

Determination of Dobson Spectral Characteristics, a New Method

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The Dobson instrument has been used for the determination of total ozone column (TOC) since the mid-1920s. A complete description of the instrument operation, principles of measurement, and use is available elsewhere; briefly, the instrument measures the difference between the intensity of selected wavelength pairs in the 300-340 nm spectral range. The ESRL Global Monitoring Division (GMD) operates 16 of these instruments throughout the world, and serves as the Central Calibration Laboratory for measurements with this instrument. The record of TOC starts in the early part of the 1900s, and the part of the record prior to 1979 is almost exclusively from measurements with the Dobson instrument. As newer measurement techniques are developed to measure TOC, the relationship with the existing record must be established. As the requirements for accuracy increase, a better understanding of the instrument characteristics is needed. In the past, only one Dobson instrument (D083, the World Primary Standard held at ESRL GMD) has had the slit functions measured. This is a time-consuming process that required the instrument be taken to a special facility specializing in this characterization. All other instruments have then been optically aligned mechanically to resemble that reference instrument. The data processing algorithms were developed based on the characteristics of the reference instrument, and consistently applied to the world network. There are differences in the TOC results of the individual Dobson instruments and stations, especially when compared to other measurement systems, ground-based and satellite-borne. To understand these differences, a method is being developed for quick characterization of the individual Dobson instruments while at the instrument's normal operational site. NASA provided several Avantes AvaSpec-2048x14 Fiber Optic Spectrometers (specifications are compatible with the Dobson instrument spectral characteristics) to ESRL for investigation. We present the first results of measurements inside the photomultiplier box of several Dobson instruments, and a method for determining the slit functions. In addition, investigation of other optical and spectral characteristics of Dobson, such as internal stray light levels, is ongoing.

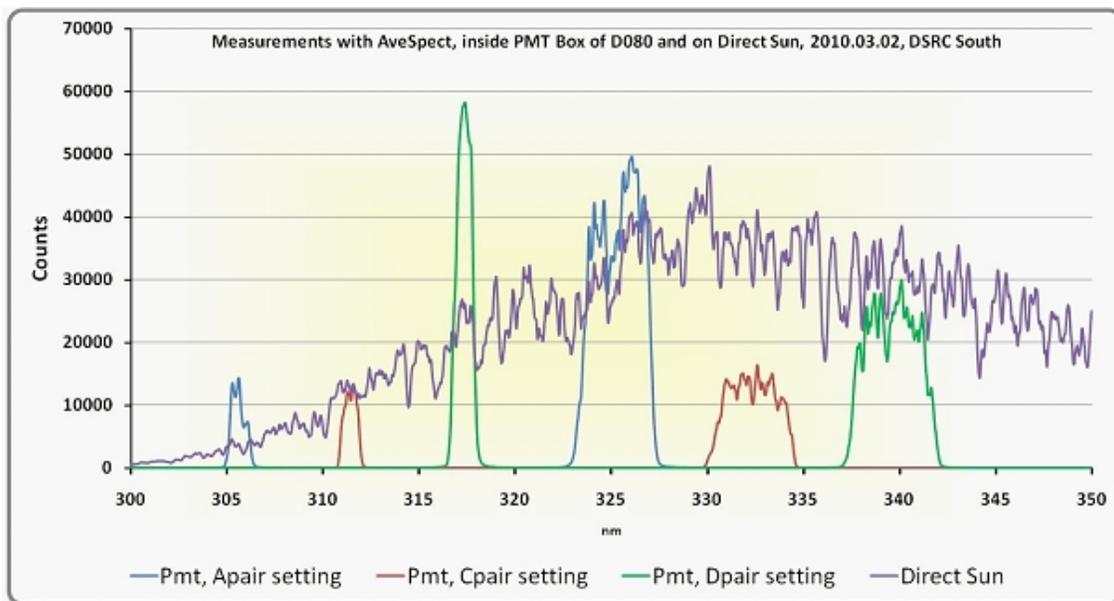


Figure 1. Unprocessed measurements on the direct sun and inside Dobson D080.