WG8 Exercises on Spatial Representativeness and Exceedance Situation Indicators

SR analysis for Tuscany Region (Italy)

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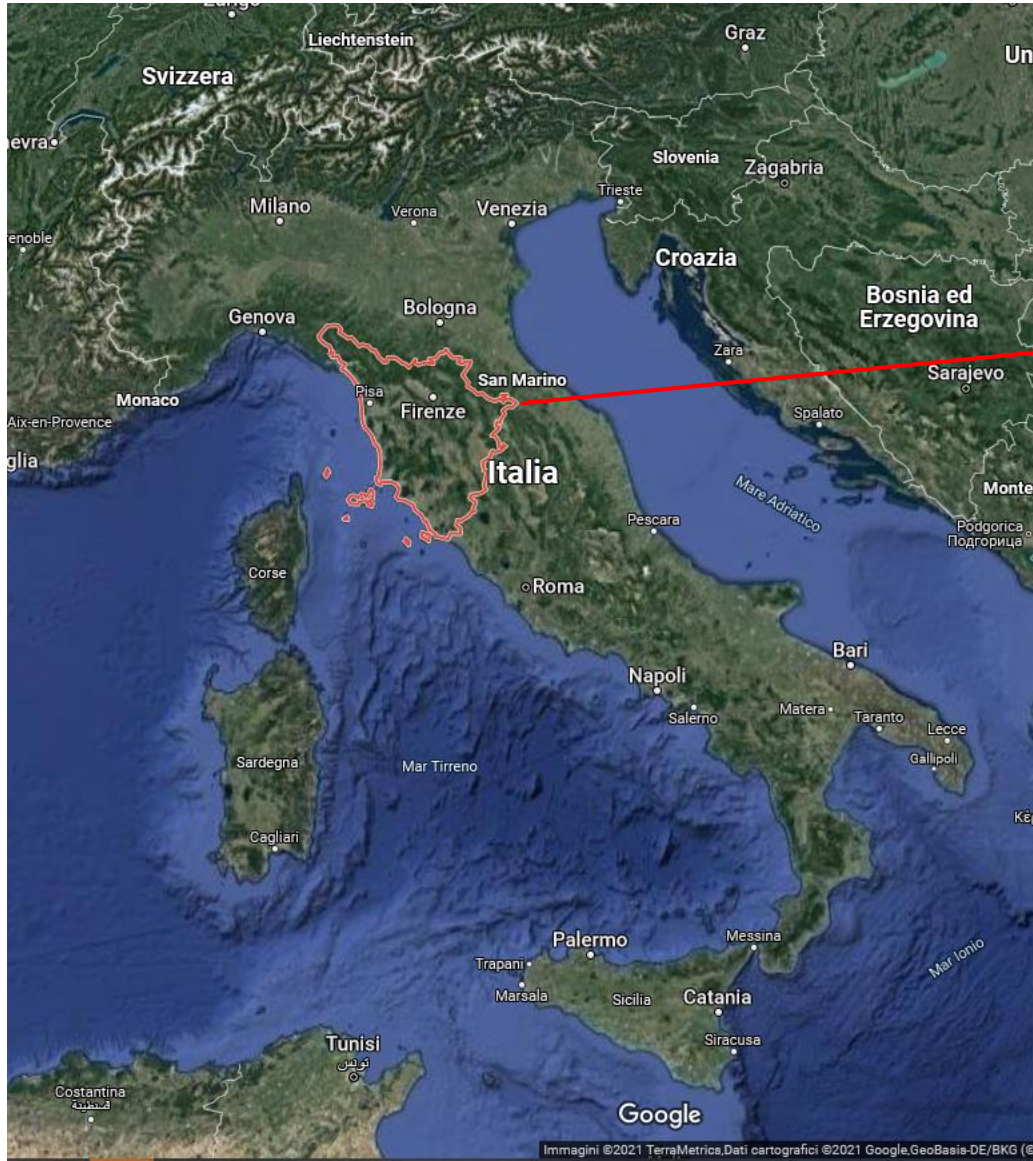B.P. Andreini – C. Collaveri (ARPAT)
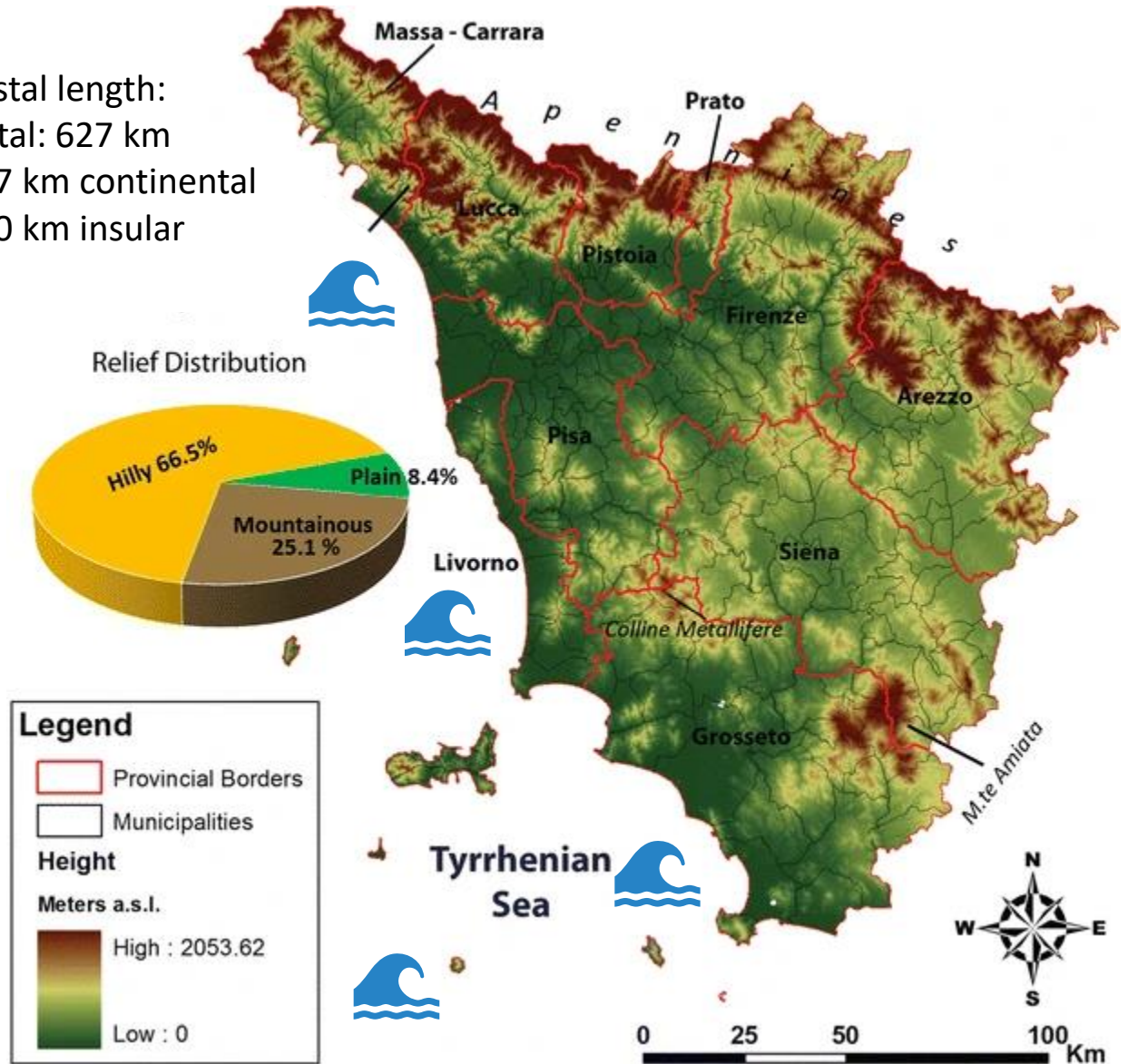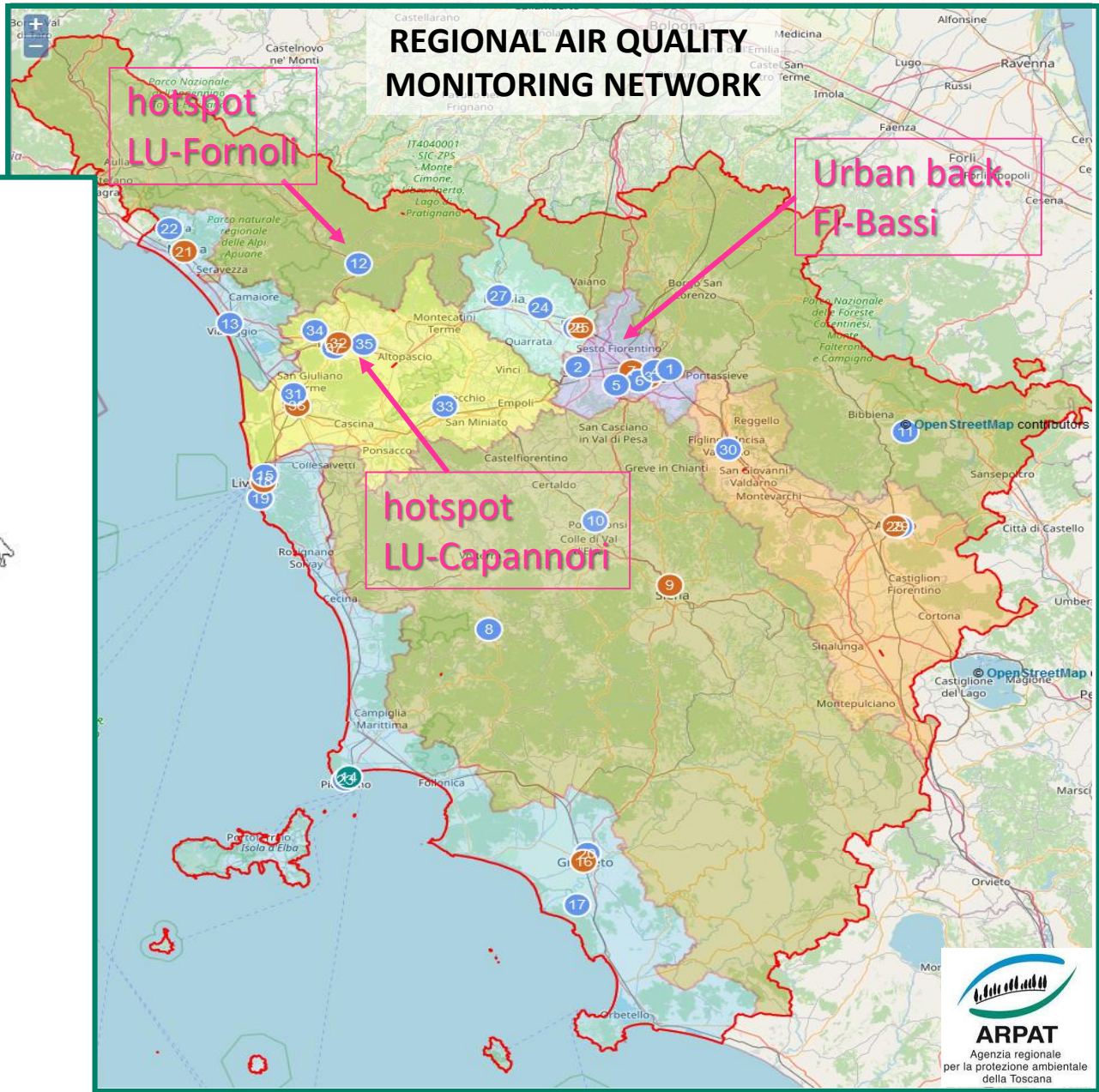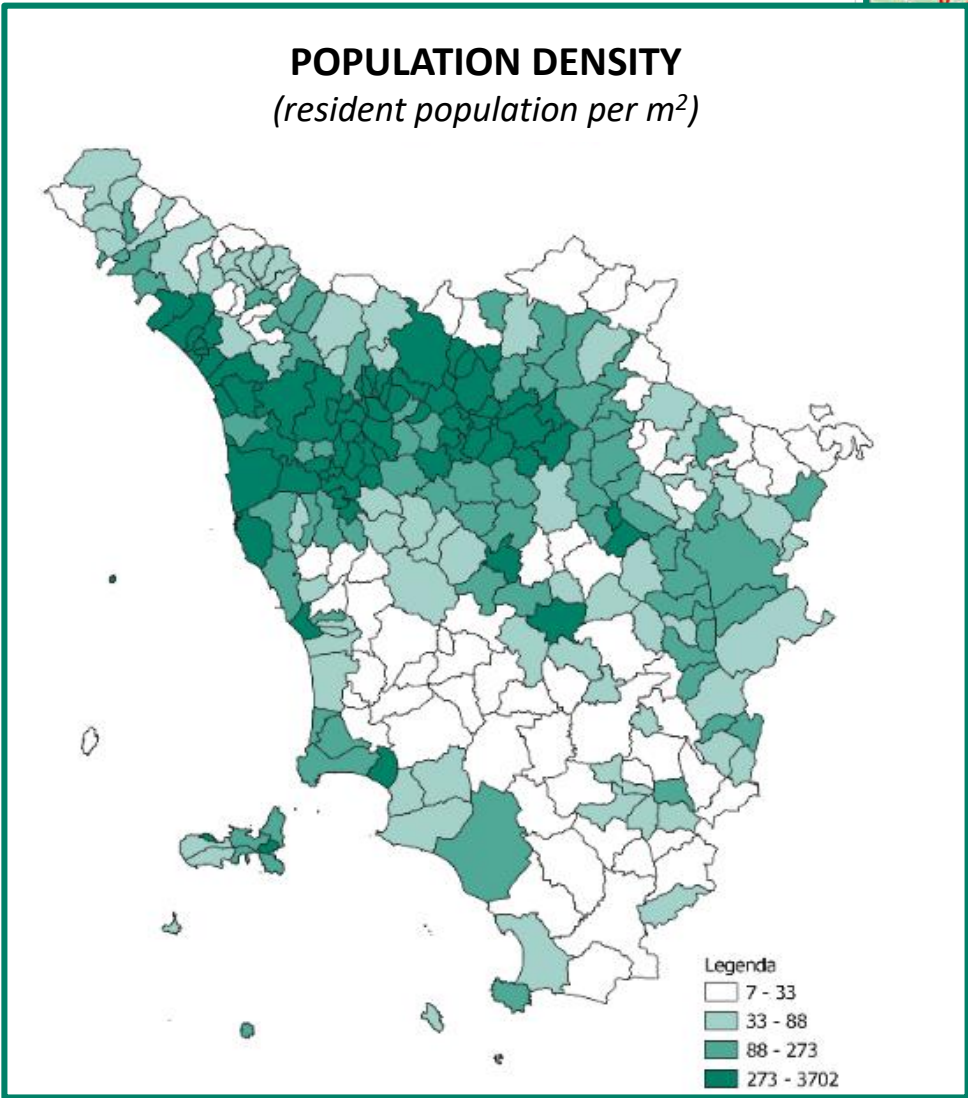
Tuscany Region

Coastal length:
 - total: 627 km
 - 397 km continental
 - 230 km insular

Relief Distribution

Hilly 66.5%
Plain 8.4%
Mountainous 25.1 %

Legend

Provincial Borders
Municipalities
Height
Meters a.s.l.

High : 2053.62
Low : 0

Source: https://link.springer.com/article/10.1007/s10346-017-0861-4#Fig1

POPULATION DENSITY
(resident population per m²)

Legenda
- ☐ 7 - 33
- ☐ 33 - 88
- ☐ 88 - 273
- ☐ 273 - 3702

REGIONAL AIR QUALITY MONITORING NETWORK

hotspot LU-Fornoli

Urban back. FI-Bassi

hotspot LU-Capannori

LEGEND
- 🔵 Background
- 🟠 Traffic
- 🟢 Industrial

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Data & method

- Model: WRF-CAMx (eurelian model) annual mean concentrations -2km resol. –no bias adj.
  - http://www.lamma.rete.toscana.it/camx-info-sul-modello-previsionale --> *some detailed info*

- Model data used: 2015 and 2017 as previous work (modelled concentrations at station location)
  - Annual Mean
  - 90.4th percentile

- But also different available years : 2019-2020-2022

- Considered location points: background stations (urban & rural types - hotspots)

- Different lower cutoff values are evaluated
  - 2 or 4 µg/m^3 for PM10 and NO2

- Different tolerance levels values are evaluated
  - 10% 15 % 20% for background stations

- Compare the findings obtained with these evaluations with the current SR used in the Tuscany Region (based on daily mean values)
  - https://www.regione.toscana.it/-/elenco-pubblicazioni-inerenti-la-rappresentativita-spaziale-delle-stazioni-di-rilevamento-della-qualita-dell-aria-in-toscana
  - Vitali L., Ciancarella L., Cionni G., Cremona G., Piersanti A., Righini G. (2013): Rappresentatività spaziale di misure di qualità dell'aria. Valutazione di un metodo di stima basato sull'analisi dei campi di concentrazione simulati dal modello nazionale MINNI, Rapporto Tecnico RT/2013/3/ENEA, ENEA.

- Pollutants: PM10 / NO2

RESULTS-PM10
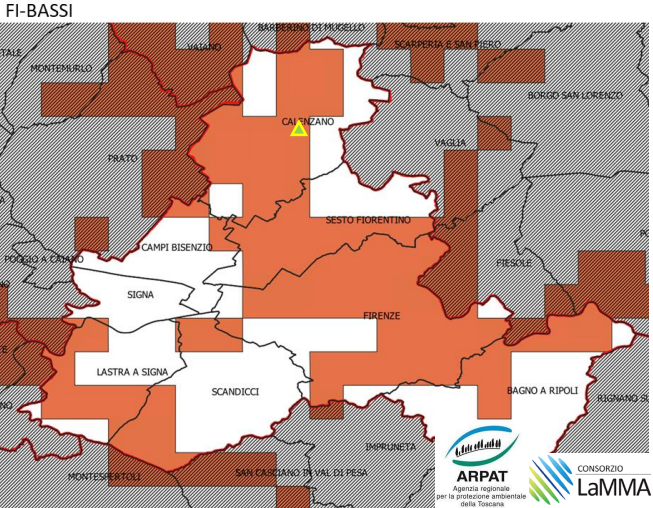
Current SR of the urban background station point FI-BASSI (red pixels)

Year 2017
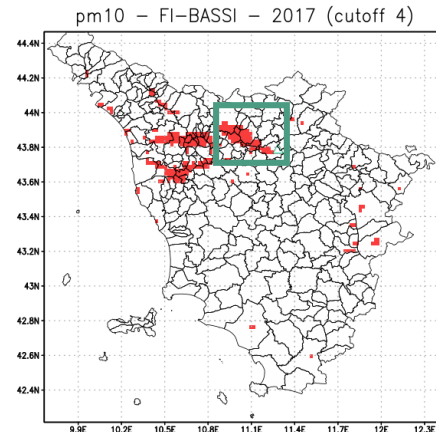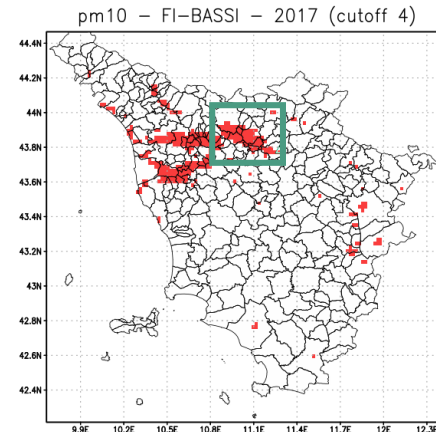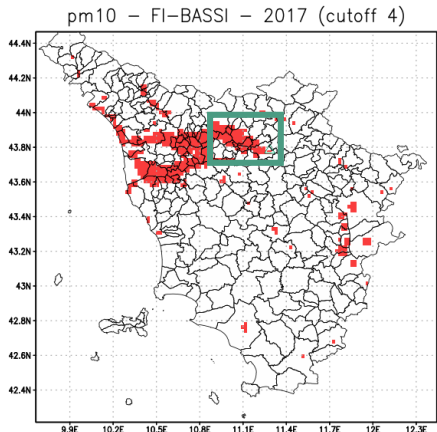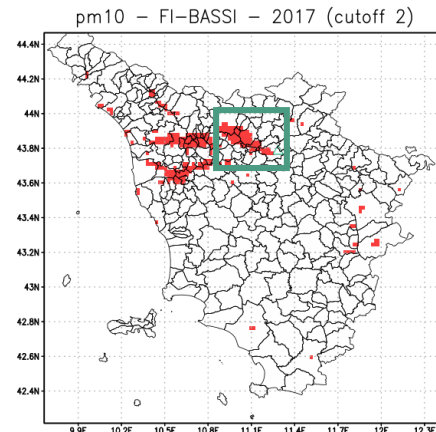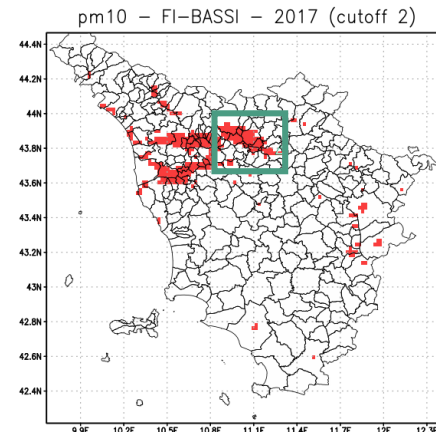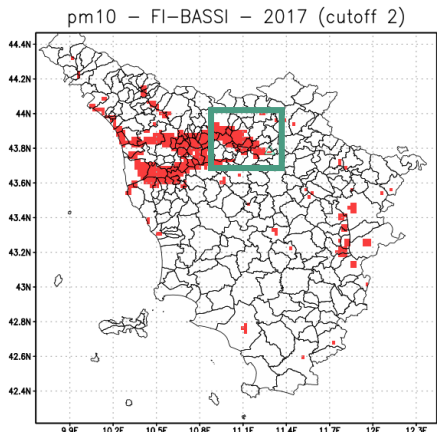
more or less the same area

New SR of the station point FI-BASSI (red pixels) with threshold of 20% - 15% - 10% (from left to right) and cutoff $2\mu g/m^3$ (up) and $4\mu g/m^3$ (bottom)

RESULTS-PM10

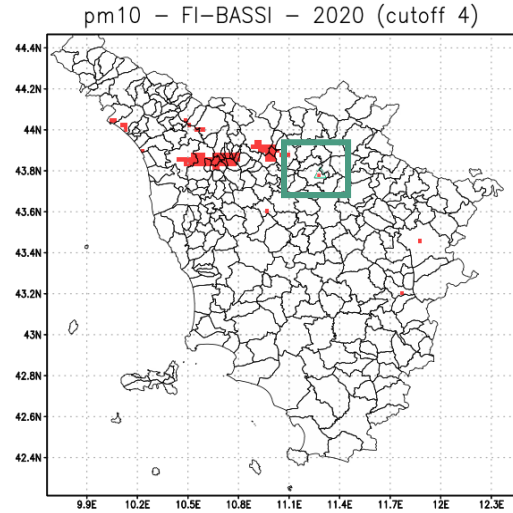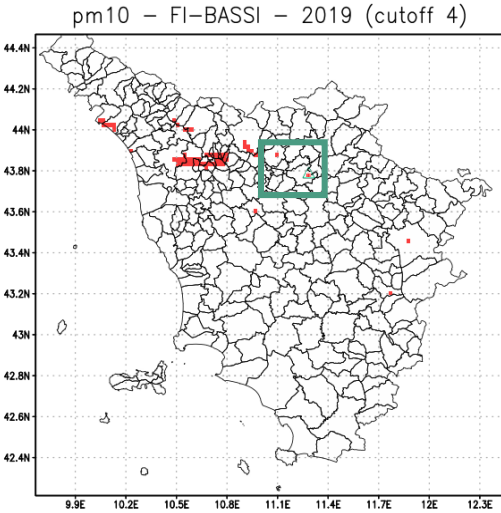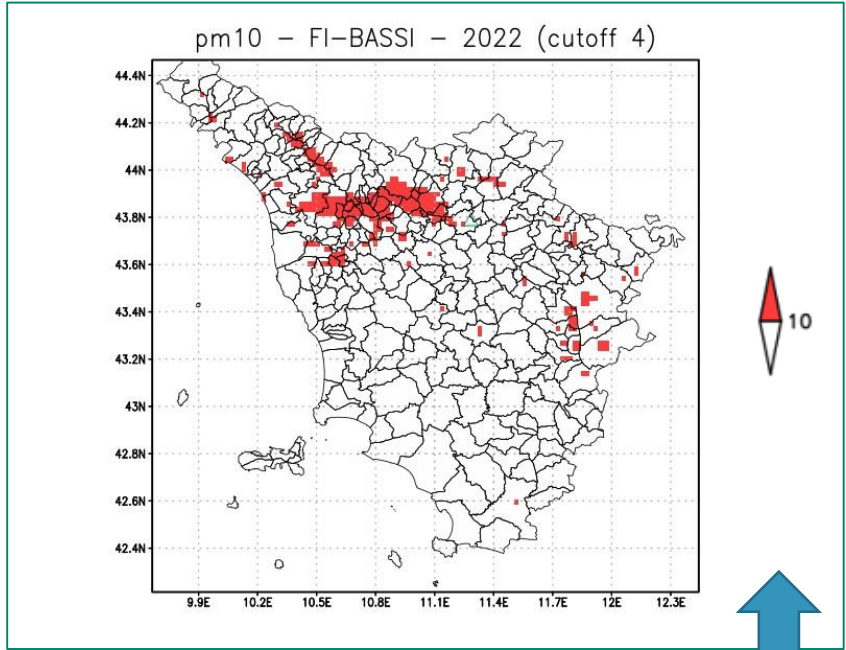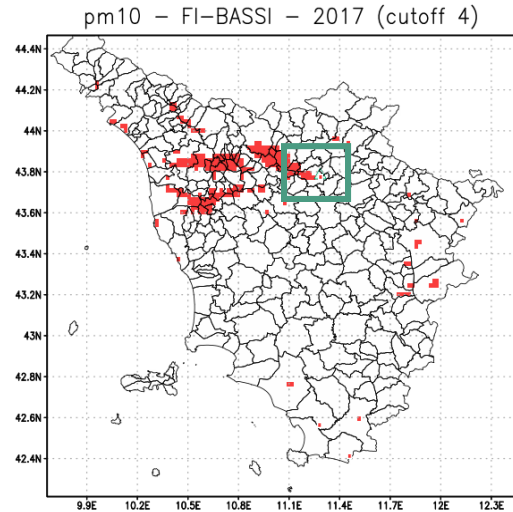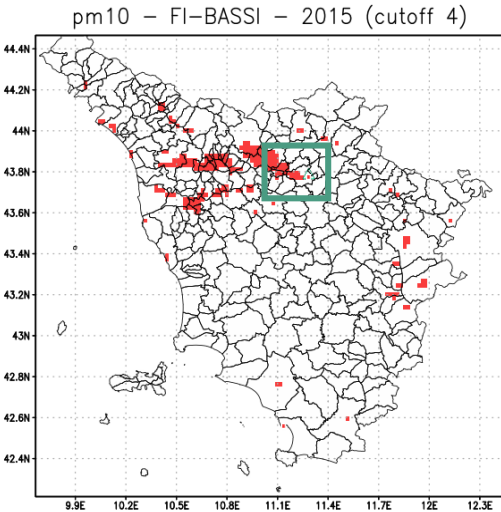station point FI-BASSI (red pixels) in different years

2015 - 2017 use the same emission inventory

2019 -2020 use the same emission inventory

The changes in the area are caused by different emission inventory used (general reduction of pollutants)

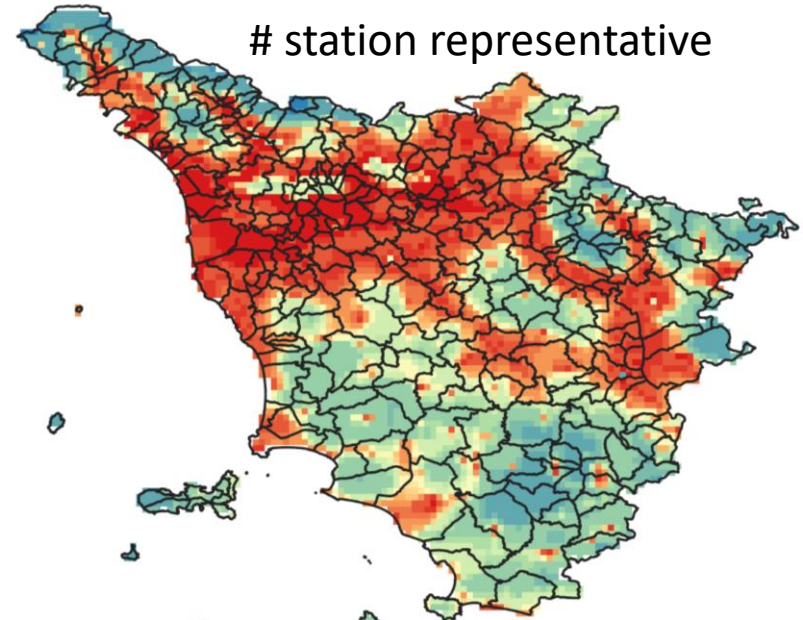The impact of the different meteorology is non significant on this proposed method of SR→ *stability of the method*

90.4th percentile that for station data corresponds to 35 exceedances of 50μg/m³ → more similar to the current SR
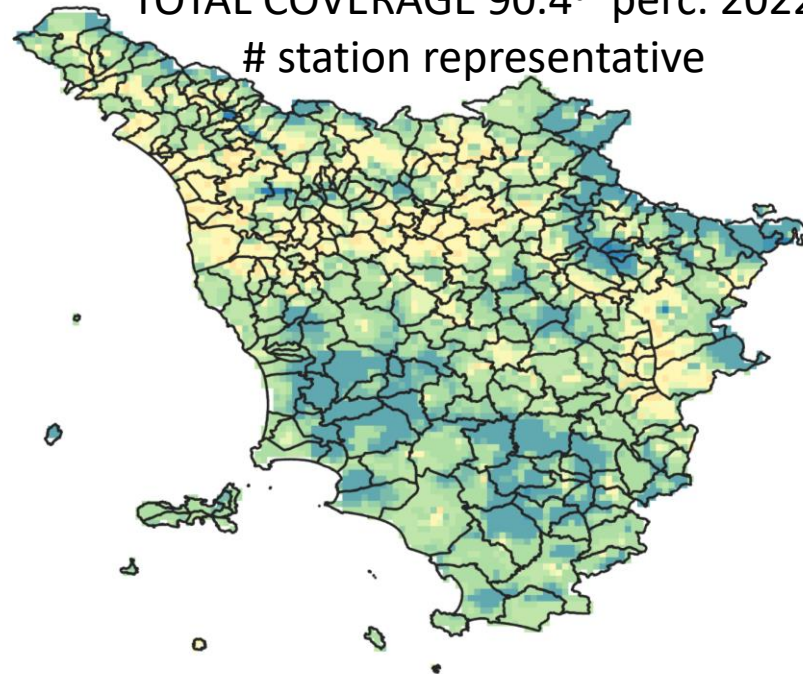
RESULTS-PM10

TOTAL COVERAGE annual mean 2017
station representative
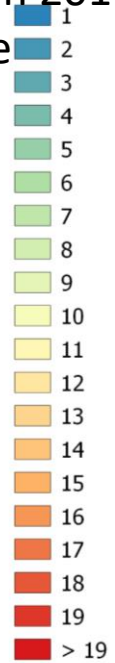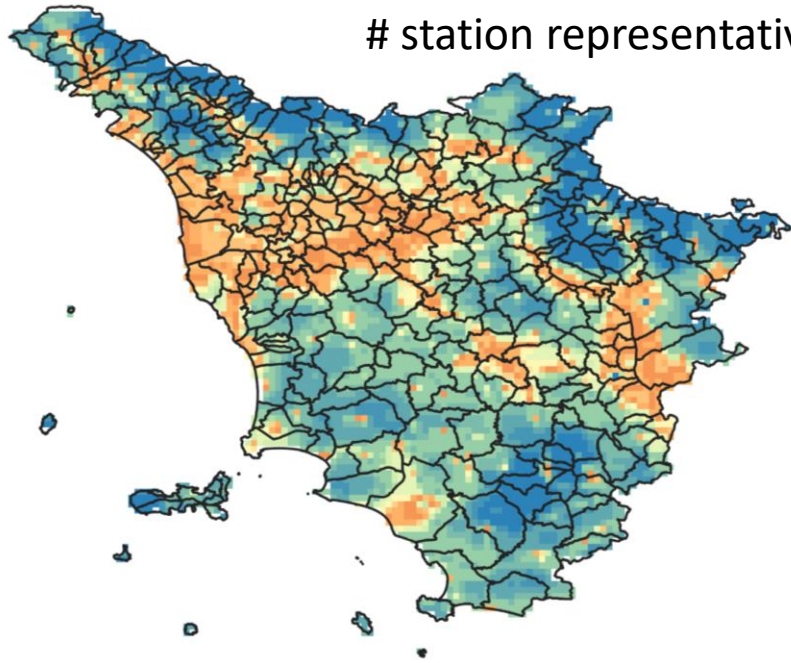
TOTAL COVERAGE annual mean 2022
station representative

TOTAL COVERAGE 90.4th perc. 2022
station representative

Legend: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, > 19

Using the 90.4th percentile → less overlapping areas involving station points with different beahviour

RESULTS-PM10

With the new directive (COM/2022/542) applied to the measurements:

Applied for 2022 to PM10 annual mean threshold = 20 $\mu g/m^3$:

- AR-ACROPOLI   20 $\mu g/m^3$ → not exc.
- FI- FIGLINE   22 $\mu g/m^3$ → exceed

- FI-BOBOLI   19 $\mu g/m^3$ → not exc
- FI-BASSI   21 $\mu g/m^3$ → exceed

→ not in the case we use the 90.4th percentile

Applied for 2022 to PM10 daily mean threshold = 18 $\mu g/m^3$:

- PI-PASSI   10 $\mu g/m^3$ → not exc
- PI-S. CROCE   23 $\mu g/m^3$ → exceed

OPEN QUESTION: Some point stations that overlapping some areas have actually different behaviuour → try to investigate better with other percentiles or other metrics → italian group (ENEA)

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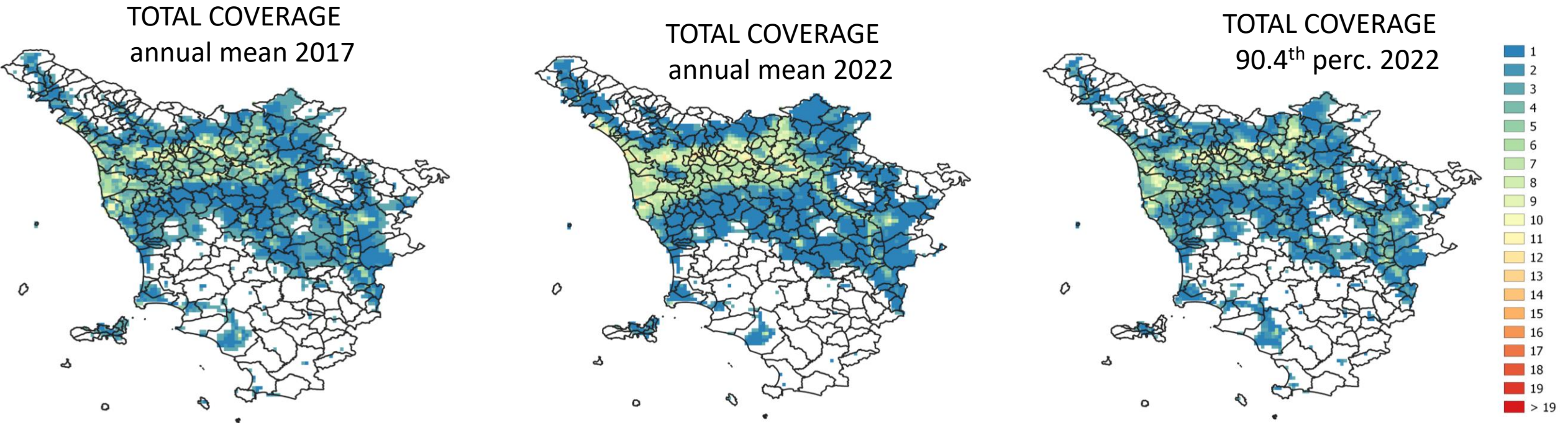della Toscana

RESULTS-PM10

HOTSPOT stations

LU-Capannori & LU-Fornoli represents 2 hotspot and their have a very local rapresentativeness (with all the cutoff and thres. considered)
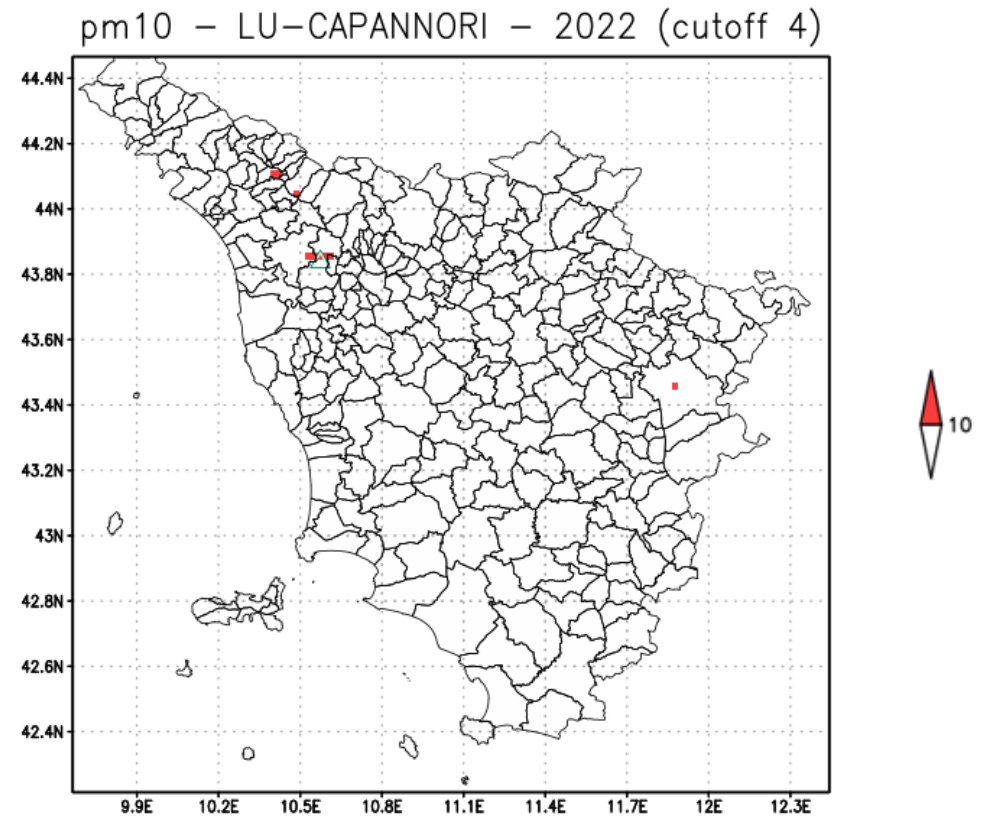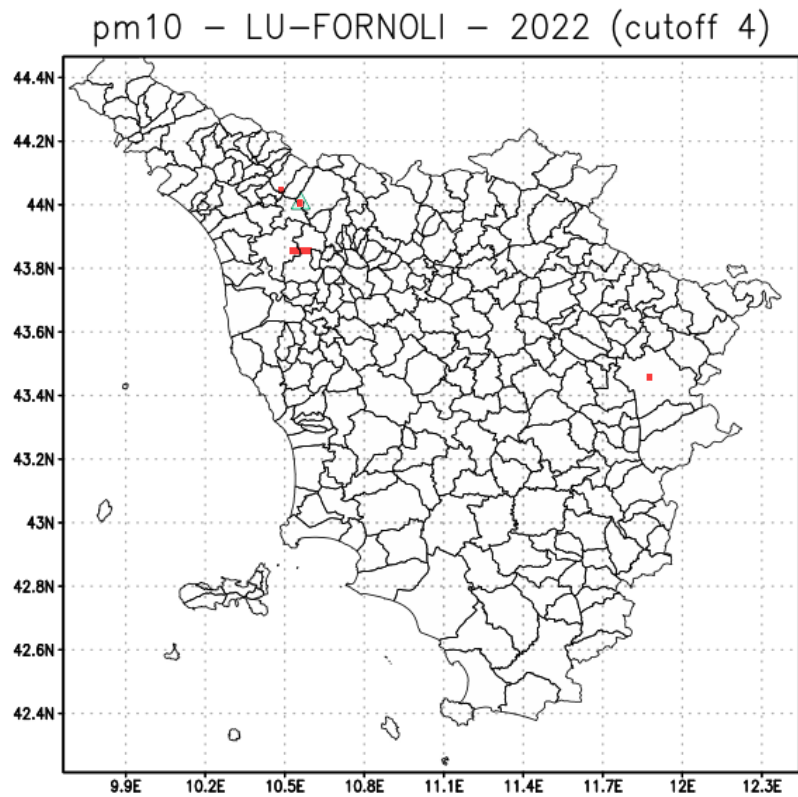
RESULTS-NO2

Cutoff 2 or 4μg/m³ give differences especially in the south inner part of the region and the upper part of the Apennines characterized by lower concentration estimates. (→ 2μg/m³)

TOTAL COVERAGE
annual mean 2017

TOTAL COVERAGE
annual mean 2022

TOTAL COVERAGE
90.4th perc. 2022

The SR currently used in Tuscany Region for the NO2 shows not such differences with this new one, as PM10 does.