FAIRMODE Technical Meeting

University of Aveiro, Aveiro, Portugal

24-25 June 2015

Source and Receptor oriented models intercomparison exercise

Design of the Chemistry Transport Models application

G. Pirovano[1], M.T. Pay[2], M. Reizer[3], C.A. Belis[4]

(1)

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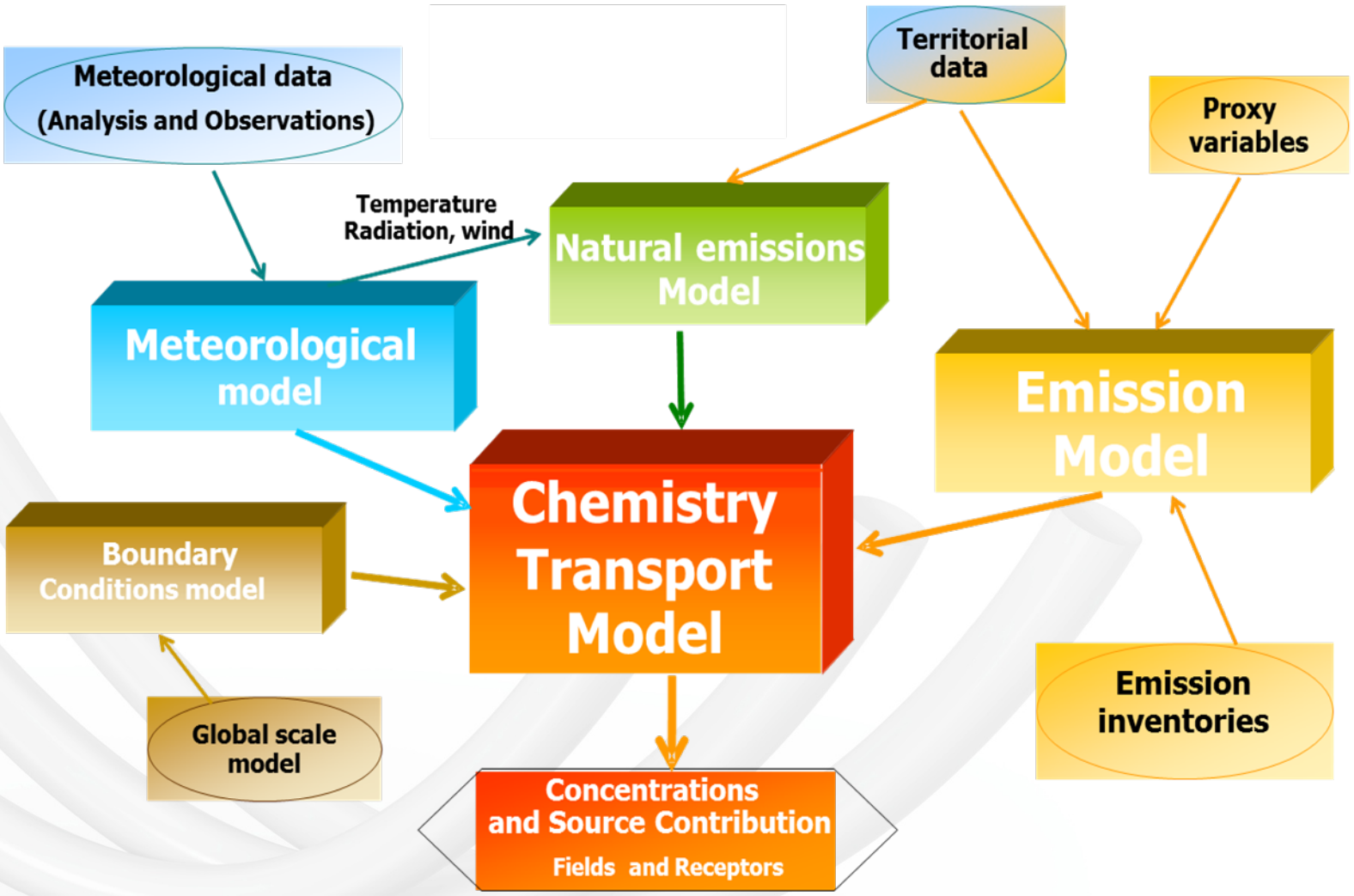
(4)

Introduction

- The **first** phase of the CTMs-RMs inter-comparison will be focused on a **reference site**, where both kind of models will be applied

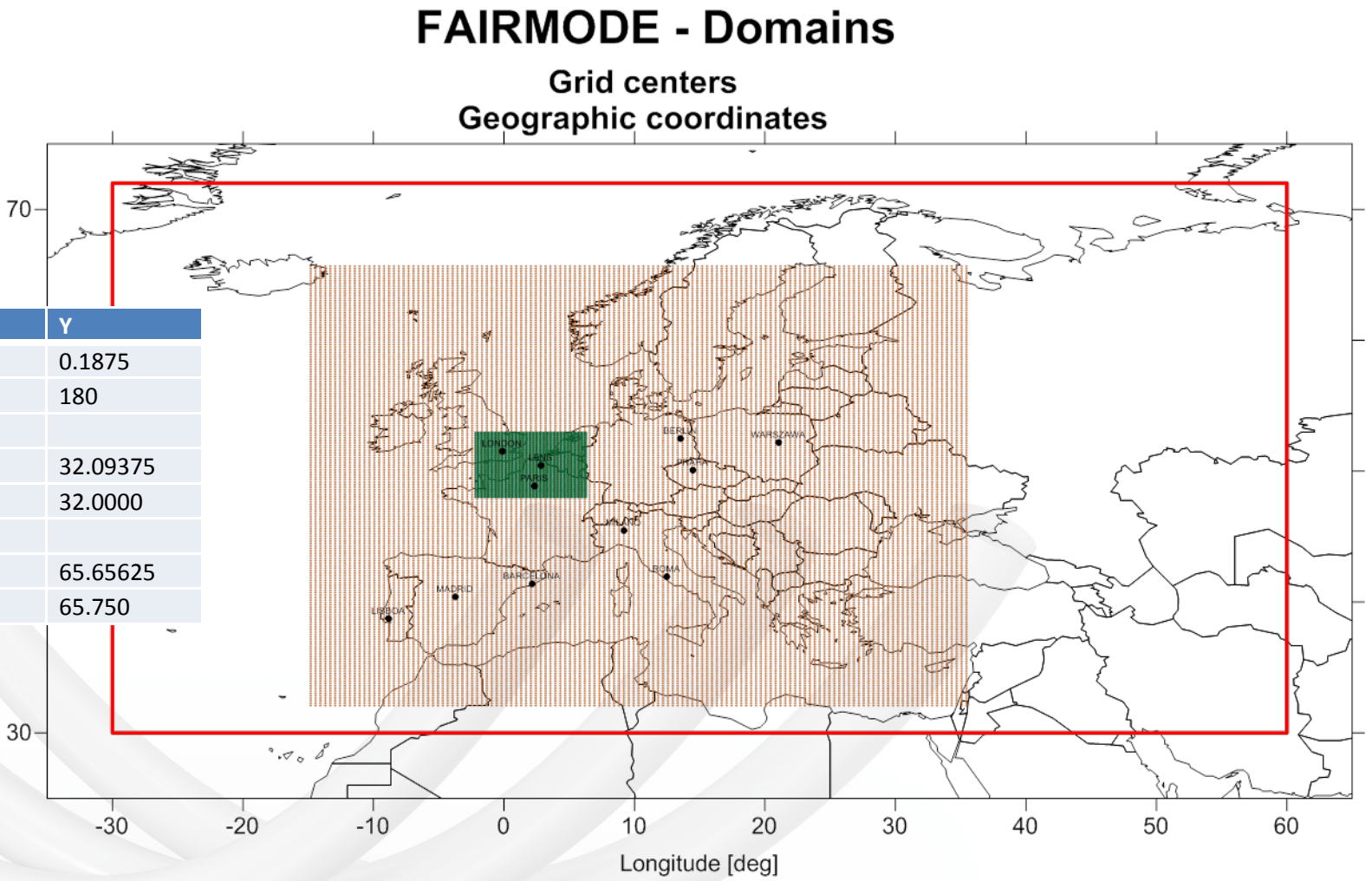
- CTMs require the design of a whole **model application** including:
  a) the definition of a modeling domain;
  b) the reconstruction of the input data set;
  c) the CTM application and the evaluation of model performance (MPE);
  d) the source contribution evaluation (SCE).

The modeling system



The FAIRMODE domains

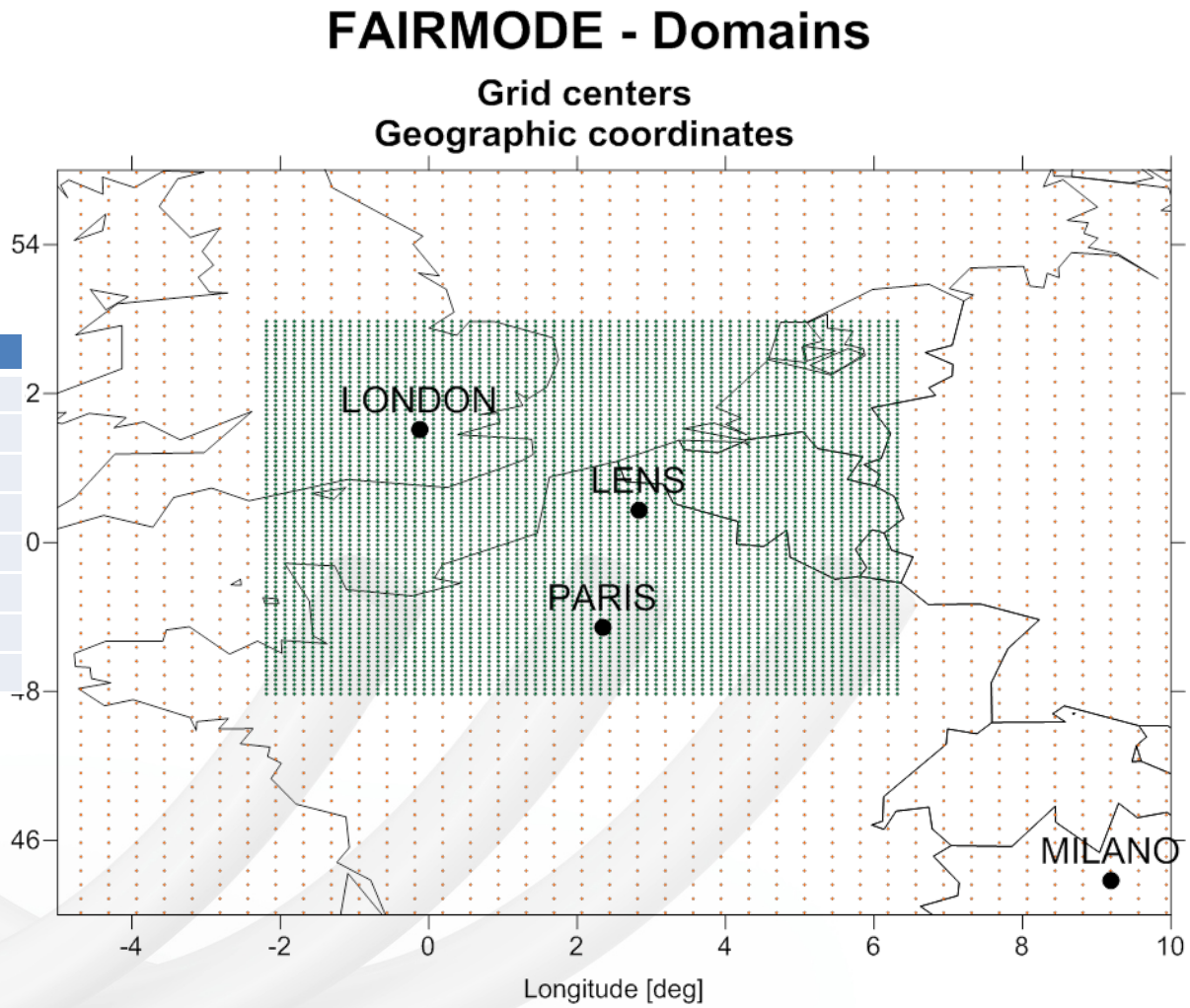
	X	Y
D	0.375	0.1875
N	135	180
SW_centre	-14.8125	32.09375
SW_corner	-15.0000	32.0000
NE_centre	35.4375	65.65625
NE_corner	35.625	65.750



TNO - DLONxDLAT step = 0.125 x 0.0625 [deg]

The FAIRMODE domains

	X	Y
D	0.125	0.0625
N	69	81
SW_centre	-2.1875	47.96875
SW_corner	-2.2500	47.9375
NE_centre	6.3125	52.96875
NE_corner	6.3750	53.0000



TNO - DLONxDLAT step = 0.125 x 0.0625 [deg]

Period of study

- Observed data for Lens case study are regularly available from **9/3/2011** to **6/3/2012** as **daily** data each **3** days.

- The two selected periods should be the most representative for both “hot” and “cold” seasons in France, being also long enough to include peak episodes and low concentration situations. Moreover, being observed data available each 3 days, 3 months of simulation are needed in order to pair at least 30 observations.

Summer**: from **1/6/2011** to **31/08/2011
Winter**: from **15/11/2011** to **15/02/2012

(Proposal)

Anthropogenic emissions

TNO SoAp 2011 data set

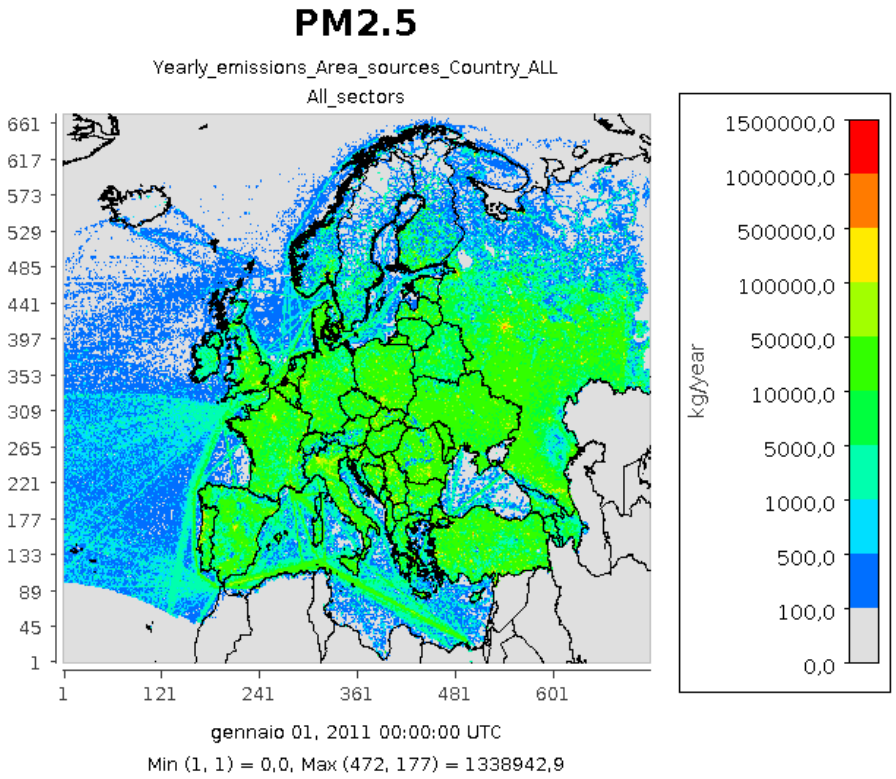
SNAP	SNAP_Name
1	Energy industry
21	Residential and commercial/institutional combustion, coal
22	Residential and commercial/institutional combustion, light liquid fuel
23	Residential and commercial/institutional combustion, medium liquid fuel
24	Residential and commercial/institutional combustion, heavy liquid fuel
25	Residential and commercial/institutional combustion, gas
26	Residential and commercial/institutional combustion, solid biomass (wood)
34	Industry (combustion & processes)
5	Fugitive emissions from fuels
6	Product use including solvents
71	Road transport, exhaust, gasoline
72	Road transport, exhaust, diesel
73	Road transport, exhaust, LPG/natural gas
74	Road transport, non-exhaust, gasoline evaporation
75	Road transport, non-exhaust, wear
8	Non-road transport
81	International shipping, marine diesel oil
82	International shipping, heavy fuel oil
9	Waste treatment
10	Agriculture

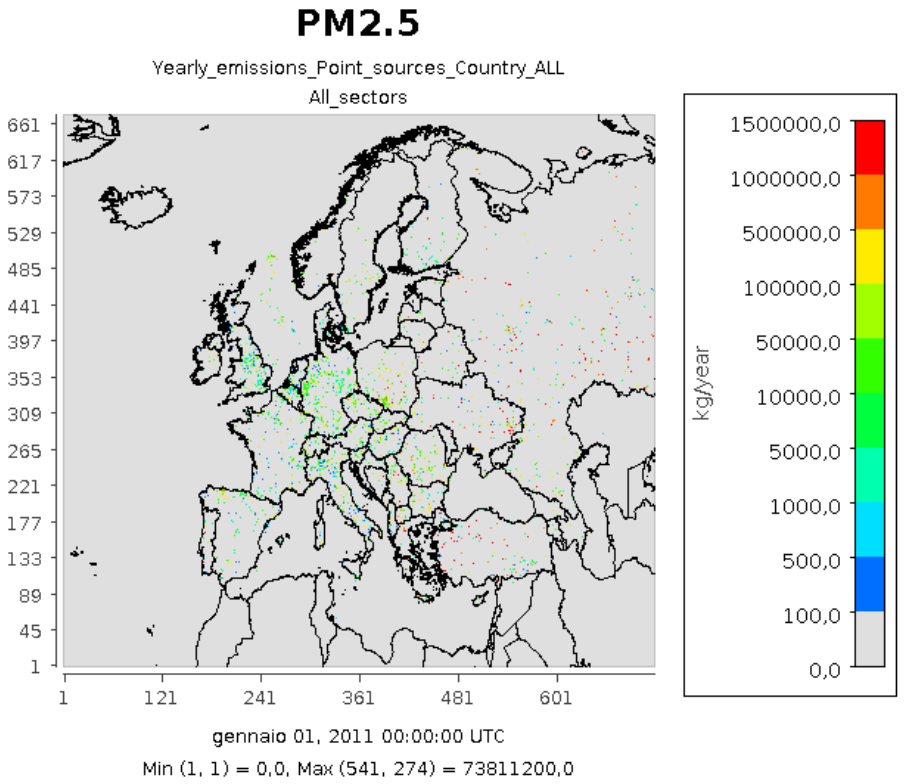
TNO - DLONxDLAT step = 0.125 x 0.0625 [deg]

TNO_MACC-III inventory by *J. Kuenen, A. Visschedijk, H. Denier van der Gon*

Anthropogenic emissions

TNO SoAp 2011 data set





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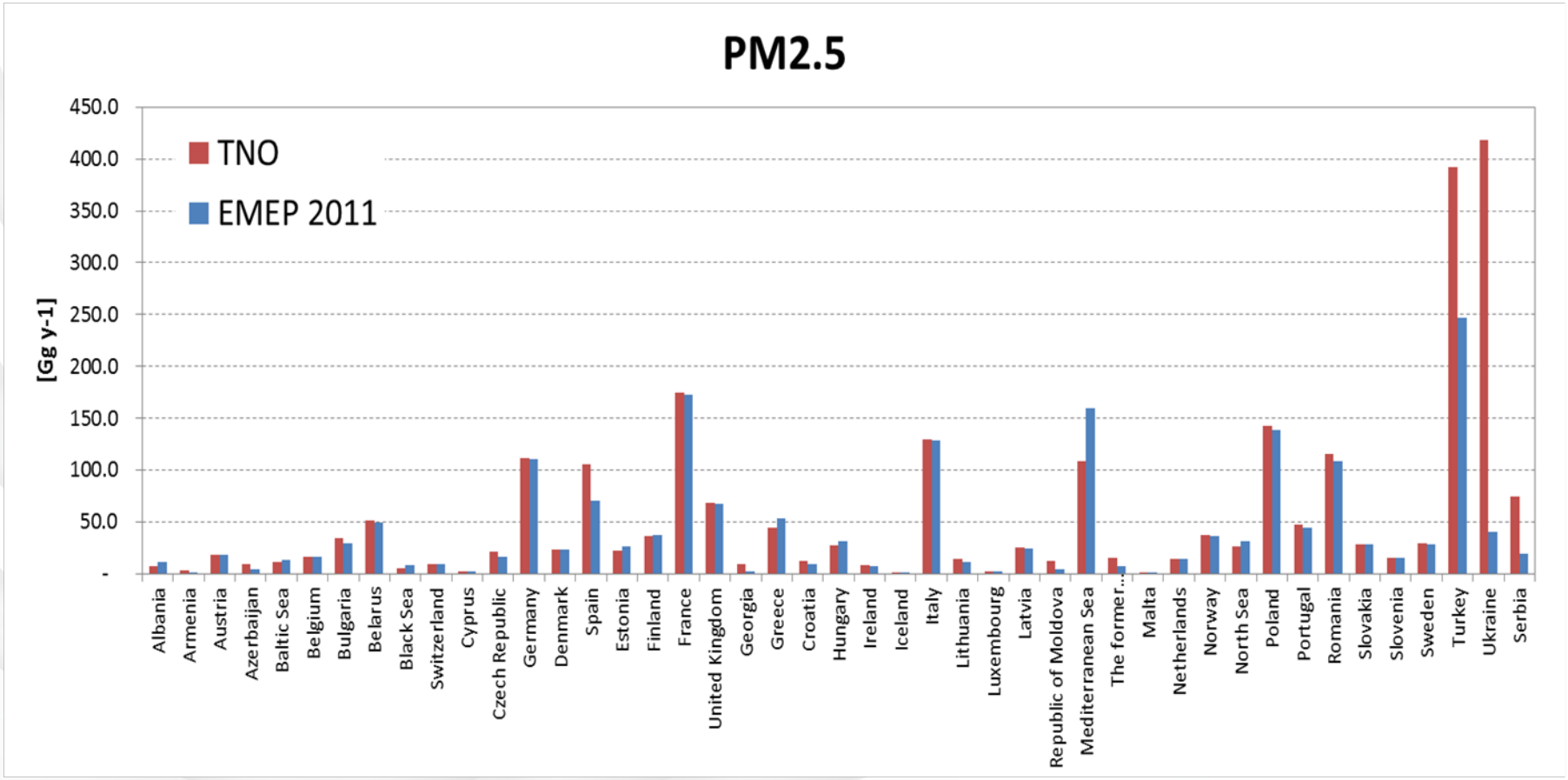
Anthropogenic emissions

TNO SoAp 2011 data set



TNO_MACC-III inventory by *J. Kuenen, A. Visschedijk, H. Denier van der Gon*

Anthropogenic emissions

Chemical speciation

- **PM speciation factors** allows to split $PM_{2.5}$ and PMcoarse emissions into: EC, OC, Na, SO_4 and Other minerals; factors are available for each country and SNAP sector
- **NO_X** emissions are supposed to be split into NO (97%) and NO_2 (3%) for each country and SNAP sector
- **SO_X** emissions are supposed to be split into SO_2 (98%) and SO_4 (2%) for each country and SNAP sector
- No information are available for **NMVOC speciation**, therefore this aspect will be left in charge to each modelling team. In Europe a widely adopted approach is applying SNAP dependent NMVOCs speciation profiles which are based on Passant (2002). Those profiles consider SNAP from 1 to 9.

Anthropogenic emissions

Profiles

- **Height profiles** are available for SNAP sector

SNAP 1	category	10	90	170	310	470	710	990
1	public power stations	0	0	0	0.08	0.46	0.29	0.17
2	Residential and commercial/institutional combustion	0.06	0.44	0.5	0	0	0	0
34	industry	0	0	0.04	0.19	0.41	0.3	0.06
5	extraction fossil fuel	0.1	0.8	0.1	0	0	0	0
6	solvents	1	0	0	0	0	0	0
7	road transport	1	0	0	0	0	0	0
8	other mobile, international shipping	1	0	0	0	0	0	0
9	waste	0.011	0.089	0.15	0.4	0.35	0	0
10	agriculture	1	0	0	0	0	0	0

- **Time profiles** are available as Monthly, Daily and Hourly factors

Natural emissions

Dust

Under the term “dust”, actually, there are several possible modeled contributions:

- Saharan dust taken into account just through boundary conditions
- Saharan dust emissions modelled inside the domain
- Natural dust other than Saharan
- Traffic resuspension

Modeling teams could include any of these terms, sharing information about the adopted approach

Sea salt emissions

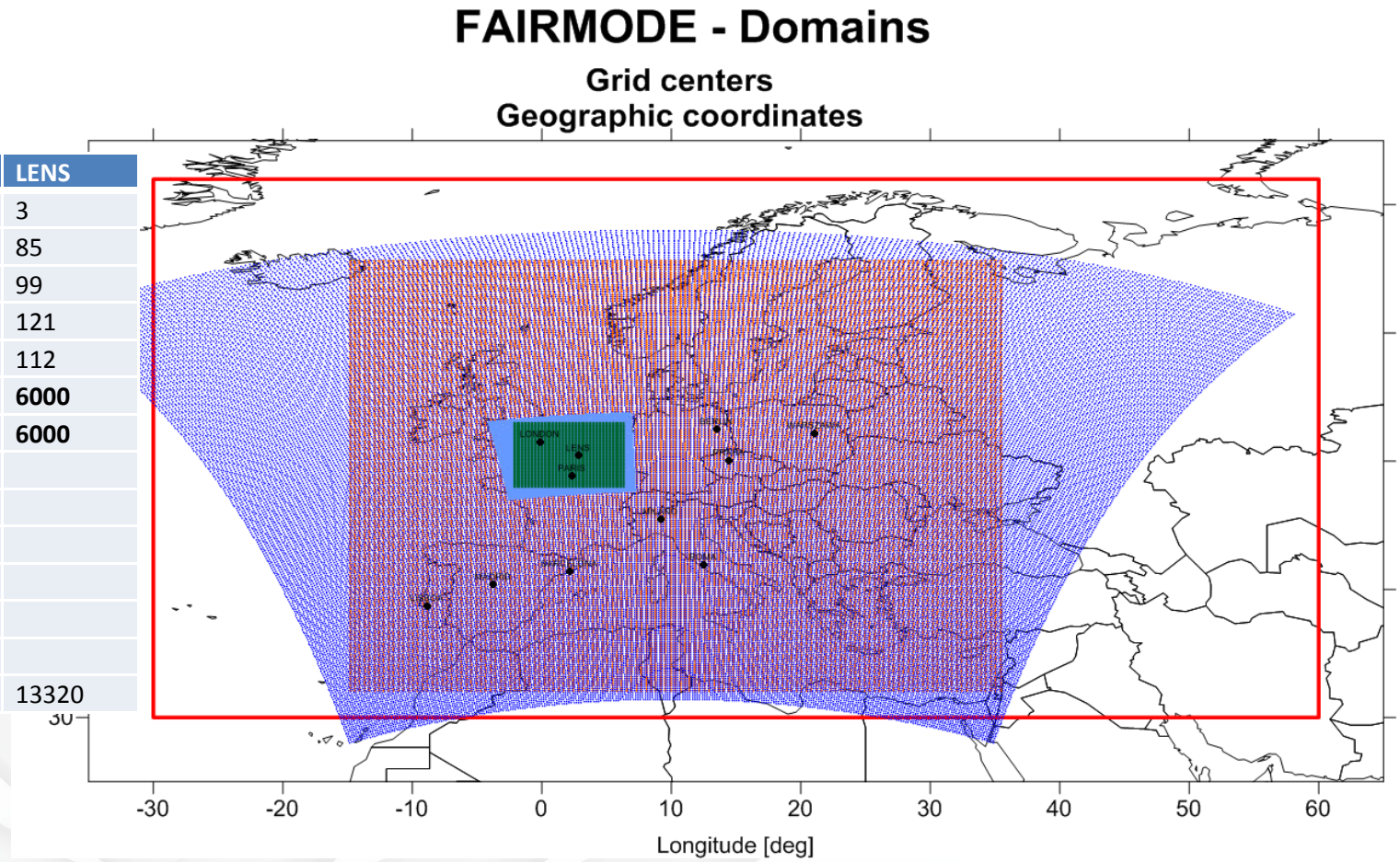
They should be included.

BVOC emissions

They should be mandatory.

Meteorological fields

	EU	LENS
parent_grid_ratio	1	3
i_parent_start	1	85
j_parent_start	1	99
e_we	271	121
e_sn	225	112
dx	**18000**	**6000**
dy	**18000**	**6000**
map_proj	'lambert'	
ref_lat	50	
ref_lon	10	
truelat1	30	
truelat2	60	
stand_lon	10	
# of cells	60480	13320



Meteorological fields

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map_proj	'lambert'	
ref_lat	50	
ref_lon	10	
truelat1	30	
truelat2	60	
stand_lon	10	
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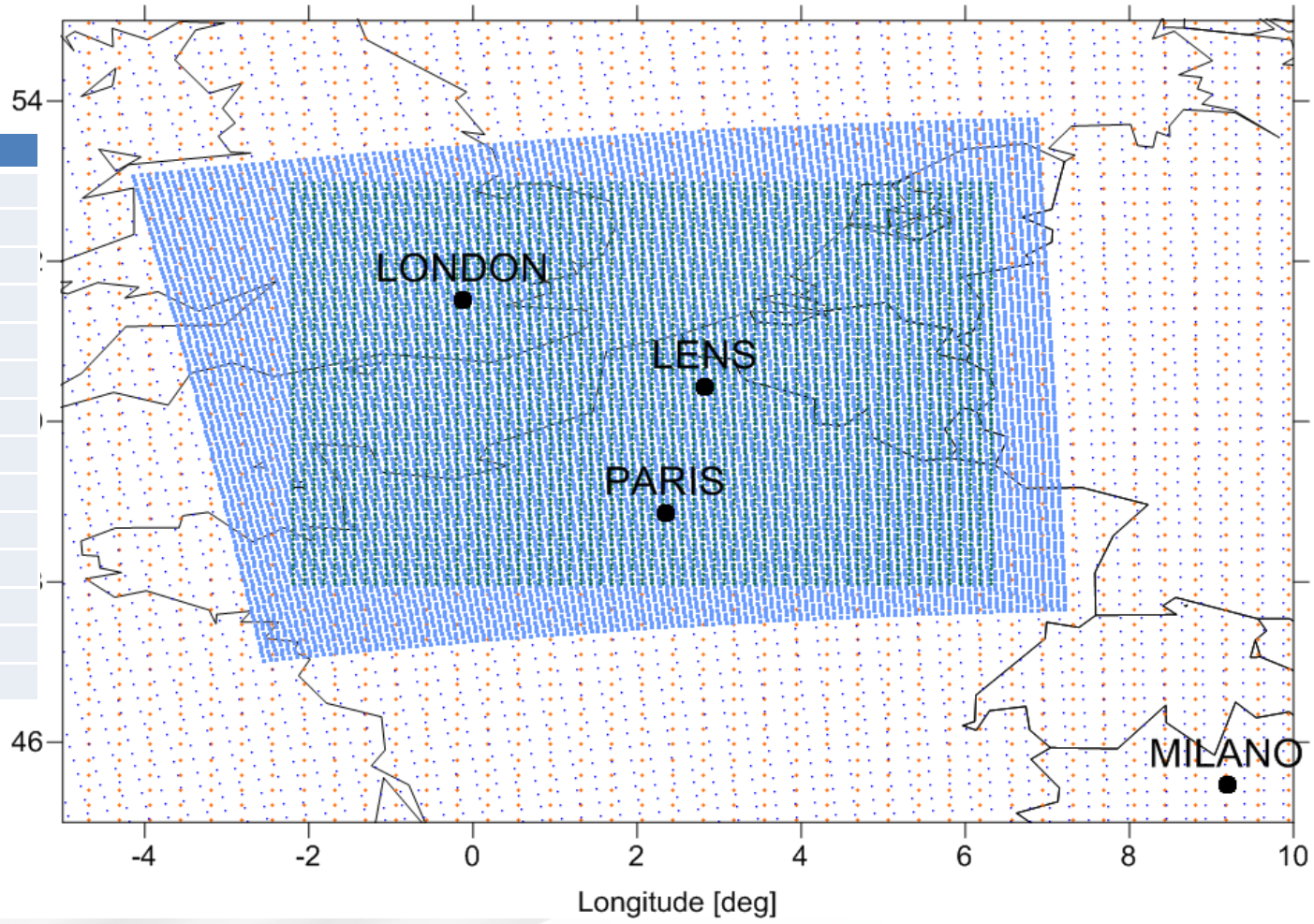


Meteorological fields

- **Model Configuration** (proposal)

Physical process	Option
Microphysics	WRF Single-Moment 6-class scheme,
Longwave Radiation	Rapid Radiative Transfer Model scheme,
Shortwave Radiation	Dudhia scheme,
Surface Layer	Revised MM5 Monin-Obukhov scheme,
Land Surface Model	unified Noah land-surface model,
Planetary Boundary layer	Yonsei University scheme, minutes between boundary-layer physics calls every time step
Cumulus Parameterization	New Grell scheme

- **WRF simulation should be validated.**

- WRF data should be stored in a repository area accessible by ftp

Boundary Conditions

- **Global model (MACC)**
  - Which release is available for requested periods?
  - Which variables?
  - Which temporal and spatial resolution?

- Global scale fields data should be stored in a repository area accessible by ftp

Base case (all sources)

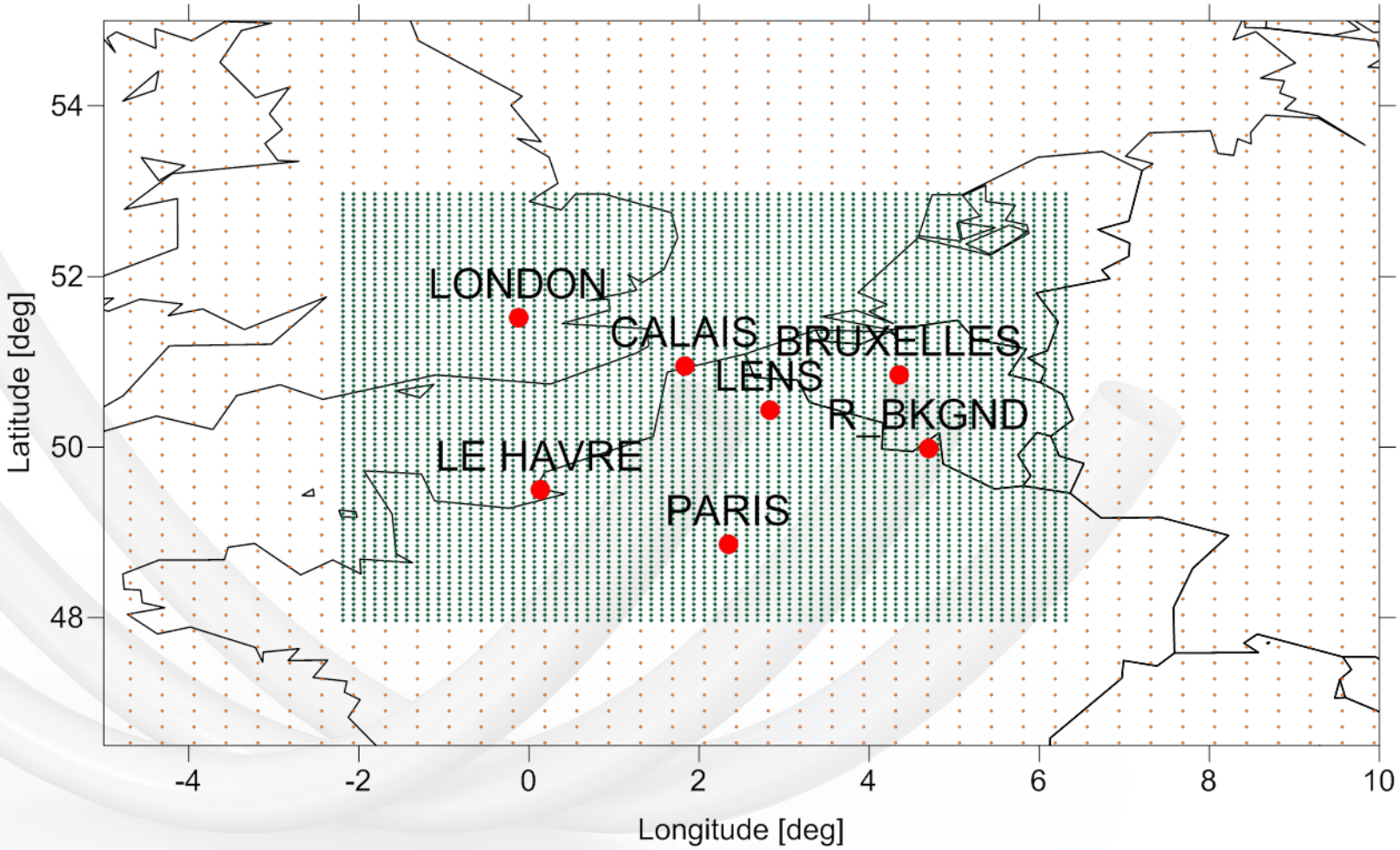
- To be performed over **EU** + **Lens** domain
  - Optionally EU fields may be derived from an EU run performed by other teams
- Model Performance Evaluation (**MPE**)
  - MPE is mandatory for each simulation
  - In-house or centralized MPE?
  - Common tools and methodology (e.g. DELTA tool)?
- Observed data
  - Airbase data over EU and Lens area
  - EMEP data over EU and Lens area
  - Lens PM composition data

Data to be delivered

- **Gridded** data (at a later stage?)
  - Which grids/subgrids?
- **Receptor** data (mandatory)
  - The receptors should include Lens, at least, but also other cities and 1 background site
  - Hourly resolution
  - Total concentration and Source Contribution Estimates (mass closure issues...)

Receptors

(Proposal)



Sources (I)

- **Emission category** tracking **Set I = 8** **Set II = 14**

	Set I	Set II
Energy industry	01_ENI	01_ENI
R & C combustion, coal	99_OTH	**02_OTH**
R & C combustion, light liquid fuel	99_OTH	**02_OTH**
R & C combustion, medium liquid fuel	99_OTH	**02_OTH**
R & C combustion, heavy liquid fuel	99_OTH	**02_OTH**
R & C combustion, gas	99_OTH	**02_OTH**
R & C combustion, solid biomass (wood)	02_BIO	02_BIO
Industry (combustion & processes)	34_IND	34_IND
Fugitive emissions from fuels	99_OTH	99_OTH
Product use including solvents	99_OTH	99_OTH

Sources (II)

- **Emission category** tracking **Set I = 8** **Set II = 14**

	Set I	Set II
Road transport, exhaust, gasoline	07_RTR	**71_RTG**
Road transport, exhaust, diesel	07_RTR	**72_RTD**
Road transport, exhaust, LPG/natural gas	07_RTR	07_RTR
Road transport, non-exhaust, evaporation	07_RTR	07_RTR
Road transport, non-exhaust, wear	07_RTR	**75_RTW**
Non-road transport	99_OTH	99_OTH
International shipping, marine diesel oil	08_SHP	08_SHP
International shipping, heavy fuel oil	08_SHP	08_SHP
Waste treatment	99_OTH	99_OTH
Agriculture	10_AGR	10_AGR
Dust	11_DST	11_DST
Sea Salt	99_OTH	**11_SLT**
Biogenic SOA	99_OTH	**11_BSO**

Sources (III)

- **Source area** tracking (optional)
  - Lens area (local emissions)
  - Paris area (regional emissions)
  - London area (regional emissions)
  - Benelux area (regional emissions)
  - Boundary conditions (long range transport).

Requested variables

- **Variables** (proposal)
  - PM10, PM2.5: mass concentration, EC, POA, SOA, NO3, SO4, NH4, Other Primary
  - PM precursors: NO, NO2, HNO3, SO2, NH3, VOC (to be discussed)
  - PM tracers (optional): Levoglucosan and other tracers, if any

- **Data format**
  - A data format already used in previous modeling exercise (e.g. (https://wiki.met.no/_media/emep/emep-experts/output_format_wiki_v20150331.docx)

Who & What

(Proposal)

Action	Item	WHO	Ref.	Where
Input Data	Boundary conditions	INERIS	F. Meleux	INERIS
	Meteorological fields (including MPE)	WUT	M. Reizer	WUT
	Meteorological observations	WUT	M. Reizer	WUT
	Emissions	TNO	J.J. Kuenen	TNO/JRC
	Air quality observations Airbase and EMEP data …..Field campaigns	 RSE/BSC INERIS/ VMM	 G. Pirovano/M.T.Pay O. Favez J. Vercauteren	 JRC JRC
Base Case	CTMs EU+Lens run	All	All	
	CTMs MPE	BSC	M.T. Pay	BSC
Source Apportionment	CTMs LENS run	All	All	
	CTMS EU run (optional)			
	CTMs/RMs SCEs comparison at receptors	JRC/RSE	C.Belis/G.Pirovano	JRC
	CTMs gridded SCEs analysis (optional)	?	?	?

When (Timetable)?

(Proposal)

	2015						2016				
	07	08	09	10	11	12	01	02	03	04	05
Delivery of the input data	■	■									
Base case simulations and MPE		■	■	■	■						
SA simulations				■	■	■	■				
CTM and RM intercomp. evaluation								■	■	■	■