Total Column Ozone: A More Representative "Best Representative Daily Value"

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Long-term ground-based datasets of total column ozone (TCO) and their subsequent analyses of ozone recovery are predicated on the basis of a best representative value for each day's measurements. For Brewer spectrophotometers this is defined by the World Ozone Data Centre as selecting the mean of a day's valid direct sun (DS) measurements, and if none are available, the mean of a day's valid zenith sky (ZS) measurements. For mid- and high-latitudes where cloudy skies are prevalent this binary choice can often lead to the daily average value being based on a small number of DS measurements, whilst many more valid ZS measurements are rejected. Further the small number of contributing DS measurements is unlikely to be spread evenly through the day, and hence may not be the most representative of the underlying daily mean. Against this must be balanced the fact that TCO values derived from DS measurements are directly calibrated at regular intervals, whilst zenith sky measurements are dependent on a further polynomial fitting step.

Here we describe a methodology to address this issue and combine both DS and ZS measurements into a single "Best Representative Daily Value". The method takes into account periods of time when valid measurements are more frequent and the relative uncertainty of each measurement. It is applied to circa. 15 year long ozone records in the United Kingdom where we assess the re-evaluated datasets in terms of their wider daily time sampling, the mean observation time and number of contributing observations. The re-evaluated time series are compared with the original data series and satellite overpass data, whilst the impact of this methodology on both apparent ozone recovery and frequency of low ozone events is investigated.