Approcci di *Source Apportionment* a confronto nel progetto MED-APICE

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Common Mediterranean strategy and local practical Actions for the mitigation of Port, Industries and Cities Emissions

Project co-financed by the European Regional Development Fund MED Programme 2007-2013

Budget: 2.281.400,00 €

Project timetable: June 2010-November 2012

APICE's contents

The focus

Reduction of air pollution in port cities,
selecting the most effective policies in terms of cost/benefits balance

Specific objectives

1. **Pinpointing the relative contribution** to air quality **of pollution sources** in the 5 project harbour areas *(focus on PM10 & PM2.5)*

2. **Strengthen the governance capacity to arbitrate** between conflicting socio-economic & environmental interests by including the air pollution analysis and trend scenarios within the already existing Sectorial Plans

3. **Facilitate and promote voluntary agreements** between local administration, port authorities, ship owners and cargos' handlers to reduce air pollution caused by on-berth vessels ("green ports" approach)

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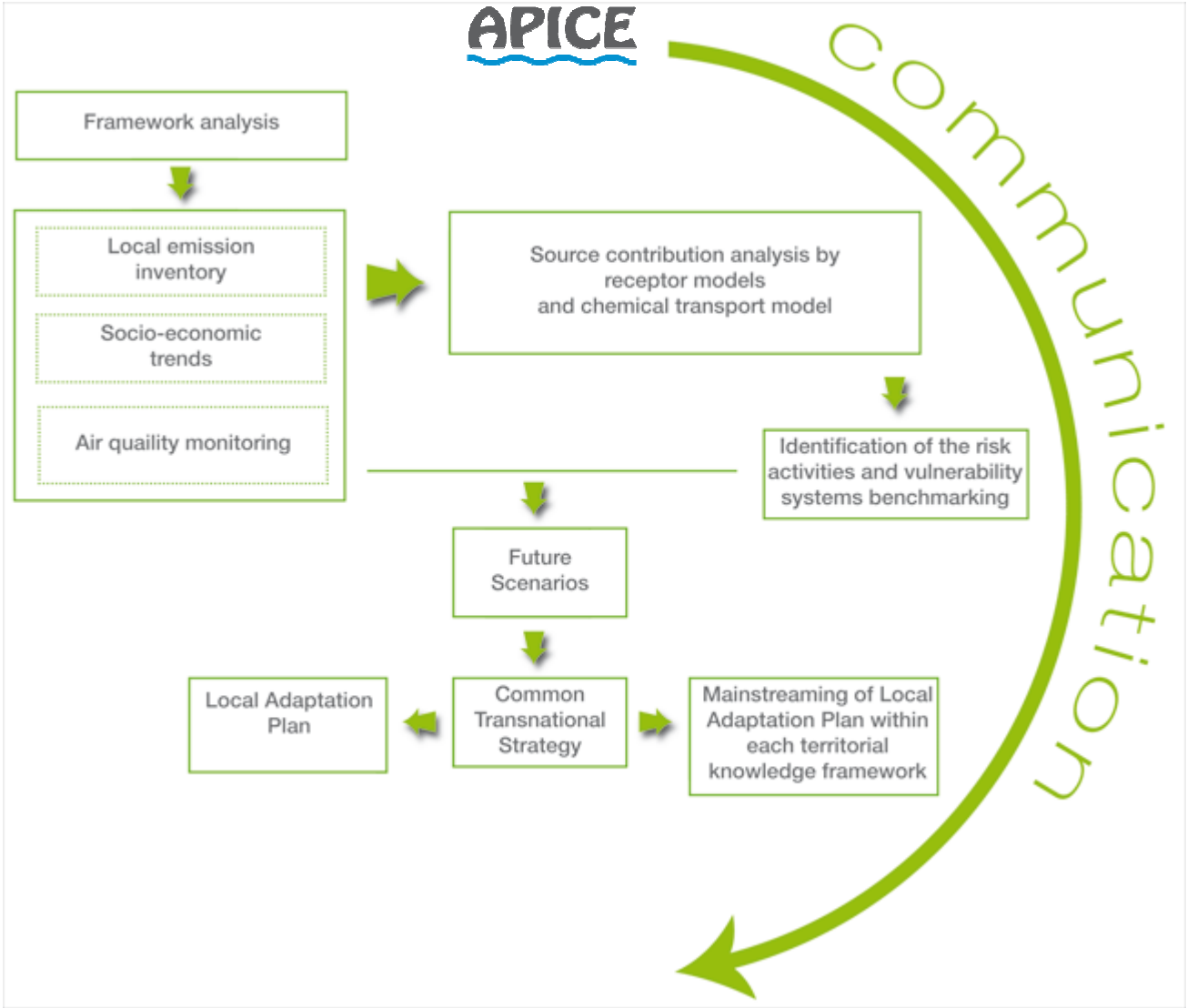
http://www.apice-project.eu

Results section



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Framework analysis

Comparative analysis of the air quality status of the 5 port-cities

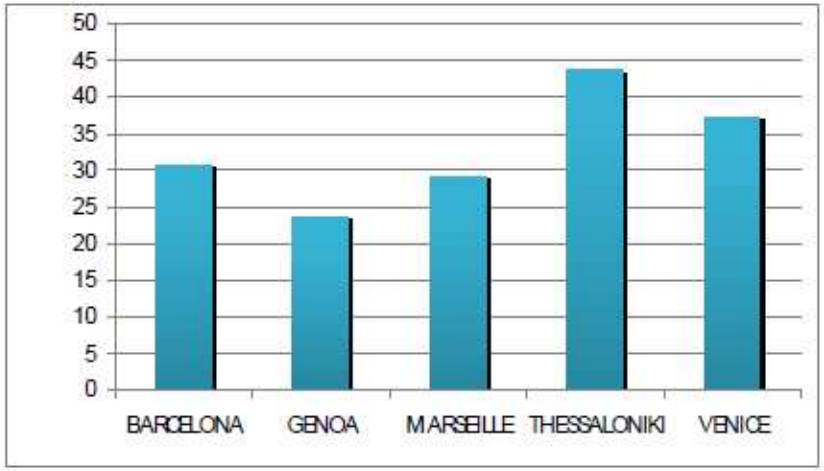


Figure 15 . PM10 annual average values in µg/m^3 during 2009, for the five cities

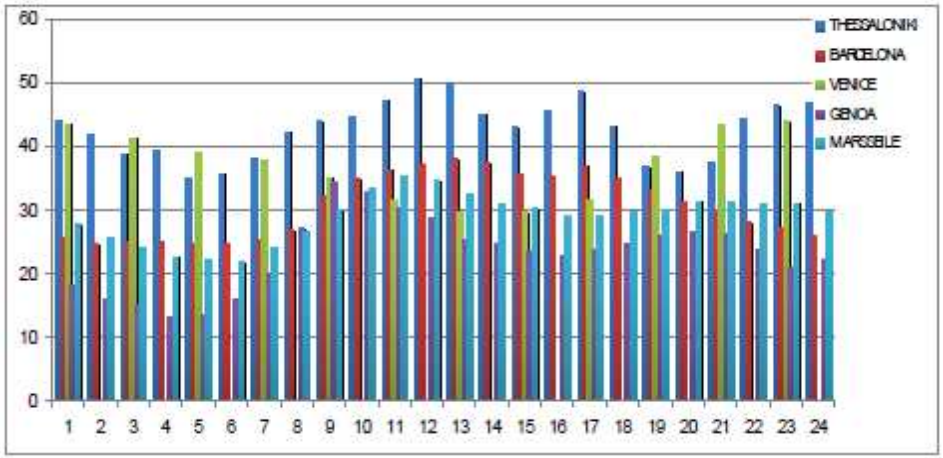


Figure19 Hourly variation of PM10 (in µg/m^3) during 2009, for the five cities.

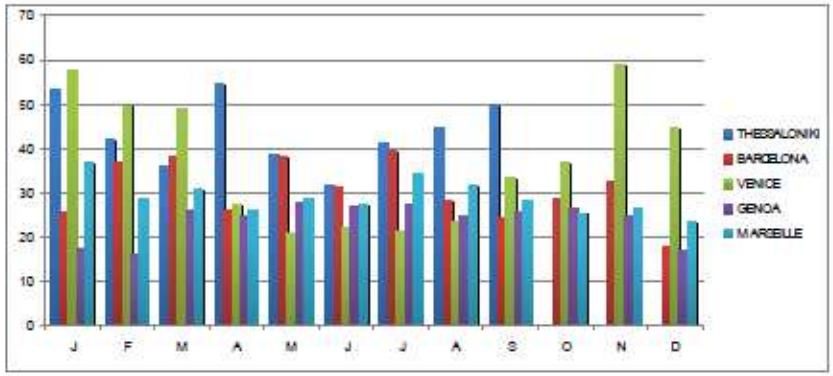
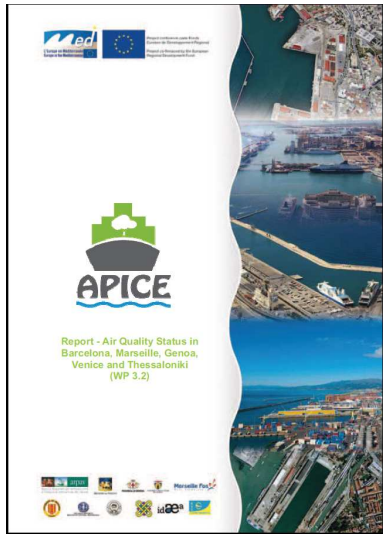


Figure16 Monthly variation of PM10 (in µg/m^3) during 2009, for the five cities.



PM2012
Perugia, 17 Maggio 2012

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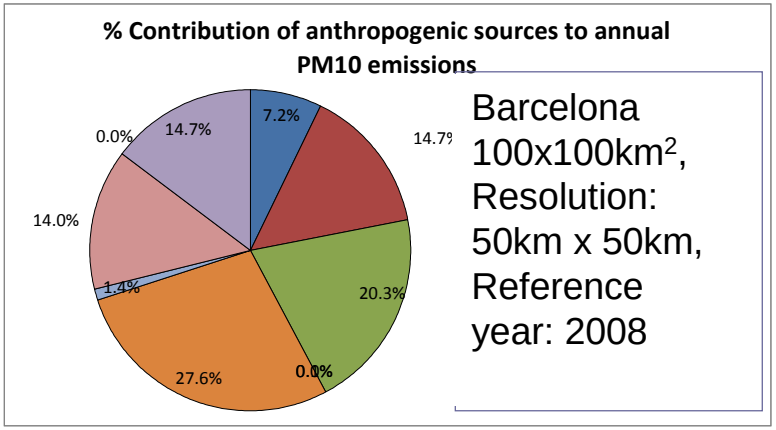
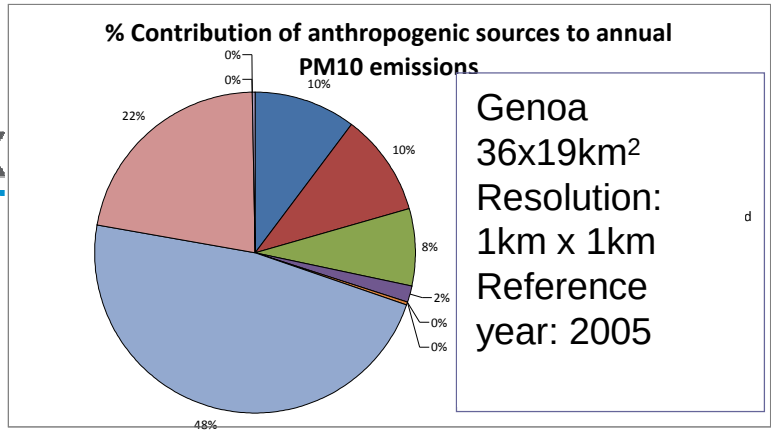
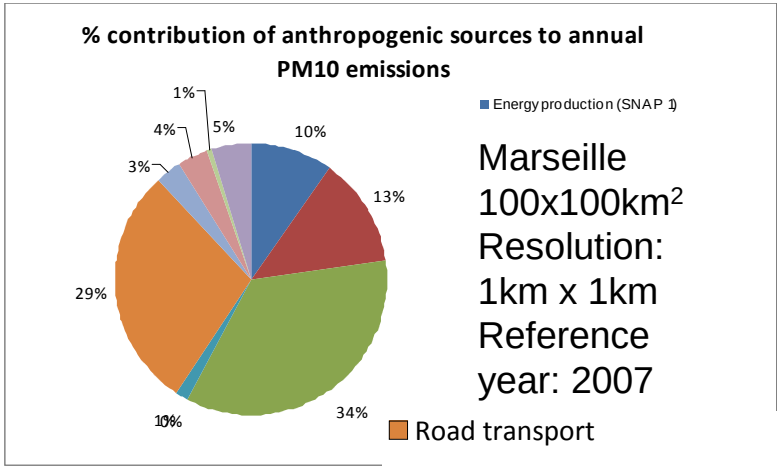
PM10 emissions pie diagrams



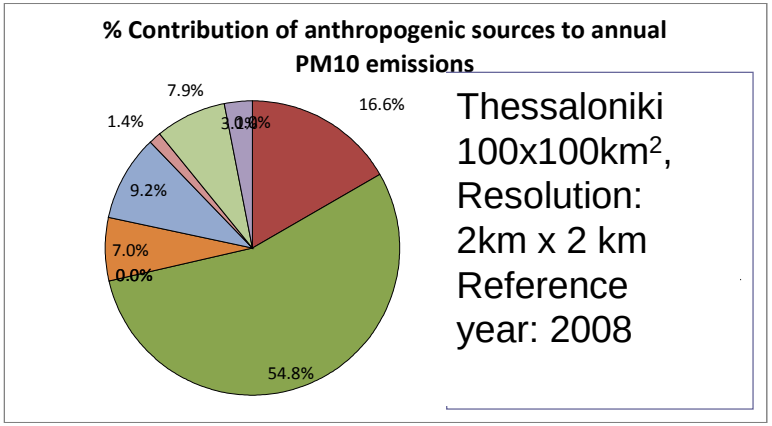
Barcelona
100x100km^2,
Resolution:
50km x 50km,
Reference
year: 2008



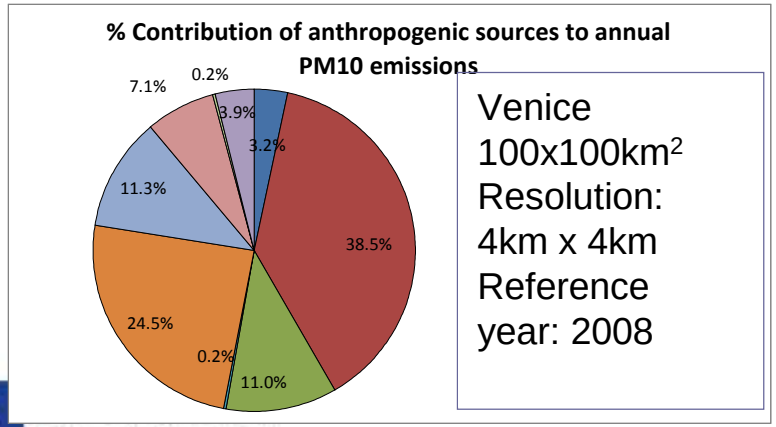
Genoa
36x19km^2
Resolution:
1km x 1km
Reference
year: 2005



Marseille
100x100km^2
Resolution:
1km x 1km
Reference
year: 2007



Thessaloniki
100x100km^2,
Resolution:
2km x 2 km
Reference
year: 2008



Venice
100x100km^2
Resolution:
4km x 4km
Reference
year: 2008

Local Emission inventories

- Energy production
- Central heating
- Industries
- Extraction and distribution of fossil geothermal energy
- Solvent and other product use
- Road transport
- Non-road transport (without ship and harbor activities)
- Ship and harbor activities
- Waste treatment and disposal
- Agriculture

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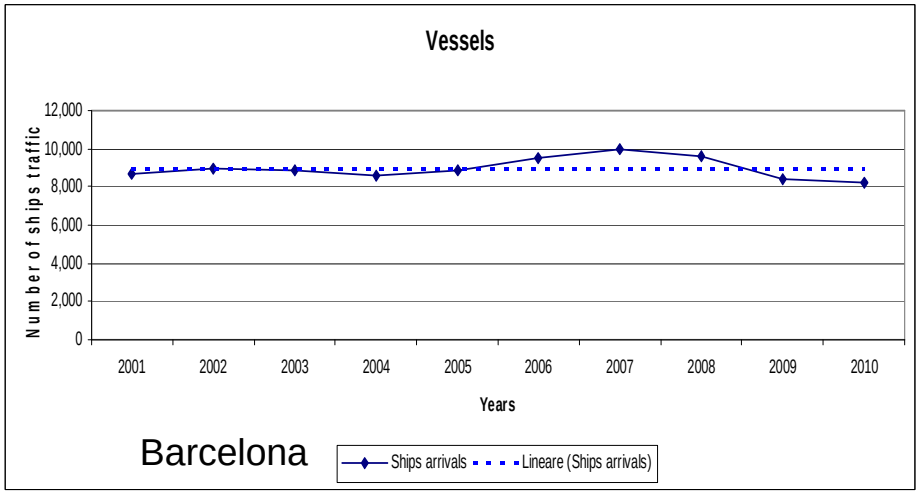
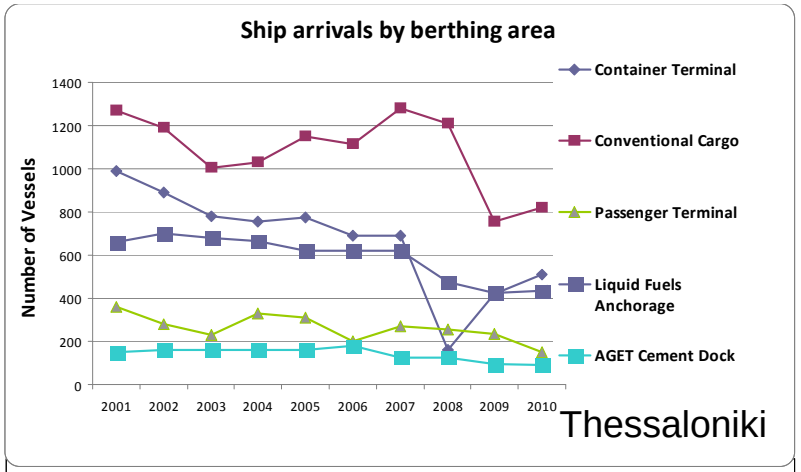
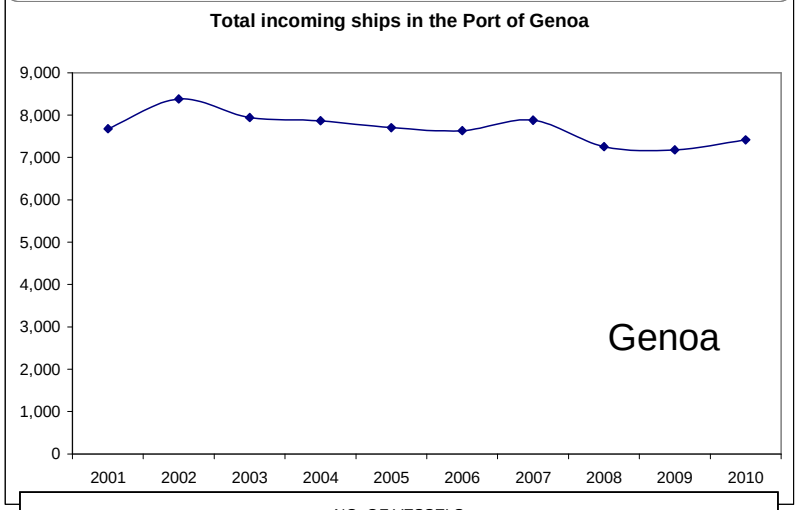
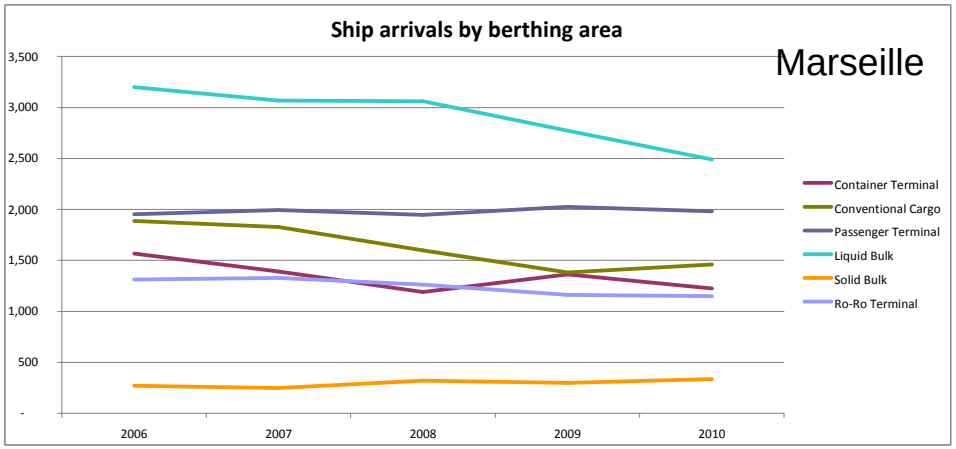
Socio-economic trends

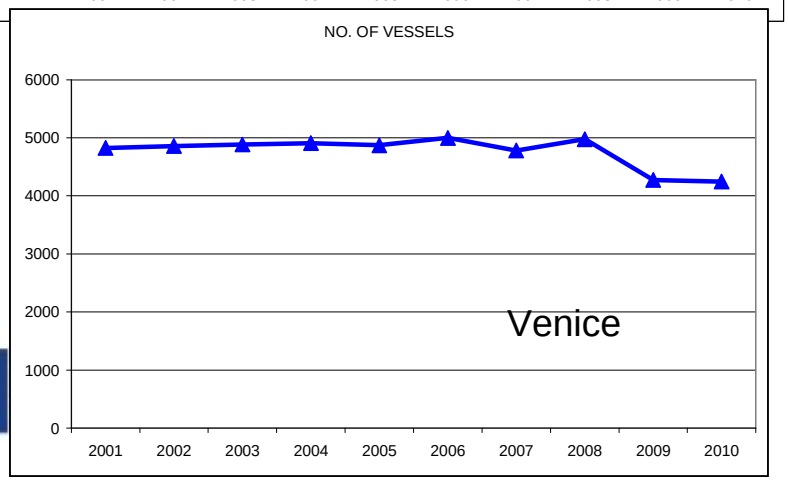
Ships arrivals







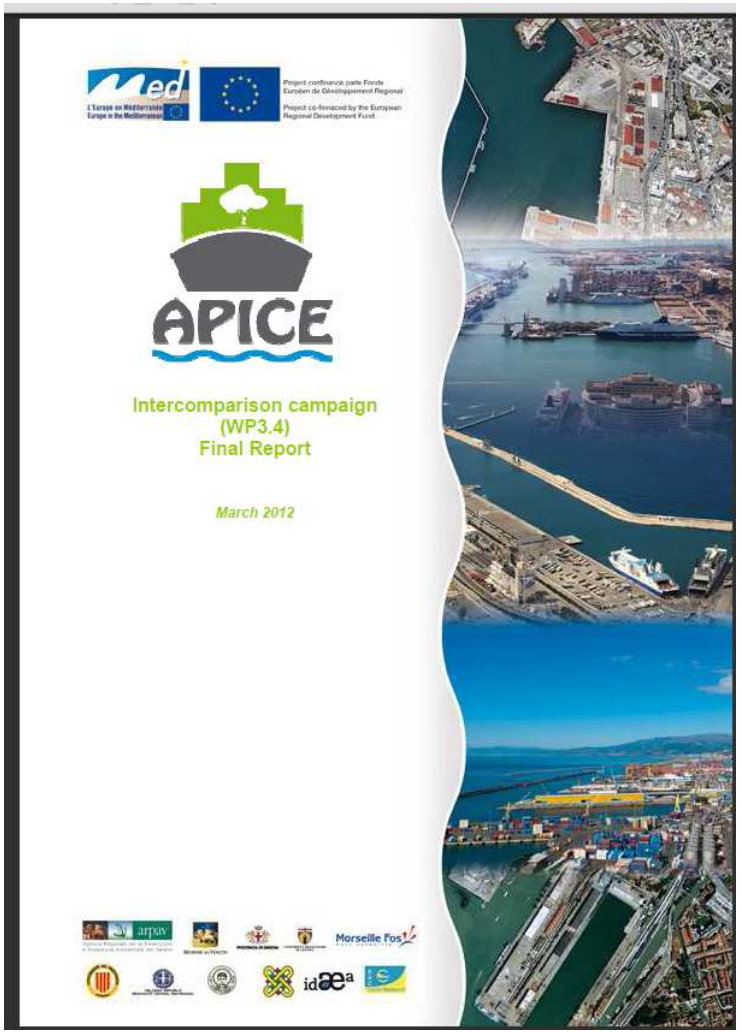




PM2012
Perugia, 17 Maggio 2012

Intercomparison sampling in Marseille

25th January – 2nd March 2011



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Receptor model configurations & identified and quantified sources

Pilot area	Barcelona	Genoa	Marseille	Thessaloniki	Venice
Partners	**IDAEA-CSIC**	**Univ Genoa**	**Aix Marseille Univ.**	**UOWM**	**Univ Genoa and IDAEA-CSIC on behalf of ARPA Veneto**
Model used	*PMF*	*PMF*	*CMB*	*PMF*	*PMF*
Species included	22 variables : Ca, K, Na, Mg, Fe, Mn, SO_4^{2-}; V, Ni, Cu, Zn, Sn, Sb, Pb, NO_3^-, NH_4^+, EC and five OC fractions (OC1, OC2, OC3, OC4 and Pyrolitic C)	15 variables : Al, Si, P, K, Ca, V, Fe, Ni, Cu, Zn, SO_4^{2-}, NH_4^+, NO_3^-, OC and EC	23 variables : 4 PAHs, 6 n-alkanes, 3 hopanes, levoglucosan, OC, EC, V, Ni and Pb for CMB and Al, Ca, Fe, Ti, Na^+ and Cl^- for crustal dust and sea salt	37 variables : 8 PAHs, SO_4^{2-}, NH_4^+, NO_3^-, Al, Ca, K, Na, Mg, Fe, Mn, Ti, P, V, Cr, Ni, Cu, Zn, As, Rb, Sr, Sb, Cd, Sn, Pb, Li, Sb, La, OC and EC	21 Variables : Ca, Na, Mg, Fe, SO_4^{2-}, V, Ni, Cu, Zn, Sn, Sb, Pb, NO_3^-, NH_4^+, EC, OC, E-ALK, O-ALK, H-PAH, HOPA, DHAA.
Number of factors/sources	7	5	8 source profiles plus Sea Salt and Dust	6	7

Source group	Source and source types derived from Source Appotionment analysis				
Road	Vehicular exhaust, Road Dust	Road	Vehicular*	Road Dust	Vehicular Exhaust+Sea spray, Road dust
Residential	Biomass burning		Biomass burning vegetative detritus (incomplete combustion of wax alkanes) and natural gas combustion.	Residential combustion	Residential
Industrial and Shipping	Fuel Oil Combustion	Industrial/Marine	Coke Production, HFO Combustion/shipping, Steel manufacturing	Marine-Shiping emissions/industriy	Industrial/marine
Primary natural	Aged Sea Spray, Mineral/industrial	Dust	Sea Salt, Dust	Natural sea salt,	Dust
Secondary	Secondary aerosol	Secondary I Secondary II	Secondary amonium, nitrate and suflate and other OM	Secondary aerosols	Secondary I, Secondary II

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(Intercomparison campaign, Final Report, Table 4.1)

PM2.5 Source Apportionment intercomparison

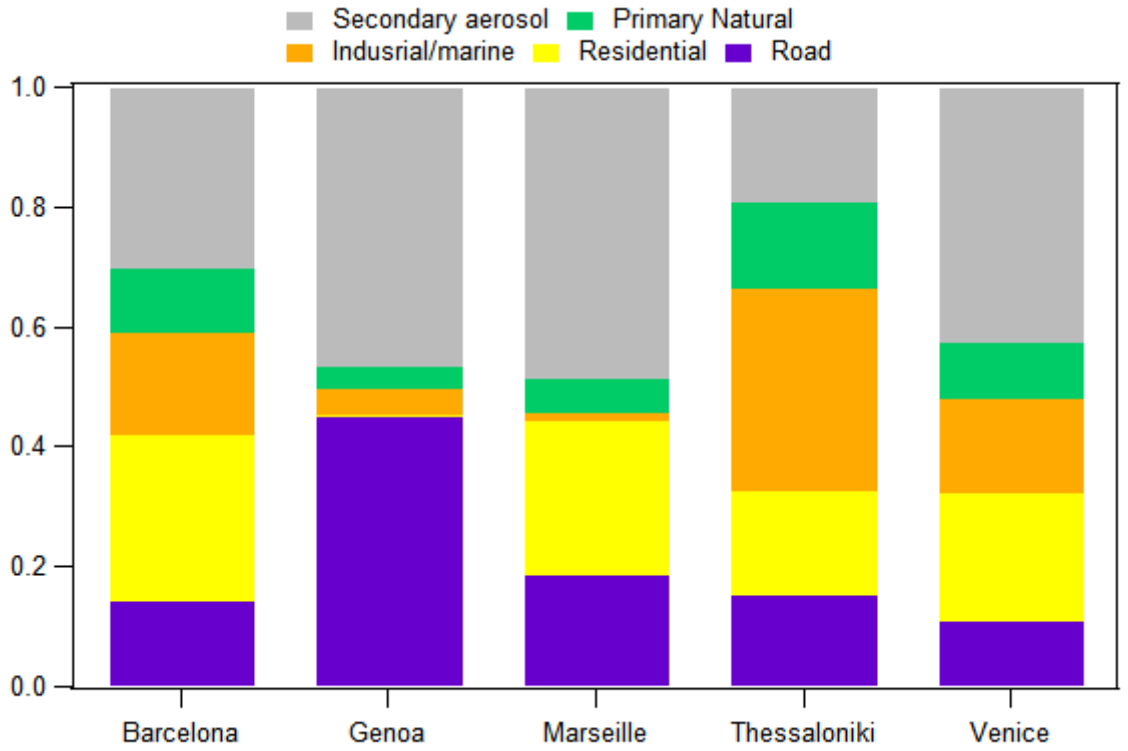

Figure 4.2. : Average relative contributions of source groups to PM2.5

Table 4.2: Absolute concentrations of PM2.5 (µg/m³) originating from the different source groups

µg/m³	Barcelona	Genoa	Marseille	Thessaloniki	Venice
Road	4.7	11.7	5.0	5.1	3.5
Residential	9.1	nd	6.8	5.6	7.0
Industrial and Shipping	5.6	1.3	0.4	11.2	5.0
Primary natural	3.5	0.9	1.5	4.6	3.1
Secondary	9.9	12.0	13.0	6.3	13.8

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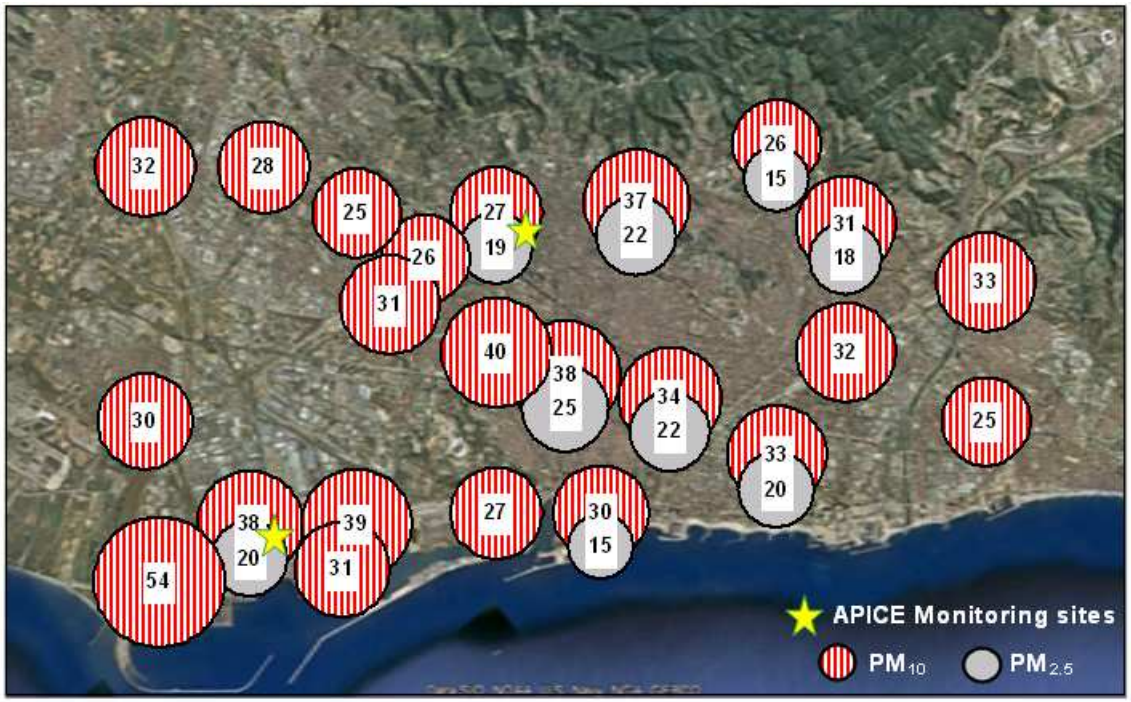
Long monitoring campaign in Barcelona



-PM_{10}, $PM_{2.5}$, PM_1, NOx, SO_2, H_2S, Meteo real time measurements

-PM_{10} & $PM_{2.5}$ sampling using high-vol instruments (2 samples of each fraction per week)

-Chemical characterization of samples

-ICP-AES (Al, Fe, Ca, K, Na, Mg, S, P)

- ICP-MS (Li, Be, Ti, Mn, Co, Cu, Zn, Ni, V, Sn, Sb, Cd, Pb, Bi, Th, U, Mo, Sr, Rb, Cr, As, Se, Ge, Ga, Zr, Hf, Ta, Tl, Rare earths, etc)

- Ionic chromatography (SO_4^{2-}, NO_3^-, Cl^-). Electrode for NH_4^+

- OC and EC by Sunset

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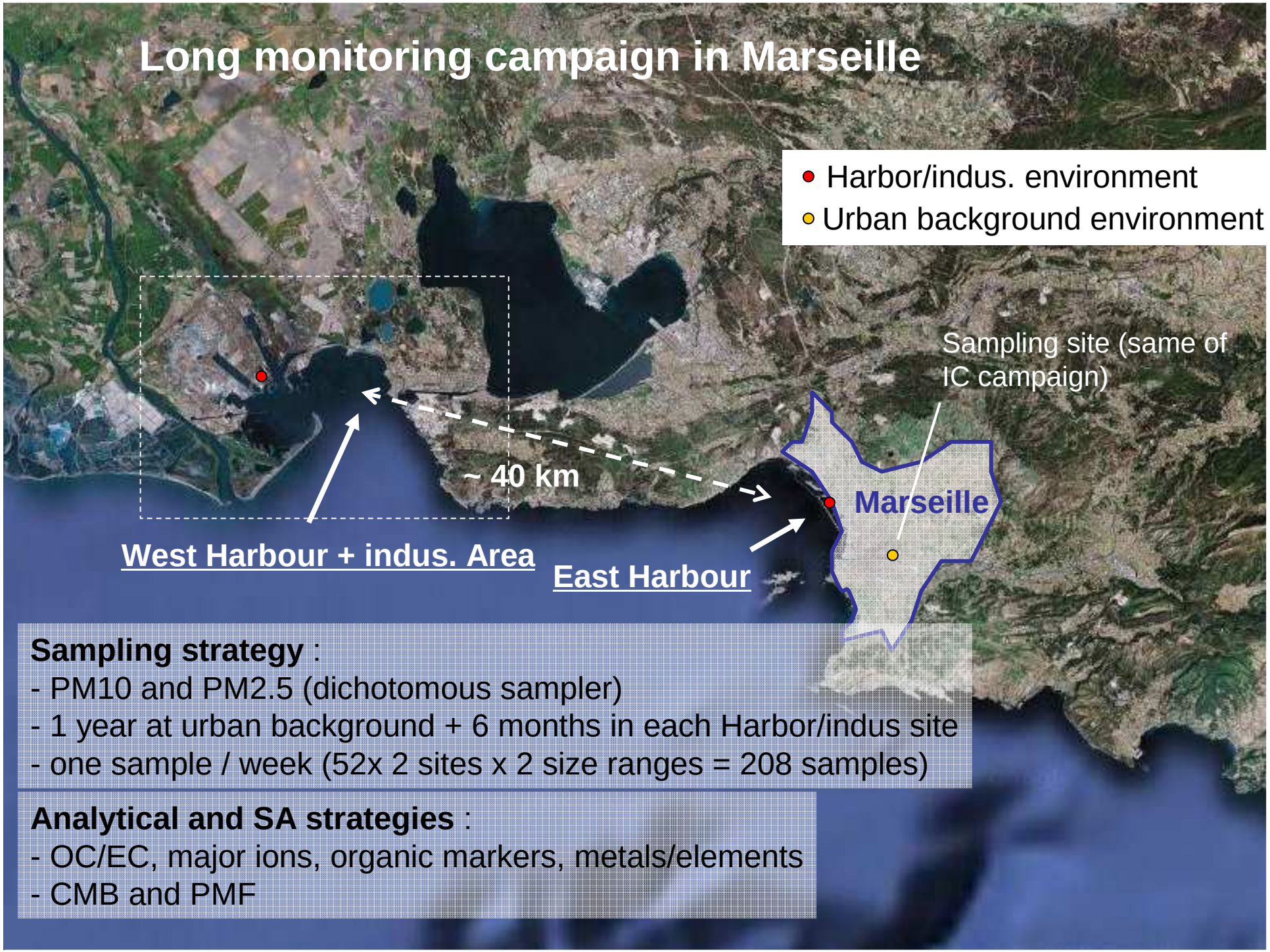
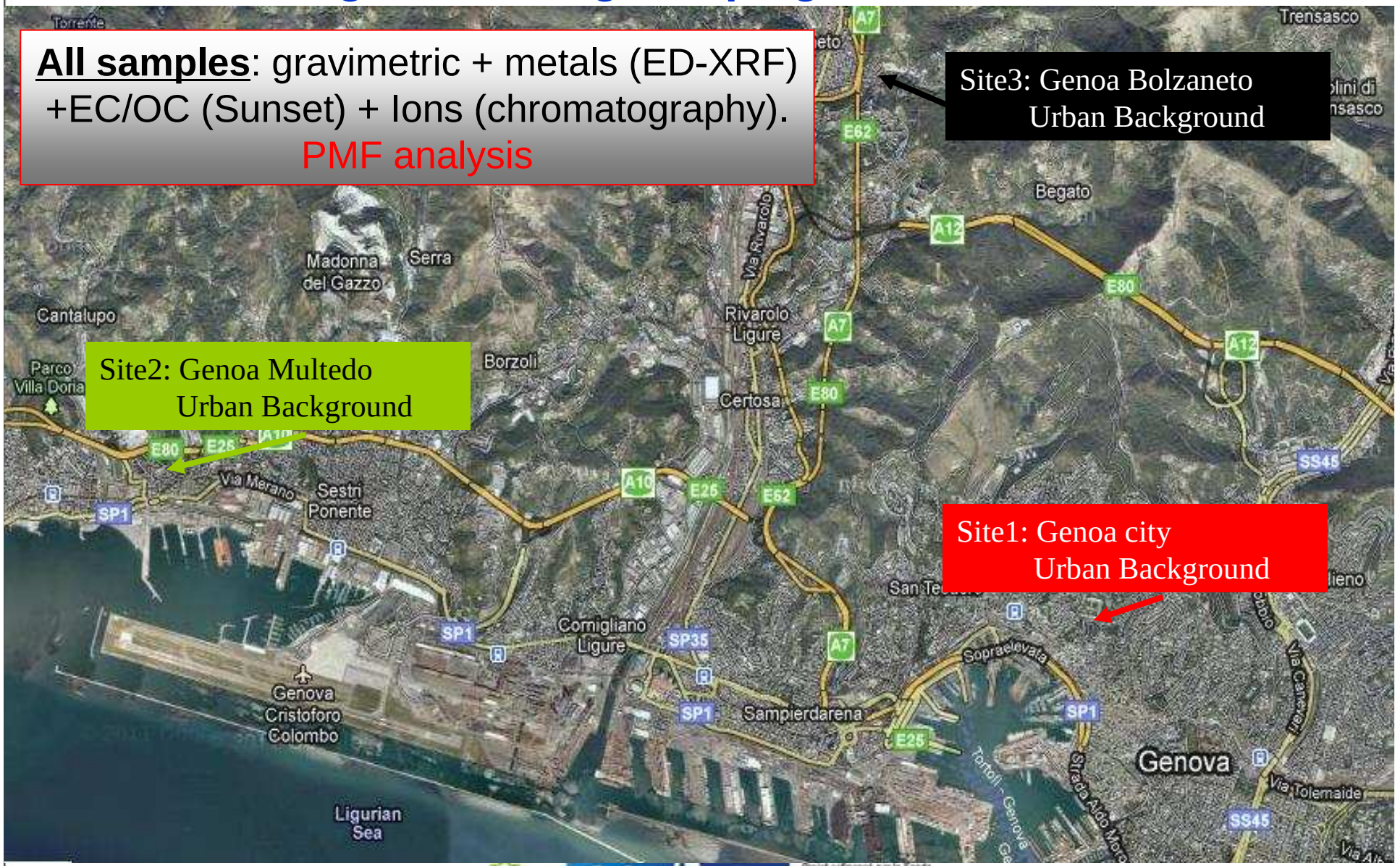
Long monitoring campaign in Marseille



Sampling strategy :
- PM10 and PM2.5 (dichotomous sampler)
- 1 year at urban background + 6 months in each Harbor/indus site
- one sample / week (52x 2 sites x 2 size ranges = 208 samples)

Analytical and SA strategies :
- OC/EC, major ions, organic markers, metals/elements
- CMB and PMF

Long monitoring campaign in Genoa



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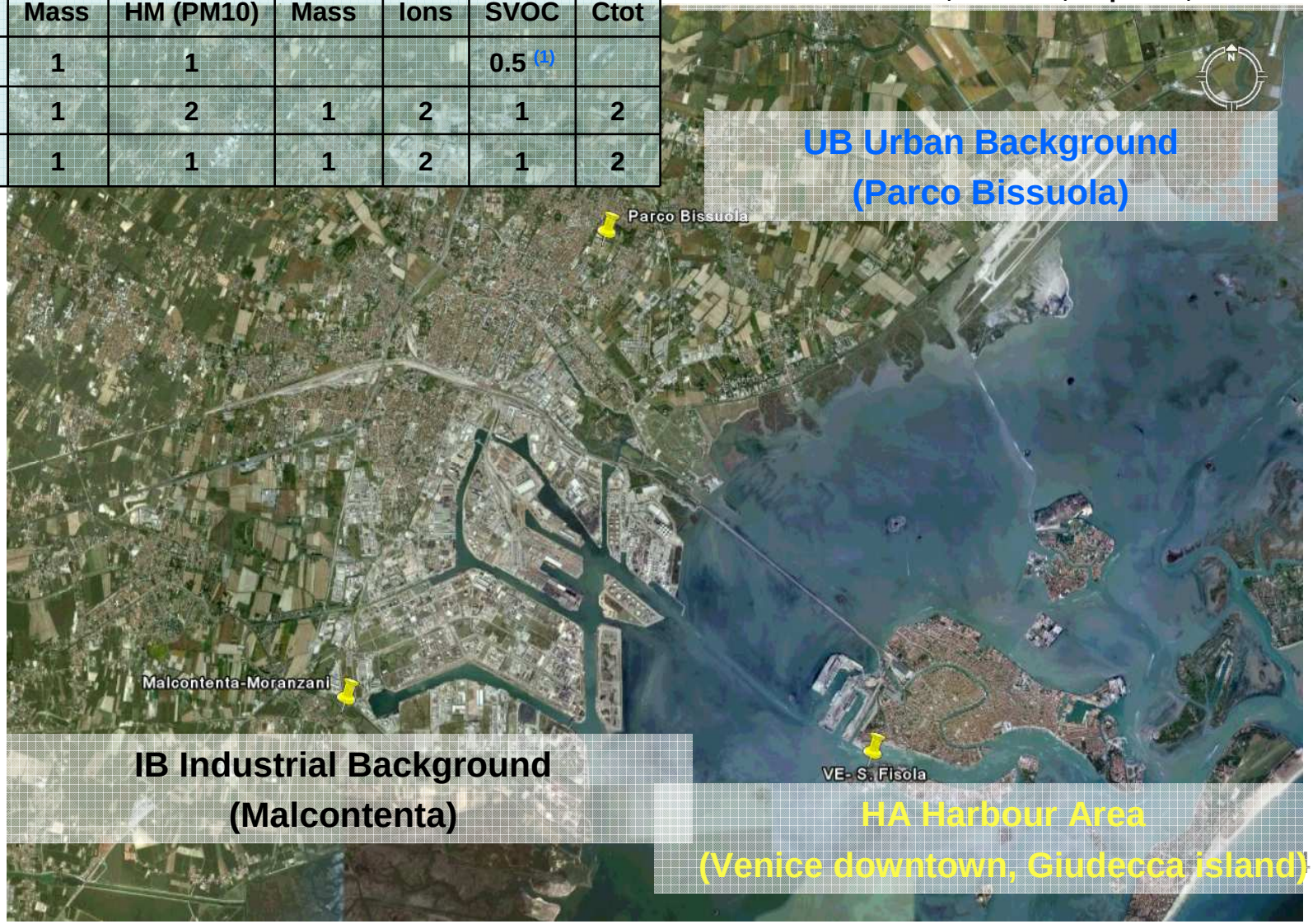
Long monitoring campaign in Venice

	PM10		PM2.5			
Site	Mass	HM (PM10)	Mass	Ions	SVOC	Ctot
HA	1	1			0.5 (1)	
UB	1	2	1	2	1	2
IB	1	1	1	2	1	2

Ions	Na, Cl, K, SO4, NO3, NH4, Mg, Ca
Heavy Metals	As, Ni, Pb, Cd, V, Cu, Zn, Al, Mn, Cr, Co, Sb, S
SVOC	PAHs, Alkanes, hopanes, steranes



Long monitoring campaign in Thessaloniki

PARAMETERS	SITE 1 - Harbor	SITE 2 - Urban
PM2.5	X	X
PAH's	X	X
Ionic species	X	X
OC/EC	X	X
Metals	X	X
Wind speed	X	
Wind direction	X	
Temperature	X	X
Humidity	X	X
Radiation	X	
Rainfall	X	

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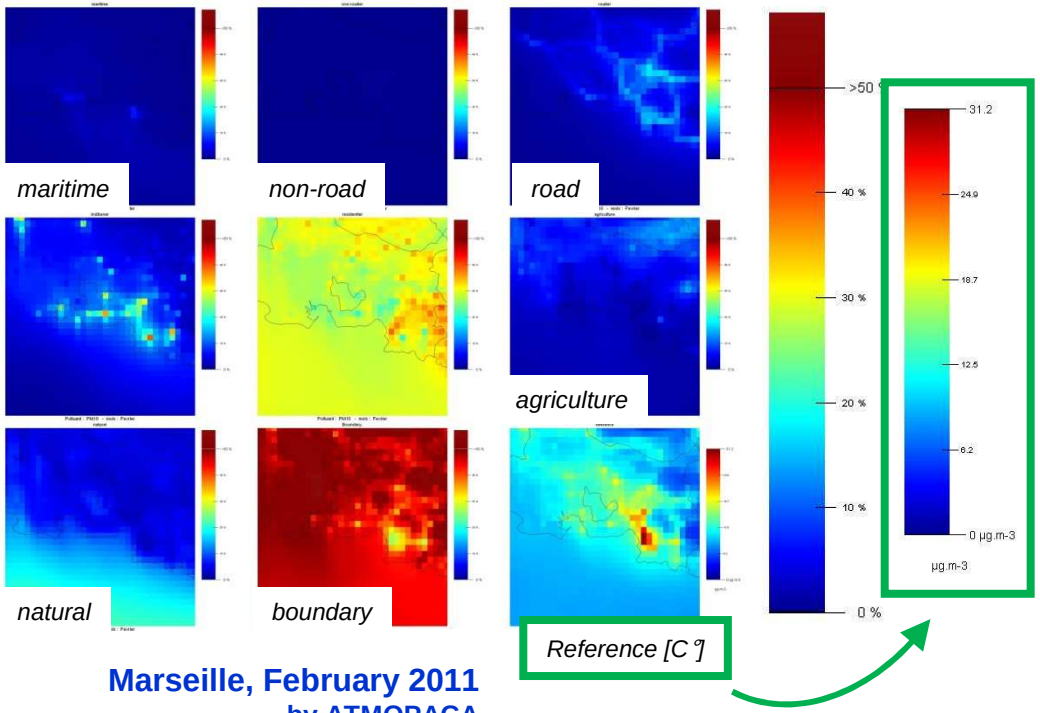
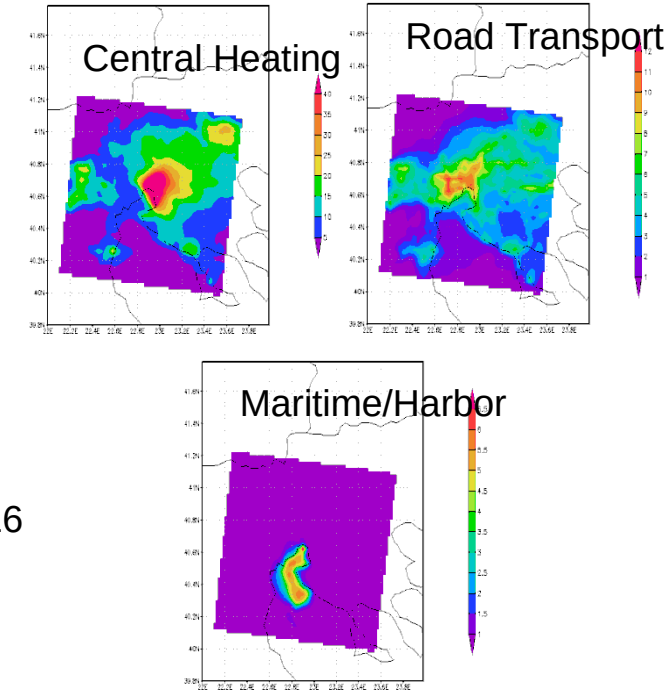
Source Apportionment by Chemical Transport Models

CHIMERE (Barcelona, Marseille)



Marseille, February 2011
by ATMOPACA

CAMx (Genoa, Venice, Thessaloniki)



Thessaloniki , 6 December 2011
by Aristotle University AUTH

2 different periods for 2011 base case run:
- Summer (from June to August 2011)
- Winter (mid-November to mid-December 2011)

Source Apportionment:
Zero-Out Methodology (CHIMERE) or SA tool (PSAT CAMx)

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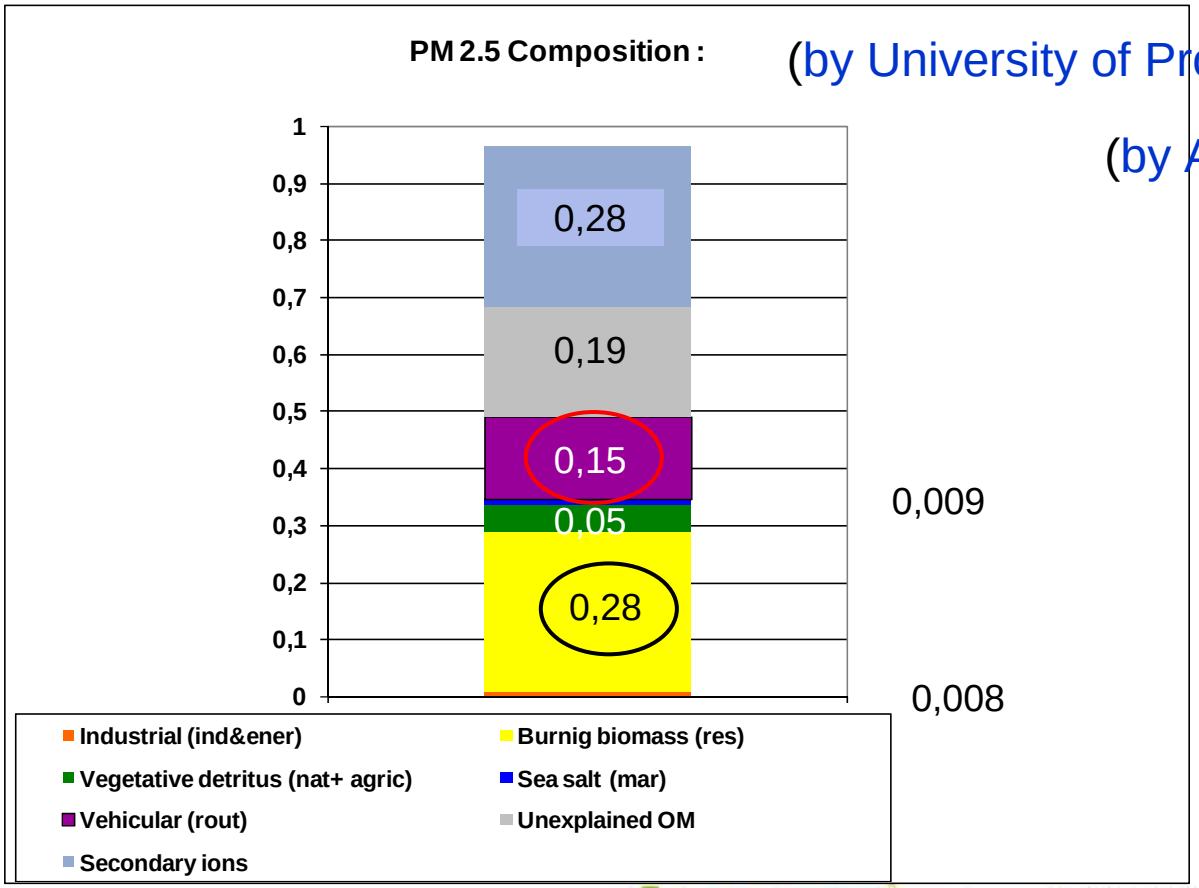
Receptor model outcomes *vs* CTM outcomes

Monthly average PM2.5 at “5 avenues” site in Marseille

Industry / energy
Residential / tertiary
Natural
Agriculture
Maritime
Non road
Road
External

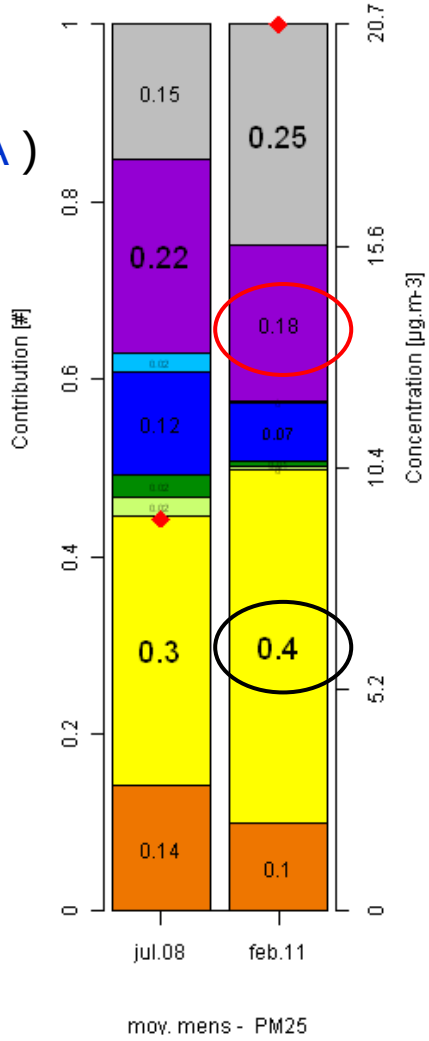
Préliminary CMB from measurements



(by University of Provence)

(by ATMOPACA)

CHIMERE model



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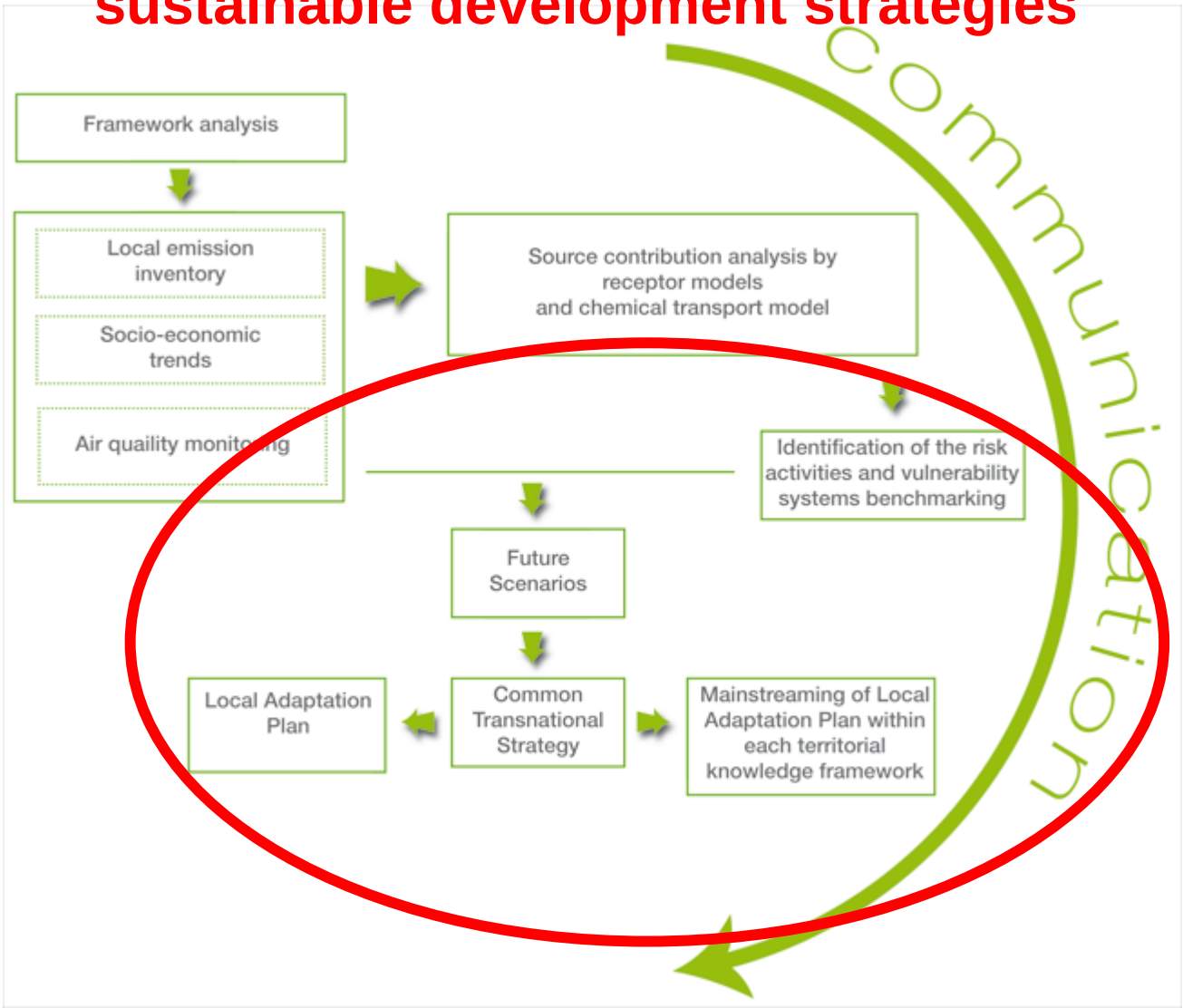
Model application and scenarios for port cities sustainable development strategies



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Prossimi appuntamenti di APICE

Meeting di progetto: Genova 27-28 Giugno 2012

Conferenza finale: Venezia Novembre 2012

More info: **http://www.apice-project.eu**

fliguori(at)arpa.veneto.it

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Si ringrazia il Programma MED che ha finanziato il progetto
e i partner di progetto:

Barcellona: Agenzia Nazionale per la Ricerca spagnola IDAEA-CSIC e Agenzia per gli studi marittimi ambientali EUCC

Marsiglia: Università della Provenza ed Autorità portuale

Genova: Università e Provincia

Salonicco: Università Aristotele , Università della Macedonia Occidentale e Amministrazione Decentralizzata della Macedonia e Tracia

Venezia: Regione del Veneto e ARPAV (Lead Partner)