Screening the consistency of emissions inventories

Towards a monitoring dashboard

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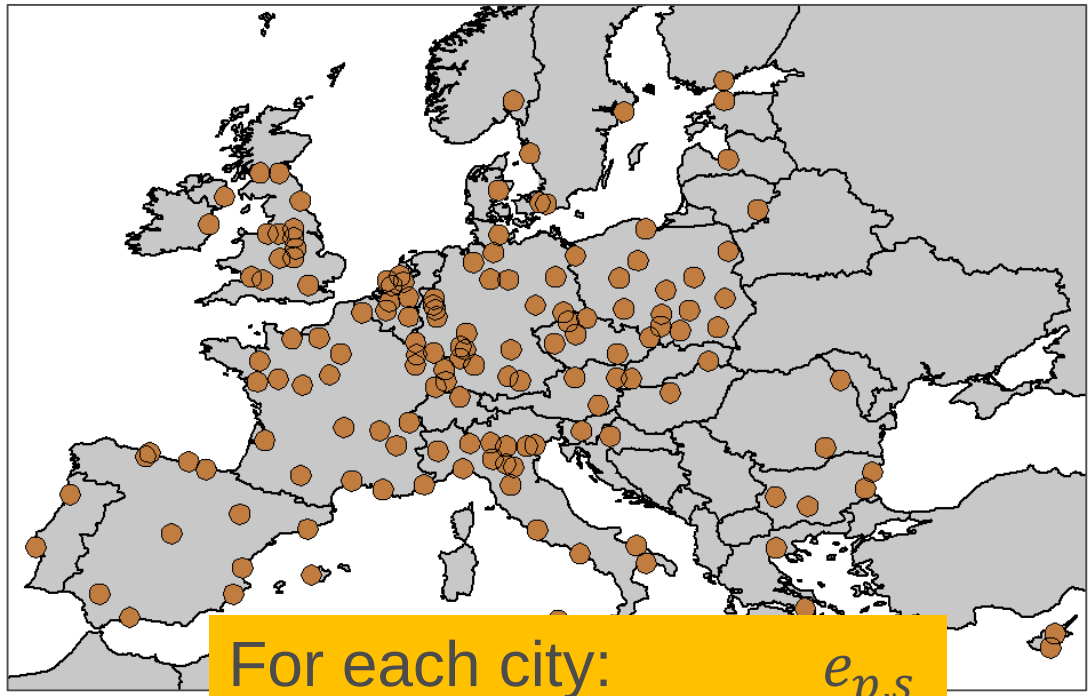
The screening method



For each city: $e_{p,s}$

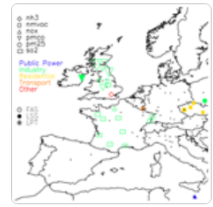
For each country: $E_{p,s}$

pollutant

sector

Methods for assessment of models 08 Jul 2022

A multi-pollutant and multi-sectorial approach to screening the consistency of emission inventories



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Only aggregated emissions data necessary!

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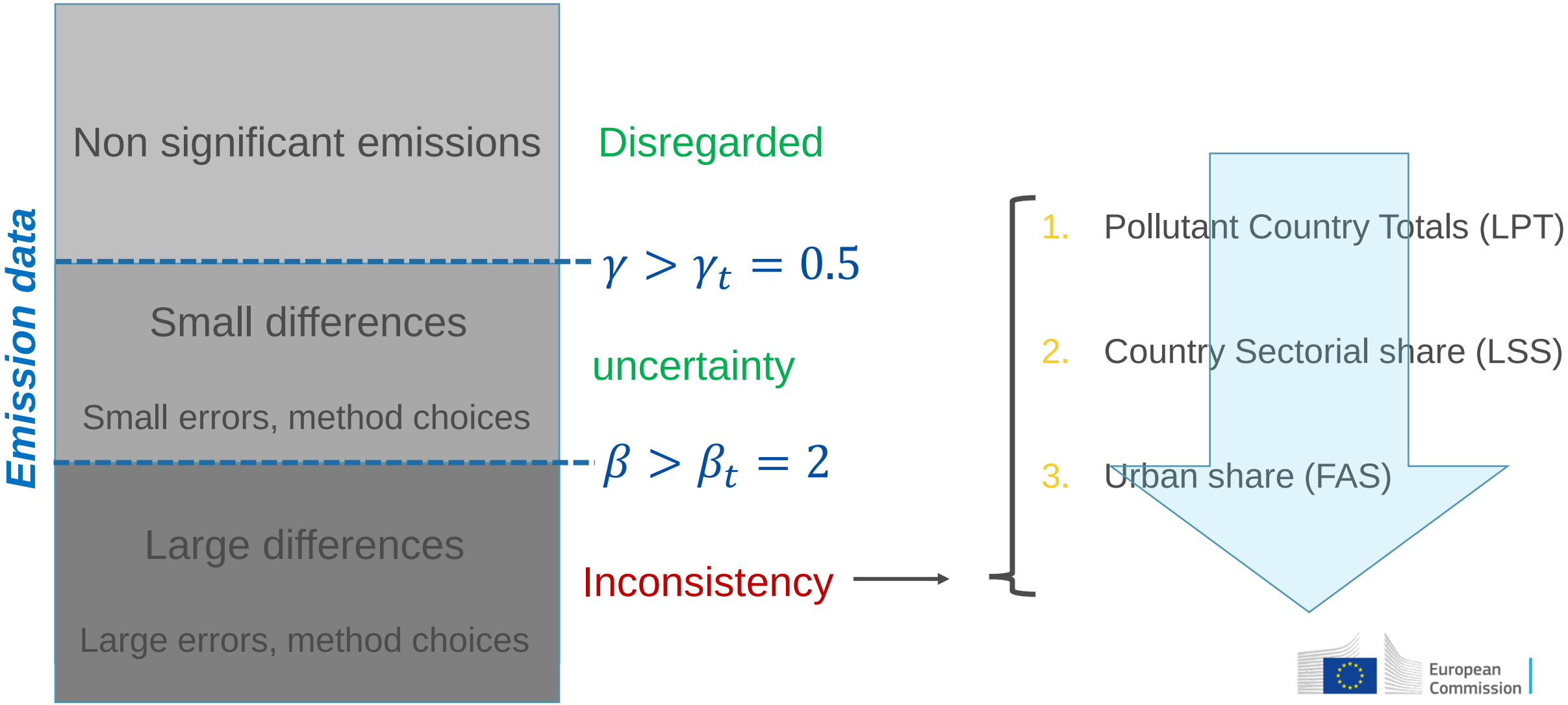
Relevant emissions AND detection of inconsistencies



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Application: CAMS v22 vs. V42 (2015)

- **Spatial coverage**: EU
- **Focus areas**: 150 Atlas cities
- **Sectors**: Transport (F), Residential (C), Industry (B), Power-plant (A), Other [(J) Waste + (D) Fugitives + (E) Solvents + (I) OffRoad]
- **Pollutants**: SO_2, NH_3, $PPM_{2.5}$, PPM_C, NO_x, NMVOC

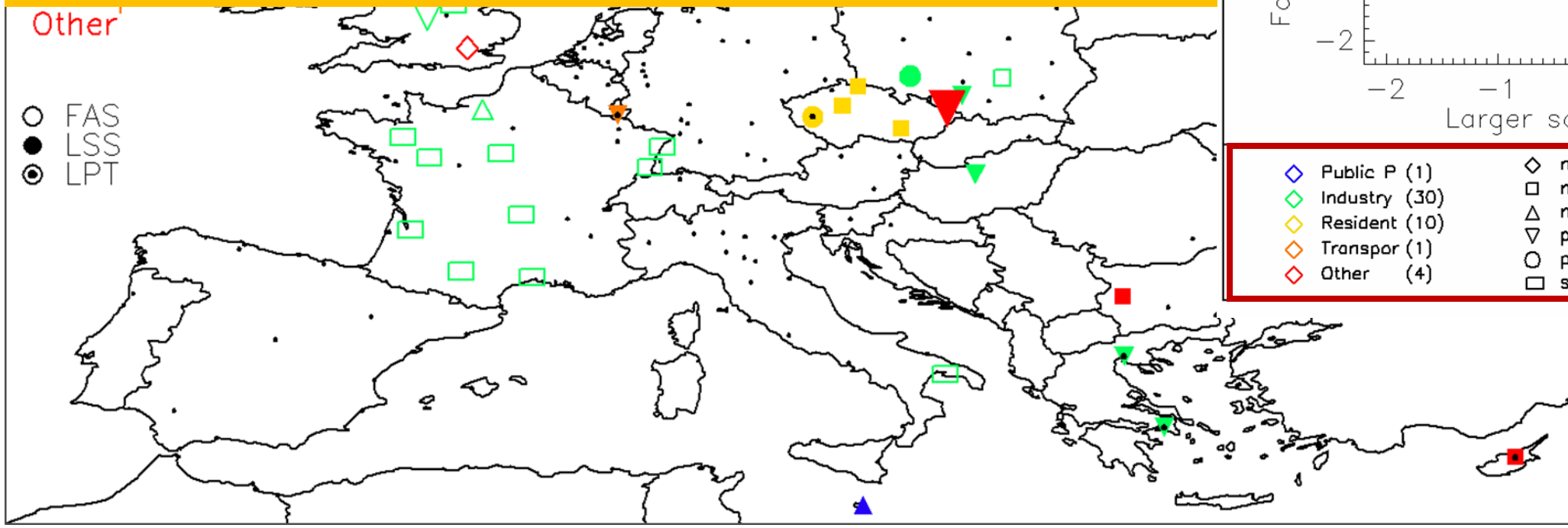
- $\gamma_t = 0.5$ and $\beta_t = 2$

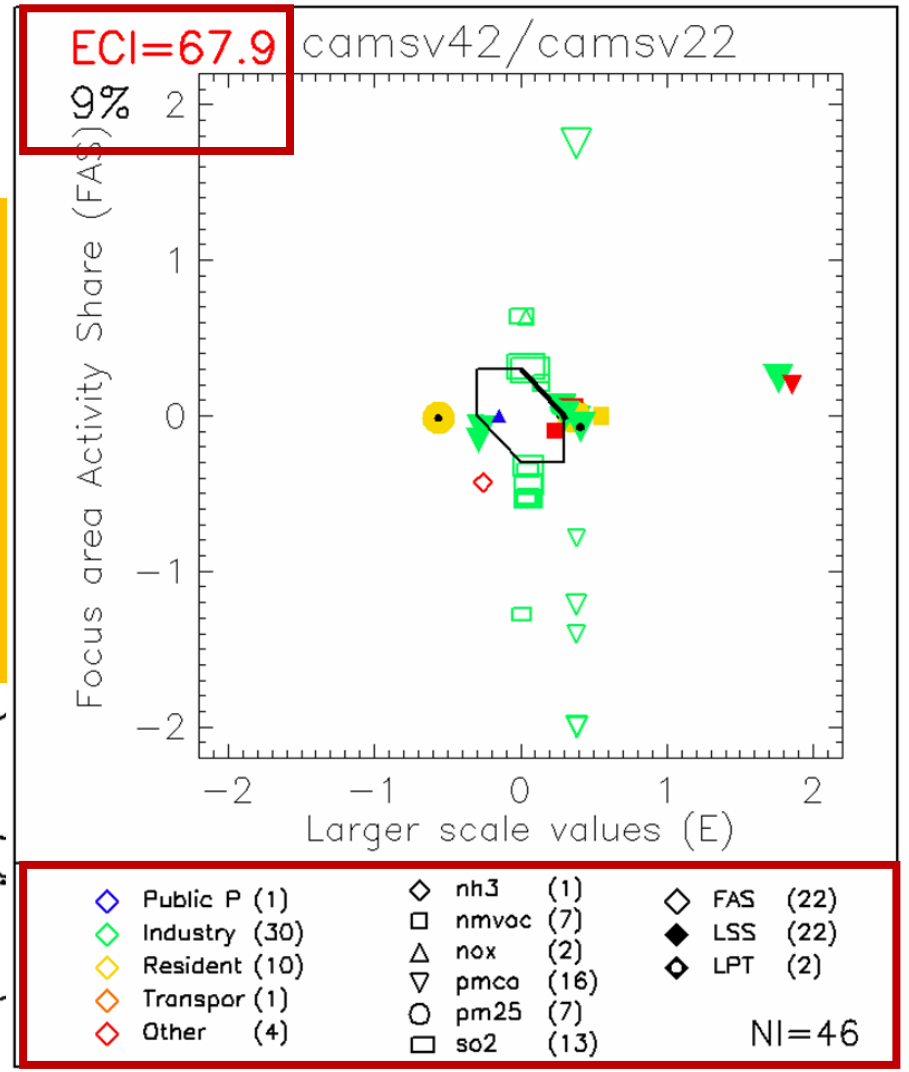
Application (CAMS42 vs CAMS22 (2015)

5 sectors x 6 pollutants x 150 cities = 4500 values

NI = 46 = Number of inconsistencies (= 9%)

ECI = 68: Inconsistencies are up to 68 times the assumed level of uncertainty





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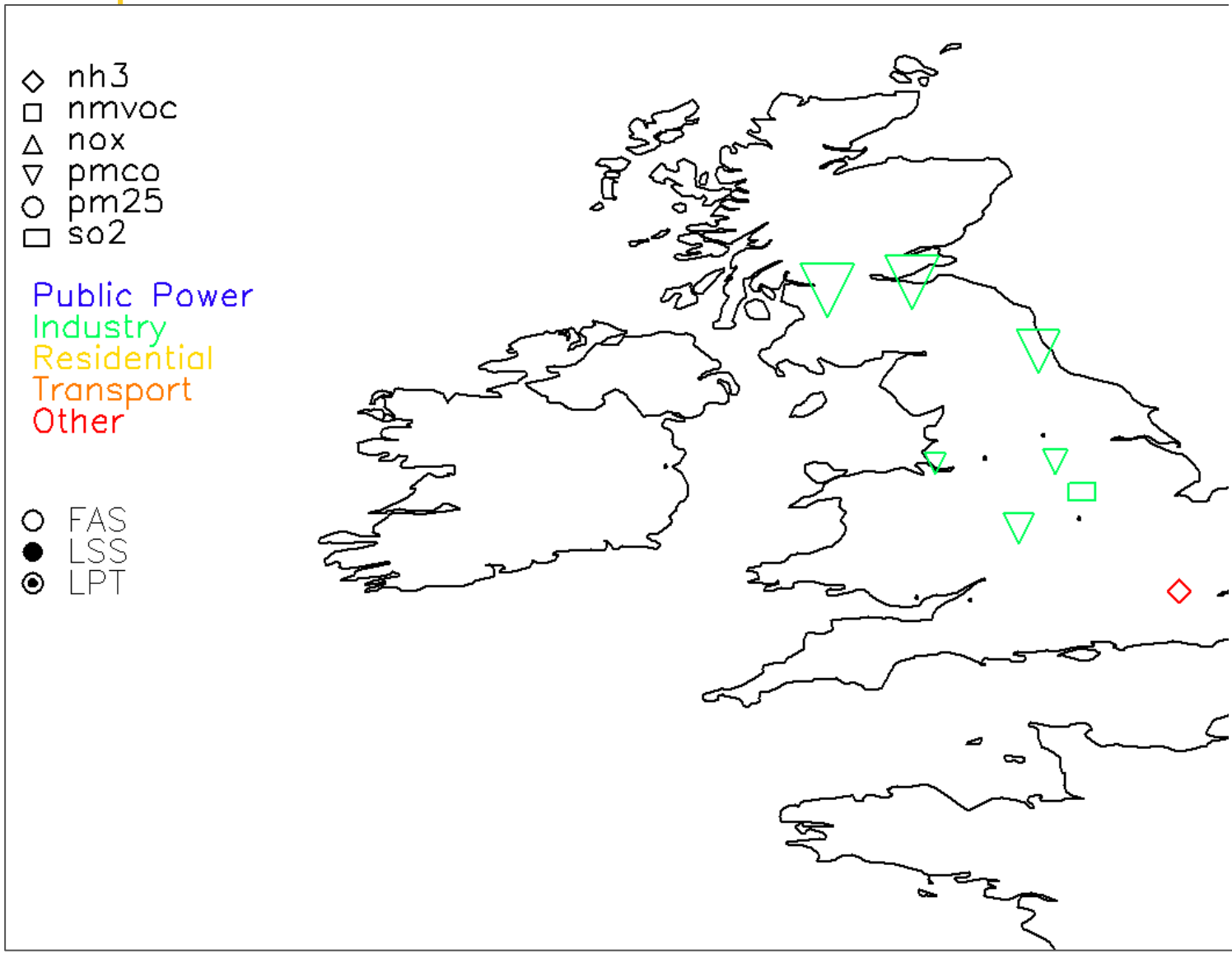
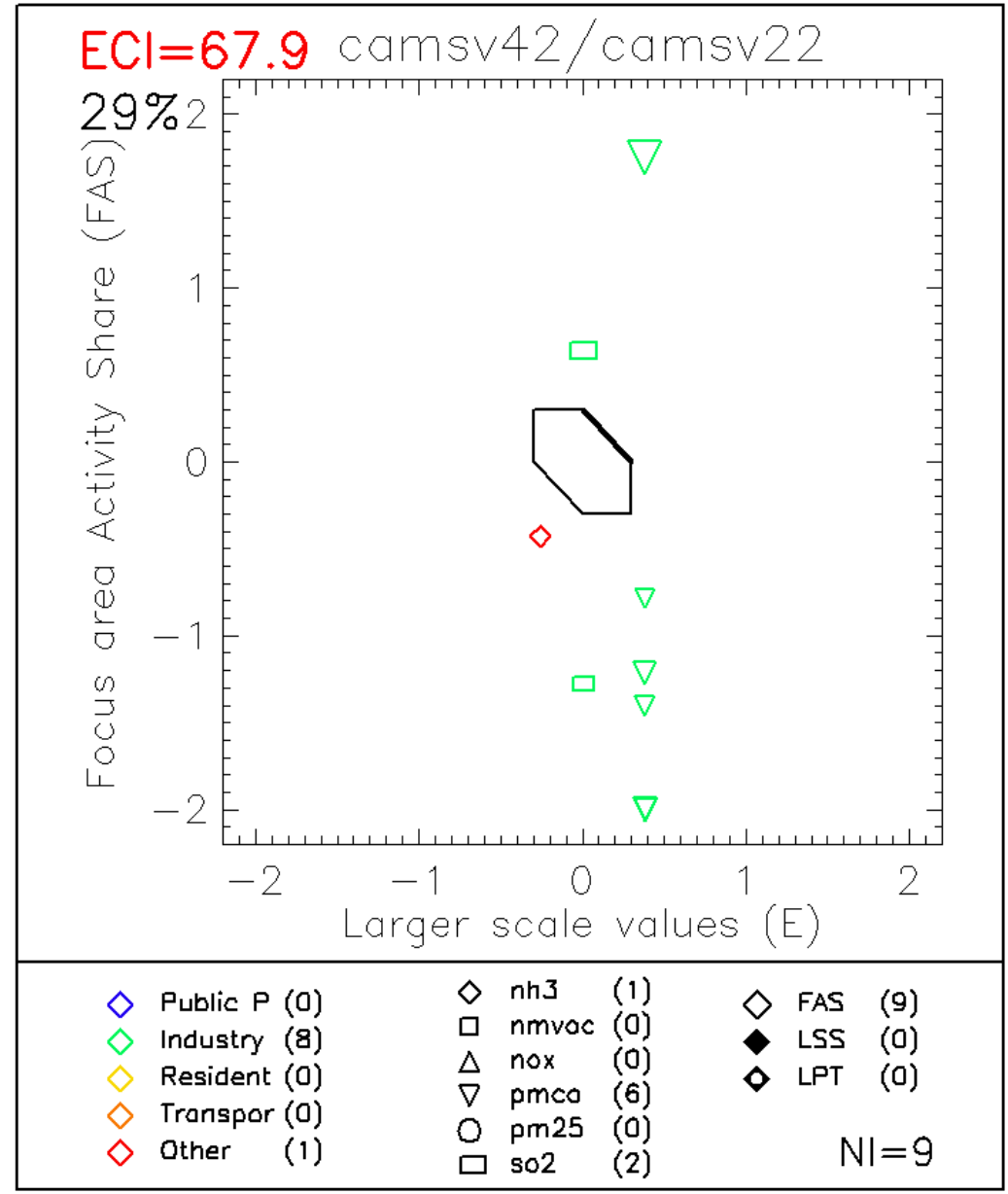
Country zooms





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Possible uses

- Inventory vs. inventory
- Inventory version vs. inventory version
- Inventory version & year vs. inventory version & year

Conclusions

- This method is a screening approach
  - Among relevant emissions, only large differences are detected (>β_t).
  - Inconsistencies are large enough to identify a “better” inventory despite no truth is known.
  - These inconsistencies can be justified (methodological choices) or should be corrected (errors).
  - Feedback of these inconsistencies to emission developers as a step to improvements
- The methods settings are flexible:
  - Choice of focus and large scale areas
  - Pollutants & sectors
  - Relevance and inconsistency thresholds
  - Only aggregated emission data are necessary
- One issue: Only applicable as 2 by 2 comparison!

Towards a monitoring dashboard

FAIRMODE meeting, October 2021

Joint
Research
Centre

Building an “ensemble reference”

CAMS (p, s, city)

EMEP (p, s, city)

EDGAR (p, s, city)

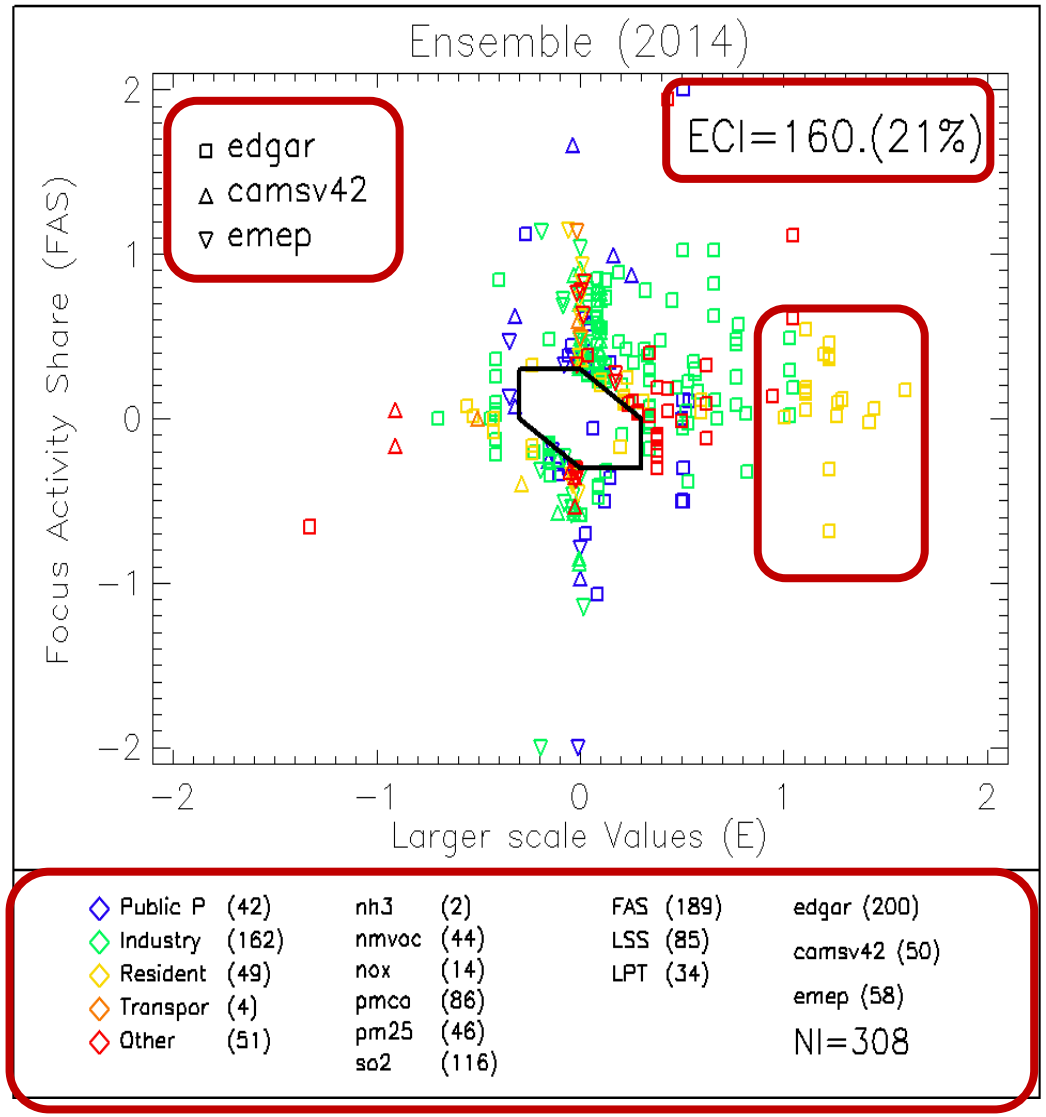
} Median

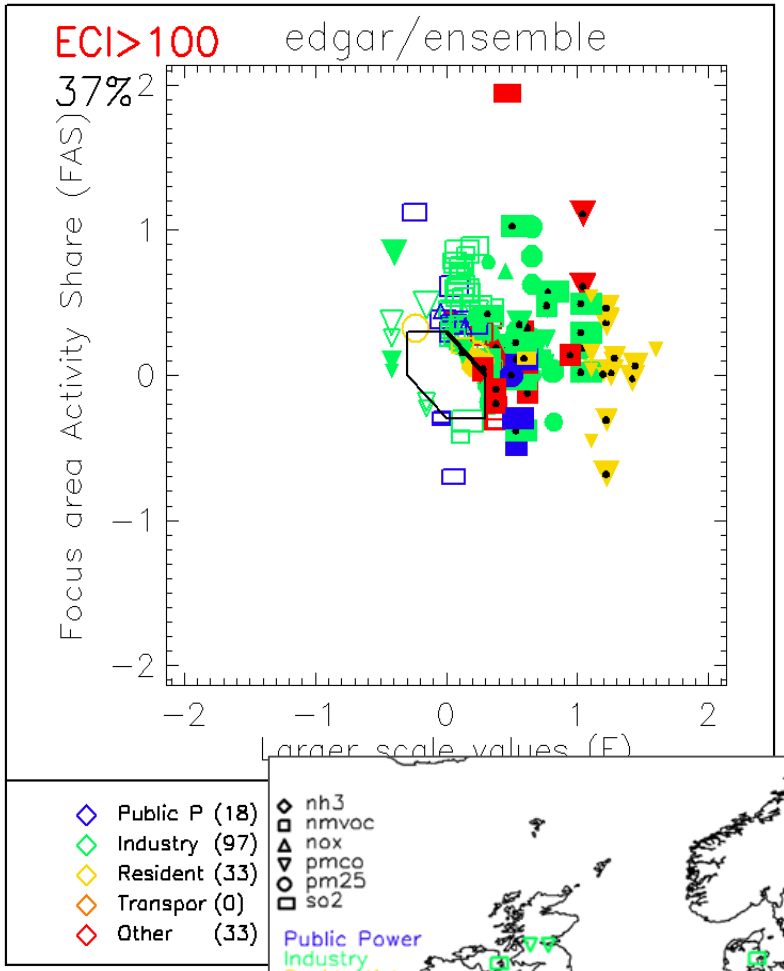
Monitoring status via the ensemble benchmark

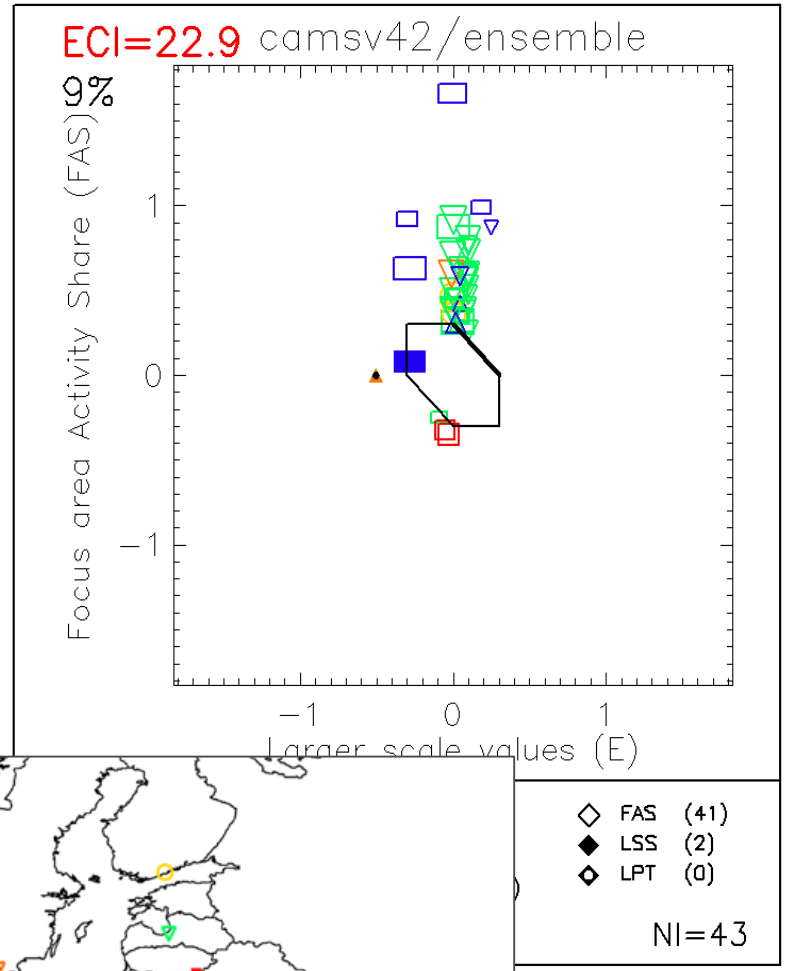
Monitoring the variability of the ensemble

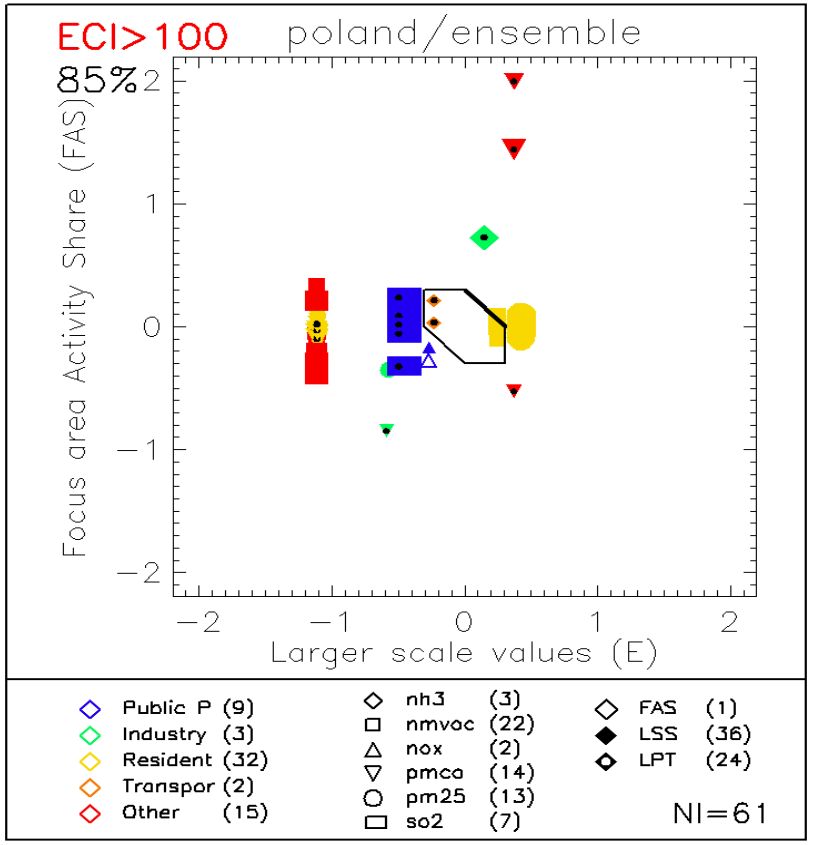
Identification of the inventory to check

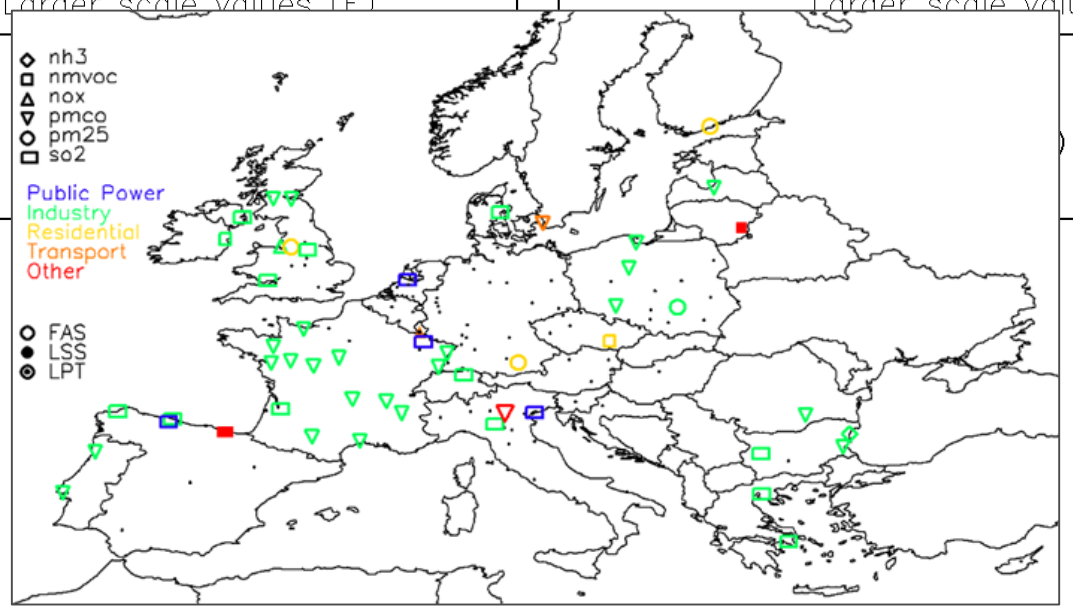
Overview of main inconsistencies

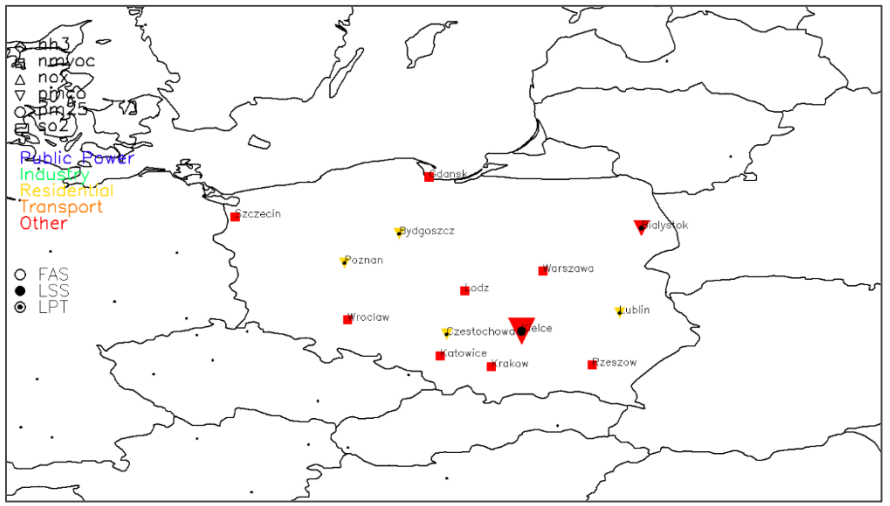



ECI>100 edgar/ensemble
37%
Focus area Activity Share (FAS)
Larger scale values (E)
Public P (18)
Industry (97)
Resident (33)
Transpor (0)
Other (33)
FAS (41)
LSS (2)
LPT (0)
NI=43

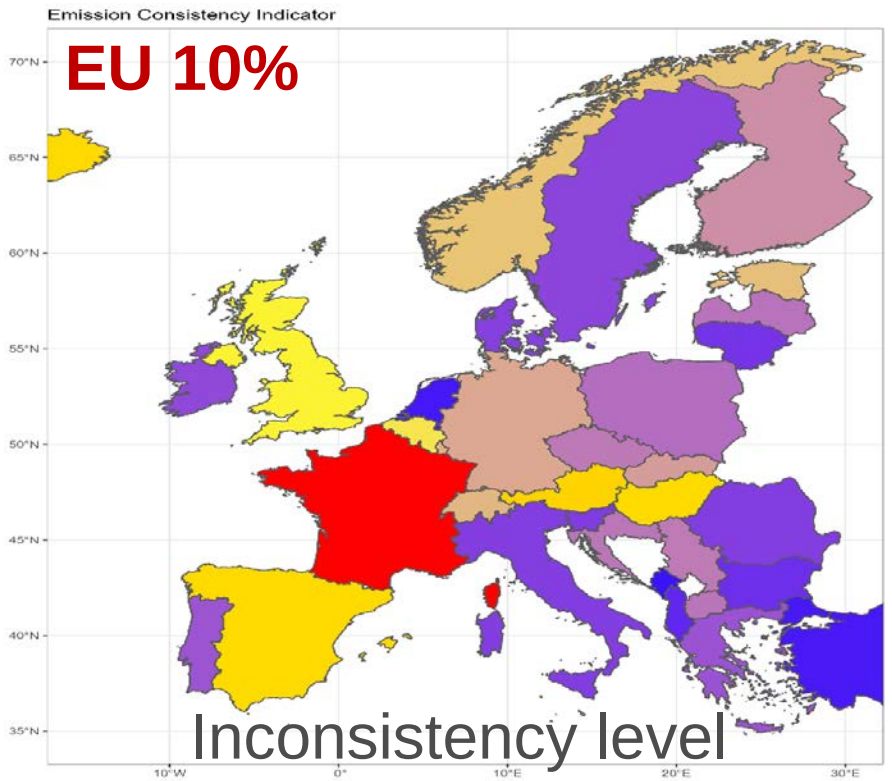

ECI=22.9 camsv42/ensemble
9%
Focus area Activity Share (FAS)
Larger scale values (E)


ECI>100 poland/ensemble
85%
Focus area Activity Share (FAS)
Larger scale values (E)
Public P (9)
Industry (3)
Resident (32)
Transpor (2)
Other (15)
nh3 (3)
nmvoc (22)
nox (2)
pmco (14)
pm25 (13)
so2 (7)
FAS (1)
LSS (36)
LPT (24)
NI=61

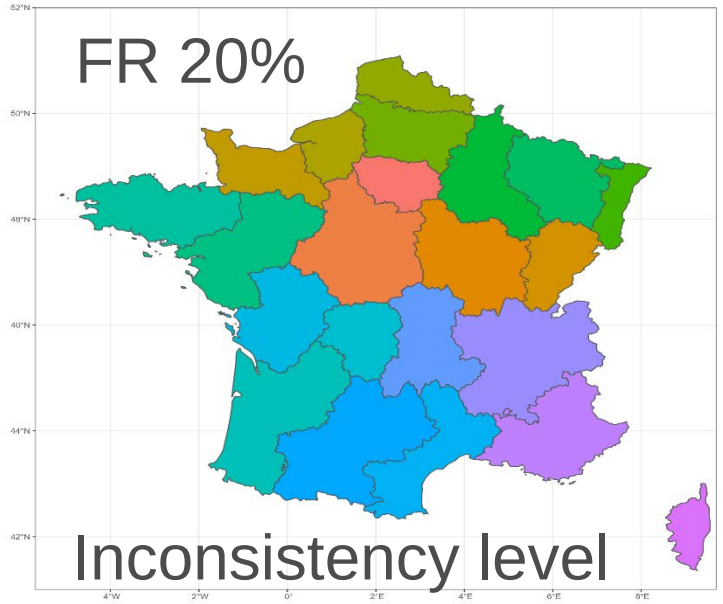

nh3
nmvoc
nox
pmco
pm25
so2
Public Power
Industry
Residential
Transport
Other
FAS
LSS
LPT


Public Power
Industry
Residential
Transport
Other
FAS
LSS
LPT
Gdansk
Szczecin
Bydgoszcz
Olsztyn
Poznan
Warszawa
Lodz
Wroclaw
Lublin
Czestochowa
Katowice
Krakow
Rzeszow

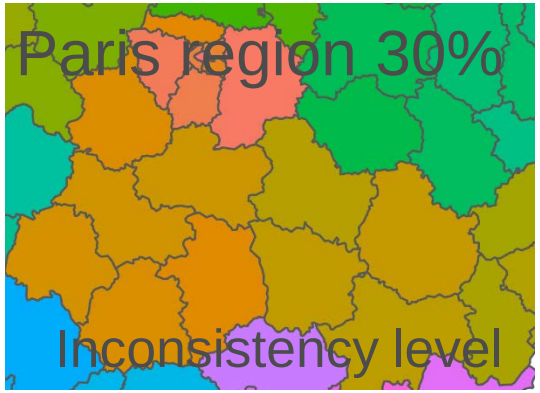
Top-down emission consistency dashboard



Public P	9		NH3	0		LPT	40
Industry	30		NMVOC	6		LSS	10
Residential	10		NOx	10		FAS	20
Transport	3		PMCO	30			
Other	18		PM25	5			
			SO2	19		NI=70	



Public P	0		NH3	0		LPT	5
Industry	20		NMVOC	6		LSS	10
Residential	0		NOx	12		FAS	5
Transport	0		PMCO	0			
Other	0		PM25	0			
			SO2	2		NI=20	



Public P	0		NH3	0		LPT	2
Industry	10		NMVOC	1		LSS	6
Residential	0		NOx	8		FAS	2
Transport	0		PMCO	0			
Other	0		PM25	0			
			SO2	1		NI=10	

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Conclusion & proposal for discussion

- Compare top-down versions between them (e.g. CAMX86 vs CAMS87)
- Regularly update the top-down ensemble and monitor progress. The ECI indicator and dashboard inform on the current status of variability and inform about remaining inconsistencies (type and magnitude).
- Discuss main inconsistencies and possibly solve them.
- If not solvable with top-down info only, compare with local bottom-up. Support with gridded composite mapping for specific pollutants/sectors if helpful.
- At each Fairmode technical meeting: discussion on major inconsistencies and explain how they have been (or should be) tackled. Draw recommendations on best practice.

Thank-you

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