



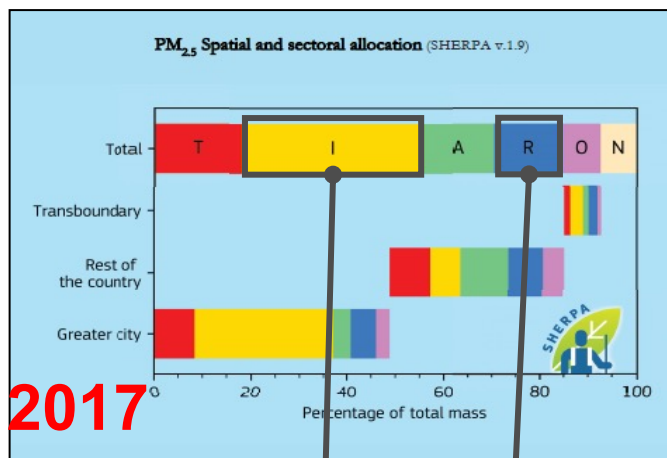
Proposal for a QA/QC approach for emissions

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E. Pisoni, J. Koenen, S. Lopes-Aparicio,
M. Guevara et al.*

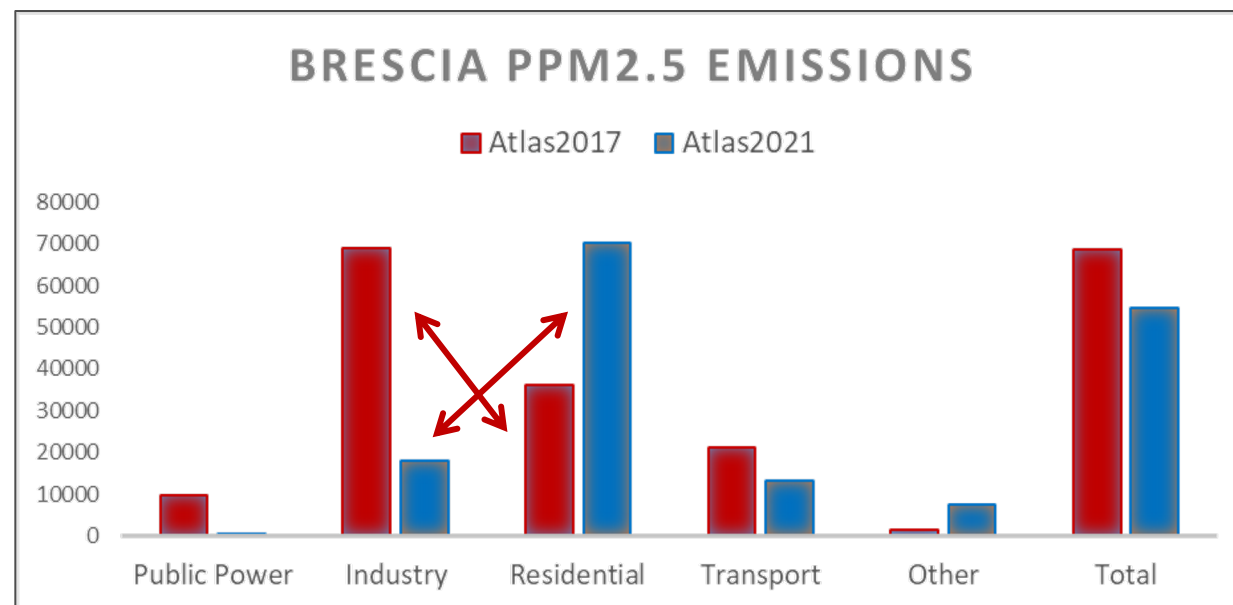
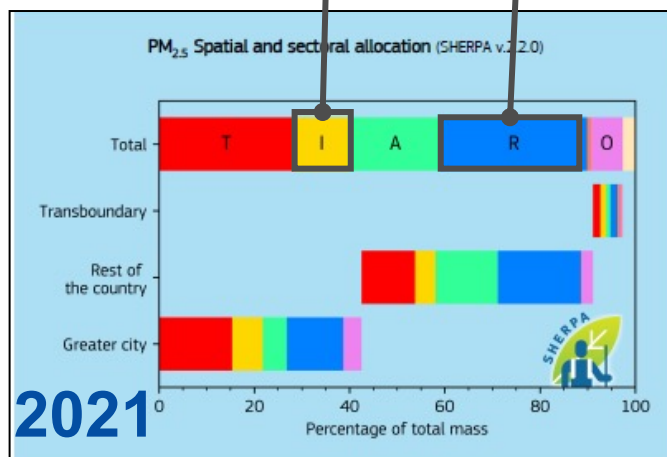
Motivation

Brescia

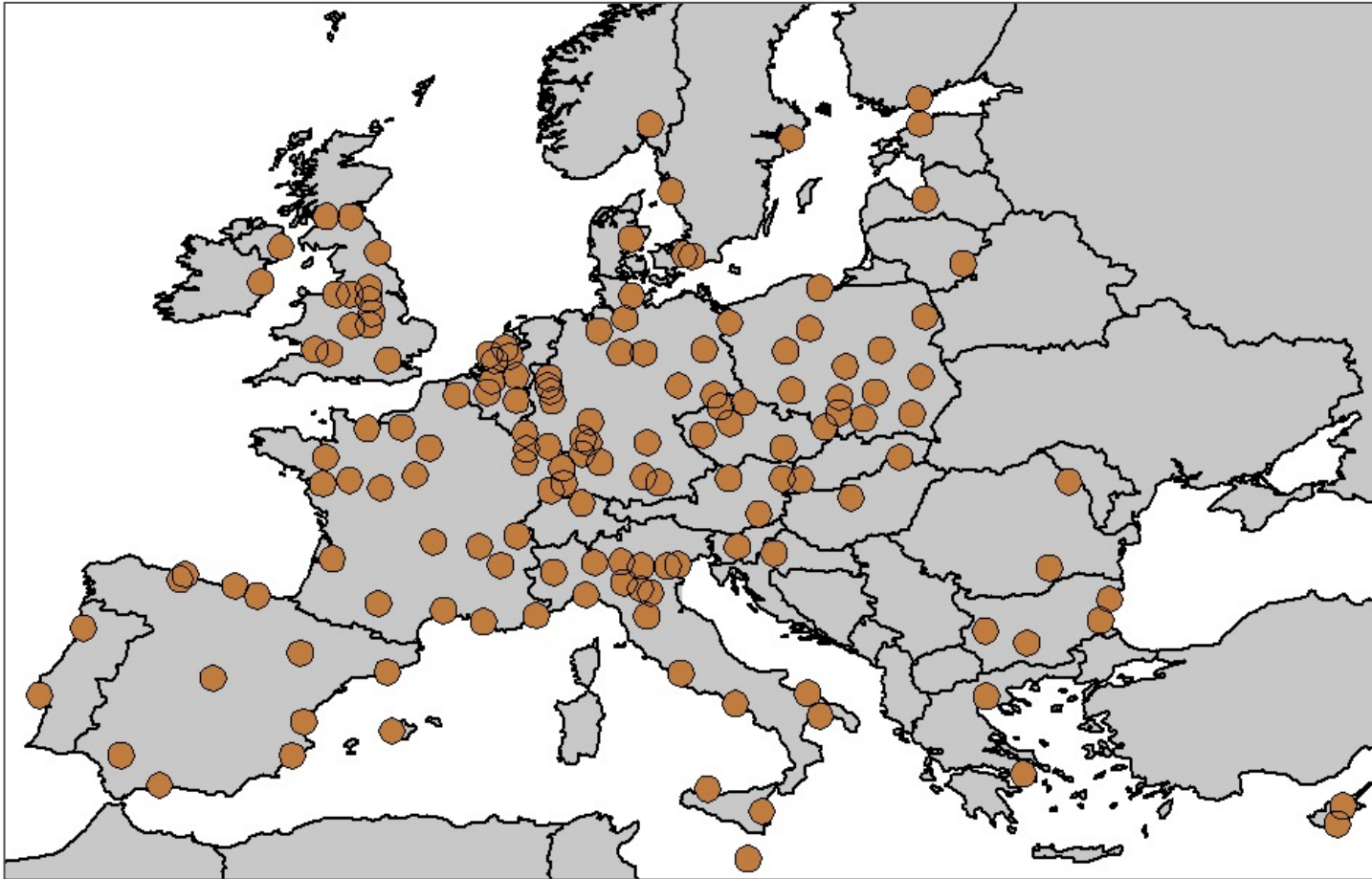
Atlas 2017



Atlas 2021



Required input data



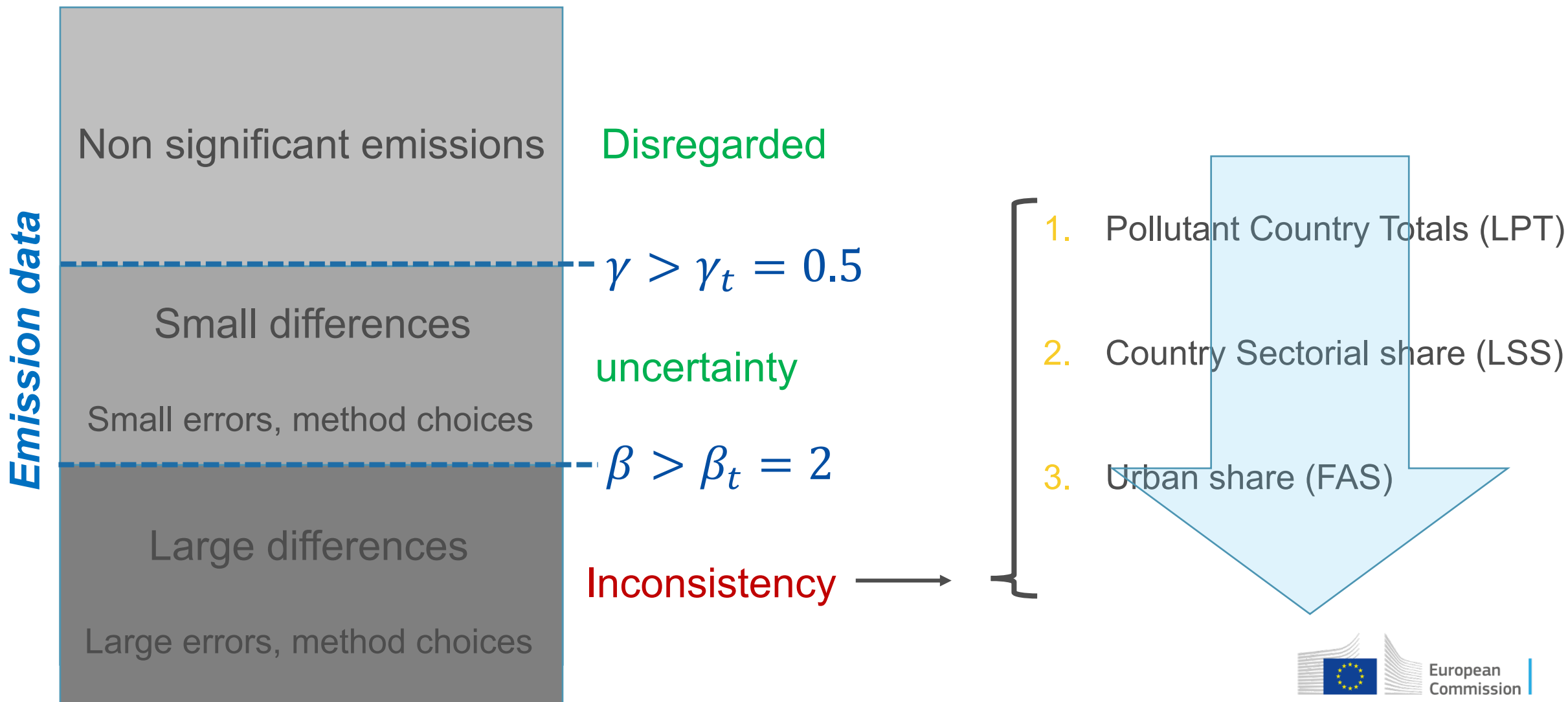
For each city: $e_{p,s}$

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

pollutant

sector

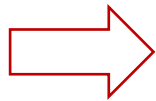
Relevant emissions AND detection of inconsistencies



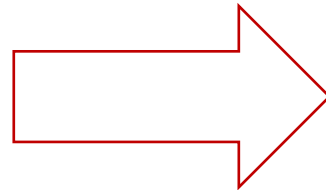
Decomposition (I)

$e_{p,s}$

$E_{p,s}$



\bar{E}_p



$$e_{p,s} = \frac{e_{p,s}}{E_{p,s}} * \frac{E_{p,s}}{\bar{E}_p} * \bar{E}_p$$

Urban
Activity
Share

UAS

Country
Sector
Share

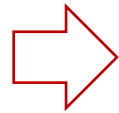
LSS

Country
Pollutant
Total

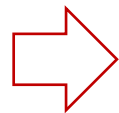
LPT

Decomposition (II)

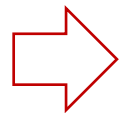
$$\frac{e_{p,s}^1}{e_{p,s}^2} = \frac{e_{p,s}^1}{E_{p,s}^1} * \frac{E_{p,s}^1}{\bar{E}_p^1} * \frac{\bar{E}_p^1}{\bar{E}_p^2} * \frac{e_{p,s}^2}{E_{p,s}^2} * \frac{E_{p,s}^2}{\bar{E}_p^2}$$



$$\log\left(\frac{e_{p,s}^1}{e_{p,s}^2}\right) = \log\left(\frac{e_{p,s}^1}{E_{p,s}^1}\right) + \log\left(\frac{E_{p,s}^1}{\bar{E}_p^1}\right) + \log\left(\frac{\bar{E}_p^1}{\bar{E}_p^2}\right) + \log\left(\frac{e_{p,s}^2}{E_{p,s}^2}\right) + \log\left(\frac{E_{p,s}^2}{\bar{E}_p^2}\right)$$



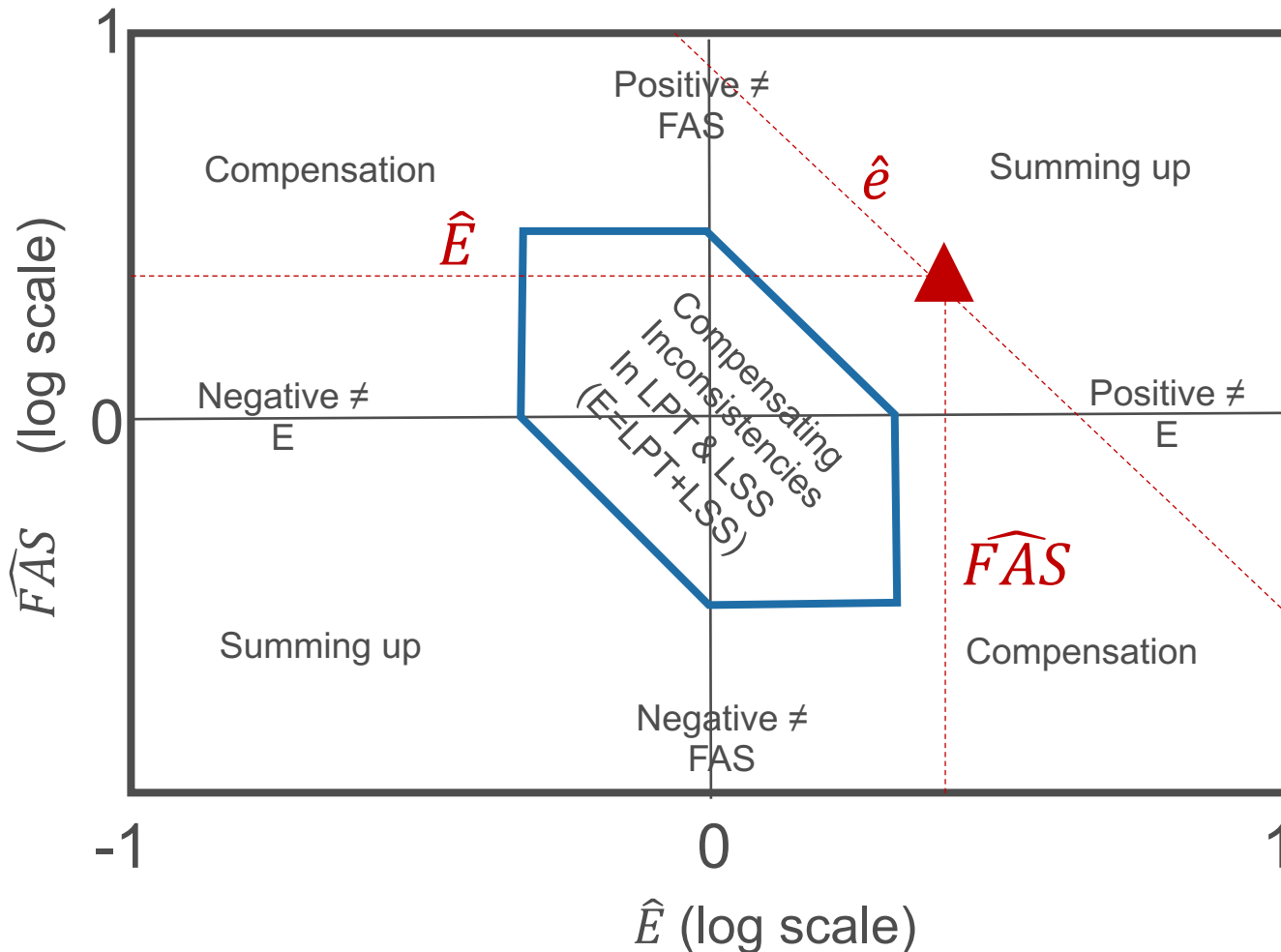
$$\hat{e} = \widehat{UAS} + \widehat{CSS} + \widehat{CPT}$$



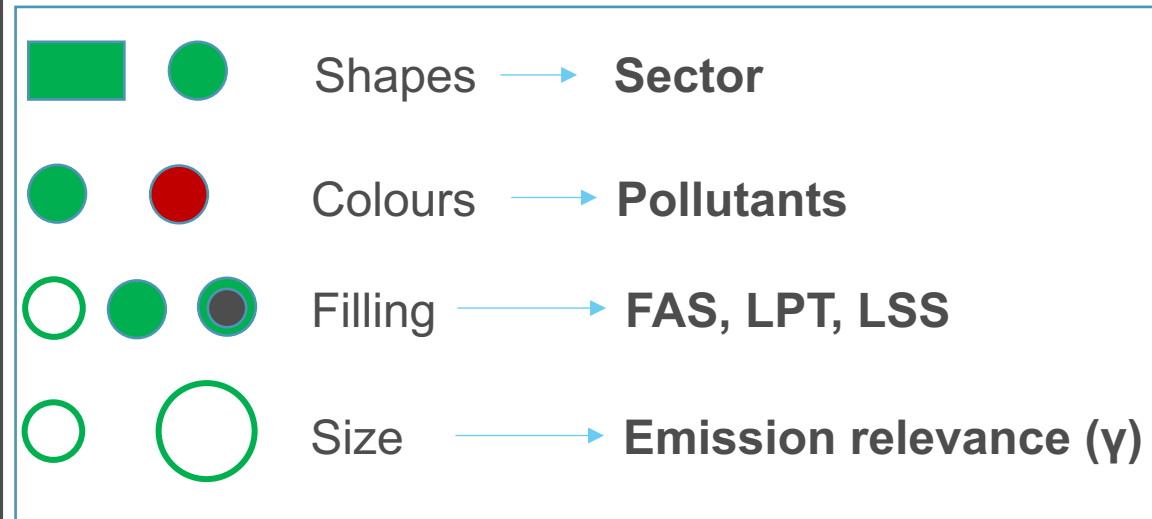
$$\hat{e} = \widehat{UAS} + \hat{E}$$

Country values

Diamond representation



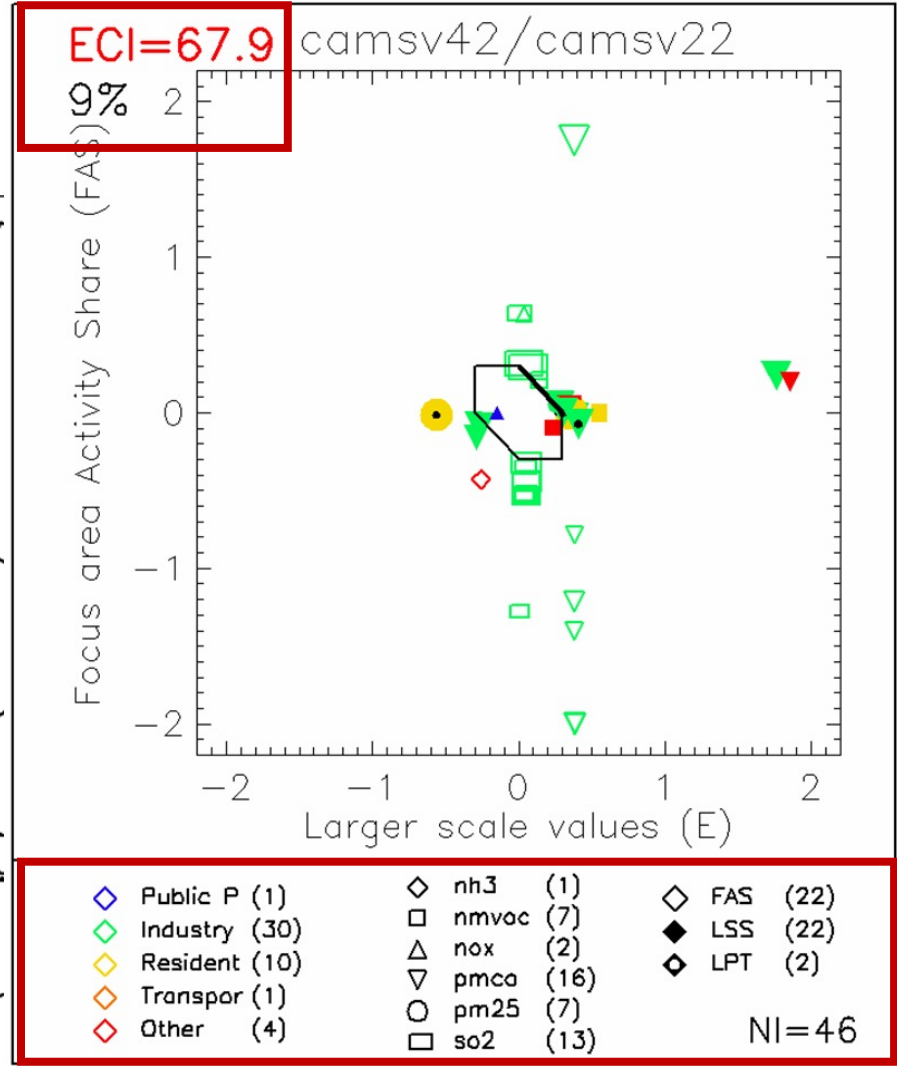
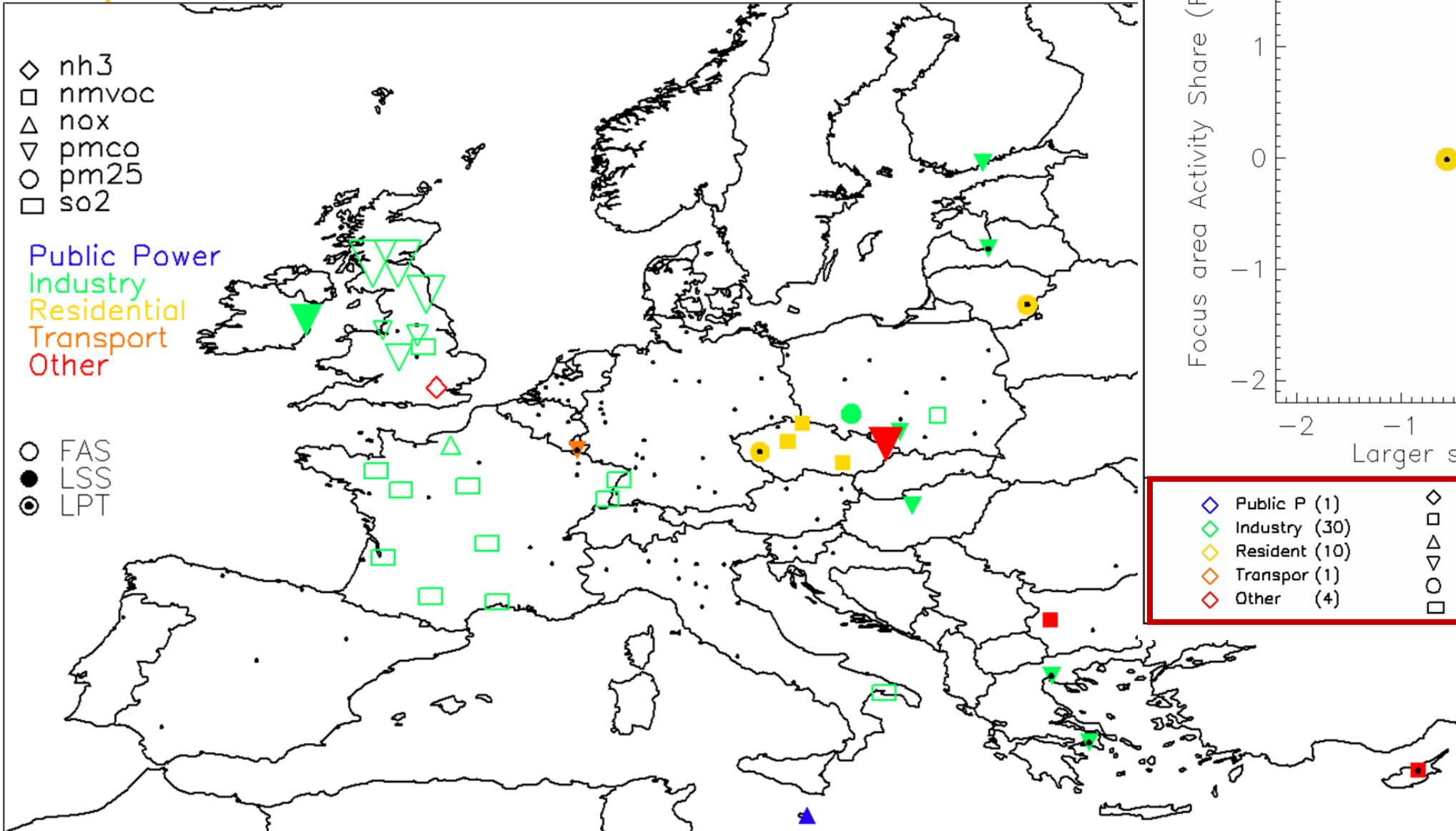
Only (p,s) that fulfill $\gamma > \gamma_t$ & $\beta > \beta_t$ are shown



Application: CAMS v22 vs. V42 (2015)

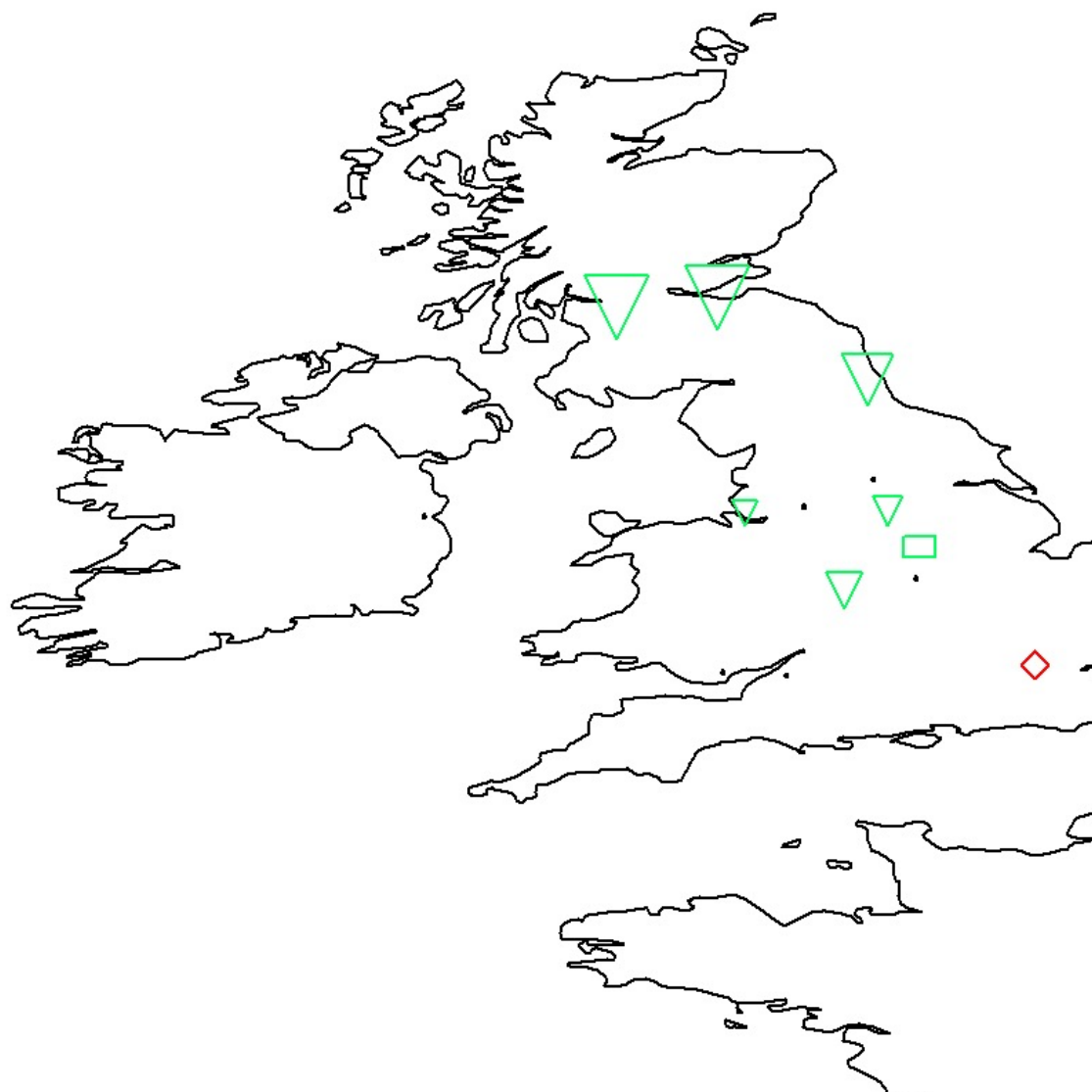
- **Spatial coverage:** EU
- **Focus areas:** 150 Atlas cities
- **Sectors:** Transport (F), Residential (C), Industry (B), Power-plant (A), Other [(J) Waste + (D) Fugitives + (E) Solvents + (I) OffRoad]
- **Pollutants:** SO₂, NH₃, PPM_{2.5}, PPM_C, NO_x, NMVOC
- $\gamma_t = 0.5$ and $\beta_t = 2$

Application (CAM542 vs CAM522 (2015))

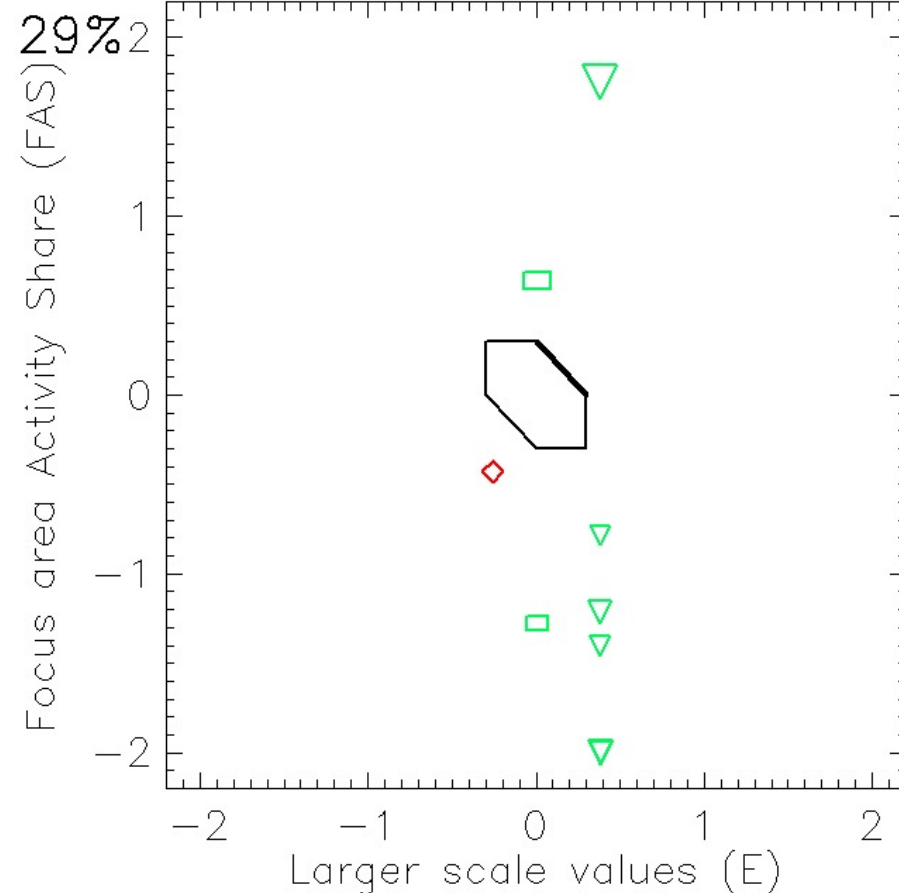


Country zooms

- ◇ nh3
 - nmvoc
 - △ nox
 - ▽ pmco
 - pm25
 - so2
- Public Power
Industry
Residential
Transport
Other
- FAS
 - LSS
 - ⊙ LPT

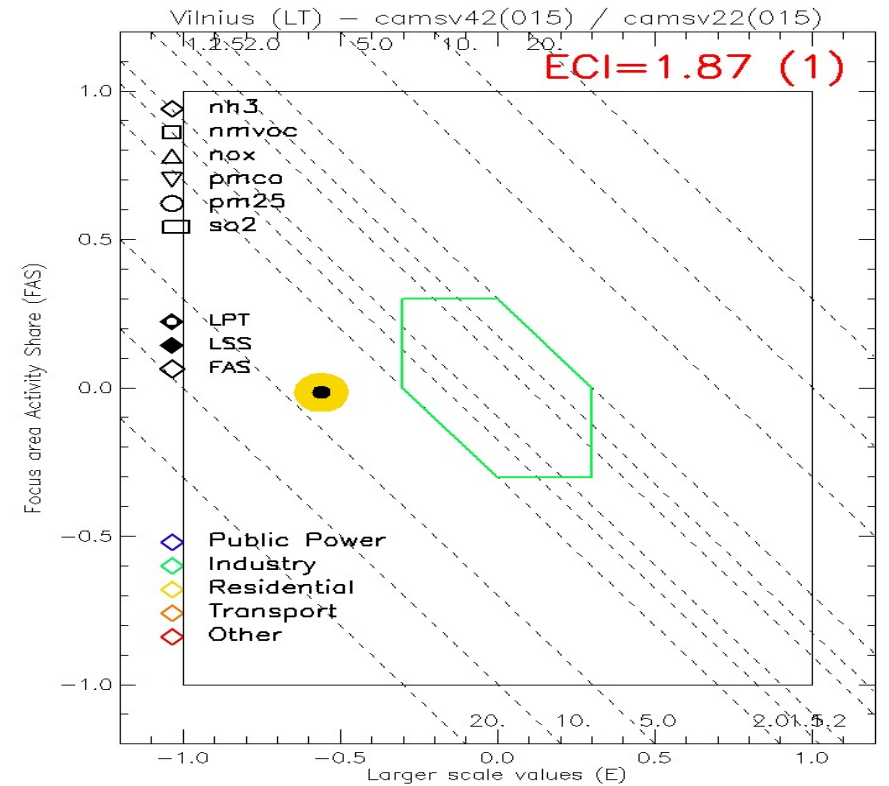
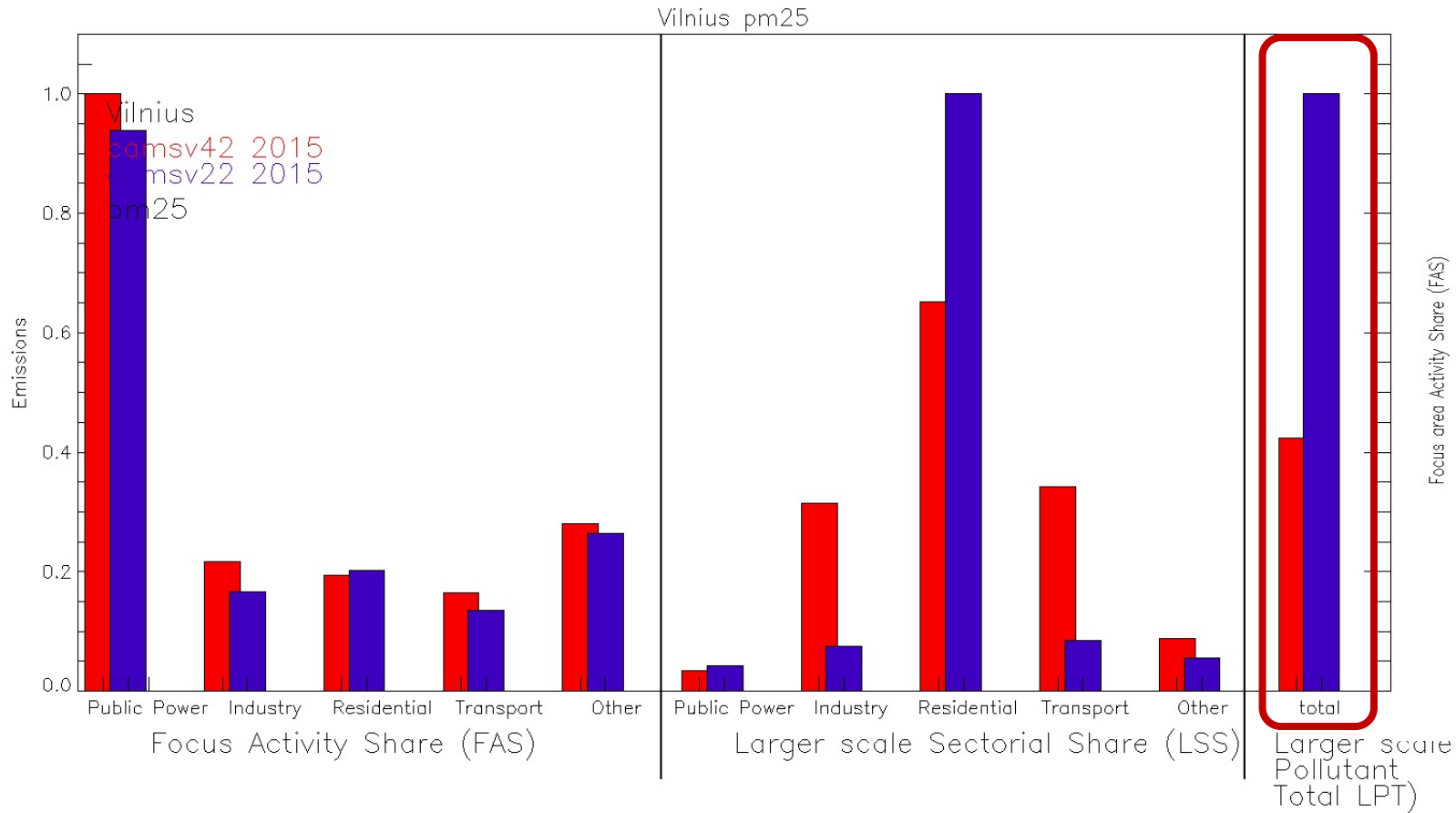


ECI=67.9 camsv42/camsv22



- | | | |
|----------------|-------------|-----------|
| ◇ Public P (0) | ◇ nh3 (1) | ◇ FAS (9) |
| ◇ Industry (8) | □ nmvoc (0) | ◆ LSS (0) |
| ◇ Resident (0) | △ nox (0) | ◆ LPT (0) |
| ◇ Transpor (0) | ▽ pmco (6) | |
| ◇ Other (1) | ○ pm25 (0) | |
| | □ so2 (2) | |
- NI=9

City zooms (Vilnius – PM25)

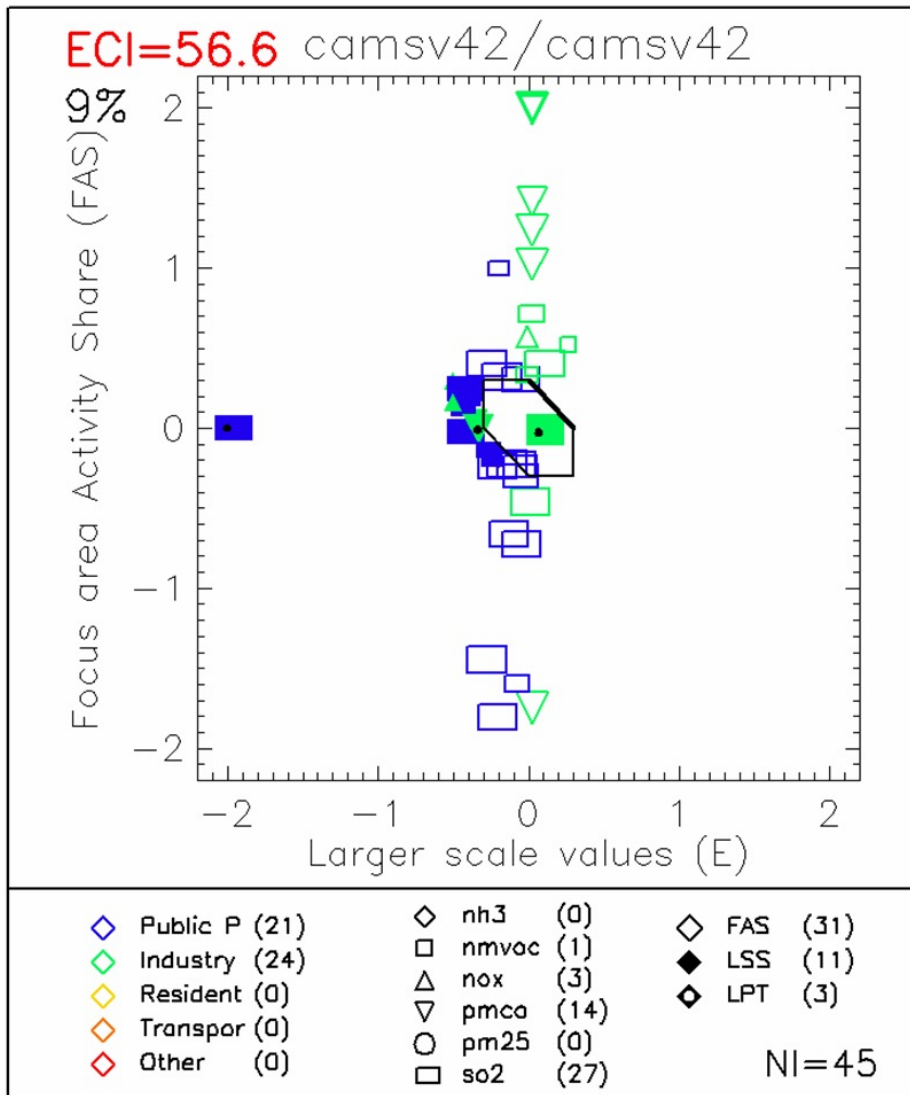
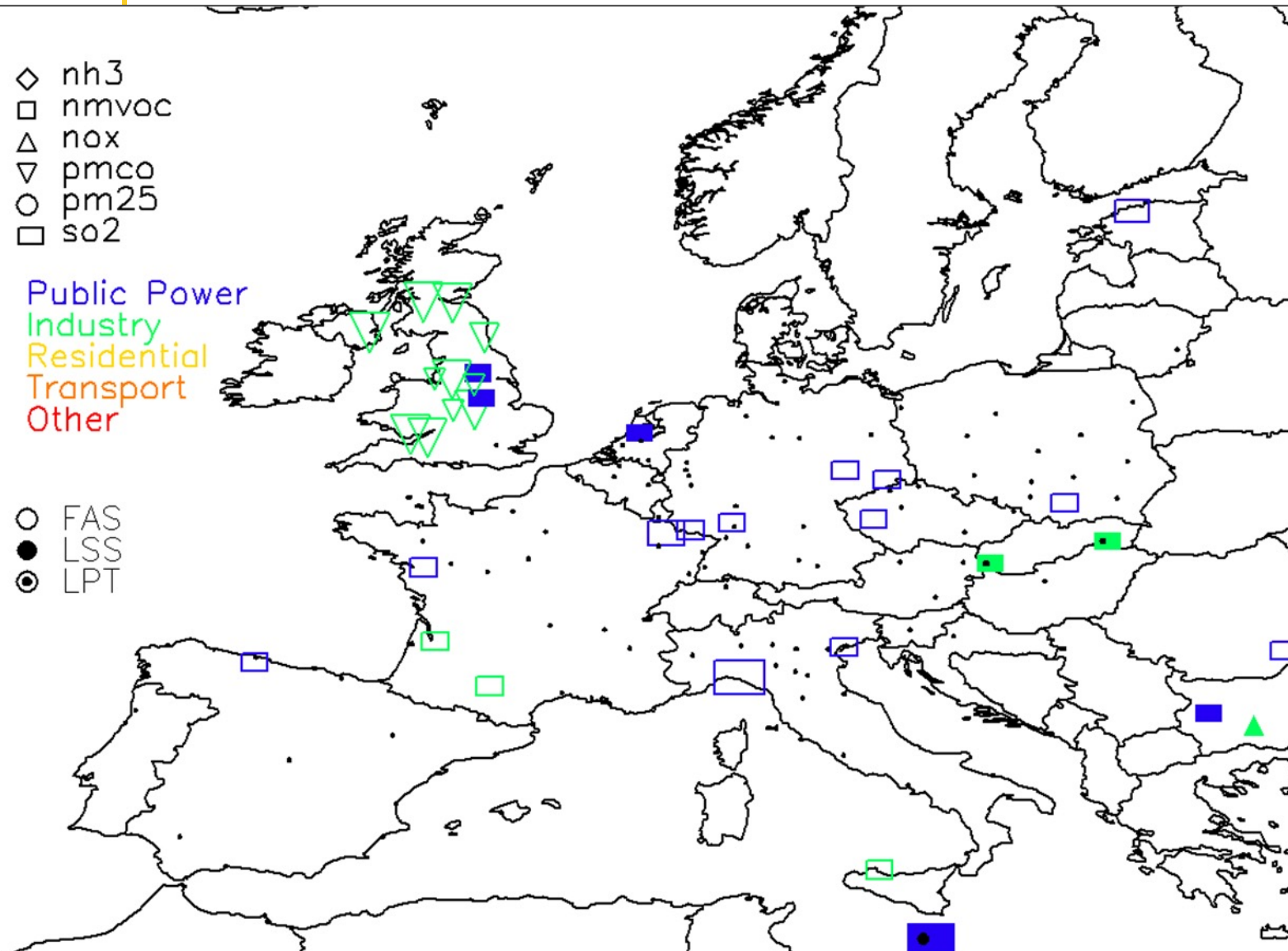


Possible uses

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

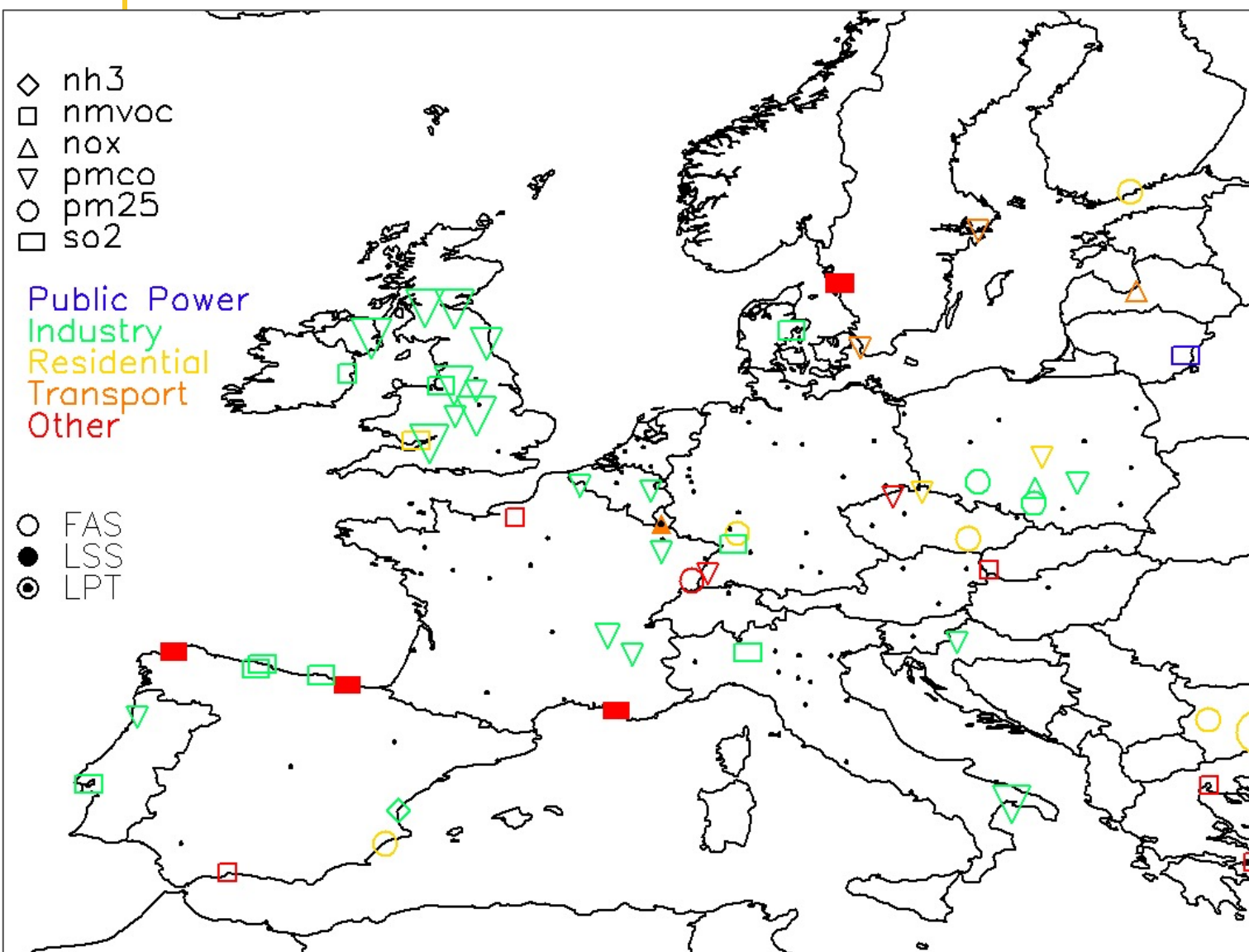
Inventory version & year vs. inventory version & year

CAMS42 2015 vs. CAMS42 2014

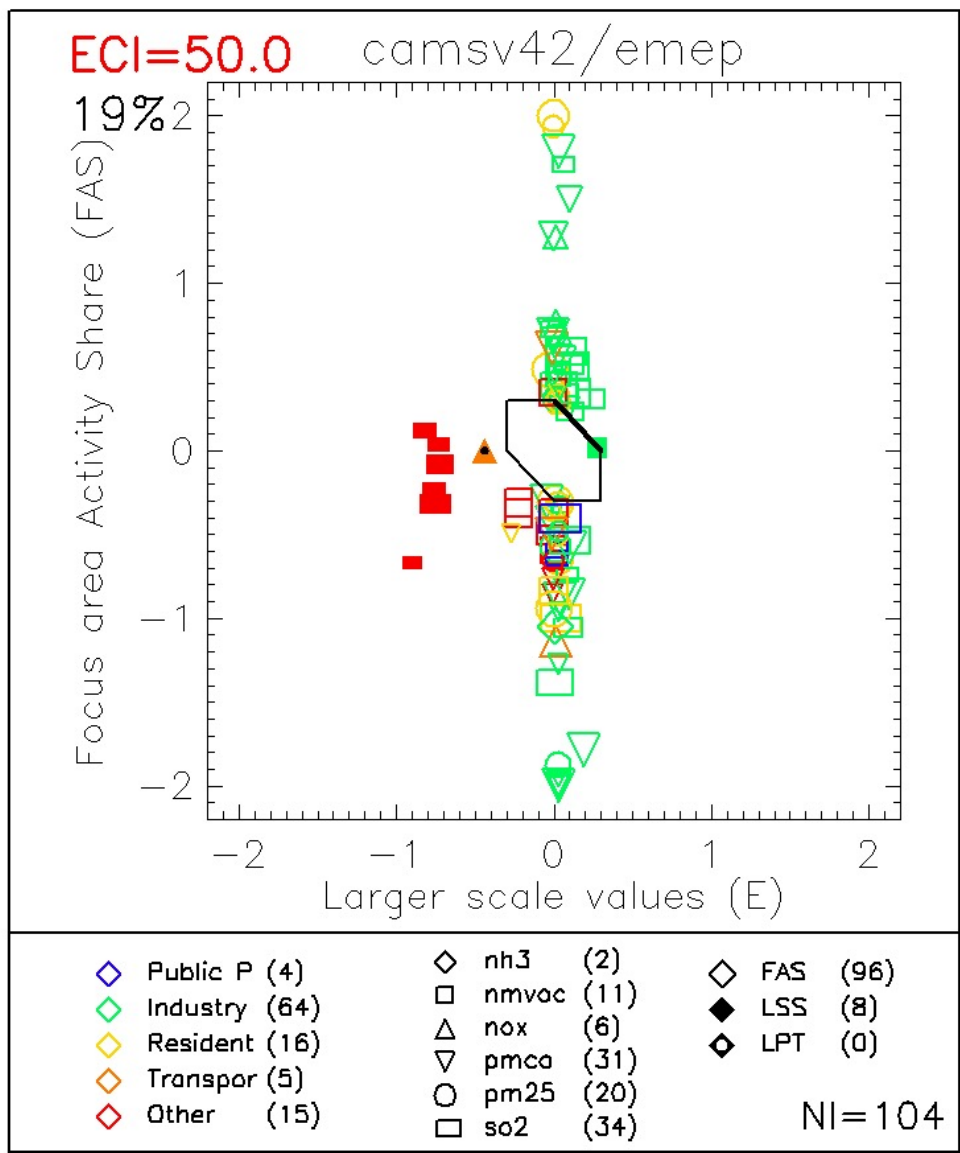


Inventory vs. inventory

CAMSV42 (2015) vs EMEP (2015)



- ◇ nh3
 - nmvoc
 - △ nox
 - ▽ pmco
 - pm25
 - so2
- Public Power
Industry
Residential
Transport
Other
- FAS
 - LSS
 - ⊙ LPT



Conclusions

- This method is a screening approach
 - Among relevant emissions, only large differences are detected ($>\beta_t$).
 - These differences, named inconsistencies are large enough to ensure that a “better” inventory can be identified 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

Conclusions

- The method allows for a systematic QA/QC (e.g. testing of new version...)
- It allows for comparisons between inventories (e.g. top-down vs bottom-up)
- Creation of a top-down EU “Ensemble” to facilitate bilateral comparisons

Thank-you