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**Dataset name:** iCUPE Dataset (DS) from Deliverable 1.1.2:

**DS on aerosol physical and optical characteristics, including equivalent black carbon at Ny-Ålesund (Svalbard)**

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**Place and date:** Bologna, Italy, 24 July 2020

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The produced dataset (in csv-format) contains physical and optical characteristics of aerosol population measured for the period 2016-2019 at the Italian Arctic station “Dirigibile Italia” in Ny-Ålesund (Svalbard Archipelago).

Long-term in-situ aerosol measurements at this station are performed at the Gruvebadet observatory (78.918 °N, 11.895 °E; 61 m above sea level), which is located 800 m south-west of the Ny-Ålesund research village.

### **Aerosol size distribution**

At Gruvebadet, the aerosol size distribution is measured by a scanning mobility particle sizer spectrometer TSI SMSP 3034 (in the range 10-487 nm), and by an aerodynamic particle sizer TSI APS 3321 (in the range 500-20000 nm) since 2010. All data are collected with a frequency of 10 minute.

The TSI SMPS 3034 collects data in 54 size channels centred at  
Dsmps=(micron) (54 channels)

0.0104	0.0111	0.012	0.0129	0.0138	0.0149
0.0160	0.0172	0.0184	0.0198	0.0213	0.0229
0.0246	0.0264	0.0284	0.0305	0.0328	0.0352
0.0379	0.0407	0.0437	0.047	0.0505	0.0542
0.0583	0.0626	0.0673	0.0723	0.0777	0.0835




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0.0898	0.0965	0.1037	0.1114	0.1197	0.1286
0.1382	0.1486	0.1596	0.1715	0.1843	0.1981
0.2129	0.2288	0.2458	0.2642	0.2839	0.3051
0.3278	0.3523	0.3786	0.4068	0.4371	0.470

The TSI APS 3321 collects data in 51 size channels centred at  
 Daps=(micron) (51 channels)

0.542	0.583	0.626	0.673	0.723	0.777
0.835	0.898	0.965	1.037	1.114	1.197
1.286	1.382	1.486	1.596	1.715	1.843
1.981	2.129	2.288	2.458	2.642	2.839
3.051	3.278	3.523	3.786	4.068	4.371
4.698	5.048	5.425	5.829	6.264	6.732
7.234	7.774	8.354	8.977	9.647	10.37
11.14	11.97	12.86	13.82	14.86	15.96
17.15	18.43	19.81	>20micron		

For each channel of SMPS and APS, the quantity DN/DlogD is provided.

Data are stored in monthly files, and separately for SMPS and APS that contains columns of collected measurements in the following order:

- column 1** Date time (DD/MM/AAAA HH:MM) in UTC
- column 2** DN/DlogD 1st channel
- column 3** DN/DlogD 2nd channel
- .....
- column XX** DN/DlogD last channel

where: XX = 55 for SMPS 3034 (fine particles) & XX = 52 for APS 3321 (coarse particles) & in the 1<sup>st</sup> column: DD – day, MM – month, AAAA – year, HH – hour, MM – minute, UTC – Universal Coordinated Time

Note, there are gaps (i.e. no data) in measurements due to instruments' failures. In particular, there are few periods (Month(s)/Year) without measurements (i.e. the files are empty).

For SMPS these periods are:

01/2016, 02/2016, 06-12/2016, 01/2017, 11/2017, 12/2017, 01/2018

For APS these periods are:

01/2016, 02/2016, 06-12/2016, 01/2017, 11/2017, 12/2017, 01/2018, 11/2018, 12/2018

### **Aerosol optical parameters and Equivalent Black Carbon (EBC)**

At Gruebadet, the aerosol scattering is measured at one wavelength (530 nm, Nephelometer Radiance Research M903), while the aerosol absorption is evaluated at three wavelengths with a Radiance Research PSAP at 1-minute time resolution (Bond et al. 1999), since 2010. Data are averaged over 1-hour interval. The absorption coefficients are measured at 467 nm, 530 nm, and 660 nm, with a precision ranging between 20-25%. Measurements are performed generally during April-September, with a limited number of data during a winter season. Absorption measurements are corrected according to Bond et al. (1999) and Virkkula (2010) for filter transmission, flow, and sampling filter area. Data are not corrected for aerosol scattering, while shadowing effect is considered to be negligible due to the low aerosol loading. Absorption coefficients are normalized at standard pressure (1 atm) and temperature (0°C) conditions. The black carbon content is evaluated considering the central value according to Zanatta et al. (2018), with a MAC (mass absorption cross section) of 7.72 m<sup>2</sup>/g.

The Scattering and Absorption coefficients are in Mm<sup>-1</sup>, and  
The Equivalent Black Carbon (EBC) content is in ng/m<sup>3</sup>.

Data are stored in annual files that contains columns of collected and evaluated data in the following order:

- column 1** Date time stamp (DD/MM/AAAA HH:MM) in UTC
- column 2** Scattering coefficient at 530 nm (Mm<sup>-1</sup>)
- column 3** Absorption coefficient at 467 nm (Mm<sup>-1</sup>)
- column 4** Absorption coefficient at 530 nm (Mm<sup>-1</sup>)
- column 5** Absorption coefficient at 660 nm (Mm<sup>-1</sup>)
- column 6** Equivalent Black Carbon (EBC) (ng/m<sup>3</sup>)

where: in the 1<sup>st</sup> column: DD – day, MM – month, AAAA – year, HH – hour, MM – minute

There are 3 datasets resulted from the iCUPE Task 1.1 "Integration of observations provided by research infrastructures and networks":

- Dataset on aerosol ultrafine particle size distribution (<https://doi.org/10.5281/zenodo.3961388>)
- Dataset on aerosol large particle size distribution (<https://doi.org/10.5281/zenodo.3961473>)
- Dataset on scattering, absorption and equivalent black carbon (<https://doi.org/10.5281/zenodo.3961350>)

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**References:**

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- Virkkula, A (2010): *Correction of the Calibration of the 3-wavelength Particle Soot Absorption Photometer (3 $\lambda$  PSAP)*, *Aerosol Sci. Tech.*, 44, 706-712, <https://doi.org/10.1080/02786826.2010.482110>
- Zanatta, M., Laj, P., Gysel, M., Baltensperger, U., Vratolis, S., Eleftheriadis, K., Kondo, Y., Dubuisson, P., Winiarek, V., Kazadzis, S., Tunved, P., and Jacobi, H.-W. (2018): *Effects of mixing state on optical and radiative properties of black carbon in the European Arctic*, *Atmos. Chem. Phys.*, 18, 14037-14057, <https://doi.org/10.5194/acp-18-14037-2018>