The Intercomparison of Brewer and Dobson Spectrophotometers Total Ozone Measurements at the Marambio Base, Antarctica

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Study Site
The Marambio Base is located at the Seymour Island, Graham Land, Antarctic Peninsula Region (64.241°S, 56.624°W, Fig. 1). It is a permanent Argentine research station that was founded in 1969. At the Marambio Base, various scientific activities are carried on, including stratospheric ozone monitoring and atmosphere radio-sounding.

Data and Methods
The data were collected by two collated high-quality total ozone monitoring instruments:

- **Brewer spectrophotometer MkIII B199**
  This instrument was installed in 2010 and it is operated by the Czech Hydrometeorological Institute.

- **Dobson spectrophotometer D099**
  The Dobson spectrophotometer was installed in 1987 and it is operated by the National Meteorological Service of Argentina.

Due to the solar zenith angle, both instruments can only make observations since mid-August to the end of April. For the intercomparison, daily mean total ozone was used. Between January 2011 and December 2013, there were in total 577 days for which there existed valid data. For each day, a Brewer/Dobson ratio was calculated (BRE/DOB).

Both instruments allow making Direct Sun (DS) and Zenith Sky (ZS) observations, which were, together with daily mean total ozone column, number of observations and their standard deviation, taken in account when performing the intercomparison.

In order to assess the differences between daily mean total ozone column obtained by the Brewer and Dobson spectrophotometers, basic statistical methods (t-test, Spearman correlation, Kruskal-Wallis non-parametric ANOVA) were used.

**Results and Summary**
- Daily mean total ozone column measured by the Brewer Spectrophotometer was in average 1.3% higher than the one measured by the Dobson spectrophotometer.
- The BRE/DOB ratio was significantly (level of significance 0.05) higher than 1 in all months except XI (Fig. 2), the mean was highest in the months with lowest solar zenith angle (1.03 in VII).
- No strong relationships (correlation coefficient over 0.5) were observed between the BRE/DOB ratio and the mean total ozone column, number of observations and the standard deviation of observations.
- With increasing mean total ozone column and number of observations by the Brewer and by the Dobson spectrophotometers the variability of the BRE/DOB ratio decreased (Fig. 3).
- Compared to other groups of measurement types, the BRE/DOB ratio was significantly lower when the Brewer - DS and Dobson - ZS measurement types were applied (mean = 1.0), there was also a significant difference between the DS and B-ZS/D-S groups (Fig. 4).
- Extreme values of the BRE/DOB ratio were observed mostly when total ozone column was low (up to 220 DU), there was a low solar zenith angle, low number of individual observations and the type of total ozone observation was B-DS, D-ZS (Fig. 3, 4 and 5).

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