



36 007 606

REF
PAES
95-01

Stratospheric Ozone and UV-B Measurements at Saturna Island, B.C.

1994 Annual Report

Science Division
report

Report 95-01, March, 1995

[Internal publication]

Bill Taylor

Science Division, Environment Canada, Vancouver, British Columbia

SUMMARY

The average total column ozone over Saturna Island measured 5.5 percent below the pre-1980 mean in 1994. This compares to the national average of 3.1 percent below pre-1980 values for the same period. These figures represent an improvement over 1993 when the differences were -8.1 percent for Saturna and -7.7 percent for Canada. The UV Index exceeded the pre-1980 mean by a full point on numerous occasions during the summer months and by two full points during spring. Such elevated UV values are consistent with depressed ozone thicknesses which may be attributed to natural causes as well as anthropogenic depletion of the ozone layer.

Measurements of total column ozone and UV-B are taken several times a day using a Brewer Spectrophotometer located at Saturna Island, British Columbia (Figure 1). The Climate Section of the Science Division routinely analyses these data to detect departures from the pre-1980 means for ozone and UV-B.



Figure 1: Map of British Columbia showing location of Saturna Island in the Strait of Georgia.

In 1994, the average total column ozone over Saturna Island measured 5.5 percent below the pre-1980 mean. This compares to the national average of 3.1 percent below pre-1980 values for the same period.¹ These figures represent a slight improvement over 1993 when the differences were 8.1 percent for Saturna and 7.7 percent for Canada.

Scientists at the Experimental Studies Division of Environment Canada in Downsview cautioned in April that the slight improvement in ozone thicknesses occurring then did not indicate a permanent recovery of the ozone layer. They warned that the gradual long-term thinning of the ozone layer, caused by CFCs and other industrial substances, would likely continue into the next century. The temporary improvement in 1994 was due to natural factors including an unusually cold winter in the east and the diminishing effects of debris from the 1991 eruption of Mount Pinatubo.²

Figure 2 is a plot of 1994 daily ozone thickness values (Dobson Units) compared to the pre-1980 mean, as well as the 1993 ozone values from Saturna Island. A 14-day moving average has been applied to these daily values in order to filter out the natural, day-to-day variability in the thickness of the ozone layer. Figure 3 depicts the difference between monthly total column ozone and the pre-1980 monthly means. The gaps in the graphs for the months of February, March and December in both figures are due to missing data during those months.

Figures 2 and 3 show that the largest negative departure from pre-1980

LIBRARY
ENVIRONMENT CANADA
PACIFIC REGION

values occurred in April while the greatest positive anomaly occurred in November. Monthly averages for late summer and early fall including August, September and October were very close to the pre-1980 base-line.

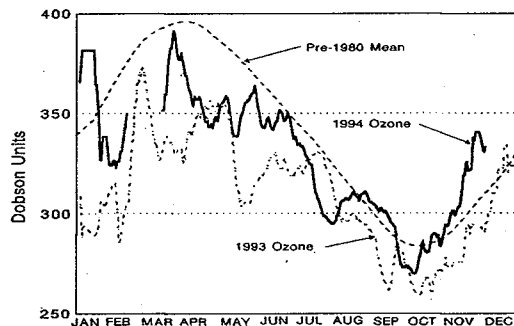


Figure 2: Thickness of the total column ozone over Saturna Island, B.C. Thickness values are 14-day centered averages.

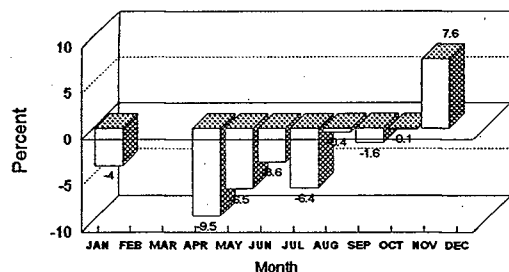


Figure 3: Monthly departures from the pre-1980 mean total column ozone at Saturna Island, B.C.

The negative departure for July of 6.4 percent is noteworthy since this is a time of year when UV intensities are naturally high. Thinner ozone means more UV reaching the ground than usual.

The daily UV Index™ at Saturna for 1994 is shown in relation to pre-1980 levels in Figure 4. Higher than normal UV intensities may be due to the natural variation in the thickness of the ozone layer or the effects of ozone depletion as well as other factors such as reflection off bright clouds. Climatologically, the UV intensity is highest in the months of June and July, typically reaching peak values of 7.0. In 1994, southern British Columbia experienced clear sky UV levels lying

generally between 7.0 and 8.0 during that period. The highest peaks relative to normal occurred in May when the UV Index exceeded the normal value of 5.5 by as much as 2 full points.

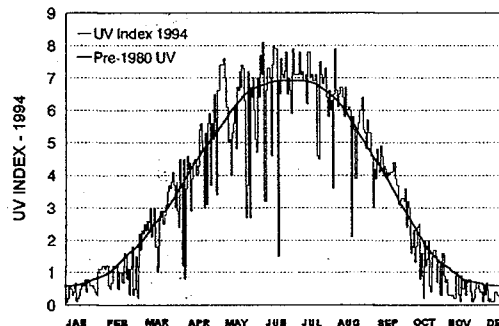


Figure 4: Daily UV Index values for 1994 at Saturna Island, B.C.

Environment Canada has been monitoring total column ozone from its site on Saturna Island since 1991 using a Brewer Spectrophotometer. The pre-1980 ozone baseline was estimated from the data from the Total Ozone Mapping Spectrometer (TOMS) aboard the Nimbus 7 Satellite calibrated against ground based measurements from other sites. The pre-1980 mean UV climatology was computed empirically from mean ozone values and sun zenith angle.³

Acknowledgment. The author is thankful for the review of this manuscript by Tom Medlicott of Environment Canada, Prairie and Northern Region.

REFERENCES

1. Environment Canada, Ozone Watch, *Ozone 1994*, Canadian Meteorological Centre, January, 1995.
2. Environment Canada, Press release: *Ozone thinning over Canada in January and February 1994*, April, 1994.
3. Burroughs W.R., Vallee M., Wilson, L.: 1992, *Climatology of Daily Total Ozone and Ultraviolet-B Radiation Levels*, Environment Canada, Research Report No. (MSRB) 92-005.

The UV Index is a Registered Trademark of Environment Canada.