Für Mensch & Umwelt

Umwelt Bundesamt

FAIRMODE WG8

Spatial representativeness – Test Germany

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Unit: air quality assessment

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Setting

- Year: 2022
- Pollutants: NO2, PM10, PM2.5, O3, SO2 → annual mean
- Type of model: CTM (RCG) and CTM + data fusion (OI)
- Model scale: 2x2 km² (up to urban background levels, no street canyon)
- Background stations (rural, urban), air quality zones 2022

General remarks

- Clear definition what is meant by “lower cut-off (LCO)” e. g. **minimum width of tolerance interval (ΔC)** around the concentration value at the station location (C) with C± 0.5ΔC

- Don’t try to increase tolerance level and lower cut-off to cover the whole zone! ➔ Analyse the gaps
  - AQ zone classification
  - AQ network

- Exclude (uncovered) low concentration values below AT? → revised AQD Annex IV B 2:

(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;

General remarks

ANNEX II

ASSESSMENT THRESHOLDS

SECTION 1 - ASSESSMENT THRESHOLDS FOR HEALTH PROTECTION

Pollutant	Assessment threshold (annual mean, unless specified)
$PM_{2.5}$	5 µg/m^3
PM_{10}	15 µg/m^3
Nitrogen dioxide (NO_2)	10 µg/m^3
Sulphur dioxide (SO_2)	40 µg/m^3 (24-hour mean)(1)
Benzene	1,7 µg/m^3
Carbon monoxide (CO)	4 mg/m^3 (24-hour mean)(1)
Lead (Pb)	0,25 µg/m^3
Arsenic (As)	3,0 ng/m^3
Cadmium (Cd)	2,5 ng/m^3
Nickel (Ni)	10 ng/m^3
Benzo(a)pyrene	0,12 ng/m^3
Ozone (O_3)	100 µg/m^3 (maximum 8-hour mean)(1)

(1) 99th percentile (i.e. 3 exceedance days per year).

Setting

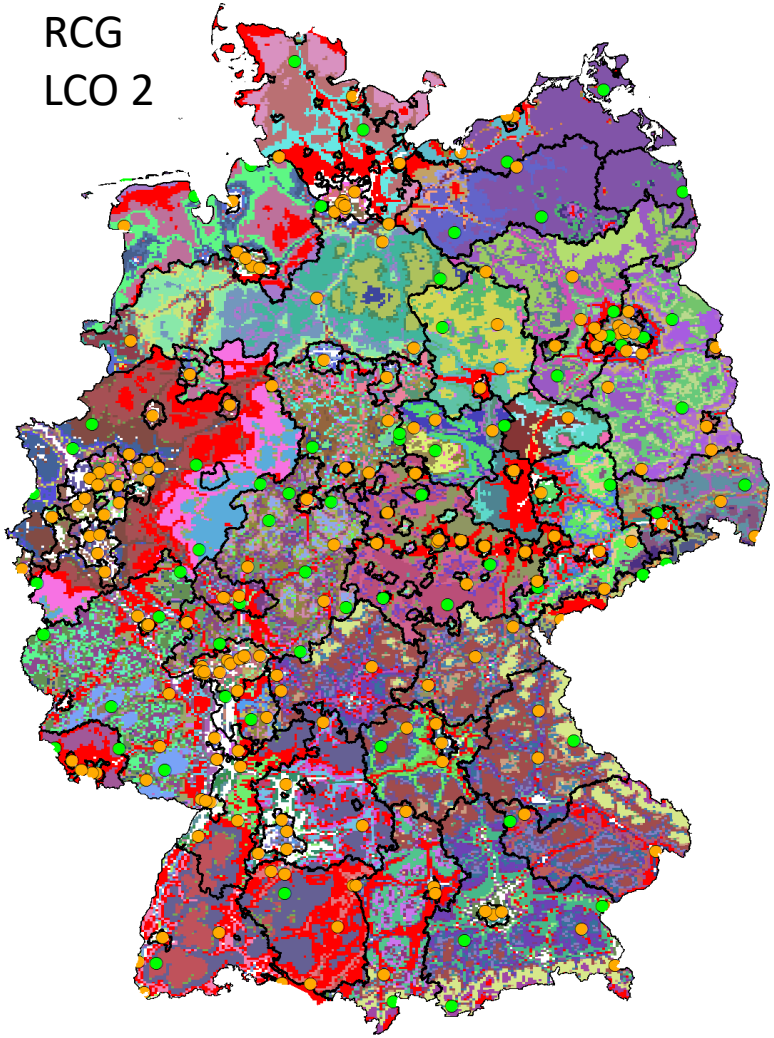
What‘s new:

- Rural background station → SRA on NUTS1 level (no zone limitation)
- Tolerance level 10 %
- Correct interpretation of the lower cut-off (LCO)
- Runs with different lower cut-offs:
  - PM2.5: 1 and 2 µg/m³
  - PM10: 1, 2 and 3 µg/m³
  - NO2: 2 and 4 µg/m³
  - O3: 2, 4 and 6 µg/m³
  - SO2: 2 µg/m³ → negative values (lower threshold)

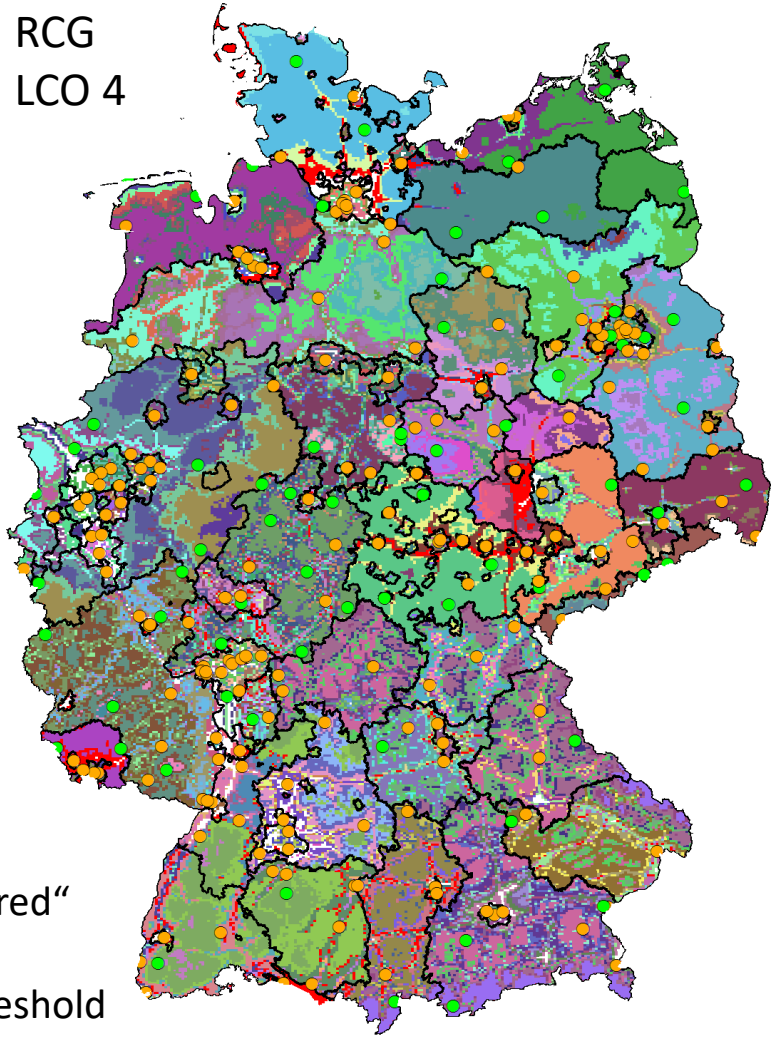
NO2 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2



RCG
LCO 4

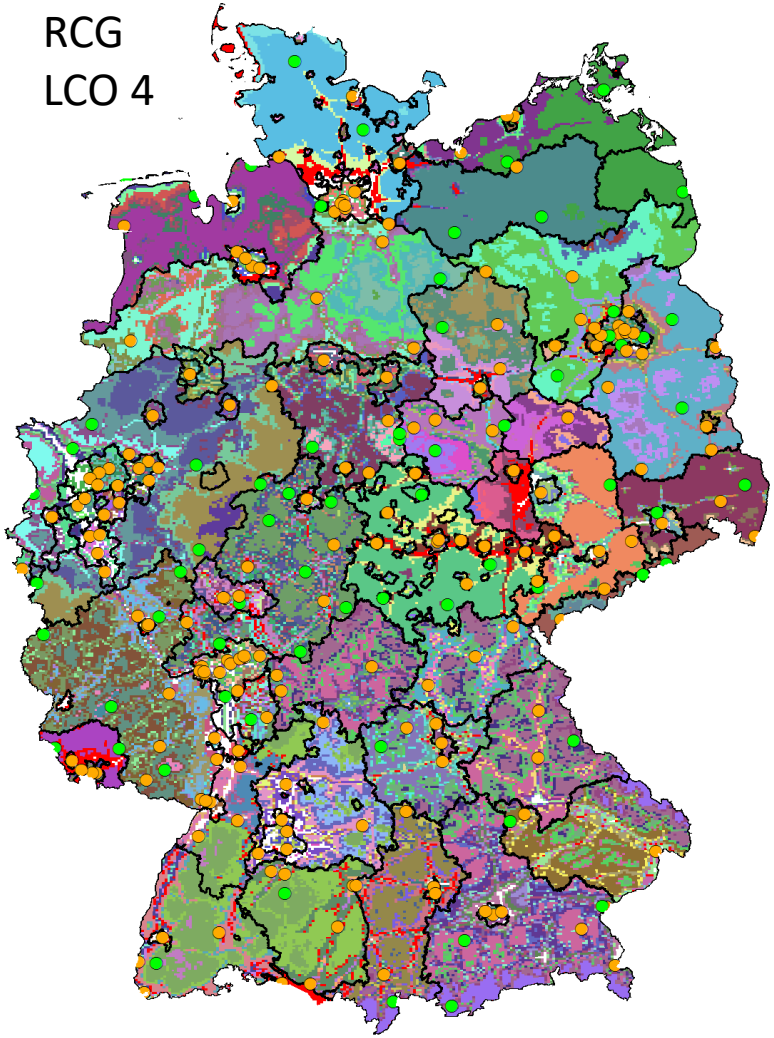


in red: „uncovered“ areas below assessment threshold

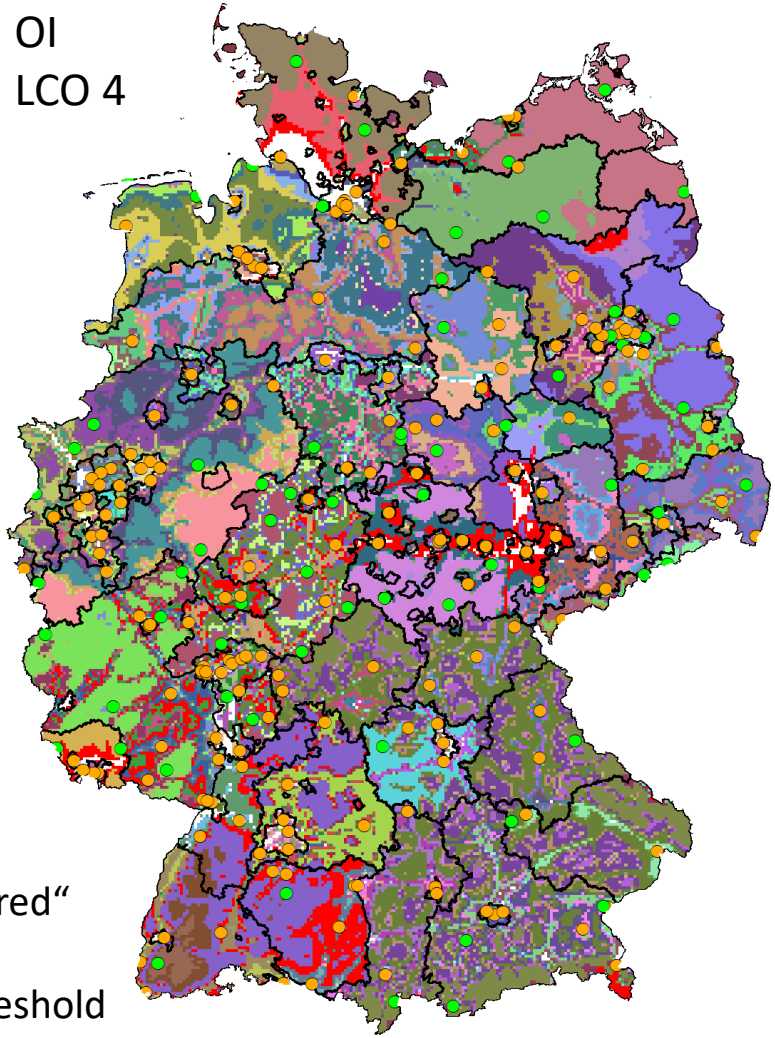
NO2 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 4

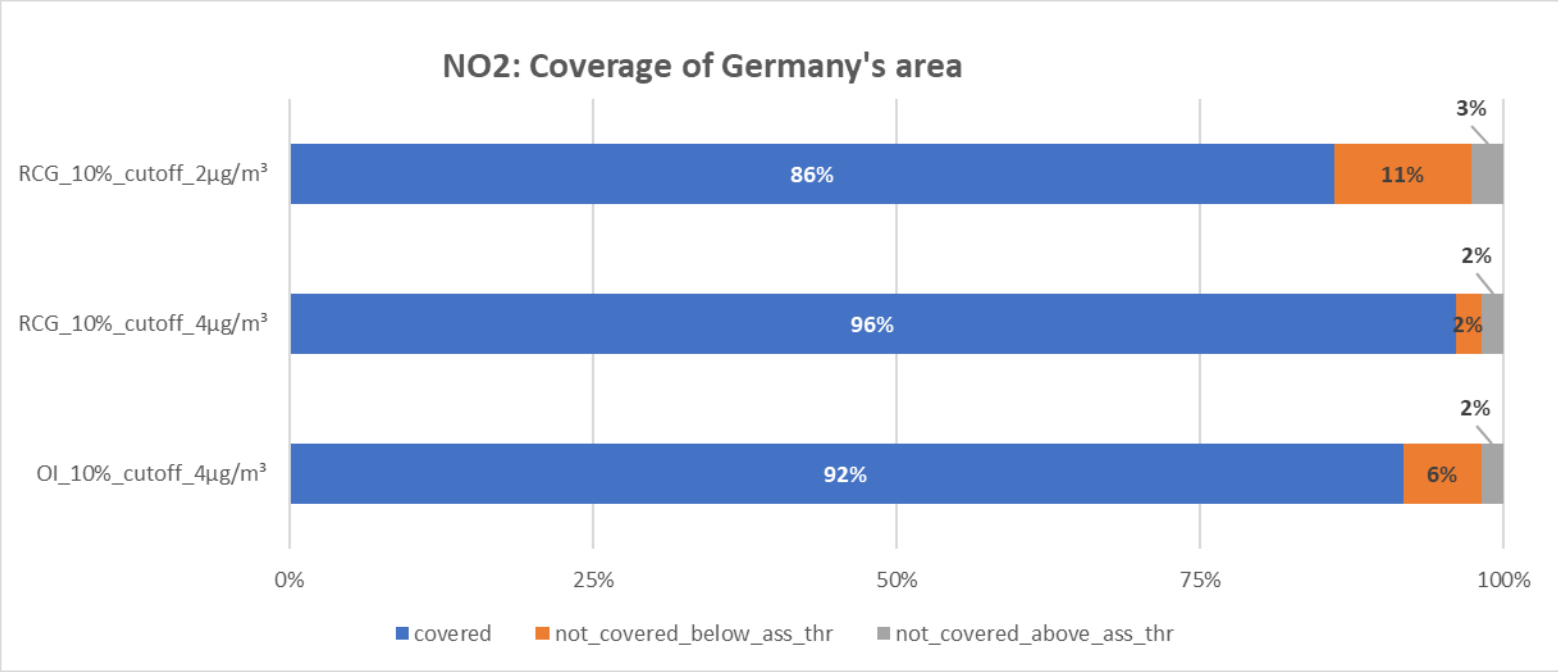


OI
LCO 4



in red: „uncovered“ areas below assessment threshold

NO2 – statistics



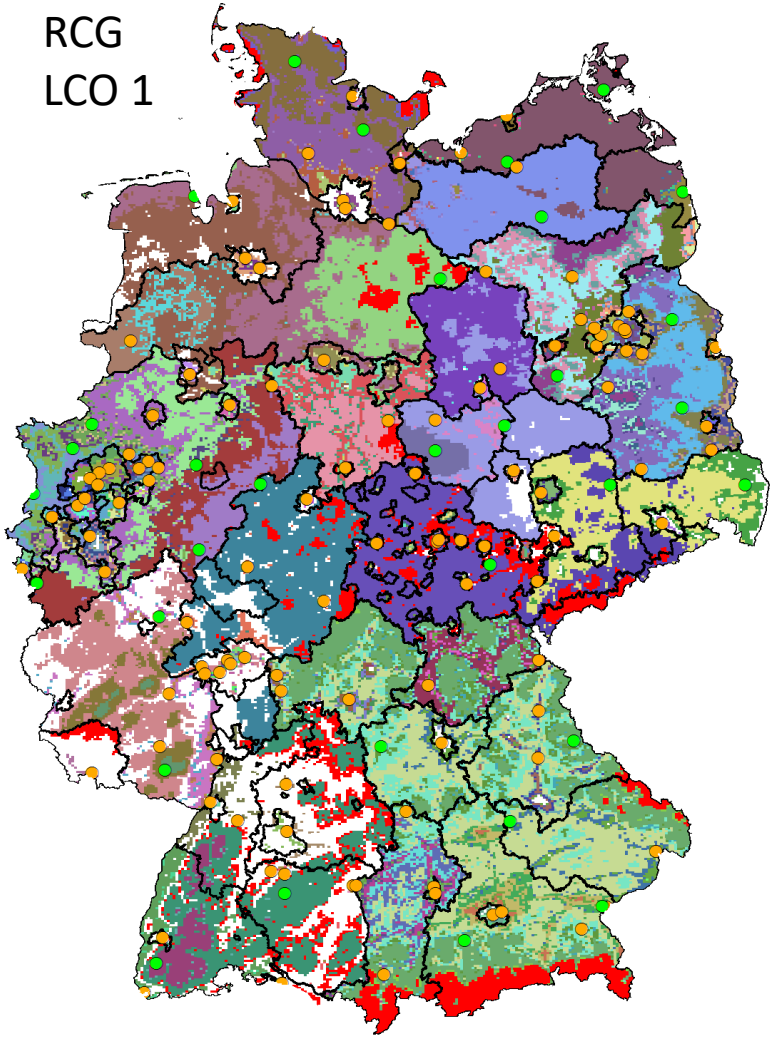
Conclusion:

- „RCG 10 % LCO 2“ covers 86% of the (relevant) areas → our recommendation
- „RCG 10 % LCO 4“ shows only small improvements
- Data fusion shows no further improvements, (but higher concentration levels)

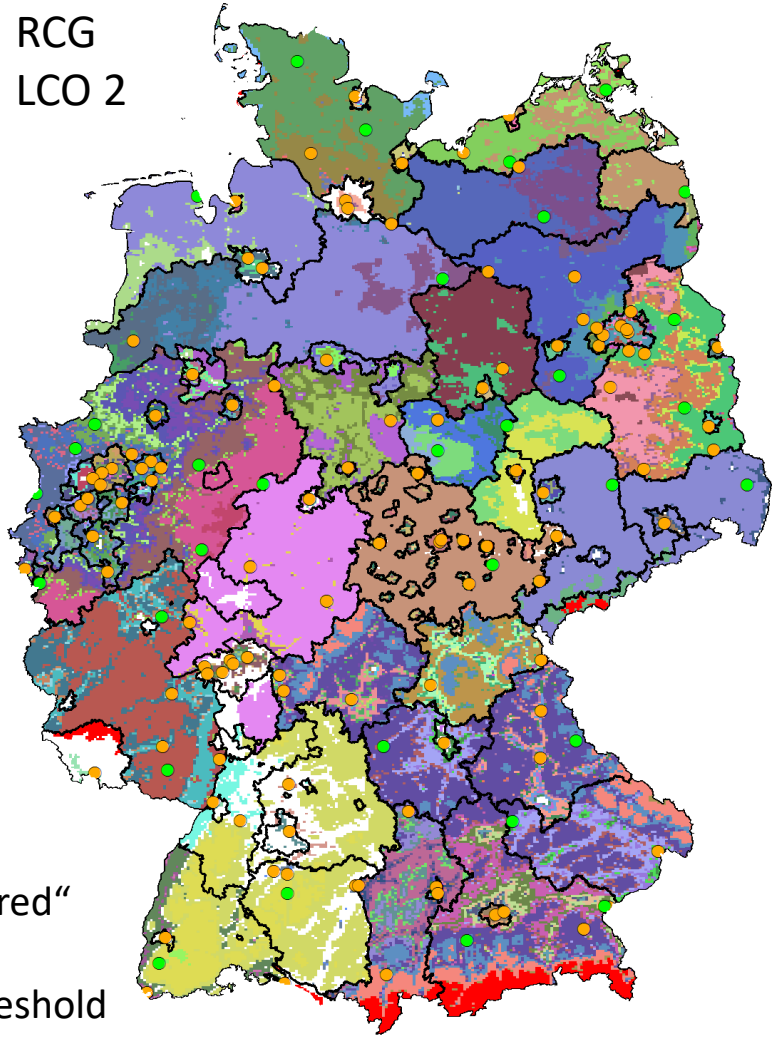
PM2.5 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 1



RCG
LCO 2

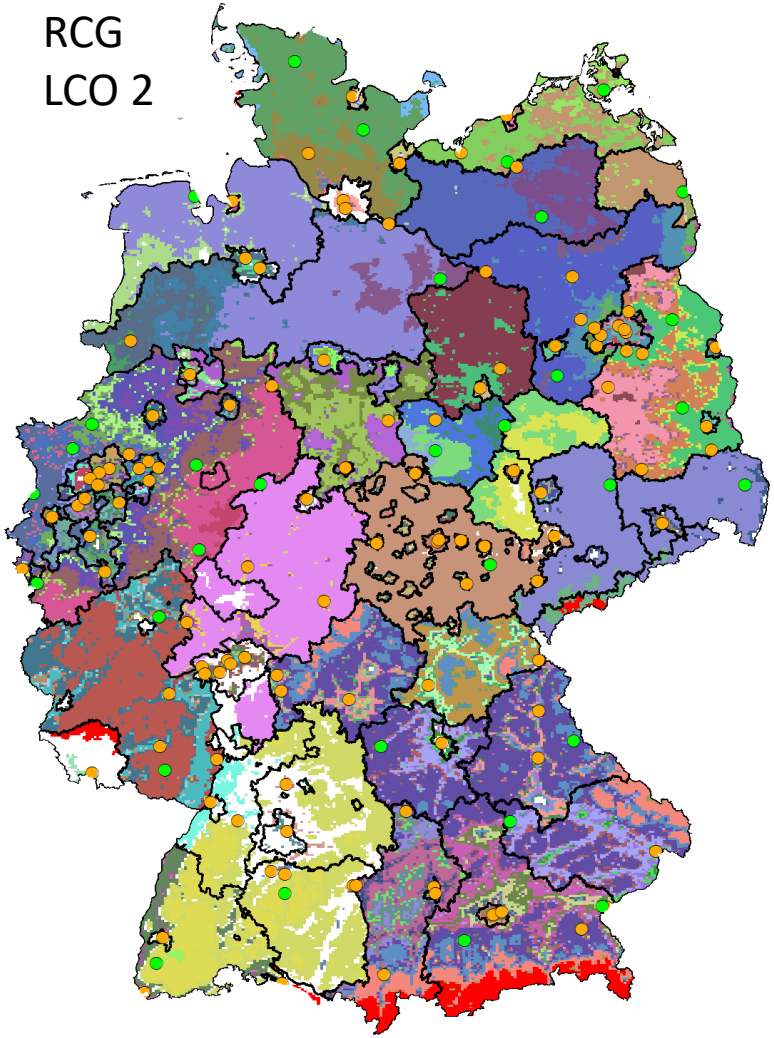


in red: „uncovered“ areas below assessment threshold

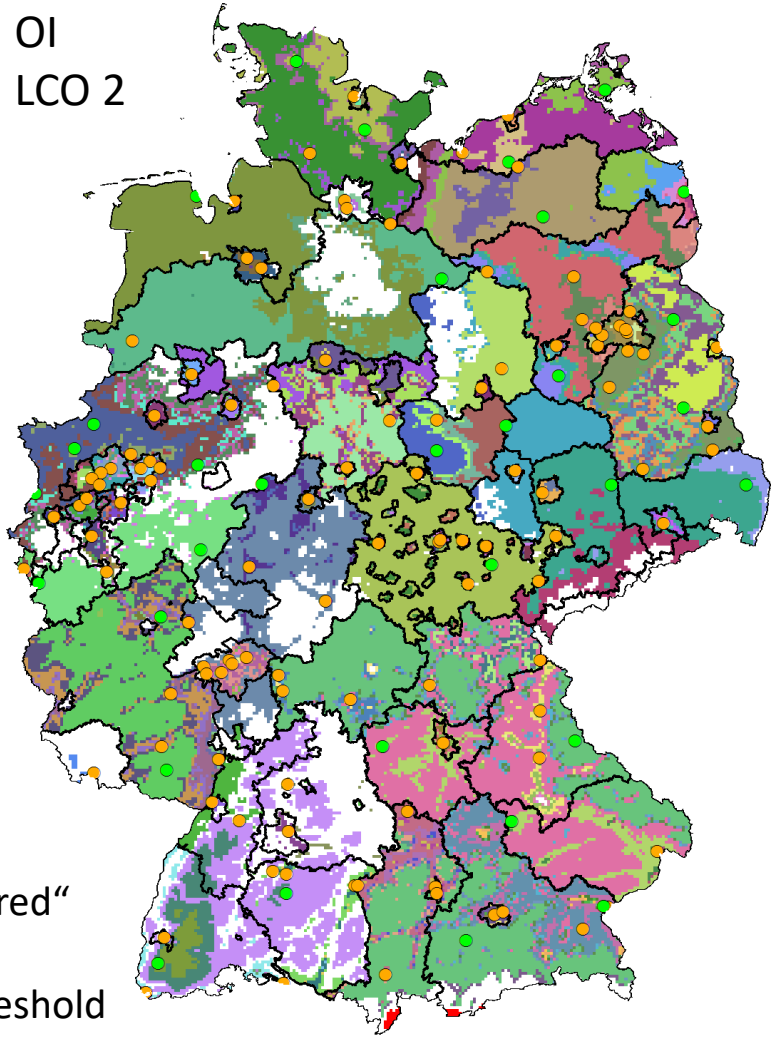
PM2.5 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2

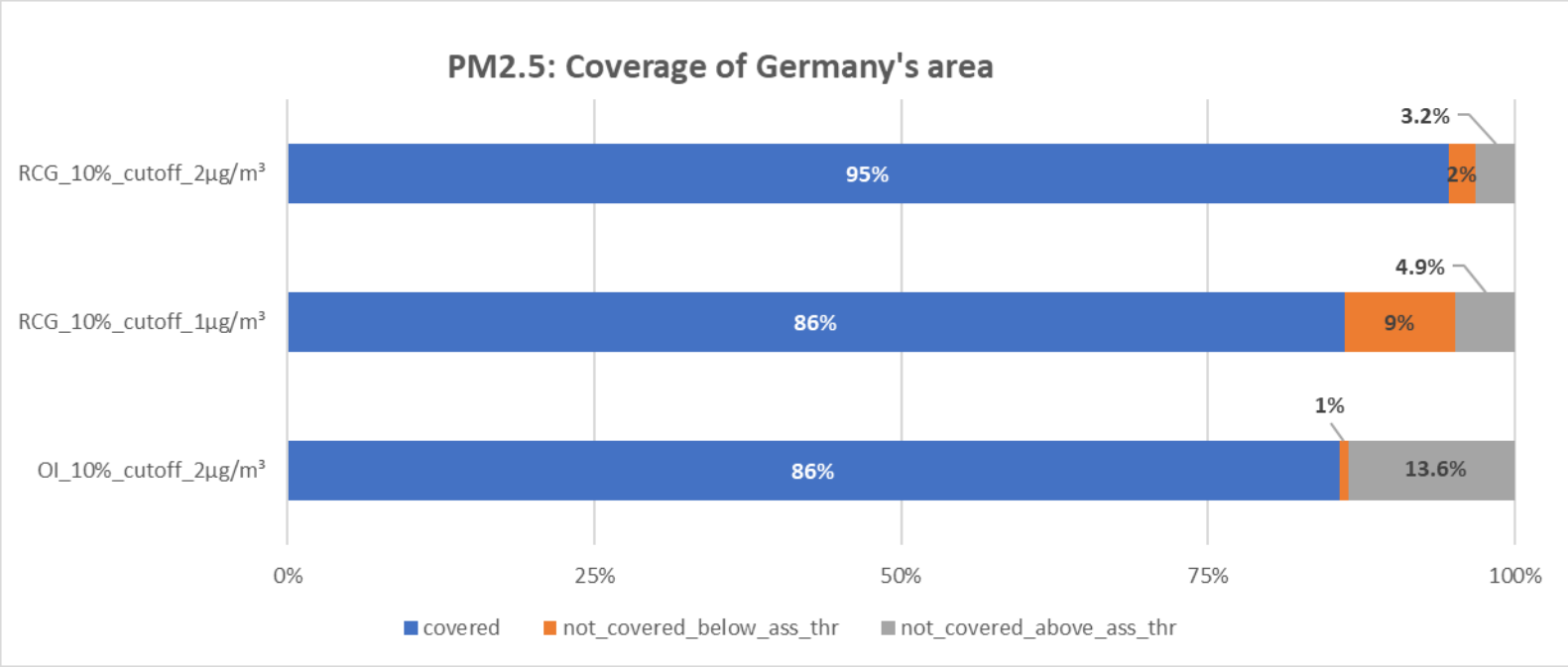


OI
LCO 2



in red: „uncovered“ areas below assessment threshold

PM2.5 – statistics



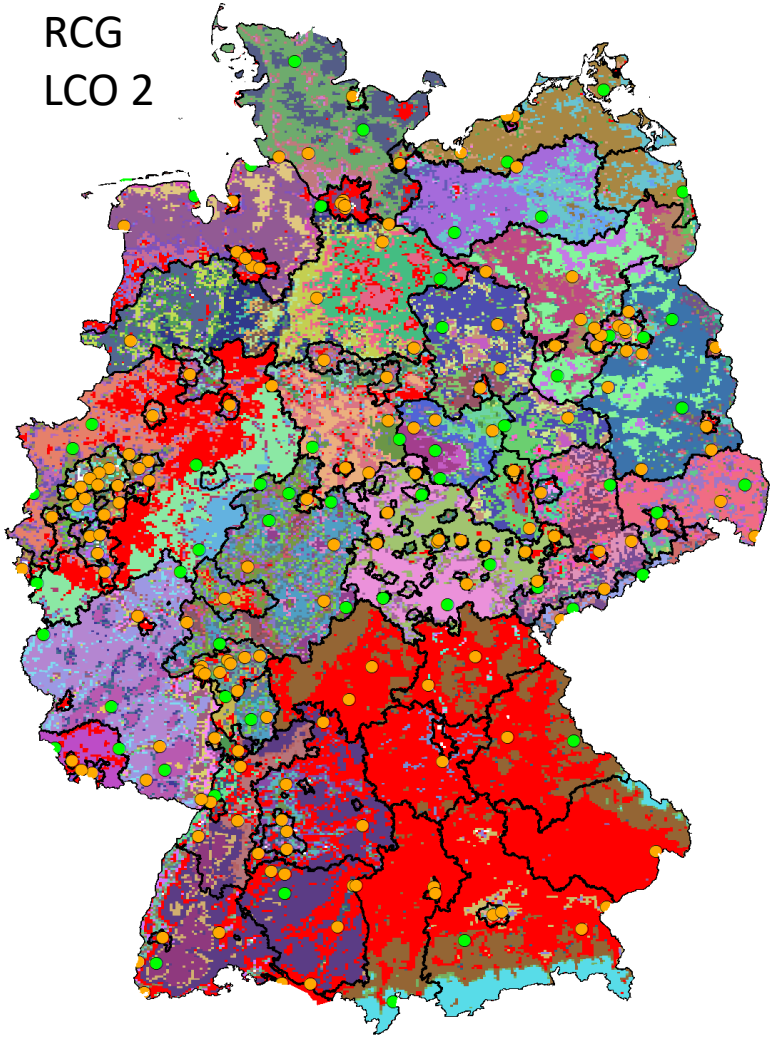
Conclusion:

- „RCG 10 % LCO 1“ doesn’t cover about 5% of relevant areas
- „RCG 10 % LCO 2““ covers 95% of the (relevant) areas → our recommendation
- Data fusion shows no advantage → increased uncovered areas due to higher concentration values

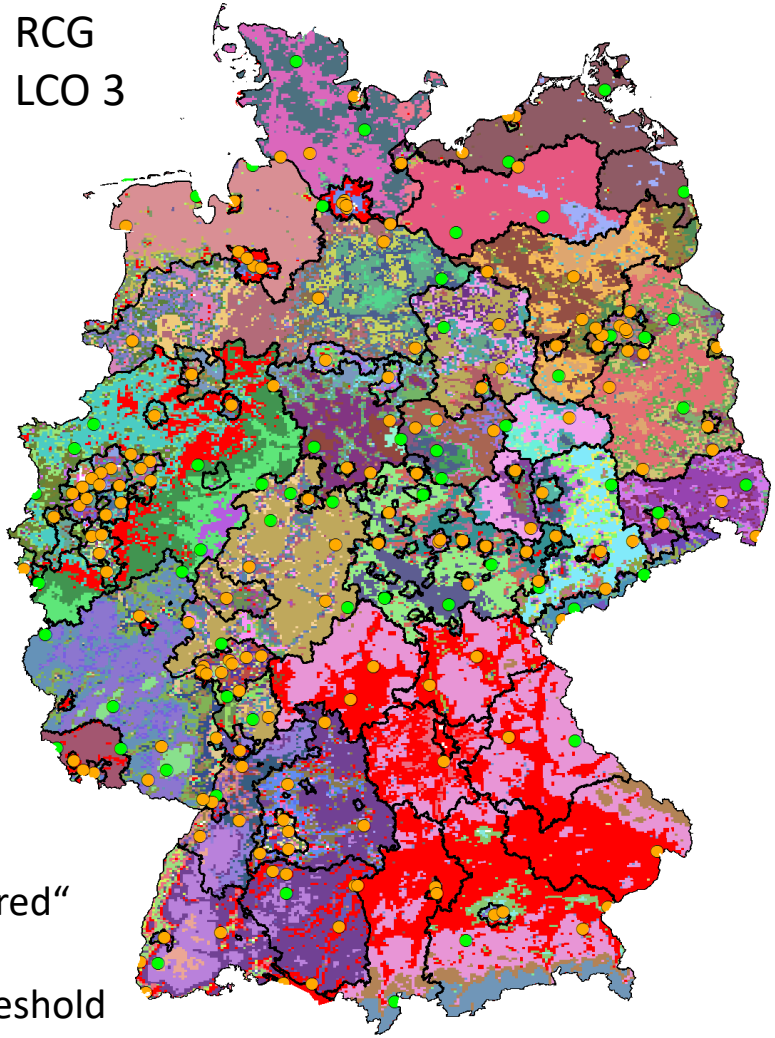
PM10 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2



RCG
LCO 3

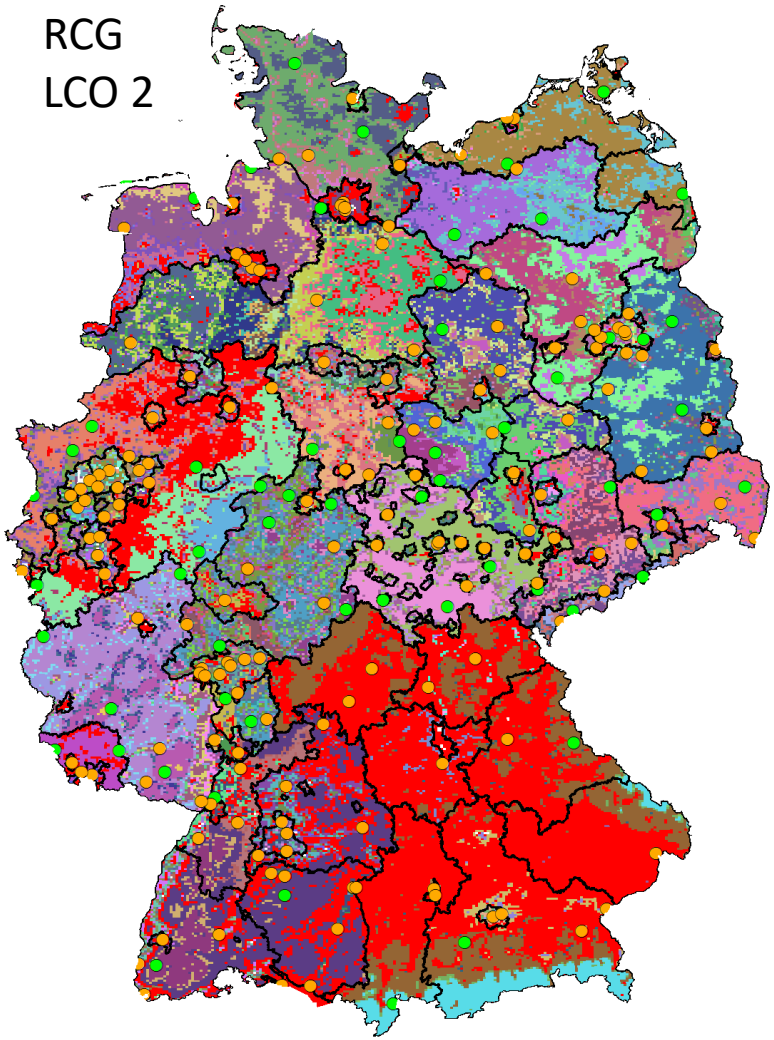


in red: „uncovered“
areas below
assessment threshold

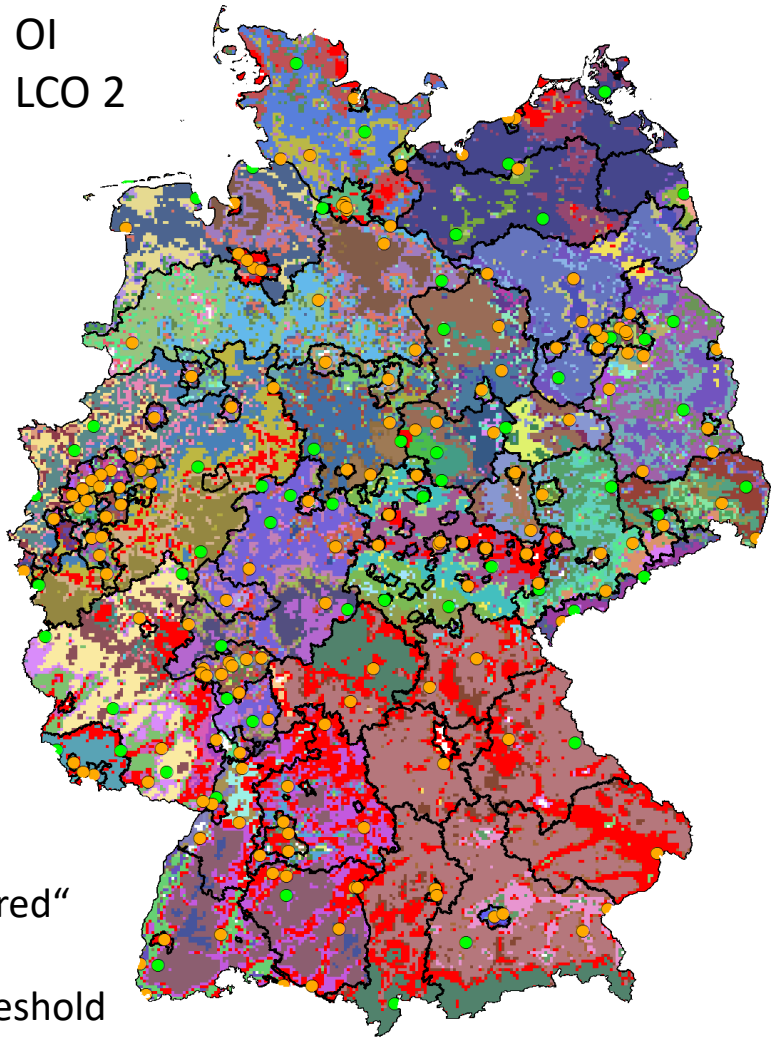
PM10 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2

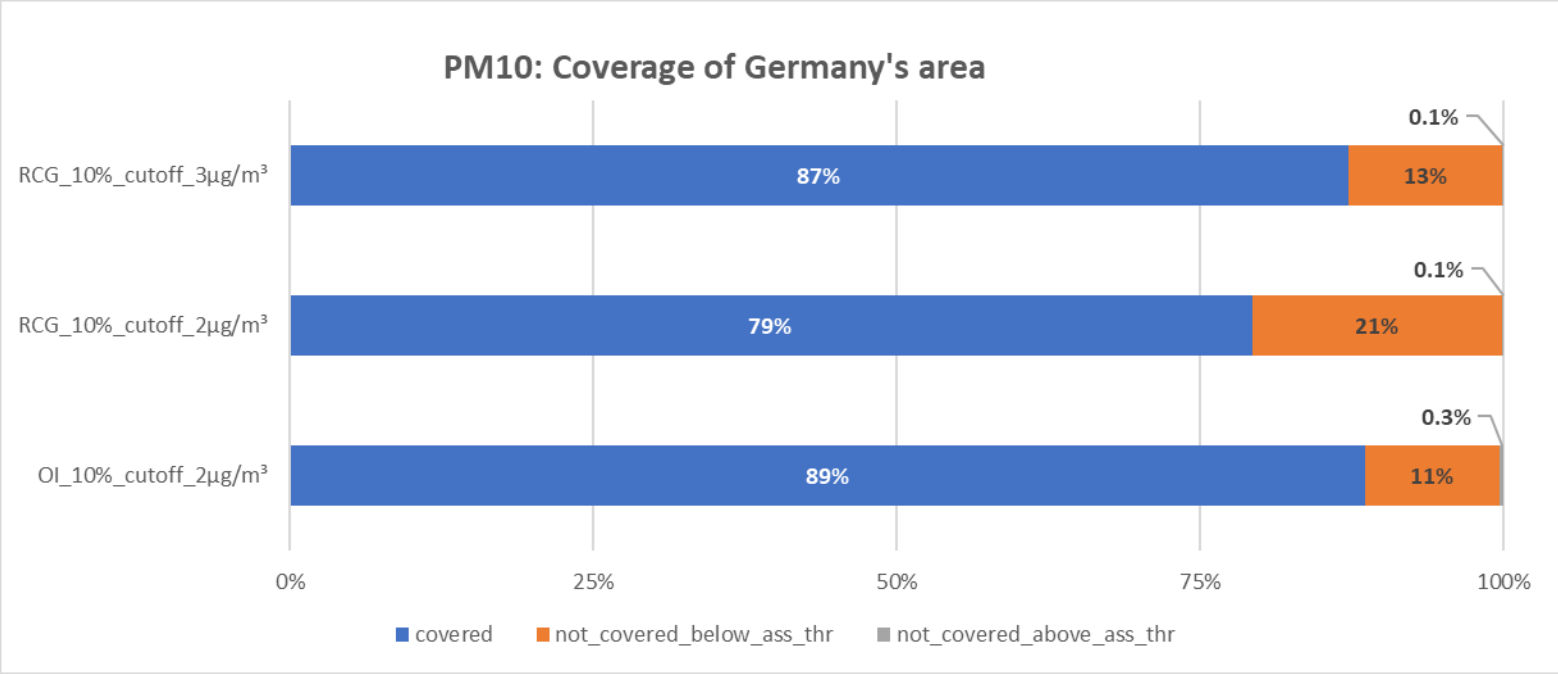


OI
LCO 2



in red: „uncovered“ areas below assessment threshold

PM10 – statistics



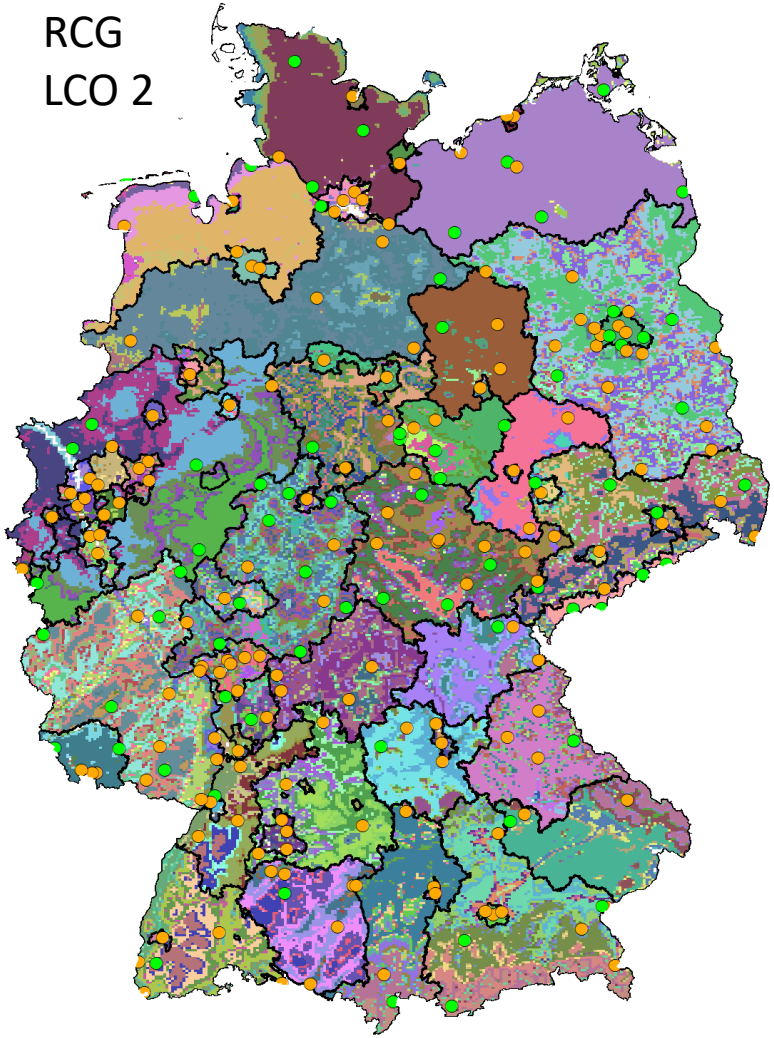
Conclusion:

- „RCG 10 % LCO 2““ covers 79% of the (relevant) areas → our recommendation
- „RCG 10 % LCO 3“ shows no further improvements
- Data fusion shows no further improvement

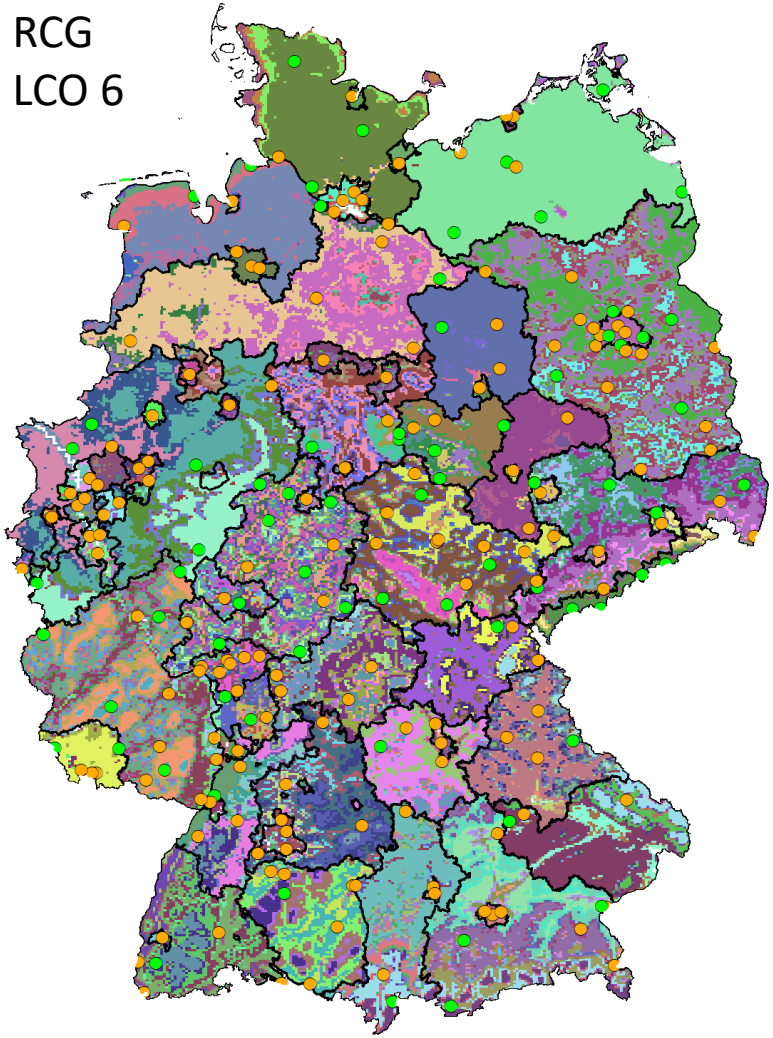
O3 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2



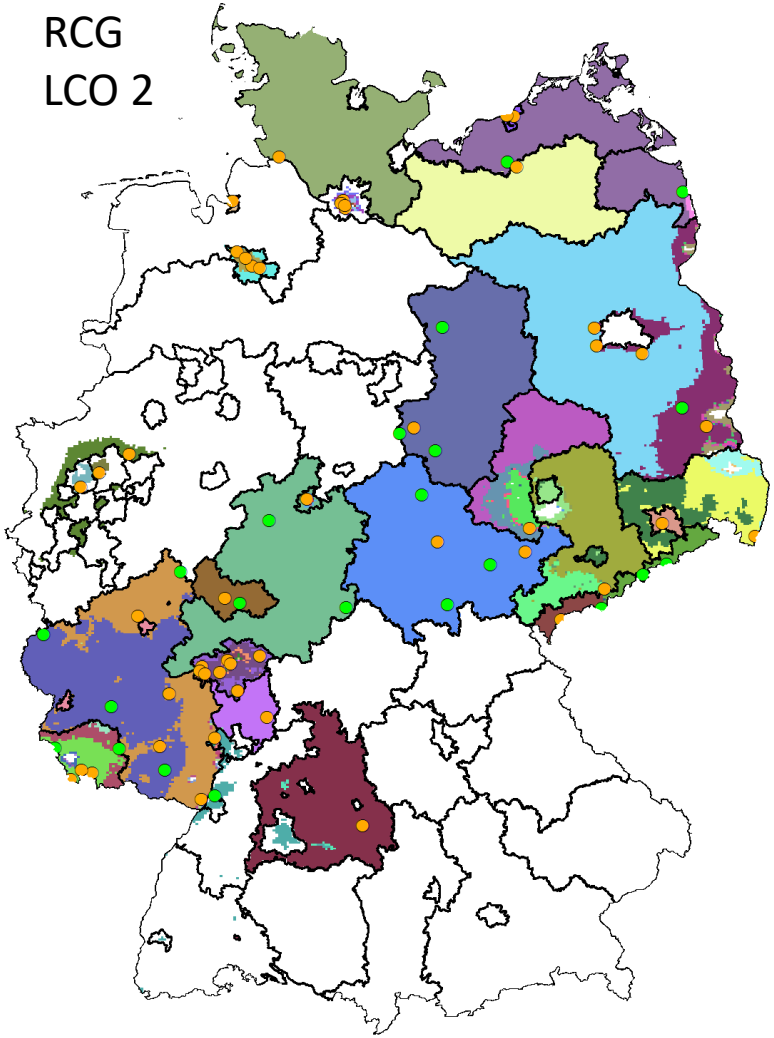
RCG
LCO 6



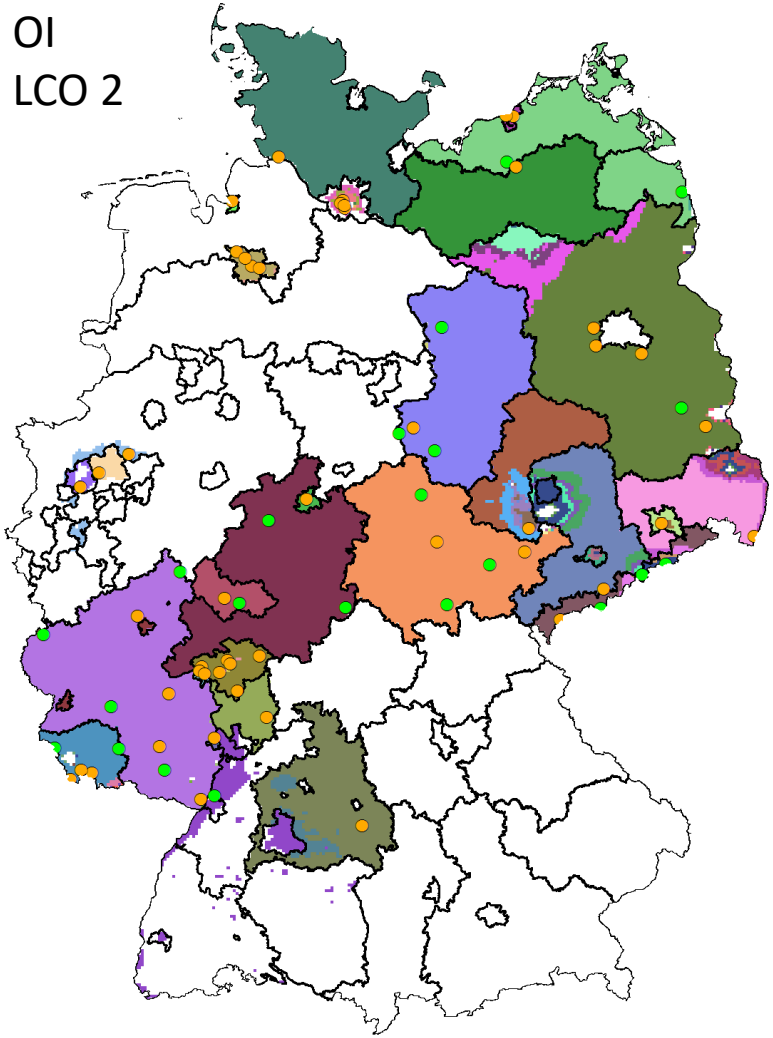
SO2 – tolerance level 10 %

rural background
urban background
suburban background

RCG
LCO 2



OI
LCO 2



Conclusions

- Changes (rural station not limited by zones, correct interpretation of LCO) increased the „coverage“
- Don’t try to increase tolerance level and lower cut-off to cover the whole zone!
  ➔ Analyse the gaps
- Use raw model data instead of data fusion data
  - Raw model data is independent from measurement data → if you use measurement data for data fusion some assumption regarding SR is needed and influence the dataset
  - Data fusion datasets show no further improvements
- Higher tolerance levels and LCO could be lead to an „over-representation“ → many stations are representive for the same area

Conclusions

- Exclude (uncovered) low concentration values below the assessment threshold
  - It‘s not nescessary to implement additional measurements for these low concentration ranges

- NO2 / PM / O3: Configurations with 10 % tolerance level and 2 µg/m³ lower cut-off show reasonable results

- To exclude meteorological impact on SR do further tests for another year or average concentrations for several years?