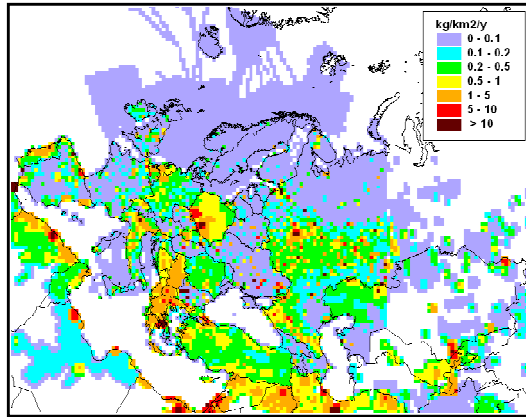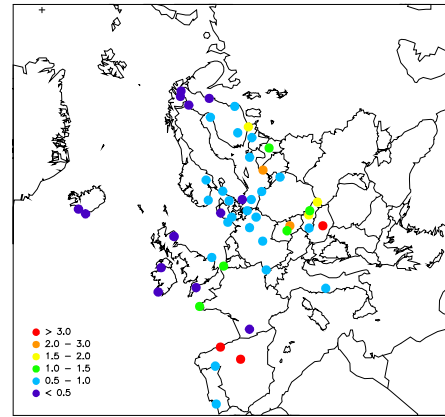# EMEP case study on heavy metal pollution assessment

Ilia Ilyin, EMEP/MSC-E
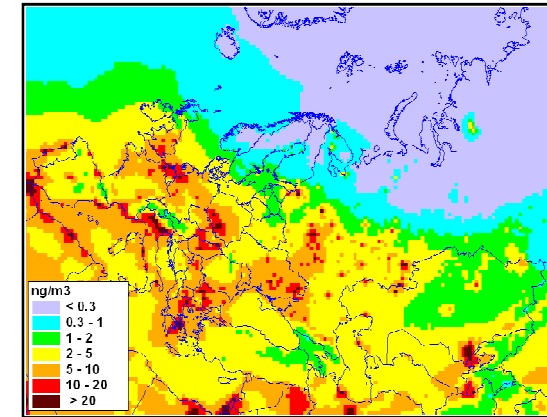
Annual EMEP information on HMs for countries

Emissions

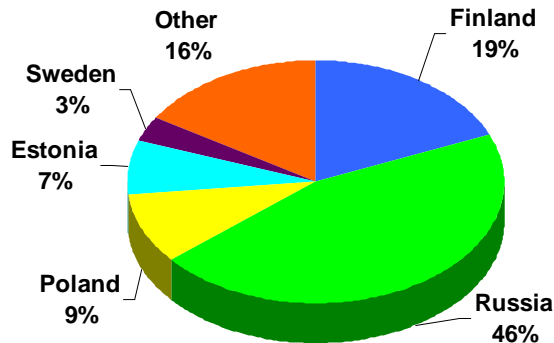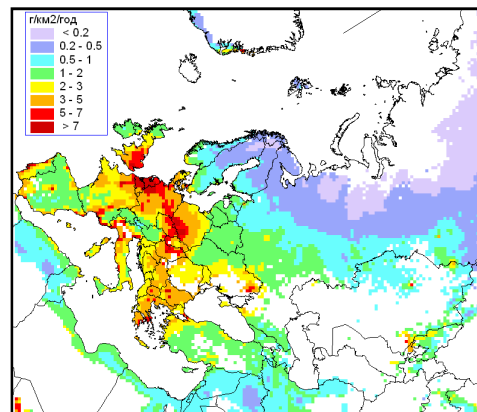**Monitoring data**

Modelled pollution levels

Source-receptor relationships

Information for WGE

Validation

EMEP/MSC-E

TFMM, 19-20 November 2009, Ispra, Italy
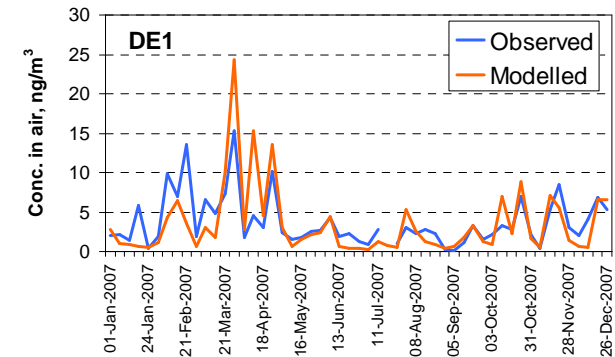
Why is the case study suggested?

Factors affecting quality of the pollution assessment:

➤ Uncertainties of emission data (completeness of the data, spatial distribution, temporal variability etc..)

➤ Uncertainties of monitoring data (network density, data quality, representativeness of stations etc….)

➤ Uncertainties of modelling (spatial resolution, model parameterizations, etc ...)

Detailed complex analysis of pollution for an individual country can be performed in the framework of special case study

Case study

Main purpose:
A complex analysis of factors affecting quality of the assessment of heavy metal pollution levels using variety of available information (detailed emissions, monitoring and modelling).

Expected output:
- Detailed assessment of pollution levels and factors controlling them in individual countries

- Recommendations to further improvements of pollution assessment components (quality of emissions, model parameterizations, quality and representativeness of monitoring data etc..)

Metal: Pb, Cd, Hg (according to a country's choice)

Participants: MSC-E, national experts, CCC, CEIP, WGE; under TFMM

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General scheme of the case study

Emission data

Meteo and geophys.

Monitoring data

Improvements

Atmospheric modelling

Modelling again

Analysis of results

Recommendations; Improved assessment of pollution levels

EMEP/MSC-E

TFMM, 19-20 November 2009, Ispra, Italy
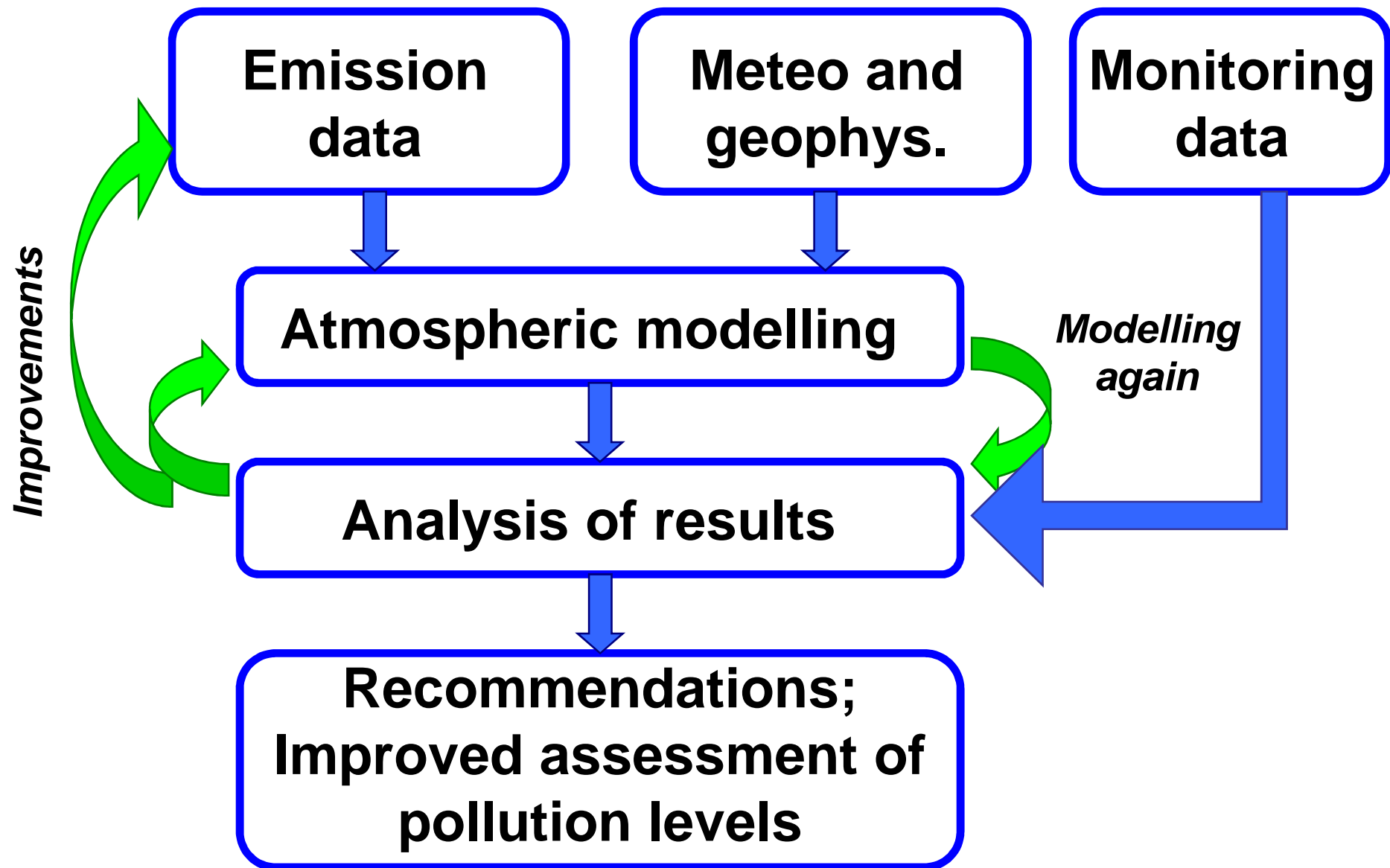
Draft programme of the case study on heavy metal pollution assessment

WP1. Emission data preparation for modelling and analysis

WP2. Collection and analysis of monitoring data

WP3. Preparation of input geophysical and meteorological data for modelling and modification of the model

WP4. Atmospheric modelling

WP5. Complex analysis of results

WP6. Improved model assessment of pollution levels in a country

WP1. Emission data preparation for modelling and analysis

Objective: Prepare maximum detailed HM emission data set for a country for modelling
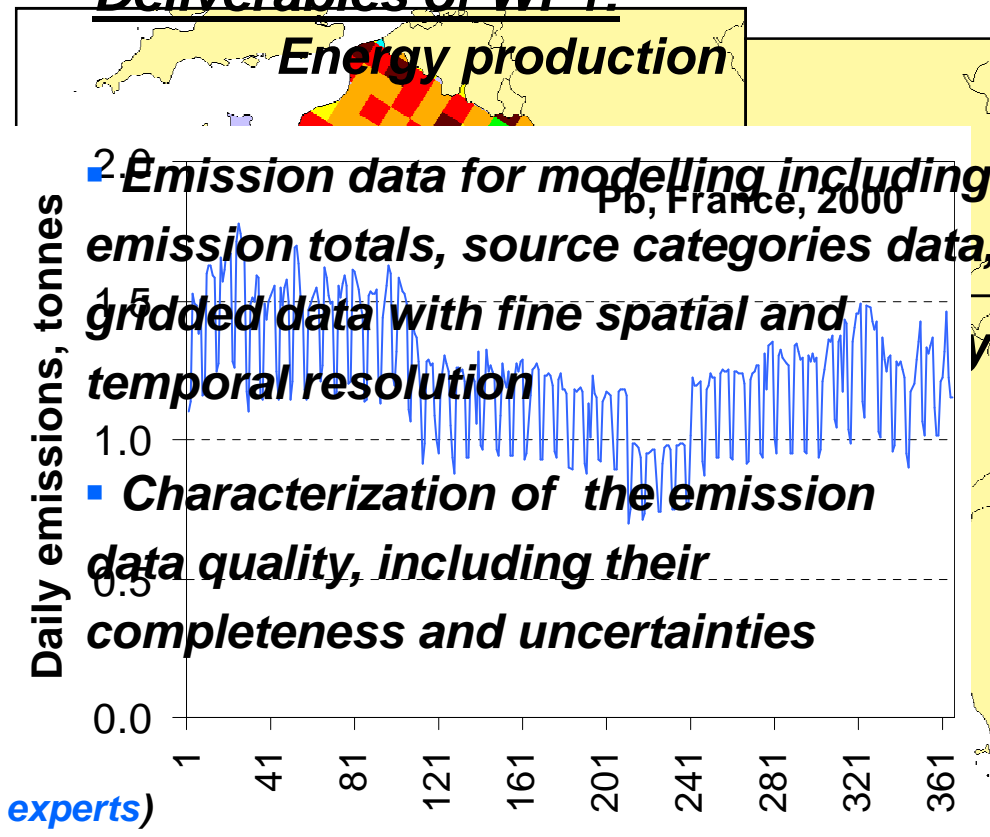
Basic requirements:

➢ **Total emissions in a country** (*Nat. experts, CEIP*)

➢ **Emission source categories data** (*Nat. experts, CEIP*)

➢ **Data with high spatial resolution (e.g., 10x10 km)** (*Nat. experts*)

➢ **Emissions in other countries** (*CEIP, MSC-E*)

Additional requirements:

➢ **Large point source data** (*Nat experts*)

➢ **Temporal variability of emissions** (*Nat experts*)

➢ **Emission factors** (*Nat. experts*)

➢ **Particle size distribution** (*Nat. experts*)

Deliverables of WP1:

Energy production

- **Emission data for modelling including emission totals, source categories data, gridded data with fine spatial and temporal resolution**

- **Characterization of the emission data quality, including their completeness and uncertainties**

Pb, France, 2000

Daily emissions, tonnes

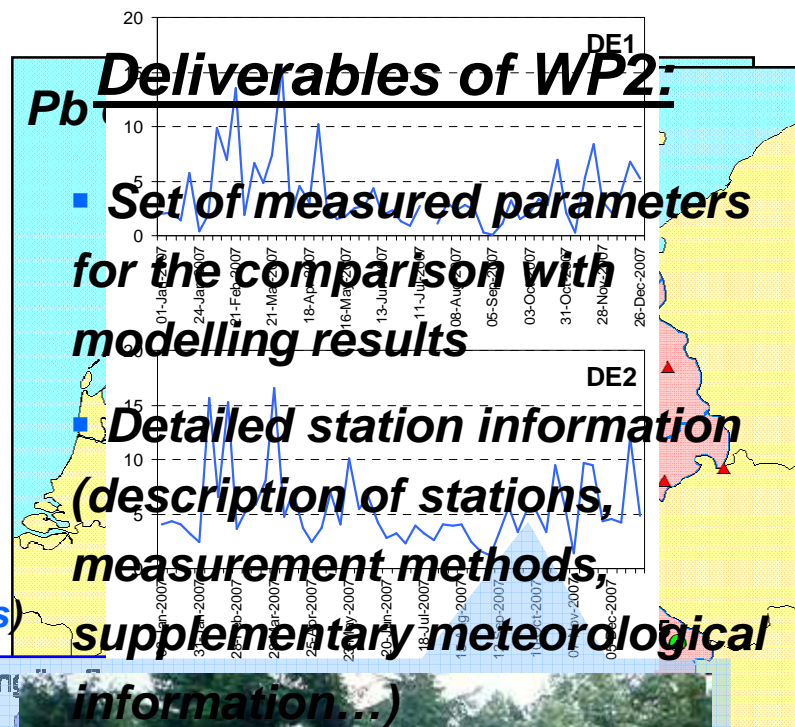# WP2. Collection and analysis of monitoring data for pollution assessment

Objective: Collect and evaluate the existing information on measurements of HMs at national scale

Basic requirements:

➤ *Meas. data at EMEP stations (CCC)*

➤ *Detailed site description, its representativeness (CCC, nat. experts)*

➤ *High temporal resolution (days, weeks) (CCC, nat. experts)*

Additional requirements:

➤ *Meas. data at national networks (Nat. experts)*

➤ *Meteorological information (precipitation, wind,…) (Nat. experts)*

➤ *Additional measurement information (e.g., concentrations of HMs in mosses, throughfall measurements, ….) (Nat. experts, WGE)*

➤ *Field campaigns (Nat. experts)*

Deliverables of WP2:

▪ *Set of measured parameters for the comparison with modelling results*

▪ *Detailed station information (description of stations, measurement methods, supplementary meteorological information…)*

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WP3. Preparation of input data for modelling

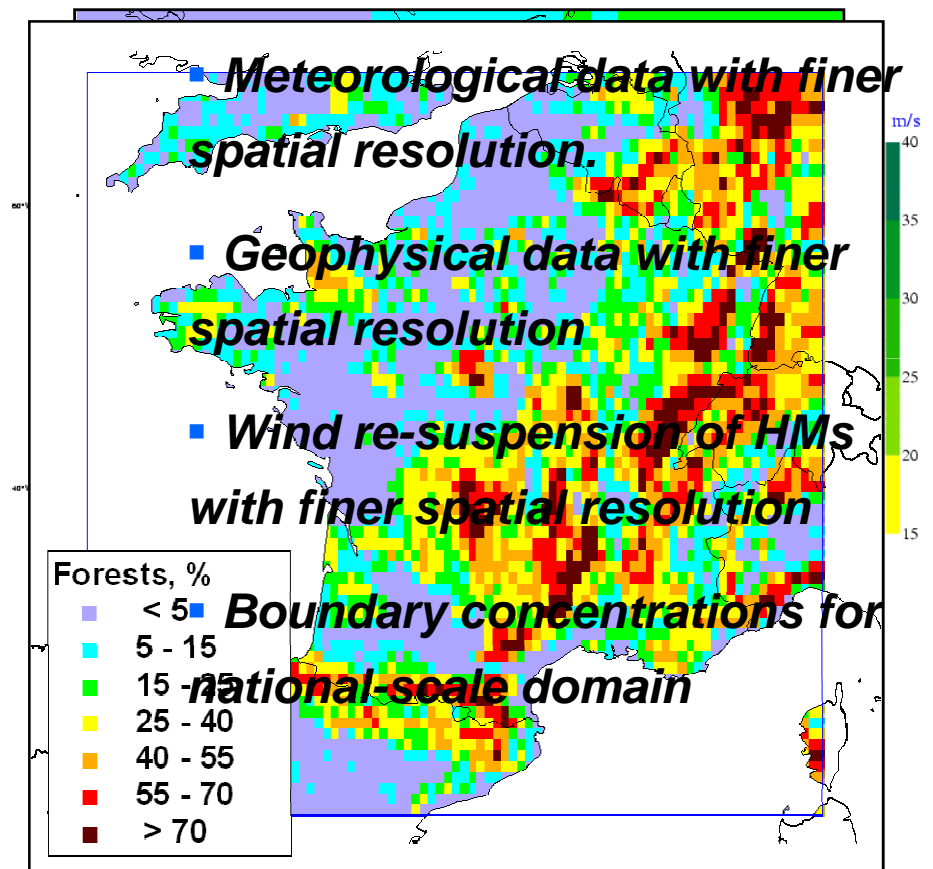**Objective:** Collect input data for modelling with required spatial resolution

Basic list of the input data with high spatial resolution (MSC-E)

- ➢ Meteorological data
- ➢ Geophysical data (land cover, conc. in soils …)
- ➢ Computed boundary concentrations
- ➢ Wind re-suspension of HMs

Additional list of the input data (national experts)

- ➢ Concentrations of HMs in soil
- ➢ Dust suspension
- ➢ Country-specific land-cover
- ➢ Critical loads

Deliverables of WP3:

- ■ Meteorological data with finer spatial resolution.
- ■ Geophysical data with finer spatial resolution
- ■ Wind re-suspension of HMs with finer spatial resolution
- ■ Boundary concentrations for national-scale domain

Forests, %
- < 5
- 5 - 15
- 15 - 25
- 25 - 40
- 40 - 55
- 55 - 70
- > 70

m/s
40
35
30
25
20
15

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WP4. Atmospheric modelling *(MSC-E)*

**Objective:** Produce detailed modelling information on pollution levels over a country for further analysis

Basic set of calculations

➢ *Modelling over a country with current (50 x 50 km) and fine spatial resolution (e.g., 10 x 10 km)*

➢ *Source-receptor modelling for a country. So* admin. regions. *Receptors:* admin. regions an

➢ *Contribution from the global sources estim*

➢ *Modelling of pollution from different source*

Additional calculations

➢ *Modelling with different temporal resolution*

➢ *Modelling with detailed vertical distribution*

France, administrative regions

➢ *Calculations of pollution levels from individual LPS*
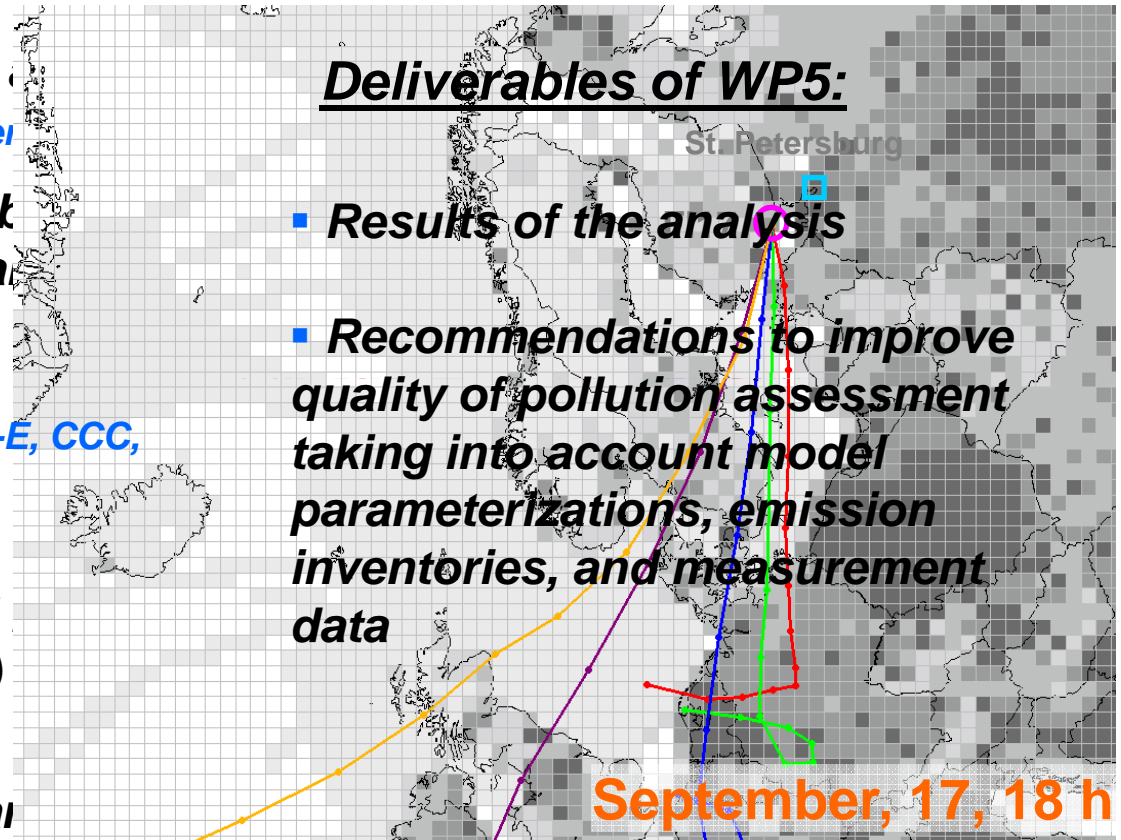
➢ *Calculations of national models (nat. experts)*

Deliverables of WP4: *modelling results*
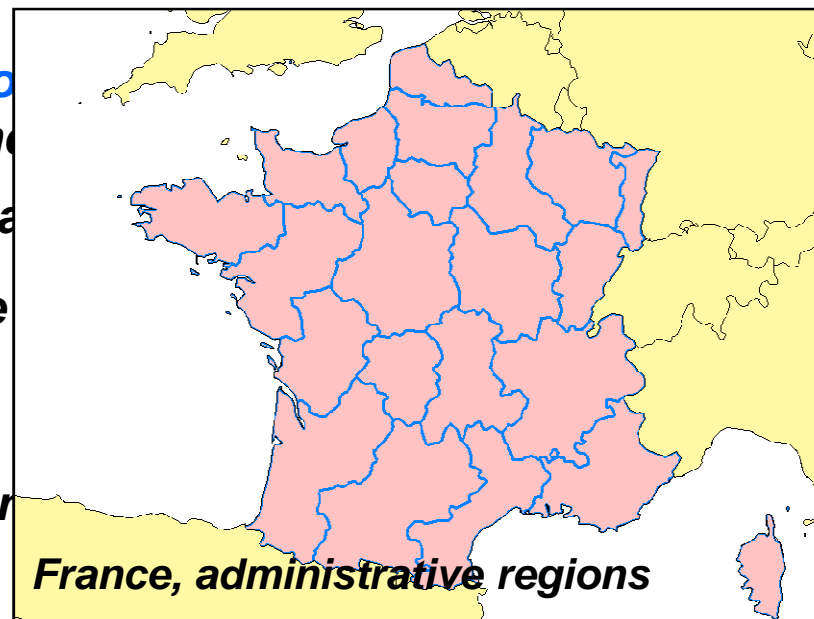
WP5. Complex analysis of results

Objective: Perform comprehensive analysis of modelling results obtained in WP4, identify reasons of the discrepancies between modelled and measured values and work out recommendations.

➢ *Comparison with measurements* with national models *(MSC-E, nat. experts)*

➢ *Analysis of discrepancies using* *trajectories for selected grid cells a* *source-receptor results (MSC-E)*

➢ *Analysis of monitoring data (MSC-E, CCC, nat. experts)*

➢ *Model parameterizations (vertical* *dry deposition and wet scavenging)*

➢ *Influence of different emission par* *(spatial resolution, temporal variability etc.* *(MSC-E, CEIP, nat. experts)*

Deliverables of WP5:

St. Petersburg

■ *Results of the analysis*

■ *Recommendations to improve quality of pollution assessment taking into account model parameterizations, emission inventories, and measurement data*

September, 17, 18 h

Emission, g/km2/y   Traj. Height, m

0.001 -	5.000		Layer 1 (40 m)	
5.000 -	30.000		Layer 2 (110 m)	
30.000 -	100.000		Layer 3 (230 m)	
100.000 -	500.000		Layer 5 (700 m)	
			Layer 7 (	

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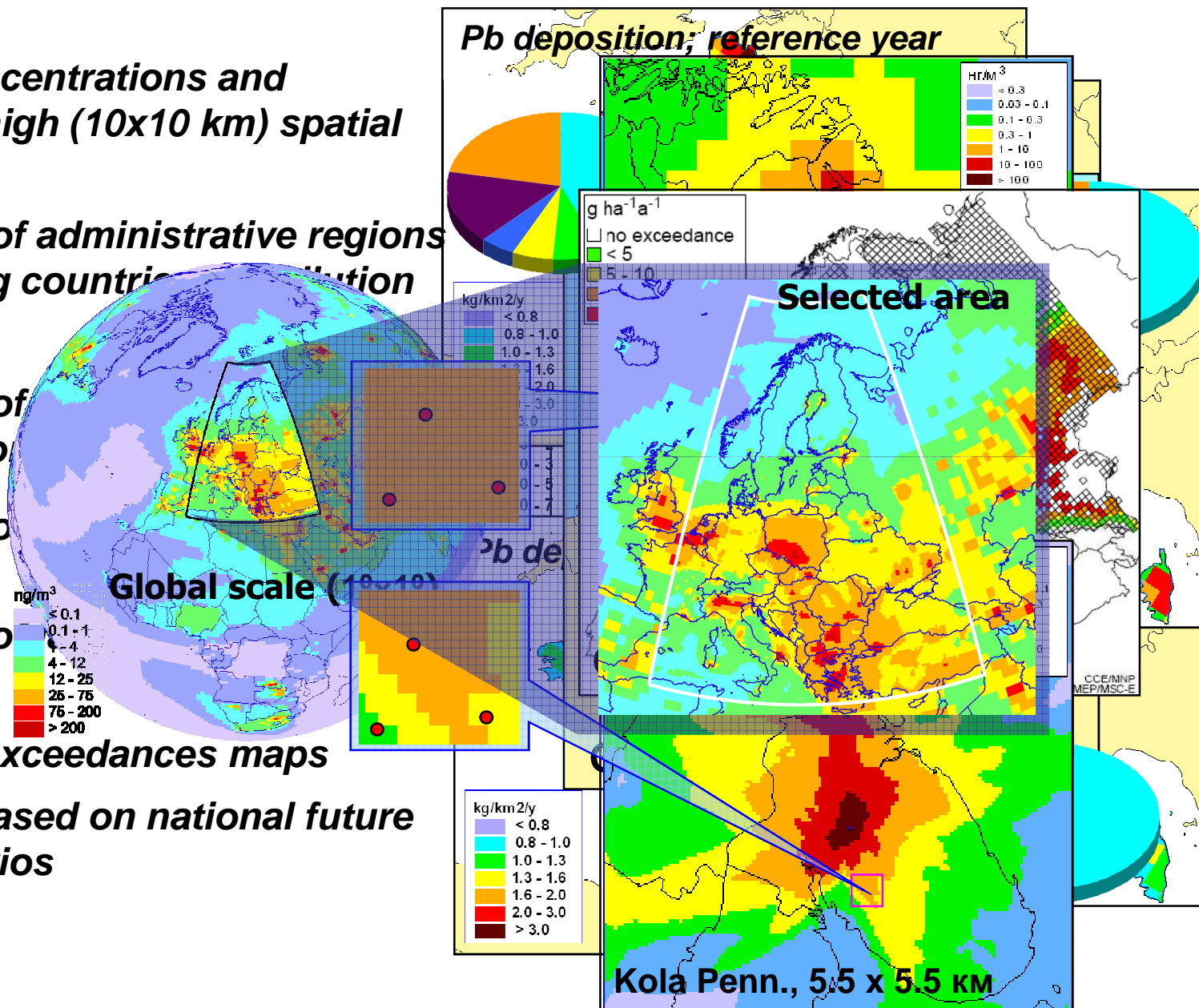# WP6. Model assessment of pollution levels in a country

Objectives: Produce state-of-the-art assessment of pollution in a country taking into account recommendations of WP5 (modelling, monitoring, emissions)

Activities under WP6

➢ *Revision the model parameterizations, if necessary (MSC-E)*

➢ *Selection of most appropriate monitoring data (both EMEP and other), from viewpoint of represenatativeness of stations and quality of measurements (MSC-E, CCC, nat. experts)*

➢ *Updating emission data set (MSC-E, CEIP, nat. experts)*

➢ *Additional model calculations to produce improved assessment (MSC-E)*

Deliverables of WP6:

- **Calculated concentrations and deposition with high (10x10 km) spatial resolution**

- **Contributions of administrative regions and neighbouring countries pollution levels**

- **Contributions of country's pollution**

- **Contributions of pollution levels**

- **Contributions of pollution levels**

- **Critical loads exceedances maps**

- **Simulations based on national future emission scenarios**

Pb deposition; reference year

Selected area

Global scale

Kola Penn., 5.5 x 5.5 км

EMEP/MSC-E

TFMM, 19-20 November 2009, Ispra, Italy

Participants of the WPs

Activity	Brief description	Participants
WP1	Emission preparation	National experts, MCS-E, CEIP
WP2	Monitoring data	National expert, CCC, MCS-E, WGE
WP3	Input data for modelling	MSC-E, national experts
WP4	Atmospheric modelling	MSC-E, national experts
WP5	Analysis of results	MSC-E, national experts, CCC, CEIP
WP6	Improved assessment	MSC-E, national experts, CCC, CEIP, CCE

Concluding words….

❑ **The case study is focused on a country, takes into account country-specific peculiarities and uses national data**

❑ **The case study programme should be flexible and be carried out gradually**

❑ **Its purpose is to establish reasons of uncertainties of pollution assessment, in particular, discrepancies between modelled and measured values**

❑ **The case study is aimed at the improvement of pollution assessment in a country**

❑ **Results of the study can be used as supporting information for further development of national environmental policy**

❑ **Countries interested in taking part in the case study are welcomed!**