TROPOS
Leibniz Institute for Tropospheric Research

ACTRiS

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2016-1-4

Basic information:

Location of the quality assurance: TROPOS, lab: 118

Delivery date: January 25, 2016 and February 16, 2016

Setup in the laboratory: January 25, 2016 and February 16, 2016

Comparison period: February 16, 2016 – February 22, 2016

Principal Investigator	Home Institution	Participant	Instrument
Valérie Gros	LSCE		GRIMM #54161103

Summary of Intercomparison:

Pre-status:
The GRIMM MPSS INERIS was not working well, therefore, it was necessary to send the system back to GRIMM for checks and possible repairs.

Final status:

The GRIMM MPSS INERIS passed the quality standards of ACTRIS and GAW.

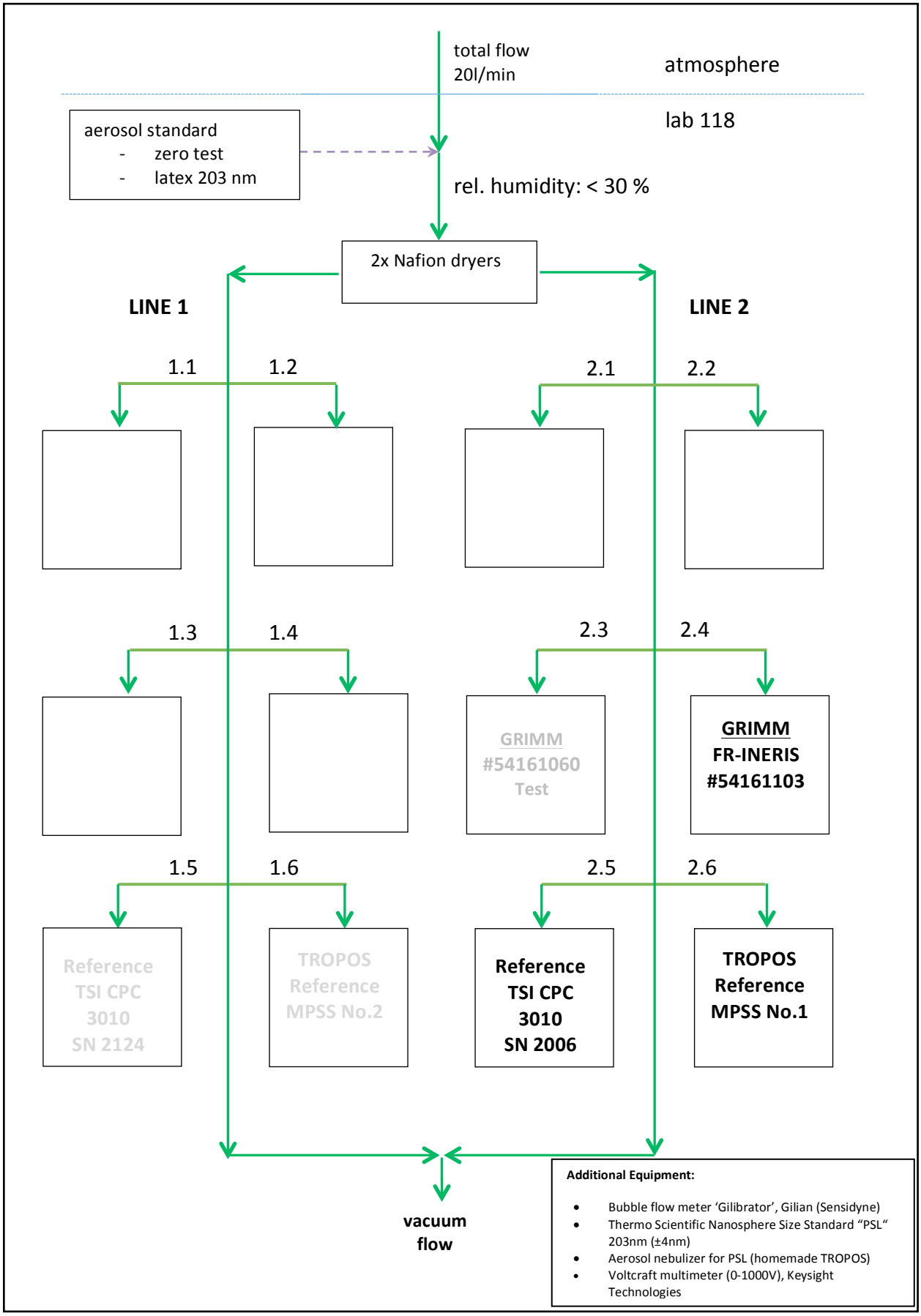
- Tag 1: GRIMM/FR: Stepping system, Am source, 0.3 L/min aerosol flow and 3 L/min sheath flow, 15 seconds waiting time, precision = 5, size range 10.25-1093 nm with 45 channels, 10 minutes scanning time
- Tag 2: GRIMM/FR: Stepping system, **NI-63**, 0.3 L/min aerosol flow and 3 L/min sheath flow, 15 seconds waiting time, precision = 5, size range 10.25-1093 nm with 45 channels, 10 minutes scanning time
- Tag 3 (18.02.): GRIMM/FR: **Stepping system**, **Kr.85**, 0.3 L/min aerosol flow and 3 L/min sheath flow, 15 seconds waiting time, precision = 5, size range 10.25-1093 nm with 45 channels, 10 minutes scanning time
- update software GRIMM-FR (from V. 1.2.3 to V. 1.5.9)

  Ambient 18.02.: GRIMM/FR: **scanning system**, **Kr.85**, 0.3 L/min aerosol flow and 3 L/min sheath flow, 15 seconds waiting time, precision = 5, size range 7.97-1357 nm with 143 channels, 5 minutes scanning time (see picture taken). Without impactor.

List of Components

	Specification	**Reference MPSS No.1**	**GRIMM FR-INERIS**
Position (Line)		1.6	1.4
Company		TROPOS	GRIMM
Software		TROPOS 5.7	GRIMM
CPC		Model 3772 SN: 3772141701	Model 5.416 SN : 54161103
Flow ratio		1.0 : 5.0	0.3 : 3.0
Source		Kr85	Am241
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



Pre- Status of the Candidate (February 16th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref1	MPSS	3772 SN 3772141701	2.6	**1.004**	l/min	0	# cm^{-3}
TROPOS		Total CPC	3010 SN 2006	2.5	**1.019**	l/min	0	# cm^{-3}
INERIS		GRIMM CPC	54161103	2.4	**0.304**	l/min	0	# cm^{-3}

Time Series

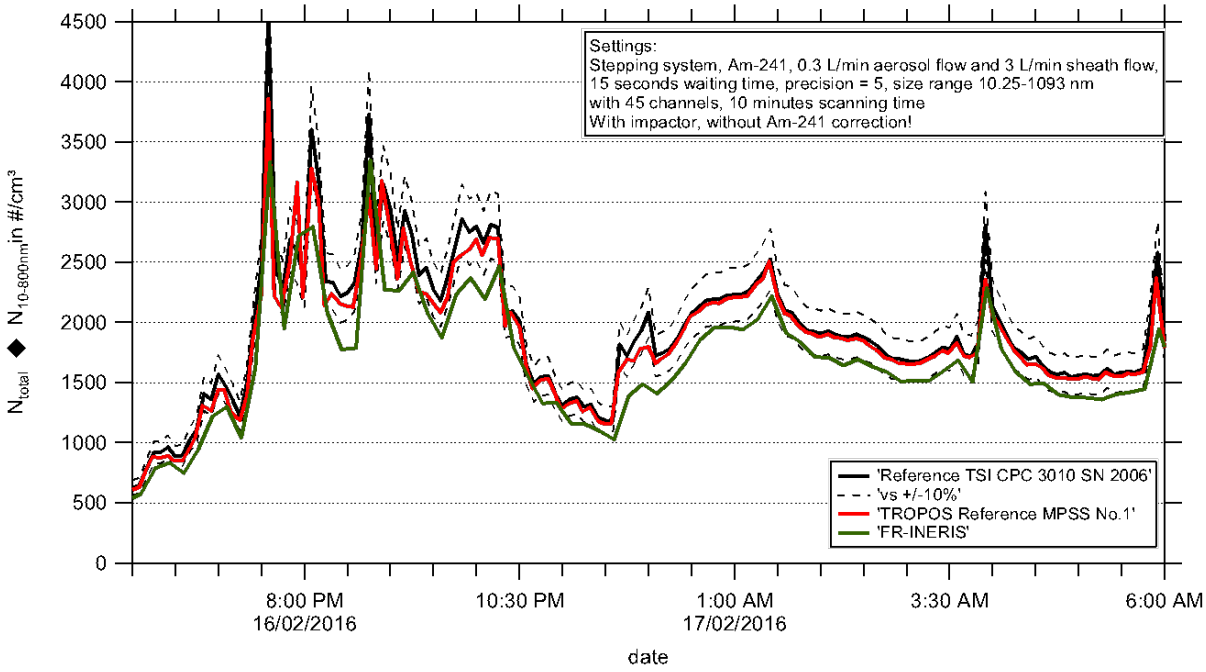


Figure 01: Time series (February 16, 2016 6:00 pm – February 17, 2016 6:00 am) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

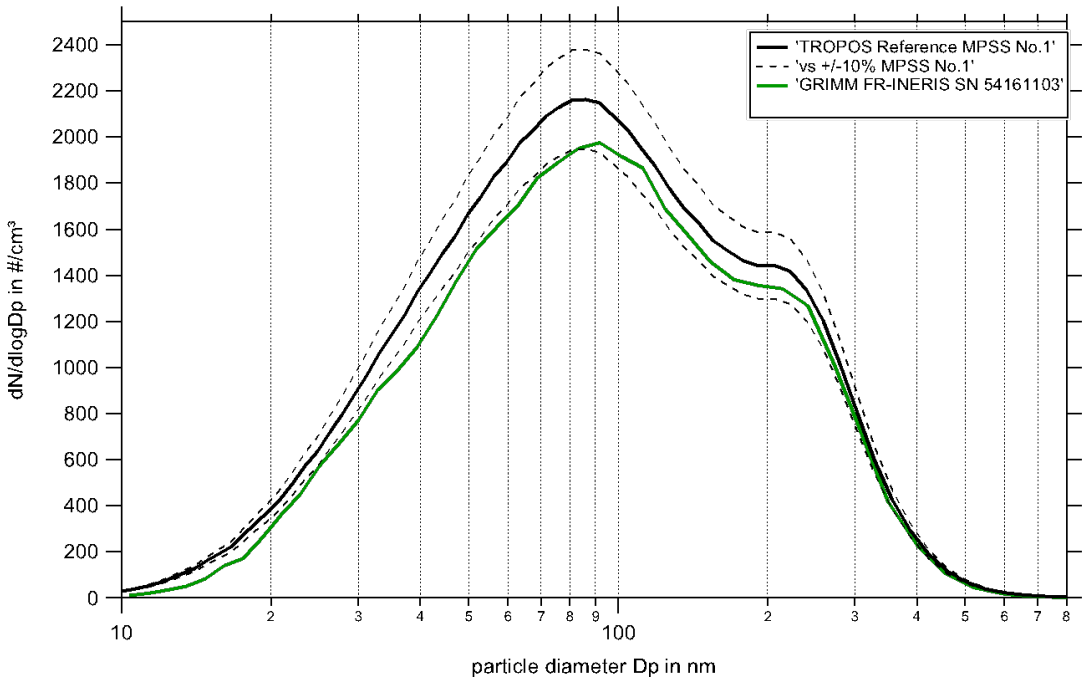


Figure 02: Comparison of mean particle number size distribution of GRIMM-MPSS and TROPOS Reference MPSS No.1 from February 16, 2016 6:00 pm until February 17, 2016 6:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation between the Reference CPCs Model 3010 and TROPOS Reference MPSS No.1

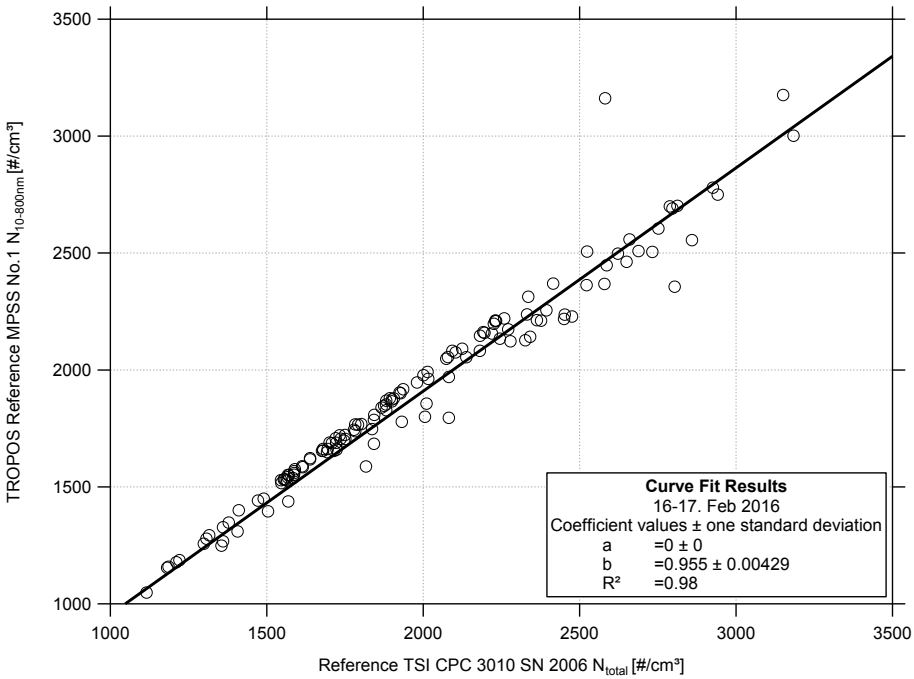


Figure 03: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Correlation between the Reference TSI CPC Model 3010 and GRIMM FR-INERIS

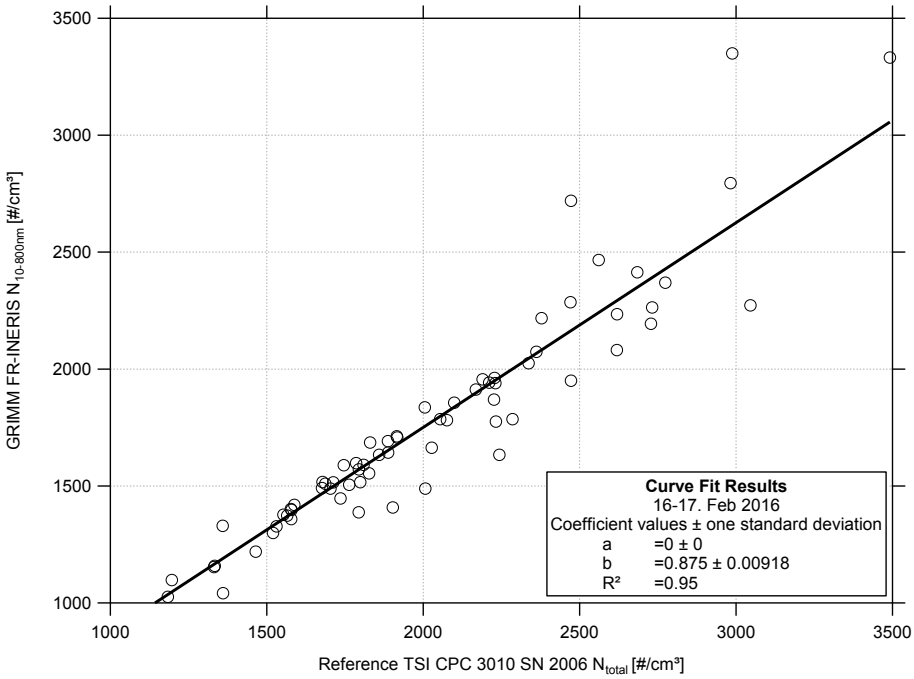


Figure 04: Linear regression between the number concentrations of the GRIMM FR-INERIS and TROPOS Reference TSI CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Correlation between the TROPOS Reference MPSS No.1 and GRIMM FR-INERIS

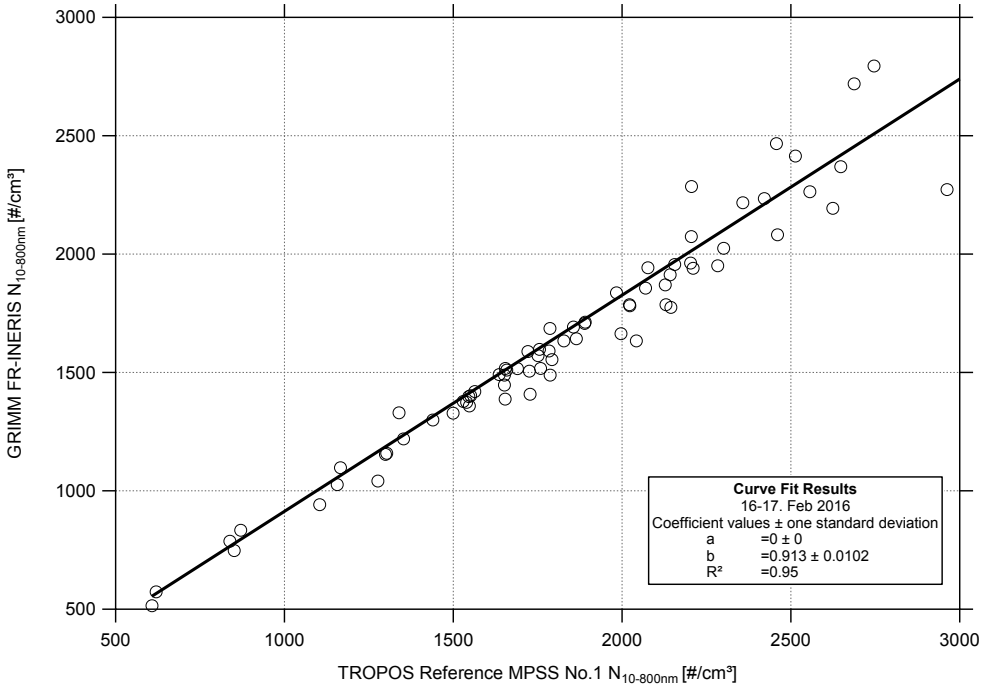


Figure 05: Linear regression between the number concentrations of the GRIMM FR-INERIS and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final Status of the Candidate (February 22)

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

Institute	System		Latex 203 [nm]	slope
TROPOS	Reference MPSS No.1	Pre-status	202	**4.97**
		final	**202.83**	**4.97**
FR	GRIMM	Pre-status	206	-
		final	**203.94**	

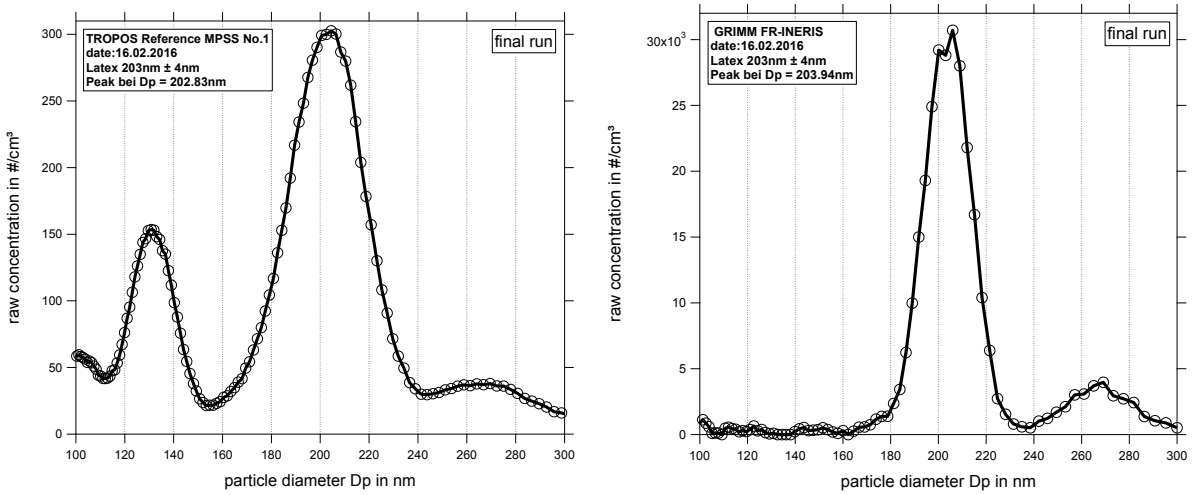


Figure 06: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on February 16, 2016.

Time Series

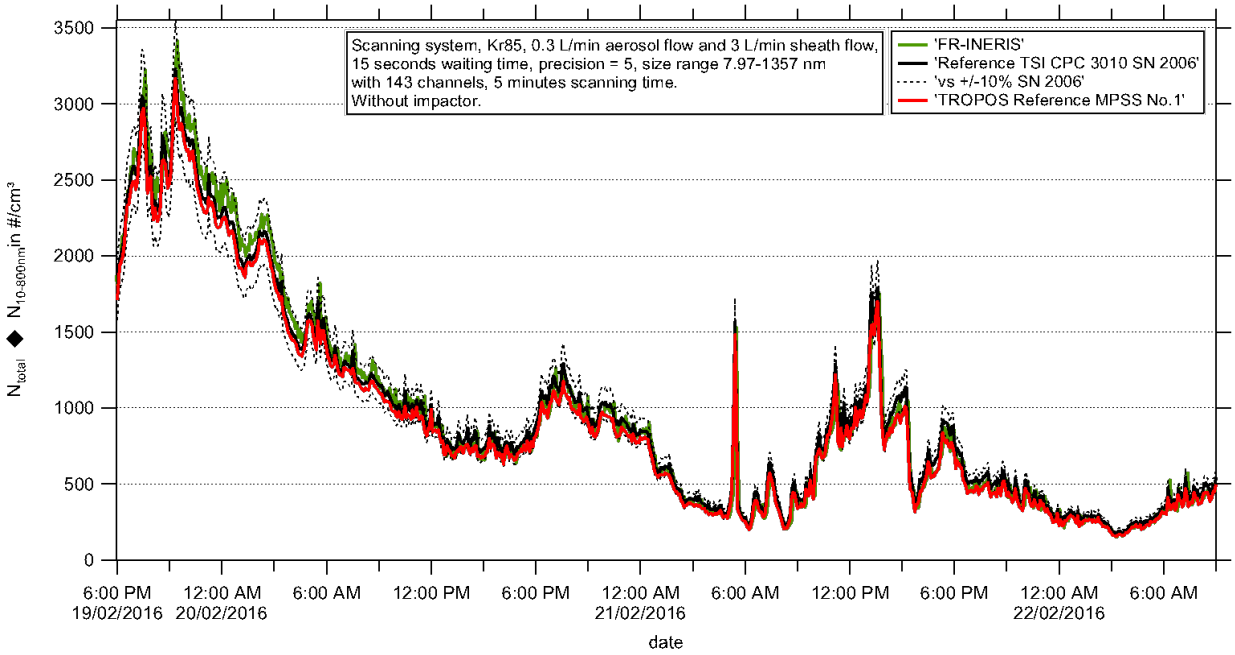


Figure 07: Time series (February 19, 2016 6:00 pm – January 22, 2015 6:00 am) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

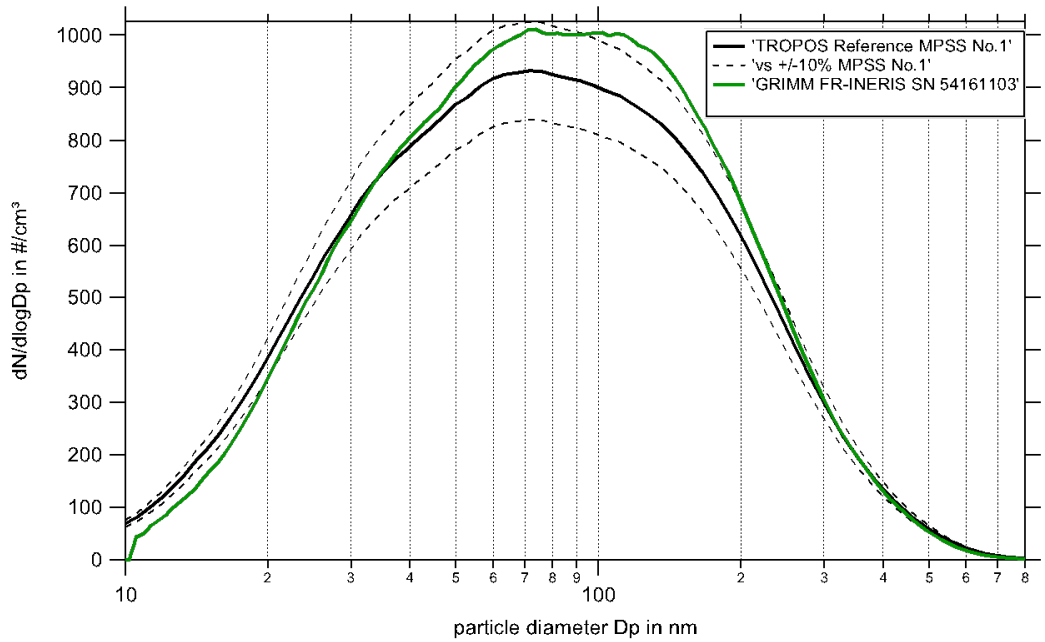


Figure 08: Comparison of mean particle number size distribution of GRIMM FR-INERIS and TROPOS Reference MPSS No.1 from February 16, 2016 6:00 pm until February 17, 2016 6:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation between the Reference CPCs Model 3010 and TROPOS Reference MPSS No.1

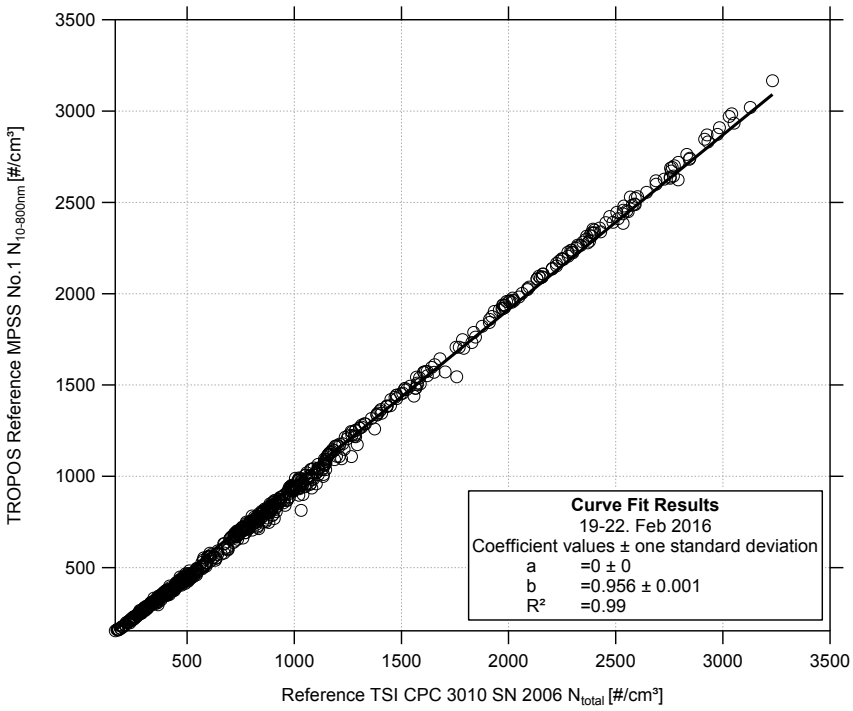


Figure 09: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Correlation between the Reference TSI CPC Model 3010 and GRIMM FR-INERIS

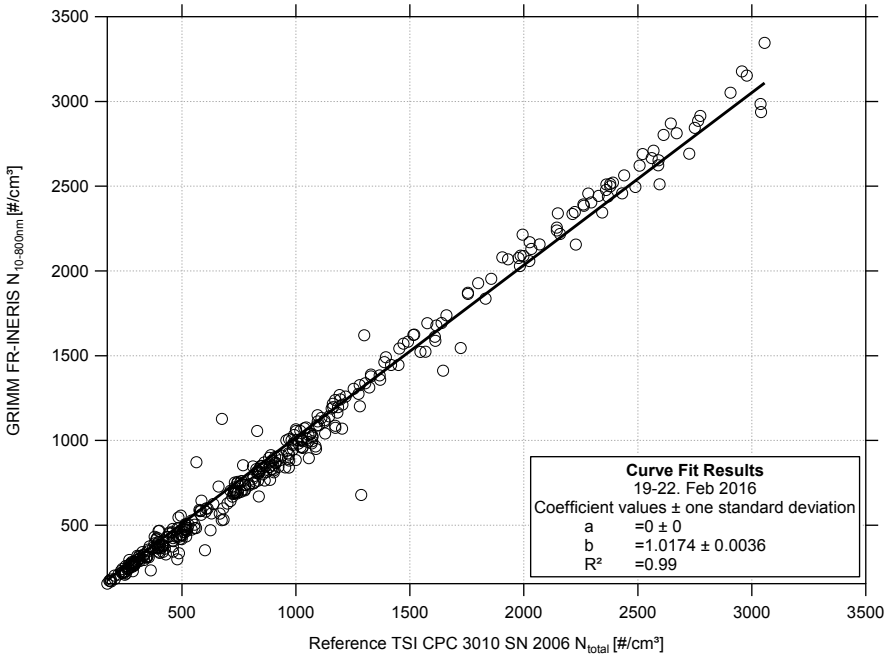


Figure 10: Linear regression between the number concentrations of the GRIMM FR-INERIS and TROPOS Reference TSI CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Correlation between the TROPOS Reference MPSS No.1 and GRIMM FR-INERIS

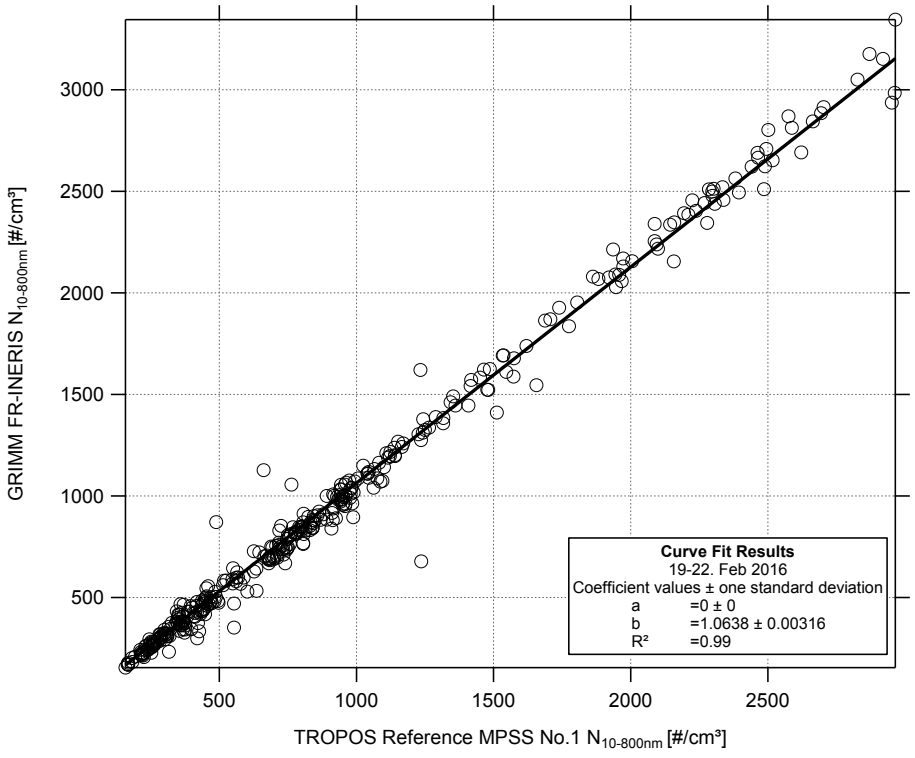


Figure 11: Linear regression between the number concentrations of the GRIMM FR-INERIS and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.