Comparison of Online and Offline ED-XRF Techniques for Atmospheric PM10 Measurement

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INTRODUCTION

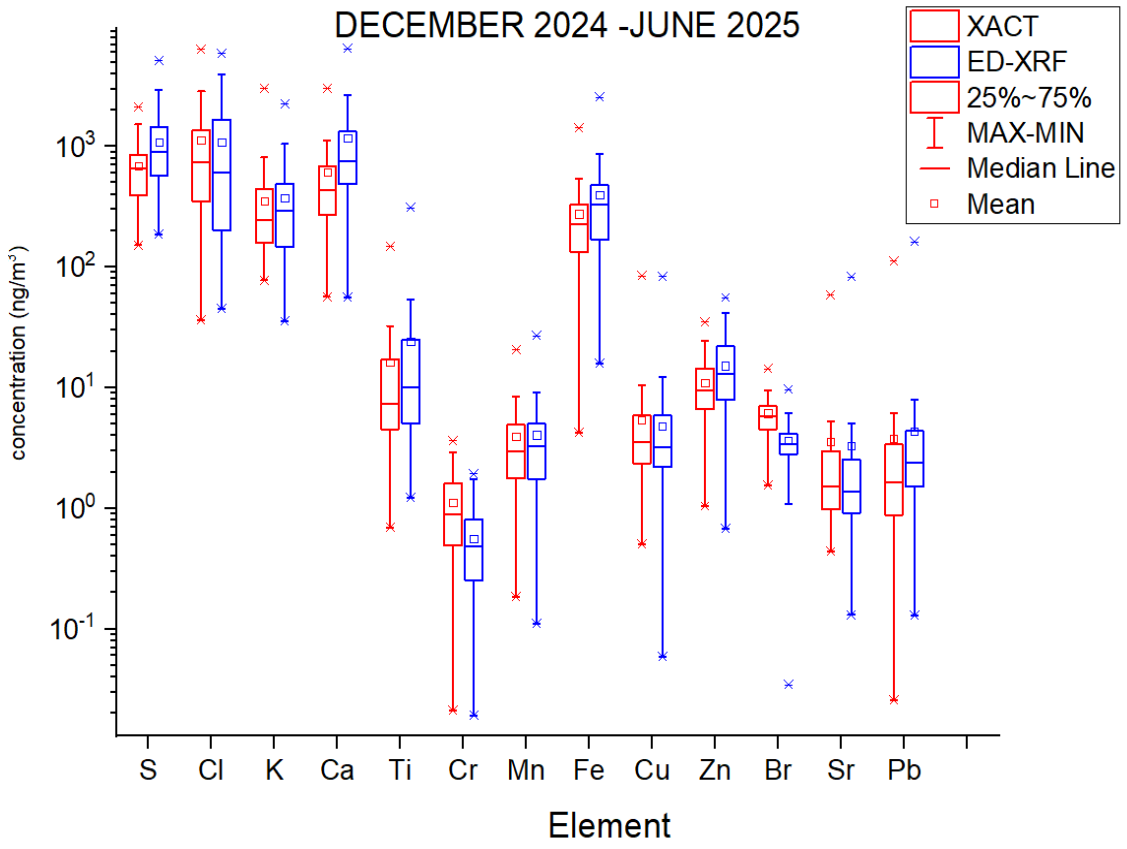
EXPERIMENT	ED-XRF (offline)	XACT (online)
SITE	ECO (*) (LAB-BASED XRF ANALYSIS)	ECO (IN SITU)
COLLECTED FILTERS	(*)samples was collected on filters using a dual-channel sampler at 2.3 m^3 h^{-1}	instrument automatically samples and analyses spots
SUBSTRATE	quartz	teflon
PM	PM 10	
TIME RESOLUTION	24 h	3h
# OF ELEMENT	19 elements from Al to Pb	36 elements from Al to Bi

(*) Unga, F., et al., Determination of aerosol composition by ED-XRF on Teflon and quartz substrates: potentialities and limits. Aerosol Research, 2025. 3(2): p. 405-415

METHODS

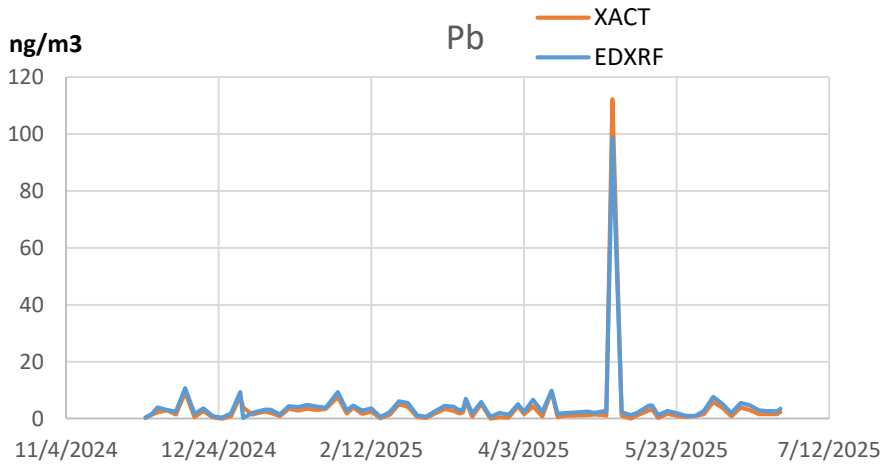
METHOD	ED-XRF (offline)	XACT (online)
TIME	From December 2024 to June 2025 (76 sample)	
ELABORATION DATA	Data < MDL replaced with 0.5 x MDL	3-h samples were averaged to 24-h to match daily filters. less than 6 valid 3-hourly values available. Data < MDL replaced with 0.5 x MDL
INTERCOMPARISON	13 elements with concentrations consistently above the MDL for both online and offline techniques: (S, Cl, K, Ca, Ti, Cr, Mn, Fe, Cu, Zn, Br, Sr, Pb)	
STATISTICAL ANALYSIS	Linear regression, R^2	

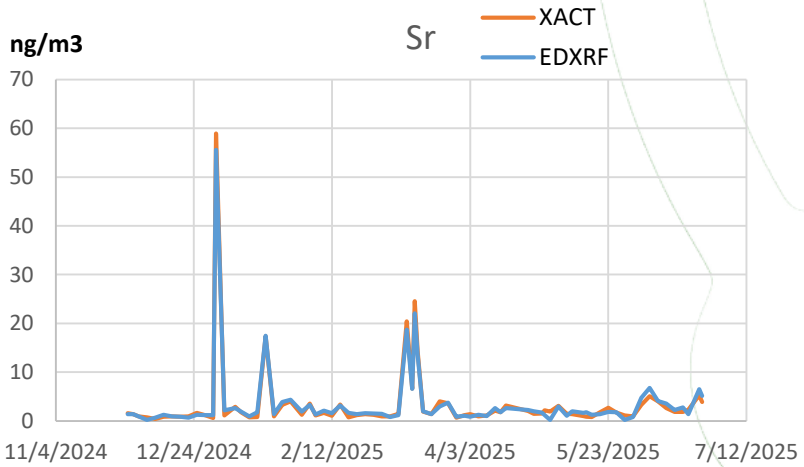
RESULTS: intercomparison of Xact and ED-XRF

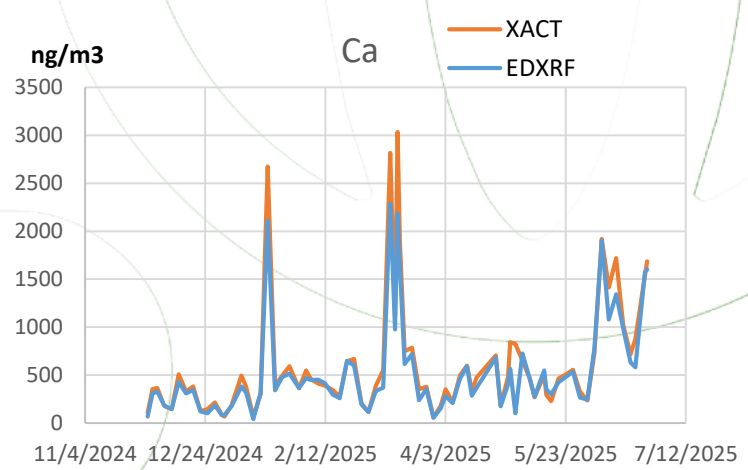


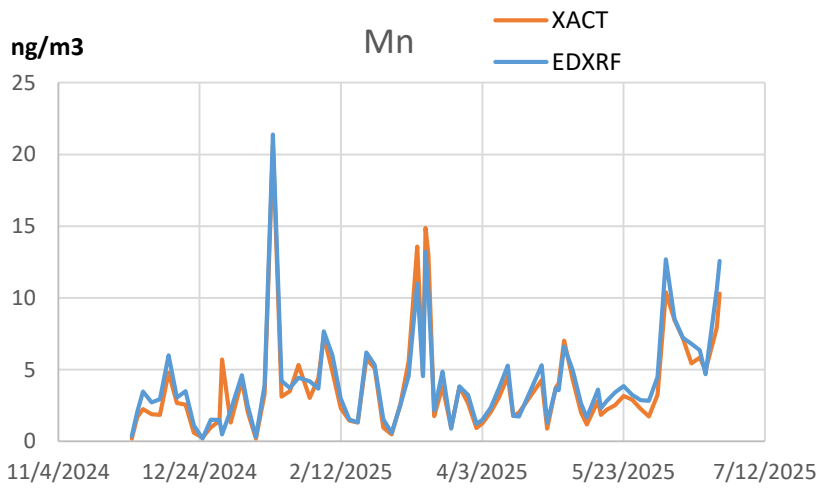
ELEMENT	LINEAR REGRESSION (SLOPE)	R^2
SULPHUR	0.75	0.79
CHLORINE	0.62	0.69
POTASSIUM	0.75	0.85
CALCIUM	0.89	0.97
TITANIUM	1.13	0.99
CHROMIUM	0.69	0.91
MANGANESE	1.01	0.92
IRON	0.77	0.99
COPPER	0.96	0.82
ZINC	1.05	0.84
BROMIUM	0.68	0.60
STRONTIUM	1.02	0.95
LEAD	1.05	0.96

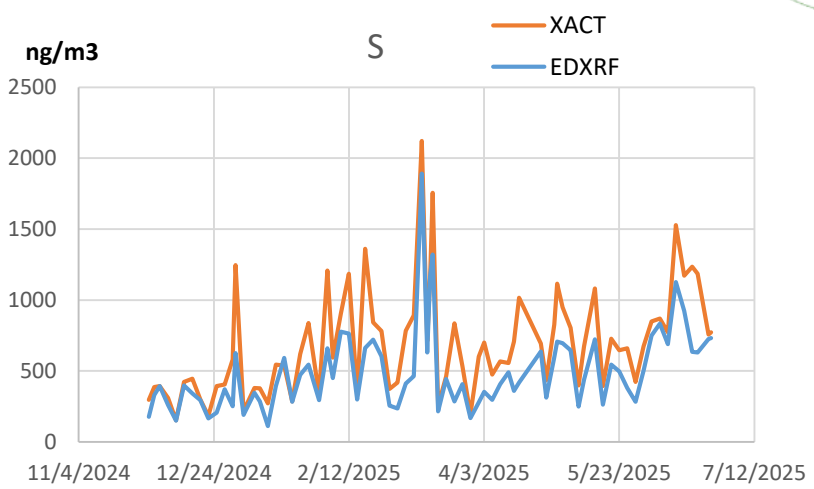
RESULTS: intercomparison of Xact and ED-XRF

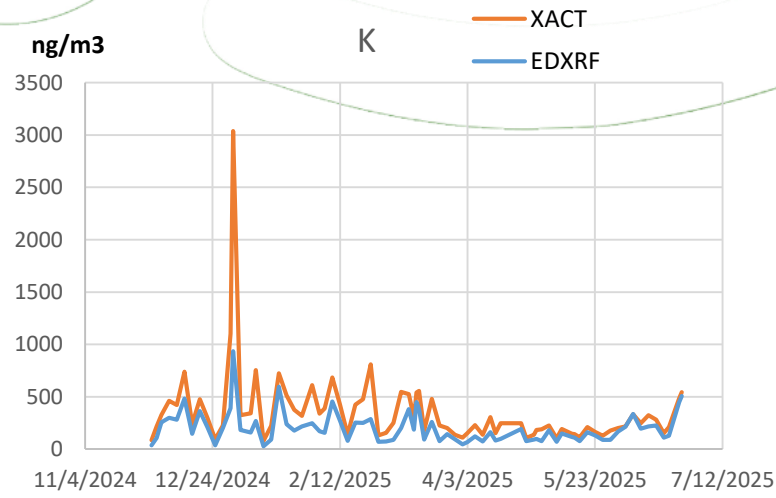






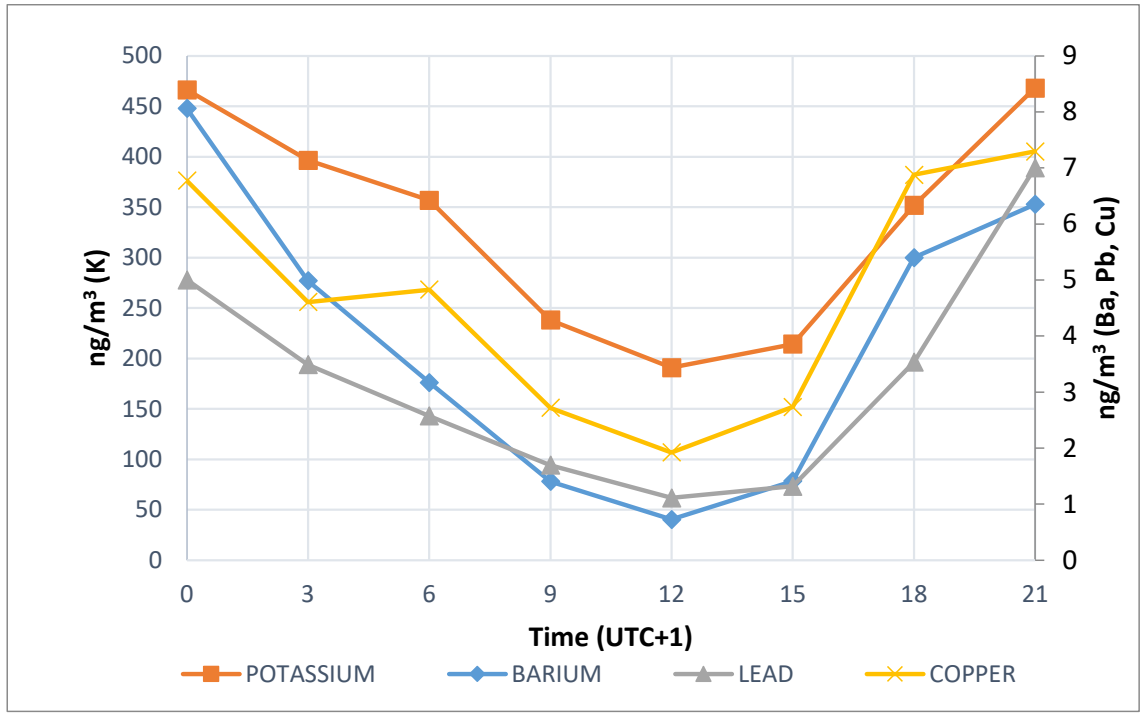




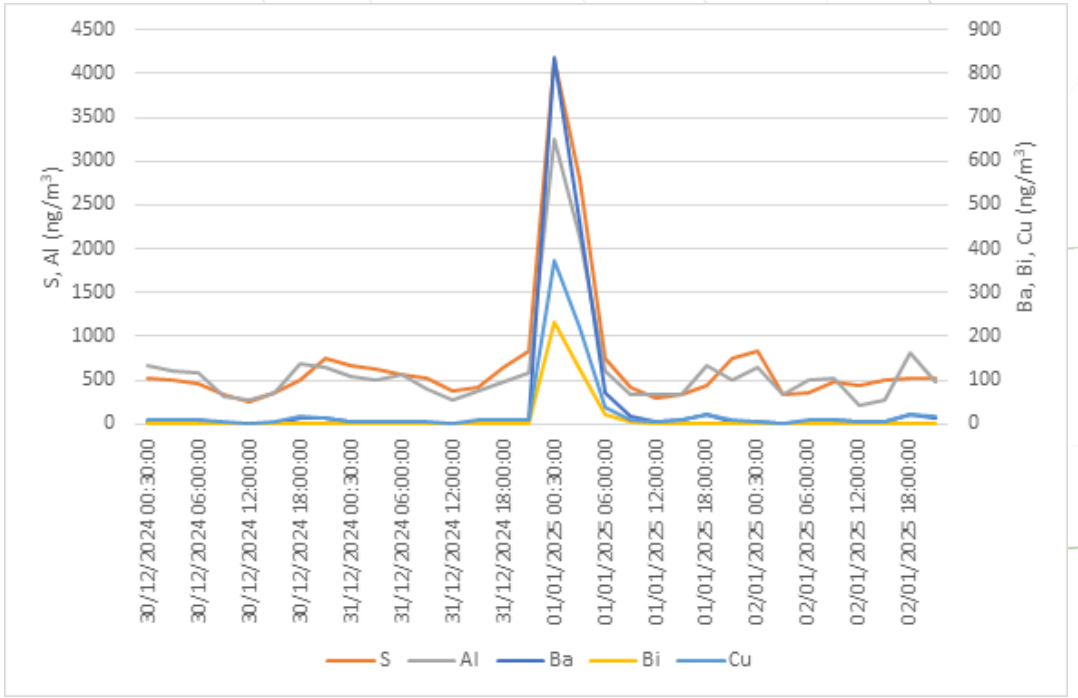


TIME RESOLUTION OF XACT

BOUNDARY LAYER



FIREWORKS 1 JANUARY



CONCLUSION

- Results obtained with the two XRF techniques were **compared** in order to verify the goodness and reliability of the analyses of XAct;
- Different substrates were used for comparison (**Teflon and quartz**) and **13 elements** were compared;
- The concentrations of the elements compared show overall **good correlation** (best correlations for Ti, Mn, Sr, Pb);
- Participation in the MITRAP project.

FUTURE OBJECTIVES

- Investigating possible underestimation of ED-XRF during high pollution events;
- Intercomparison in which the same filters will be analysed by both system.

THANKS!

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