Environnement et Changement climatique Canada
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Zenith Sky Chart Coefficient Generation SOP for the Brewer Spectrometer

The Canadian Brewer Spectrometer Network
Réseau Canadian de spectrophotometric – Brewer

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Version 2.0

Canada

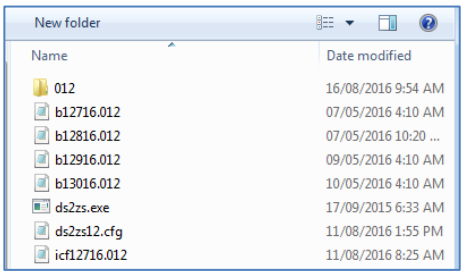
Introduction

The Brewer spectrophotometer utilizes two main methods for determining column ozone, direct sun (DS) and zenith sky (ZS). The DS measurements are processed using Beer's Law however the ZS measurements are processed using an empirical parametric equation with 9 parameters. These parameters can be calculated using large data sets of near simultaneous DS and ZS measurements that were conducted over a wide range of ozone values and air mass factors.

The nine parameters used in the equation describe the relationship between the total ozone column (TOC) and the ZS measured values. These relations include effects from the instrument and from the sky. By modeling the effects from the sky it is possible to separate the two effects and then the effects from the instrument can be represented as a linear correction to the sky effect. This process is described in detail in *Fioletov et al*, 2011.

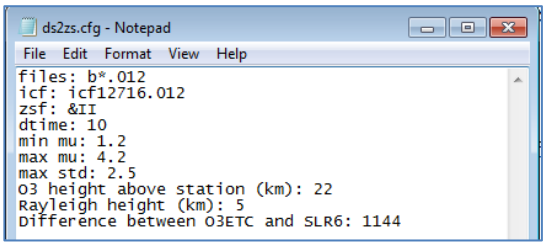
Data Processing

1. Create a test directory and copy into this directory the following;



   - The relevant b-files for the brewer requiring the zenith sky chart coefficient.
   - The icf file for the brewer being analyzed.
   - The ds2zs.exe file.
   - The ds2zs.cfg file.

2. Open the ds2zs.cfg file with notepad. Enter the parameters relevant to the Brewer being analyzed. A completed configuration file for Brewer 012 is illustrated below.



The parameters are defined as;

   - files: change the b file naming to reflect the brewer being analyzed as displayed above.
   - icf: enter the icf file to use in re-processing .
   - zsf: refers to one of the following 4 models based on location.
      a. &I: Tropics Albedo = 0.05,
      b. &II: Midlatitudes Albedo = 0.05,
      c. &III: High Latitudes Albedo = 0.05,
      d. &IV: High Latitudes Albedo = 0.80.

- dtime: maximum time difference between ZS and DS (default 10).
- min mu: minimum air mass factor for DS/ZS pairs (default 1.2)
- max mu: maximum air mass factor for DS/ZS pairs (default 4.2).
- max std: max DS/ZS ozone standard deviation within the measurement (default 2.5).
- O_3 height above station (km): ozone layer height above the station (default 22 km).
- Rayleigh height (km): effective air height for Rayleigh calculations (default 5 km).
- Difference between O_3ETC and SLR6: the difference between O_3ETC and SLR6 at calibration.

3. Save this newly created configuration file, i.e. ds2zs012.cfg in the same test directory created earlier.

4. Highlight and drag the new configuration file into the ds2zs.exe file.

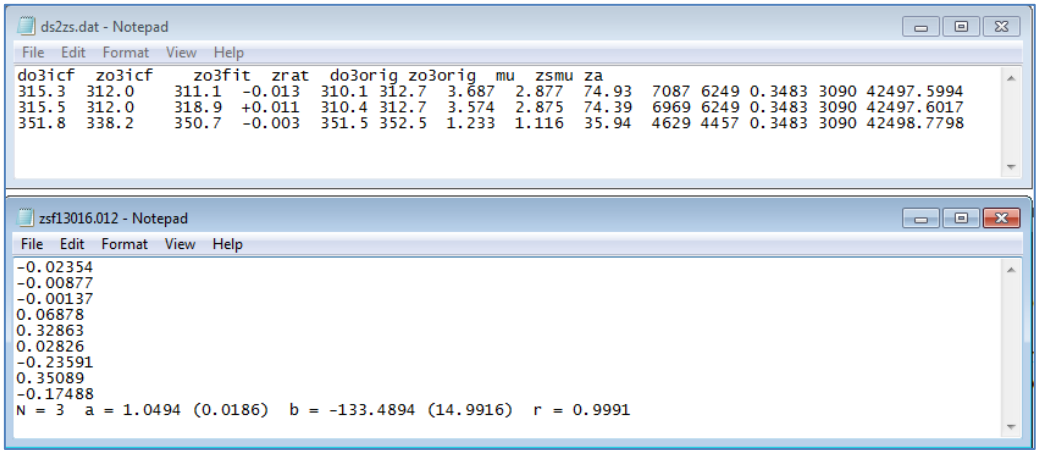
5. The ds2zs.exe program will execute it's routine and create two files in this same directory;

    a. ds2zs.dat: file contains the ozone data that was used in the processing and reprocessed ZS data with the new calculated coefficients.

    b. ds2zs.zsf: file contains the newly calculated coefficients and statistics for the ZS processing. This file is used by the operational Brewer software once it has been renamed.

6. Rename ds2zs.zsf file as follows, zsfJJJyy.### i.e. zsf13016.012.

7. Copy the new zsf file into the OP_ST file of the Brewer being analyzed.



Acknowledgments/References: Vladimir Savastiouk, DS2ZS Data Processing Tool for Calculating Zenith Sky Chart Coefficients for Brewer Spectrophotometers. March 2015.