PART'AERA: Comparison of PM10 emission sources and measurement methods on both sides of the Alps

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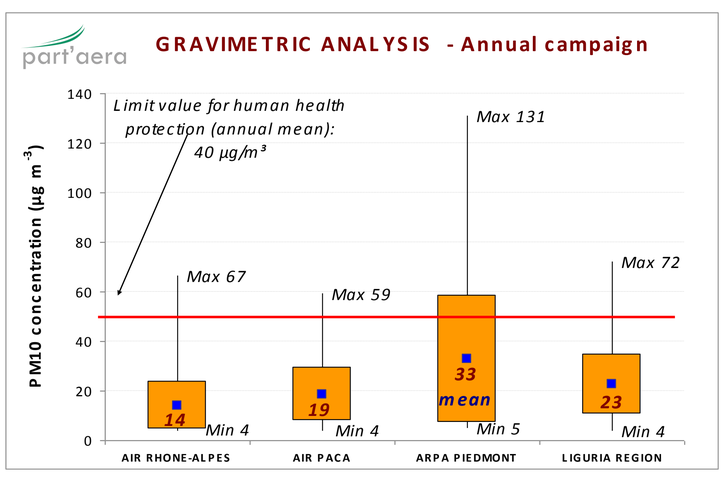
*Every winter the alpine region suffers **pollution episodes** due to emissions of particulate matter and its precursors, propitiated by meteorology and topography unfavorable to dispersion.*

As a result every year, both France and Italy recorded violations of the limits of European law for different pollutants.

PART'AERA is a European project, funded by EFRD, realized in the ALCOTRA zone from January 2013 to march 2015 with a partnership of 4 different subjects: Arpa Piemonte and Liguria Region in Italy, Air Rhône-Alpes and Air PACA (Provence Alpes- Côte d'Azur) in France. **Aim of the project** is to harmonize knowledge on measurement methods on both sides of the Alps and to evaluate the emission sources of atmospheric particulate matters (PM).

A **PM_{10} ANNUAL SAMPLING CAMPAIGN** was carried out from July 2013 to July 2014 with gravimetric and automatic instruments, in all four Part'Aera sites, both rural and urban.



* *Formally its not possible comparing results of Liguria Region with other partners, as the annual campaign in Cengio lasts only from April to July 2014.*

PM_{10} gravimetric annual means in all sites **do not exceed the annual limit value of 40 mg/m³** both in urban and rural contests.

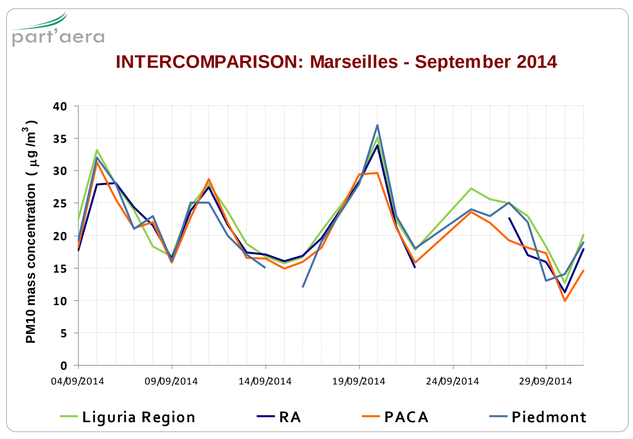
Highest variability was found in Turin, due to emissions and meteorological conditions of Po Valley.

A **good correlation** between gravimetric and two different automatic instruments (**TEOM-FDMS**, used in France and **Gauge Beta**, in Italy) was found.

Nevertheless French instruments overestimated, whilst Italian monitors showed an underestimation in comparison with the gravimetric method.

A **FIELD INTERCOMPARISON** of PM10 gravimetric measurement methods was also carried out in Marseilles, inside the park Longchamp, a background site in the city center.

2 types of gravimetric samplers - Partisol PLUS 2025 for French partners and Skypost PM HV for Italian ones - have sampled for 28 days throughout September 2014.



The **results** were **consistent with** the data quality objectives of Dir. **2008/50/CE**. The standard deviation, between 2.1% and 14.9% (average deviation 8.1%) is related to the use of different operators, modes of transport and laboratories.

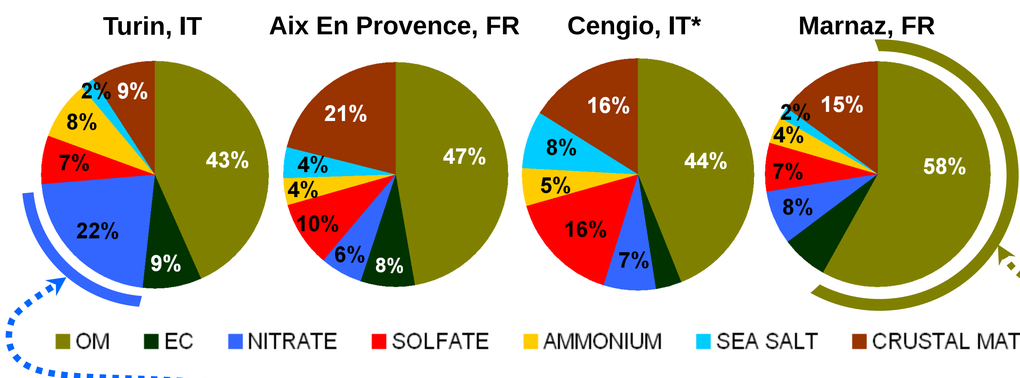
An annual campaign to carry out in-depth **CHEMICAL SPECIATION** was also performed with high volume PM10 Digitel DA80 sampler (120 sampling days).

All analyses were performed by LGGE-CNRS and LCME-University of Savoy laboratories, France.

part'aera	**Chemical speciation List of analytes**
Carbonaceous Species:	OC EC et TC
Anions:	Cl^-, NO_3^-, SO_4^{2-}, Oxalates
Cations:	NH_4^+, Ca_2^+, Mg_2^+, K^+, Na^+
Metals:	Al, Sb, As, Ba, Cd, Cs, Co, Cr, Fe, La, Mn, Mo, Ni, Pd, Cu, Se, Sn, Sr, Rb, Ti, V, Zr et Zn
Organic species:	• Levoglucosane, mannosane, galactosane, glucose, mannitol, arabitol and sorbitol • PAH, alkanes

PM mass balance on annual mean concentrations shows that most species identified are: **organic matter, crustal matter, sulfates and nitrates** which constitute from 63% up to 87% of particulate matter.

(Annual campaign in Liguria Region - Cengio lasts from April to July 2014).

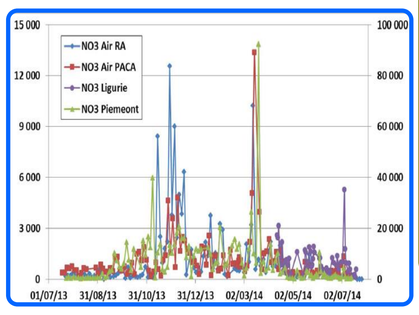


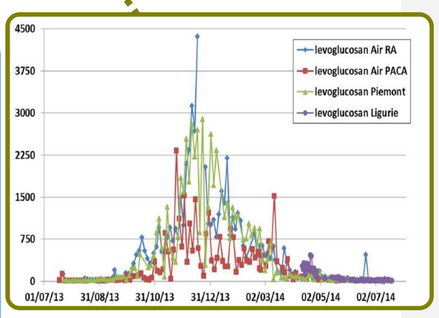
MASS BALANCE EQUATION

$[PM10] = [OC*1.75]+[EC]+[nss\text{-}sulfate]+[NO_3^-]+[NH_4^+]+3*[Na]+10*[Ca]$

N.B. As a reference data item it has not been used mass of PM_{10} but the sum of analyzed components.

Secondary inorganic PM_{10} components, such as ammonium nitrate, are well represented at **Piedmont** site. Concentrations of NO_3^- and NH_4^+ exceed even 10 times those measured in other sites.





At **Marnaz** more than 50% of PM10 concentration is OM (Organic Matter), due to the considerable impact of biomass burning in such a typical alpine valley. Levoglucosan is an unique marker of biomass burning and shows an important colinearity with OM.

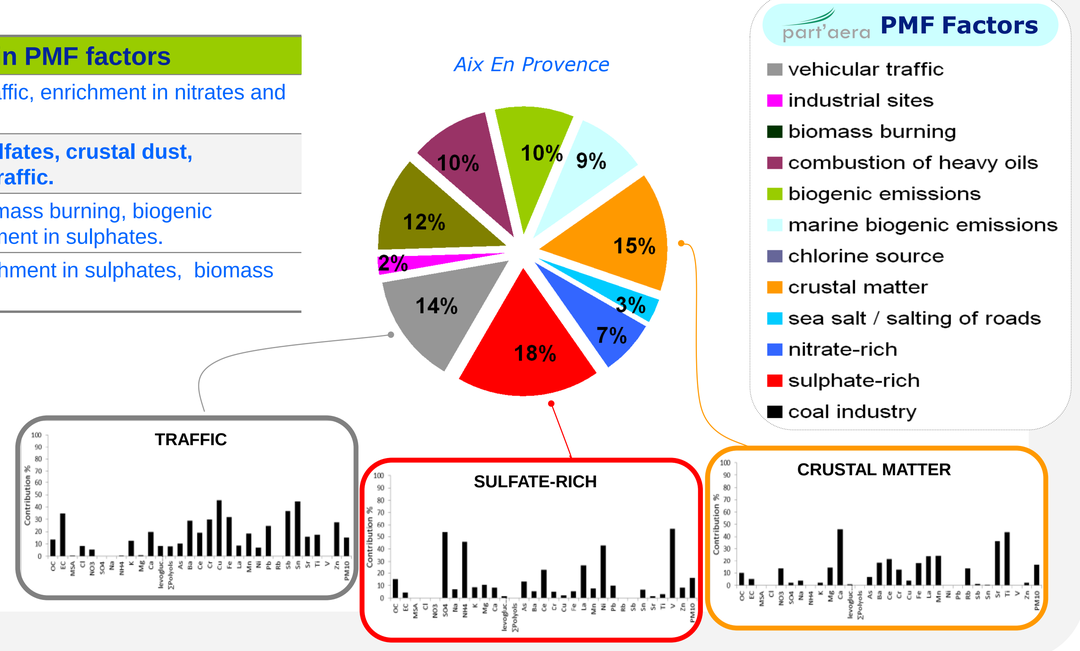
Mass balance analysis have been used to identify and apportion sources of PM, within the **PMF SOURCE APPORTIONMENT** model.

PMF analysis led to identification of **12 factors** for Part'aera sites. Each factor being a linear combinations of species characteristic of every source.

PART'AERA - Main PMF factors	
TURIN IT	Emissions from traffic, enrichment in nitrates and sulfates.
Aix en Provence FR	**Enrichment in sulfates, crustal dust, emissions from traffic.**
Marnaz FR	combustion of biomass burning, biogenic emissions, enrichment in sulphates.
Cengio IT	Crustal dust, enrichment in sulphates, biomass burning.

Source apportionment Es.:

PMF annual campaign outcome for **Aix En Provence** (PACA) with its three major factors profiles.



Project data available on official website: www.partaera.eu