TROPOS
Leibniz Institute for Tropospheric Research

ACTRiS

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2016-1-5

Basic information:

Location of the quality assurance: TROPOS, lab: 118

Delivery date: January 25, 2016

Setup in the laboratory: January 25, 2016

Comparison period: January 25, 2016 – January 29, 2016

Principal Investigator	Home Institution	Participant	Instrument
Nikolaos Mihalopoulos	UoC/NOA	Nikos Kalivitis	TROPOS-MPSS: homemade TSI CPC Model 3772 # 70717021

Summary of Intercomparison:

Pre-status:
The TROPOS MPSS UoC/NOA was in good condition but 15% lower than the TROPOS Reference MPSS No.1.

Final status:
The TROPOS MPSS UoC/NOA passed the quality standards of ACTRIS and GAW. The system is within the 10% range of the TROPOS Reference MPSS No.1. During this week

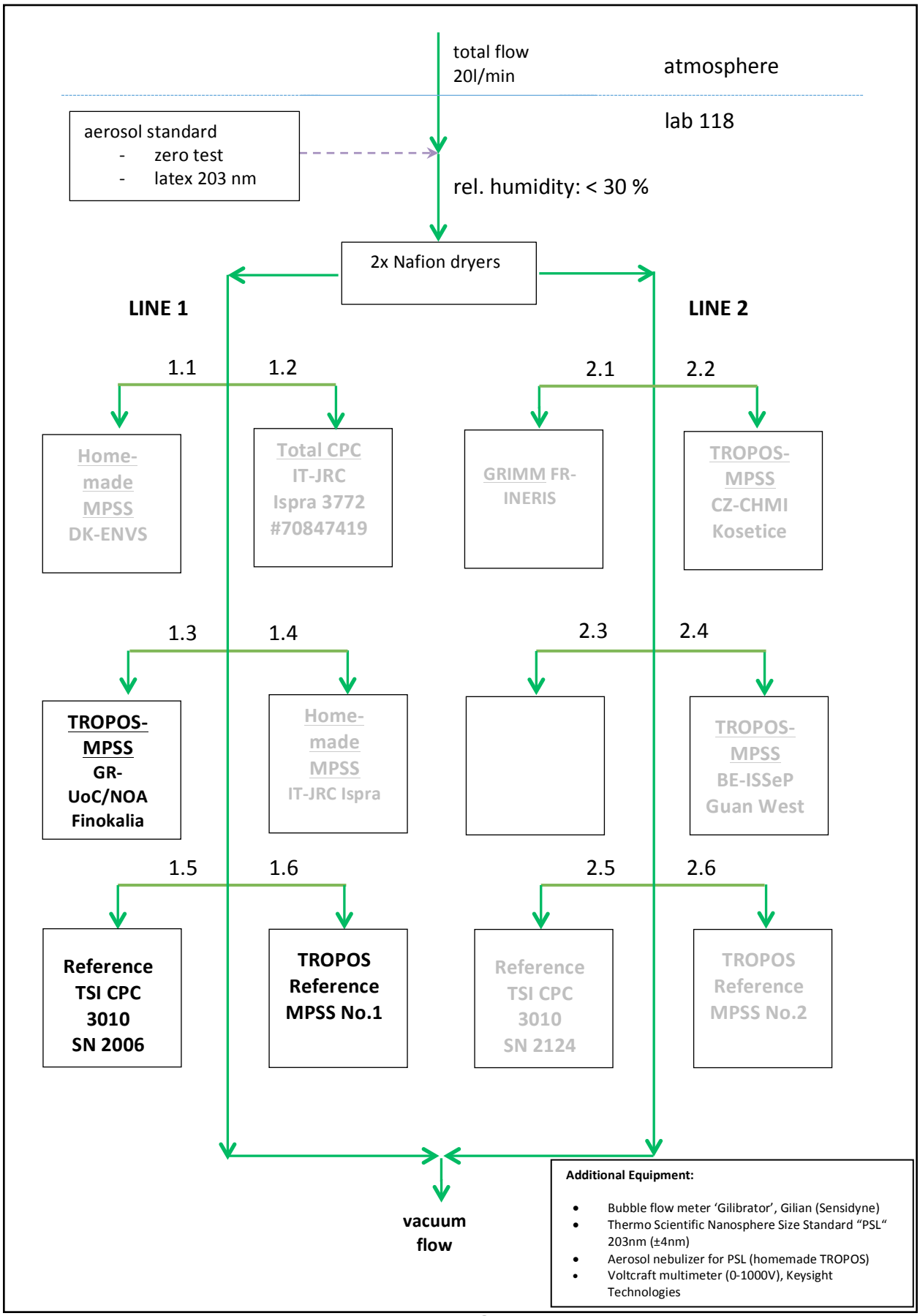
there are a lot of ultrafine particles that is the reason why the correlation to the TROPOS total CPC 3010 is sometimes out of the 10% range.

- 25.01.2016: Setup TROPOS MPSS UoC/NOA in the lab 118. The instrument was sent without source. We used a Kr85 from TROPOS. -> pre-status overnight run
- 26.01.2016: CPC Workshop in lab 130.
- 26.01.2016: Check and cleaning of the MPSS -> it was necessary to bring the DMA to the mechanical workshop. We changed the slit from 0.45 mm to 0.5 mm. Run without the nafion dryer.
- 27.01.2016: DMA back in the MPSS after cleaning. Nafion dryer was by Andrea Haudek checkup.
- 28.-29.01.2016: final status overnight run with ambient

List of Components

	Specification	Reference MPSS No.1	GR-UoC_NOA Finokalia
Position (Line)		1.6	1.3
Company		TROPOS	TROPOS
Software		TROPOS 5.7	TROPOS 4.7.2
CPC		Model 3772 SN: 3772141701	Model 3772 SN : 70717021
Flow ratio		1.0 : 5.0	1.0 : 5.0
Source		Kr85	Kr85
HV cassette		positive	positive
DMA		Hauke medium	Hauke medium
Flow meas.	Aerosol	✓	✓
Dryer		✓	✓
RH sensor	Inlet	✓	✓
T sensor		✓	✓
RH sensor	Sheath air	✓	✓
T sensor		✓	✓
Dryer		✓	✓
p sensor		✓	

Laboratory Setup



TROPOS Reference Systems during the pre-status night measurement

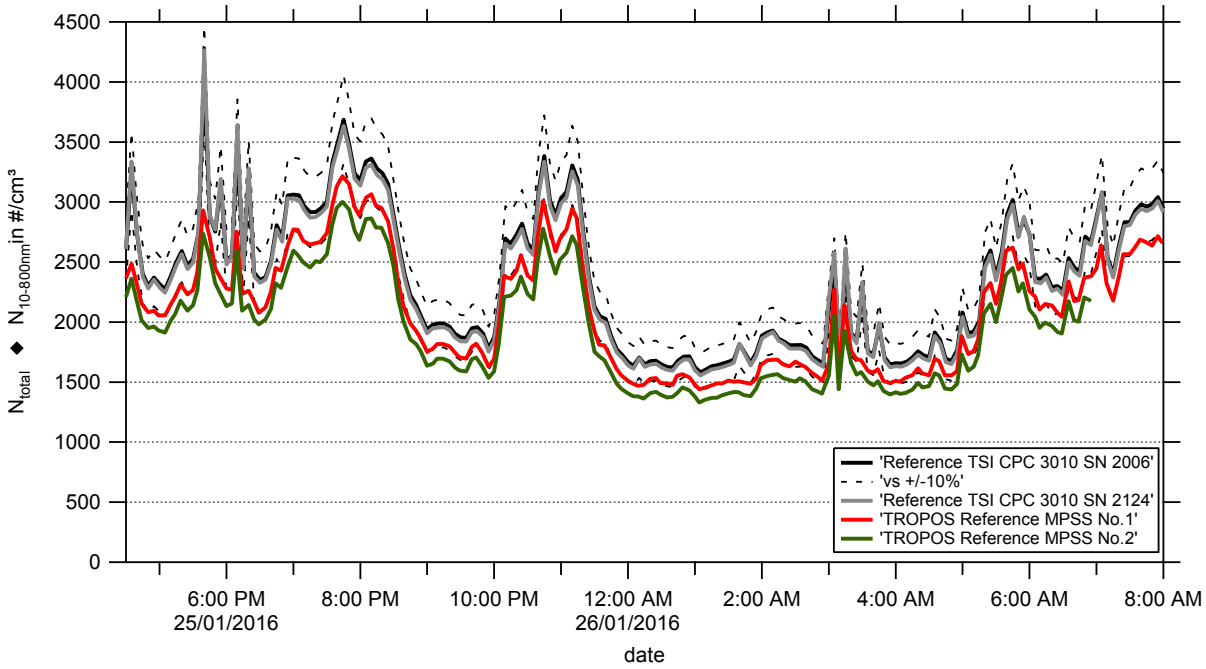


Figure 01: Time series (January 25, 2016 18:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the two TROPOS Reference MPSS systems and total number concentration (N_{total}) of the two reference TSI-CPCs Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre- Status of the Candidate (January 25th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref1	MPSS	3772 SN 3772141701	1.6	**1.026**	l/min	1	# cm^{-3}
TROPOS		Total CPC	3010 SN 2006	1.5	**1.025**	l/min	0	# cm^{-3}
UoC/NOA	Finokalia	TROPOS-TSI	3772 SN 70717021	1.3	**0.985**	l/min	0	# cm^{-3}

High voltage calibration

Institute	System	[V]	0 V	4 mV	80 mV	800 mV
TROPOS	Reference MPSS No.1	Pre-status	-	-	-	-
		final	**0**	**5**	**100**	**1000**
UoC/NOA	Finokalia	Pre-status	0	4.2	99	1004
		final	**0.2**	**5.1**	**100**	**1000**

Latex 203nm ±4nm (pressure 1009 hPa, 23.0°C)

Institute	System		Latex 203 [nm]	slope
TROPOS	Reference MPSS No.1	Pre-status	201	-
		final	**202.8**	**4.9**
UoC/NOA	Finokalia	Pre-status	208	2.74
		final	**204.18**	**2.85**

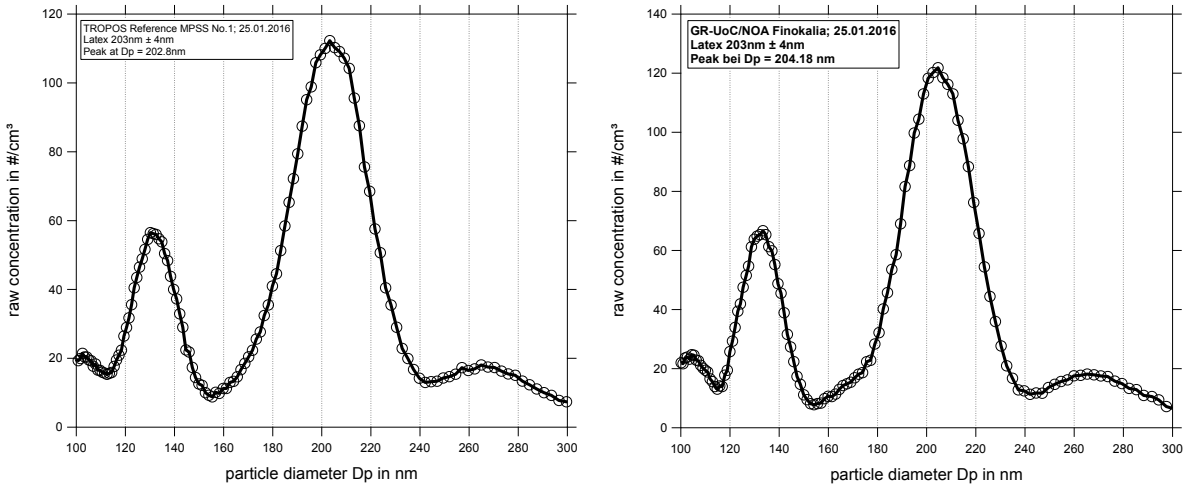


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on January 25th, 2016.

Time Series

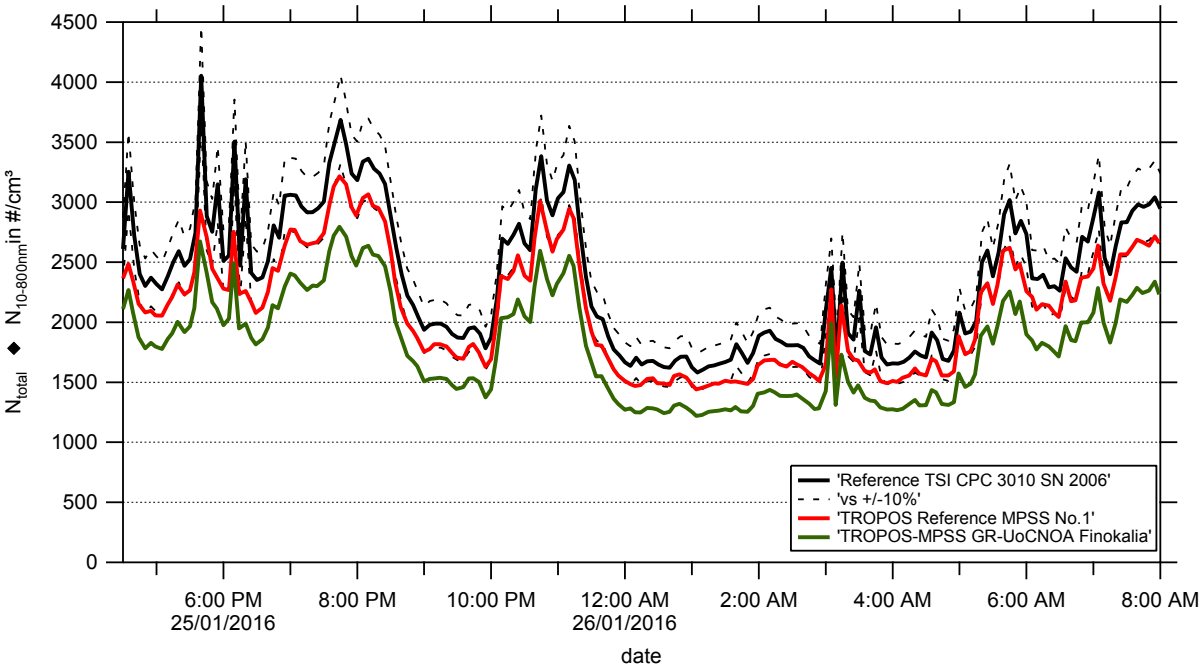


Figure 03: Time series (January 25, 2016 18:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

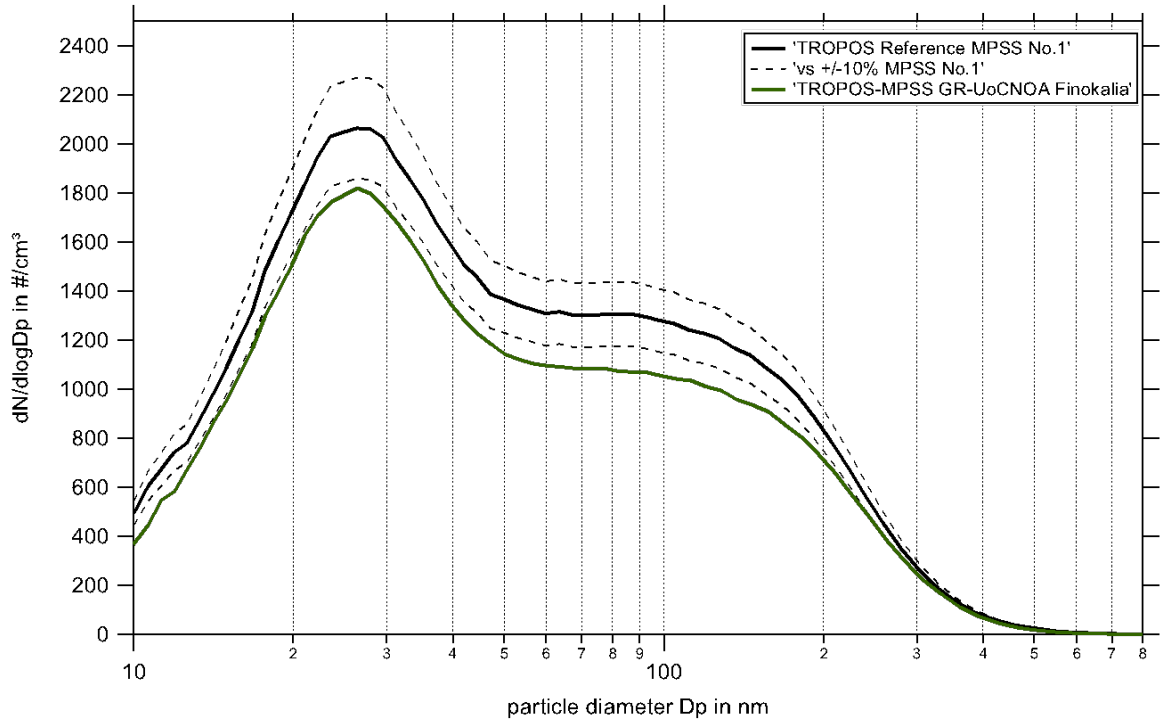


Figure 04: Comparison of mean particle number size distribution of Candidate MPSS and TROPOS Reference MPSS No.1 from January 25, 2016 18:00 pm until January 26, 2016 08:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

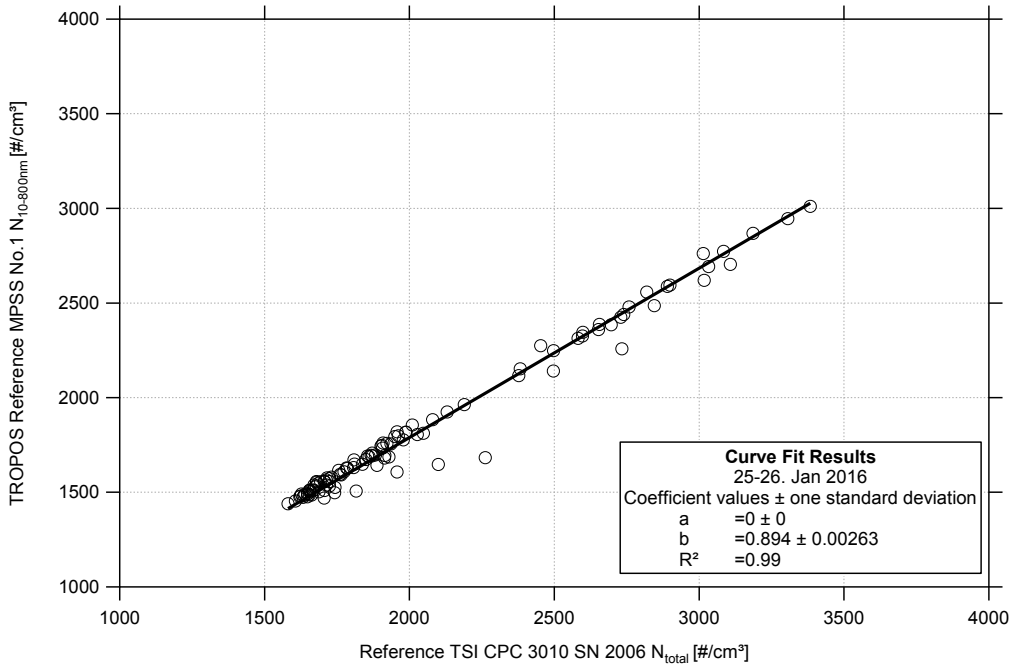


Figure 05: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

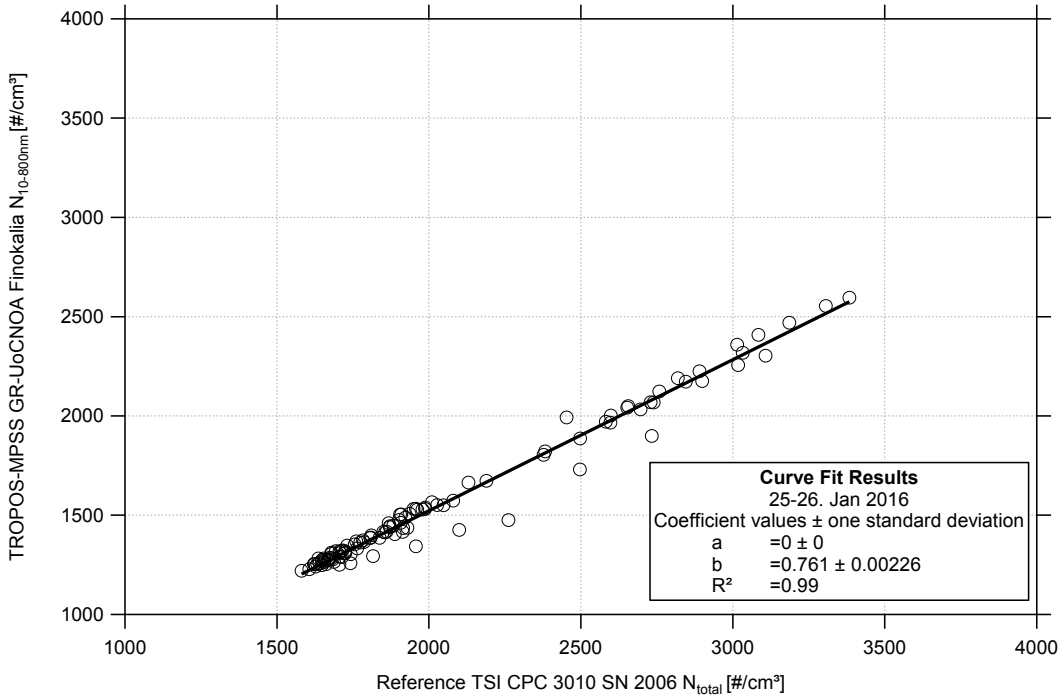


Figure 06: Linear regression between the number concentrations of the TROPOS-MPSS GR-UoC/NOA Finokalia and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

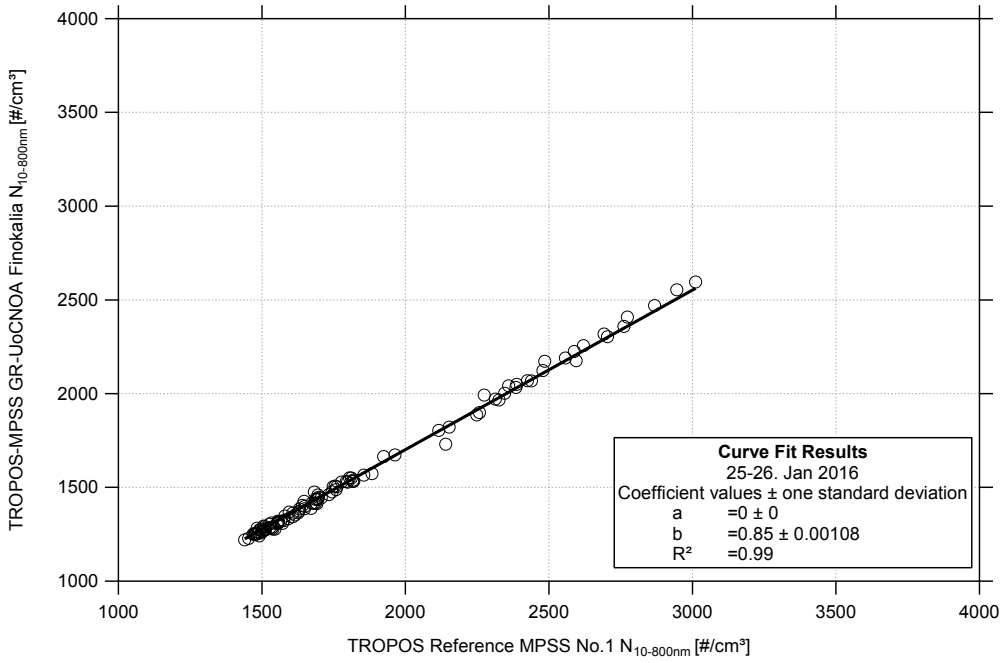


Figure 07: Linear regression between the number concentrations of the TROPOS-MPSS GR-UoC/NOA Finokalia and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final Status of the Candidate (January 28th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref1	MPSS	3772 SN 3772141701	1.6	**1.034**	l/min	0	# cm^{-3}
TROPOS		Total CPC	3010 SN 2006	1.5	**1.035**	l/min	0	# cm^{-3}
UoC/NOA	Finokalia	TROPOS-TSI	3772 SN 70717021	1.3	**1.010**	l/min	0	# cm^{-3}

High voltage calibration

Institute	System	[V]	0 V	4 mV	80 mV	800 mV
TROPOS	Reference MPSS No.1	Pre-status	-	-	-	-
		final		**4.9**		**1000**
UoC/NOA	Finokalia	Pre-status	-	-	-	-
		final		**4.9**		**999.5**

Latex 203nm ±4nm (pressure 1007 hPa, 23.0°C)

Institute	System		Latex 203 [nm]	Slope
TROPOS	Reference MPSS No.1	Pre-status	-	-
		final	**202.9**	**4.97**
UoC/NOA		Pre-status	-	-
		final		**2.82**

Time Series

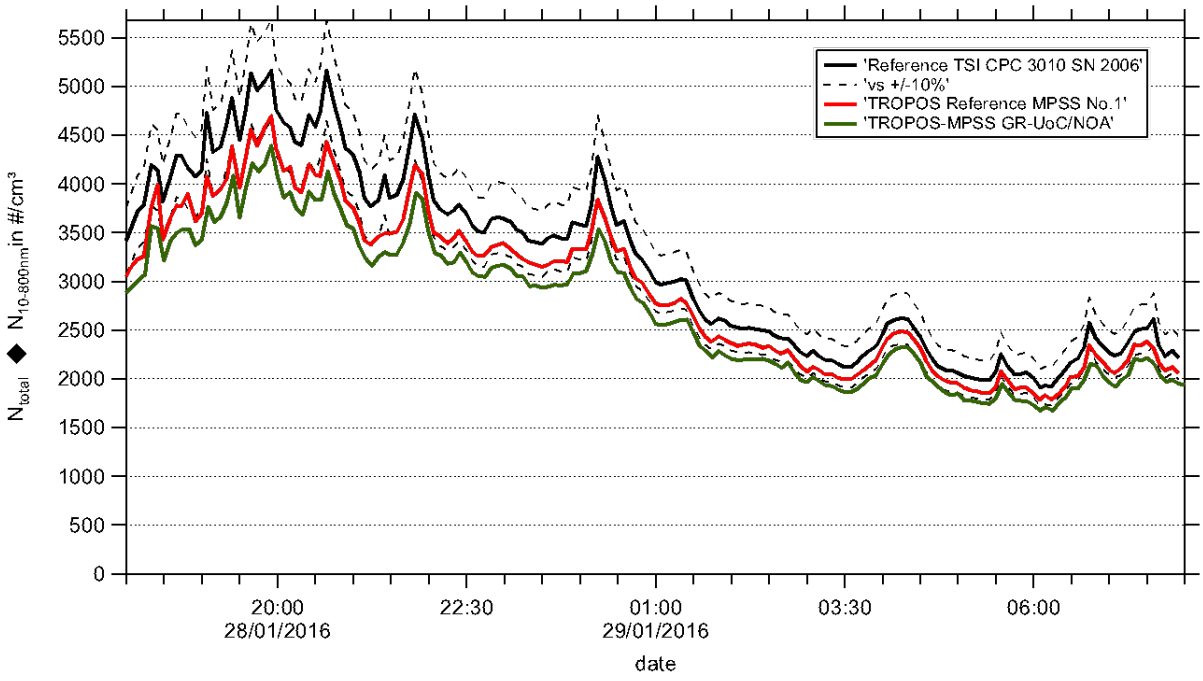


Figure 08: Time series (January 28, 2016 18:00 pm – January 29, 2016 08:00 am) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

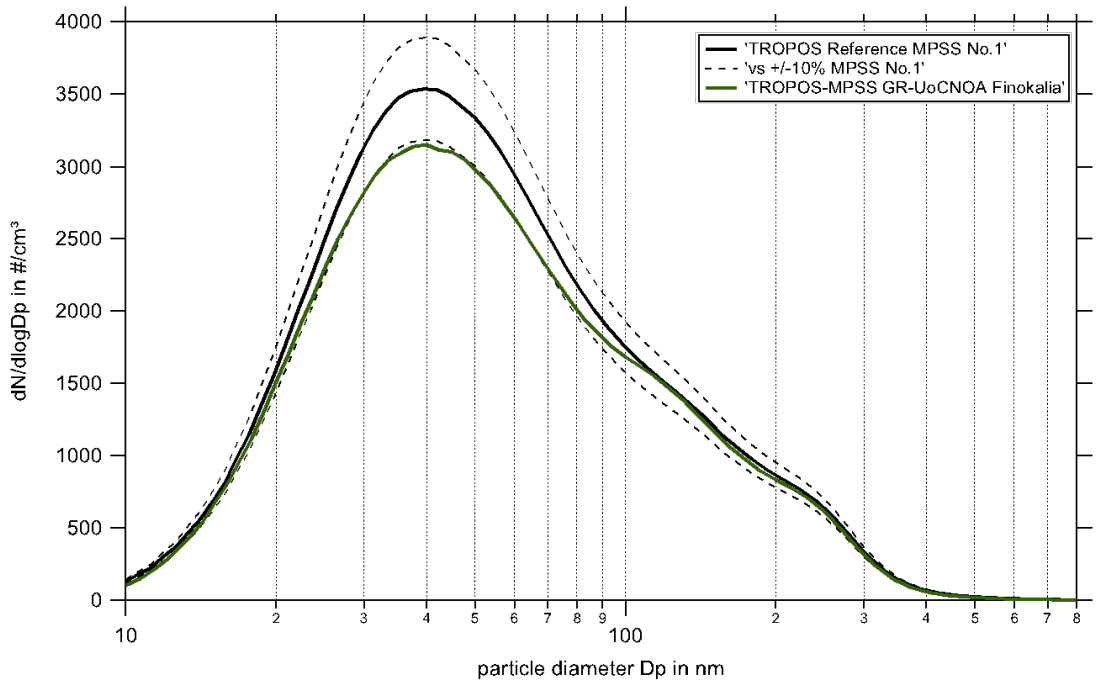


Figure 09: Comparison of mean particle number size distribution of Candidate MPSS and TROPOS reference MPSS No.1 from January 28, 2016 18:00 pm until January 29, 2016 06:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

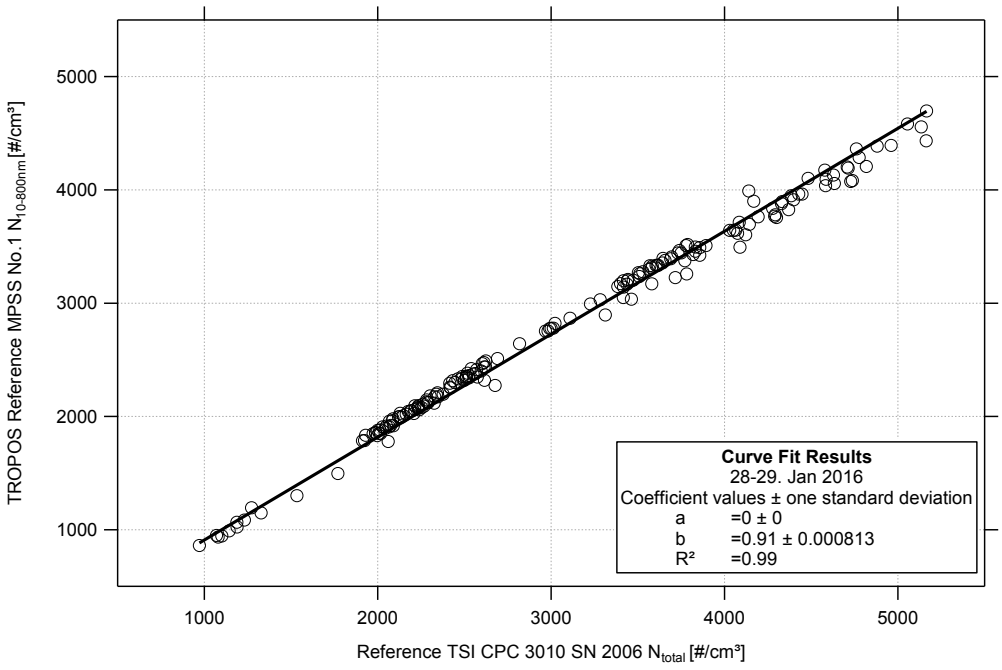


Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

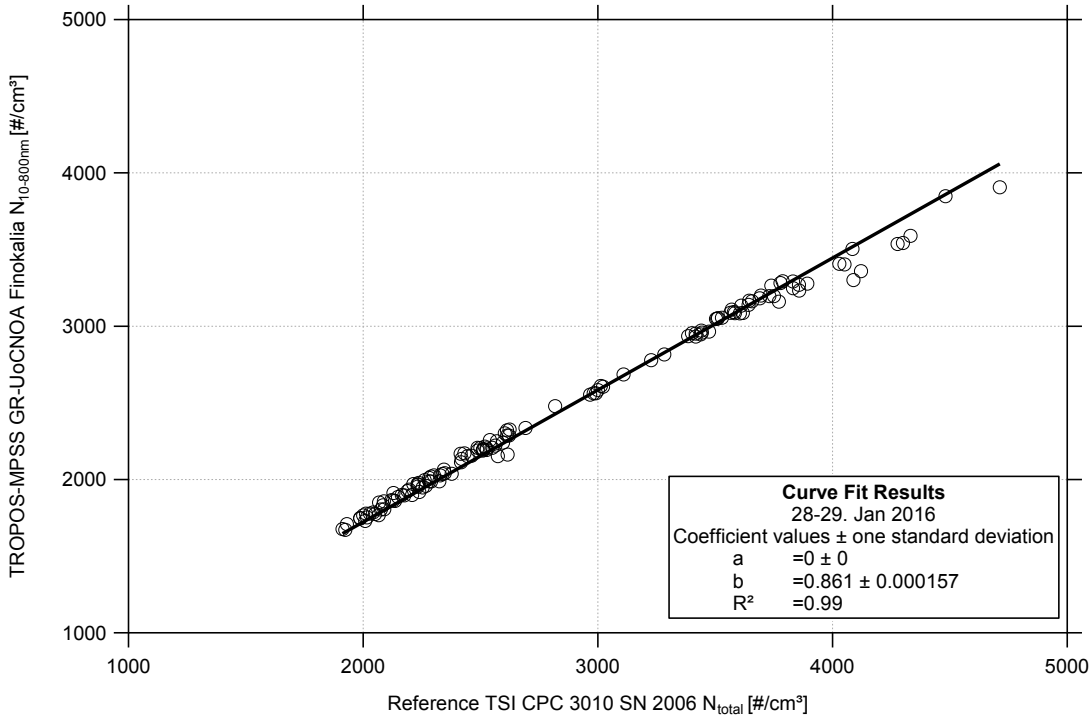


Figure 09: Linear regression between the number concentrations of the TROPOS-MPSS GR-UoC/NOA Finokalia and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

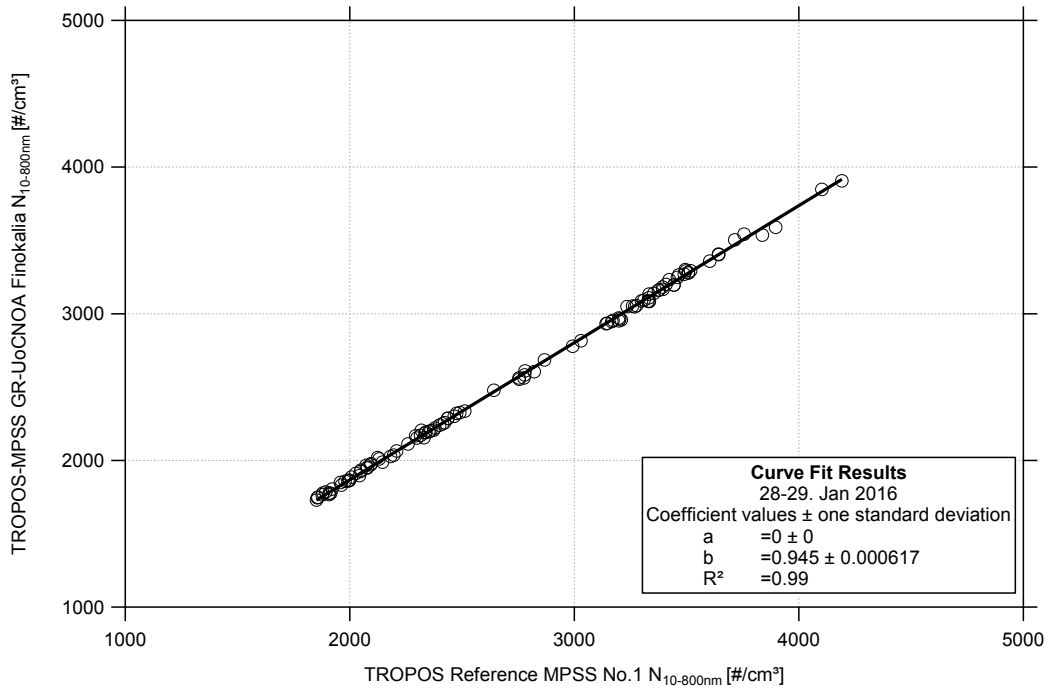


Figure 10: Linear regression between the number concentrations of the TROPOS-MPSS GR-UoC/NOA Finokalia and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.