

The European Commission's science and knowledge service

Joint Research Centre



Feedback from the Training on emissions distribution methodology and introduction to EDGAR WEB-based gridding tool (February, 2018)

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19th Joint EIONET & UNECE Task Force on Emission Inventories & Projections Meeting

Sofia, Bulgaria, 25-27 April 2018



Description

Organiser: Joint Research Centre of the European Commission, Directorate for Energy, Transport and Climate/Air and Climate Unit.

Joint activity: Emissions Database for Global Atmospheric Research (EDGAR) & Task Force on Emission Inventories and Projections (TFEIP).

Topic: Emissions distribution and gridding focusing on the methodology described in EMEP/EEA air pollutant emission inventory guidebook, and the EDGAR methodology and gridding tool for emissions distribution. During the training, participants used the EDGAR Web-based gridding tool to distribute EDGAR emissions (input files prepared by EDGAR team) and their national emissions.

Sectors: Road transport and small combustion activities sectors.

Target group: intended for countries with limited experience of reporting gridded data at 0.1x0.1 degree resolution as now required under the Convention and the National Emission Ceilings (NEC) Directive: Country experts from the Danube Region, EU candidate countries, EU potential candidate countries and Countries associated to Horizon 2020.

The training in 2018 was organized as a follow up of the EDGAR & TFEIP training/workshop in 2014.

Contributors & participants

EC/Joint Research Centre

- **Marilena Muntean, Diego Guizzardi, Edwin Schaaf, Greet Janssens-Maenhout**

TFEIP

- **Jeroen Kuenen**, TNO/co-chair of the TFEIP Expert Panel on Combustion and Industry
- **Leonidas Ntziachristos**, Univ.-Prof. PhD., Aristotle University Thessaloniki/co-chair of the TFEIP Expert Panel on Transport

Country experts

- **Mirela Poljanac**, EKONERG Ltd, Atmospheric Protection and Climate Change Department, Croatia
- **Nebojsa Redzic**, Serbian Environmental Protection Agency
- **Orsolya Farkas**, KTI Institute for Transport Sciences, Hungary
- **Canan Esin KÖKSAL**, General Directorate for Environmental Management, Climate Change and Air Management Department, Ministry of Environment and Urbanization, Ankara, Turkey

Participants from Hungary, Romania, Slovakia, Croatia, Serbia, Albania, Republic of Moldova, Turkey, Bosnia & Herzegovina.

Setting

Training: "Emissions distribution methodology and introduction to EDGAR WEB-based gridding tool"

Date: 19-20 February 2018

Location: EC/Joint Research Centre, Ispra, Italy

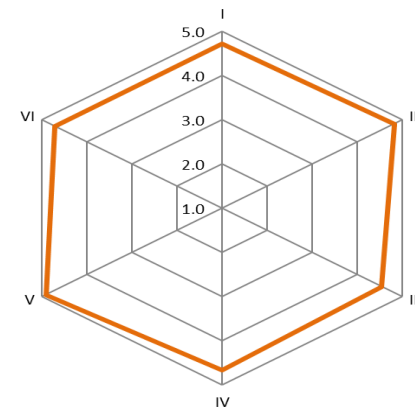
Agenda:

- **Session 1** "Convention on Long-Range Transboundary Air Pollution and EMEP/EEA: reporting requirements on gridded emission inventories"
- **Session 2** "Countries' Expertise and Perspectives"
- **Session 3** "Emissions inventory and emissions distribution: EDGAR methodology"
- **Session 4** "EDGAR Web-based gridding tool"
- **Session 5** "Practical applications and use the EDGAR Web-based gridding tool"
- **Lesson learned**



Lessons learned and feedback

Summary of the evaluation
I Agenda, II Speakers, III Documentation, IV Facilities and Services, V Before the event, VI Overall



4=agree and 5=completely agree

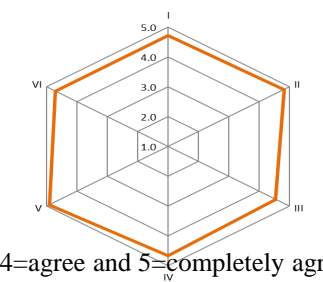
Lessons learned

General

- This training was very useful.
- The experts had the opportunity to run the tool and manage to produce certain results.
- Guidance was provided on how to prepare the input files with national emissions and distribute them using this tool; the focus was on methods suitable for reporting spatial data required under the LRTAP Convention and NEC Directive.
- The EDGAR trainings/workshops demonstrated that the emissions distribution work could be done, but this job requires cooperation between different professions, financial resources, time and a lot of work.
- In particular, detailed technical knowledge together with tips and advice provided by the EDGAR team, the TFEIP experts as well as by the experts from other countries who attended the workshops were/are useful.
- The fact that the presentations/training documents are available to all the participants via a secured link and the opportunity to attend the meeting as remote participant via WebEx was very much appreciated.
- Exchanging contact information between experts from neighbouring countries would be useful.
- Future trainings on this topic would be very much appreciated.

Lessons learned and feedback

Summary of the evaluation
 I Agenda, II Speakers, III Documentation, IV Facilities and Services, V Before the event, VI Overall



Lessons learned

Specific	
TFEIP	EDGAR has already reached a level of maturity and can be really helpful for policy at a centralised level and to assist countries that have no alternative gridding tools or experience.
Turkey	We used/will use the knowledge provided in both trainings (2014 and 2018) organised by the JRC for national reporting.
Moldova	The country has limited capacity, expertise and knowledge in gridding of emissions. A tool as the EDGAR Web-based gridding tool can be useful for gridding of national emissions, supporting the country in the reporting of official data under the CLRTAP.
Albania	Suggestion: because the capacity/budget is not enough, for the Balkan countries e.g. a pilot project would be useful to fulfil this obligation.
Bosnia and Herzegovina	<ul style="list-style-type: none"> A gridding tool is very useful to distribute emissions especially for small and low capacity countries such as Bosnia and Herzegovina. The most important lesson of the training is the application of the final results (gridded emissions) for the local and governmental authorities e.g. for emissions reductions plans, management of air quality and different strategies. Suggestion: future trainings within possible project(s) for the Western Balkan countries would be useful.

Future perspective

EDGAR Web-based gridding tool

For the foreseeable future - due to security reasons we are not able to continue to provide access to this tool to the experts outside the JRC.

Content: session 1

“Convention on Long-Range Transboundary Air Pollution and EMEP/EEA: reporting requirements on gridded emission inventories”

General

WHAT IS REQUIRED?

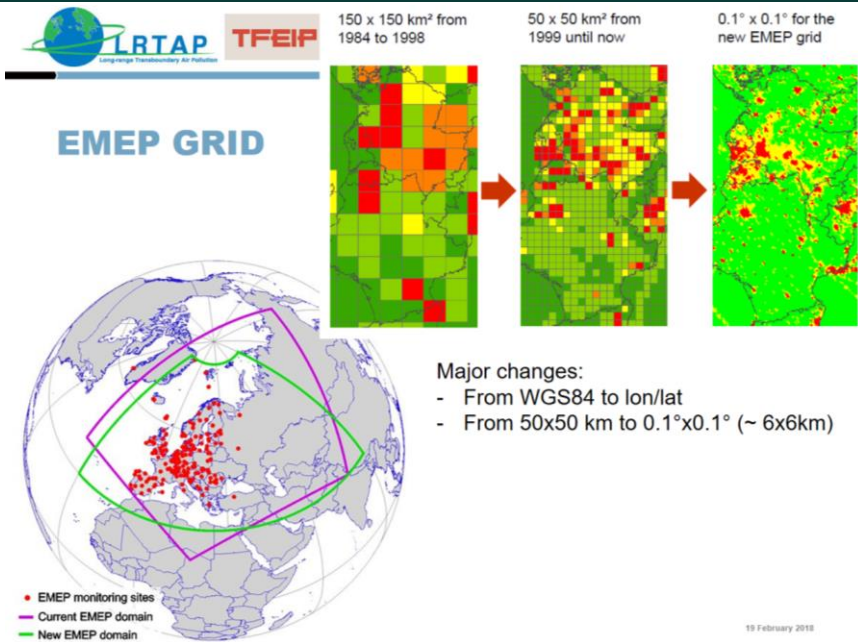
- › All signatories: LRTAP Convention
- › All EU MS: EU National Emission Ceilings Directive 2016/2284/EU

	Reporting requirement	Pollutants	Timing	Frequency	Years to report
DIRECTIVE (EU) 2016/2284	National emission inventories	SO ₂ , NO _x , NH ₃ , NMVOC, CO, Cd, Pb, Hg, PAHs, PCDD/F, HCB, PCBs, As, Cr, Cu, Ni, Se, Zn	15 Feb (t-2)	Annual	1990 to t-2
	Spatially disaggregated national emission inventories	PM _{2.5} , PM ₁₀ , TSP, BC	15 Feb (t-2)	Annual	2000 to t-2
	Large point source inventories	SO ₂ , NO _x , NMVOC, NH ₃ , CO, Cd, Hg, Pb, POPs*, PM _{2.5} , PM ₁₀ , BC	1 May (t-2)	Every 4 years	t-2 only
	Emissions projections	SO ₂ , NO _x , NMVOC, NH ₃ , PM _{2.5} , BC	1 May (t-2)	Every 4 years	t-2 only
	Informative Inventory report (IIR)	All pollutants in national emission inventory	15 Mar (t-2)	Annual	All years covered by the inventory
LRTAP Reporting Guidelines ECE/EB.AIR/125	National emission inventories	SO ₂ , NO _x , NH ₃ , NMVOC, CO, Cd, Pb, Hg, POPs*, As, Cr, Cu, Ni, Se, Zn	15 Feb (t-2)	Annual	1990 to t-2
	Informative Inventory Report (IIR)	PM _{2.5} , PM ₁₀ , TSP, BC	15 Feb (t-2)	Annual	2000 to t-2
	Emission projections (for Parties to the Gothenburg Protocol)	All pollutants in national emission inventory	15 Mar (t-2)	Annual	1990 to t-2 (2000 to t-2 for PM)
	Gridded emissions	SO _x , NO _x , NH ₃ , NMVOC, CO, PM ₁₀ , PM _{2.5} , Cd, Pb, Hg, PAHs, PCDD/F, HCB, PCB, BC	1 May (t-2)	Every 4 years from 2015 onward	2020, 2025, 2030, and where available also 2040 and 2050
	Gridded emissions	SO _x , NO _x , CO, NMVOC, NH ₃ , PM ₁₀ , PM _{2.5} , Cd, Pb, Hg, PAHs, PCDD/F, HCB, PCB, BC	1 May (t-2)	Every 4 years from 2017 onward	year t-2 only
	Large point sources	SO _x , NO _x , CO, NMVOC, NH ₃ , PM ₁₀ , PM _{2.5} , Cd, Pb, Hg, PAHs, PCDD/F, HCB, PCB, BC	1 May (t-2)	Every 4 years from 2017 onward	year t-2 only

Emissions and reporting

19 February 2018

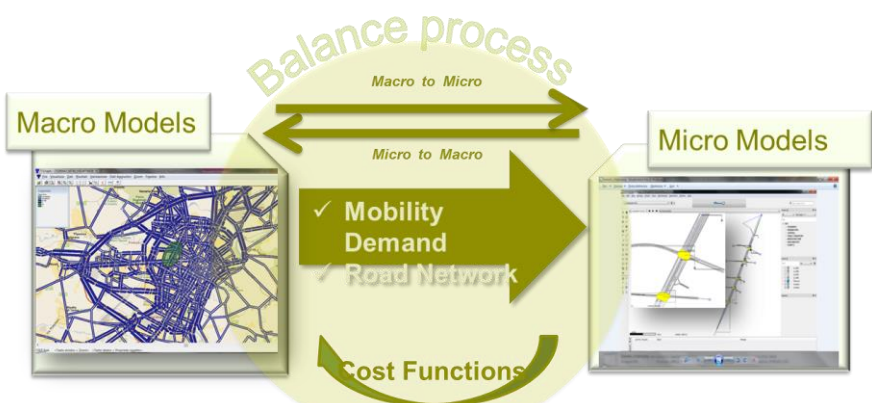
Gridding emissions requirements



19 February 2018

Sector specific

e.g. road transport



Bottom-up vs top-down

- Higher resolution does not necessarily mean higher accuracy
- In a spatially-resolved inventory, uncertainty in activity data profiles may be larger than uncertainty in emission factors.

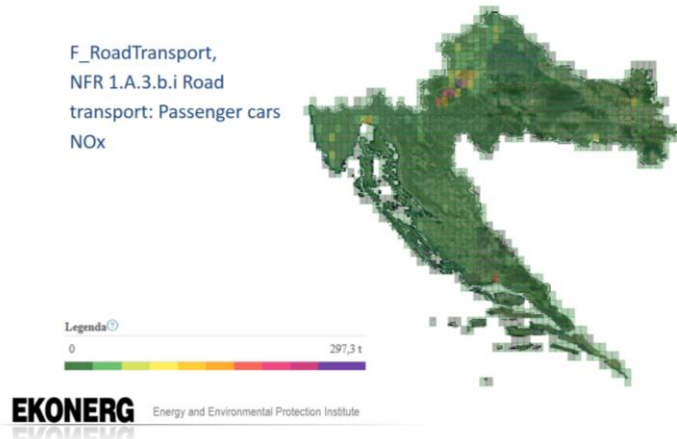
Content: session 2

Countries' Expertise and Perspectives

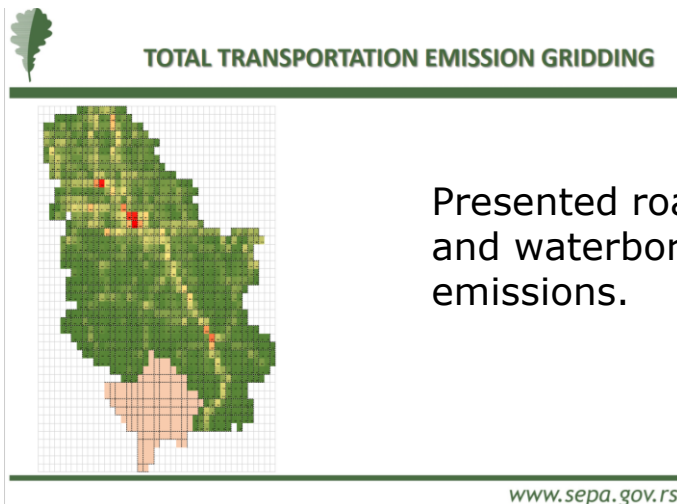
Croatia

Description of the methodology to estimate and distribute emissions from transport sector and small combustion activities, including results.

Results: gridded emissions from Road transport, 2015



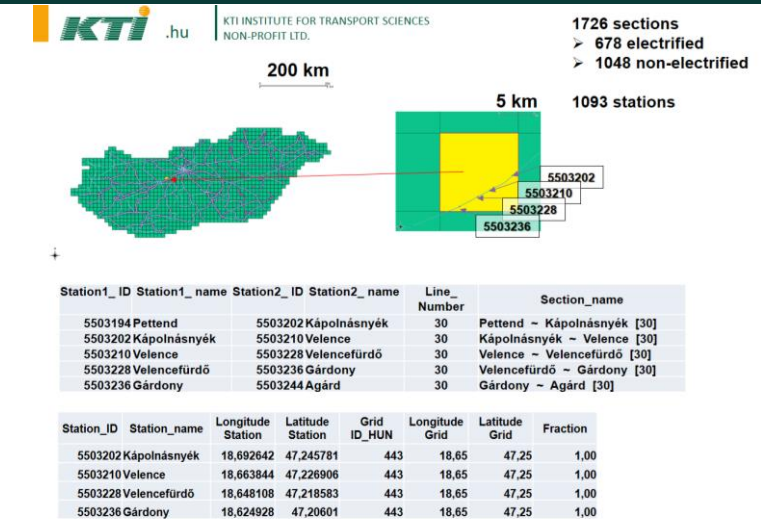
Serbia



Presented road, railway and waterborne gridded emissions.

Hungary

Description of the methodology to estimate and distribute emissions from railway, including results.

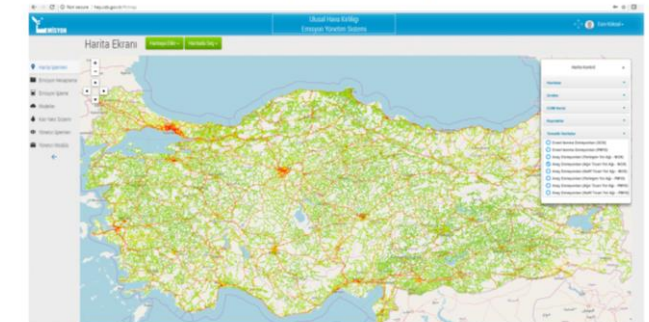


Turkey

Description of the the "National Air Emission Management System in Turkey" and how the EDGAR methodology was applied for road transport sector, including results.

TR NATIONAL; HEAVY COMMERCIAL, NO_x

- Road Type and Network;
- Same Methodology of EDGAR integrated



Content: session 3

EDGAR methodology: emissions estimation and emissions distribution

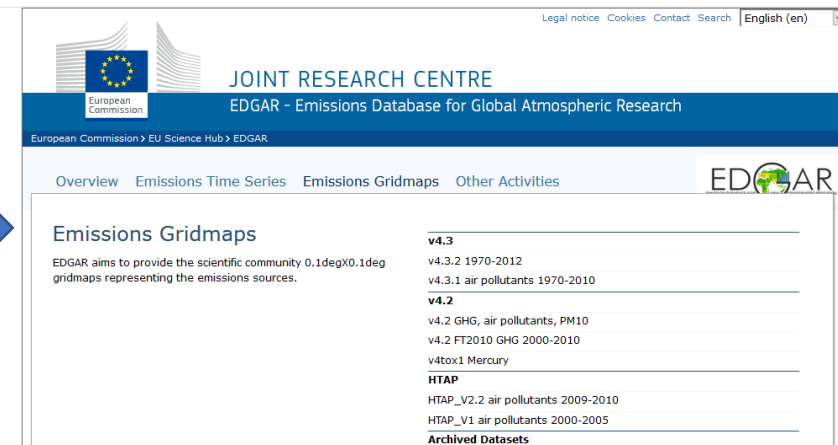
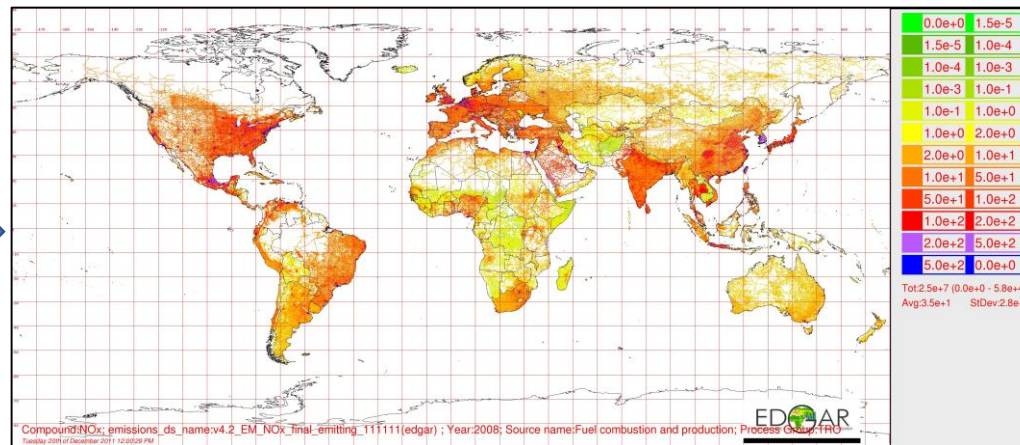
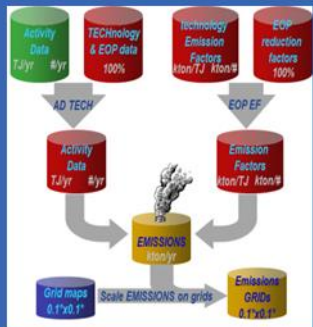
Technology-based
activity data

Technology-based
emission factors

Emissions
as
country
totals

Proxy
data

Gridded
emissions



Methodology

Final products: emissions & grid maps

Website: <http://edgar.jrc.ec.europa.eu>

Content: session 4

EDGAR We-based gridding tool: 1) Small combustion activities and 2) Road transport

EDGAR codes: emissions input file (1A4i)

Dataset	EDGAR RCO EMISSIONS						
Process code	RCD						
IPCC code	1A4						
unit	Ktons						
Year from	2008						
Year to	2012						
Substance	Process code	Count by ISO A3	2008	2009	2010	2011	2012
PM10	RCD.AGR.DIE.NSF	HRV	0.026166	0.024431	0.023643	0.023484	0.023484
PM10	RCD.AGR.GGS.NSF	HRV	NULL	NULL	NULL	NULL	NULL
PM10	RCD.AGR.HFO.NSF	HRV	0.00074	0.00074	0.000592	0.00074	0.00074
PM10	RCD.AGR.LPG.NSF	HRV	0.000511	0.000511	0.000511	0.000511	0.000511
PM10	RCD.AGR.MOG.NSF	HRV	0.001465	0.001302	0.001302	0.001302	0.001302
PM10	RCD.AGR.NGS.NSF	HRV	0.00035	0.000333	0.000378	0.000366	0.000366
PM10	RCD.AGR.OKE.NSF	HRV	NULL	NULL	NULL	NULL	NULL
PM10	RCD.COM.BKB.MBO	HRV	NULL	NULL	NULL	NULL	NULL
PM10	RCD.COM.BKB.SBO	HRV	NULL	NULL	NULL	NULL	NULL
PM10	RCD.COM.BKB.STV	HRV	NULL	NULL	NULL	NULL	NULL
PM10	RCD.COM.CHA.MBO	HRV	NULL	0.00293	0.00293	0.00293	0.00293
PM10	RCD.COM.CHA.SBO	HRV	NULL	0.001507	0.001507	0.001507	0.001507
PM10	RCD.COM.CHA.STV	HRV	NULL	0.003232	0.003232	0.003232	0.003232
PM10	RCD.COM.DIE.NSF	HRV	0.013712	0.012295	0.011662	0.010245	0.010245
PM10	RCD.COM.GGS.NSF	HRV	0.000024	0.000029	2.45E-05	2.15E-05	2.15E-05

- Substance is e.g. CO₂, NO_x, SO₂, BC, PM₁₀, PM_{2.5}, PAH_BaP etc.
- Process code is e.g. **RCD.RES.LGN.SBO**; RCO stands for “small combustion activities”, RES “residential subsector”, and LGN “Lignite/Brown Coal” as fuel used in SBO “small boiler appliance”
- Country_ISO_A3 is e.g. ROU, HRV, SVK, SVN for Romania, Croatia, Slovakia and Slovenia respectively.

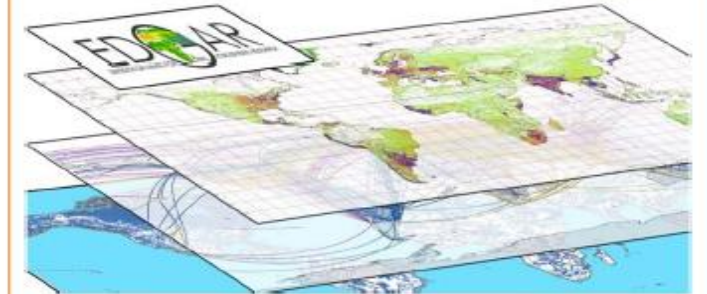
EDGAR codes: emissions input file (1A3b)

A	B	C
1 Dataset	f_HRV_ROU_SRB_HUN_NOx_emissions	
2 Process code	TRO.ROA	
3 IPCC code	1A3b	
4 unit	Ktons	
5 Year from		2006
6 Year to		2012
7 Substance	Process code	Country_ISO_A3
8 NOx	TRO.ROA.DIE.BS0	HRV
9 NOx	TRO.ROA.DIE.HD0	HRV
10 NOx	TRO.ROA.DIE.LD0	HRV
11 NOx	TRO.ROA.DIE.PC0	HRV
12 NOx	TRO.ROA.HFO.HD0	HRV
13 NOx	TRO.ROA.LPG.PC0	HRV
14 NOx	TRO.ROA.MOG.HD0	HRV
15 NOx	TRO.ROA.MOG.LD0	HRV
16 NOx	TRO.ROA.MOG.MC0	HRV
17 NOx	TRO.ROA.MOG.MP0	HRV
18 NOx	TRO.ROA.MOG.PC0	HRV
19 NOx	TRO.ROA.OKE.LD0	HRV
20 NOx	TRO.ROA.NGS.PC0	HRV
21 NOx	TRO.ROA.NGS.BS0	HRV
22 NOx	TRO.ROA.BDS.BS0	HRV
23 NOx	TRO.ROA.BDS.BS0	ROU

- “Substance” stands for e.g. CO₂, NO_x, SO₂ etc.
- “Process code” means e.g. **TRO.ROA.DIE.BS0**
with the codes of three digits:
TRO-transport,
ROA-road transport sector, and
DIE-Gas/Diesel Oil as fuel used in BS0-buses

Import emissions dataset

Gridding tool:
emissions distribution on maps



Download .txt
gridmaps

Create
and download
.png maps

GIS, Presentations, Posters,
Comparisons...

Content: session 5

Emission distribution: 1) practical applications and 2) use of the EDGAR Web-based gridding tool

1) EDGAR methodology and practical applications

Point sources - power generation

Area sources - small combustion activities

Line sources - road transport

2) Area sources

Small combustion activities

1) Point sources

Power plants



Bulgaria: Coal Power Plants location (2004)

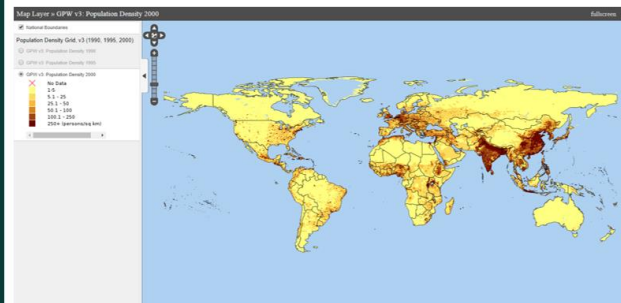


3) Line sources

Road transport

Step 1: find the proxy data-source:

Example: <http://sedac.ciesin.columbia.edu/data/set/gpw-v3-population-density>



Population Density Grid in 2.5 arc-minute (0.0833 degree resolution) for 1990, 1995, 2000 (new version 0.01 degree resolution)

Step 1: Download the road country map

Download "OpenStreetMap" data for your country from <http://www.openstreetmap.org>, which is open data

Commonly Used Formats

[croatia-latest.osm.pbf](#); [croatia-latest.shp.zip](#), (ESRI compatible shape files)

Other Formats and Auxiliary Files

[croatia-latest.osm.bz2](#); [.poly](#) file that describes the extent of this region; [.osc.gz](#) files that contain all changes in this region; [raw directory index](#) allowing you to see and download older files

Different road types (definition e.g for USA):

Motorway - Interstate Highways

Primary - Interstate Business Routes

Secondary - State highways, State business routes, Some country routes, Major County routes

Residential - minor routes in residential areas

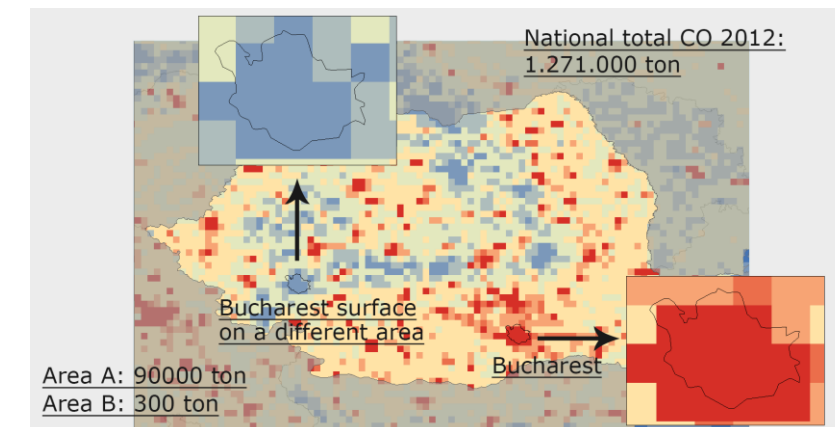
Source: http://wiki.openstreetmap.org/wiki/Talk:United_States_roads_tagging

Practical application e.g.

Romania CO emissions, which are mainly from TRO and RCO.

Calculate the % of the emissions over the 2 areas based on the national total and assign to the right box. Area A (urban)=Area B (rural)

Solution: blue 0.02%, red 7.08%



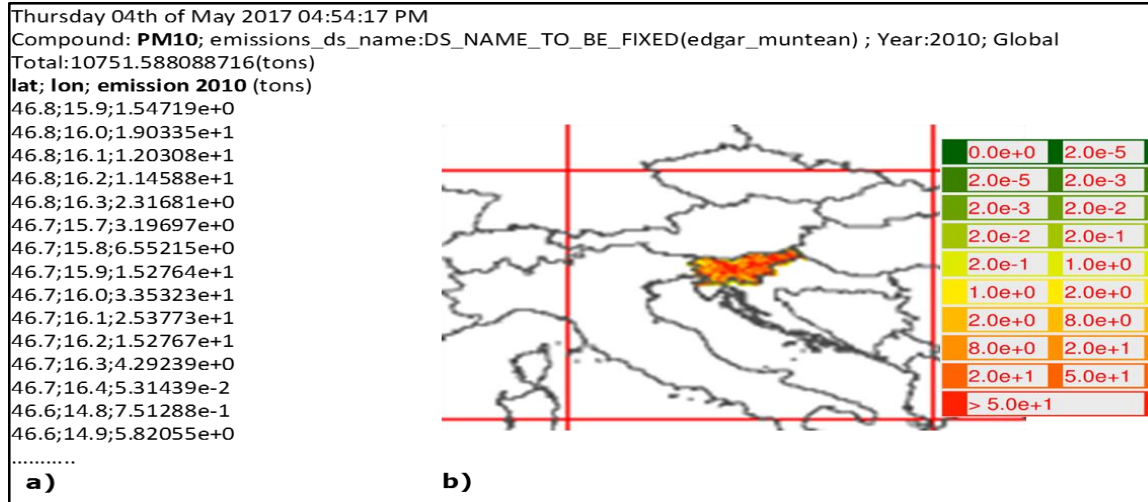
Content: session 5

Emission distribution: 1) practical applications and 2) use of the EDGAR We-based gridding tool

2) EDGAR Web-gridding tool:

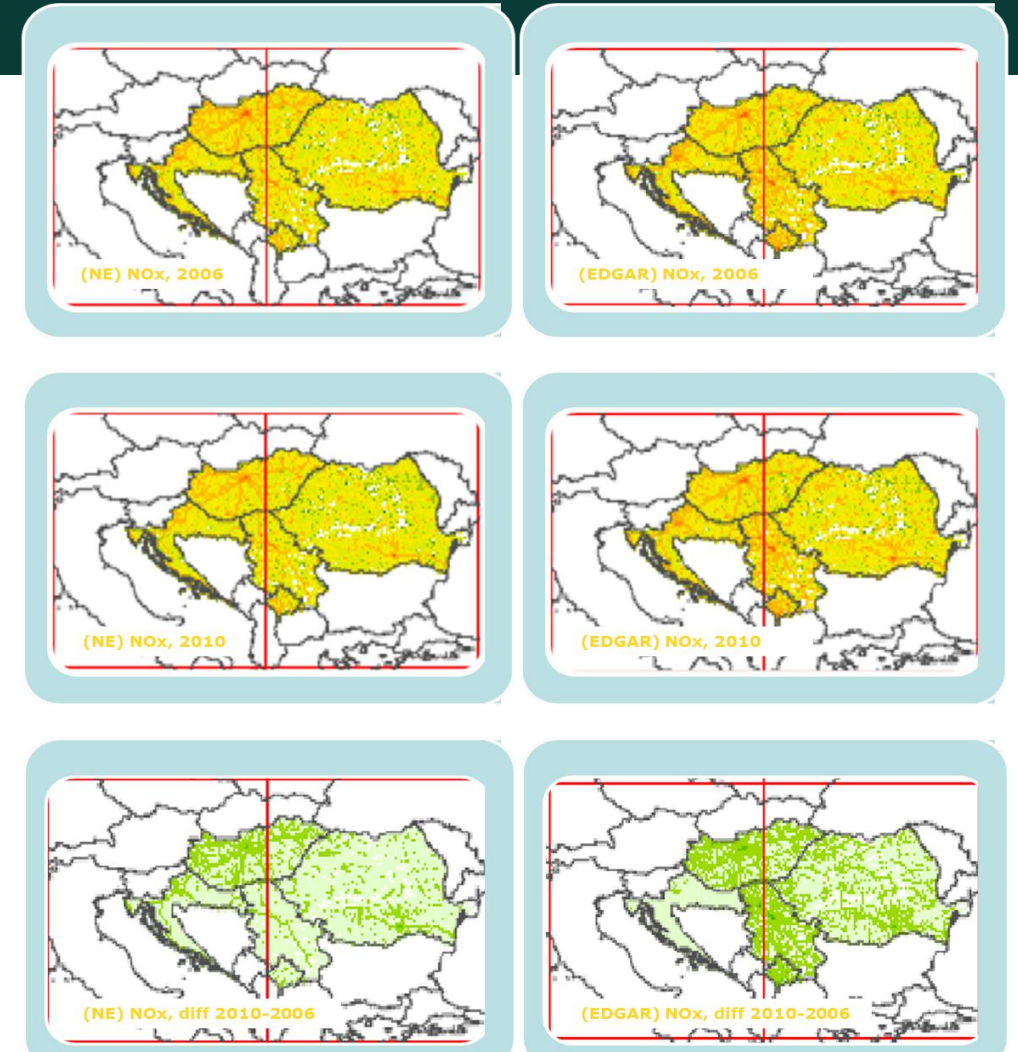
- Use of the tool by the country experts
- Create grid maps
- Discuss the results

Emission grid maps created using EDGAR Web-gridding tool (e.g. for 1A4i and 1A3b)



Slovenia, PM10 emissions from fuel used in residential subsector: a) grid map (part of) in .txt format, b) map in .png

Source: JRC reports



National Emissions for 2006 and 2010 of Croatia, Serbia, Romania and Hungary distributed using EDGAR proxy (left) and EDGAR emissions for 2006 and 2010 of Croatia, Serbia, Romania and Hungary distributed using EDGAR proxy (right), the difference is also provided.



Any questions?

EDGAR: <http://edgar.jrc.ec.europa.eu/>

Access to the training documents:
ask for password by sending an e-mail to marilena.muntean@ec.europa.eu

➤ Link to the **training documents**: http://edgar.jrc.ec.europa.eu/gridding_training_2018.php

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