aRPa FVG

agenzia regionale per la protezione dell'ambiente del friuli venezia giulia

Sistema Nazionale per la Protezione dell'Ambiente

Analysis of spatial representativeness in Friuli Venezia Giulia

FAIRMODE CT8, exercise #1

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exercise

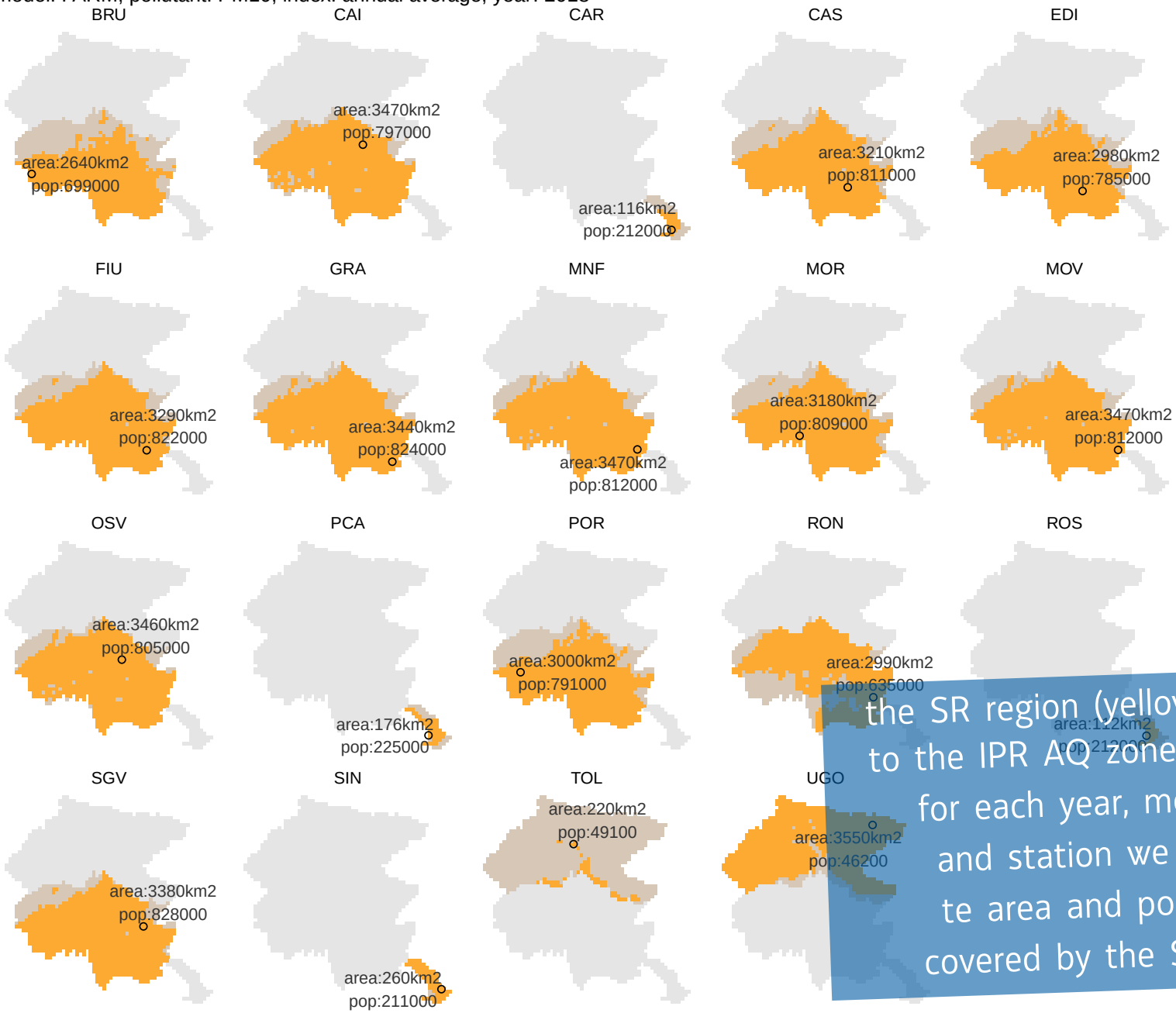
- pollutants: PM10, NO_2, O_3
- each pollutant considered separately
- AQ index: annual mean modelled concentration
- similarity criterion: concentration in range $c_{station} \pm 20\%$ (relative tolerance)
- absolute cutoff: concentration in range $c_{station} \pm 2\mu g/m^3$ (absolute tolerance) is ok, even if similarity criterion is not satisfied
- spatial representativeness (SR) region can be discontiguous
- SR region is limited to the IPR AQ zone

my choices

- domain: Friuli Venezia Giulia (north-eastern Italy)
- two models:
  - FARM (chemistry-transport model, 2 km resolution)
  - KED (kriging with external drift, same grid)
- only background stations
- periods: 2015–2020 (KED), 2017–2020 (FARM)

spatial representativeness

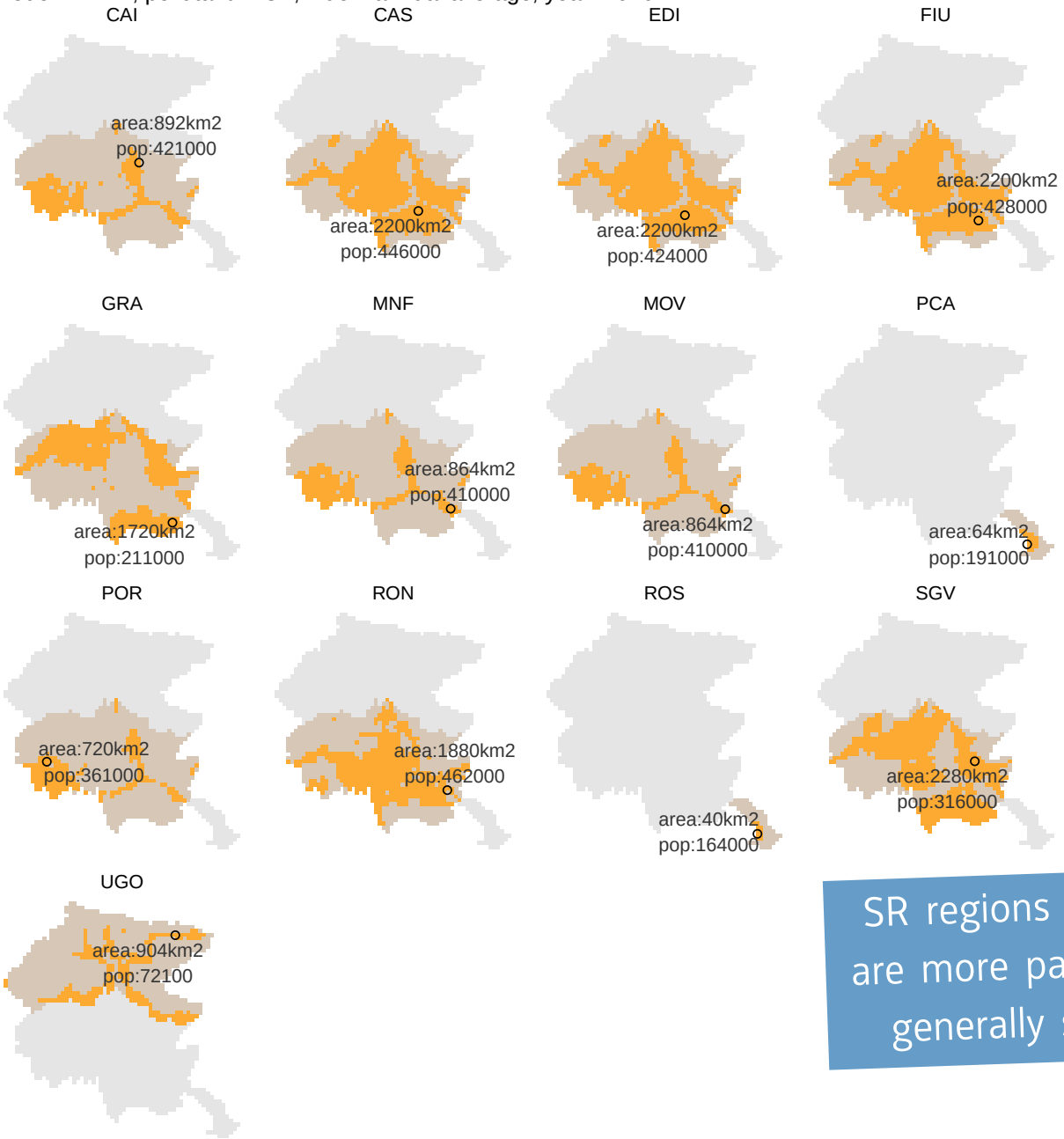
model: FARM, pollutant: PM10, index: annual average, year: 2018



the SR region (yellow) is limited to the IPR AQ zone (dark grey); for each year, model, AQI and station we calcula-te area and population covered by the SR region

spatial representativeness

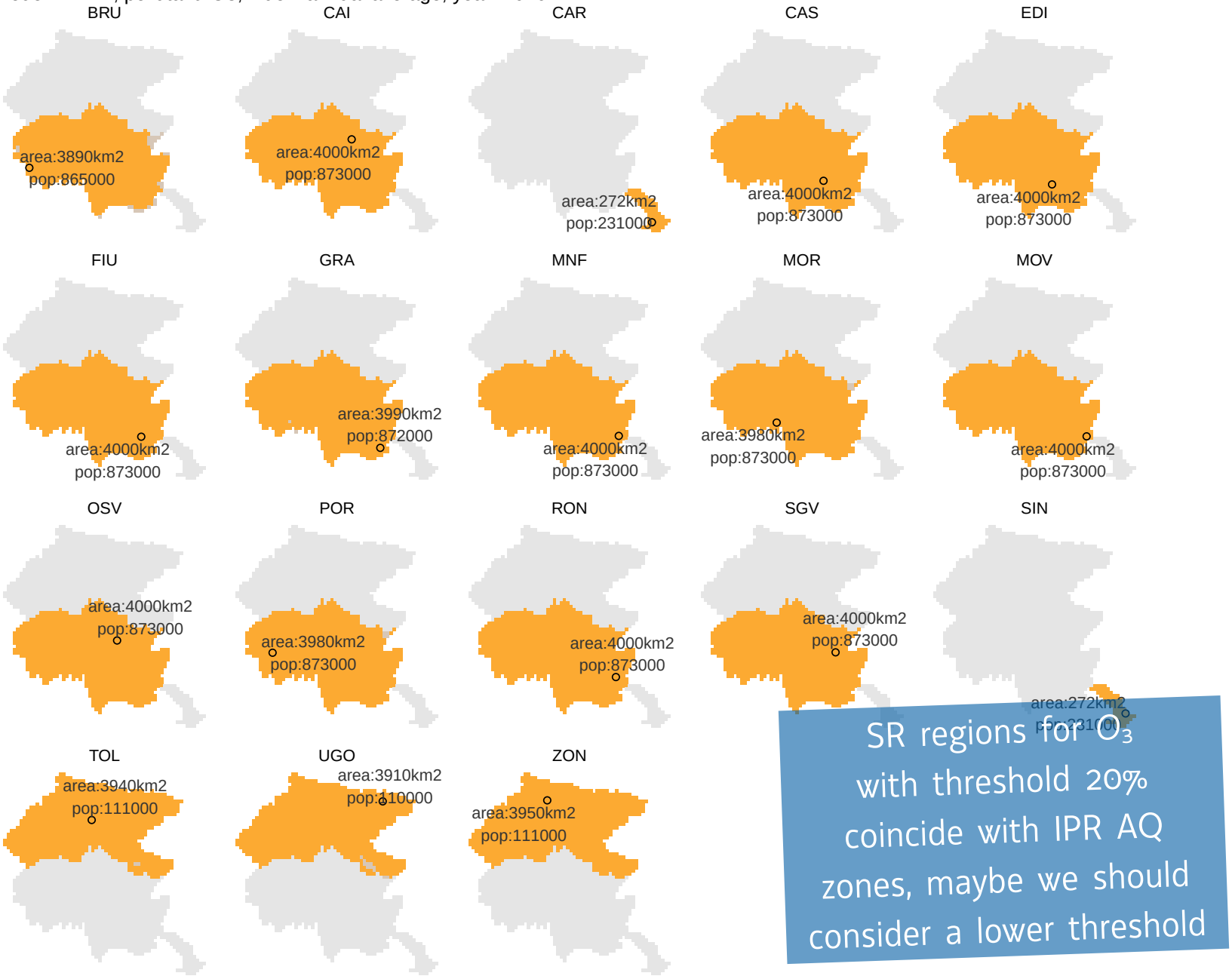
model: FARM, pollutant: NO2, index: annual average, year: 2020



SR regions for NO_2 are more patchy and generally smaller

spatial representativeness

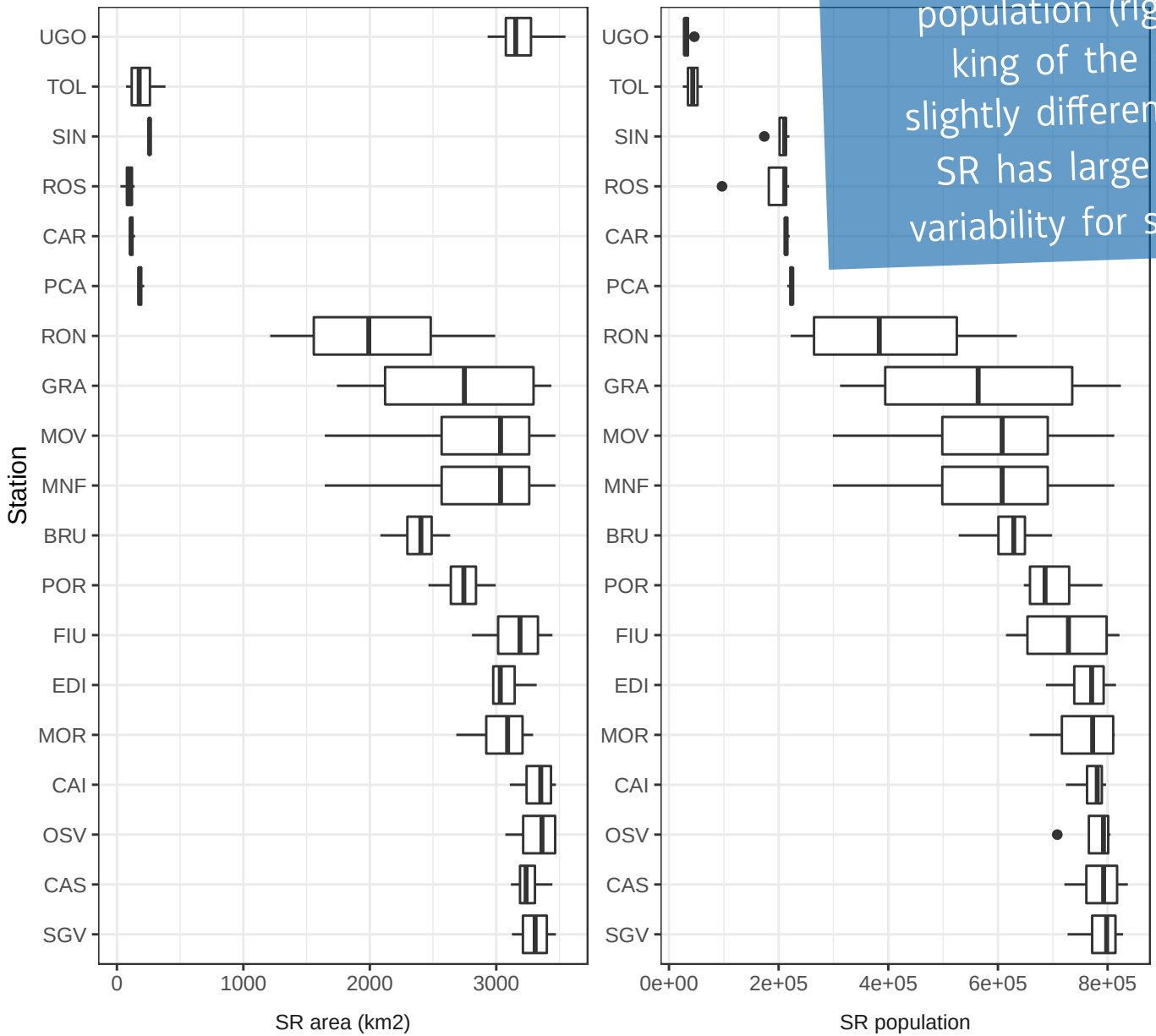
model: FARM, pollutant: O3, index: annual average, year: 2020



SR regions for O_3 with threshold 20% coincide with IPR AQ zones, maybe we should consider a lower threshold

spatial representativeness

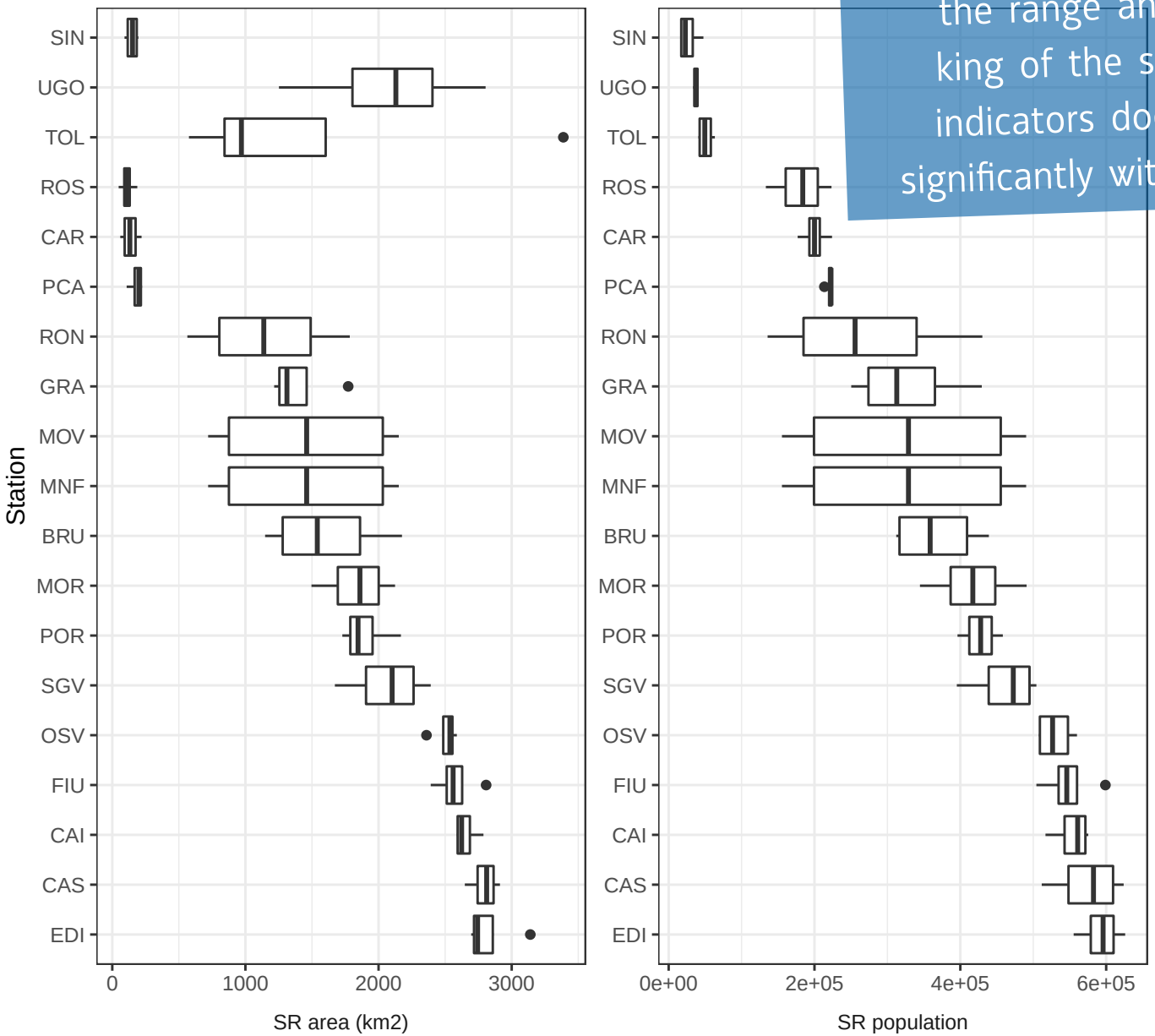
model: FARM, pollutant: PM10, index: annual average, years: 2017–2020



between SR area (left) and population (right) the ranking of the stations is slightly different (for PM10); SR has large interannual variability for some stations

spatial representativeness

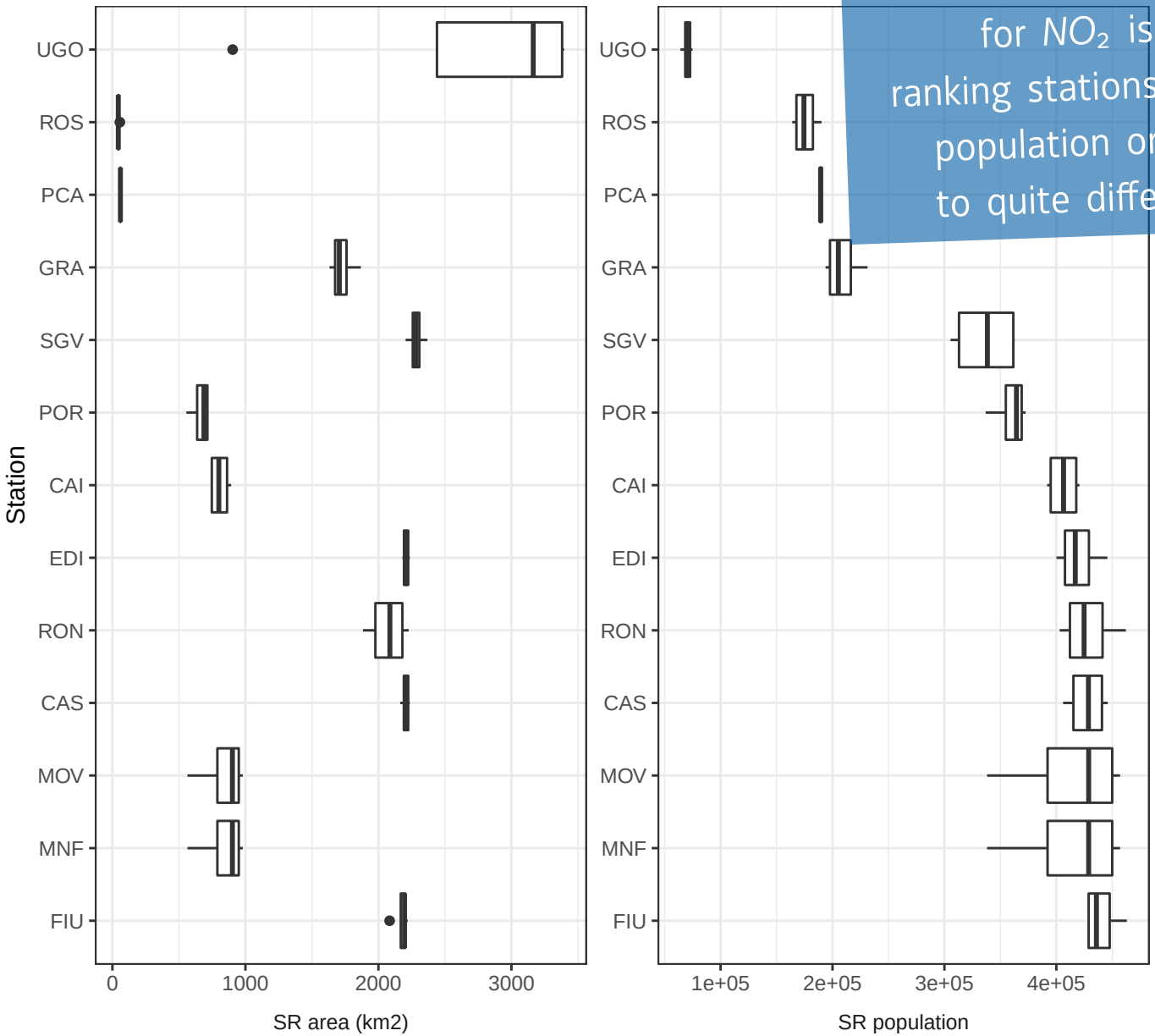
model: KED, pollutant: PM10, index: annual average, years: 2017–2020



the range and the ranking of the stations' SR indicators does not vary significantly with KED model

spatial representativeness

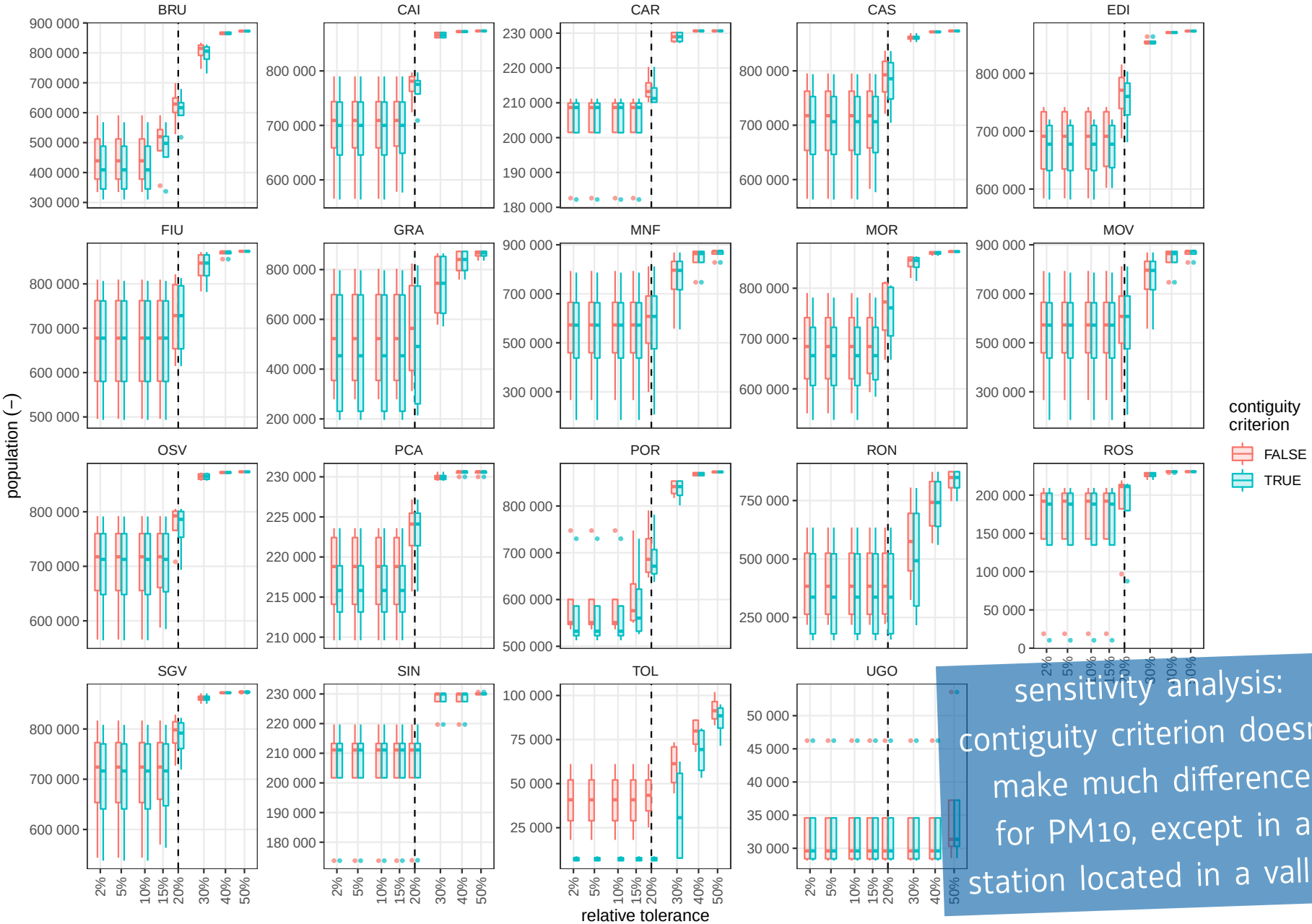
model: FARM, pollutant: NO2, index: annual average, years: 2017–2020



interannual variability for NO_2 is smaller; ranking stations with covered population or area leads to quite different results

spatial representativeness sensitivity

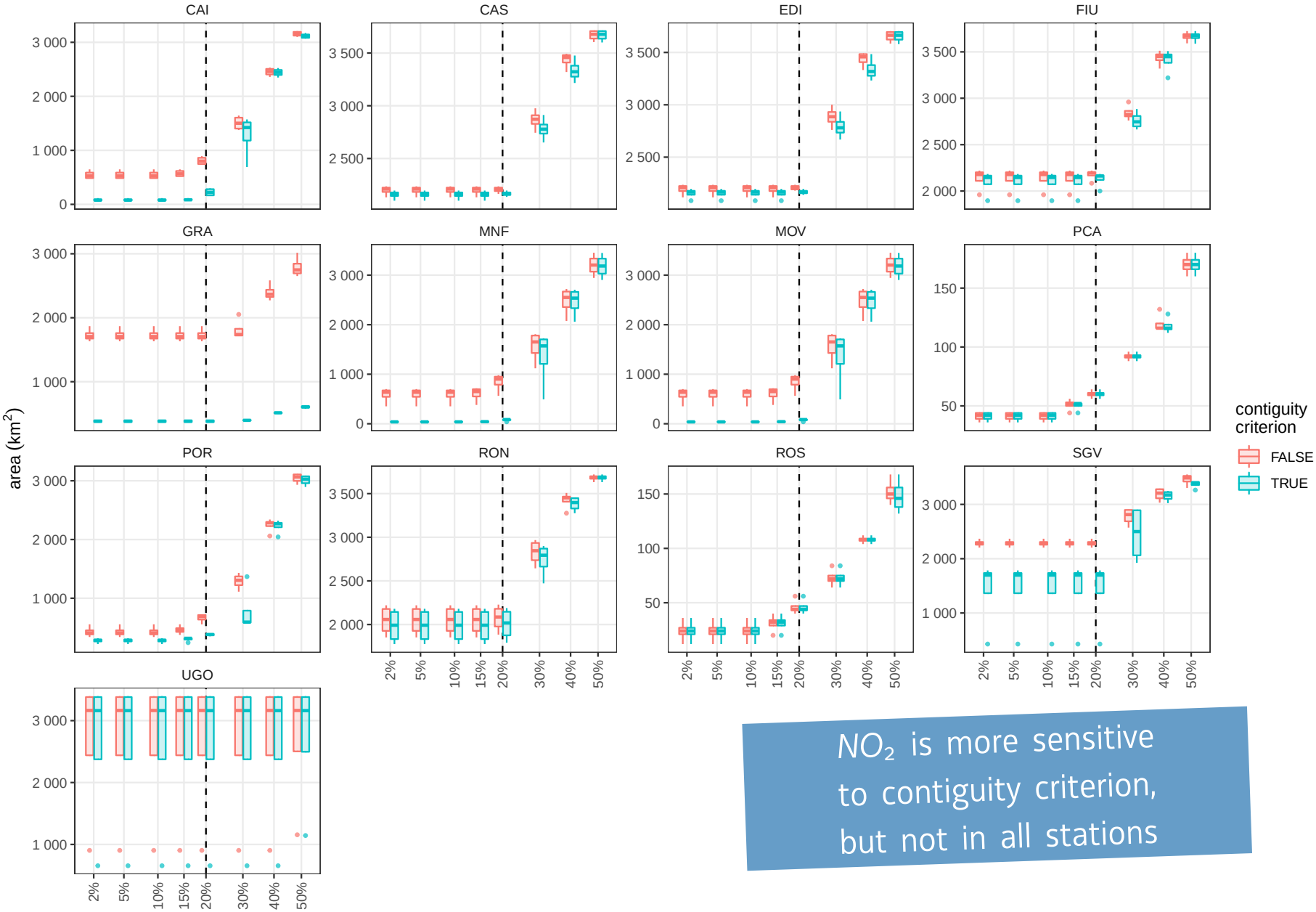
model: FARM, pollutant: PM10, AQ index: annual average, SR index: population, years: 2017−2020



sensitivity analysis: contiguity criterion doesn't make much difference for PM10, except in a station located in a valley

spatial representativeness sensitivity

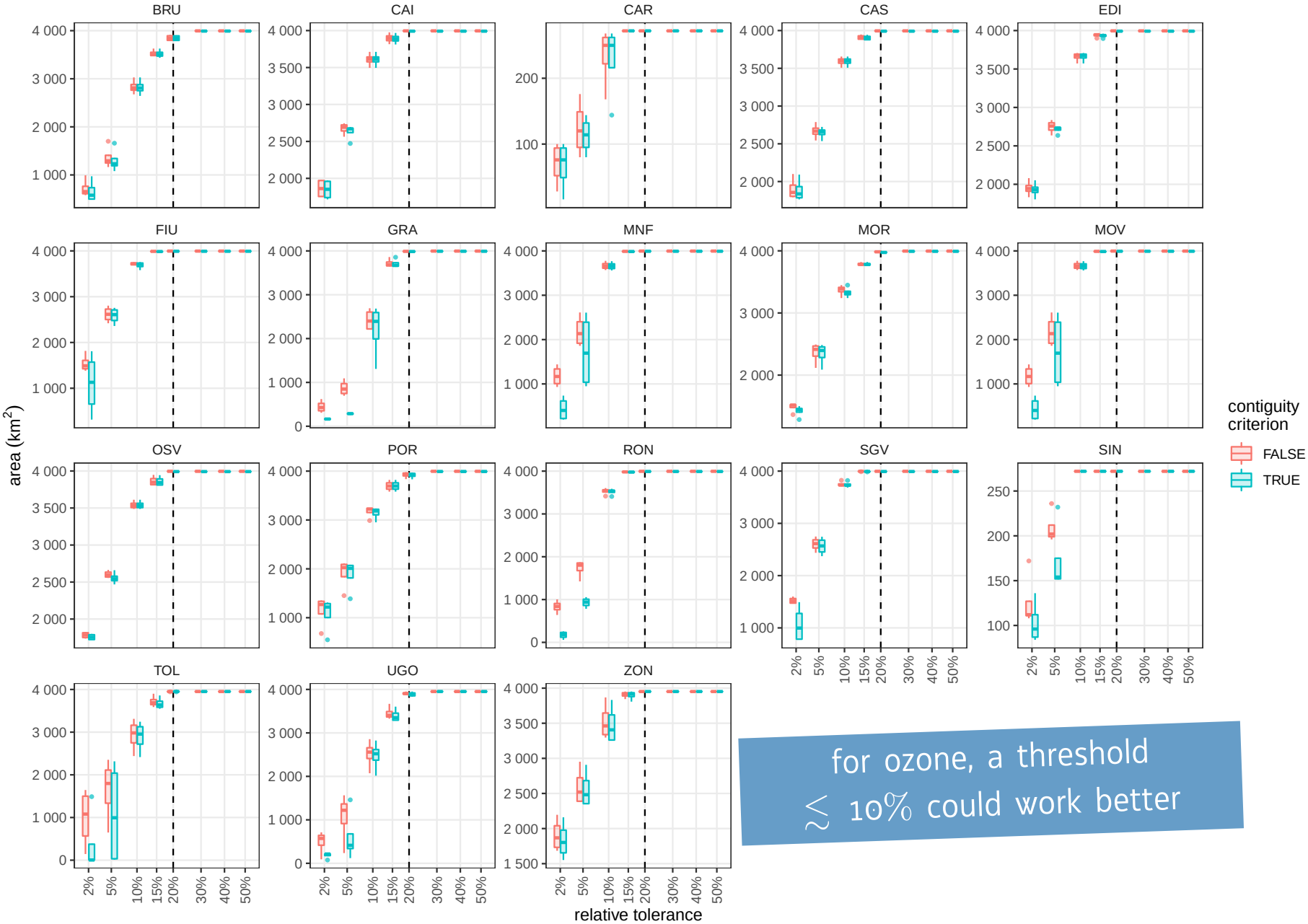
model: FARM, pollutant: NO2, AQ index: annual average, SR index: area, years: 2017−2020



NO_2 is more sensitive to contiguity criterion, but not in all stations

spatial representativeness sensitivity

model: FARM, pollutant: O3, AQ index: annual average, SR index: area, years: 2017−2020

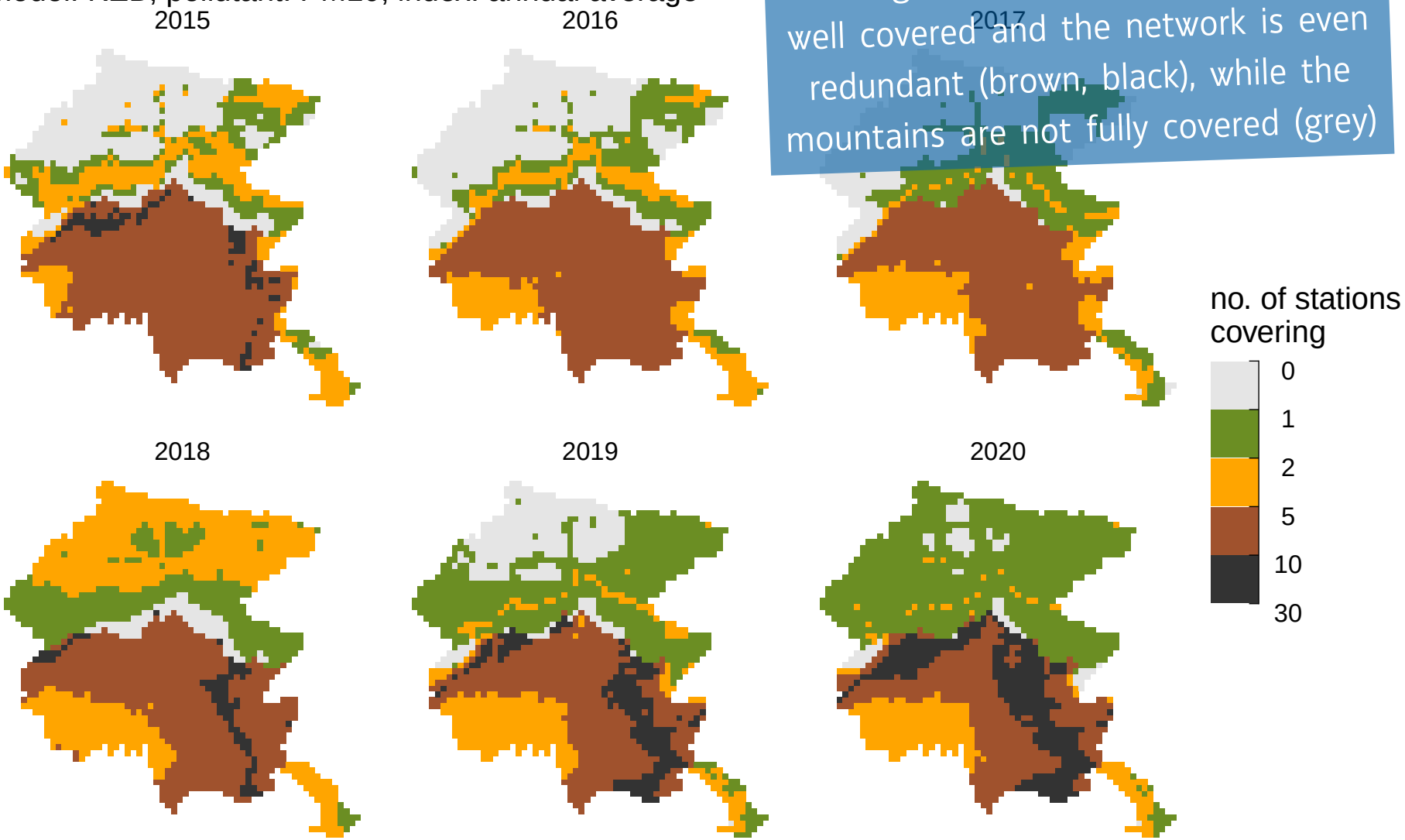


for ozone, a threshold $\lesssim$ 10% could work better

spatial representativeness coverage

model: KED, pollutant: PM10, index: annual average

we can overlay the SR regions of many stations in order to assess the coverage and redundancy of a monitoring network; in FVG the plain is well covered and the network is even redundant (brown, black), while the mountains are not fully covered (grey)



resources

Scripts for analysis and plots are available here:
`https://github.com/jobonaf/spatial-representativeness`