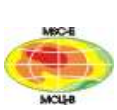


# Work of the MSC-E, Links to the TFEIP and the Focus of Future Work

## Contents

1. Spatial Considerations
2. Temporal Estimates
3. Source Completeness
4. Chemical Speciation & State
5. State of the Data



# EMEP/MSC-E current activities in the field of HM and POP emissions

Information on HM (Pb, Cd, Hg) and POP (PAHs, HCB, PCBs, PCDD/Fs) emissions	Official emission data (CEIP)	Emission data for modelling (MSC-E)
Time-series of national total emissions (annually)	X	
Gridded sectoral emissions (once in five years)	X	
Emissions of Large Point Sources (once in five years)	X	
Gridded total emissions for the latest reported year generated by CEIP (annually)	X	
<b>Historical emissions of PCBs, HCB, PCDD/Fs up to 1990</b>		X
<b>Secondary sources (re-emission and re-suspension)</b>		X
<b>Global emission inventories (PCDD/Fs, HCB, PCBs, Hg)</b>		X
<b>Speciation of Hg forms (<math>\text{Hg}^{\circ}</math>, <math>\text{Hg(II)}_{\text{gas}}</math>, <math>\text{Hg(II)}_{\text{part}}</math>)</b>		X
<b>Congener composition for POPs (PCDD/Fs – 17 congeners, PCB-153)</b>		X
<b>Emissions to other environmental compartments (PCDD/Fs, HCB)</b>		X
<b>Intra-annual variations of emissions</b>		X
<b>Time-series of gridded annual emissions 1990-2012</b>		X
<b>Vertical distribution of emissions</b>		X
<b>Emissions for the non-EMEP countries within the EMEP domain (North Africa and Middle East)</b>		X
<b>Natural emissions</b>		X

**EMEP  
National  
Submissions**

**Gap Filling  
(CEIP)**

**non-EMEP  
(MSC-W)**

**Gap Filling  
(MSC-E)**

**non-EMEP  
(MSC-E)**

**USE IN  
MODELS**

**Fine timescale  
(MSC-W)**

**non-Anth & Points  
(MSC-W)**

**Fine timescales  
(MSC-E)**

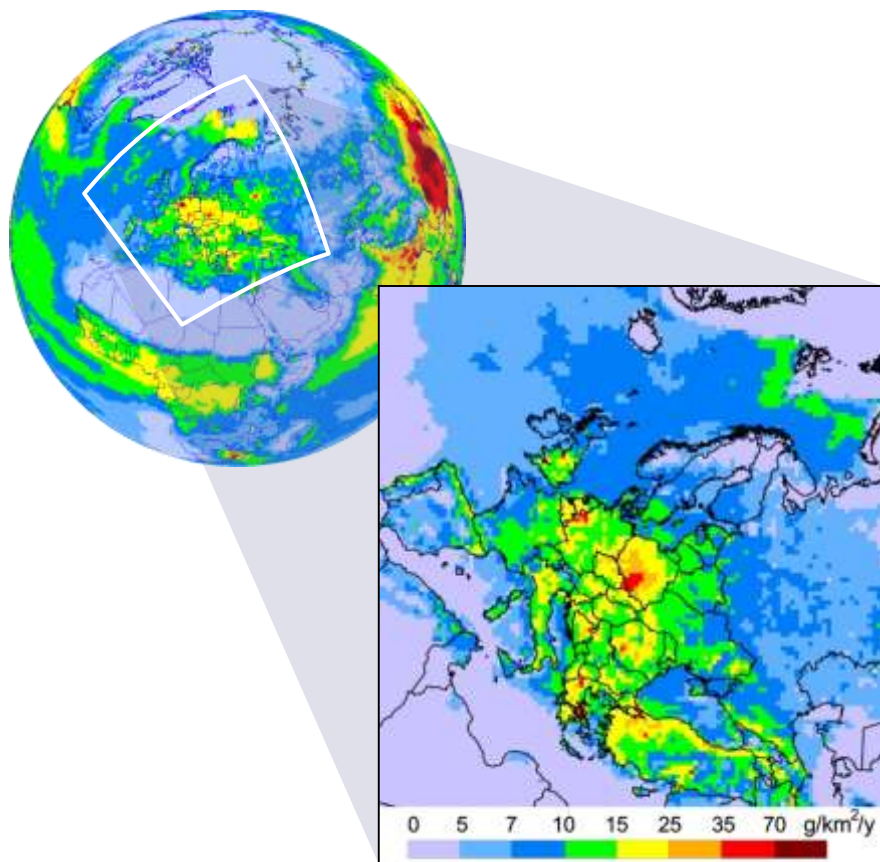
**non-Anth & Points  
(MSC-E)**

**AQ Pollutants**

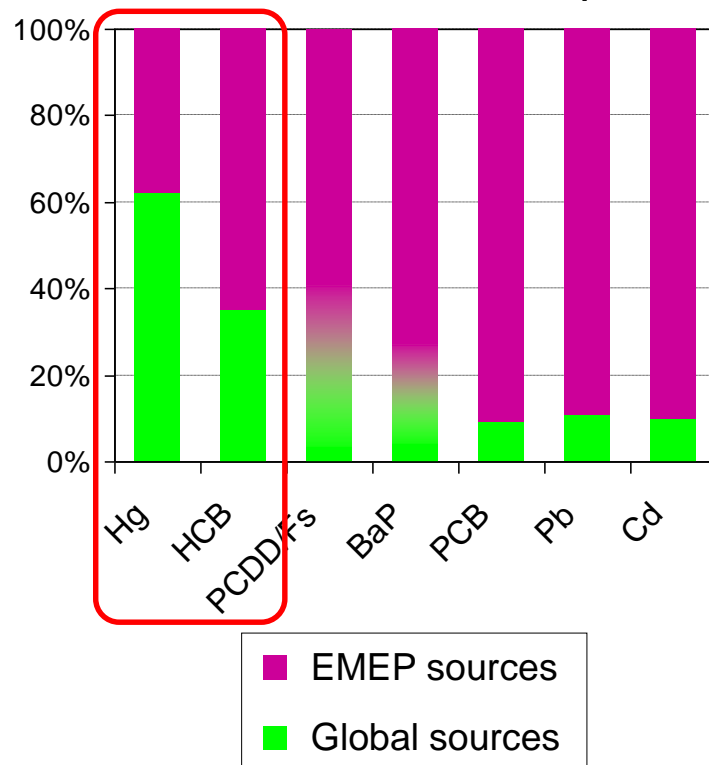
**HMs & POPs**

# SPATIAL: Global and regional emission sources

Hg deposition over the globe and in EMEP region (2010)



Contribution of regional vs. global sources to HM and POP pollution

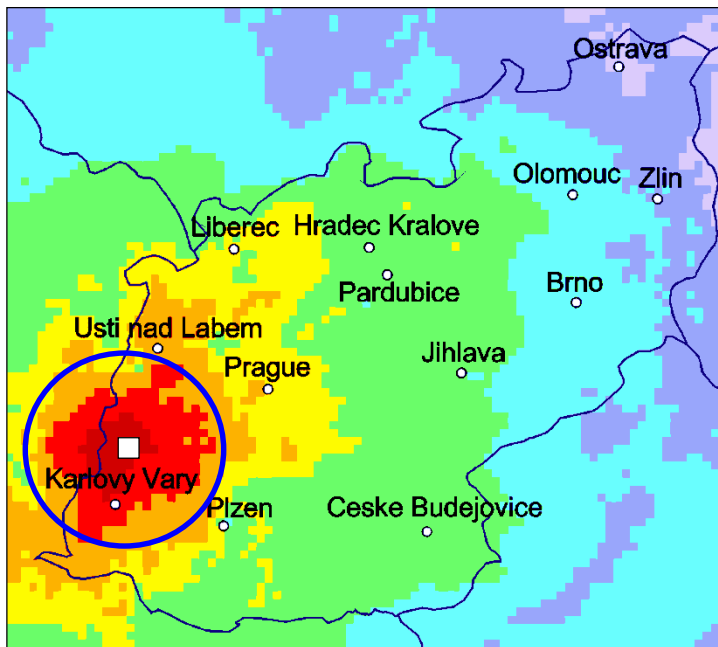


**10 - 60% from global sources**

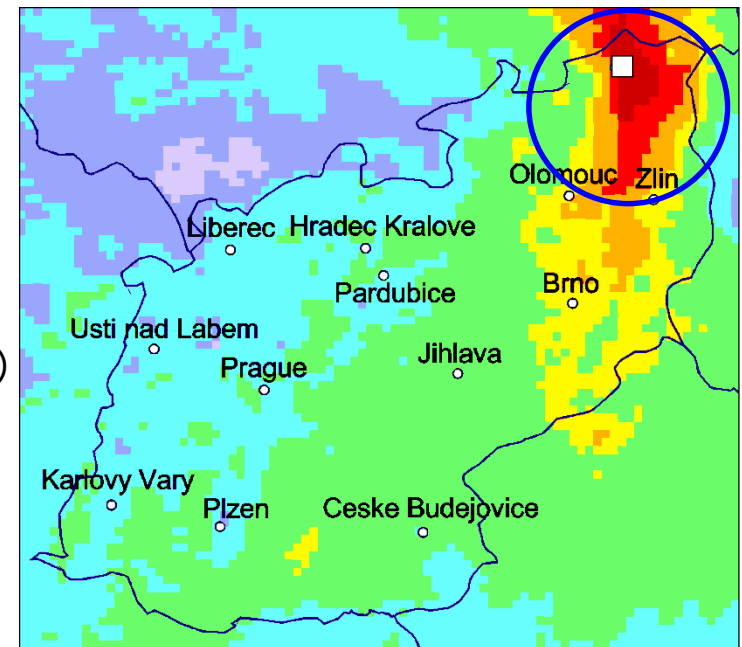
# SPATIAL: Emissions from large point sources

## Contribution of large point sources to Cd deposition

Pruněřov II Power Station  
Emission: 207 t/y (6%)



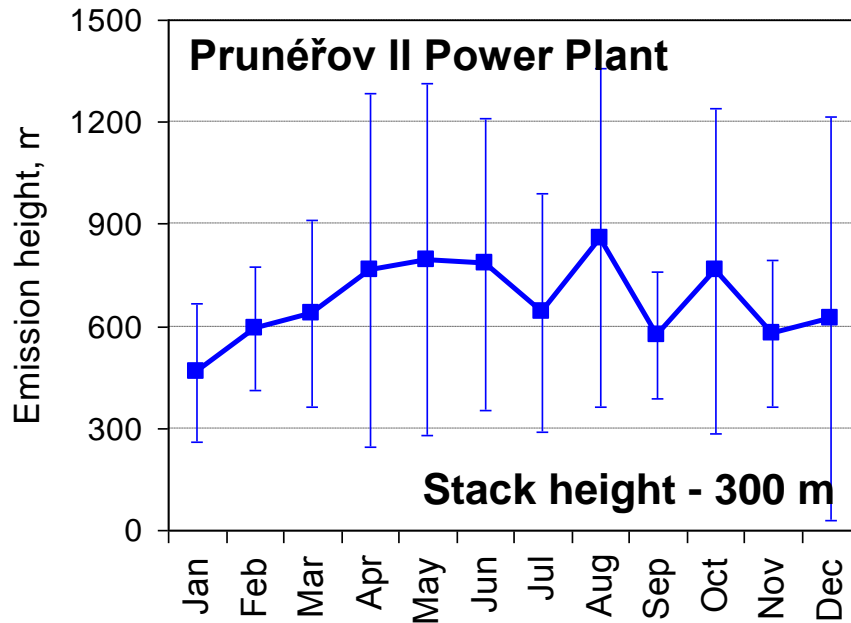
Arcelor-Mittal Ostrava Steel Plant  
Emission: 859 kg/y (26%)



**Note:** Contribution of single LPS can exceed 10-20% of Cd total anthropogenic deposition over large areas of the country

# SPATIAL: Emissions from large point sources

Estimates of effective emissions height (Brigg's approach)



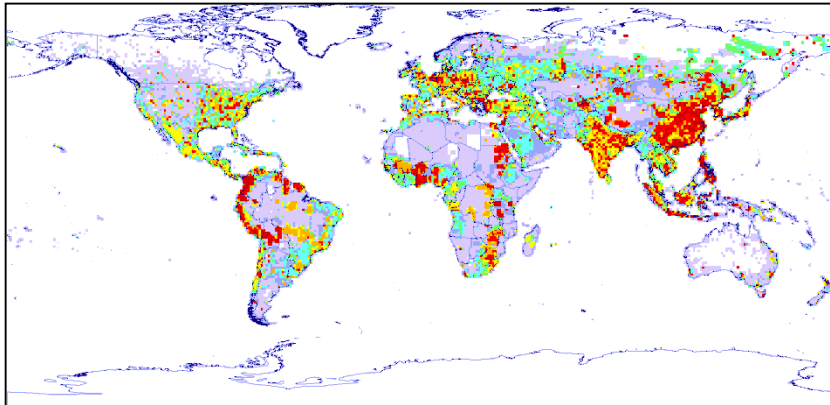
## Required parameters:

- Stack height
- Stack diameter
- Gas outflow velocity
- Gas temperature

# SPATIAL: Cooperation between EMEP and other international bodies

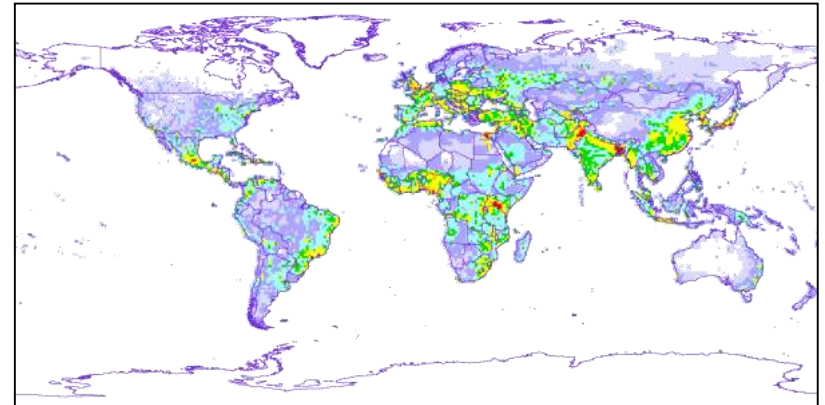
## Global emission inventories (PCDD/Fs, HCB, PCBs, Hg)

Global Hg emissions inventory,  
AMAP/UNEP, 2013



0 0.1 0.3 1 3 10 30 100 g/km<sup>2</sup>/y

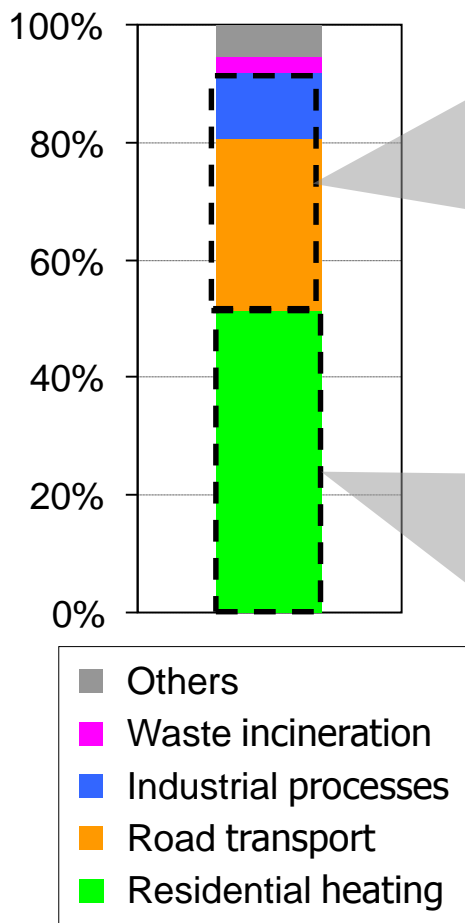
Global PCDD/F emissions based on  
UNEP Toolkit (Fiedler et al., 2007, 2012)  
and expert estimates prepared by MSC-E



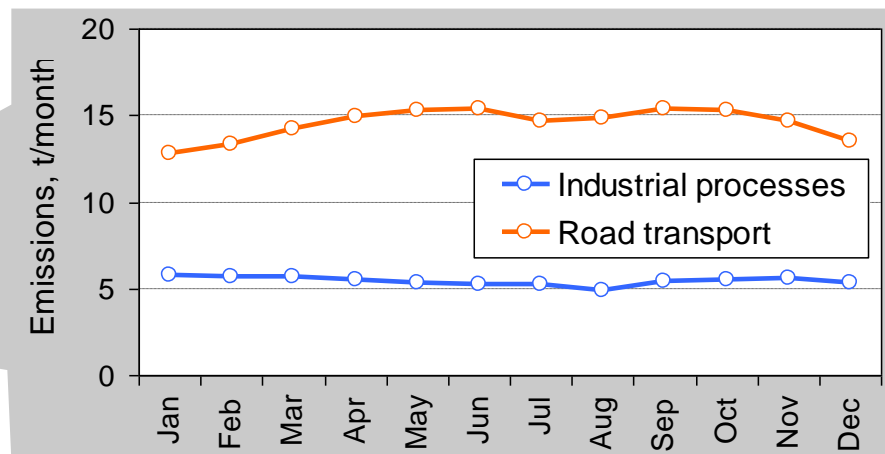
0 0.01 0.1 0.5 1 5 10 25 ug/m<sup>2</sup>/y

# TEMPORAL: Temporal variation of emissions: BaP

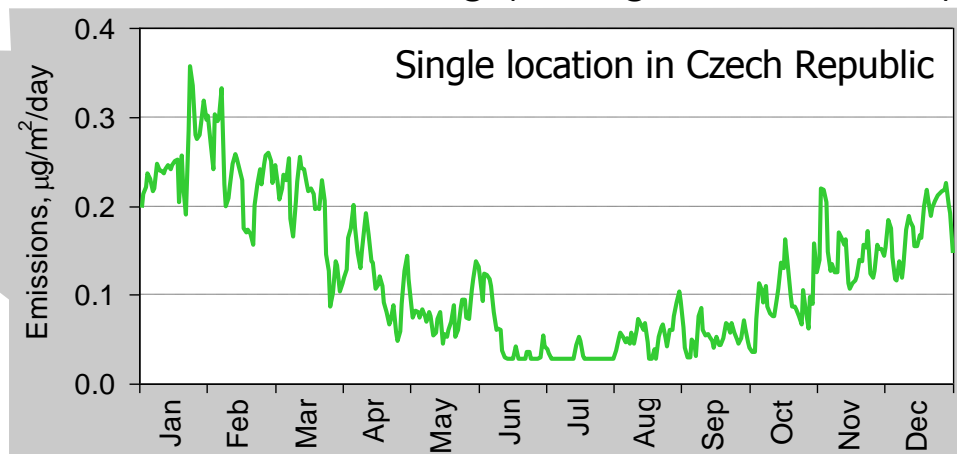
Sectors of BaP emissions in EMEP countries (2010)



Industry and road transport (*Schaap et al., 2005*)



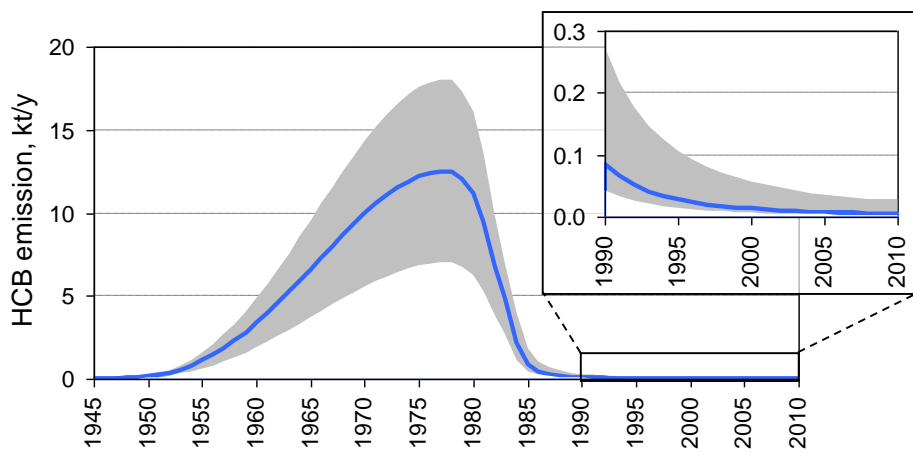
Residential heating (*Aulinger et al., 2010*)



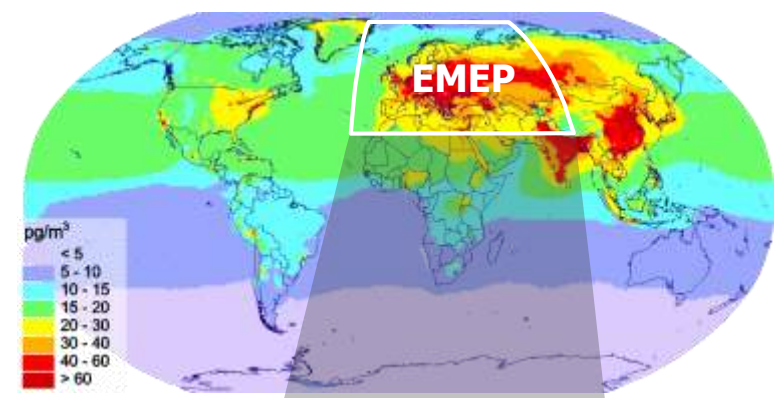


# SOURCES: Various types of HCB emissions

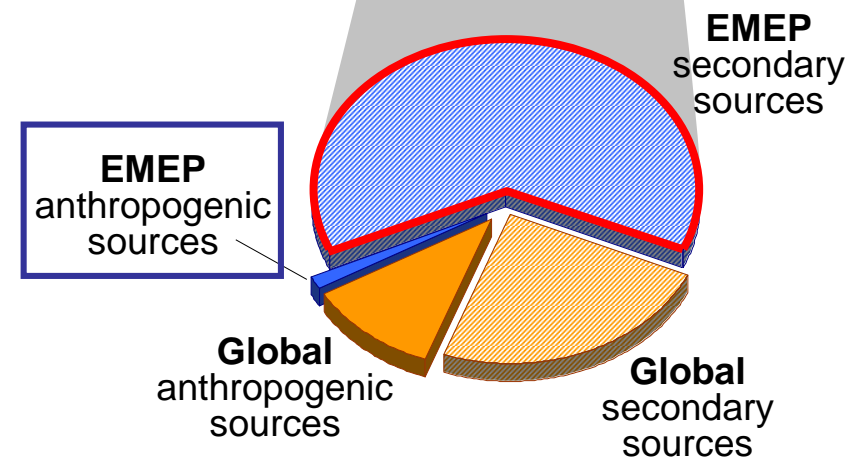
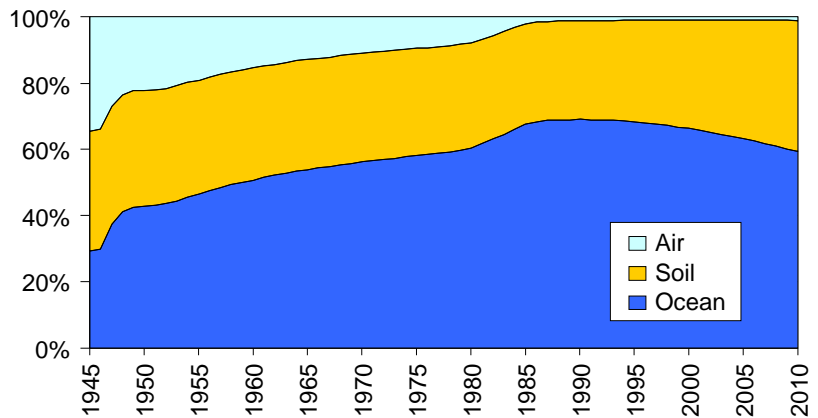
HCB global emissions (1945-2010)



HCB air concentration (2011)



HCB accumulation in different media



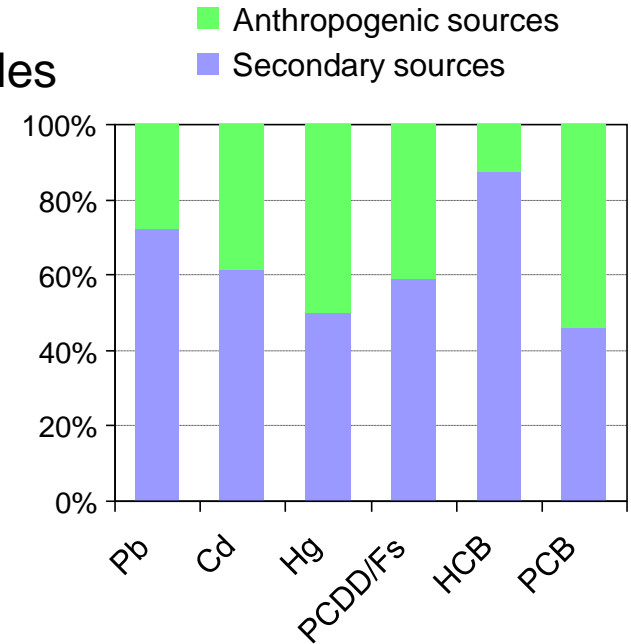
# SOURCES: Secondary sources of HM and POP pollution

## Secondary sources:

- ✓ Wind re-suspension of pollutants with aerosol particles
- ✓ Re-volatilization from environmental compartments

## Role of secondary sources:

- ✓ Essentially contribute to the contemporary pollution levels (about 50-90%)
- ✓ Delay reaction of pollution levels on the reduction of anthropogenic emissions



**Pollution of the EMEP region**

# SPECIATION: Chemical speciation of emissions: Hg

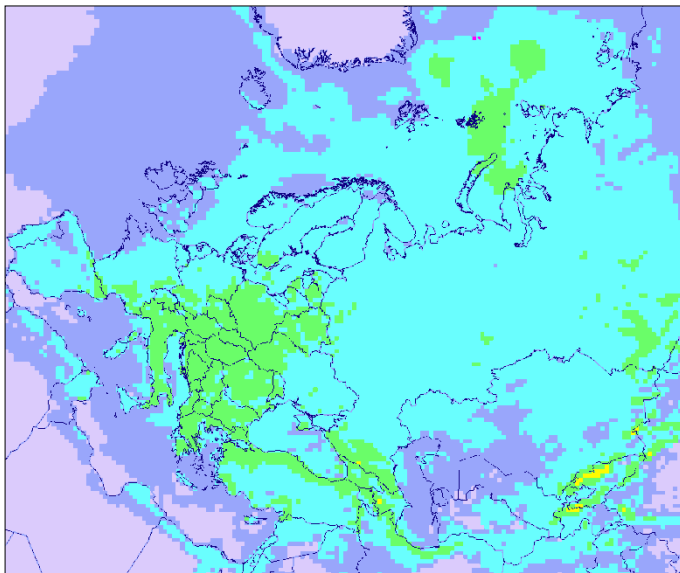
**Hg species:**  $\text{Hg}^0$ ,  $\text{Hg(II)}_{\text{gas}}$ ,  $\text{Hg(II)}_{\text{part}}$

**Reported emissions:** total Hg

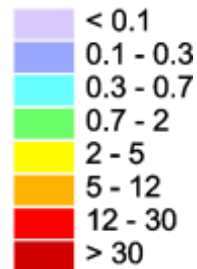
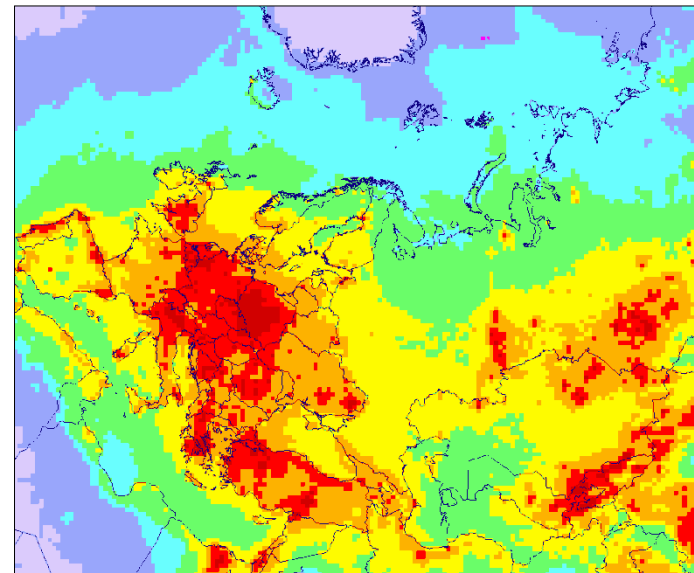
**Expert estimates:** *Axenfeld et al.*, 1991; *Pacyna et al.*, 2001

## Effect of emission speciation on Hg deposition (2010)

All Hg emissions as  $\text{Hg}^0$



All emissions as  $\text{Hg(II)}$



# State of the Reported Data

# Data completeness: Emission sectors

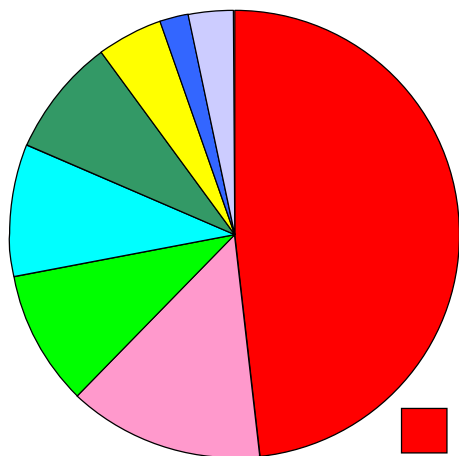
## Contribution of major source categories to **HCB** emissions



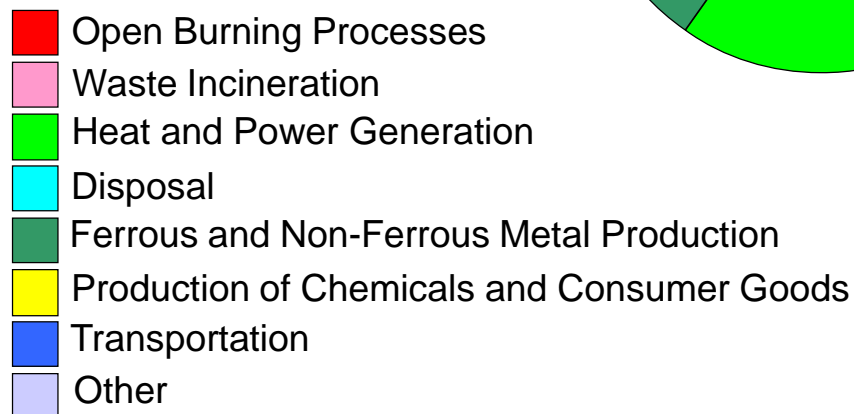
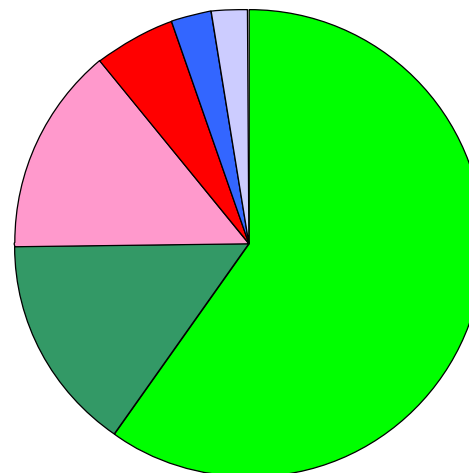
- Public electricity and heat production (1A1a)
- Road transport (1A3)
- Iron and steel production (2C1)
- Agriculture (4G)
- Waste incineration (6C)
- Other

# Comparison of source composition of PCDD/F emissions

UNEP  
(68 countries)



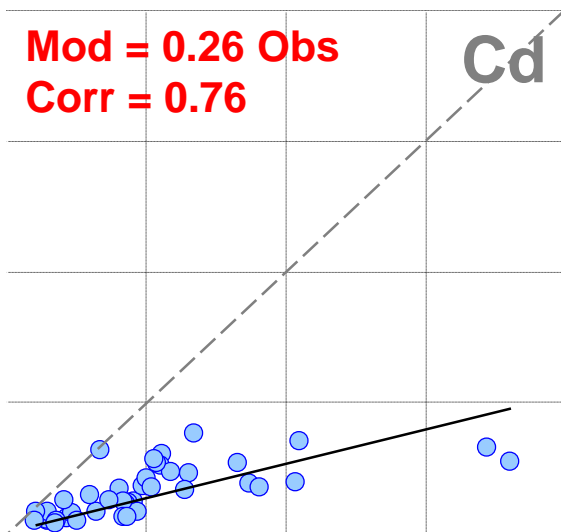
EMEP  
(39 countries)



# Uncertainty of emission inventories

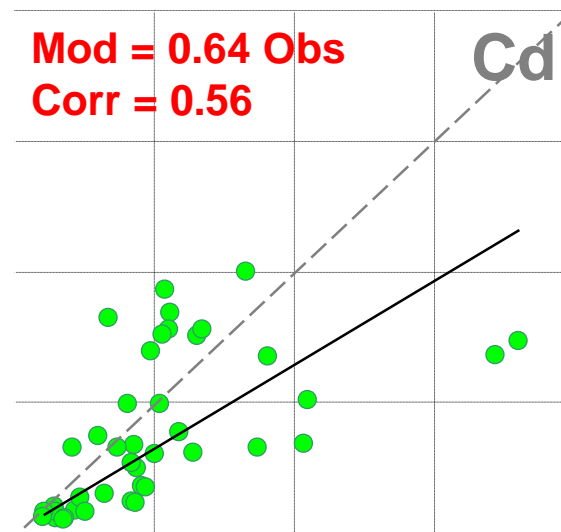
## Annual mean Cd concentration in precipitation based on **official** and **ESPreme** estimates (2000)

Official data



75% underestimation

ESPreme estimates

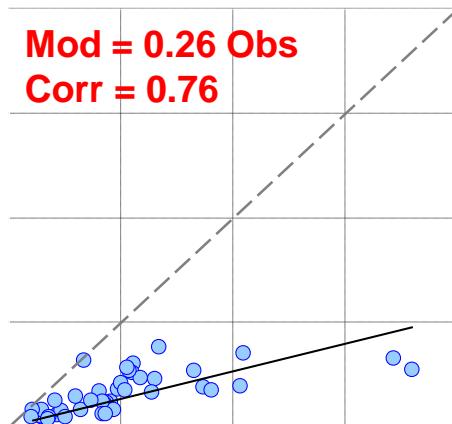


35% underestimation

# Model results vs. observations (Cd)

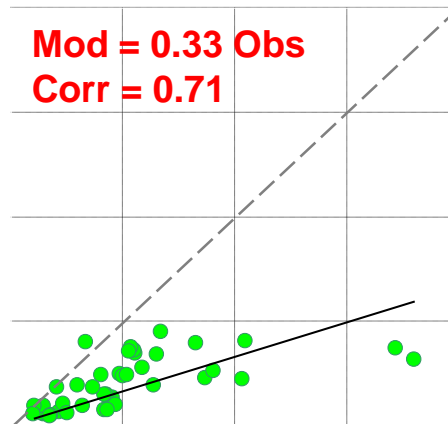
## Annual mean Cd concentration in precipitation (2000)

Official



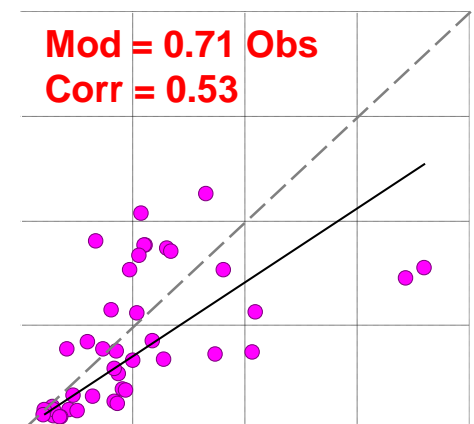
75% underestimation

Official+re-suspen.



65% underestimation

ESPROME+re-suspen.



30% underestimation



# Main topics for consideration by the TFEIP

- ✓ **Completeness and consistency** of inventories with special attention to the **EECCA countries**. First priority – **Cd and PCDD/F**.
- ✓ Range of **uncertainty** of reported emission data is needed for the evaluation of possible maximum and minimum pollution levels.
- ✓ **Collaboration** with the UNEP Minamata, Stockholm Conventions and AMAP is of mutual importance for the evaluation of non-EMEP emission sources affecting pollution of the EMEP domain.
- ✓ Generating and updating of **emission expert estimates** is highly appreciated..