

Development of correction factors for Aethalometers AE31 and AE33

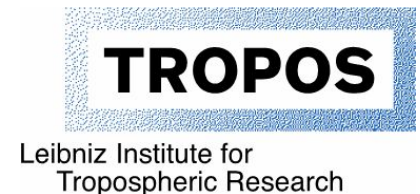
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Member of



Correction of Aethalometers

Correction of Aethalometers is difficult, since instrument sensitivity depends on aerosol type.

For AE31 the correction factor C_0 was empirically determined by comparing absorption calculation from Aethalometer and MAAP from seven field sites.

A section in the upcoming GAW report No153 will refer to an ACTRIS report, in which the method is described.

In case of strong reasons, the recommended C_0 value change can be changed.

AE31 and AE33 corrections

The particle light absorption coefficient is calculated by

$$\sigma_{ap} = b_{ATN} / C_0$$

Where the attenuation coefficient is calculated as follow:

$$ATN = -100 \times \log_e \left(\frac{I}{I_0} \right)$$
$$b_{ATN} = \frac{1}{100} \frac{A}{Q} \frac{\Delta ATN}{\Delta t}$$

Typically, the attenuation coefficient is calculated from the eBC concentration by

AE31:

$$b_{atn} = [eBC] \cdot \text{Sigma}_{atn}$$

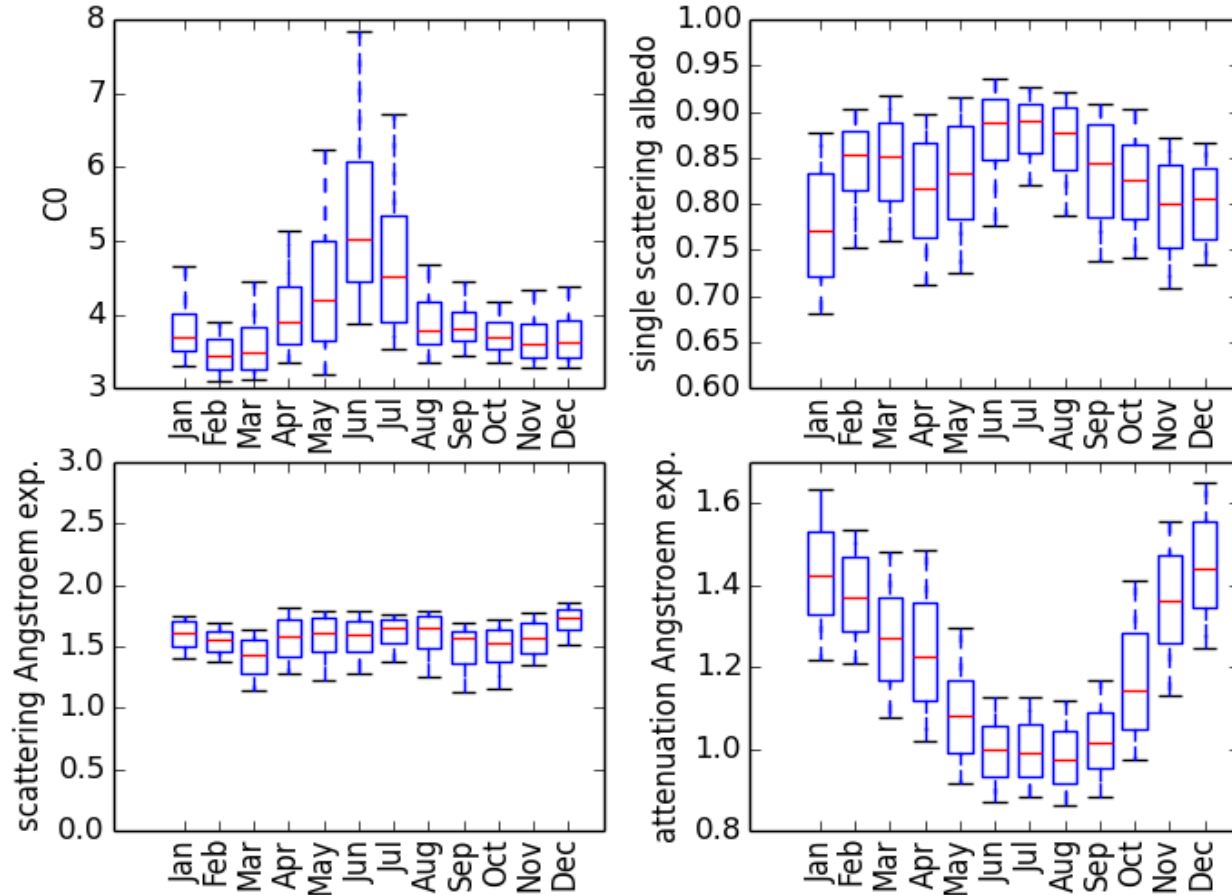
AE33:

$$b_{atn} = [eBC] \cdot k(atn) \cdot \text{Sigma}_{atn} \cdot \frac{1.57}{2.14}$$

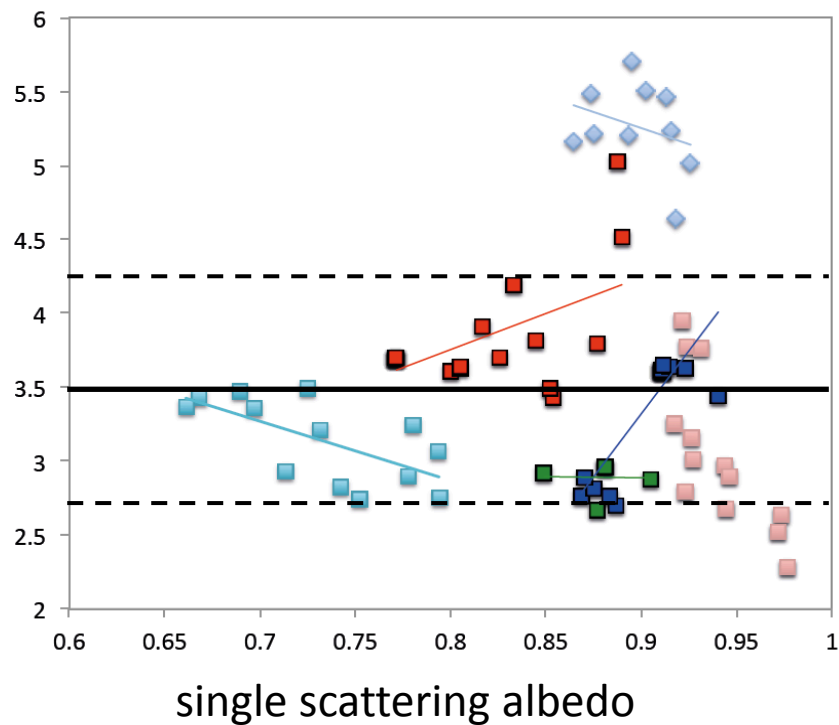
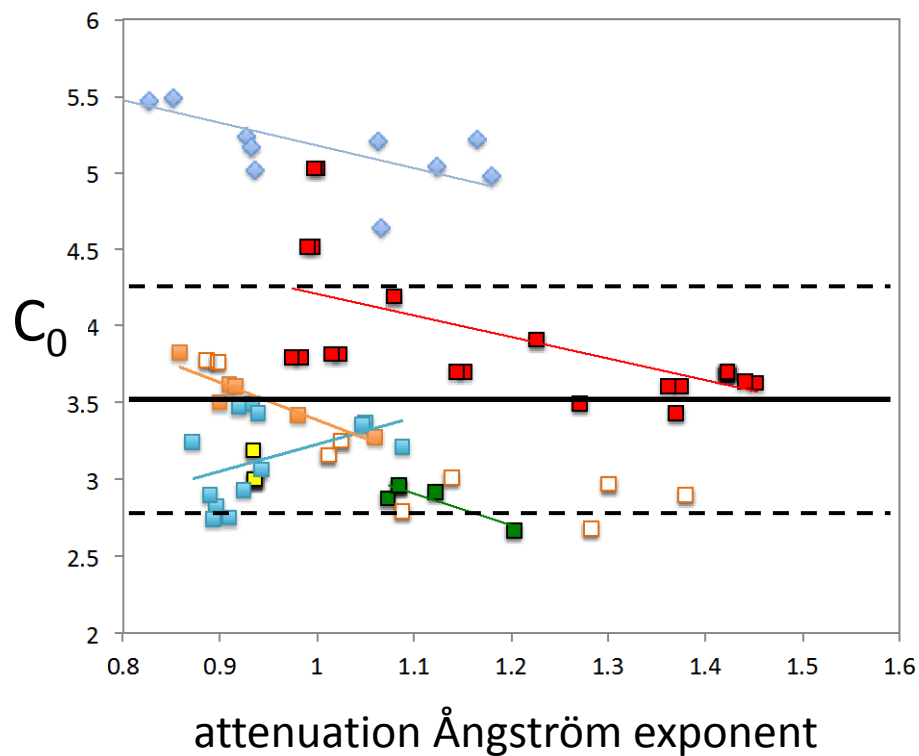
with the attenuation cross section Sigma_{ATN} (=22.2 g/m² at a wavelength 660 nm)

AE31 correction: Seasonal cycle of C_0

Ispira, Jan 2012 to Dec 2012



AE31 correction: C_0 values from eight stations



Recommended value: $C_0 = 3.5 \pm 0.875$ (25%)

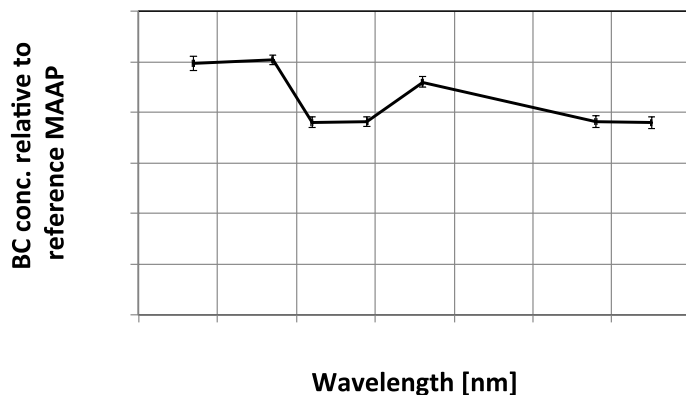
- Montseny
- Ispra
- Demokritos
- Finokalia
- Granada
- Cabauw
- ◆ Monte-Cimo
- Izana (not



AE31 correction: Wavelength dependence of BC concentration

(data from WCCAP-2015-1 workshop)

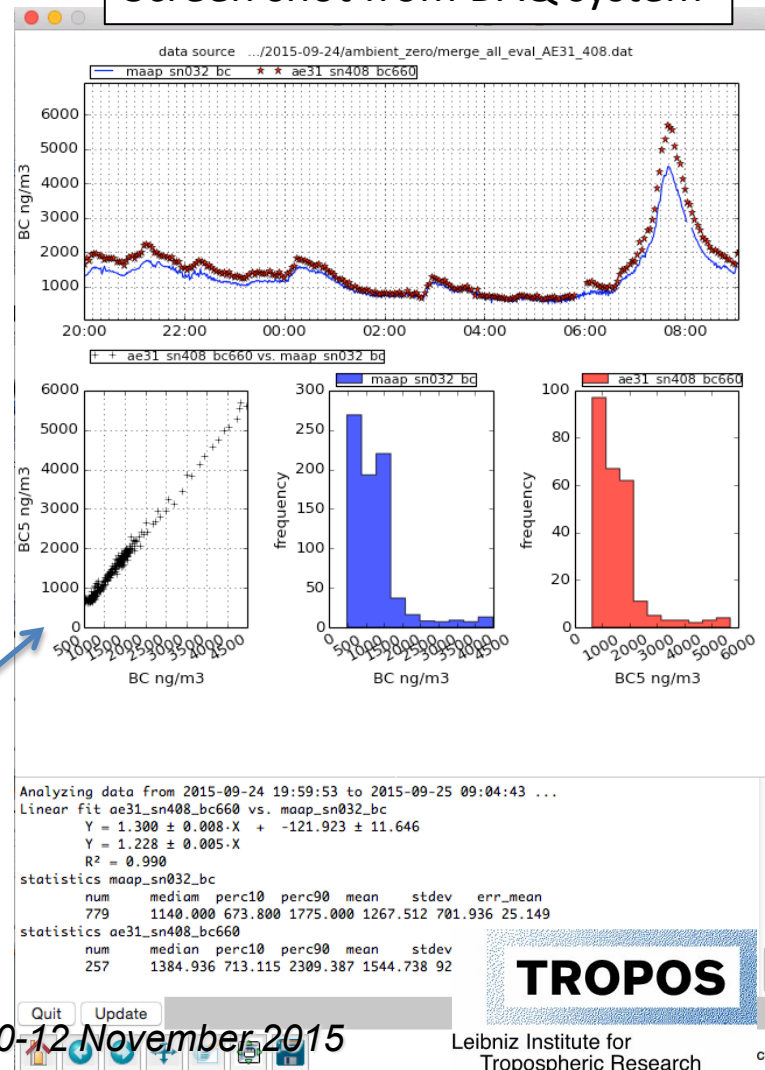
eBC concentrations of AE31 compared to MAAP



eBC concentrations vary by approx. %7

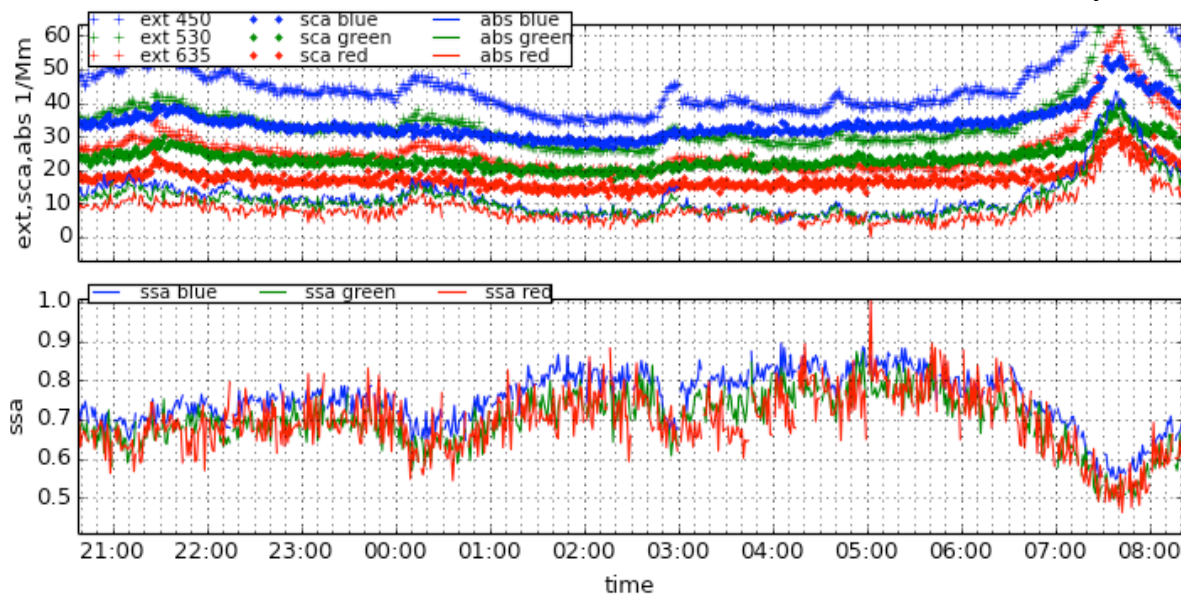
High correlation correlation coefficients ($R^2=0.998$)

Screen shot from DAQ system

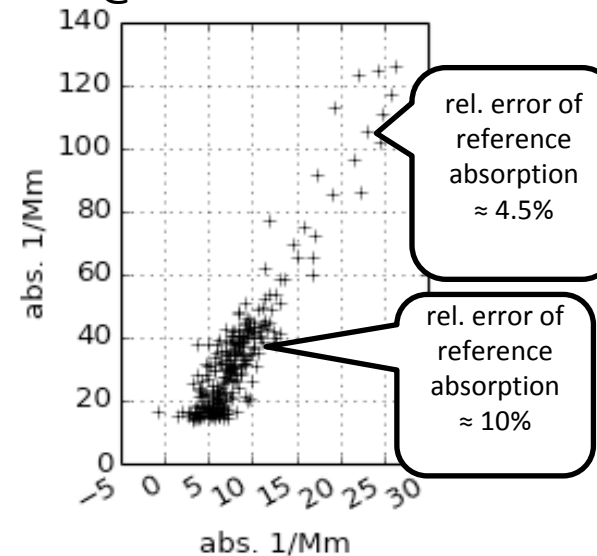


AE31 correction: wavelength dependence of correction factors C_0

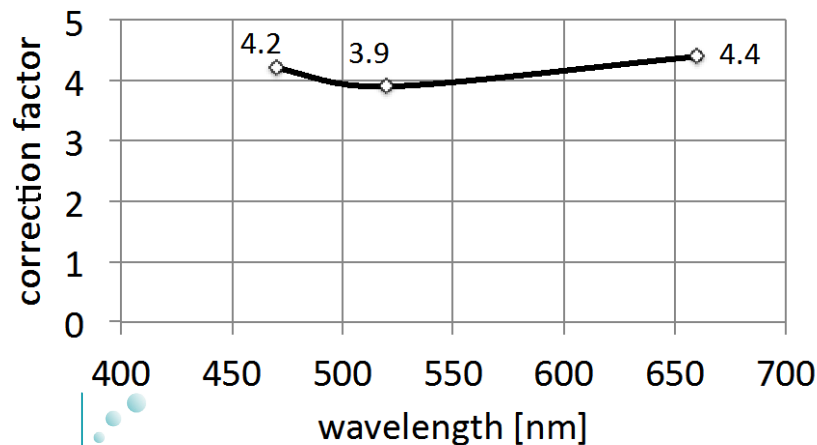
Screen shots from DAQ system



AE31 vs. reference
@660 nm



Correction factors C_0



- C_0 varies by about 10% in the wavelength range from 470 to 660 nm
- **Variation in wavelength dependence is small compared to uncertainty of C_0 (25%)**

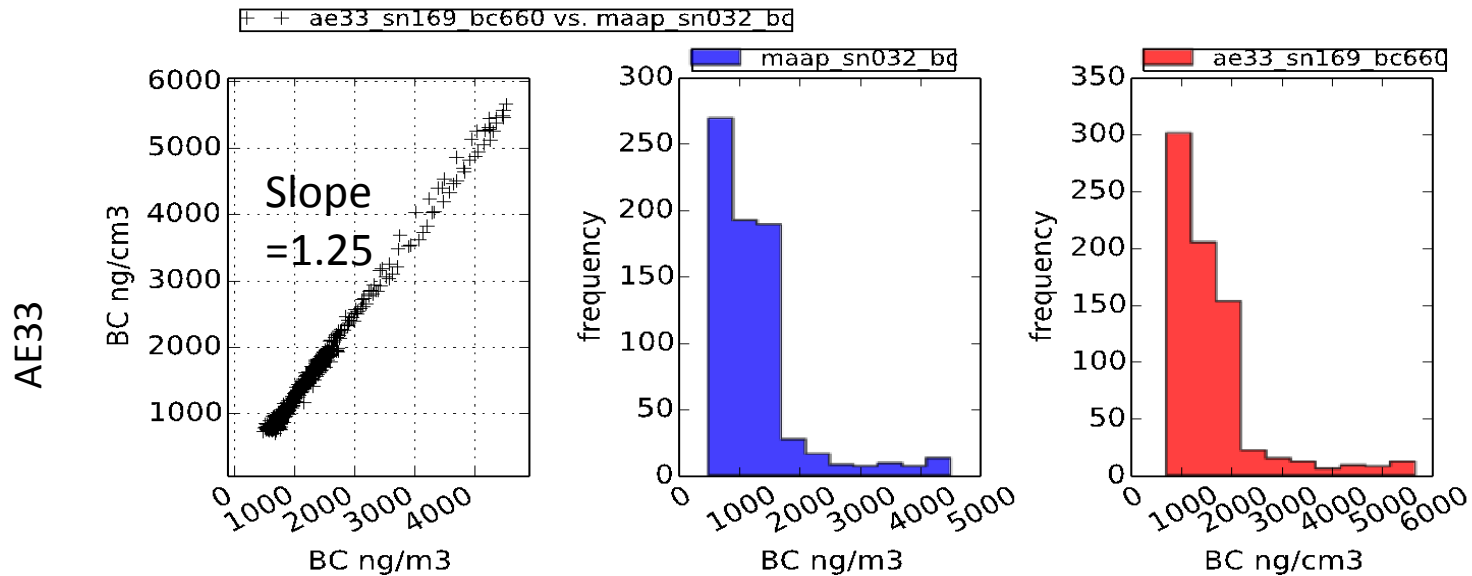
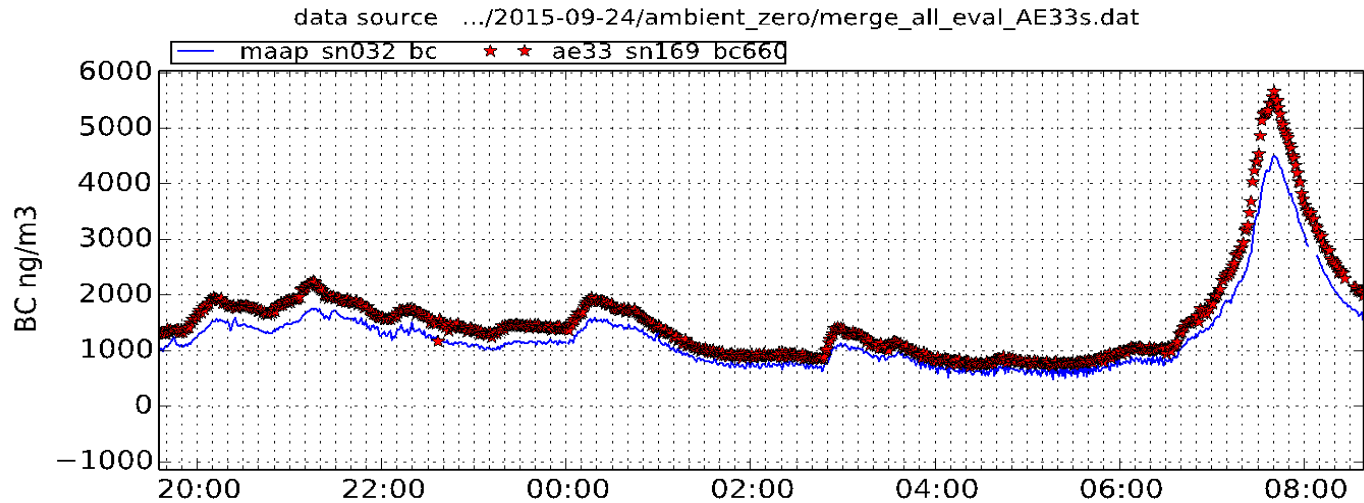
AE33 correction

Climatology is missing.

Who can contribute data ?

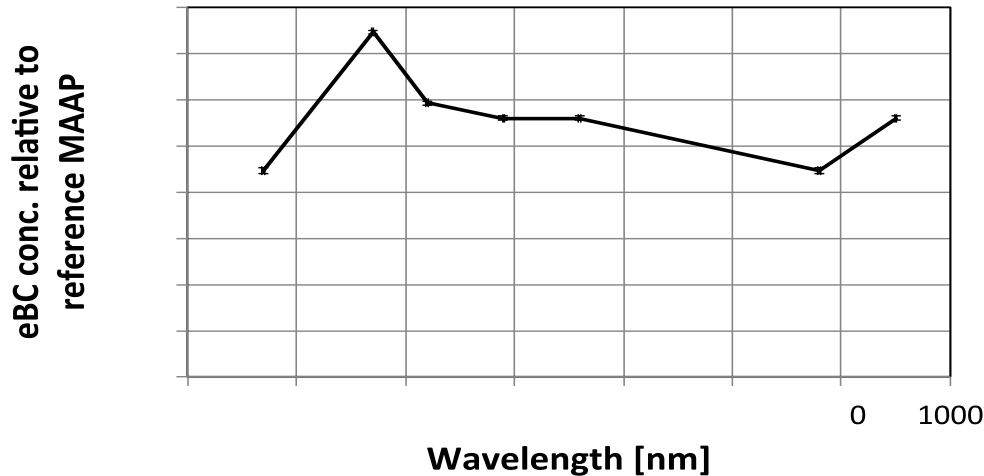
Few laboratory experiments and measurements made in Leipzig are available.

AE33 compared to MAAP



AE33 correction: Wavelength dependence of eBC and C_0

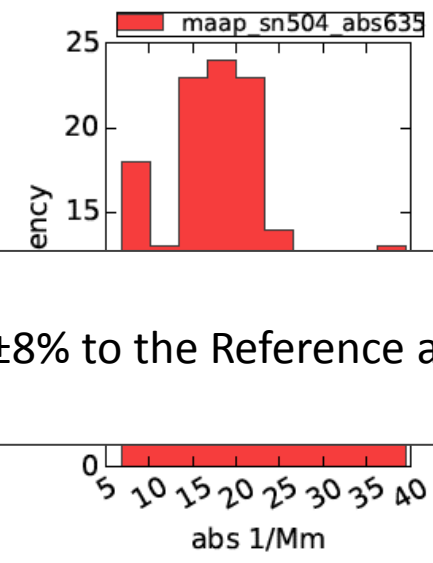
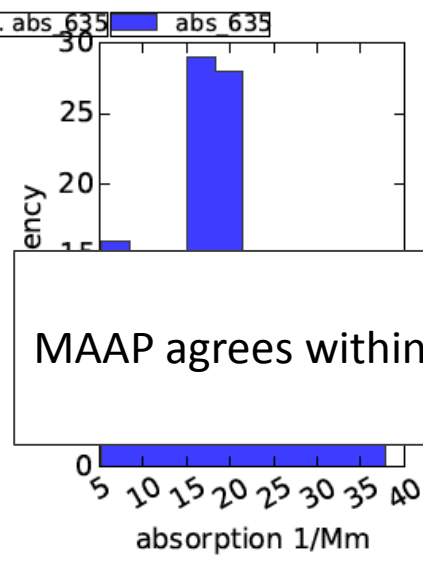
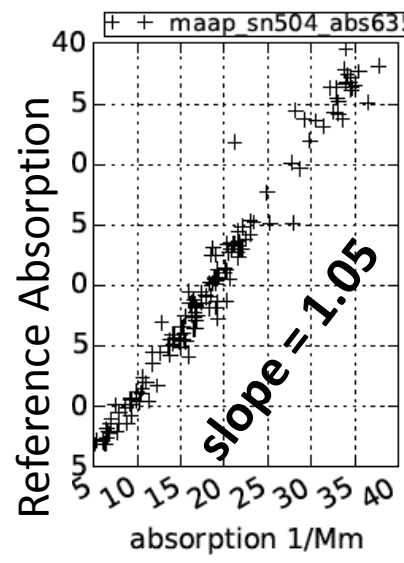
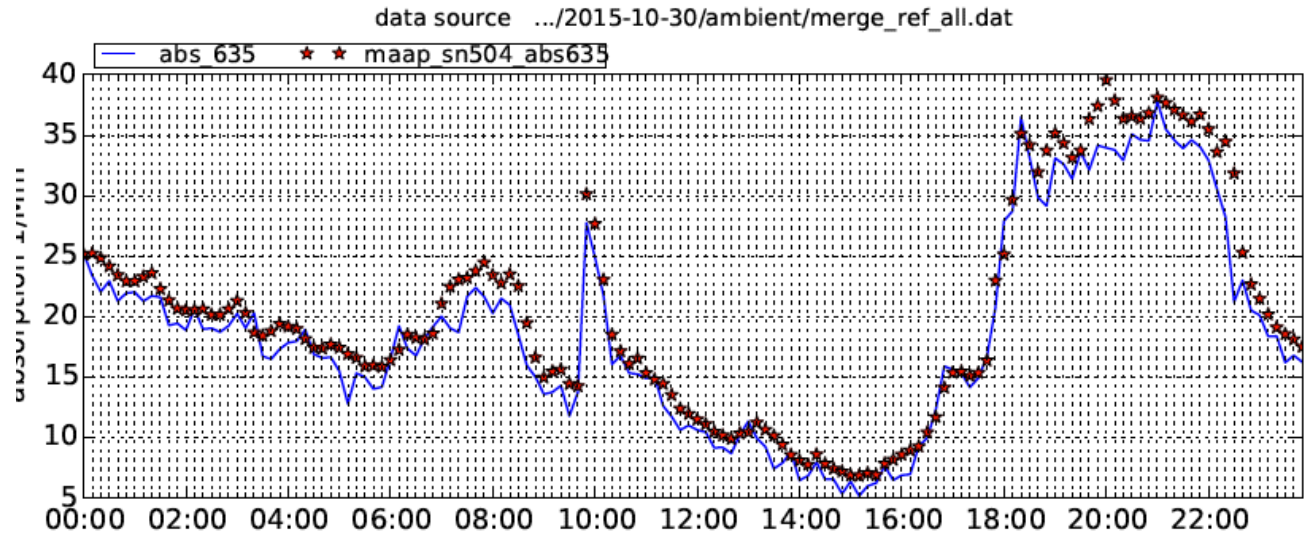
eBC concentration of AE33 compared to MAAP



C_0 values derived by comparing absorption coefficients from AE33 and the absorption reference system

wavelength	470 nm	520 nm	660 nm
C_0	3.29 ± 0.014	3.13 ± 0.013	3.21 ± 0.02
R^2	0.954	0.954	0.887

Comparison of MAAP to Reference Absorption System



MAAP agrees within $\pm 8\%$ to the Reference absorption

Summary

Correction factors for AE31 determined to be 3.5 with an uncertainty of $\pm 25\%$. Correction factor is independent on wavelength.

Correction factors for AE33 were derived to be approx. 3.2 from Measurements in Leipzig. Correction factor is independent on wavelength.

Needed more data !

MAAP agrees with $\pm 8\%$ to Reference absorption