Ambient Measurements of Black Carbon Using the New SP-AMS in Conjunction with Other Instruments


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Overview

• Black carbon is an important regional and global climate forcing agent
• However, studying it isn’t easy
• Optical properties depend strongly on composition and coating, which depend not only on source but atmospheric processing
• Need instruments to probe these processes directly
The SP-AMS

- Will vaporise particles containing black carbon
- Can chemically characterise and quantify the black carbon and its coating
- Will not vaporise particles that do not contain black carbon
- Is of most use when the measurement is collocated with other instruments, e.g. AMS, SP2, optical instruments
San Pietro Capofiume

Date and Time (UTC+1)

Org
NO₃
SO₄
mix 36 (µg m⁻¹)

Laser Off

2.0
1.0
0.0

AMS (µg m⁻¹)

SP-AMS (a. u.)
m/z 36 (C$_3^-$)  
PSAP  
Laser off
Inlet design

Air from stack
PM$_1$ cyclone
Drier

Thermal denuder
Bypass

Automated Valve

Aethalometer
SP-AMS
PASS
SP2

Calibration

Numbers denote mobility diameter in nm

Coefficient values ± one standard deviation
a = \(-7.153 ± 21.2\)
b = \(181.48 ± 28.1\)

SP-AMS ion rate (Hz)

SP2 mass (µg m$^{-3}$)
Beam profile (1mm wire)

Data analysis

- PIKA analysis needed
- V mode was sufficient to resolve carbon clusters
Beam profile modification?

Thermodenuder
Summary

• The SP-AMS has shown to be able to deliver composition of black carbon particles and its coatings during ambient sampling
• Need to link effects of composition to SP2 response and optical properties
• Calibration/focusing issues remain a challenge
• Much work ahead!

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