

Спектрофотометр Brewer MkIII

Технические характеристики

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Introduction

A major concern in many parts of the world is the amount of harmful ultraviolet radiation from the sun and sky that people are exposed to. 'Holes in the Ozone layer' are areas of stratospheric Ozone depletion and are not confined to the North and South Poles. They are indicators of the general health of the atmosphere, and a reduction in Ozone means that more harmful UV reaches the ground.

To accurately measure stratospheric Ozone, and solar UV radiation, requires a sophisticated instrument. The Brewer is unique, designed by Environment Canada specifically for operating automatically with high accuracy over long periods of time, in all climates and environments from the tropics to Antarctica. There have been several versions of the instrument over the years, but the only model now in production is the MkIII Brewer because of its superior Ozone and UV measurement capability.

Applications

The Brewer was originally designed for the measurement of Ozone as part of the WMO Global Atmosphere Watch (GAW) programme. There is a network of instruments around the world, from deserts to the Antarctic, providing information to the World Ozone and UV Data Centre (WOUDC). The Kipp & Zonen Brewer MkIII is the only instrument in current production sanctioned by the World Meteorological Organisation (WMO) for making total column Ozone measurements.

Many Brewers are now purchased for research into the effects of Ultraviolet (UV) radiation from the sun and sky. The UV region covers the wavelength ranges 100-280 nm (UVC), 280-315 nm (UVB) and 315-400 nm (UVA). Almost all UVC, and approximately 90% of UVB, from the sun is absorbed by the Earth's atmosphere. UVA radiation at the Earth's surface is normally 15 to 20 times greater than UVB.

UV radiation has been linked to skin cancer, skin ageing, cataracts, and immune system suppression in humans and animals. In plants, enhanced UV radiation exposure has led to crop damage and reduced yields. Exposure to UV radiation can also accelerate the deterioration of materials and finishes, such as paints.

Although the necessity for UV monitoring is clear, the nature of the radiation and our sensitivity to it poses data collection challenges. This is particularly true with damaging ultraviolet (DUV) studies. Unless the spectrum of the sun and sky UV radiation and the concentration of Ozone are accurately measured it is difficult to relate UV intensities to biological responses such as UVE, the Erythema (skin) response, and the UV Index.

The Brewer MkIII provides researchers with the means to help understand solar UV radiation and its current and future impact on the biosphere and is an ideal reference instrument for networks of broadband (non-spectral) UV radiometers of lower performance.

Brewer MkIII Features

Brewers have a unique design of spectrometer that is self-compensating for the expansion and contraction of components caused by changes in temperature. This means that it can be used around the world outdoors without the need for complex temperature stabilisation. There are built-in wavelength and sensitivity check lamps.

The MkIII 'double' Brewer uses two of these spectrometers in series for improved ultraviolet measurement accuracy, due to much better stray light rejection. This gives the MkIII a significant advantage over the single spectrometer Mk II and Mk IV Brewers, which are no longer manufactured.

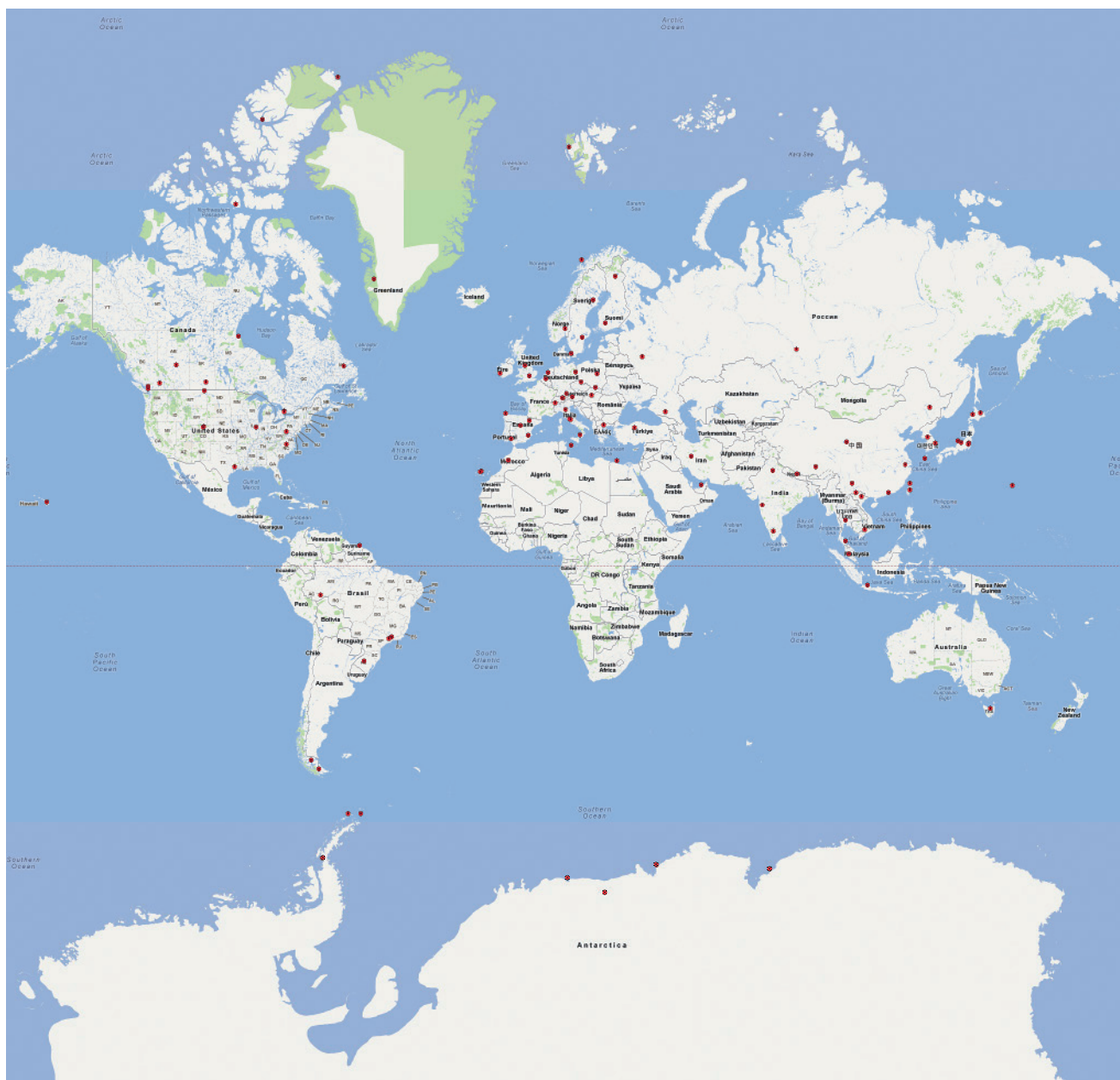
The Brewer is mounted on a dedicated azimuth tracker with a heavy duty tripod stand and makes measurements of the direct solar radiation at specific wavelengths to determine the total column Ozone and Sulphur Dioxide in the atmosphere. It also has the capability to make high resolution UV spectral scans of both the direct and global solar radiation.

The software can accurately calculate UVA, UVB, UVE (Erythema) irradiances and UVI (Index). The Brewer must be connected to a PC running the operating software in order to make measurements and store data. The PC is normally provided locally and not included with the instrument.



An internal fan, heater and humidity sensor are fitted as standard.

The spectrophotometer is supplied in a foam-lined aluminium transit case, for protection when transporting the instrument. The azimuth tracker is shipped in a substantial wooden crate.



Brewers Around the World

There are over 210 Brewers, in more than 40 countries around the World, from the tropics to the Arctic and Antarctic, most of these are shown on the map above. About 80 Brewer stations report Ozone and UV measurements to the World Ozone & Ultraviolet Data Centre (WOUDC).

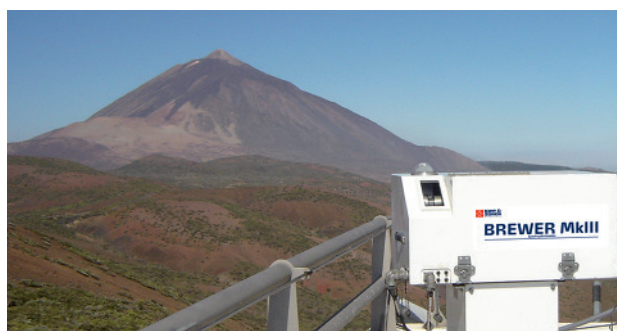
Brewer Accessories

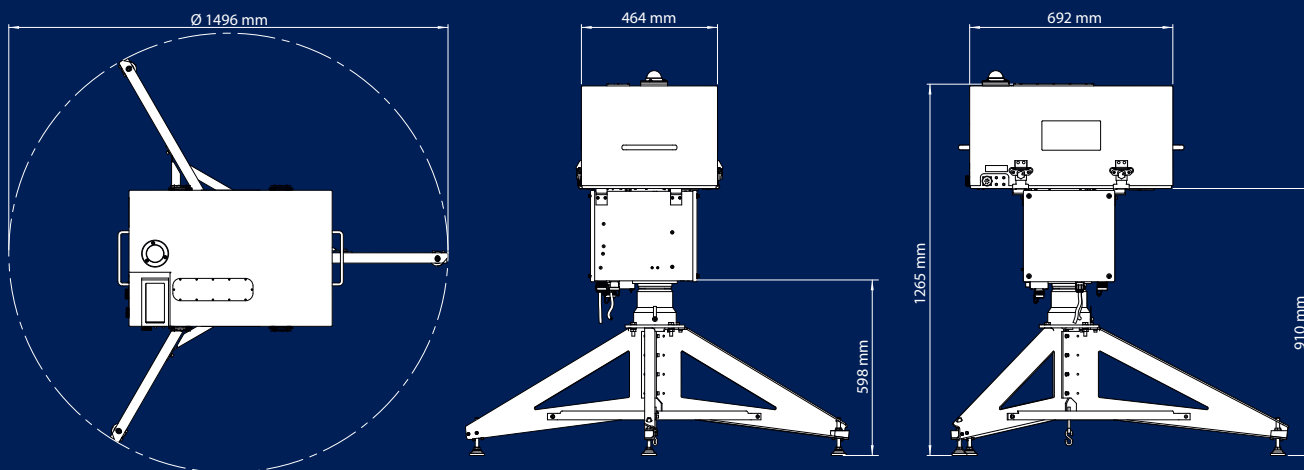
The UV-B stability kit with external Tungsten Halogen lamps is recommended for regular checks of the UV sensitivity (not required for Ozone and Sulphur Dioxide measurements).

An insulated Cold Cover extends operation from -20 °C down to -50 °C. It is required for arctic and polar conditions and locations regularly below 0 °C and/or with high wind-chill factors.

Brewer Support

The Brewer MkIII is manufactured exclusively by Kipp & Zonen, under licence of Environment Canada. Kipp & Zonen provides a full range of calibration, spares, repairs and support services for all models of Brewer.





Specifications

Measurement principle	Unique self-compensating dual Ebert spectrometers, focal length 16 cm, focal ratio f/6, first order holographic diffraction gratings with 3600 lines/mm
Detector	Low noise UV-enhanced photo-multiplier tube (PMT)
Sun tracking	Motor controlled prism in fore-optics for zenith tracking, azimuth tracker includes heavy duty tripod stand
Sun tracking resolution	Zenith 0.12 ° per step, azimuth 0.025 ° per step
Supply voltage and current	115 VAC, 50/60 Hz, 3A or 230 VAC, 50/60, 1.5A
Operating temperature range	-20 °C to +50 °C -50 °C to +50 °C with optional insulated cold cover
Wavelength range	286.5 nm to 363 nm
Wavelength resolution	0.6 nm
Wavelength stability	± 0.01 nm (over operating temperature range)
Wavelength precision	0.006 nm (± 0.002 nm) per step
Internal light sources	Tungsten-Halogen lamp for optical stability, germicidal Mercury lamp for wavelength calibration (302.5 nm)
Ozone and SO ₂ measurement wavelengths	303.2, 306.3, 310.1, 313.5, 316.8 and 320.1 nm; direct sun view through UV-quality quartz window; measurement cycle time 1.6 seconds
Column Ozone measurement accuracy	< 1 %
UV measurement	Direct sun or global radiation, UVA, UVB, UVE and UVI; global radiation view through UV-quality Quartz dome and PTFE diffuser
Communication	RS 422 serial, supplied with isolated RS-422 to RS-232 converter for connection to a PC running the operating software (PC not included)
Operating software	GW-BASIC for operation of Brewer and data storage, supplied on CD-ROM
Note: The performance specifications quoted are worst-case and/or maximum values	



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