



Instrumental Stray Light and Brewer and Dobson Total Ozone Measurements

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Abstract. Dobson and Brewer spectrophotometers are the primary, standard instruments for ground-based ozone measurements under the World Meteorological Organization's (WMO) Global Atmosphere Watch (GAW) program. The accuracy of the data retrieval for both instruments depends on a knowledge of the ozone absorption coefficients and some assumptions underlying the data analysis. Instrumental stray light causes non-linearity – a decrease – in the response of both the Brewer and Dobson to ozone at large ozone slant paths. In addition, it affects the effective ozone absorption coefficients and extraterrestrial constants that are both instrument dependent. This effect has not been taken into account in the calculation of the ozone absorption coefficients that are currently recommended by WMO for the Dobson network. The ozone absorption coefficients are calculated for each Brewer instrument individually, but, in the current procedure, the effect of stray light is not being considered. This study documents the error caused by the effect of stray light in the Brewer and Dobson total ozone measurements using a mathematical model for each instrument. For the first time, new ozone absorption coefficients are calculated for the Brewer and Dobson instruments taking into account the stray light effect. The analyses show that the differences detected between the total ozone amounts deduced from Dobson AD and CD pair wavelengths are related to the level of stray light within the instrument. The ozone data collected by three Dobson instruments between 2008 and 2012 for the first time are compared with ozone data from a collocated double monochromator Brewer spectrophotometer (Mark III). The results show the dependence of Dobson AD and CD pair measurements on stray light.