

Für Mensch & Umwelt

Umwelt   
Bundesamt

FAIRMODE WG8

# Spatial representativeness – Test Germany

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Unit: air quality assessment

German Environment Agency

## Setting

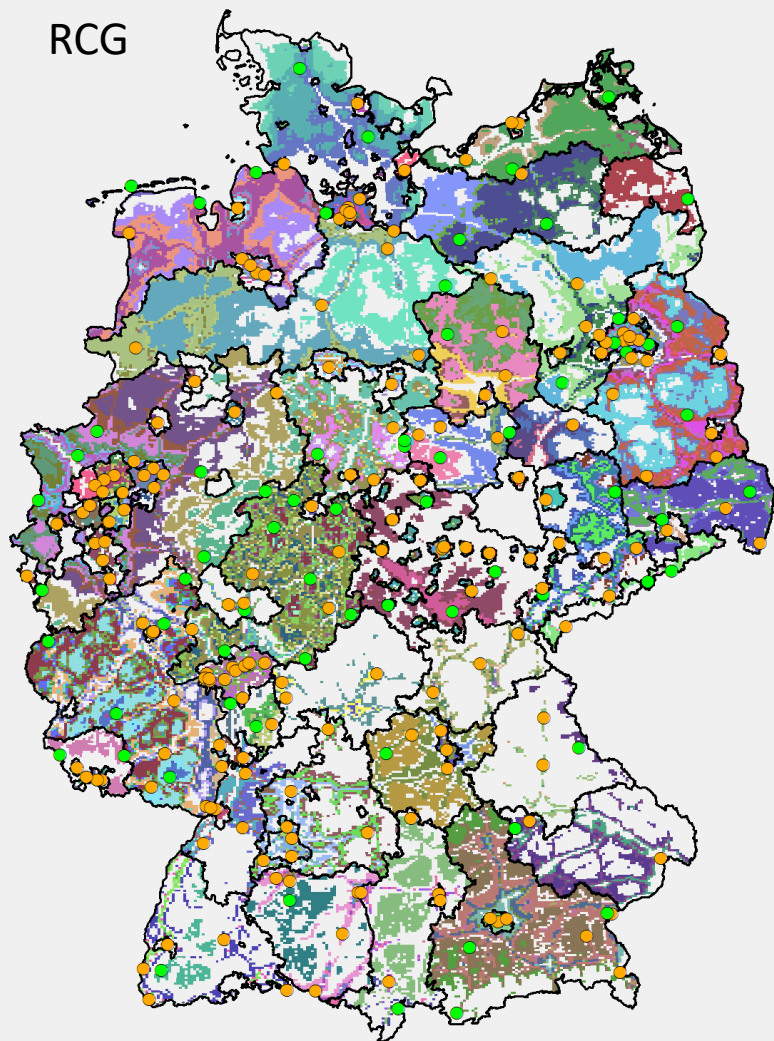
- Year: 2022
- Pollutants: NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, O<sub>3</sub> → annual mean
- Type of model: CTM (RCG) and CTM + data fusion (OI)
- Model scale: 2x2 km<sup>2</sup> (up to urban background levels, no street canyon)
- Background stations (rural, urban), air quality zones 2022

(g) sampling points shall, where possible, also be representative of similar locations not in the immediate vicinity of the sampling points. In the zones where the level of air pollutants is above the assessment threshold, the area which each sampling point is representative of shall be clearly defined. The whole zone shall be covered by the different areas of representativeness defined for each sampling points;

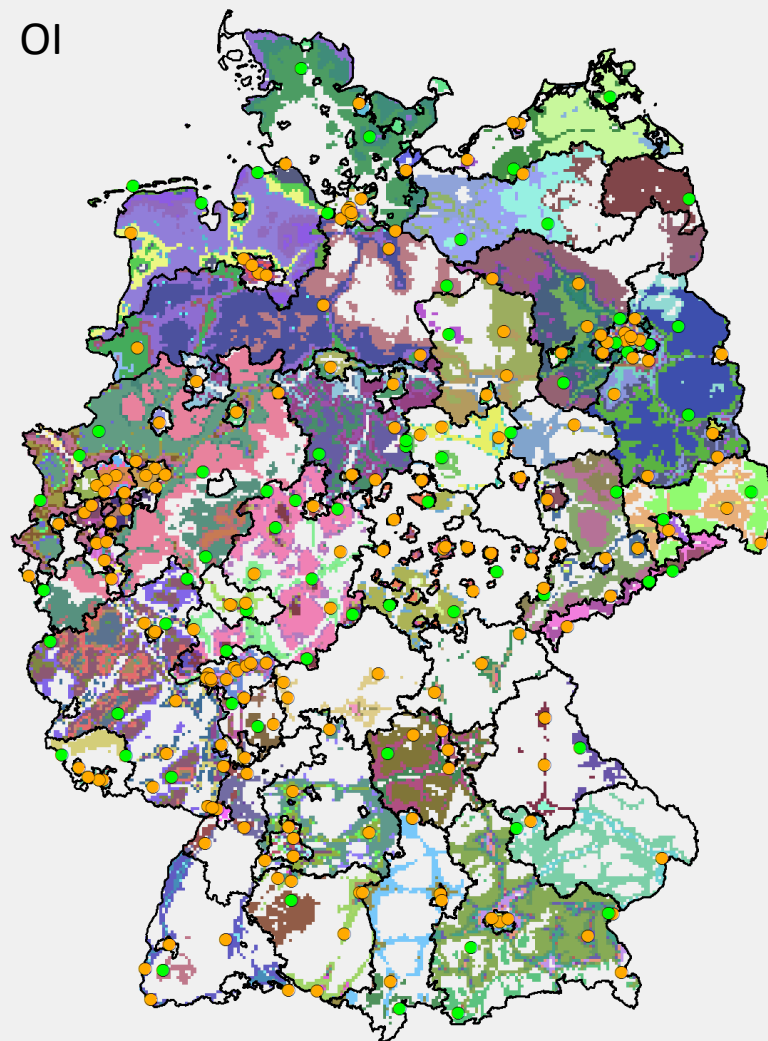
# NO<sub>2</sub> – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



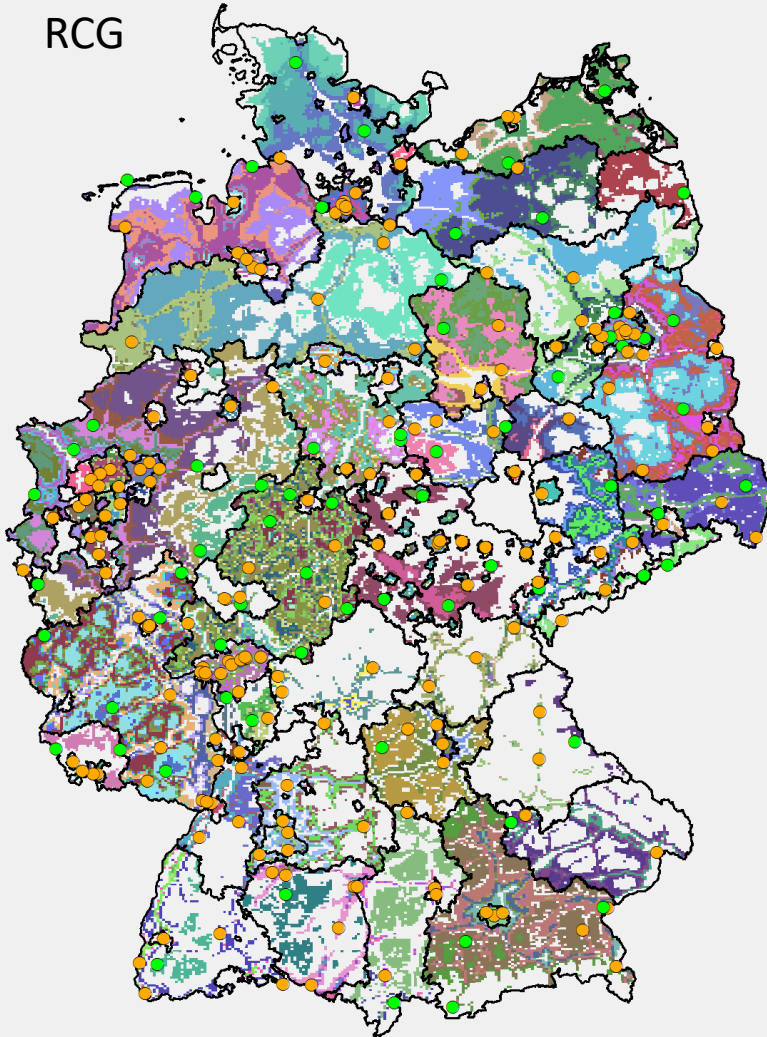
OI



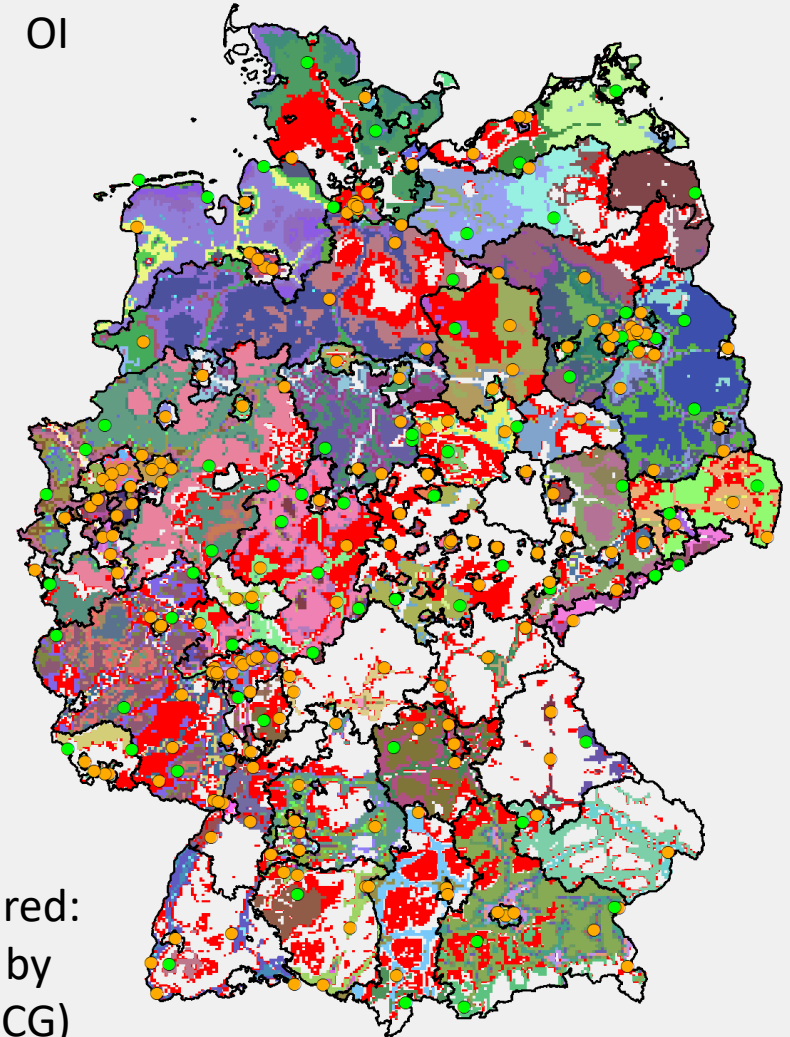
# NO<sub>2</sub> – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



OI

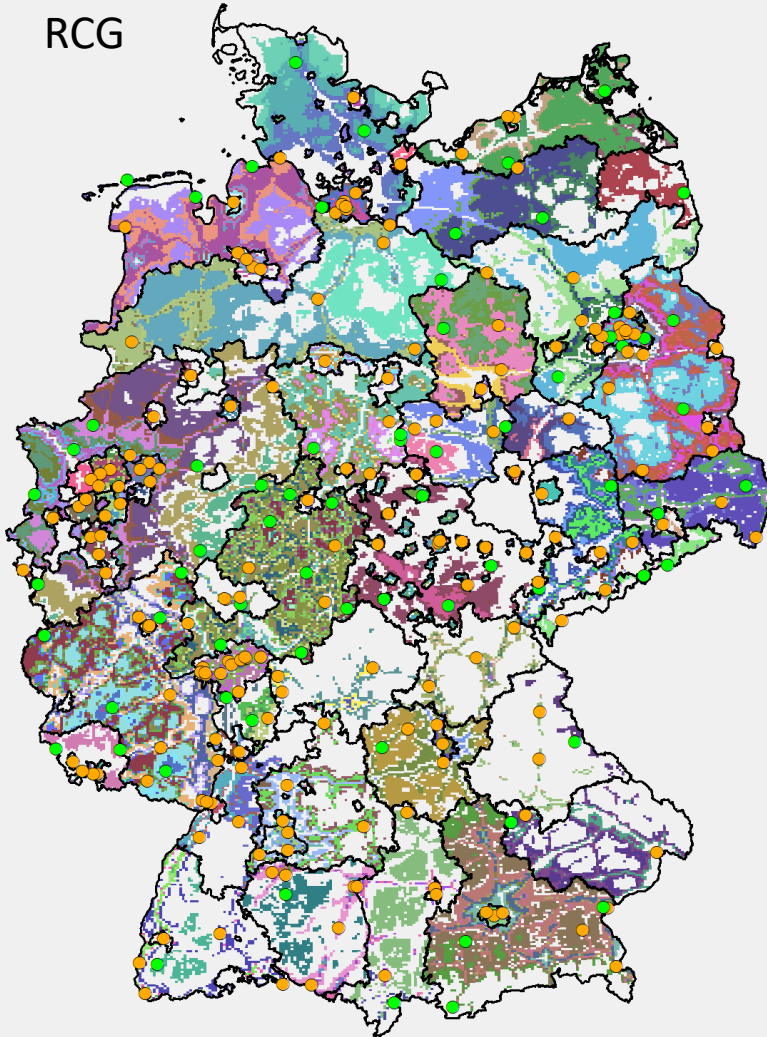


Difference in red:  
cells covered by  
raw model (RCG)

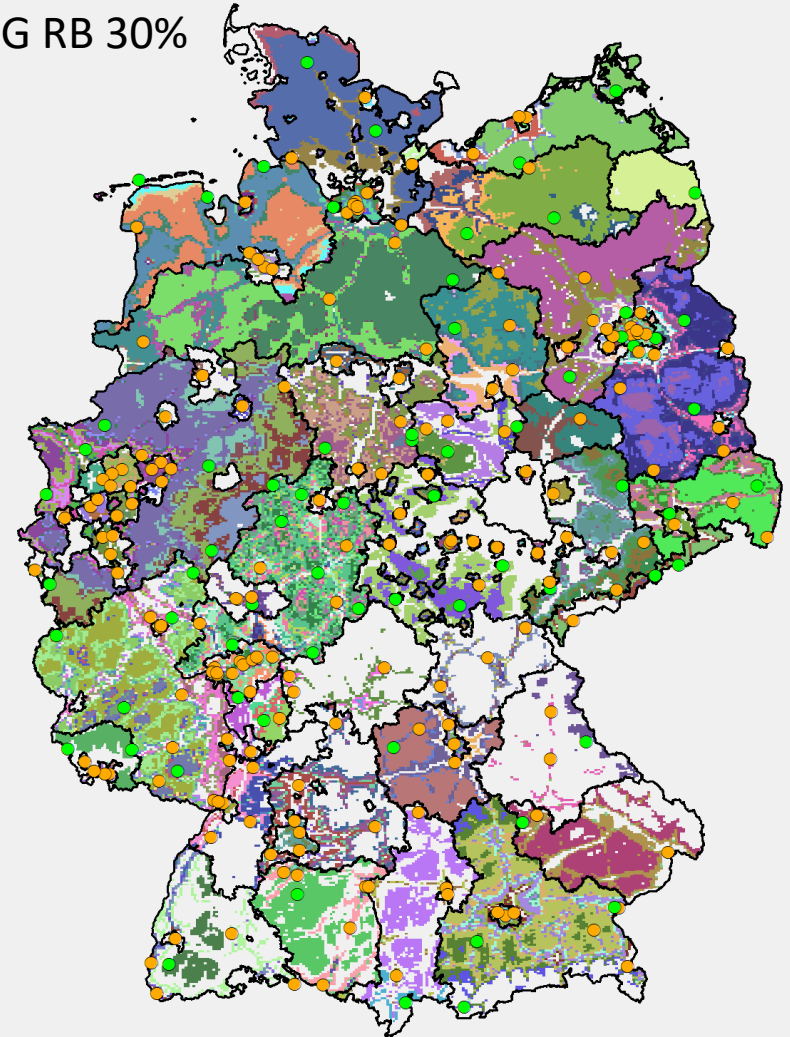
# NO<sub>2</sub> – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



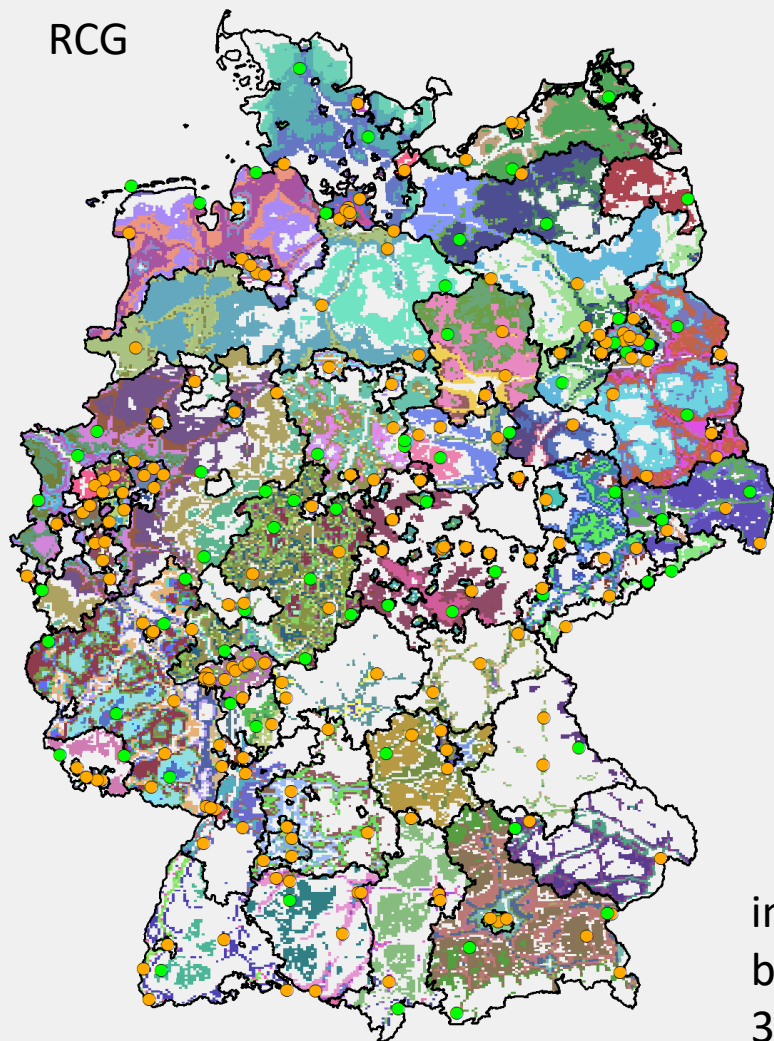
RCG RB 30%



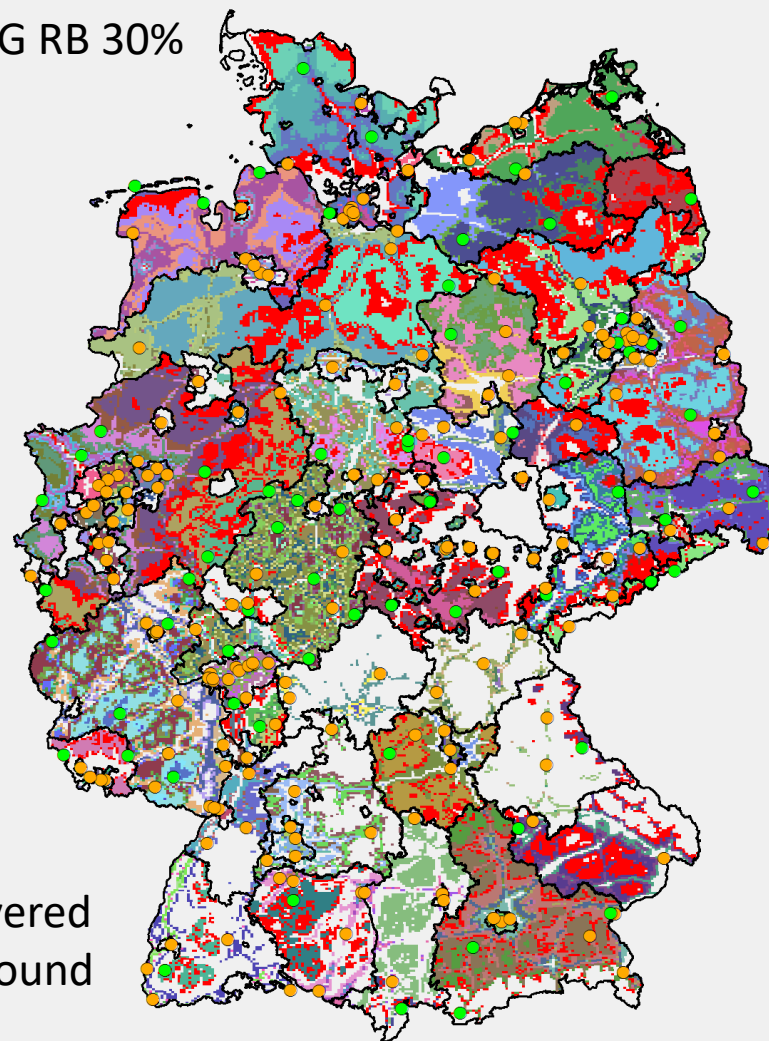
# NO<sub>2</sub> – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



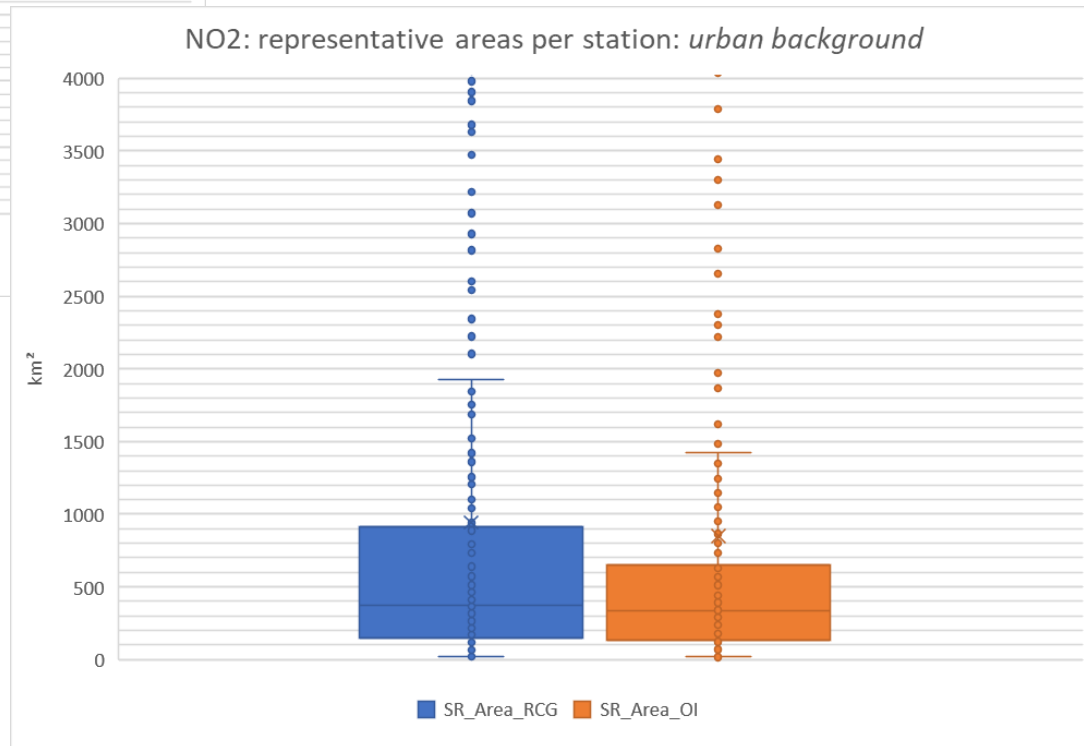
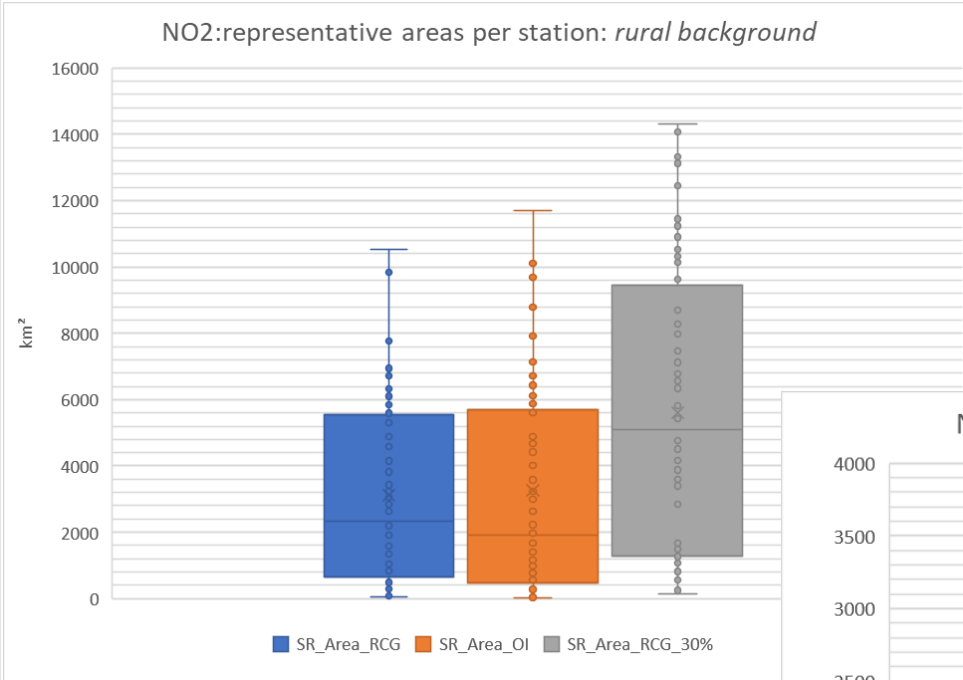
RCG RB 30%



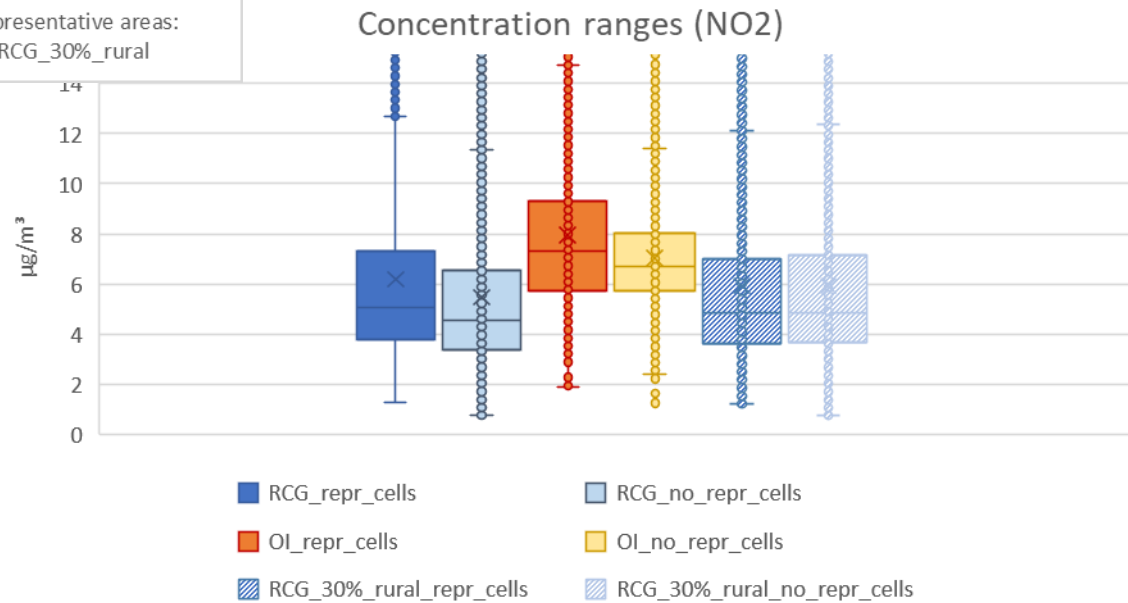
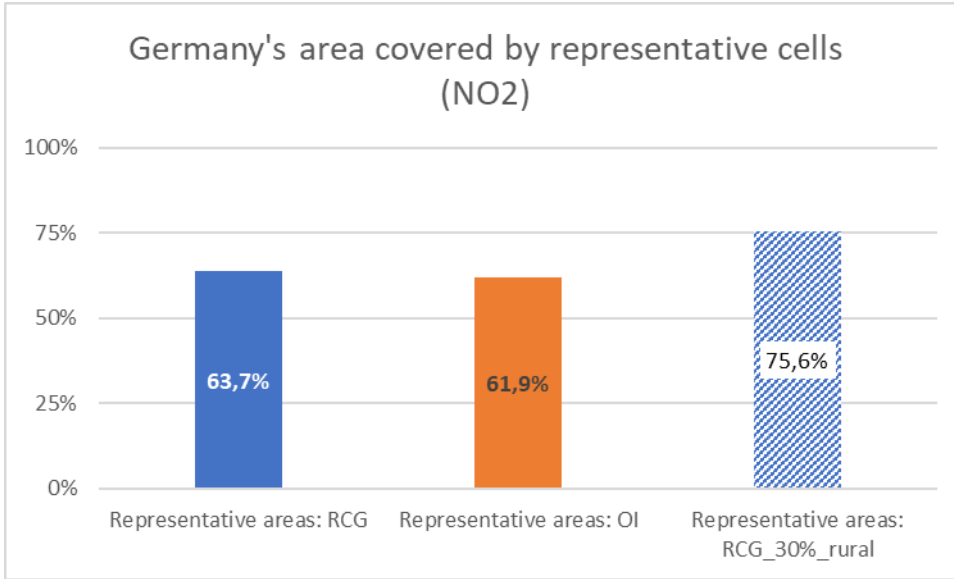
in red: cells covered  
by rural background  
30 % TL

# NO2 – statistics

at station level



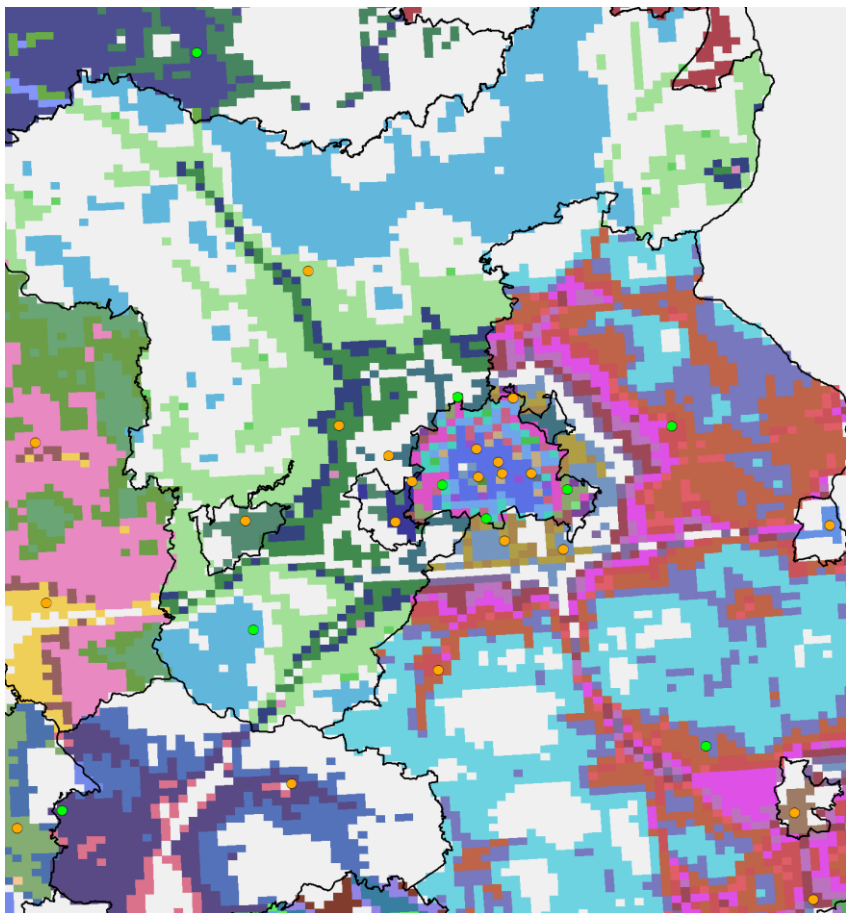
## NO<sub>2</sub> – statistics



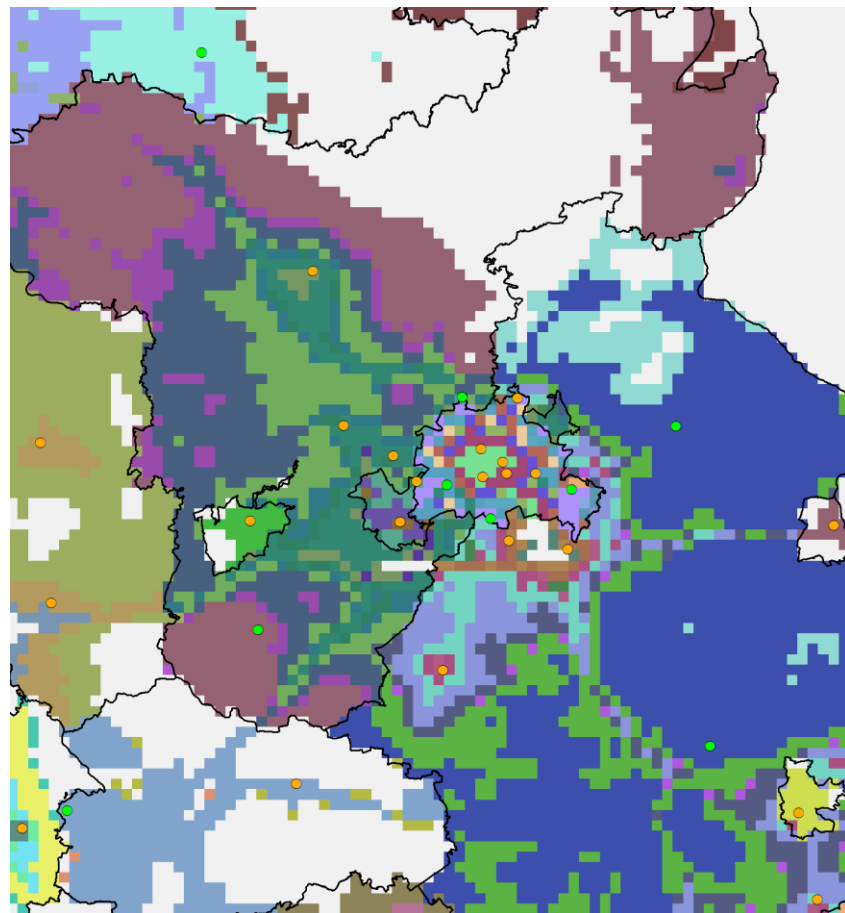


## NO<sub>2</sub> – urban areas

RCG



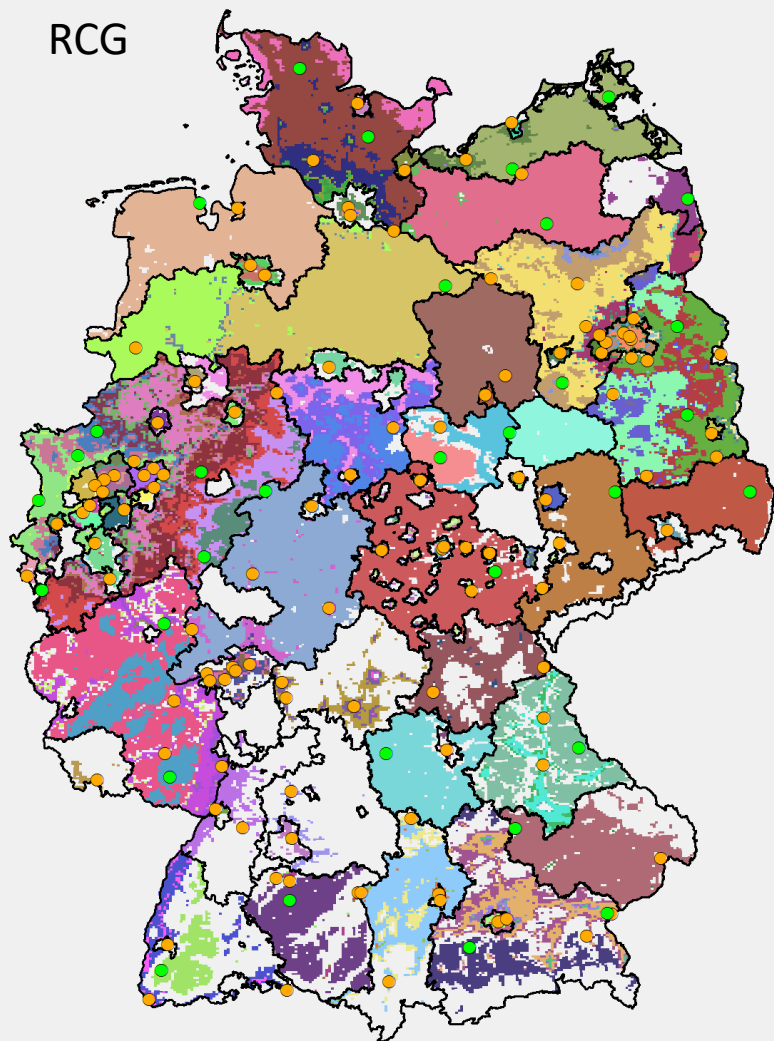
OI



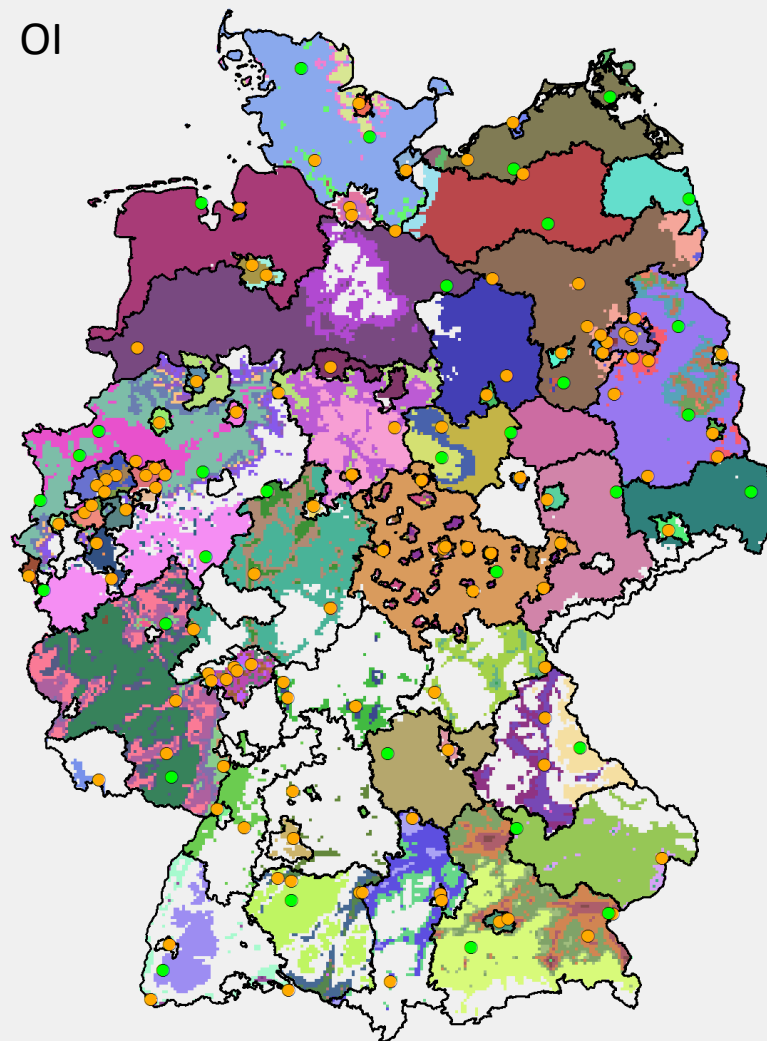
# PM2.5 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



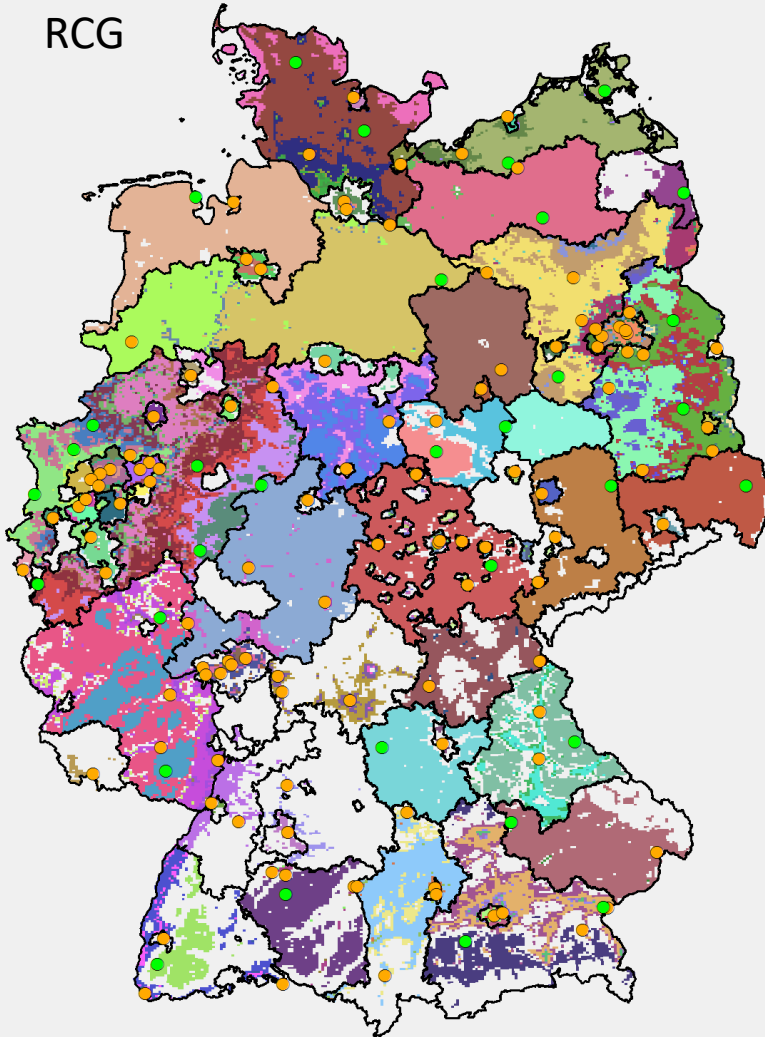
OI



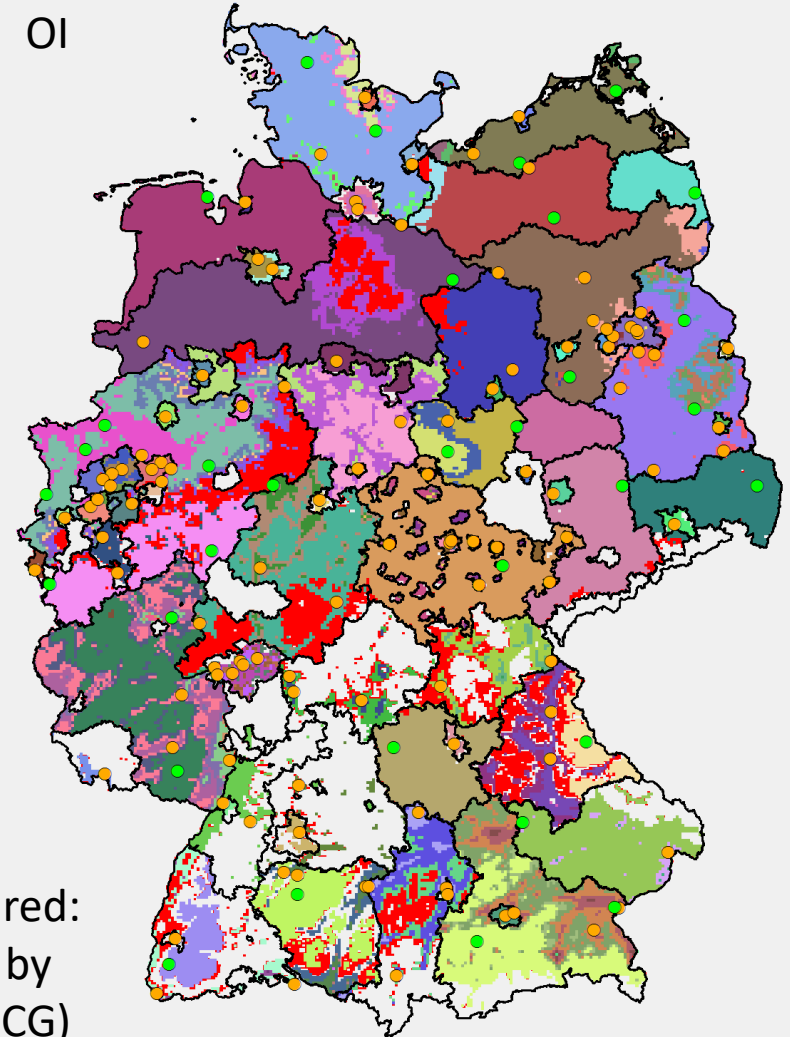
# PM2.5 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



OI

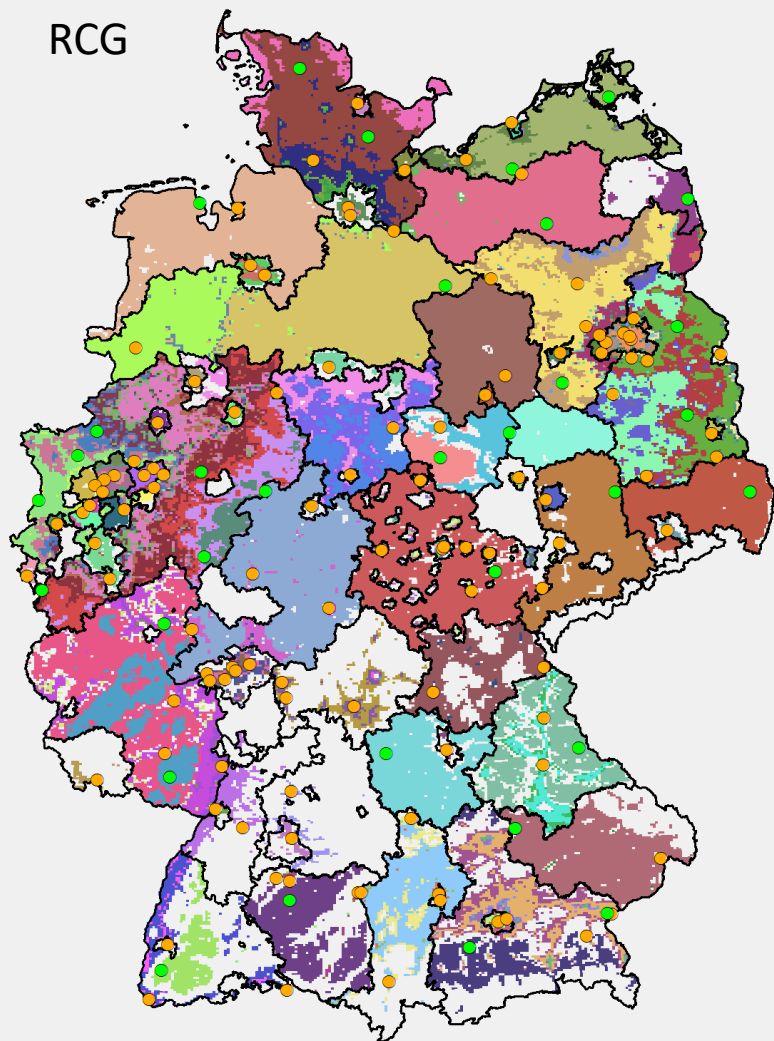


Difference in red:  
cells covered by  
raw model (RCG)

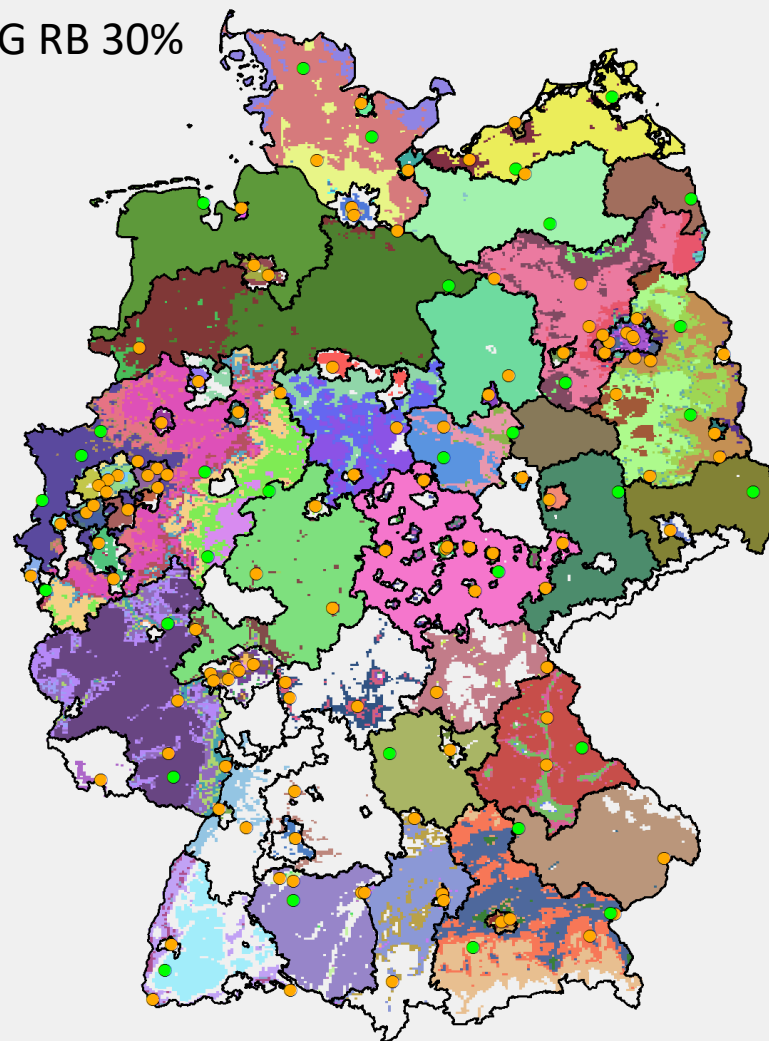
# PM2.5 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



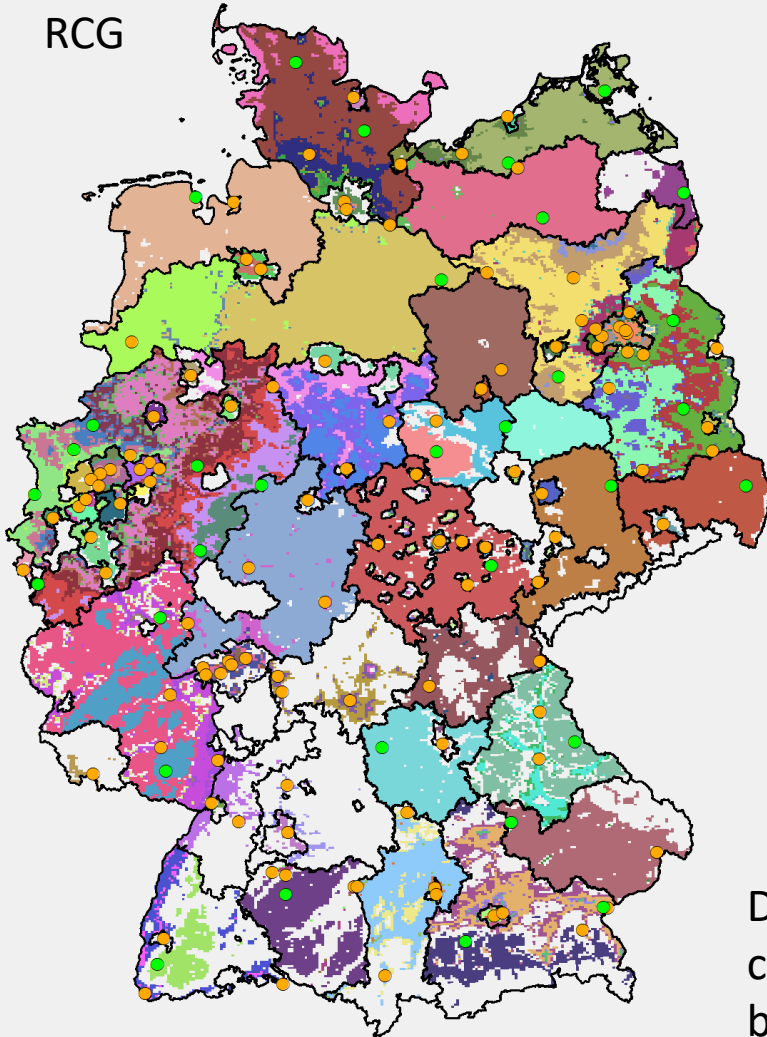
RCG RB 30%



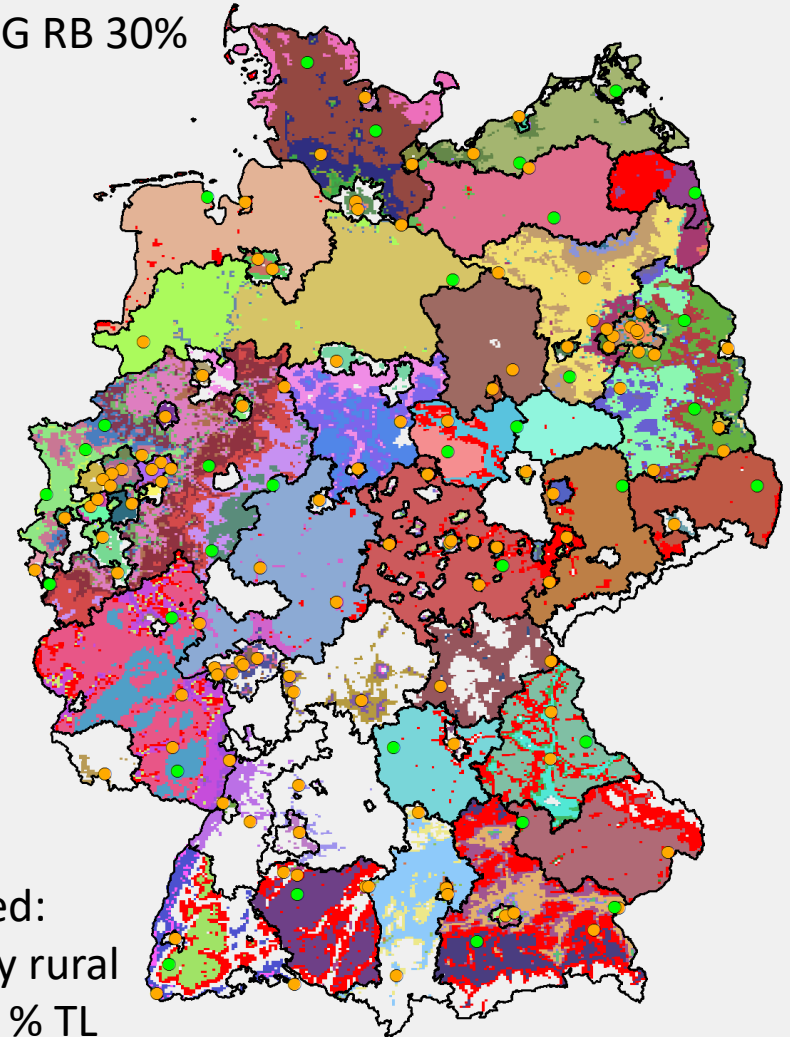
# PM2.5 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



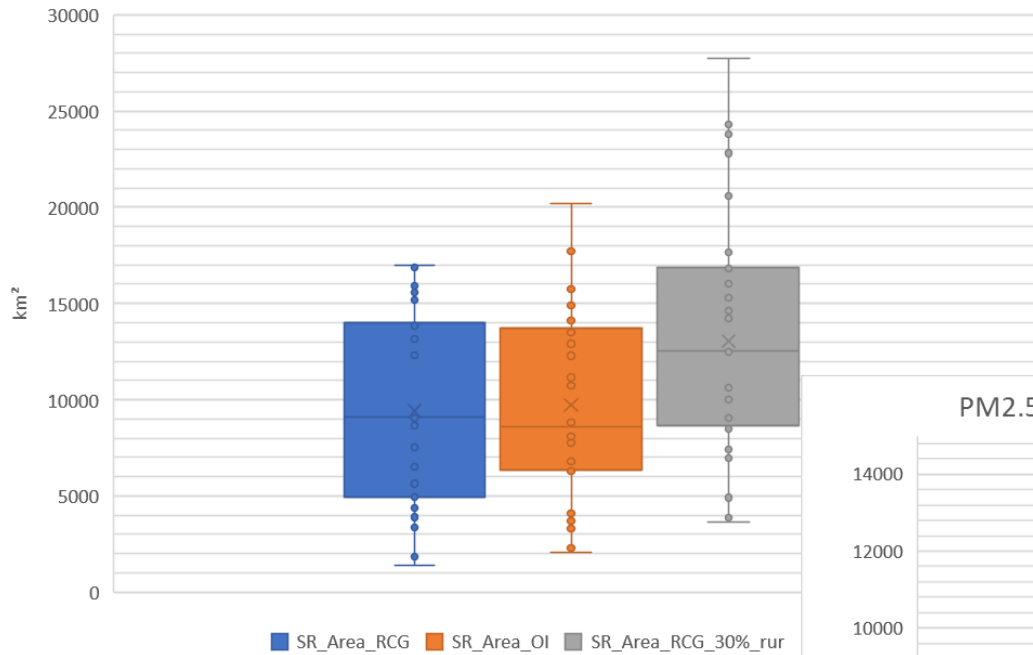
RCG RB 30%



Difference in red:  
cells covered by rural  
background 30 % TL

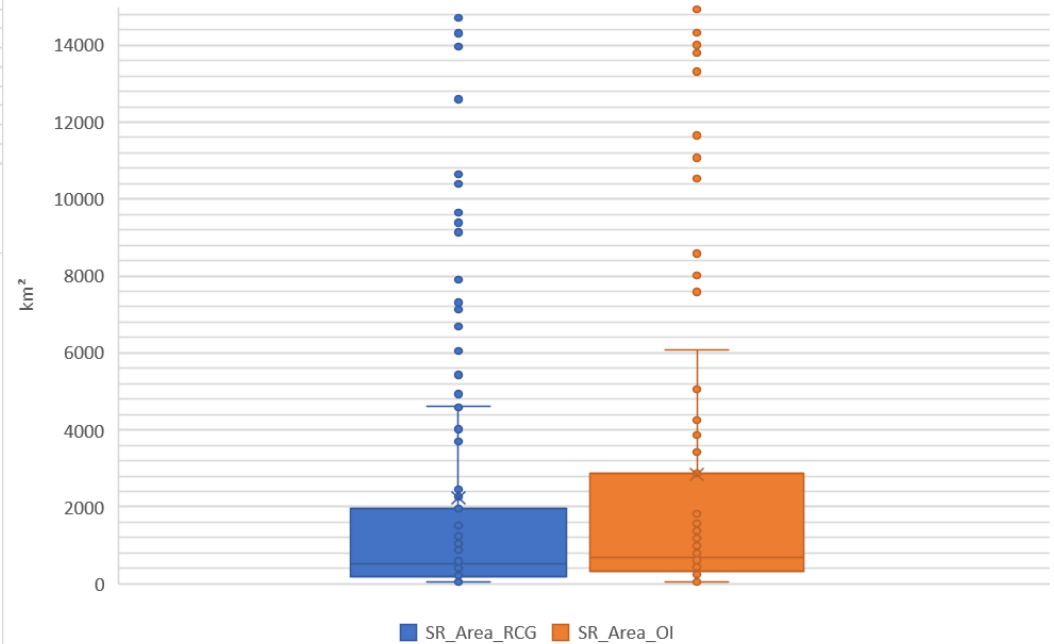
## PM2.5 – statistics

PM2.5: representative areas per station: *rural background*

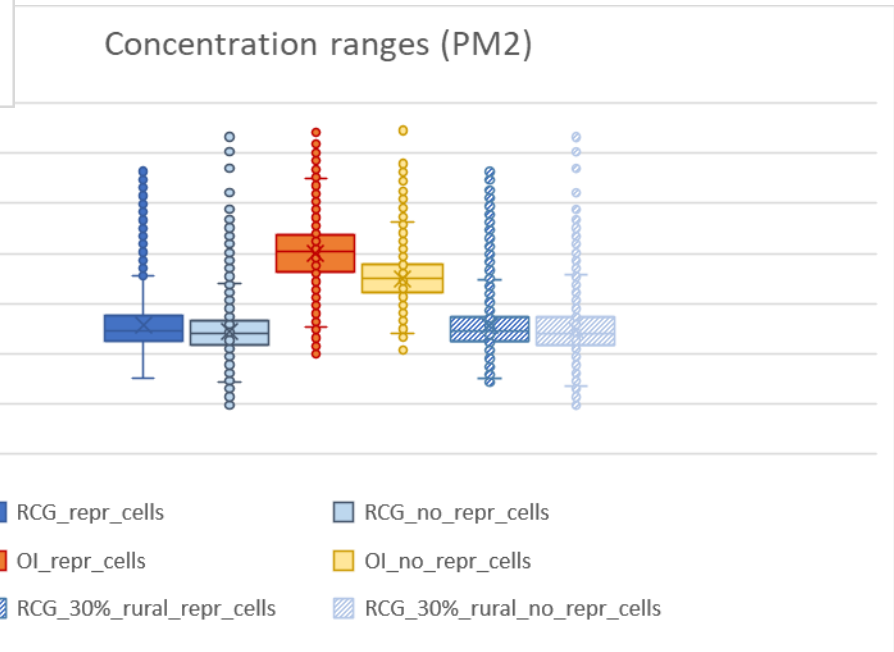
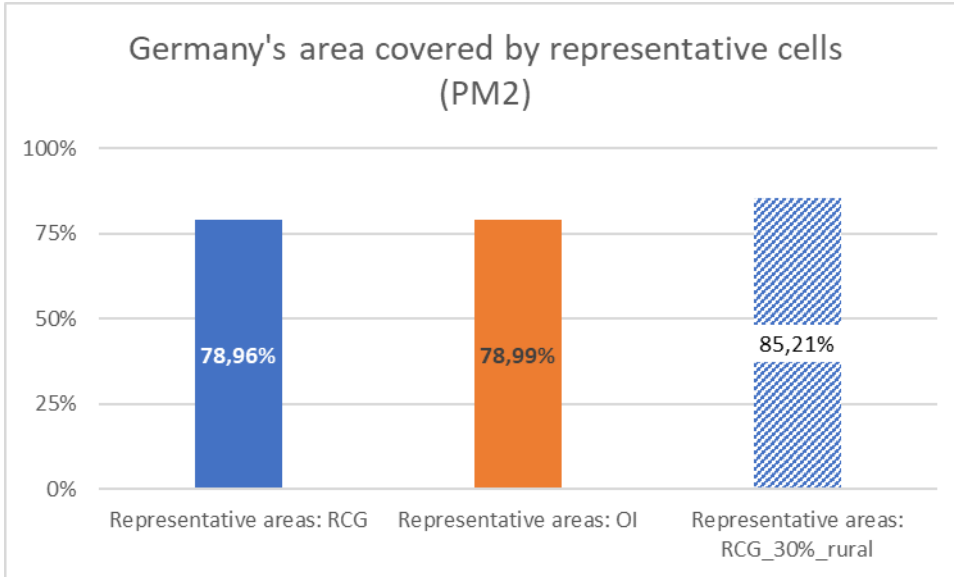


at station level

PM2.5: representative areas per station: *urban background*



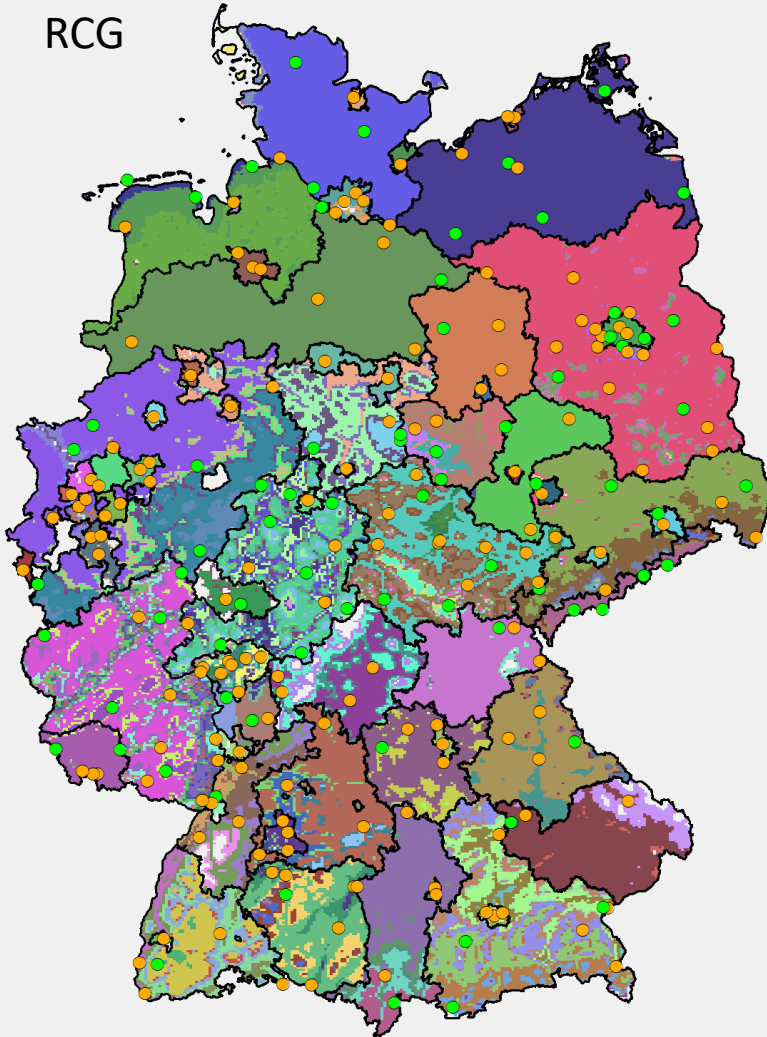
## PM2.5 – statistics



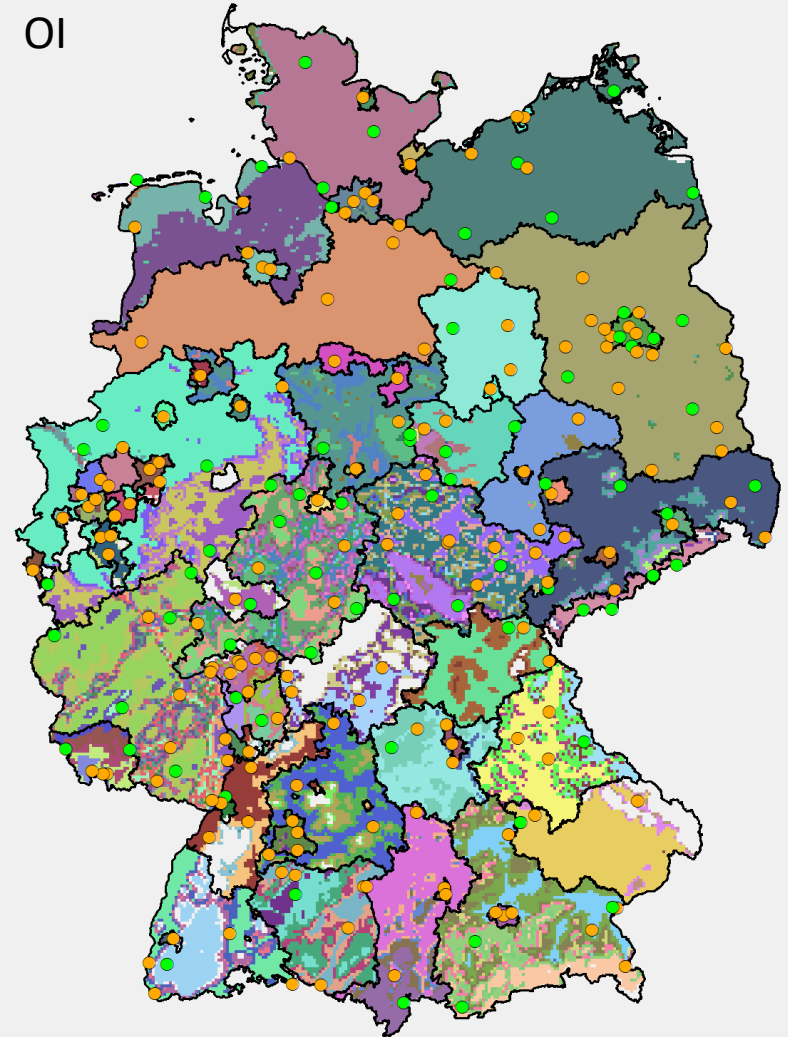
# O3 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



O1

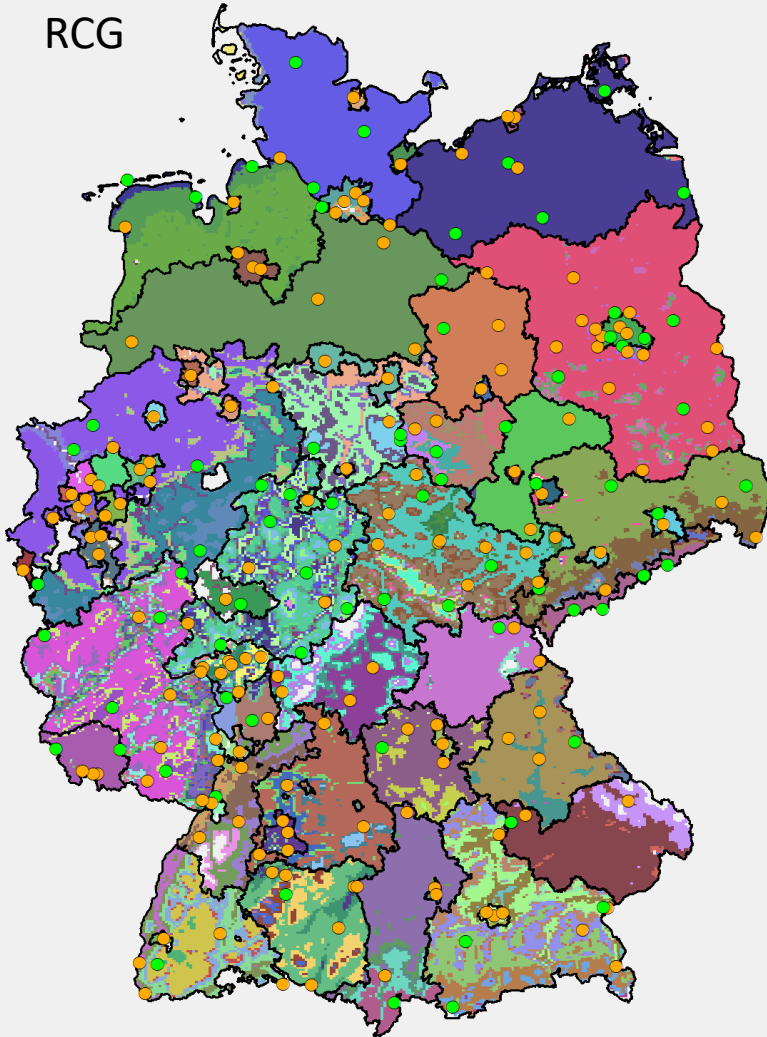




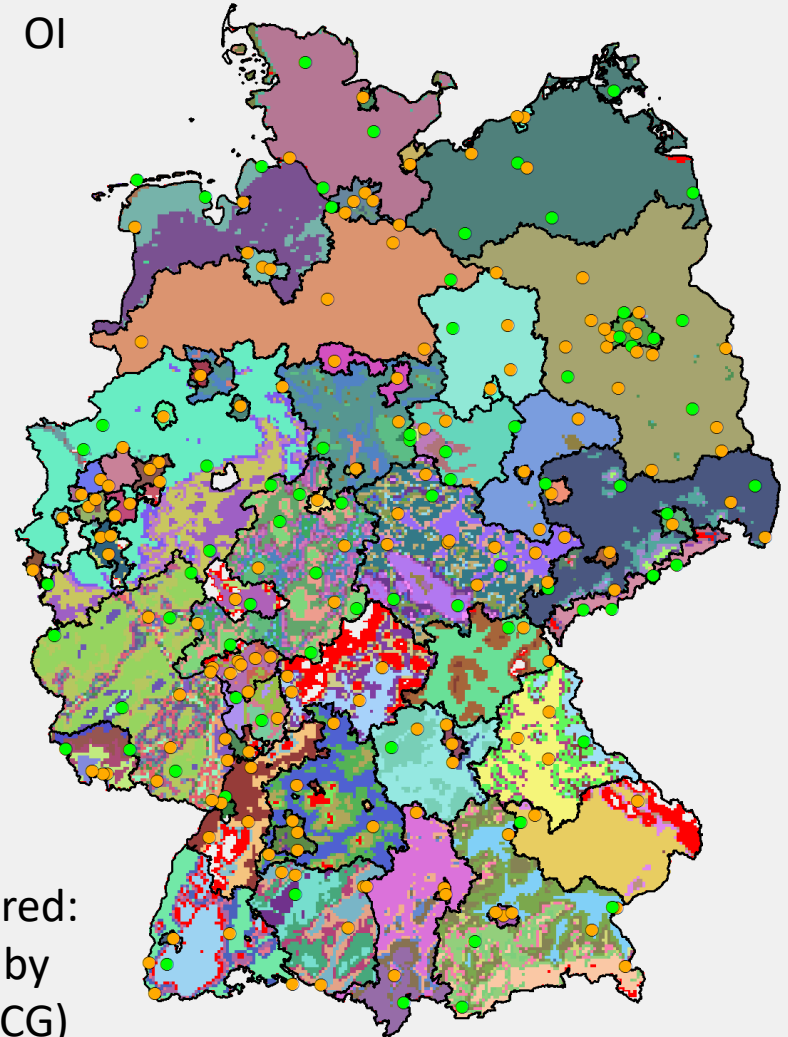
### O3 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



O1

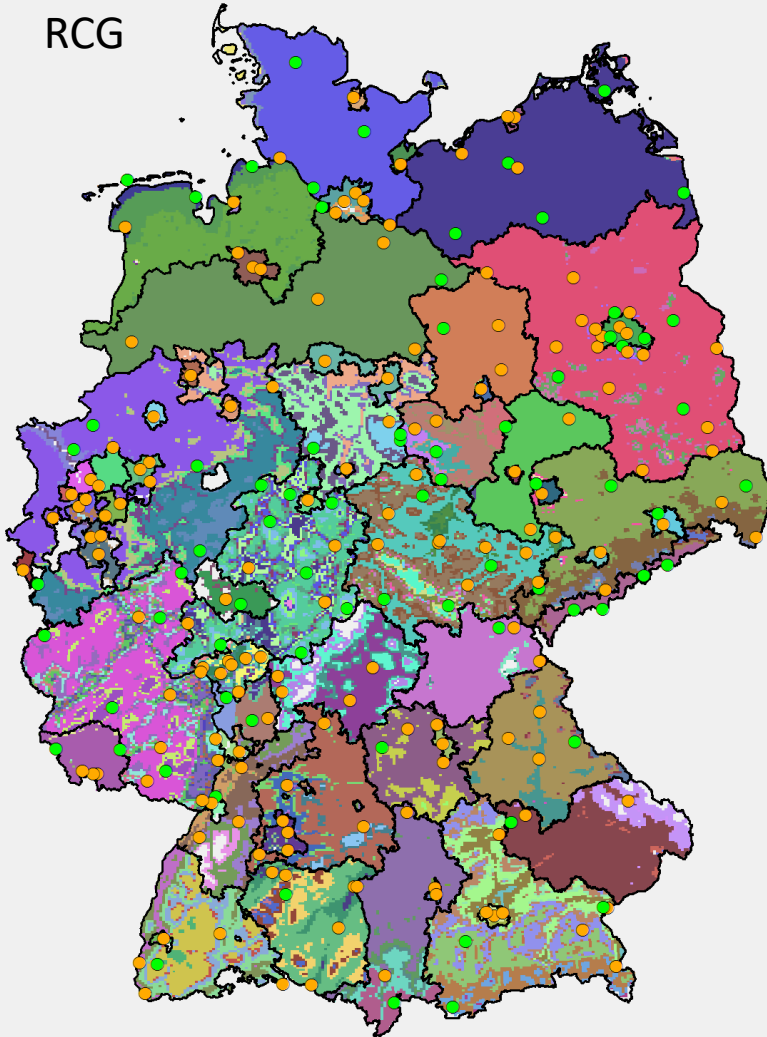


Difference in red:  
cells covered by  
raw model (RCG)

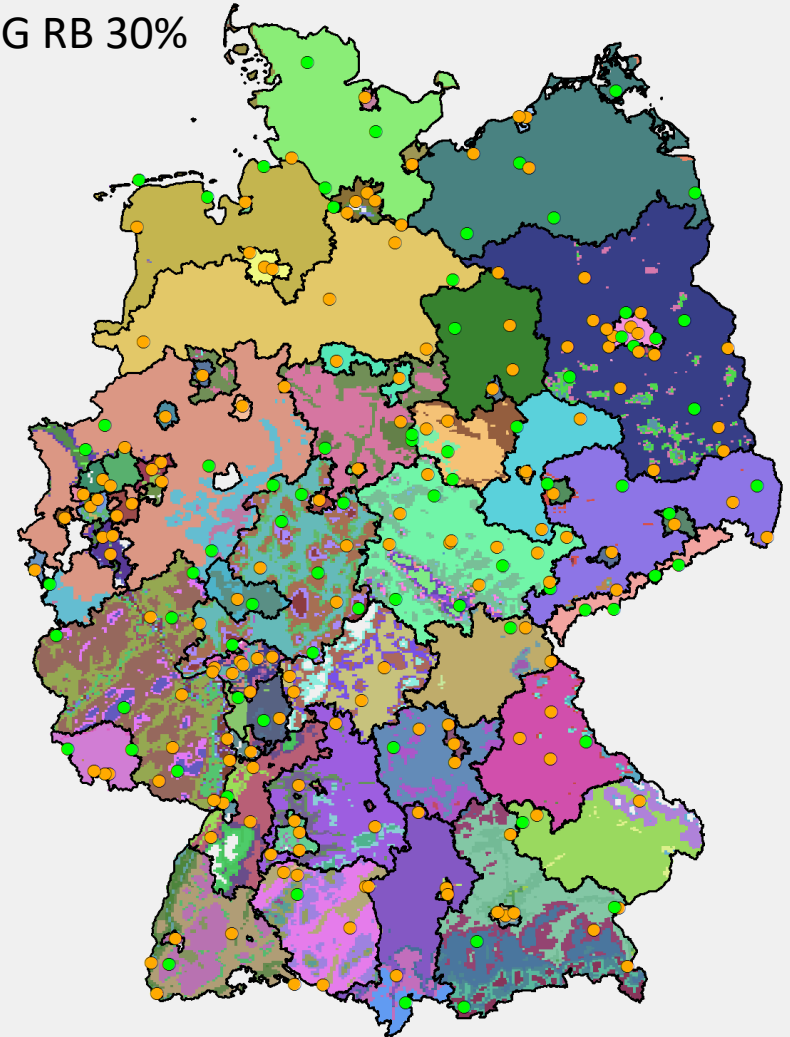
### O3 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



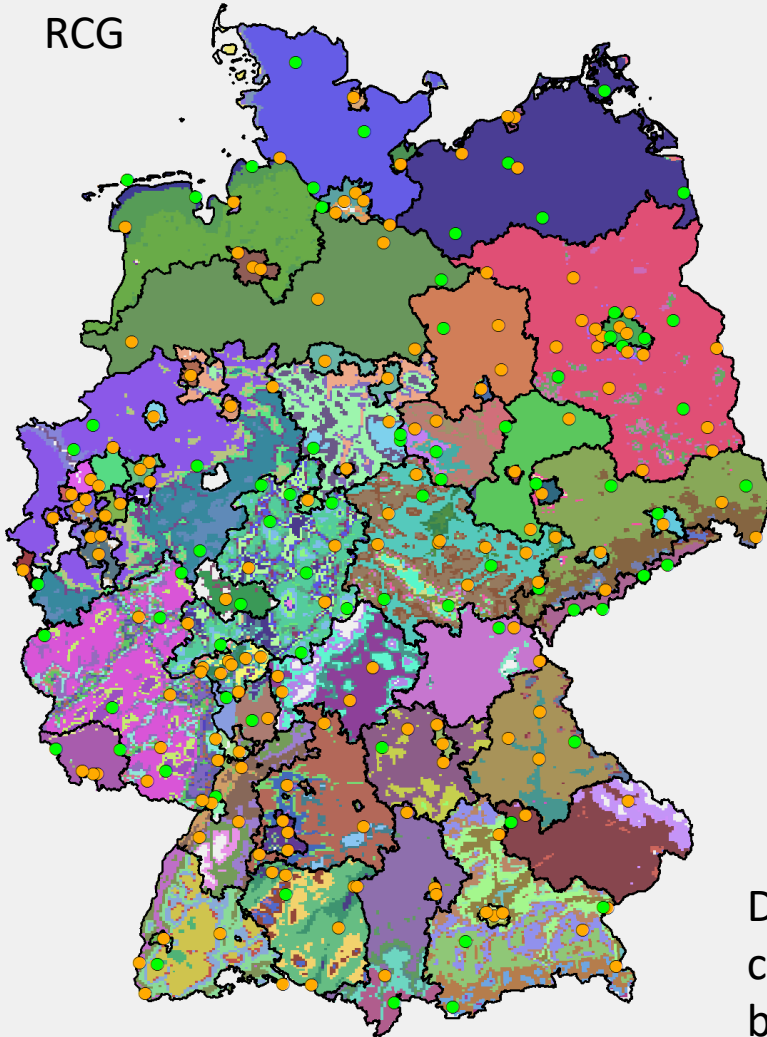
RCG RB 30%



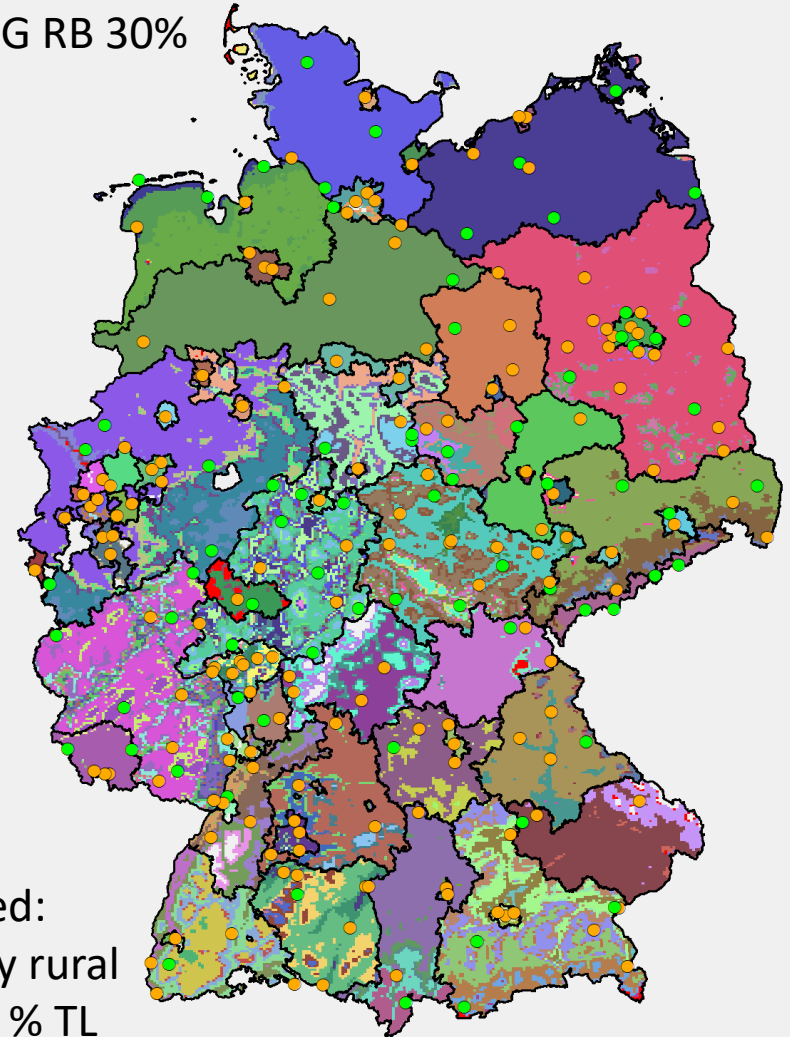
### O3 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



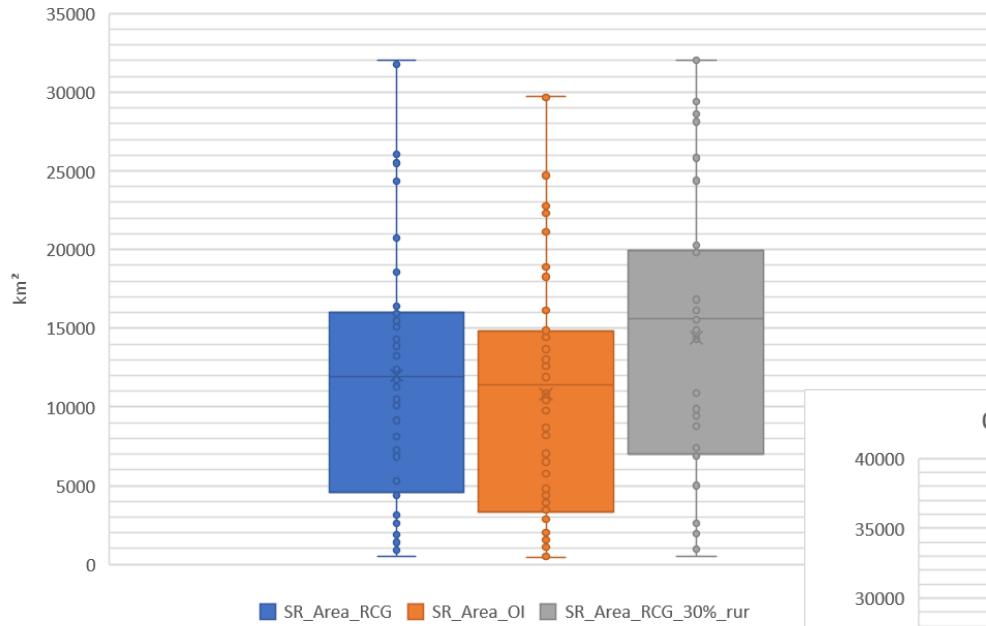
RCG RB 30%



Difference in red:  
cells covered by rural  
background 30 % TL

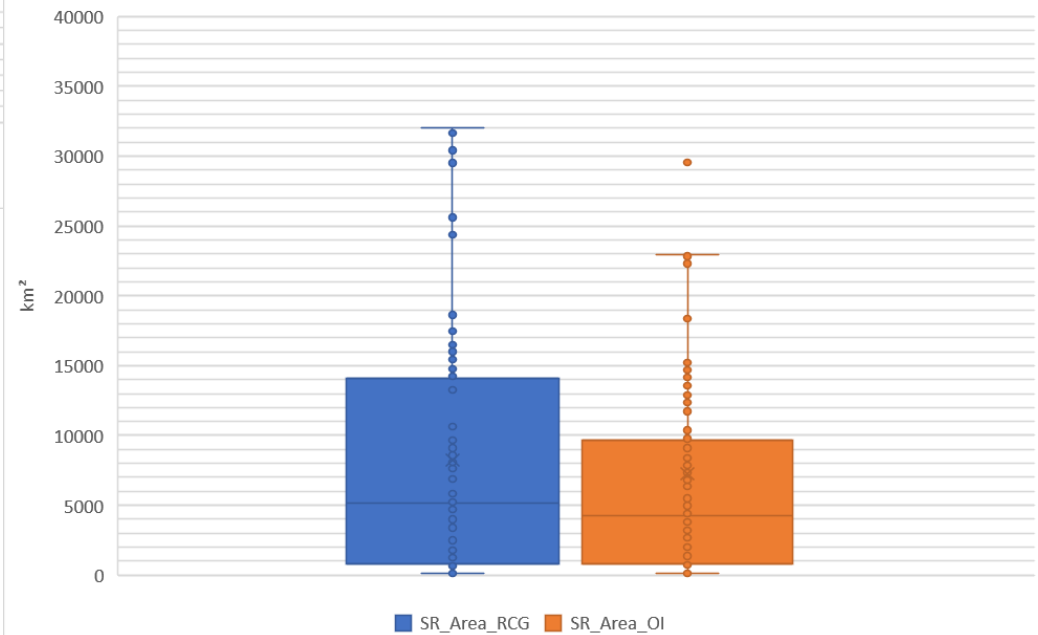
### O3 – statistics

O3: representative areas per station: *rural background*

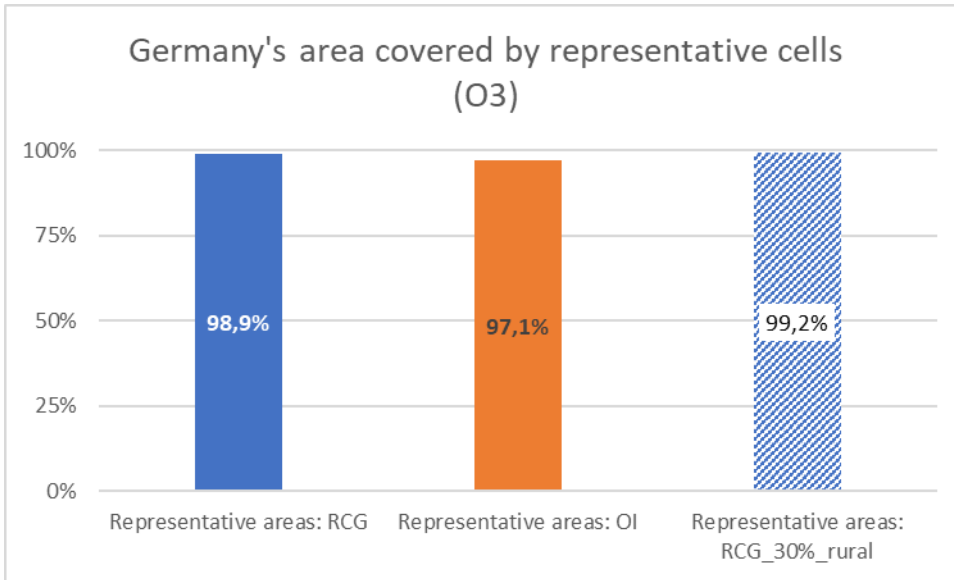


at station level

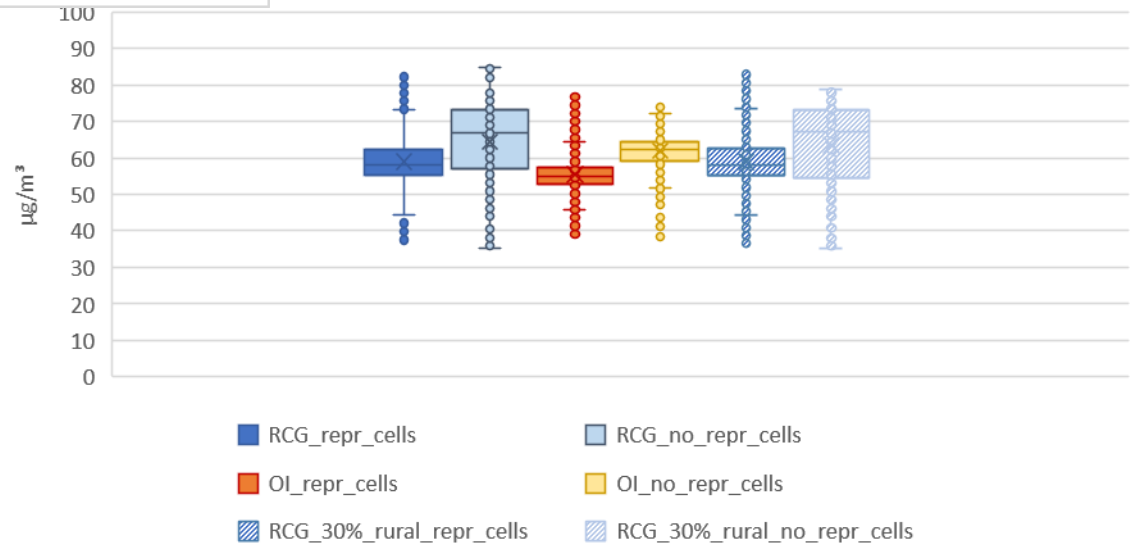
O3: representative areas per station: *urban background*



## O3 – statistics



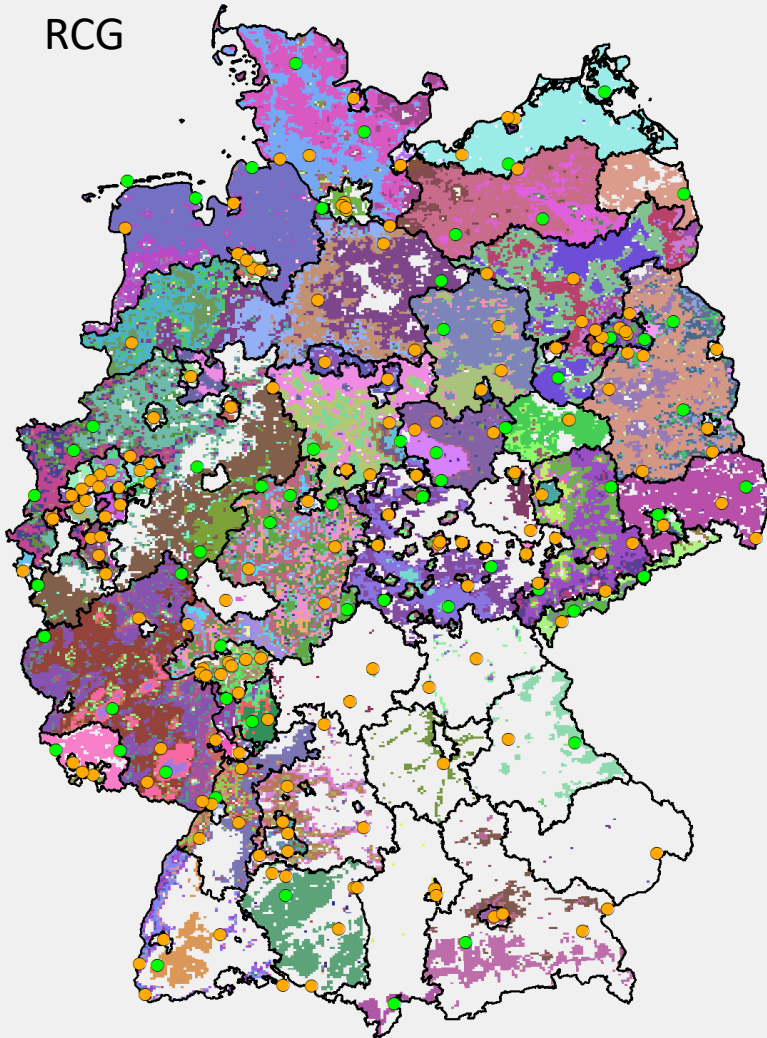
Concentration ranges (O3)



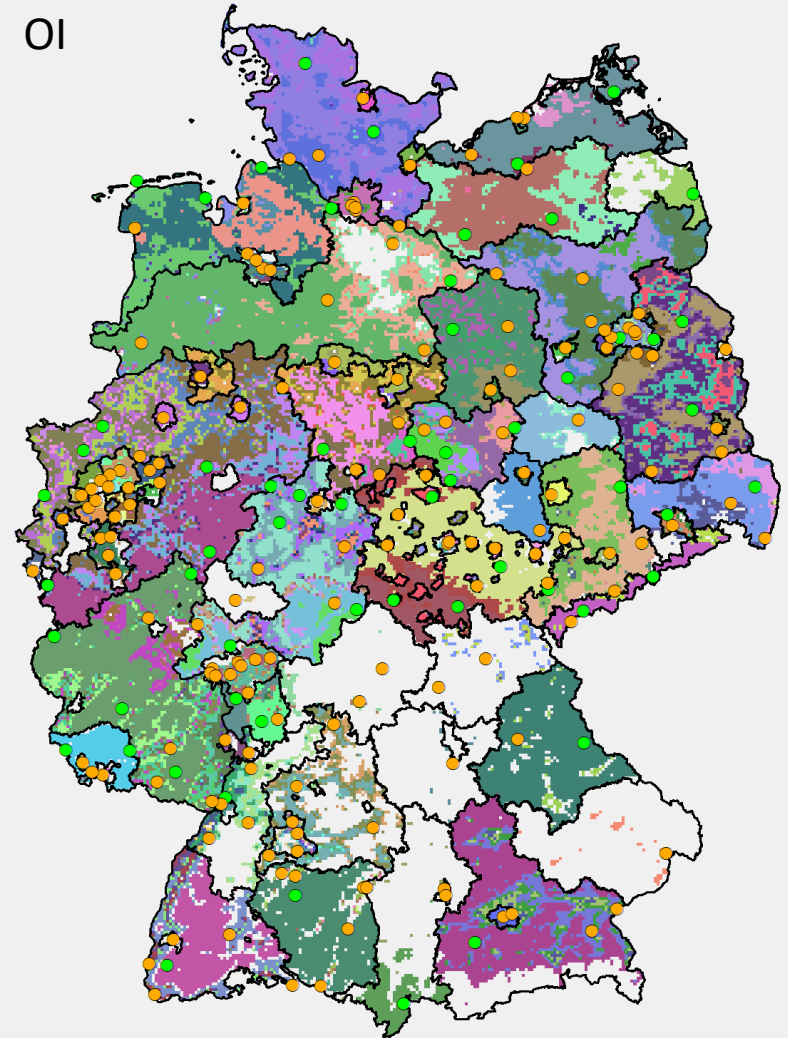
# PM10 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



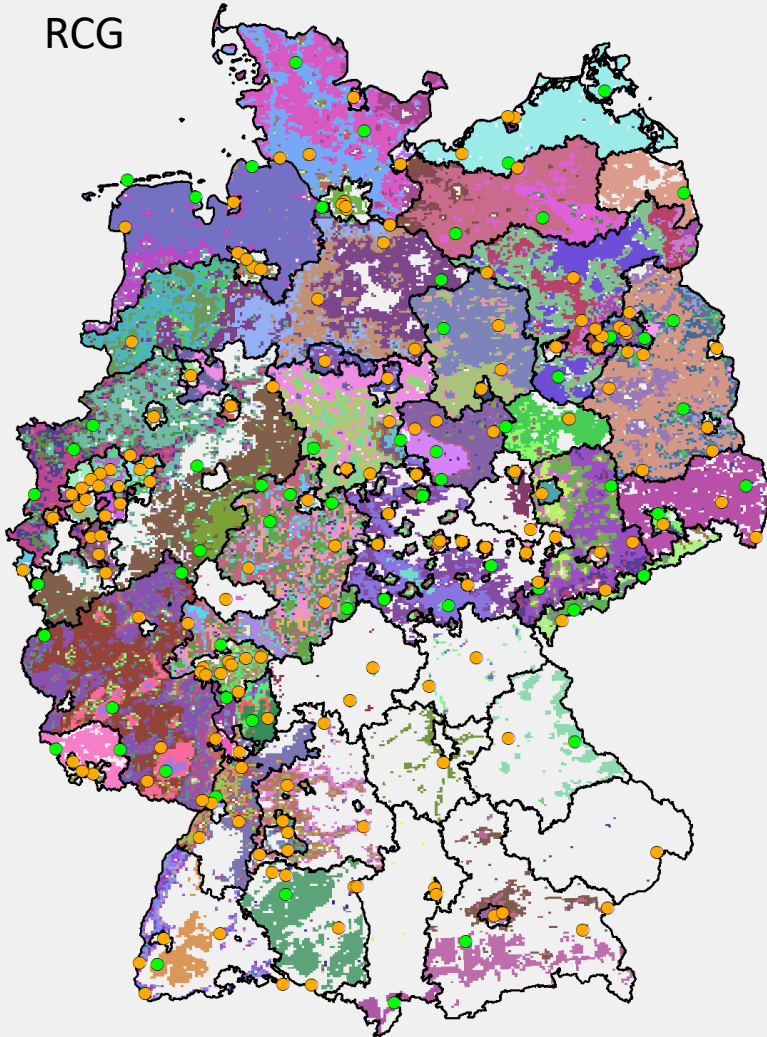
OI



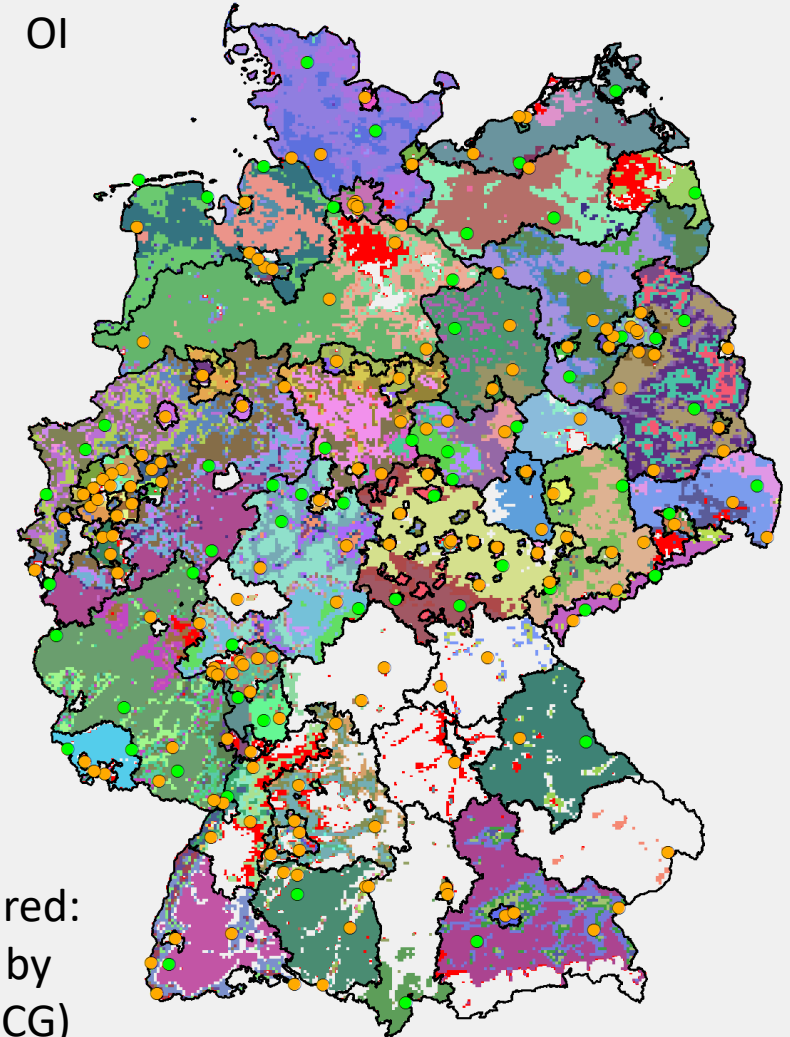
# PM10 – tolerance level 15 %

- rural background
- urban background
- suburban background

RCG



OI

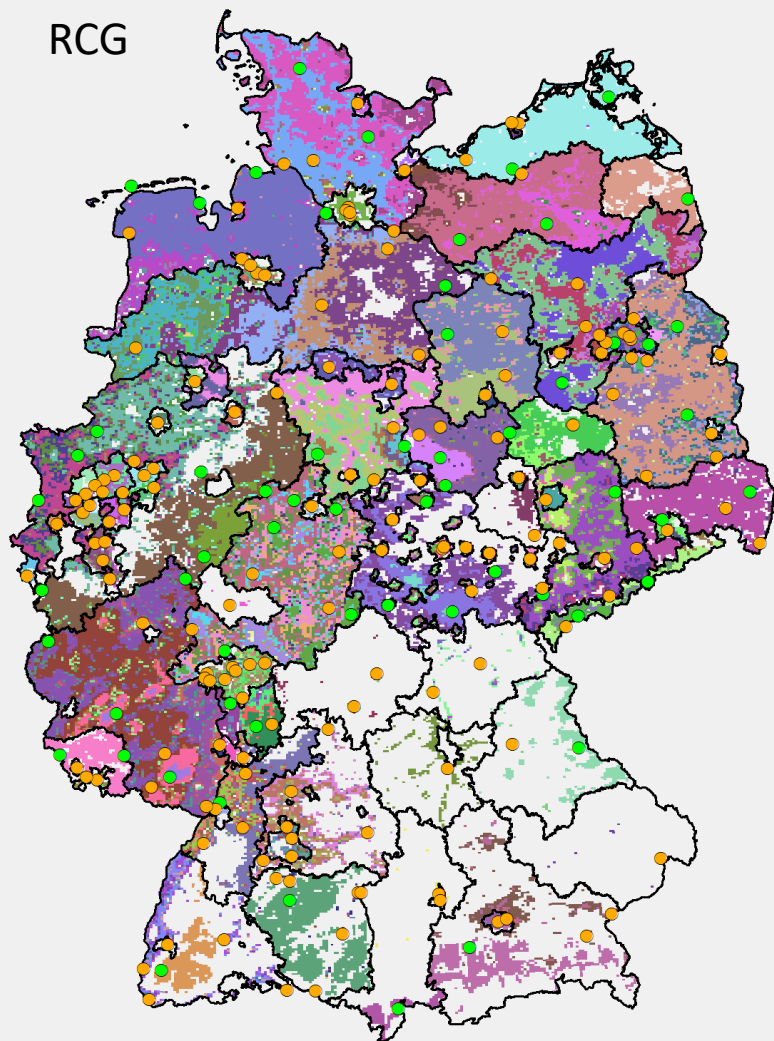


Difference in red:  
cells covered by  
raw model (RCG)

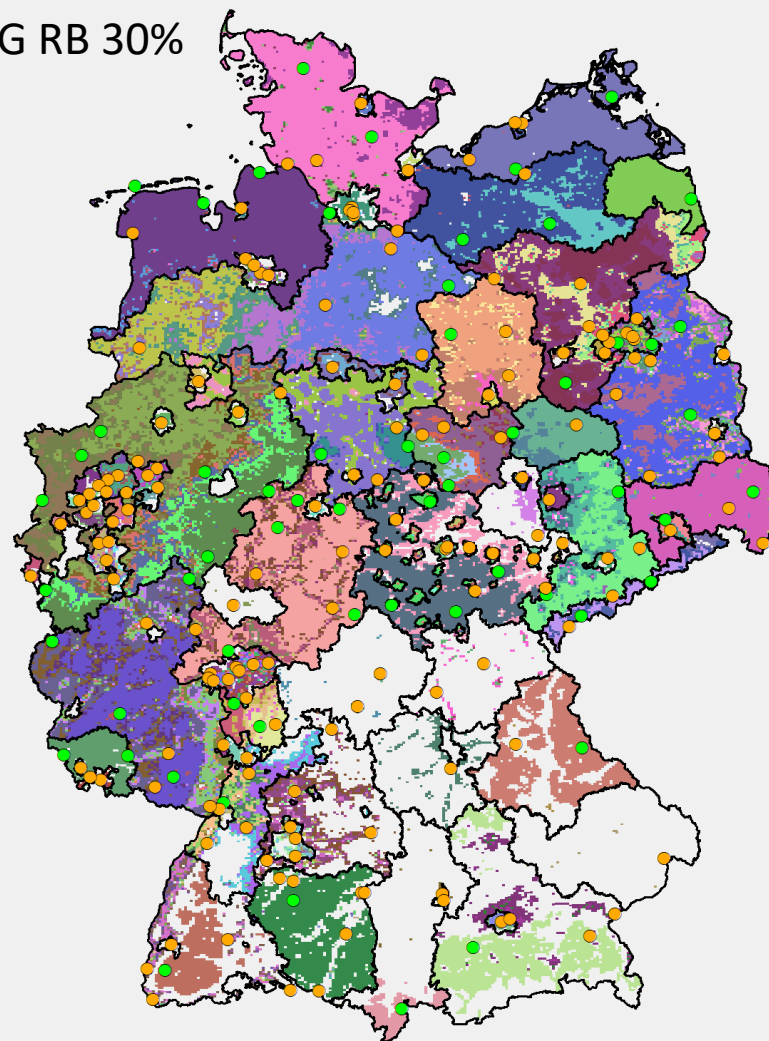
# PM10 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



RCG RB 30%

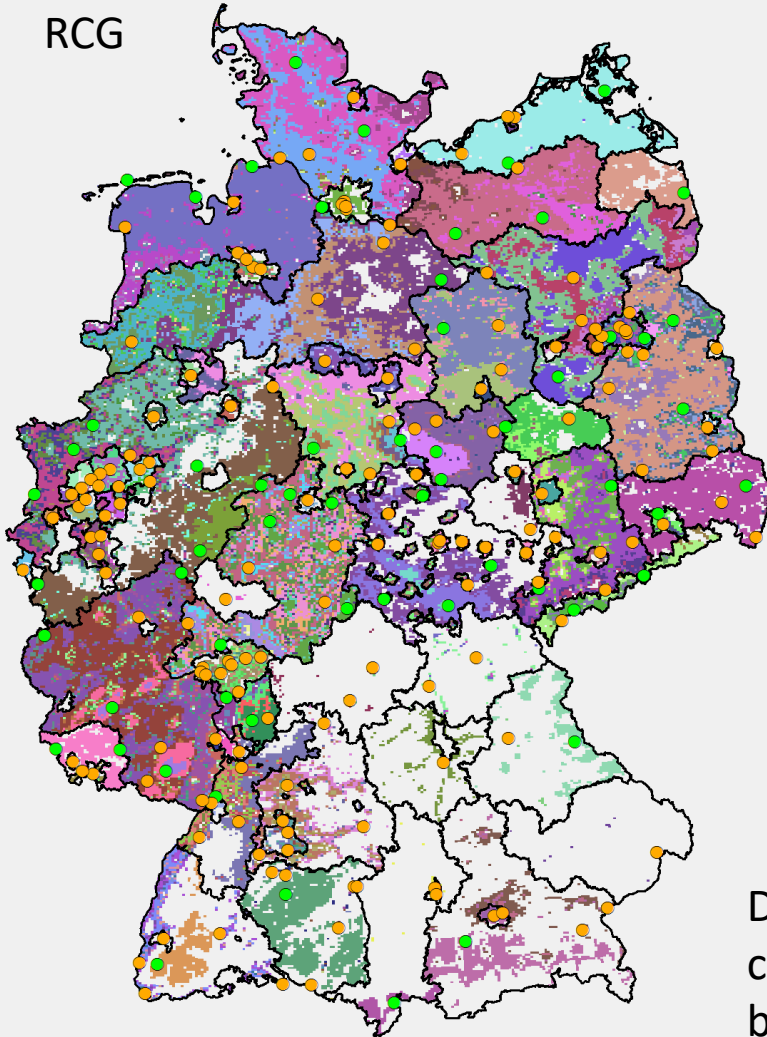




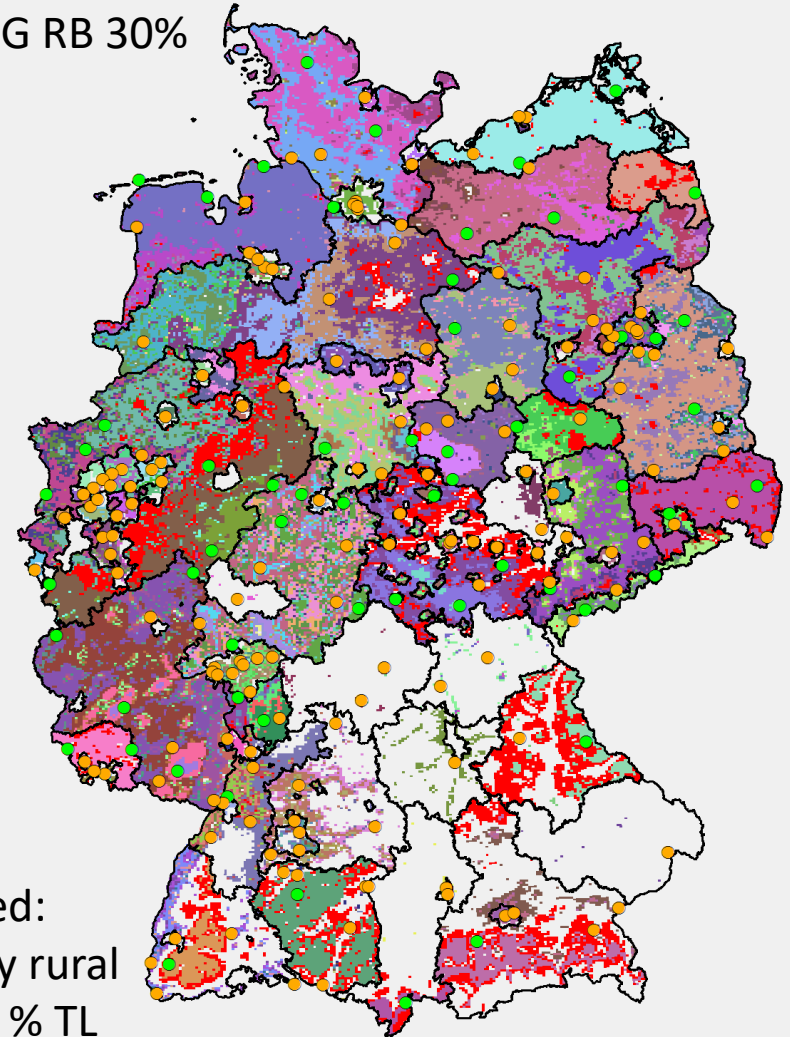
# PM10 – tolerance level 15 % - rural 30 %

- rural background
- urban background
- suburban background

RCG



RCG RB 30%



Difference in red:  
cells covered by rural  
background 30 % TL

## Conclusions

- FAIRMODE approach could be used to derive the spatial representativeness for urban and rural areas

### NO<sub>2</sub>:

- (raw) model is more suitable to cover rural concentrations
- better coverage of urban areas using data fusion dataset
- 30 % tolerance level for rural background

### O<sub>3</sub>:

- Nearly 100 % coverage
- Model and data fusion datasets show similar results

## Conclusions

### PM2.5:

- Model and data fusion datasets show similar results
- 30 % tolerance level for rural background
  
- 15 % tolerance level in agglomeration leads to an „over-representation“ → many urban background stations are representative for the whole urban area → extra run with 10 % for urban stations

## Histogramms of raw model (RCG)

