

AEROCLO-sA PEGASUS Aerosol Mass Spectrometer data

General information

Dataset name: AEROCLO-sA PEGASUS Aerosol Mass Spectrometer data
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Contact(s)

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Period

Date begin (yyyy-mm-jj): 2017-08-25
Date end (yyyy-mm-jj): 2017-09-12

Project(s)

AEROCLO

Data description

Abstract

The concentration of submicrometer particles were measured using compact time-of-flight mass spectrometer aerosol mass spectrometer (c-ToF-AMS) Aerodyne operated in the PEGASUS mobile lab. The c-ToF-AMS was operated from a certified Total Suspended Particulate (TSP) sampling head (Rupprecht and Patashnick, Albany, NY, USA) followed by a cyclone impactor cutting off aerosol particles larger than 1 μ m in aerodynamic diameter (using a flow rate of 16 lpm). A nafion drier was used to assure that was kept below 50% during the whole campaign. The instrument was operated with electron impact mode at 70eV. Flow and size distribution calibrations were carried out at the beginning of the campaign. While ion efficiency calibration where carried out twice using ammonium nitrate solution. Vaporizer temperature was set at 650 °C.

Chloride is normally underestimated by the AMS due to its refractory nature at the operating vaporization temperature (600°C). NaCl calibration method consisted in the generation of monodisperse particles (250 nm mobility diameter) of pure NaCl measured simultaneously by the AMS and the CPC. The derived scaling factor for chloride ion fragments (Cl, HCl, Cl₃₇, HCl₃₇, Cl₂ and Cl₃₇Cl) was 3.9 and for NaCl fragments (NaCl and Na₃₇Cl) was 55.

PM₁ quantification was achieved through intercomparaison of AMS and SMPS volume data. The collection efficiency (CE) was determined using off-line measurements of sulphate on PM₁ filters and average AMS data. A CE value of 0.65 was then applied to sulfate, ammonium, nitrate and organics.

Reference spectra of pure salts as ammonium nitrate, ammonium sulphate, sodium chloride and sodium hydrogen carbonate were taken at the end of the campaign. Additional reference spectra of sea water and foam were also acquired.

Observing strategy

Data were acquired with 1 min time resolution and background reference spectra were acquired every two days using HEPA filters. Final dataset has been averaged to 3 minutes time resolution to reduce noise.

References

1. Drewnick, F., S. S. Hings, M. R. Alfarra, A. S. H. Prevot, and S. Borrmann (2009), Aerosol quantification with the Aerodyne Aerosol Mass Spectrometer: detection limits and ionizer background effects, *Atmospheric Measurement Techniques*, 2(1), 33-46.
2. Drewnick, F., et al. (2005), A new time-of-flight aerosol mass spectrometer (TOF-AMS) - Instrument description and first field deployment, *Aerosol Science and Technology*, 39(7), 637-658.
3. Ovadnevaite, J., D. Ceburnis, M. Canagaratna, H. Berresheim, J. Bialek, G. Martucci, D. R. Worsnop, and C. O'Dowd (2012), On the effect of wind speed on submicron sea salt mass concentrations and source fluxes, *Journal of Geophysical Research: Atmospheres* (1984-2012), 117(D16).

Instrument information

Sensor

Instrument type:	AEROSOL MONITOR
Manufacturer:	Aerodyne
Model:	cTof AMS

Sensor resolution

Observation frequency:	1 minute
Horizontal coverage:	point measurement
Vertical coverage:	surface

Sensor location

Longitude (°):	14.5
Latitude (°):	-22.1
Height above ground (m):	2

Geographic information

Henties Bay

Location name:	Henties Bay
Platform type:	GROUND-BASED OBSERVATIONS

Measured parameter

PM1 non-refractory chemical species

Parameter name:	PM1 non-refractory chemical species
Parameter keyword:	Atmosphere > Aerosols > Particulate Matter
Unit:	microgramm per cubic meter - $\mu\text{g}\cdot\text{m}^{-3}$
Acquisition methodology and quality:	<p>The concentration of non-refractory PM1 particulate matter was measured with a compact Time-of-flight Aerosol Mass Spectrometer (c-ToF-AMS) Aerodyne operated in the PEGASUS mobile lab. Data were collected with a 1-minute time resolution and averaged to 3-minutes for final data report. The c-ToF-AMS was operated from a certified Total Suspended Particulate (TSP) sampling head (Rupprecht and Patashnick, Albany, NY, USA) followed by a cyclone impactor cutting off aerosol particles larger than 1 μm in aerodynamic diameter (using a flow rate of 16 lpm). A nafion drier was used to assure that humidity was kept below 50% during the whole campaign. A high efficiency particulate air (HEPA) filter installed in front of the instrument to sample ambient air for 15-30 minutes was used to evaluate the instruments detection limits calculated as three times the standard deviation of the measured chemical species. The ionization efficiency (IE) with respect to nitrate anions was calculated at the beginning and at the end of the campaign using nebulised 350 nm mobility diameter ammonium nitrate particles (BFSP software was used and values varied between 2.2×10^{-7} - 2.5×10^{-7}). The relative IE (RIE) of ammonium was 4.0 based on the mass spectrum of ammonium nitrate data from IE calibrations. The RIE of sulfate was determined by comparing the theoretical and the measured concentration of a solution of ammonium nitrate and ammonium sulfate and was determined to be 1.3. For the organic fraction the default value of 1.4 was used. Size calibrations were conducted once using polystyrene latex spheres (PSL). The instrument mass resolution varied from 1200-1450.</p> <p>Chloride is normally underestimated by the AMS due to its refractory nature at the operating vaporization temperature (600°C). NaCl calibration method consisted in the generation of monodisperse particles (250 nm mobility diameter) of pure NaCl measured simultaneously by the AMS and the CPC. The derived scaling factor for chloride ion fragments (Cl, HCl, Cl₃₇, HCl₃₇, Cl₂ and Cl₃₇Cl) was 3.9 and for NaCl fragments (NaCl and Na₃₇Cl) was 55.</p> <p>Quantification was then achieved through intercomparison of AMS and SMPS volume data. The collection efficiency (CE) was determined using off-line measurements of sulphate on PM1 filters and average AMS data. A CE value of 0.65 was then applied to sulfate, ammonium, nitrate and organics.</p>

Reference spectra of pure salts as ammonium nitrate, ammonium sulphate, sodium chloride and sodium hydrogen carbonate were taken at the end of the campaign. Additional reference spectra of sea water and foam were also acquired.

Sensor precision: $\pm 20\%$ but higher (30-40%) for sea salt species
Date begin (yyyy-mm-jj): 2017-08-25
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Data use information

Use constraints: The Principal Investigator of the c-ToF-AMS data for the AEROCLO-sA campaign is Barbara D'Anna (Barbara.danna@univ-amu.fr). Please contact the PI whenever using the data for publications or presentations. Data were acquired with the support of the LISA laboratory within the PEGASUS mobile platform.

Data policy: AEROCLO data policy
Database: AEROCLO-sA on BAOBAB
Original data format(s): Excel