 1 可以看出, 计算值与观测值符合得较好, $\bar{\delta}$ 值为 3.89%, 最小相对偏差为 0.71%, 计算精度较(1)式有所提高。从而也说明用日照时数来计算云对太阳紫外总辐射的影响还是比较可靠的。由表 1 还可看到, 比值 η 的变化不是很

大, 其变化范围是 44.16%—61.82%, 12 个月的平均值为 53.62%, 即阴天的太阳紫外总辐射曝辐射量是晴天相应值的 53.62%。因目前对云的观测时间较短, 还不能给出不同类型的云(如高云、中云、低云等)对太阳紫外总辐射有多大影响的结论, 只能给出云(包括高云、中云、低云)对太阳紫外总辐射总的减弱程度。

从表 1 及 M. Ilyas 的观测结果来看, 阴天的太阳紫外总辐射比晴天的太阳紫外总辐射减弱了 1/2, 一般认为水汽对太阳紫外总辐射没有直接吸收, 而云的基本成分是水, 其相态可为气态、液态或固态。阴天条件下, 大气处于较稳定状态, 尽管大气中的气溶胶粒子及人类和自然排放的各种气体(包括污染气体)不易扩散而易于聚集, 但它们对太阳紫外总辐射的散射作用综合起来考虑, 也不会使太阳紫外总辐射减弱 50%, 所以应该另有原因。既然阴天条件下, 大气污染物不易扩散, 那么与晴天相比, 它们在参与光化学反应过程中, 就能吸收掉较多的太阳紫外总辐射。特别是阴天条件下, 水汽含量的增多, 将使大气中 OH 等自由基增多, 因它们对光化学反应的催化作用, 造成阴天条件下吸收的紫外能量较晴天多, 这可能是使得阴天条件下到达地面的太阳紫外总辐射减弱较大的一个主要原因。

参考文献

- 1 Ilyas M. *Atmos. Environ.* 1987, 21(6):1483
- 2 Blumthaler M. et al. *Atmos. Environ.* 1988, 22(4):749

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Abstracts

Chinese Journal of Environmental Science

compounds.

Key words: pollution of indoor air, oxygen consumption, total organic compounds.

Development of a Novel Automatic Water Sampler.

Huang Juwen et al. (School of Environmental Engineering, Tongji University, Shanghai); *Chin. J. Environ. Sci.*, 14(6), 1993, pp. 63—65

For this development, computer technique was applied to the sampling instrument to realize the mankind-machine interaction, and to achieve the goal of intelligentization. Some reliable, lower cost elements for water sampling, memory and convention were used to realize auto-sampling. The control system of this sampling instrument adopted a monistic microprocess. The 8031 chip was used as a microprocessor, coordinated with peripheral interface circuits and function keyboard, to make it compact and low cost. The sampling and storage system consists of a wriggle pump, electromagnet, machanical transfer devices, water sample storage tank and container. This system has a simple structure with a smooth and steady operation and can be operated continuously or intermittently. Sampling time, sampling period and sampling bottle switching can be adjusted arbitrarily to collect water sample accurately, reliably and conveniently.

Key words: computer's technique, control, water sampling.

Determination of Trace Amounts of Se with Oscillopolarography.

Jiang Zhiliang et al. (Department of Chemistry, Guangxi Normal University, Guilin 541004); *Chin. J. Environ. Sci.*, 14(6), 1993, pp. 66—68

In 0.60mol/L acetic acid medium, the complex of Se(IV) and sulfanilic acid exhibits a sensitive and selective oscillopolarographic wave at -0.63 V vs. SCE. This provides a new oscillopolarographic method for the determination of Se in the range of 0.3—80ng/ml. The detection limit is achieved at 0.15ng/ml. Se in real samples was analysed by this method, with satisfactory results.

Key words: Se, sulfanilic acid, oscillopolarography.

Study on the Environmental Impact Caused by the Electromagnetic Radiation of Weihai Broadcasting Station.

Lu Deming et al. (Dept. of Physics, Qingdao University of Oceanography, Qingdao); *Chin. J. Environ. Sci.*, 14(6), 1993, pp. 69—72

The attenuation of the electrical field strength E of an electromagnetic source was investigated theoretically and experimentally. For the 10kW medium wave transmitter, the electrical field E is

less than 25V/m for distances $r > 75$ m near the ground (2m above the ground), which is lower than the "Second Class Standard" stipulated in the State Standard GB9175-88. For distances $r > 150$ m, the field strength near the ground is less than 10V/m, which is lower than the "First Class Standard". However, it is discovered from the measurements that at places such as the platforms on top of high buildings within 200m the field strength can be so strong that it exceeds the State Standard value, and that injures to human bodies can be caused by metal structures poorly earthed due to induction charge and secondary radiation.

Key words: environmental impact assessment, electromagnetic radiation, broadcasting station.

Vector-operator: A New Method for Environmental Quality Assessment and Environmental Management.

Wang Haifeng et al. (Institute of Environmental Science, Beijing Normal University, Beijing 100875); *Chin. J. Environ. Sci.*, 14(6), 1993, pp. 73—76

This paper deals with a systematical analysis on the common methods for environmental quality assessment and a new method suggested for environmental quality assessment, called Vector-Operator. This method, by mainly considering the most important environment elements while not neglecting other environment elements, uses some special arithmoprocess but maximal operator and cluster analysis. It is able to present better the real conditions of the environment. It is of general purpose and of comparability. It can be extended, repaired, modified and modelled. It not only serves effectively for science research but also provides a convenient means for decision-making, management and evaluation.

Key words: environmental assessment, environmental management, Vector-Operator.

Influence of Cloud on Solar Ultraviolet Radiation.

Bai Jianhui (Institute of the Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029); *Chin. J. Environ. Sci.*, 14(6), 1993, pp. 77—78

Cloud has an important effect on the solar ultraviolet radiation reaching the ground. Based on one year data in Xianghe Synthetical Observation station, an empiric epuation for calculating the solar ultraviolet radiation under cloudy sky conditions is obtained by using correlation analysis, and the results of the calculation are satisfactory. A simple analysis for the decrease in the solar ultraviolet radiation under cloudy sky conditions is given.

Key words: cloud, solar ultraviolet radiation, cloud fraction.