World Calibration Centre
for Aerosol Physics

Audit Report

Global GAW station Pallas, Finland

February 25, 2015

Prof. Dr. Alfred Wiedensohler, Dr. Thomas Tuch

General:

This station audit was a re-audit of the audit performed in August 2004. As in 2004, we found the station generally in a good condition. Due to the remote location Pallas station is not permanently manned. Scientists visit the station every other month. A station manager performs routine checks twice a week. To overcome possible problems resulting from this schedule all data from Pallas station are available via remote access. Data are automatically downloaded every day to the Finish Meteorological Institute (FMI). A dedicated scientist at the FMI is responsible for continuous plausibility control of the downloaded data. We consider this approach appropriate for such a remote station.

Figure 1: Pallas station 25.2.2015.

Data handling and documentation:

Manuals where present for all instruments. Performance parameters are electronically documented. These documents can be accessed remotely. Prior to the audit both MAAP and Nephelometer data for 2013 could not be found in the EBAS data base. For data availability as of February 23, 2015, see Appendix A.

We noticed that two clocks of data acquisition computers differed by 7 minutes. DAQ computer clocks should be synchronized on a regular basis.

Aerosol Inlet:

The Nephelometer and the MAAP are connected to a heated standard PM_{10} inlet. Due to the local climate conditions, icing of the inlet is a frequent problem during the winter. (Figure 2)

Figure 2: PM_{10} inlet covered by ice and snow

Note: A whole air inlet may be a better solution instead of a PM10.

A bundle dryer PermaPure type DD-600 is used an aerosol dryer for the Nephelometer. Bundle dryers are known to cause particle losses and are therefore not suitable for aerosol inlets. We recommend changing to another Nafion dryer. PermaPure offer also specific aerosol Nafion dryers now. The DMPS system is connected to the home-made inlet described in the 2004 audit report.

Instrumentation:

Particle number Size Distribution: Mobility Particle Size SpectrometerPS

Particle number size distributions in the size range from 7 to 500 nm are measured by a custom-made Differential Mobility Particle Sizer (DMPS). The DMPS consists of a Hauke type DMA (28 cm effective length) a Ni-63 bipolar diffusion charger, a programmable high voltage supply (12.5 kV) and a closed loop sheath air/excess air system, including dryer. The aerosol flow rate of this system is 0.966 l/min, sheath air flow rate is 10.4 l/min. Flow rates are checked during every visit of a scientist at the station with the primary flow standard. A rotameter for the sheath air flow is checked by the station manager twice a week. Temperature, relative humidity and pressure of the sheath air are recorded by the LabView software in addition to flow rates and number concentrations. The DMPS however does not completely fulfill the required ACTRIS standards. Especially, since FMI is full partner in ACTRIS, recommendations should be followed.

- The aerosol flow of the DMPS is not monitored. Please add a capillary for the aerosol flow measurements.
- The T/RH in the aerosol flow is not monitored**.** Please add a T/RH sensor.
- The whole system was checked for sizing accuracy with standardized Latex particles, which was not done during regular checks for several years. The sizing check with 203 nm Latex particles during the audit is shown in Figure 3. The center diameter of the gauss fit curve was found at 209.4 nm, which outside of the tolerance.
- The DMPS has to be send to a calibration activity of the ECAC (European Center for Aerosol Calibration)
- The CPC of the system (3010, #2261) has also not been calibrated.

The DMPS has been checked using a zero air filter. No false counts occurred during three subsequent measurement cycles.

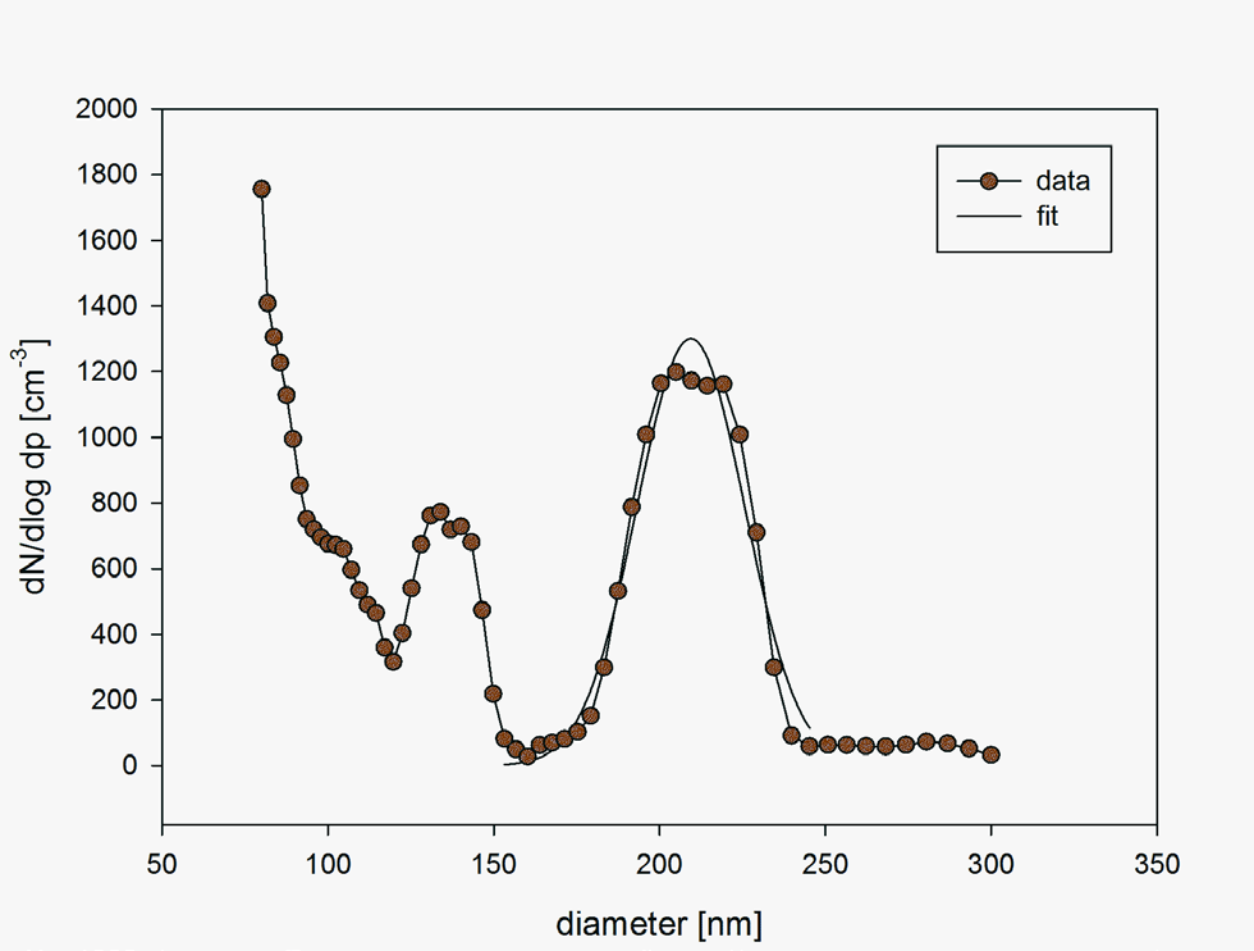


Figure 3: Sizing check of the Pallas DMPS system with 203 nm PSL

Particle Number Concentration: Condensation Particle Counter

A CPC TSI model 3010 (SN 2121) is used to determine the total particle number concentration. This instrument has been serviced by TSI in 2013. The flow rate was 0.92 l/min. The flow rate seems to be rather low, indication that either the critical orifice or the focusing nozzle is dirty. With an absolute filter attached to the inlet we observed 5 false counts within 10 minutes.

Hourly average integral particle number concentrations derived from particle number size distributions are in agreement with number concentrations measured by the total CPC as shown in Figure 4 (Regression slope = 1.085, intercept= -28.58 R^2=0.978). At concentrations below 100 cm^{-3} concentrations show two distinct lines which cannot be explained by the dataset. Again, we recommend the send the whole DMPS plus the additional CPC to the ECAC activity as soon as possible.

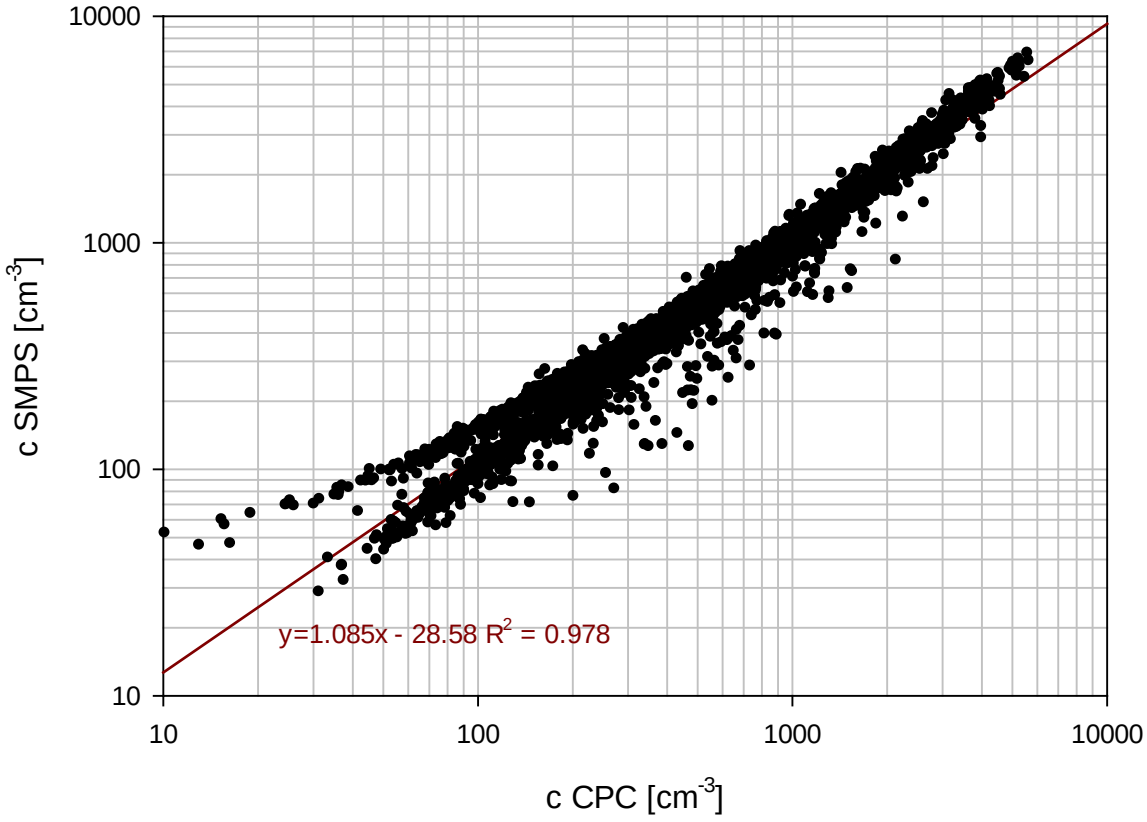


Figure 4: Comparison of particle number concentrations from DMPS and CPC measurements.

Particle Light Scattering: Integrating Nephelometer:

An Integrating Nephelometer TSI model 3563 SN 1061 is used to measure particle light scattering coefficients at Pallas. The instrument had been calibrated one month prior to the audit and during the audit. Old and new calibration constants have been similar. A short zero measurement (1 hour) showed that the instrument is in good working condition. Again, the integrating nephelometer has to be sent once to a calibration activity of the ECAC.

Particle Light Absorption: Absorption Photometer

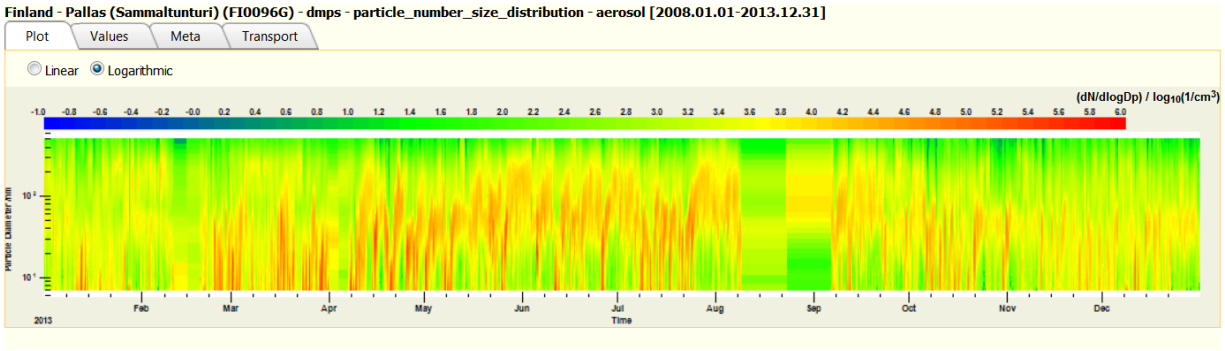
A MAAP (SN 068) is used to determine the particle light absorption coefficient. This instrument has been compared at the calibration center before, however it should participate again at a calibration activity of the ACTRIS-ECAC. The instrument is running at a flow rate of 514 Nl/min. The instrument is in good working condition.

Remarks:

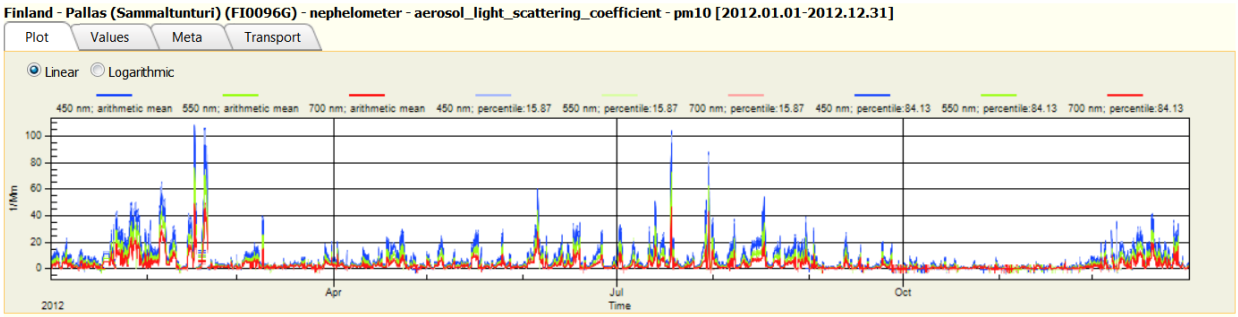
We wish to thank all personal of the Pallas GAW station for their great hospitality.

Appendix A: Data availability EBAS as of February 23 2015:

DMPS:

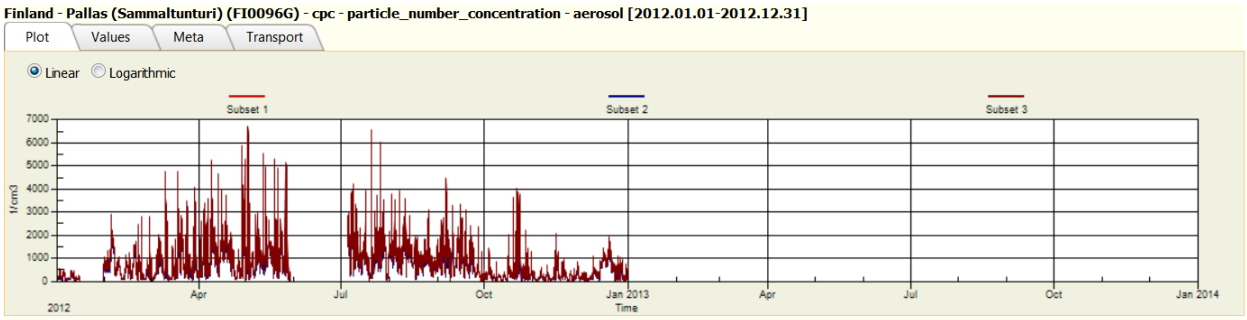


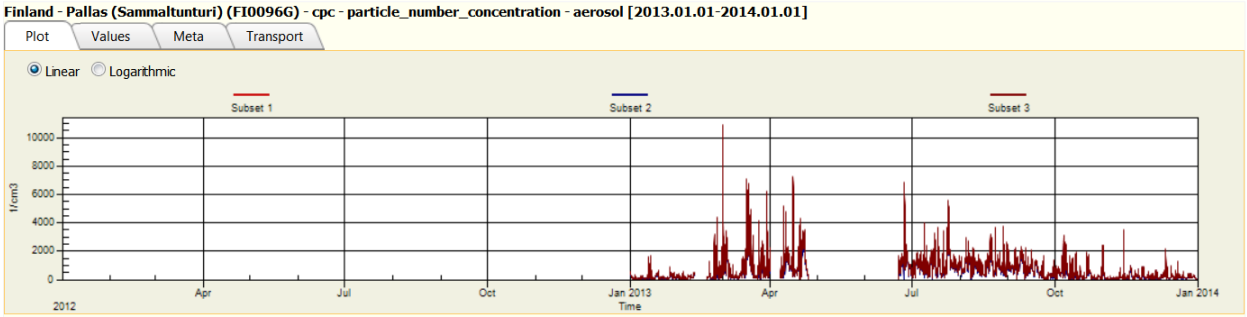
Nephelometer:



2013 not available from EBAS

CPC:


Finland - Pallas (Sammaltunturi) (FI0096G) - cpc - particle_number_concentration - aerosol [2012.01.01-2012.12.31]
Plot
Values
Meta
Transport
Linear
Logarithmic
Subset 1
Subset 2
Subset 3
1/cm3
7000
6000
5000
4000
3000
2000
1000
0
2012
Apr
Jul
Oct
Jan 2013
Apr
Jul
Oct
Jan 2014
Time


Finland - Pallas (Sammaltunturi) (FI0096G) - cpc - particle_number_concentration - aerosol [2013.01.01-2014.01.01]
Plot
Values
Meta
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Linear
Logarithmic
Subset 1
Subset 2
Subset 3
1/cm3
10000
8000
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4000
2000
0
2012
Apr
Jul
Oct
Jan 2013
Apr
Jul
Oct
Jan 2014
Time