

**17th International Conference on  
Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes  
9-12 May 2016, Budapest, Hungary**

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**FAIRMODE'S EU COMPOSITE MAPPING EXERCISE**

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**Abstract:** Within the context of FAIRMODE's Working Group 1 on Assessment, an exercise is setup in which national, regional or local air quality maps are collected and compiled into a so called "EU Composite Air Quality Map". The objective of the initiative is to gain further insight in air quality mapping for policy support in European Member States, regions and cities and to use the composite map and the lessons learnt during the process to provide further guidance for air quality model applications. The first prototype is made up out of 47 contributions and covers a large part of Europe. FAIRMODE is currently organising follow-up actions to collect feedback and lessons learnt.

**Key words:** FAIRMODE, air quality assessment

## **INTRODUCTION**

One of the aims of FAIRMODE is to harmonize modelling practices and provide guidance to EU Member States on the use of models in the framework of the Air Quality Directive. A recent survey completed by the National Contact Points pointed out that modelling activities have a clear added value to the policy making process but there is still a lack of clarity in legislation and a lack of common guidance on how to apply models in support of the implementation of the Air Quality Directive.

Over the last couple of years FAIRMODE-WG1 has focused on a QA/QC methodology (Model Quality Objectives, DELTA) and a Benchmarking process for air quality assessment. There is more and more consensus within the community on the proposed methodologies and first steps towards a CEN standardization process have been made.

Although tackling the QA/QC problem is for sure a big step in the right direction to provide common guidance, it is not sufficient. Remaining open questions within the modelling community are for example: what is the appropriate model setting (adequate resolution, adequate assumptions...)? how best to combine modelling results with monitoring data...? Providing answers to those questions is seen as the next challenge for WG1.

## **METHODOLOGY**

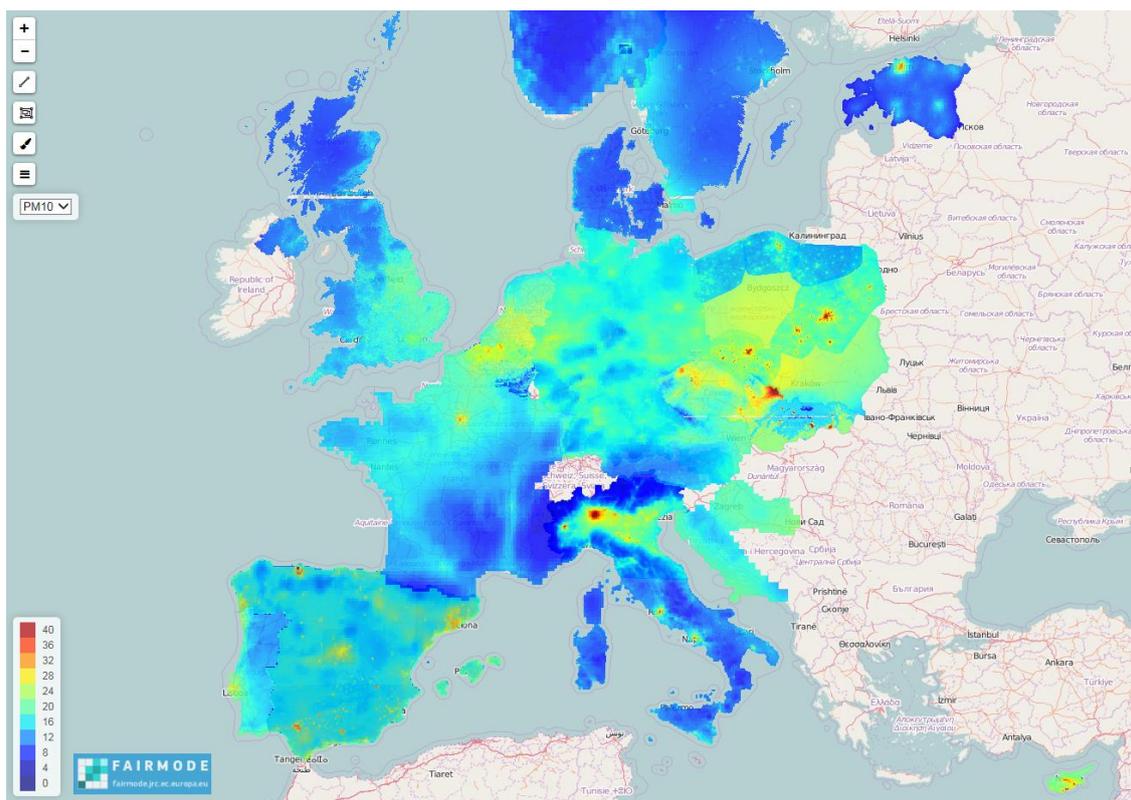
In order to open the discussion on the questions mentioned above, FAIRMODE-WG1 initiated an activity aiming at collecting and assembling modelled air quality maps, following the work initiated in the ETC/ACM pilot study (de Smet et al, 2013). The objective is to create a bottom-up composition map of air quality over Europe. National, regional or urban agencies or modelling teams were encouraged to provide their best available air quality map for their particular region. In the first phase, it was decided to limit the exercise to NO<sub>2</sub> and PM<sub>10</sub> annual averaged maps.

The first data collection started in Autumn 2015. In order to collect the maps, a dedicated upload webpage was setup within the FAIRMODE website. Interested parties were able to upload their air quality maps and provide essential meta information such as model name and version, projection system, reference year, contact details of the modelling team etc. By the end of 2015, 47 unique contributions were collected. Detailed information about those individual contributions can be found in Table 1.

**Table 1.** Overview of all contributions in the first prototype of the EU Composite Mapping Exercise. Per contribution, the country, region or city, contributing institute, contact person and model applied are given

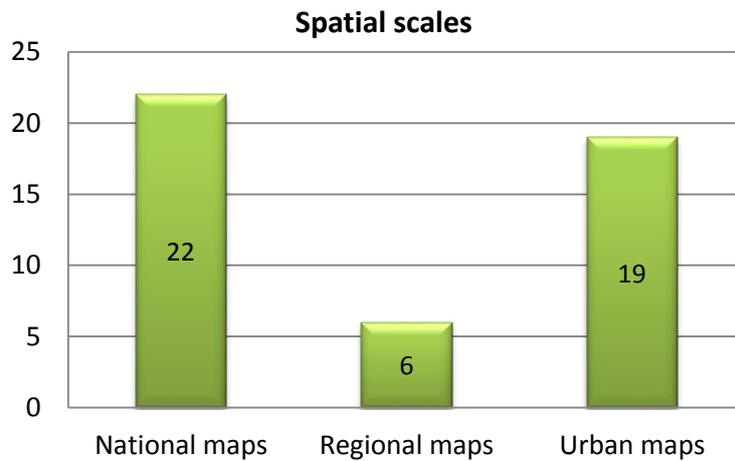
Country	Region/City	Institute	Contact person	Model
<b>Austria</b>	Austria	ZAMG	Hirtl Marcus	WRF-Chem
	Styria	Federal state government of Styria	Payer Ingrid	Gral-Graz2
	Linz	Linz - Amt der OöLandesreg.	Oitzl Stefan	GRAL-Linz
<b>Belgium</b>	Belgium	IRCEL	Fierens Frans	RIO
	Flanders	IRCEL	Fierens Frans	RIO-IFDM
	Antwerp	VITO	Lefebvre Wouter	RIO-IFDM- OSPM
<b>Croatia</b>	Croatia	DHZ	Sonja Vidic	EMEP
<b>Cyprus</b>	Cyprus	University Thessaloniki	Tsegas Georgios	MARS-aero
	Nicosia	University Thessaloniki	Tsegas Georgios	MARS-aero
	Famagusta	University Thessaloniki	Tsegas Georgios	MARS-aero
	Limassol	University Thessaloniki	Tsegas Georgios	MARS-aero
	Larnaca	University Thessaloniki	Tsegas Georgios	MARS-aero
	Paphos	University Thessaloniki	Tsegas Georgios	MARS-aero
<b>Czech Republic</b>	Czech Republic	CHMI	Benešová Nina	RIMM
<b>Denmark</b>	Denmark	Ahrus University	Jesper Heile Christensen	DEHM
<b>Estonia</b>	Estonia	KLAB	Erik Teinemaa	SMHI Grid model
<b>Finland</b>	Finland	Finnish Meteorological Institute	Karppinen Ari	SILAM
<b>France</b>	France	INERIS	MELEUX Frederik	CHIMERE
<b>Germany</b>	Germany	Umweltbundesamt	Nordmann Stephan	RCG
	Germany	Research Center Juelich	Krajsek Kai	EURAD_IM
<b>Italy</b>	Italy	ENEA	Ciucci Alessandra	AMS-MINNI
	Emila Romagna	ARPA Emilia Romagna	Stortini Michele	NINFAPESCO
<b>Netherlands</b>	Netherlands	RIVM	Joost Wesseling	NL-OPS
<b>Norway</b>	Norway	NILU	Vogt Matthias	Basemap
	Oslo	NILU	Vogt Matthias	Episode
<b>Poland</b>	Poland	Ekometria	Malgorzata Paciorek	CAMx
	Dolnoslaskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Lodzkie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Mazowieckie Voiv.	Ekometria	Malgorzata Paciorek	CALPUFF
	Opolskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Podlaskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Pomorskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Warminsko-mazurskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
	Zachodniopomorskie Voivodship	Ekometria	Malgorzata Paciorek	CALPUFF
<b>Portugal</b>	Portugal	Universidade de Aveiro	Monteiro Alexandra	CHIMERE
<b>Slovakia</b>	Slovakia	SHMU	Matejovicova Jana	IDWA
	Slovakia	SHMU	Matejovicova Jana	CEMOD
<b>Spain</b>	Mainland Spain and the Balearic Islands	CIEMAT	Theobald Mark	CHIMERE
	Canary Islands	Barcelona Supercomputing Cent.	Pay Maria Teresa	CALIOPE
	Iberian Peninsula and Balearic Islands	Barcelona Supercomputing Cent.	Pay Maria Teresa	CALIOPE
	Madrid	Barcelona Supercomputing Cent.	Pay Maria Teresa	CALIOPE
	Andalucia	Barcelona Supercomputing Cent.	Pay Maria Teresa	CALIOPE
	Catalonia	Barcelona Supercomputing Cent.	Pay Maria Teresa	CALIOPE
	Spain	Technical Univ. Madrid (UPM)	Borge Rafael	CMAQ
<b>Sweden</b>	Sweden	SMHI	Backstrom Hans	SIMAIR
<b>UK</b>	UK	Ricardo-AEA	Brookes Daniel	PCMBK
	London	CERC	Kate Johnson	ADMS-Urban

All the individual maps were assembled into the first prototype of the EU Composite Map. The result for the annual averaged  $PM_{10}$  maps is given in Figure 1. During the process, the individual maps were not resampled or interpolated to a standard grid and care was taken to maintain the data sets as provided by the participant. As can be observed from the figure below, a large part of Europe<sup>1</sup> is already covered in this first prototype. The contributions can be classified according to their spatial coverage ranging from the national down to the local level. A segregation into national, regional and urban scale maps is presented in Figure 2.



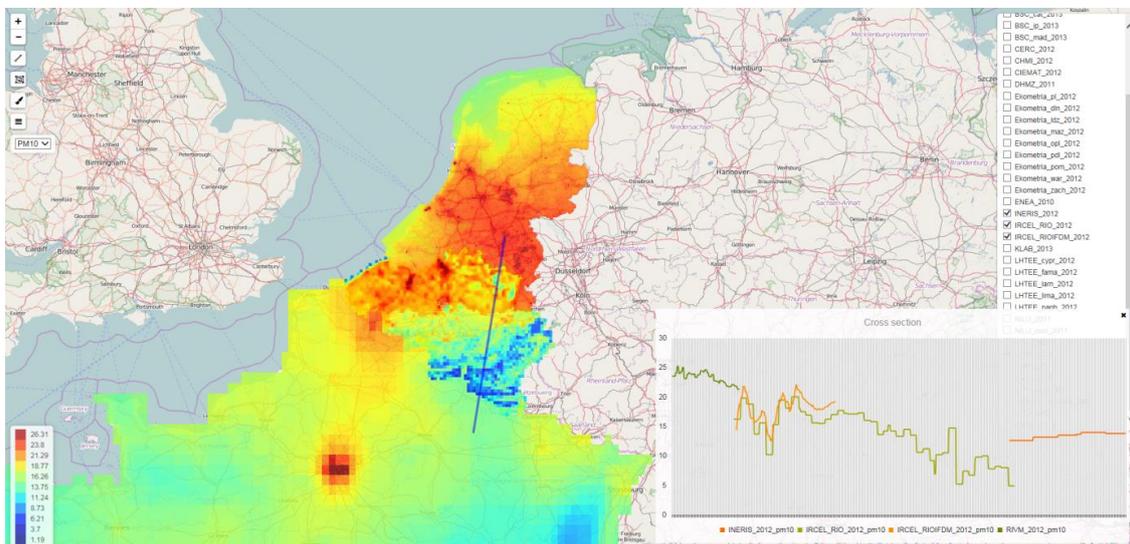
**Figure 1.** EU Composite Map for  $PM_{10}$  for the year 2012. The map is composed out of 47 individual contributions as detailed in Table 1.

<sup>1</sup> Note that the FMI and UMP contribution were delivered but not uploaded in the final system due to data format reasons. This shortcoming will be solved in the next update.



**Figure 2.** Contributions classified according to their spatial scales. Note that regional maps refer to maps produced by regional authorities and covering sub-national domains.

In order to support the analysis of the maps, a web based visualization platform was setup and made available via the FAIRMODE website. The platform allows zooming into a specific domain of interest, to enable or disable individual maps, to modify the colour legend and to draw a concentration profile along a user defined transect. An example of such a concentration profile is given in Figure 3. The concentration profile turns out to be a useful instrument to explore for example concentration differences at inter-regional or inter-national borders.



**Figure 3:** Concentration profile (right bottom) along a user defined transect (blue line). PM<sub>10</sub> concentration maps are visible for the Netherlands, Belgium and France.

## **DISCUSSION AND OUTLOOK**

The first prototype of the EU Composite Mapping clearly demonstrates the potential of such an European wide initiative. The mapping exercise will be used as common platform within FAIRMODE as a catalyst to trigger discussions on:

- Border effects which are visible between neighbouring regions or countries
- Use of data assimilation or data fusion techniques to produce air quality maps
- Quality and consistency of underlying emission inventories
- Choice of an adequate spatial resolution for a particular application
- ...

Furthermore, the exercise can also be used to convince countries or regions that are not yet using models on a regular basis to participate in the process.

In summary, the objective of this exercise is in the first place capacity building. The platform will improve comparability of assessment methodologies and will make it easier to learn from each other. Therefore, the platform is hosted in a “safe space” (the FAIRMODE website) without any link to the formal compliance checking processes.

However, a long term objective of the initiative is to contribute also to the e-Reporting process. Some Member States are already reporting modelling data in the official data flows and more Member States are expected to do so in the future. However, also here is a clear lack of guidelines on the use of models and reporting formats. It is not the objective of this initiative to deliver model data for the e-Reporting process but it is obvious that FAIRMODE can prepare the ground for a possible harmonized approach and contribute to reporting guidelines.

## **REFERENCES**

de Smet Peter, de Leeuw Frank, Horálek, Jan, Kurfürst Pavel, (2013) A European compilation of national air quality maps based on modelling, ETC/ACM Technical Paper 2013/3.