RECEPTOR MODELS FOR PARTICULATE MATTER MANAGEMENT

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N.C.S.R. “Demokritos”

Implementation of source apportionment techniques to Policy making for air quality

Development of a Cost Efficient Policy Tool for reduction of Particulate Matter in Air (**ACEPT-AIR**) is a LIFE+ project demonstrating this application

It aims to enable Authorities

- to **assess the reduction** of key environmental pollutants, as well as their interdependencies centered around **PM** levels
- to respond in a competent way to environmental issues, specific to **particulate matter** atmospheric concentrations.
- to **target** this response to specific sources allowing **efficient reduction** of PM where it matters

ACEPT-AIR Project – Objectives

Create a Policy Tool which will:

- Contain a **database** of PM concentrations, **source apportionment** studies results and **emission inventories**
- Create a **historical record** of control measures / changes in emissions and provide results in measured concentration reductions apportioned to changes in every accounted source
- Allow the policy makers to **evaluate the effects** of control measures applied on specific emission sources as well as plan new ones.

National Authorities will have to re-evaluate the present environmental policies and measures and develop new ones.

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European Commission,
and relevant Policy making Organizations

Stakeholders

Coalition of 21 Local Authorities in Athens

21 ΟΤΑ
ΣΥΝΔΕΣΜΟΣ ΓΙΑ ΤΗ ΒΙΩΣΙΜΗ ΑΝΑΠΤΥΞΗ

Δήμος Θεσσαλονίκης

The Municipality of Thessaloniki

MINISTRY OF ENVIRONMENT ENERGY & CLIMATE CHANGE

Ministry of Environment, Energy & Climate Change

ASSOCIATION OF MOTOR VEHICLE IMPORTERS REPRESENTATIVES

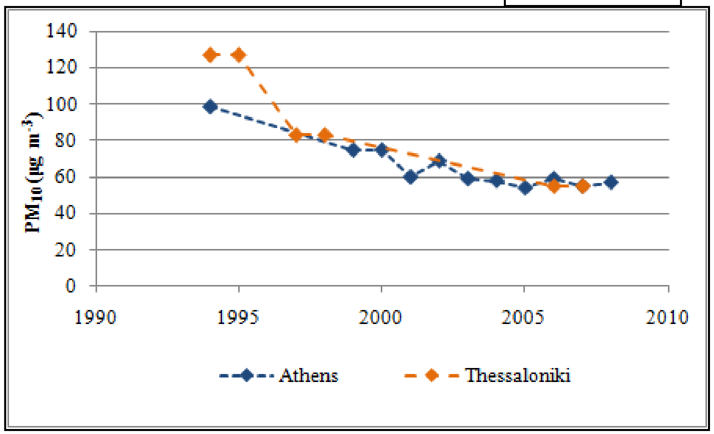
Association of Motor Vehicles Importers – Representatives

The Regional Unit of Magnesia and N. Sporades

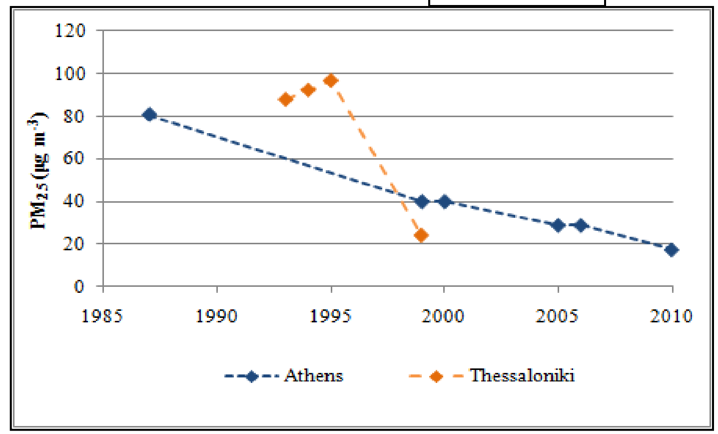
Historical PM concentrations database

- Long term trends show improved levels but still around target values

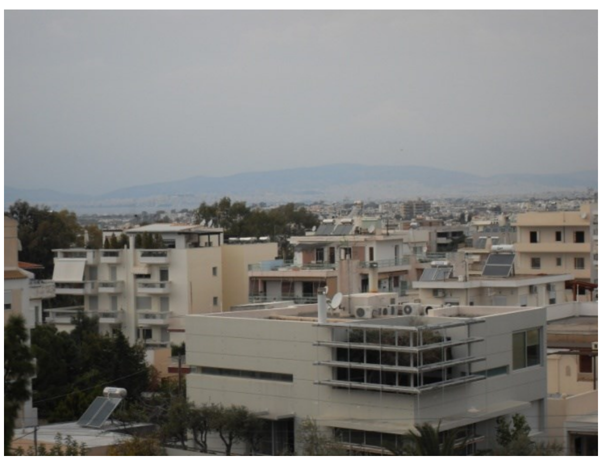
PM_{10}



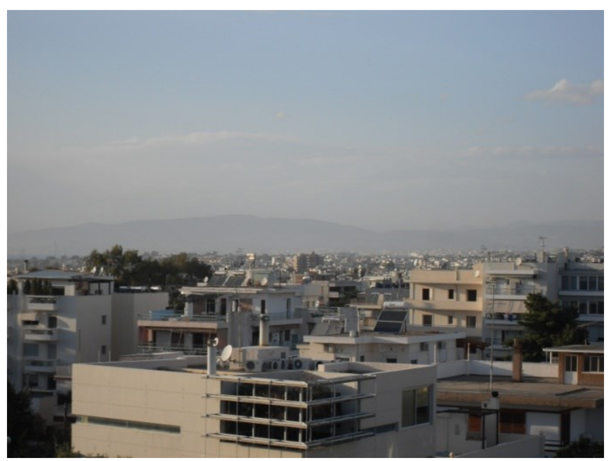
$PM_{2.5}$



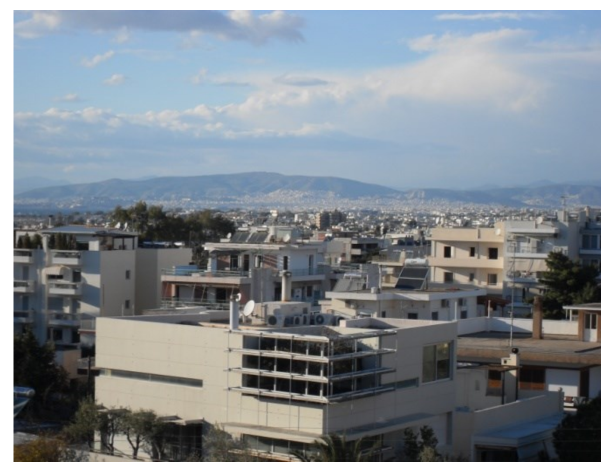
2nd March



26th February



27th February



Can we relate emissions and emission reductions to corresponding concentration levels and trends?

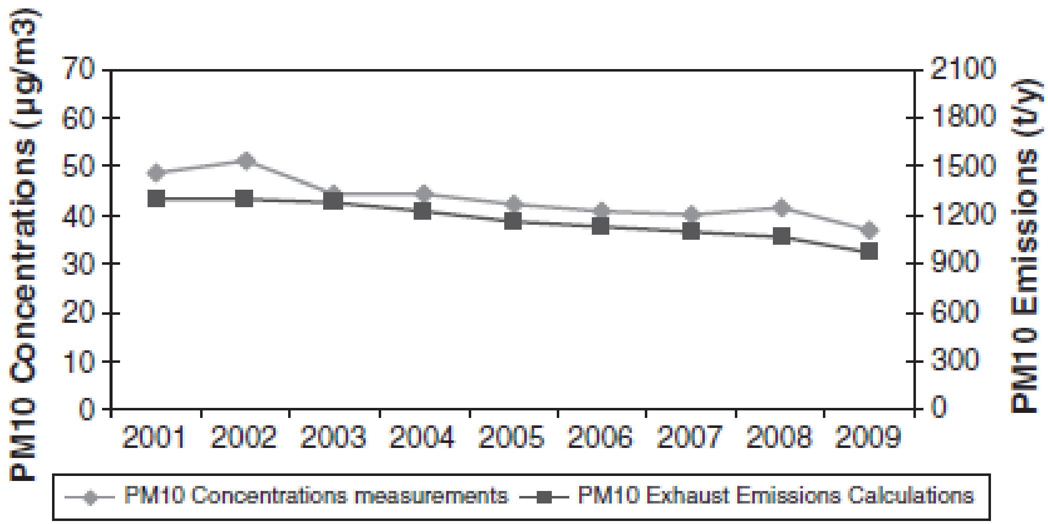


Table 2

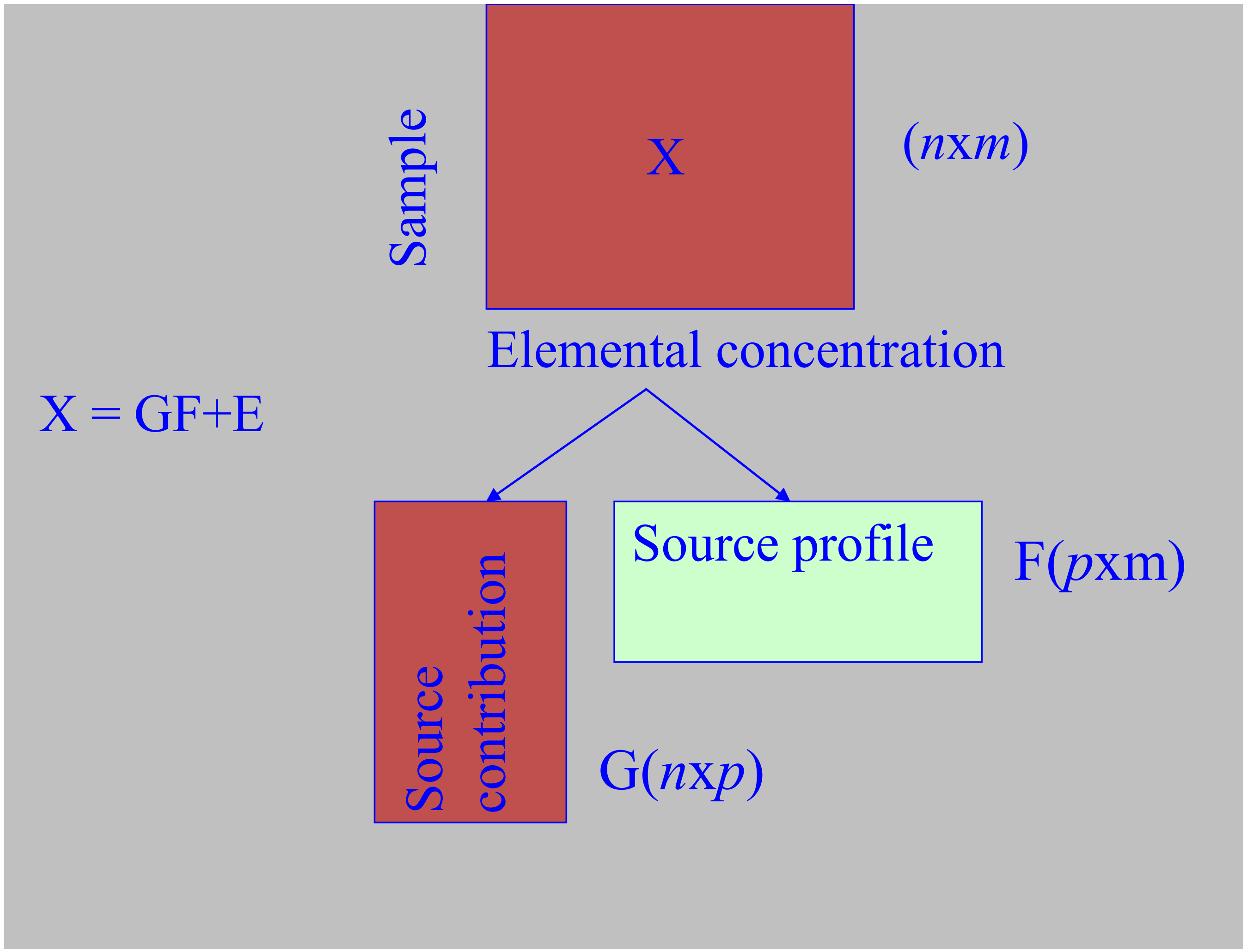
Linear best fit equation for NO_x, NO_2 and NO concentration and emission variations, average yearly change (%) and correlation coefficients.

	Linear best fit equation		Average yearly change (%)		Correlation coefficient
	Emissions	Concentrations	Emissions	Concentrations	
NO_x	$-859.26*x+46{,}500$	$-2.2106*x+135.46$	−1.79%	−1.58%	0.95
CO	$-12{,}049*x+365{,}195$	$-0.1438*x+3.6847$	−3.24%	−3.86%	0.96
PM_{10}	$-40.868*x+1376$	$-1.4824+50.737$	−2.72%	−2.68%	0.91

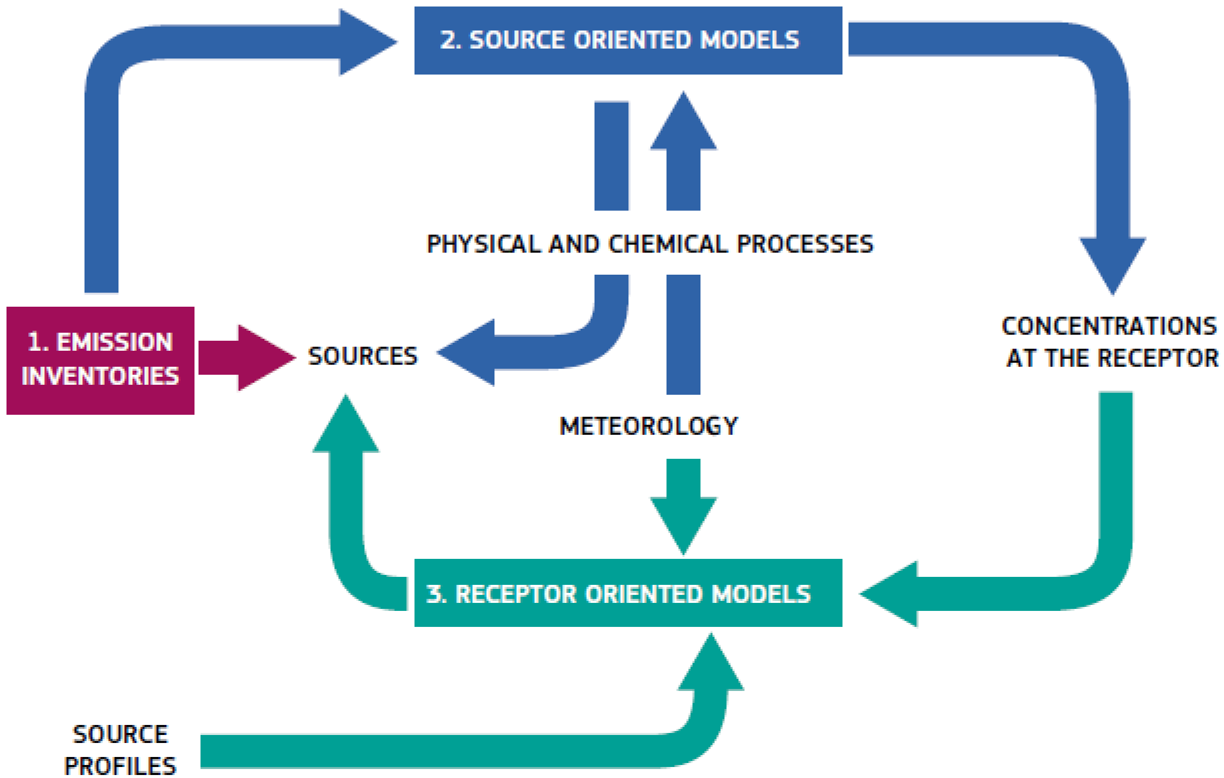
Long term emission trends in Athens for the previous decade (Progiou &Ziomas, 2011)

Science of the Total Environment 410-411 (2011) 1–7

Source apportionment first principles

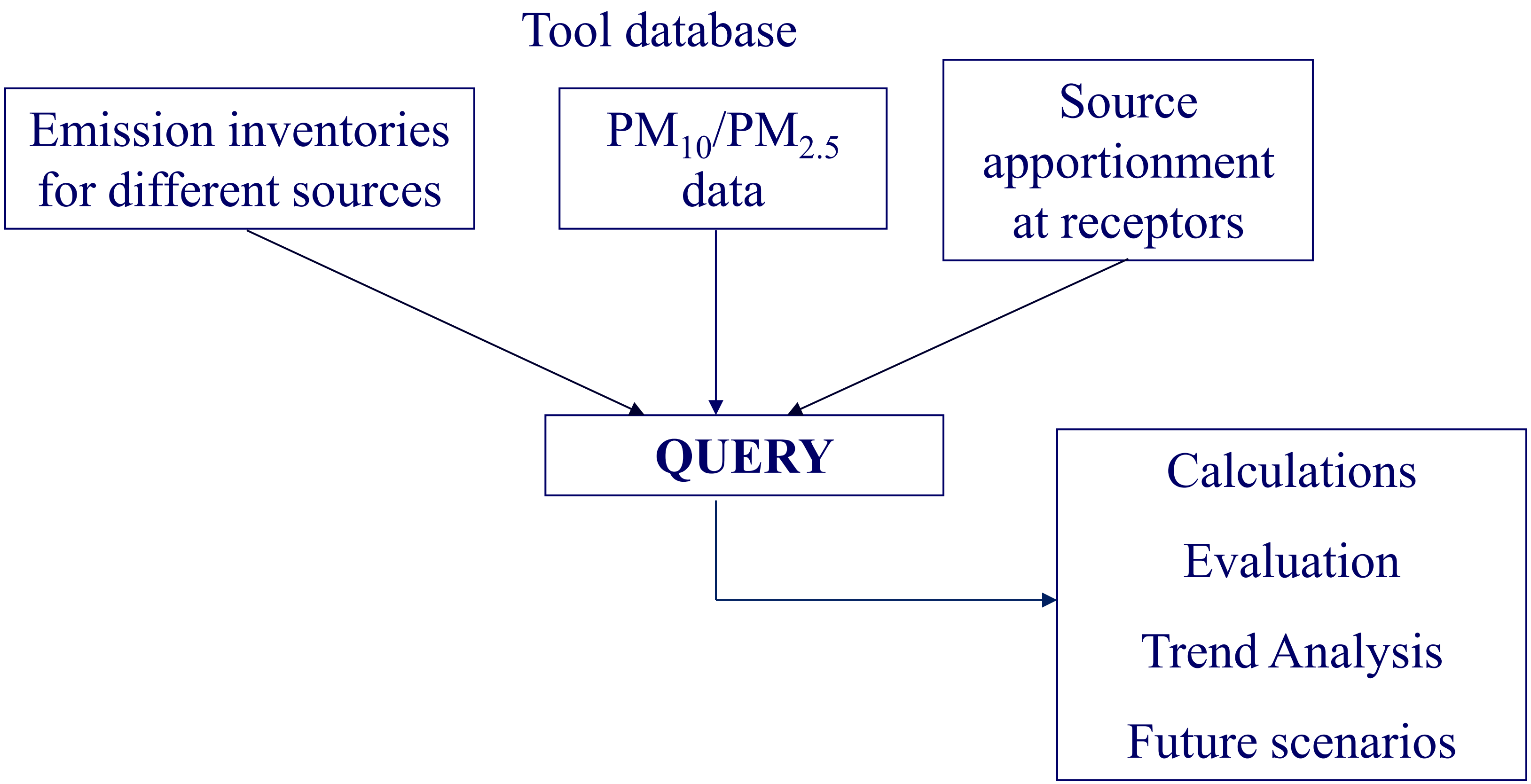


Current state of the art knowhow
on source identification and contribution to air pollution



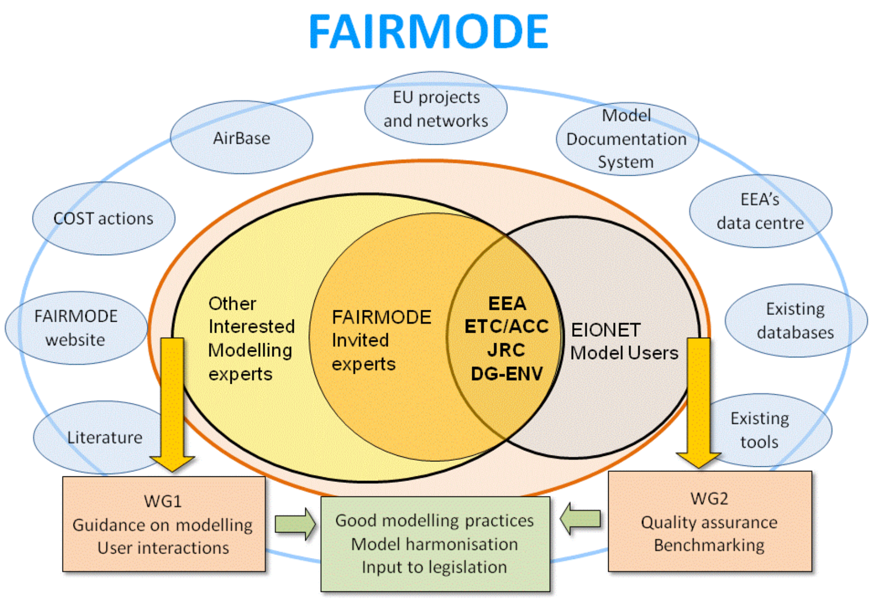
From "European guide on air pollution source apportionment with receptor models" C. Belis et al., 2014

Concept and functions
for the ACEPT-AIR Policy Tool Operational Platform



Why is ACEPT – AIR a project with high impact

Project kick off at September 2010, Call round October 2009



At the 3rd FAIRMODE plenary in Kjeller, on 16th September 2010, it was agreed that FAIRMODE would compile the recent experiences from Member States when applying modelling tools for reporting purposes under the 2008/50/EC Air Quality Directive.

FAIRMODE
Forum for air quality modelling in Europe

FAIRMODE
Work Group 2 on Quality Assurance of models
Sub Group 2 – Contribution of natural sources and source apportionment

1st Workshop - Nov 2010

Agenda

Initiative on Harmonization of Source Apportionment with Receptor Models

12/10/2012

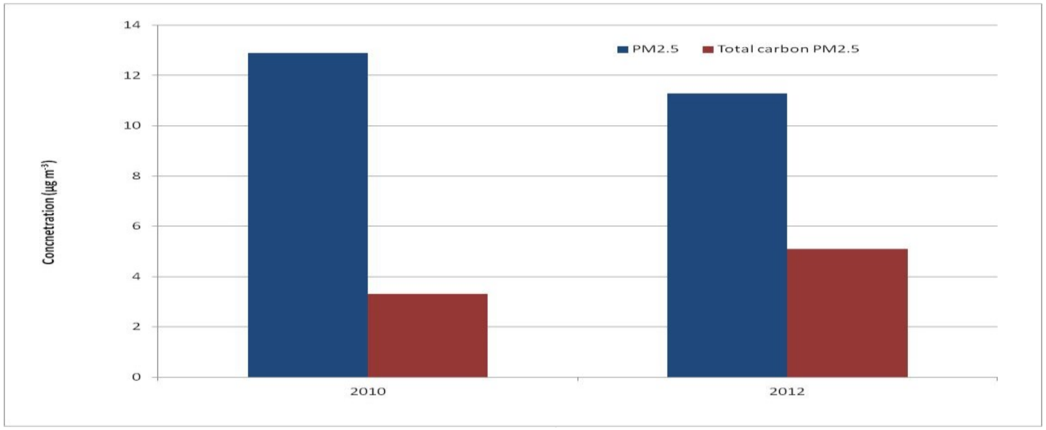
Recomendations

ON THE USE OF MODELS FOR REGULATORY PURPOSE AND TO SUPPORT AIR QUALITY POLICY

Source apportionment modeling: *There is an increasing need to demonstrate whether and to what extent exceedances of limit values can be attributed to natural sources, human practices (road salting and sanding), and transboundary pollution. In the context of the preparation and implementation of air quality plans and short-term action plans, there is also a need to identify and quantify the contribution of the main pollution sources in order to efficiently design abatement measures and assess their effectiveness.*

➢ **Main challenges**:

- Unravel the relative contribution of the multiple anthropogenic and other sources to the observed PM air concentrations,
- Verify representative coverage of the source apportionment studies in time and space or quantify the limitations
- Document the relative contribution of secondary aerosol particles to those from primary emissions, by taking into account the atmospheric processes which contribute secondary and primary PM at a given receptor site.
- $$\mathbf{Si} = a*\mathbf{Ei}+b*\mathbf{Sei}+\boldsymbol{e}$$



Potential Secondary PM formation

Pollutant	Aerosol Formation Potential*
Primary PM	1
SO_2	0.54
NOx	0.88
NH_3	0.64
NMVOCs	0.02

*According to the methodology of de Leeuw (2002)
Values on European level

Development of **A** **C**ost **E**fficient **P**olicy **T**ool for reduction of **P**articulate Matter in **AIR**

Results from Source apportionment studies in Greece

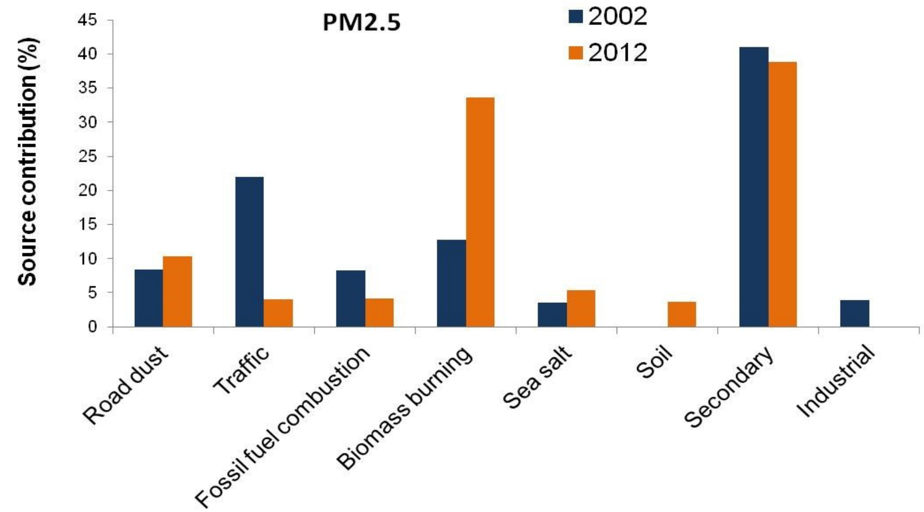
Major sources:

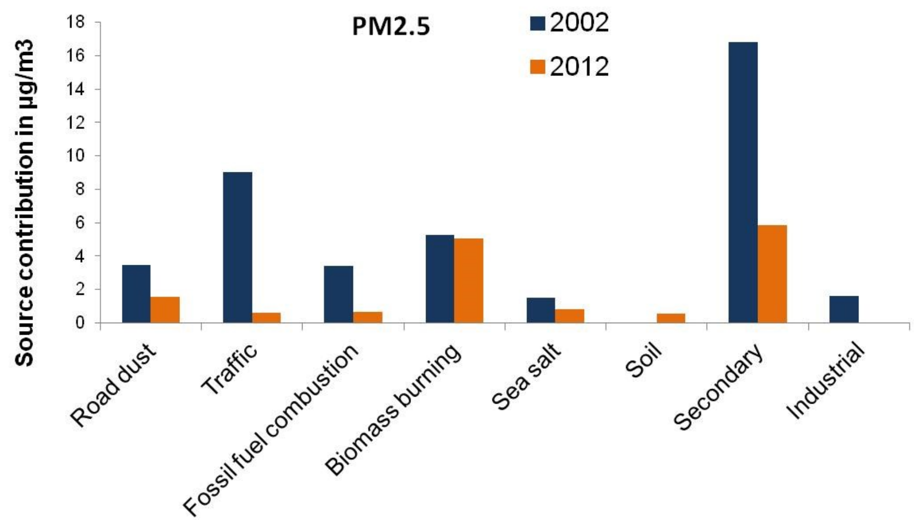
- **S1**: Road/Urban dust,
- **S2**: Traffic,
- **S3**: Oil Combustion/ Industry
- **S4**:Biomas burning/ waste
- **S5**: Marine,
- **S6**: Secondary/ Unidentified

Area / (PM) fraction	*S1*	*S2*	*S3*	*S4*	*S5*	*S6*	*SA Model*
Thes 1994 TSP*	4-9	4-5	21-42			44-70	APCA
Thes 1994 TSP*	7-11	4-5	25-33			54-66	FA/MR
Thes 2002 fine	28	38	14			20	APCA
Thes 2002 coarse	57	9	26			8	APCA
Thes 2003 PM10*	18-22	45-65	10-35				CMB
Thes 2007 PM10*	20-25	23-39	20-38	1-4	1	13-15	CMB
Thes 2011-12			ACEPT	AIR			
Athens 2002 fine	19	30	14	11	19	7	PMF
Athens 2002 coarse	54	8			16	22	PMF
Athens 2009			Other	study			
Athens 2011-12			ACEPT	AIR			
Volos 2001 fine	30		27		20	23	PMF
Volos 2008 PM10*	3-12	28-40	15-39	22-27	1-2	2-9	CMB
Volos 2011-12			ACEPT	AIR			

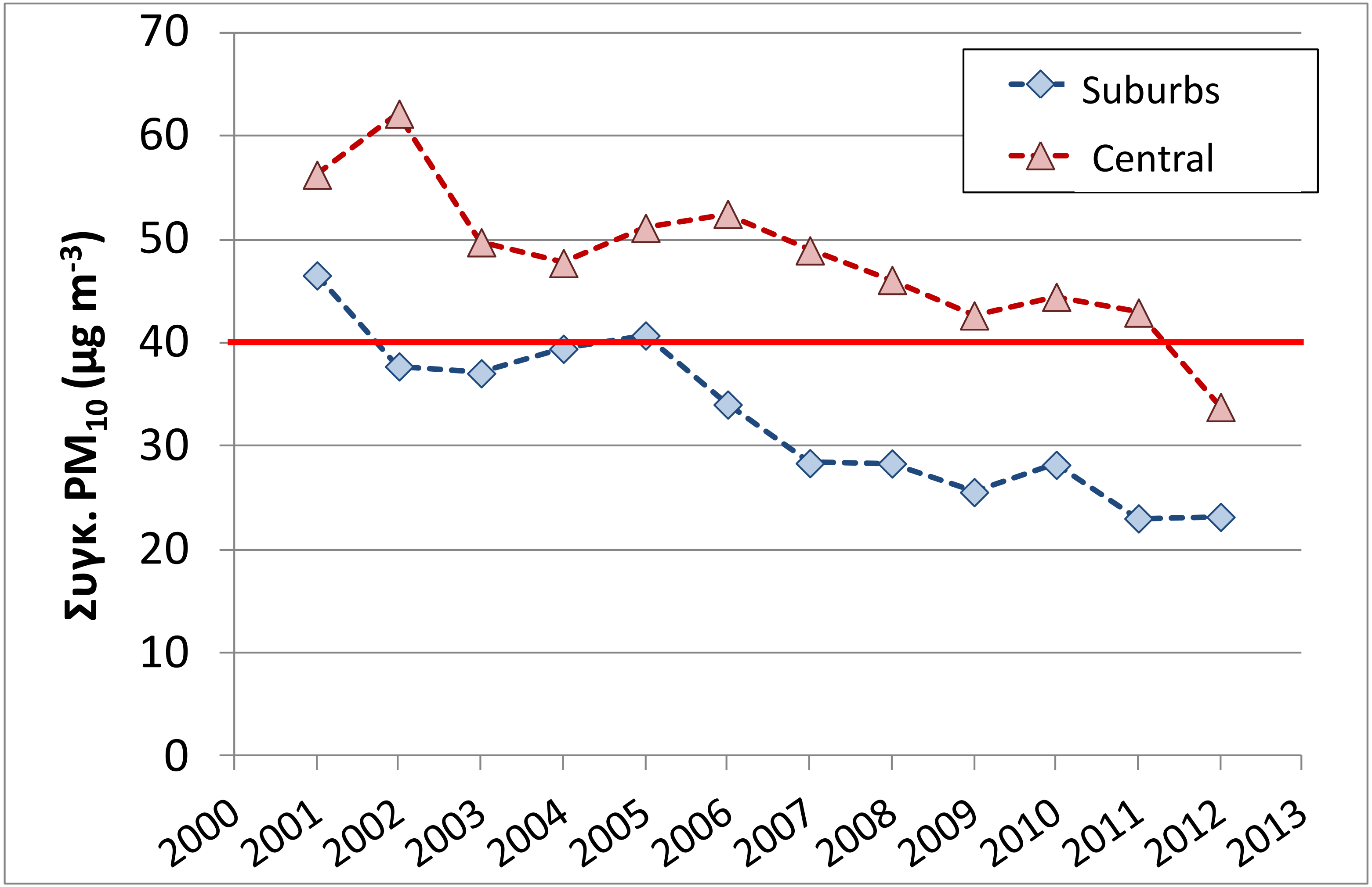
Mass Concentration apportioned to Sources at a decadal SA interval

			PM2.5 ug/m3	41	15	
	2002	2012		2002	2012	
Road dust	8.4	10.3		3.4	1.6	45%
Traffic	22.0	4.1		9.0	0.6	7%
Fossil fuel combustion	8.3	4.2		3.4	0.6	18%
Biomass burning	12.8	33.6		5.2	5.1	97%
Sea salt	3.6	5.4		1.5	0.8	55%
Soil		3.7			0.6	
Secondary	41.1	38.8		16.8	5.8	35%
Industrial	3.9			1.6		





Annual mean PM_{10} - Athens



The ACEPT-AIR Policy Tool Operational Platform

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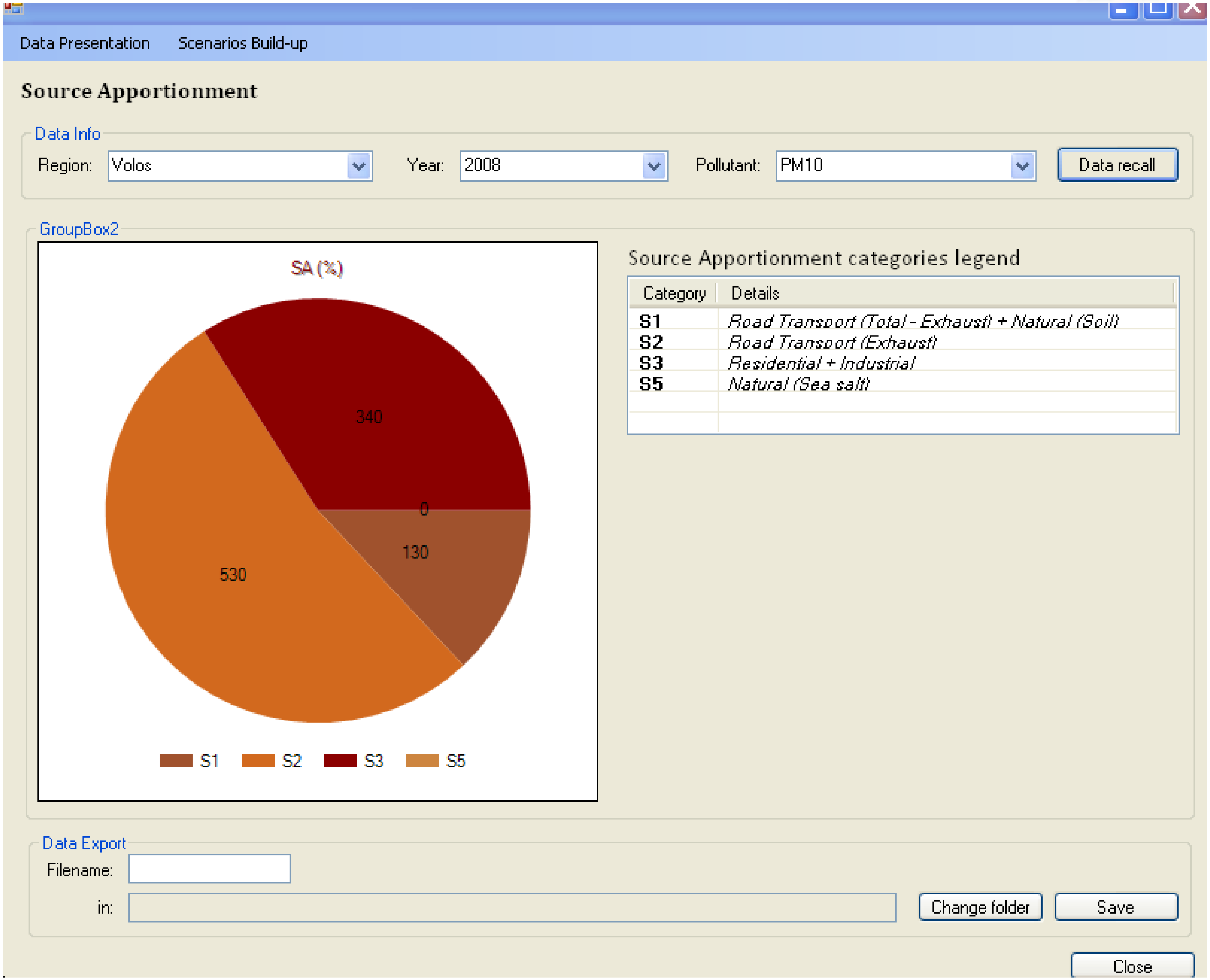
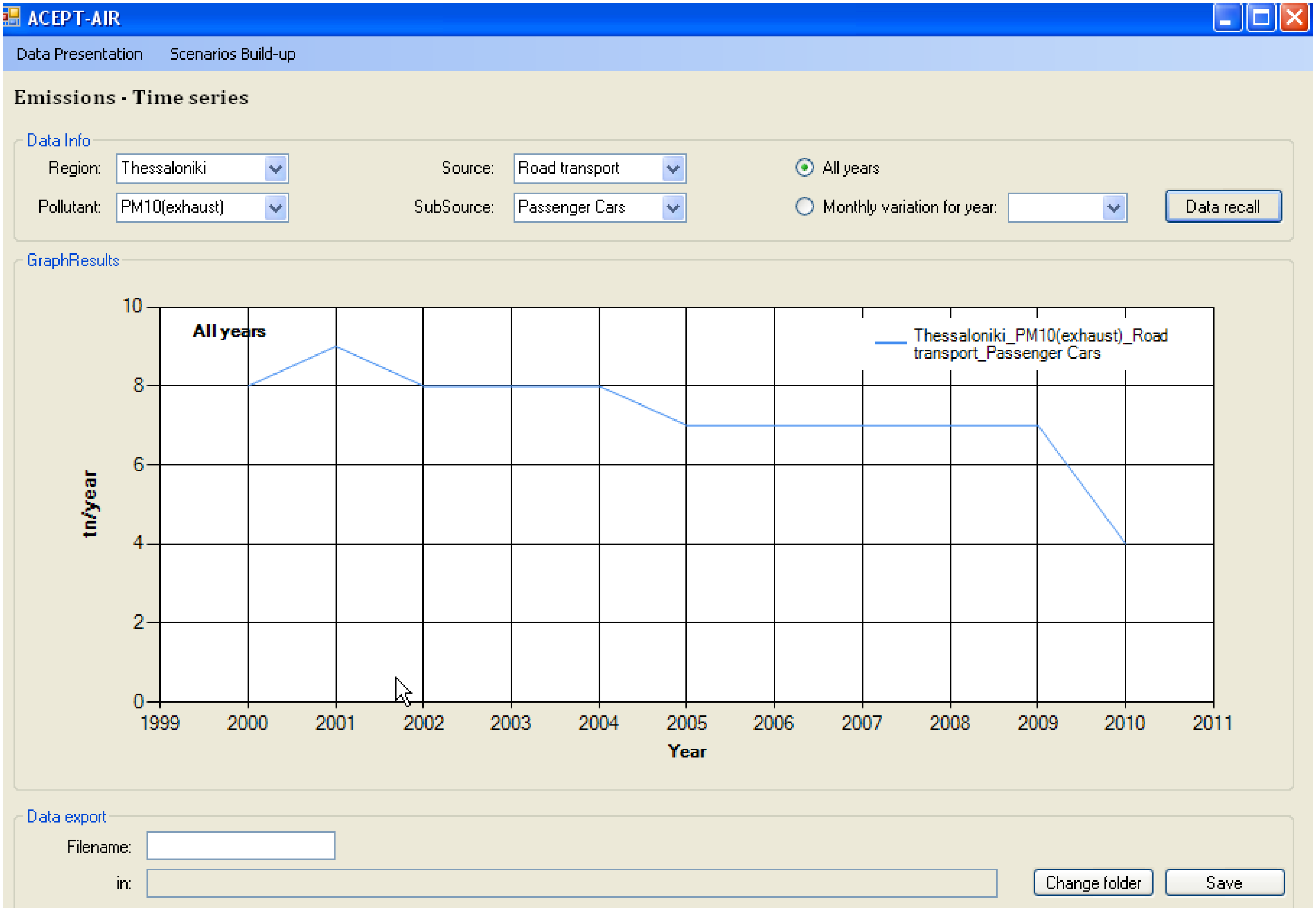


The ACEPT-AIR Policy Tool Operational Platform



The ACEPT-AIR Policy Tool Operational Platform