**Towards a Better Knowledge of Umkehr Measurements: A Detailed Study of Data from Ten Dobson Intercomparisons**

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The spectrally different changes in zenith sky ultraviolet (UV) radiation as the sun rises and sets is controlled by the ozone vertical distribution; this change is called the Umkehr effect. Measurements of the Umkehr effect are made routinely using Dobson ozone spectrophotometers at several stations. There is a well-defined scheme for the calibration of Dobsons using direct sun measurements for determining total ozone. The World standard Dobson (D083) is calibrated at the CMDL Mauna Loa Observatory using the Langley Plot Method. This instrument is then used to calibrate a traveling standard (D065) and regional standard Dobsons, such as the European regional standard (D064) at Hohenpeißenberg, Germany. Besides direct sun observations, the Dobson instrument can make zenith sky measurements for total ozone and the aforementioned Umkehr measurements. While Umkehr measurements are not the primary goal of Dobson intercomparisons, Dobson instruments took simultaneous Umkehr measurements at ten international campaigns (Arosa, Switzerland, 1990, 1999, and 2003; Izaña, Spain, 1994; Stiga Ski Field, Greece, 1997; Perth, Australia, 1997; Buenos Aires, Argentina, 1999 and 2003; Lauder, New Zealand, 2001; Dahab, Egypt, 2004). Although the procedures for making the Umkehr measurements and for reducing these measurements to profiles are defined, there is no published reference or procedure for amendment of current Dobson calibrations to produce "correct" Umkehr curves/ozone profiles. We will discuss results of the intercomparisons, uncertainties in Umkehr measurements, and the impact of the measurement errors on the retrieved ozone profiles. We will compare retrieved ozone profiles using operational [Mateer and DeLuisi, *J. Atmos. Ter. Phys., 54*, 537-556, 1992], European Commission funded project REconstraction of Vertical ozone distribution from Umkehr Estimates (REVUE) [Bojkov et al., *Meteorol. Atmos. Phys., 79*, 127-158, 2002] and newly updated algorithms against independent sets of measurements of ozone vertical profiles (ozonesonde, satellite, and ozone lidar).

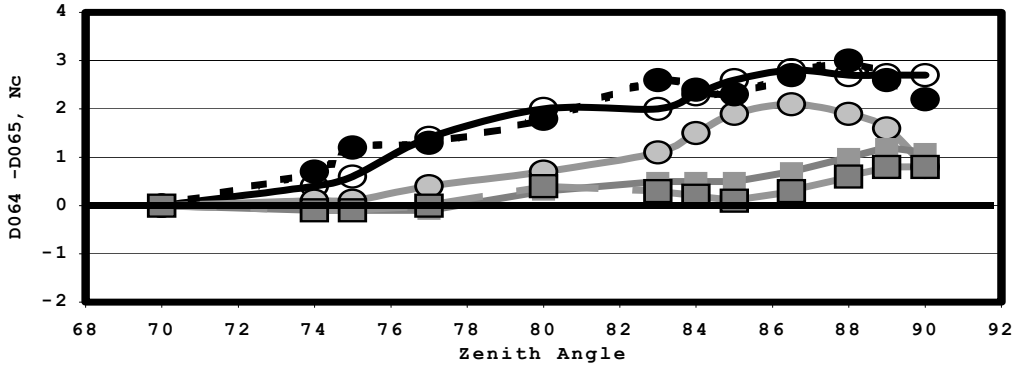


Figure 1. The comparisons between two well-calibrated and well-maintained instruments (D065) and (D064) was performed at four international campaigns: Arosa in 1990 (open circles) and 1999 (grey circles); Izaña in 1994 (dark circles) , and Dahab in 2004 (squares, where grey square represent D064 measurements before wedge calibration). The total ozone measured at the time of comparisons was 319, 281, 298, and 230 Dobson Units (DU), respectively.