Comparison of Narrow-Band and High-Resolution UV Radiometers at Barrow, Alaska

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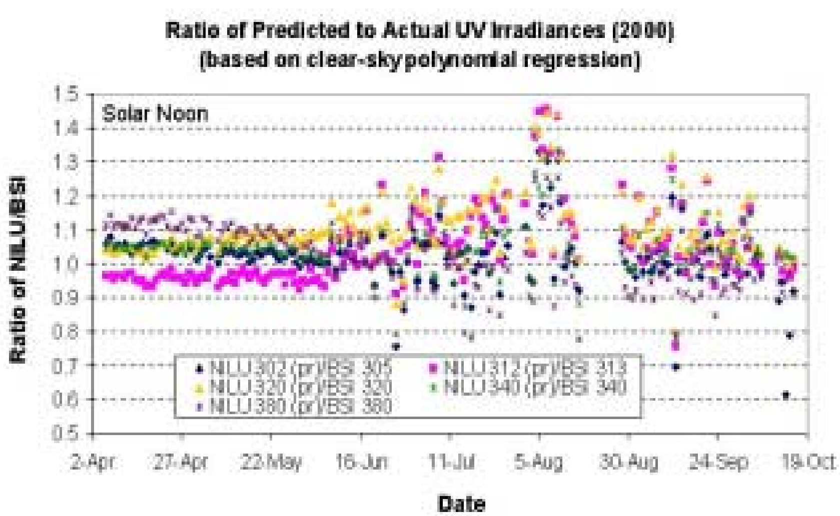
The observed losses in ozone in the Arctic have been accompanied by increased ultraviolet (UV) radiation in the spring, a time when biological systems are most sensitive to the harmful effects of UV. Current predictions for future Arctic ozone levels indicate continued depletion for at least 10 years and a very slow and possibly incomplete recovery. Because of past and possible future reductions in stratospheric ozone levels, the Arctic is an important area to investigate variations in the distribution of UV and potential effects on human health as well as on terrestrial and aquatic ecosystems. To increase the geographic coverage of monitoring UV in the Arctic, the use of narrow bandwidth radiometers has been utilized. These radiometers are useful for applications that require better resolution than offered by broadband instruments but do not require the full capabilities of a spectroradiometer. Such instruments provide reliable data on biologically effective UV dose rates, total ozone abundance, and effective cloud optical depth or cloud transmission, similar to the high-resolution spectroradiometer but at a fraction of its cost. The NOAA UV monitoring program at Barrow (71ºN, 157ºW) has utilized two different narrow bandwidth radiometers, one manufactured by Biospherical Instruments, Inc. (BSI) and the other by the Norwegian Institute for Air Research (NILU). To demonstrate the efficacy of these narrow bandwidth radiometers, which were operating side-by-side at the NOAA Barrow Observatory during the period March 25-October 17, 2000, an intercomparison was conducted with a BSI high-resolution scanning spectroradiometer located about 8 km from the observatory. The high-resolution spectroradiometer is part of the NSF Polar Programs UV Spectroradiometer Network. The BSI ground-based UV (GUV) and NILU-UV radiometers have similar spectral responses at five wavelengths in the UV spectrum with a bandwidth of about 10 nm full-width half-maximum (FWHM). Both instruments are portable, have no moving parts, and are temperature stabilized at 40ºC. However, results show that the NILU-UV radiometer overestimates the surface irradiance at all five wavelengths compared with the BSI GUV. Data from the BSI GUV shows fair agreement with the BSI spectroradiometer with ratios ranging from 0.7 to 1.5. Data from the NILU-UV radiometer is twice as high as those from the BSI GUV at the 305 and 313 nm wavelengths and by as much as ten times higher at the 340 and 380 nm wavelengths. A description of the instruments is provided as well as an overview of the calibration procedures. All comparisons are made using manufacturer-based calibrations.



The ratio of the predicted [NILU(pr)] to actual (BSI) UV irradiances based on a polynomial regression of the two radiometers, which were operating side by side at the CMDL Barrow Observatory during April 6-October 16, 2000. A regression analysis was conducted for each of the five wavelengths using a clear-sky day (June 15, 2000), and the regression equations were then applied to the solar noon values of the NILU radiometer for the entire period.