Aerosol Optical Depth: Configuration

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Introduction

AOD equation:

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

The f_0 calibration constants comes from a Langley calibration or a calibration transfer (see my previous talk)

What are the other variables?

Ozone

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

EUBREWNET's Level 1.5 product:

- Counts from B files, configurations in the server, ozone processed with the Brewer Python Module
- Cloud, airmass, and Hg filters
- Standard lamp, filter, and stray-light corrections

Counts per second

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

Raw counts for each slit converted to counts/second taking into account the effect of dark counts and dead time, plus

1) Data filters from the Ozone Level 1.5 product

2) Polarization correction from Cede *et al*. 2006

3) Correction for the Earth-Sun distance variation using Spencer 1971, as quoted by Iqbal 1983

Counts per second (2)

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

Raw counts for each slit converted to counts/second taking into account the effect of dark counts and dead time, plus

4) Filter and temperature corrections using parameters determined at the calibration campaigns:

i) Filter attenuation coefficients with spectral dependence

ii) Temperature coefficients not normalized to the first slit

Spectral coefficients

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

Instrumental slit function from calibration (provides the wavelength & FWHM), convoluted with

Bass-and-Paur's ozone absorption cross sections: k_o

Bodhaine's Rayleigh coefficients: k_R

See A. Redondas' talk "Wavelength characterization of Brewer determined in the laboratory" for more details

Optical masses and pressure

$$\tau_A = \frac{1}{m_R}\left\{ \log f_0 - \log f - D_o \frac{k_o \log 10}{1000} m_o - \frac{p}{1013} \frac{k_R \log 10}{10000} m_R \right\}$$

As in the standard Brewer algorithm:

- m_o: ozone optical mass
- m_R: Rayleigh optical mass
- p: climatological pressure at the Brewer site

(The Rayleigh optical mass is also used for the aerosol optical mass)

AOD configuration

One calibration constant f_0 for each slit

One filter attenuation coefficient for each slit and filter

One non-normalized temperature coefficient for each slit

One ozone absorption cross section k_o for each slit

One Rayleigh coefficient k_R for each slit

All these parameters are determined at the calibration campaigns!

AOD configuration at EUBREWNET's server

Inserted as a text file

Preliminary template:

Slit	Cal step	Wavelength	FWHM	Cal const	Rayleigh coeff	O3 abs coeff	SO2 abs coeff	T coeff const	T coeff wl	Filter 1 att	Filter 2 att	Filter 3 att	Filter 4 att	Filter 5 att	StrayL const	StrayL exp	SL ref
0	1024	303.2	0.6	NaN	0	NaN	0	0	0	NaN	10225	14931	21430	NaN	0	0	0
2	1024	306.3	0.6	8.07E+04	4870	1.7807	0	0	0	NaN	10205	14815	21245	NaN	0	0	0
3	1024	310.1	0.6	7.97E+04	4620	1.0049	0	0	-0.2	NaN	10185	14691	21044	NaN	0	0	0
4	1024	313.5	0.6	8.18E+04	4410	0.6767	0	0	-0.2	NaN	10172	14590	20880	NaN	0	0	0
5	1024	316.8	0.6	8.19E+04	4220	0.3751	0	0	0	NaN	10159	14504	20738	NaN	0	0	0
6	1024	320.1	0.6	8.23E+04	4040	0.2938	0	0	0.7	NaN	10151	14432	20615	NaN	0	0	0

Not working yet, expect it soon!

Closing remarks

For the Brewers taking part in the calibration campaigns, we have all the data needed to calculate the AOD

We have to do further tests with the polarization correction by Diémoz and Carreño

Product under development: other corrections? AOD levels? ...

Brewer operators should check the configurations at EUBREWNET's server