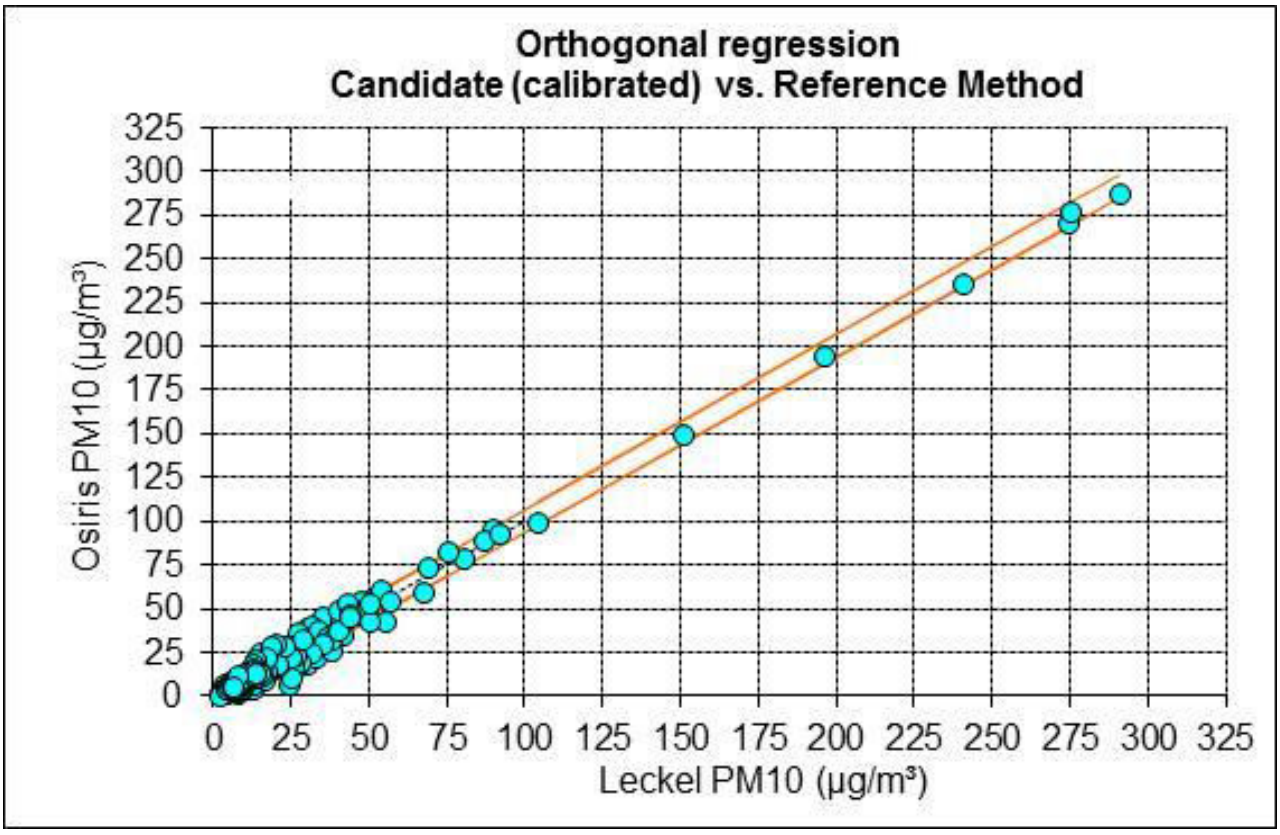
Demonstration of Equivalence of Osiris at PM10

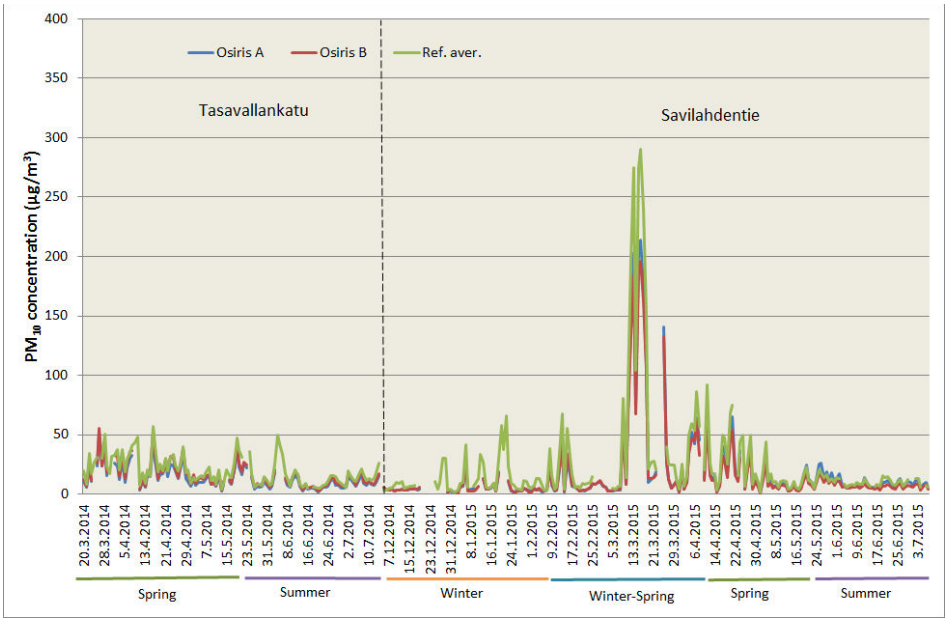
This note summarizes the results of a PM10 equivalence comparison that took place between March 2014 and July 2015 at sites in the city of Kuopio, 400 km northeast of Helsinki. The location represented inland conditions well away from maritime influences. The city is surrounded by lakes, forests and agricultural areas.

The study was undertaken by the Finnish Meteorological Institute and the full report (1) is available from www.fmi.fi.

Two Turnkey OSIRIS instruments and an approved PM10 reference sampler were co-located at the sampling sites. The reference sampler was a Leckel SEQ47/50 sequential sampler which is designated as a PM10 reference method in accordance with CEN EN 12341.



OSIRIS PM10 linearity



Comparative seasonal PM10 time series

RAW DATA			RESULTS AFTER CALIBRATING		
Regression	1,401y + -0,153		N (Spring)	142	n
Regression (i=0)	1,398y		N (Summer)	73	n
N	284	n	N (Fall)	0	n
			N (Winter)	69	n
Outliers	15	n	Outliers	31	n
Outliers	5,3%	%	Outliers	10,9%	%
Mean CM	15,9	µg/m³	Mean CM	22,132	µg/m³
Mean RM	22,1	µg/m³	Mean RM	22,132	µg/m³
Number of RM > 0,6 * LV	48	n	Number of CM > 0,6 * LV	48	n
Number of RM > LV	19	n	Number of CM > LV	21	n
REGRESSION RESULTS (RAW)			**REGRESSION RESULTS (CALIBRATED)**		
Slope b	0,71389	significant	Slope b	1,002	
Uncertainty of b	0,005		Uncertainty of b	0,007	
Intercept a	0,10954		Intercept a	-0,045	
Uncertainty of a	0,200		Uncertainty of a	0,281	
r^2	0,988		r^2	0,988	
Slope b forced trough origin	0,715	significant			
Uncertainty of b (forced)	0,0040				
EQUIVALENCE TEST (RAW)			**EQUIVALENCE TEST (CALIBRATED)**		
Uncertainty of calibration	0,31	µg/m³	Calibration	1,401y -0,153	
Uncertainty of calibration (forced)	0,20	µg/m³	u(calibration)	0,310	µg/m³
Random term	2,71	µg/m³	Random term	3,93	µg/m³
Additional uncertainty (optional)	0,00	µg/m³	Additional uncertainty (optional)	0,00	µg/m³
Bias at LV	-14,20	µg/m³	Bias at LV	0,06	µg/m³
Combined uncertainty	14,45	µg/m³	Combined uncertainty	3,93	µg/m³
Expanded relative uncertainty	57,8%	**fail**	Expanded relative uncertainty	15,7%	***pass***
Ref sampler uncertainty	1,00	µg/m³	Ref sampler uncertainty	1,00	µg/m³
Limit value	50	µg/m³	Limit value	50	µg/m³

Data summary

After local calibration, the expanded relative uncertainty of the OSIRIS instruments when compared to the CEN reference method is 15.7%. This is much better than the 25% maximum measurement uncertainty required to meet the performance requirements of the EU Air Quality Directive 2008/50/EC.

1. Demonstration of the equivalence of PM measurements in Kuopio 2014-2015, Walden et al. Finish Meteorological Institute Report 2017:1