

Limit value exceedances areas (LVEA) comparison

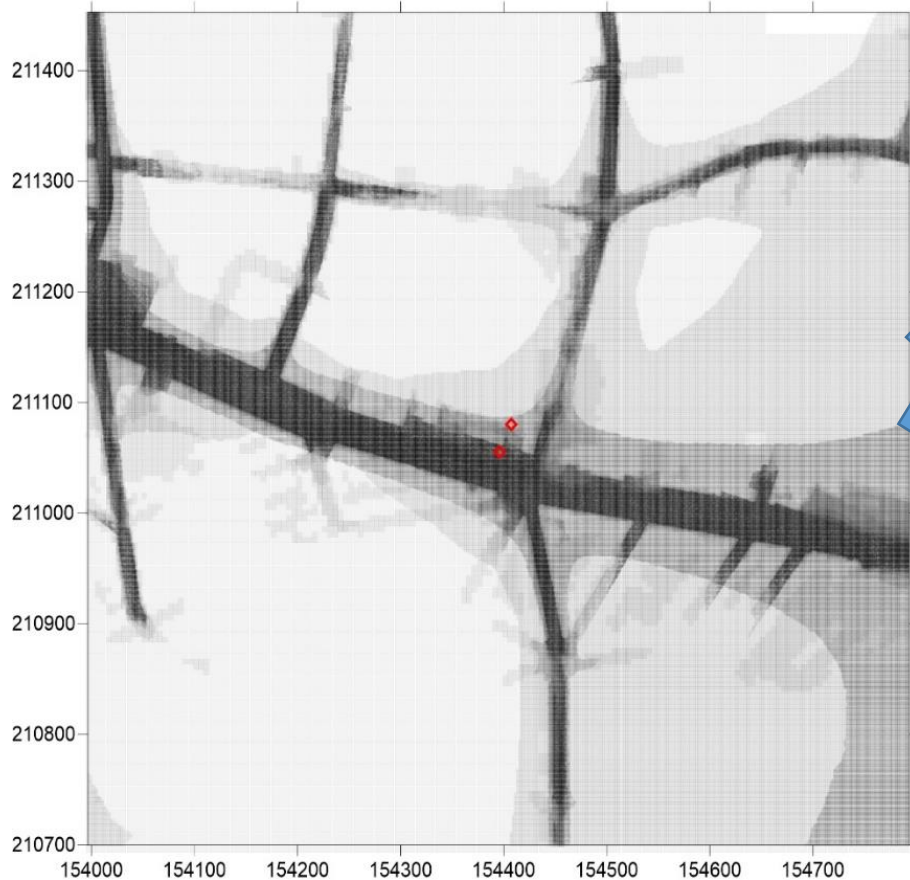
FAIRMODE WG4
Microscale Modelling

How different are the LV exceedance areas?

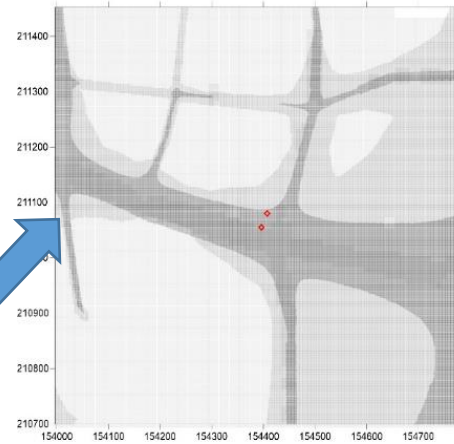
Annual Limit Value for NO₂ (40 µg/m³): Model ensembles

Darkest grey → all models
Darker grey → more models
Lighter grey → less models
White → no models

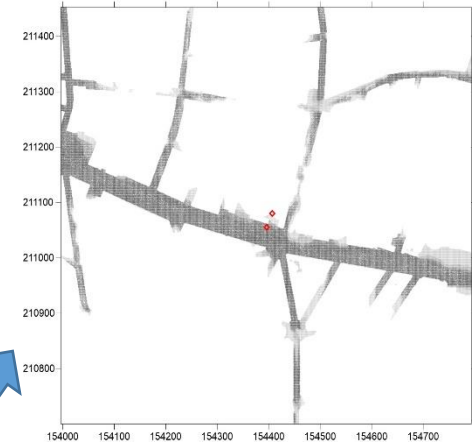
ALL MODELS LVEA ANNUAL NO2



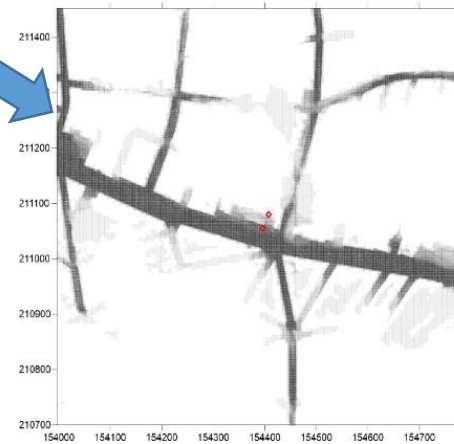
GAUSSIAN MODELS LVEA NO2 ANNUAL



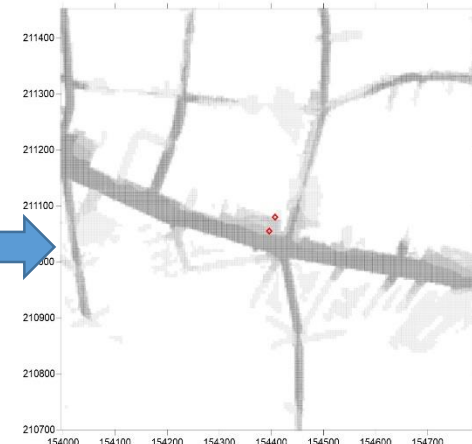
NO GAUSSIAN 1M MODELS LVEA NO2 ANNUAL



NO GAUSSIAN LVEA NO2 ANNUAL



NO GAUSSIAN MODELS 2-5 M LVEA NO2 ANNUAL



Annual NO₂ LV exceedance area

CFD

NO-Gaussian

Lagrangian

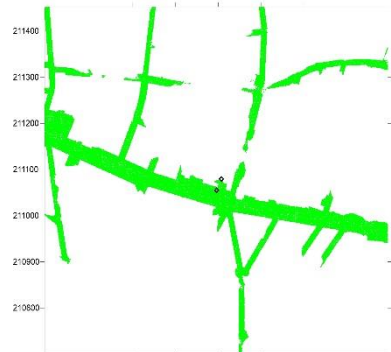
AI

Gaussian

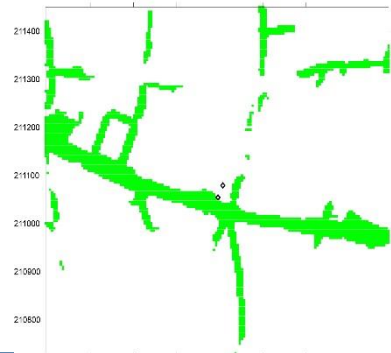
LVEA ANNUAL NO2 CIEMAT_STARd_1m



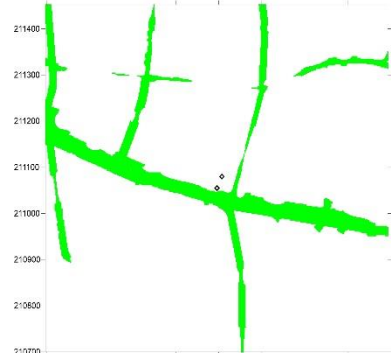
LVEA ANNUAL NO2 CERC_CIEMAT_1m



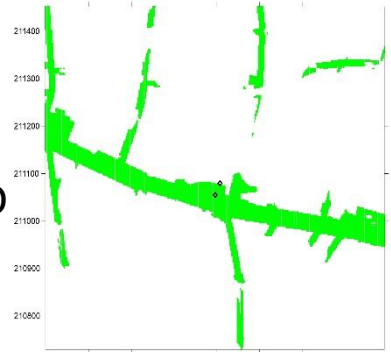
LVEA ANNUAL NO2 UOWM_ADREA_5m



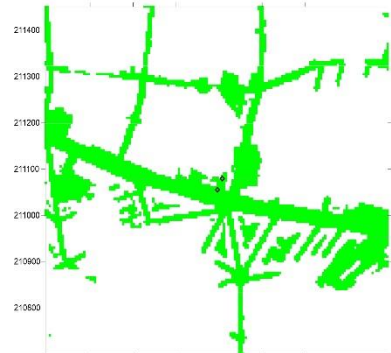
LVEA ANNUAL NO2 SZEO-OpenFoam_2m



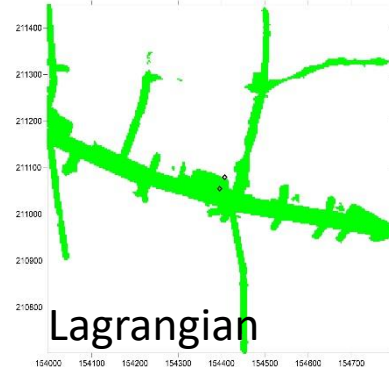
LVEA ANNUAL NO2 VITO-OpenFoam_2.5m



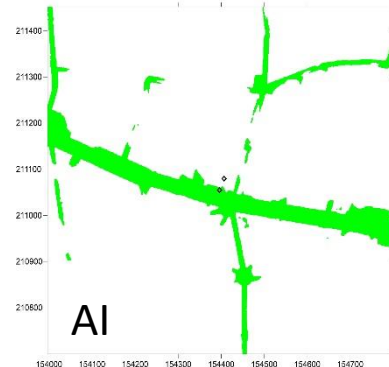
LVEA ANNUAL NO2 UPM-PALM4U_5m



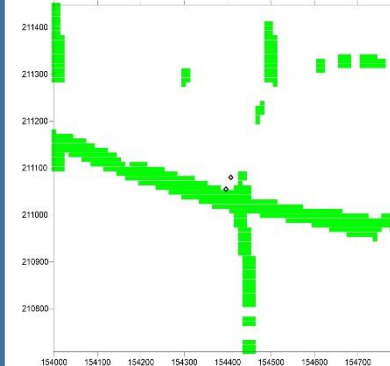
LVEA ANNUAL NO2 ENEA_PMSS_3m



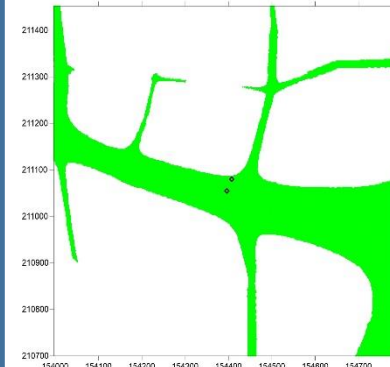
LVEA ANNUAL NO2 AIR-D-AI-3m



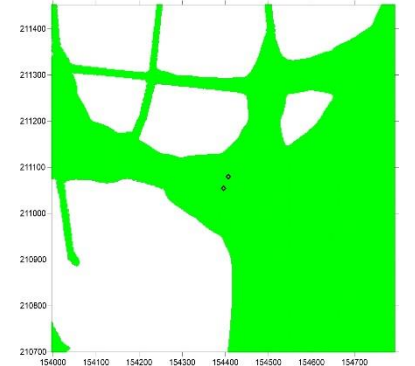
LVEA ANNUAL NO2 VITO-AtmoStreet10m



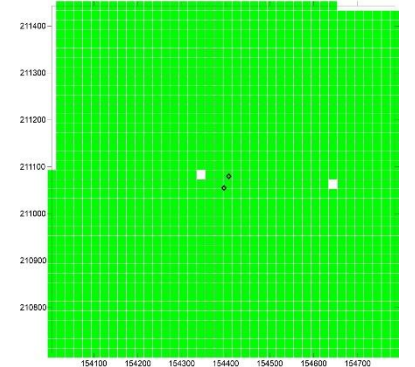
LVEA ANNUAL NO2 RICARDO_RAPIDAIR_2m



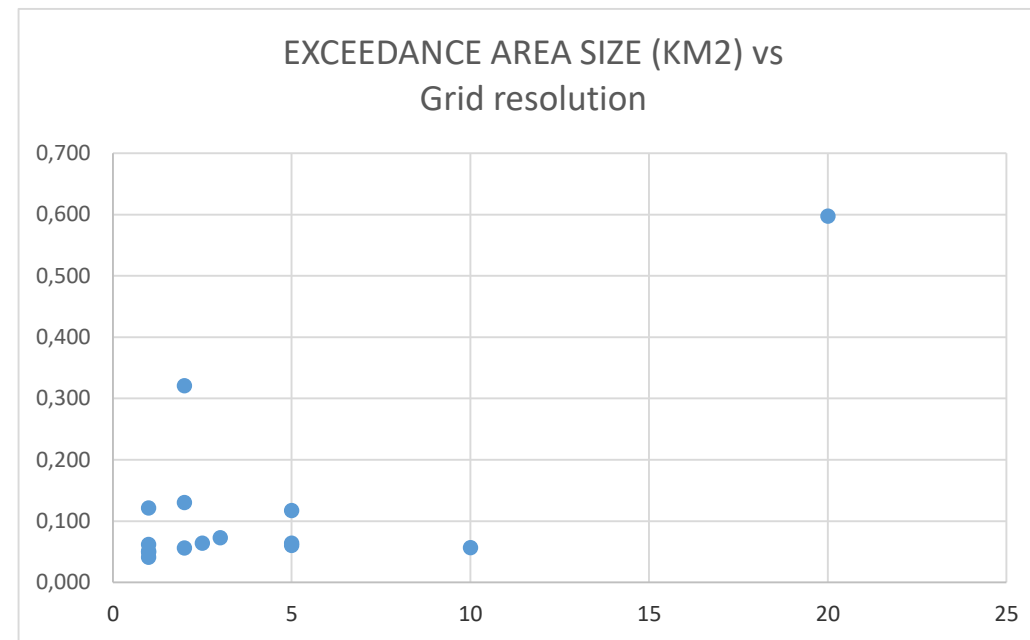
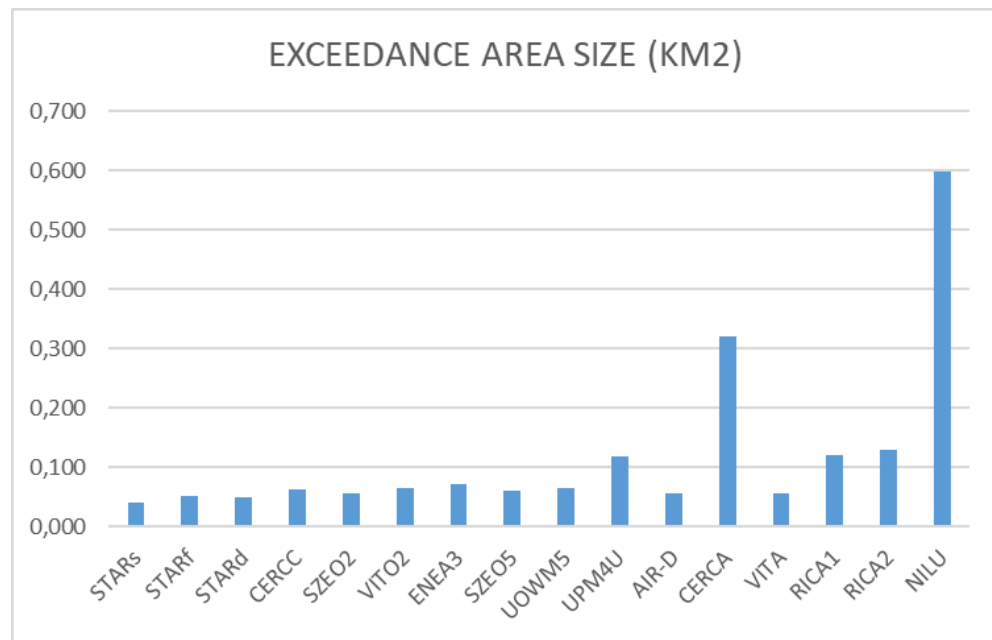
LVEA ANNUAL NO2 CERC_ADMS_2m



LVEA ANNUAL NO2 NILU_EPISODE_20m



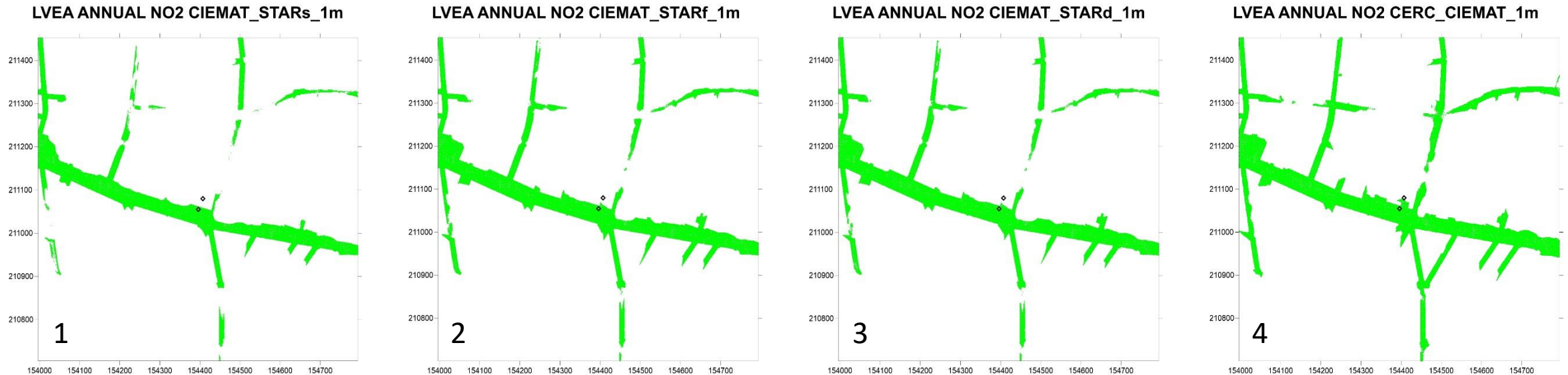
Annual NO₂ LV exceedance area



LVEA with same model but different methodology

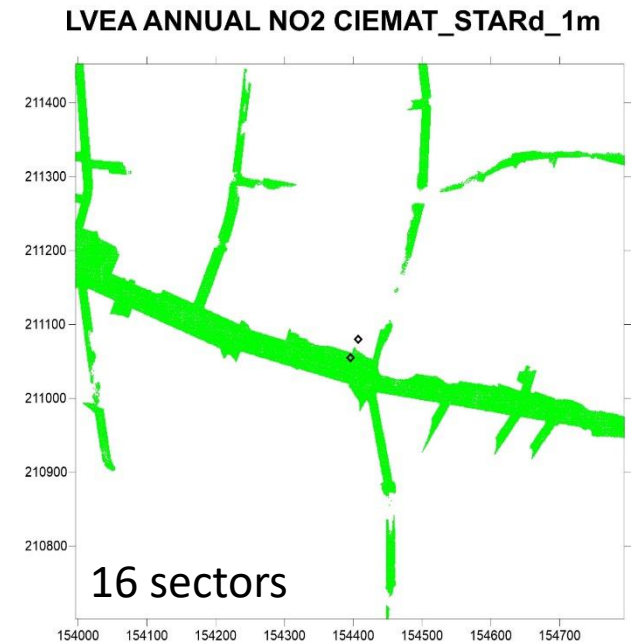
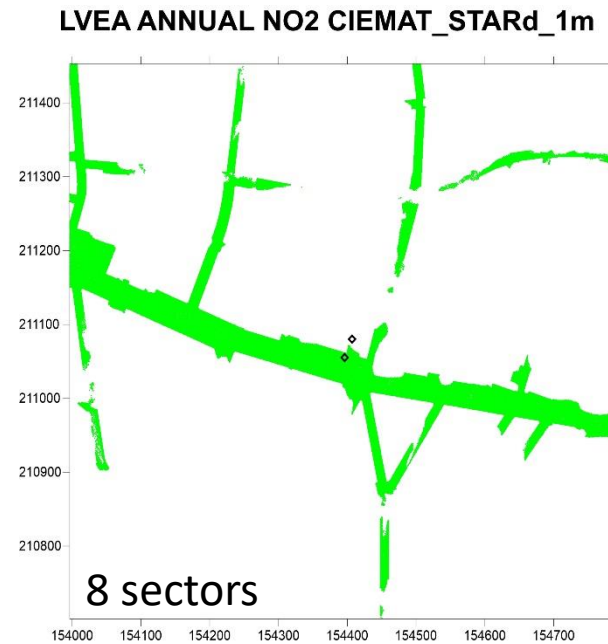
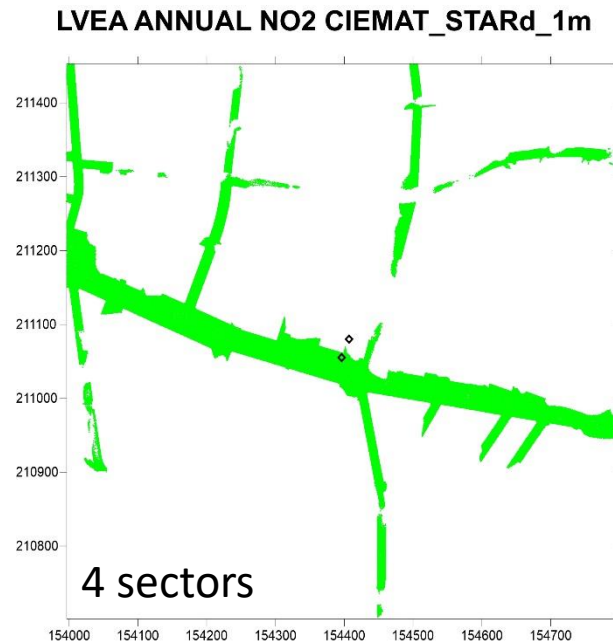
16 wind sectors

1. CIEMAT simple. One reference wind speed. Weighted average.
2. CIEMAT wind factor. Wind speed bins. Weighted average
3. CIEMAT detailed. Reconstruction hour by hour time series of concentration map
4. CERC-CIEMAT. Wind sectors combined with emission scenarios.



LVEA with same model & methodology but different number of scenarios

4, 8 and 16 wind sectors CIEMAT-DETAILED



Comments about LV exceedance areas (LVEA)

- Larger LVEA for most of Gaussian models ... but LVEA is not limited by buildings in several cases
- NO-Gaussian models have similar LVEA covering main streets and some other ones.
- CFD using wind sector scenarios (CIEMAT, CERC-CIEMAT, UOWM, VITO) and old SZE have similar LVEA.
- UPM based on LES simulation of representative days predicts a larger LVEA than the other CFD cases.
- Estimated LVEA from Lagrangian model (ENEA) and Artificial Intelligence (AIR-D) are very similar to CFD cases
- Some (small?) differences when using same model but different methodologies for retrieving long-term average concentrations
- Some (small?) differences when using same model & methodology but different number of scenarios

Spatial representativeness areas (SRA) comparison

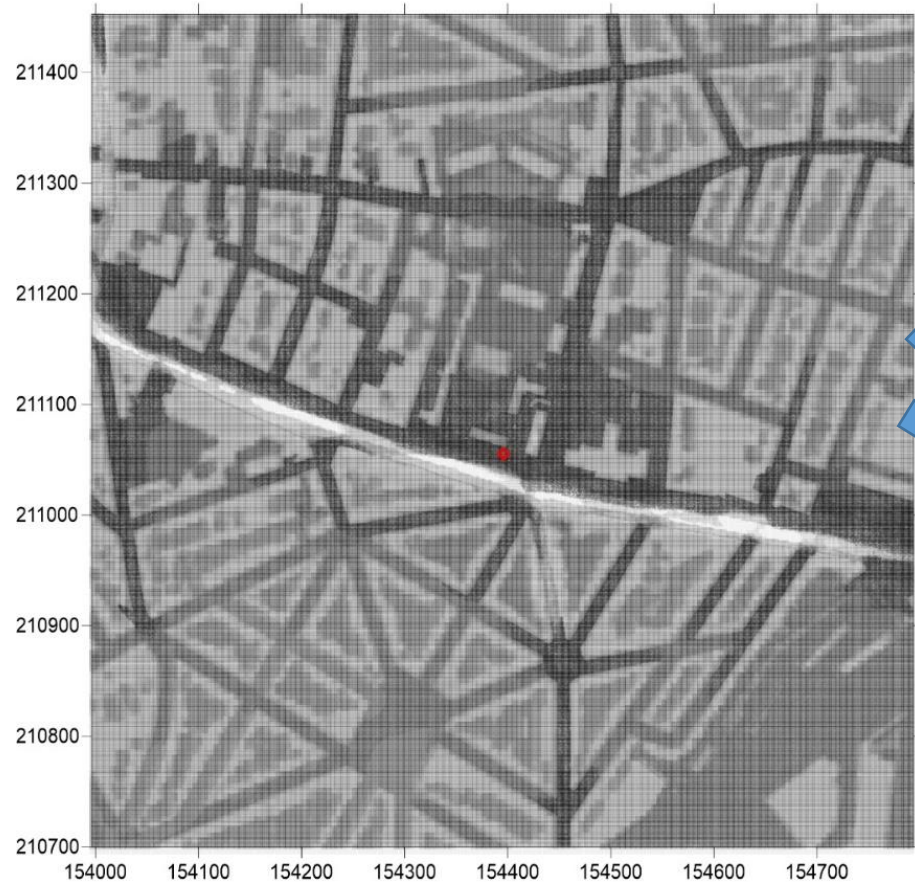
FAIRMODE WG4
Microscale Modelling

How different are the spatial representativeness areas?

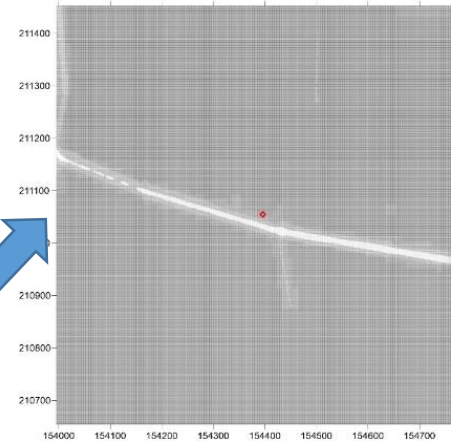
Traffic station (20% tolerance): Model ensembles

Darkest grey → all models
Darker grey → more models
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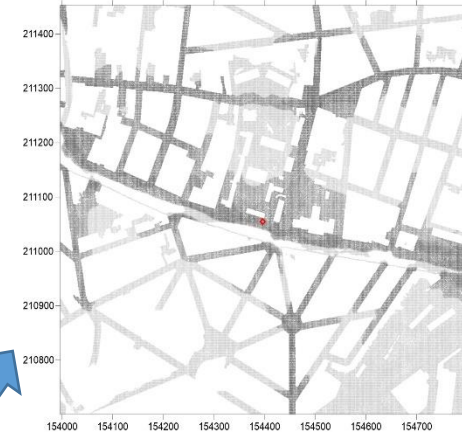
ALL MODELS SRA2 traffic station



GAUSSIAN MODELS SRA2 traffic station



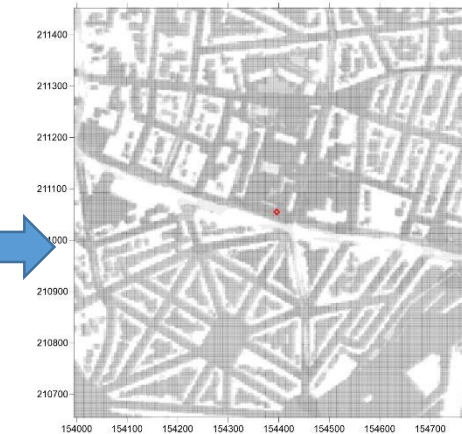
NO GAUSSIAN 1M MODELS SRA2 traffic station



NO GAUSSIAN SRA2 traffic station



NO GAUSSIAN MODELS 2-5 M SRA2 traffic station



SRA for traffic AQ station (tolerance 20%)

CFD

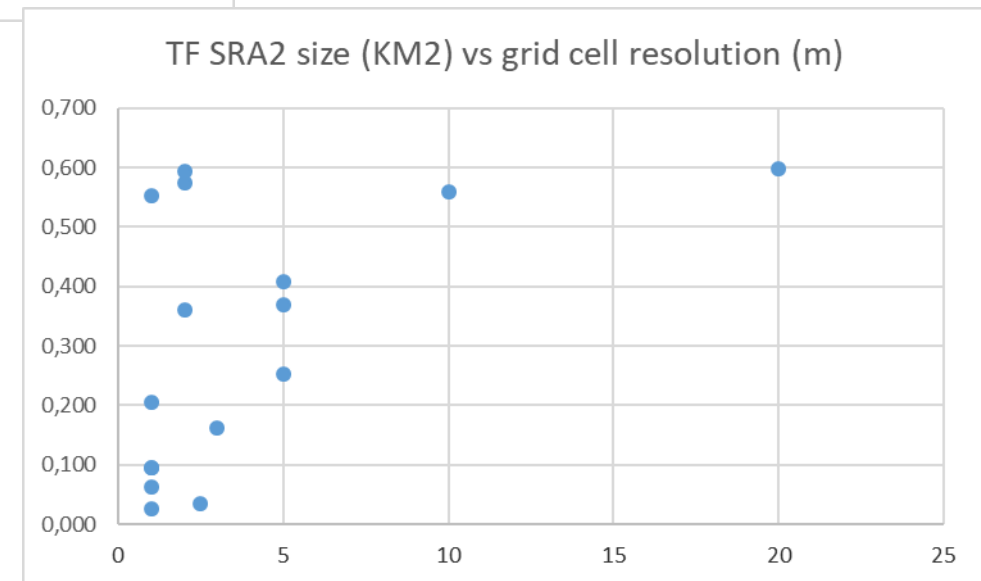
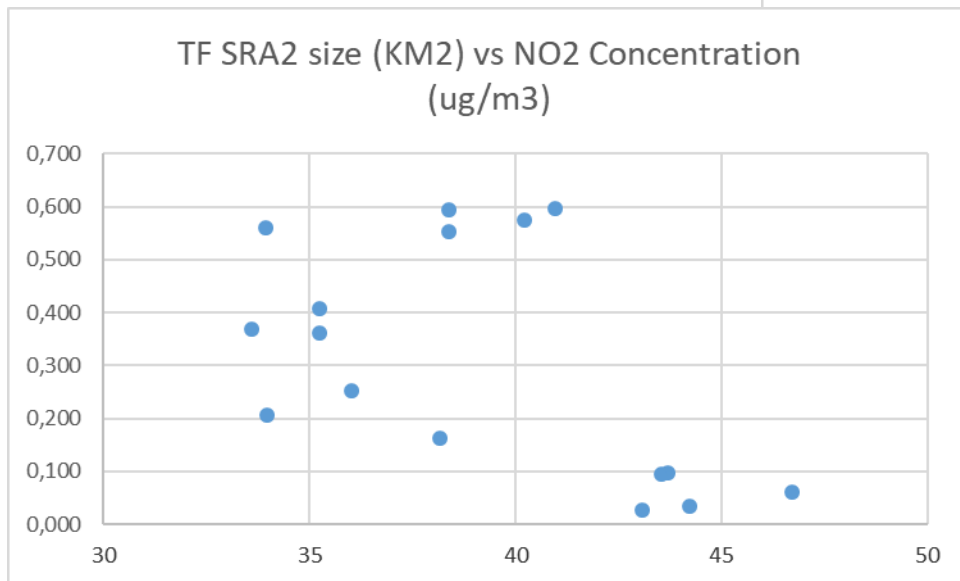
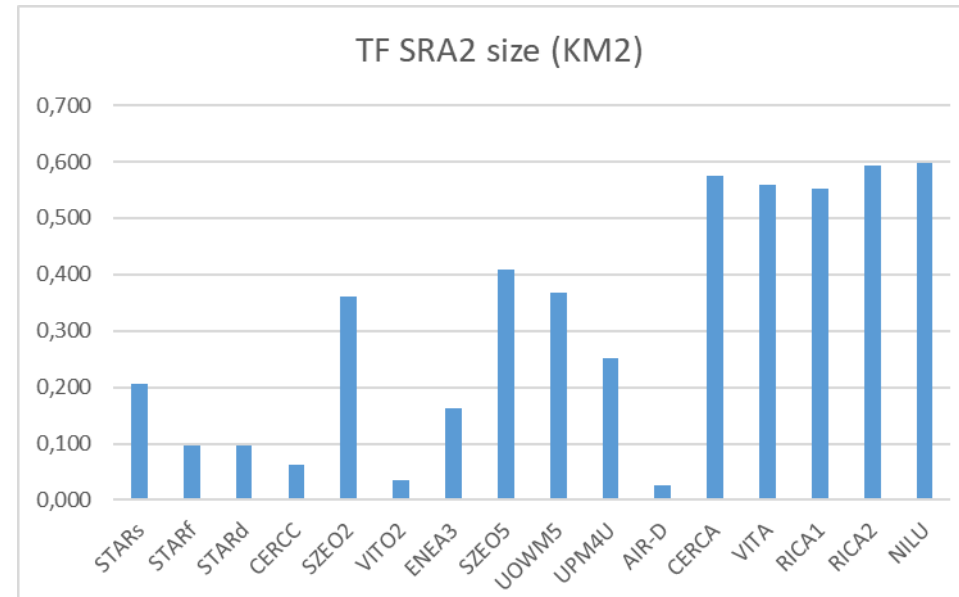
NO-Gaussian

Lagrangian

AI

Gaussian

SRA for traffic AQ station (tolerance 20%)

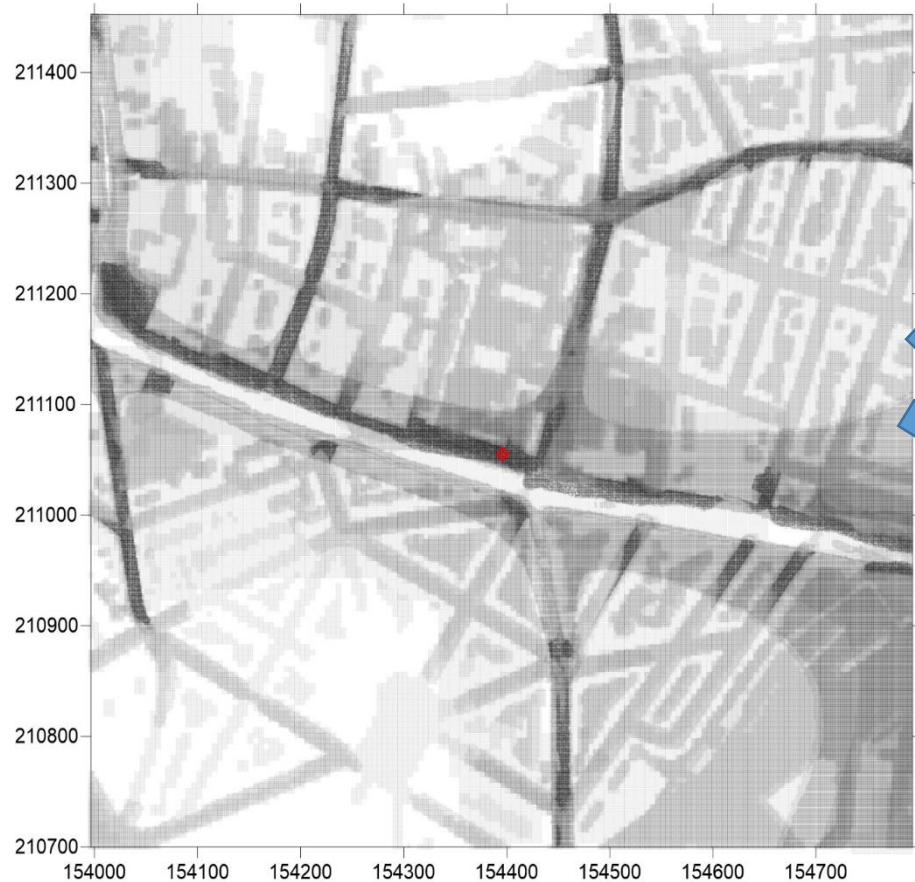


How different are the spatial representativeness areas?

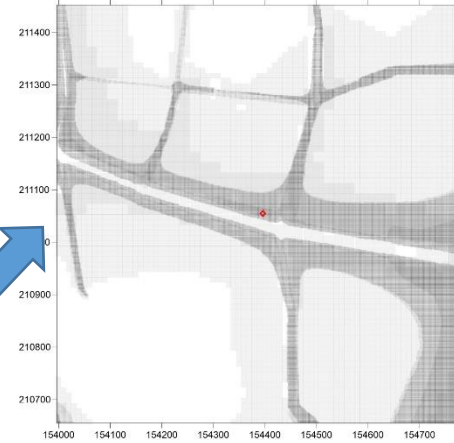
Darkest grey → all models
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Traffic station (10% tolerance): Model ensembles

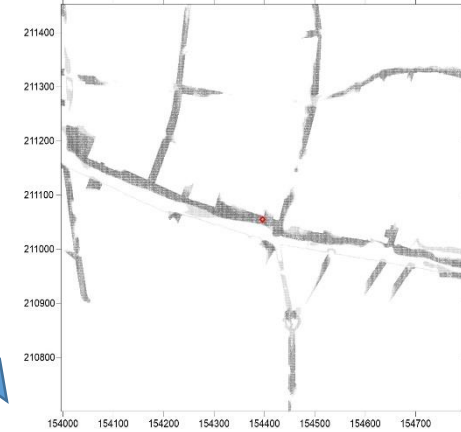
ALL MODELS SRA traffic station



GAUSSIAN MODELS SRA traffic station



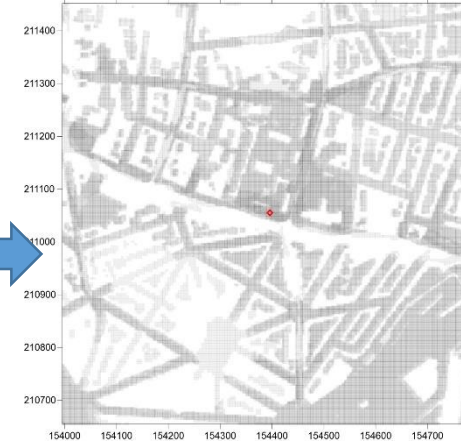
NO GAUSSIAN 1M MODELS SRA traffic station



NO GAUSSIAN SRA traffic station



NO GAUSSIAN MODELS 2-5 M SRA traffic station



SRA a for traffic AQ station (tolerance 10%)

CFD

NO-Gaussian

Lagrangian

AI

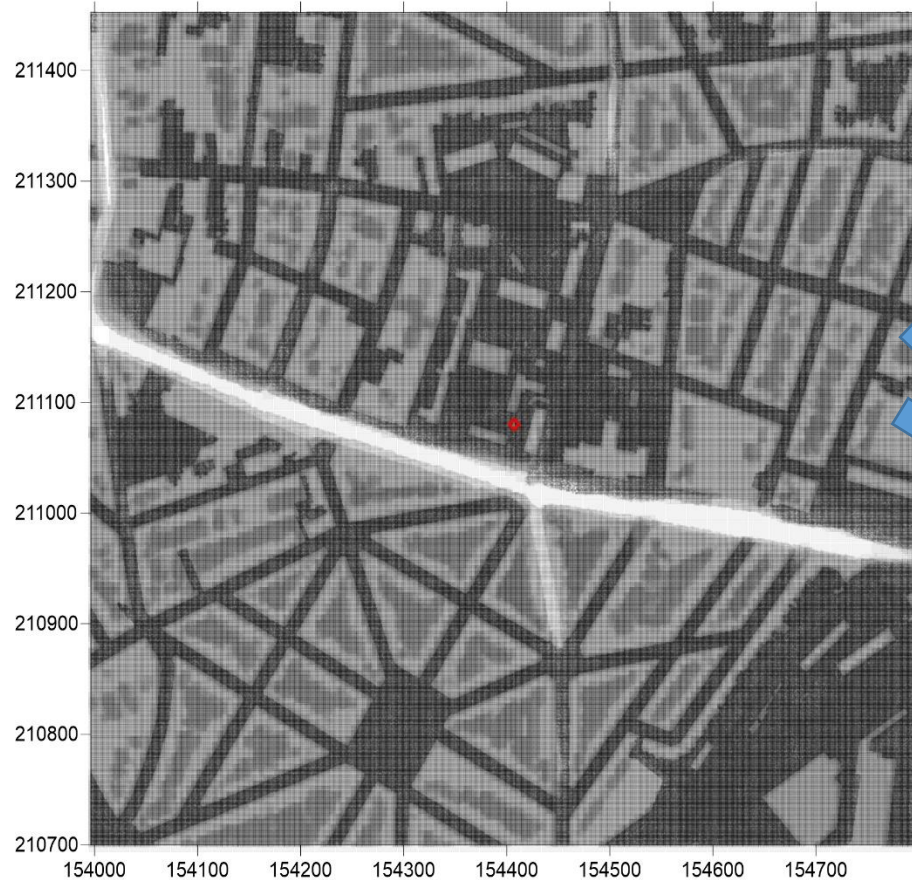
Gaussian

How different are the spatial representativeness areas?

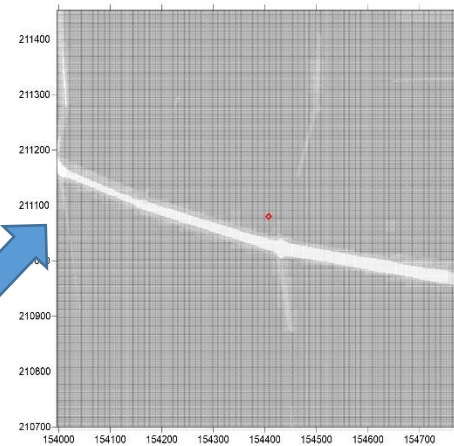
Darkest grey → all models
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Background station (20% tolerance): Model ensembles

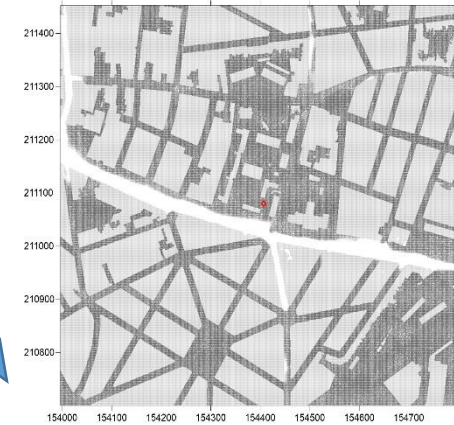
ALL MODELS SRA2 BG station



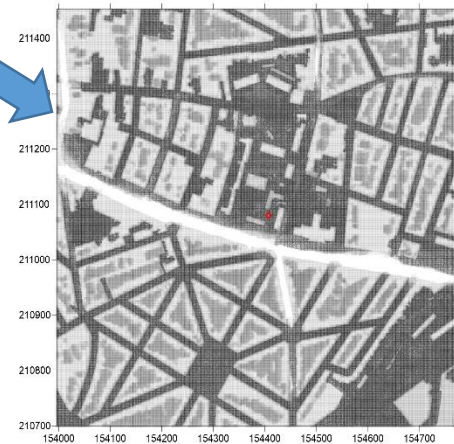
GAUSSIAN MODELS SRA2 BG station



NO GAUSSIAN 1M MODELS SRA2 BG station



NO GAUSSIAN SRA2 BG station

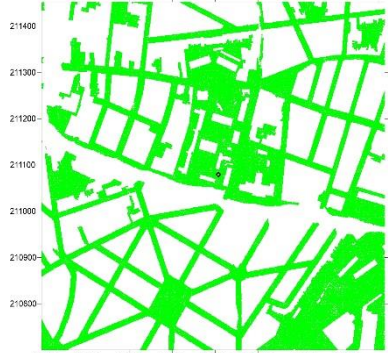


NO GAUSSIAN MODELS 2-5 M SRA2 BG station

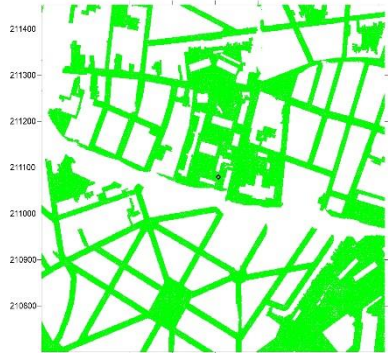


SRA for background AQ station (tolerance 20%)

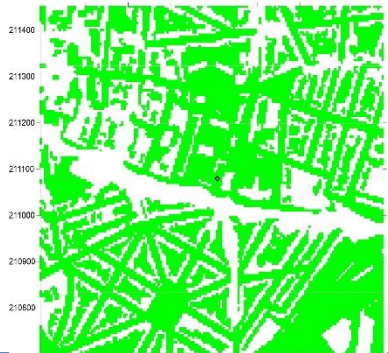
SRA2 BG station CIEMAT_STARd_1m



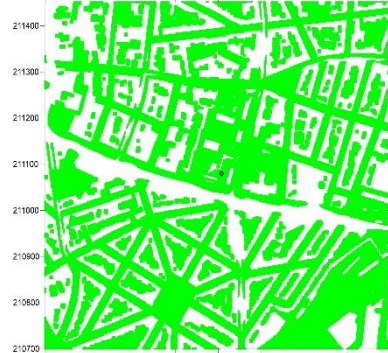
SRA2 BG station CERC_CIEMAT_1m



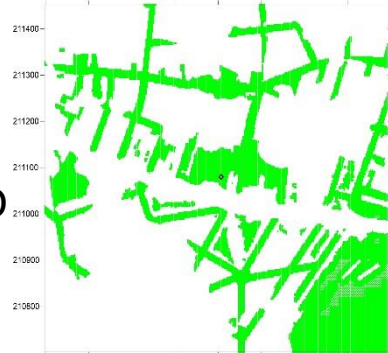
SRA2 BG station UOWM_ADREA_5m



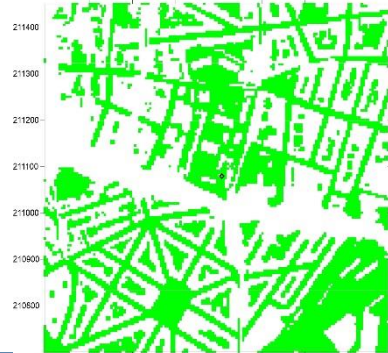
SRA2 BG station SZE0-OpenFoam_2m



SRA2 BG station VITO-OpenFoam_2.5m



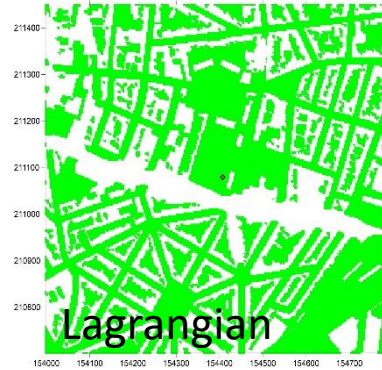
SRA2 BG station UPM-PALM4U_5m



CFD

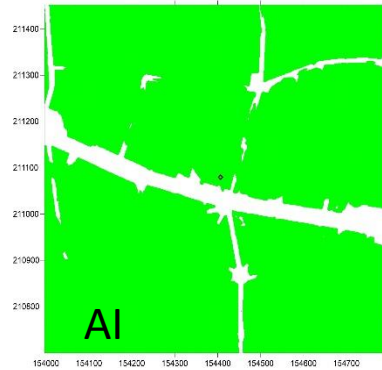
NO-Gaussian

SRA2 BG station ENEA_PMSS_3m



Lagrangian

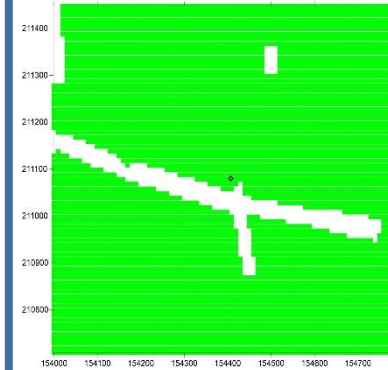
SRA2 BG station AIR-D-AI-3m



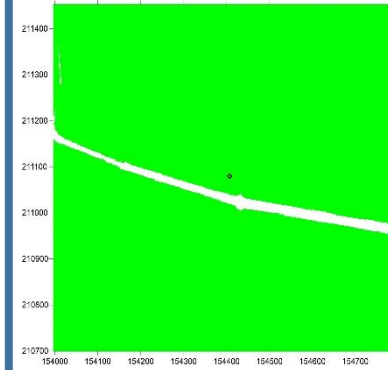
AI

Gaussian

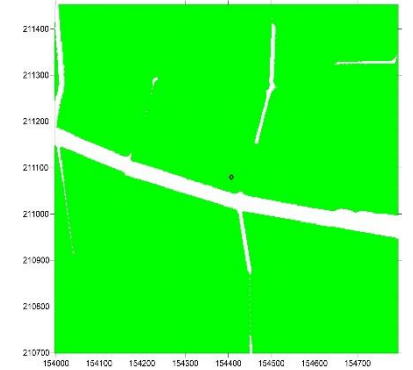
SRA2 BG station VITO-AtmoStreet10m



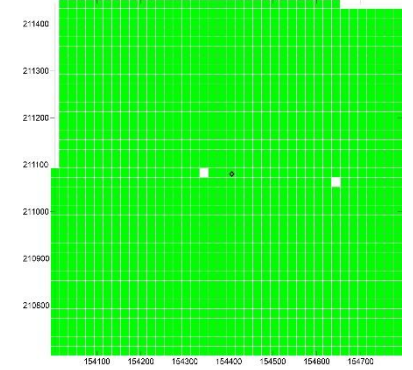
SRA2 BG station RICARDO_RAPIDAIR_2m



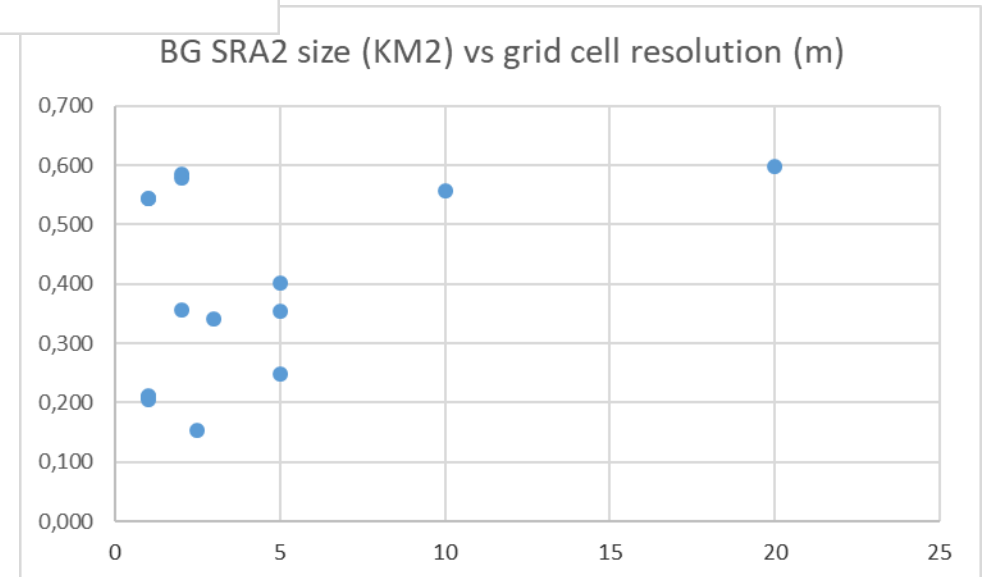
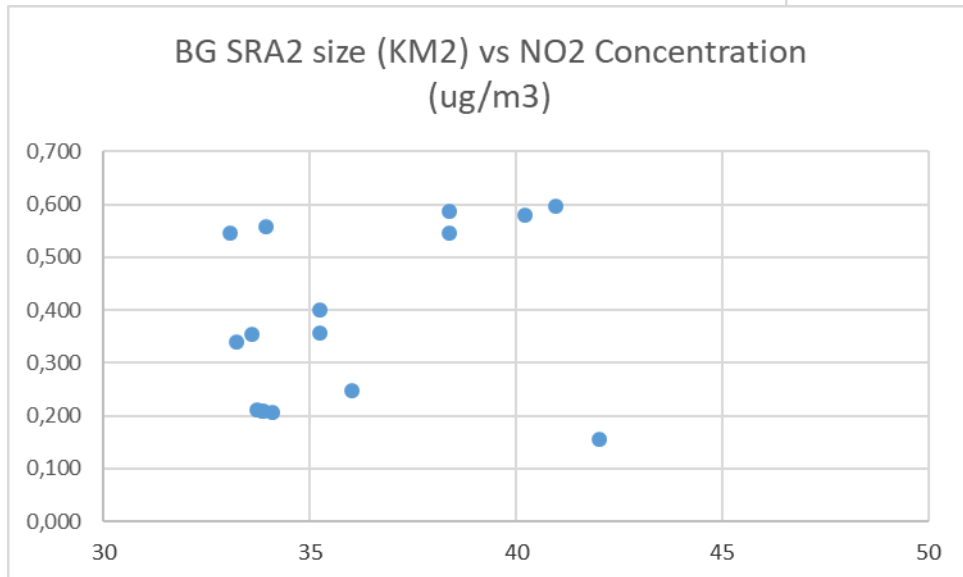
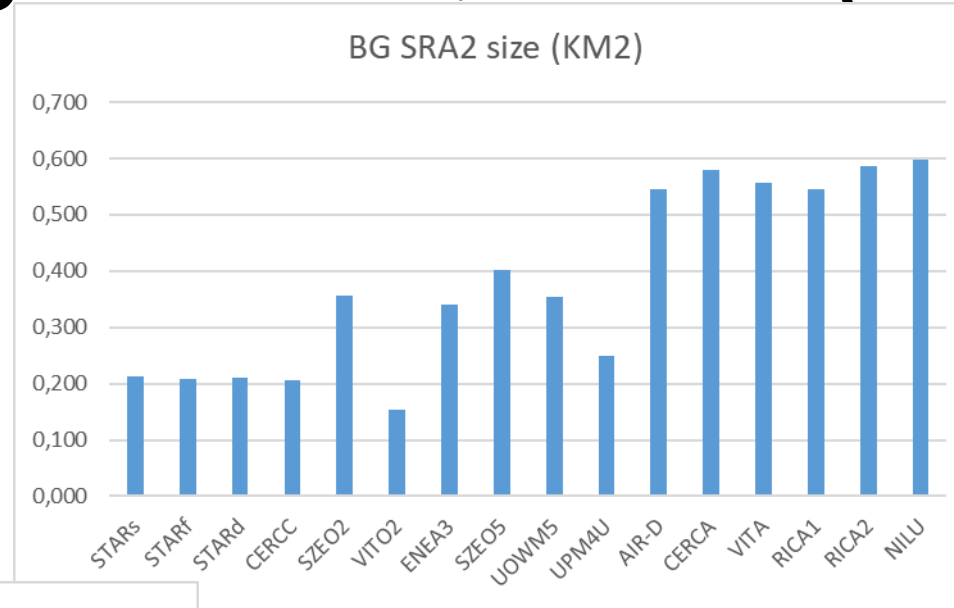
SRA2 BG station CERC_ADMS_2m



SRA2 BG station NILU_EPISODE_20m



SRA for background AQ station (tolerance 20%)

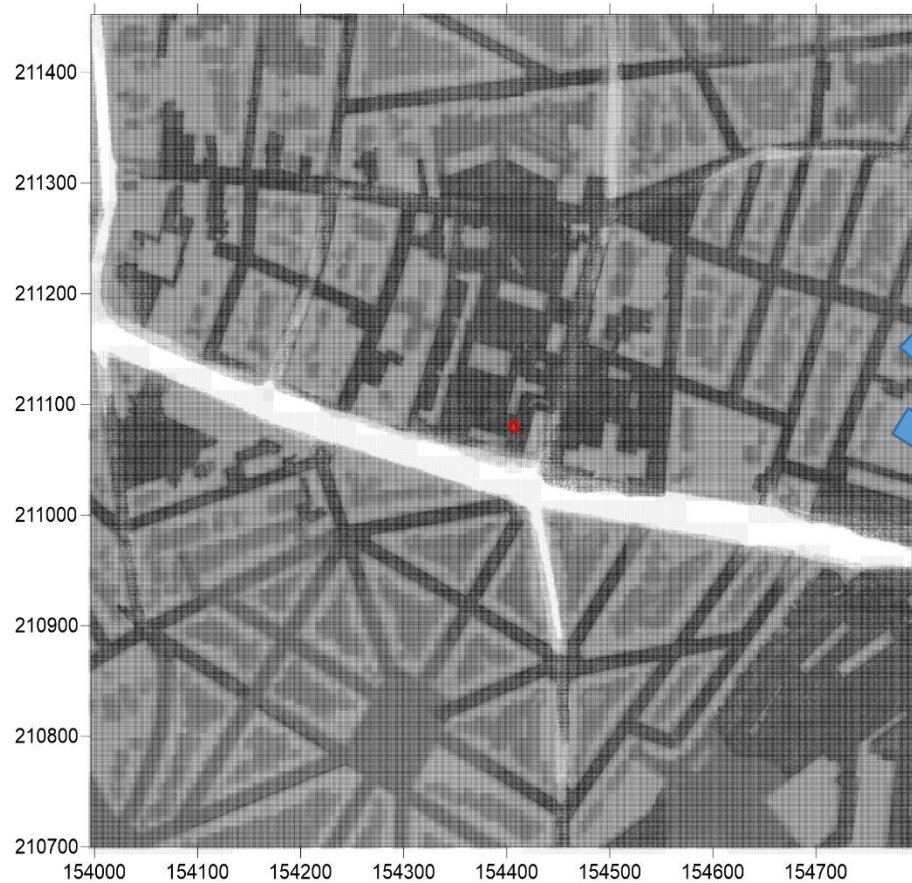


How different are the spatial representativeness areas?

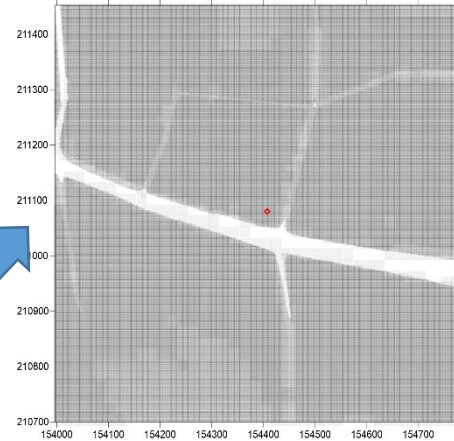
Darkest grey → all models
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Background station (10% tolerance): Model ensembles

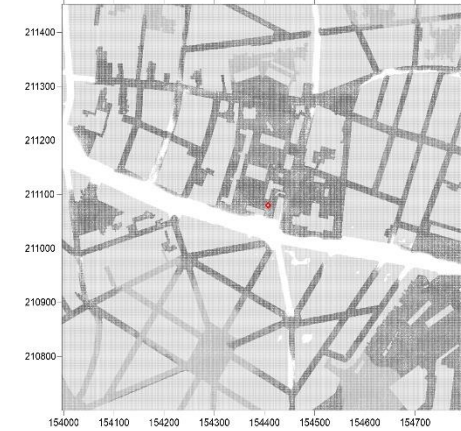
ALL MODELS SRA BG station



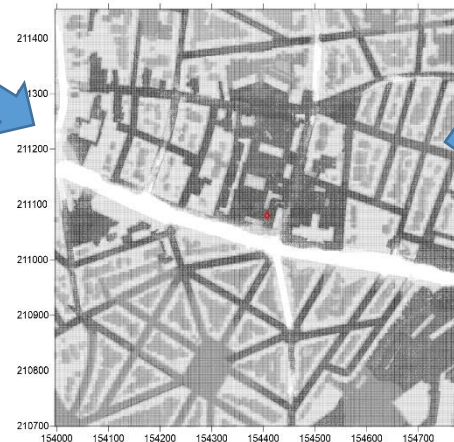
GAUSSIAN MODELS SRA BG station



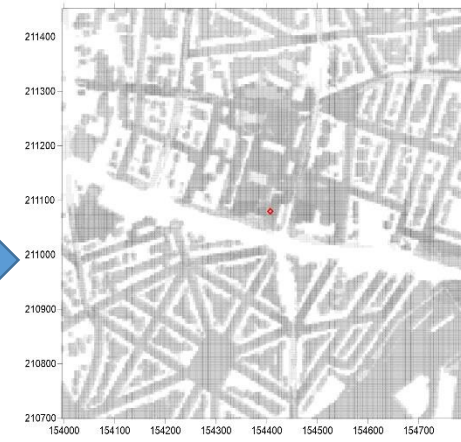
NO GAUSSIAN 1M MODELS SRA BG station



NO GAUSSIAN SRA BG station

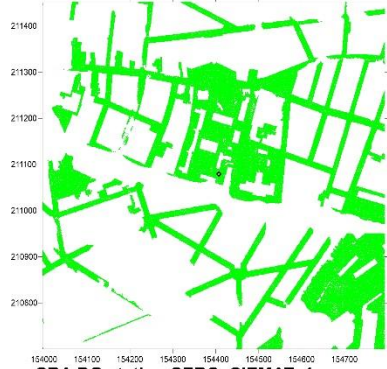


NO GAUSSIAN MODELS 2-5 M SRA BG station

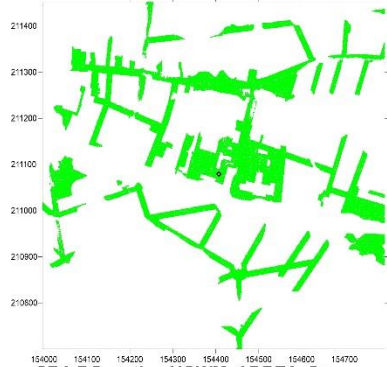


SR area for background AQ station (tolerance 10%)

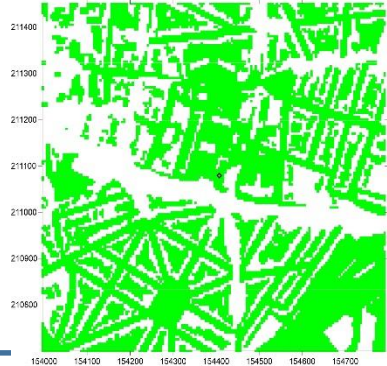
SRA BG station CIEMAT_STARd_1m



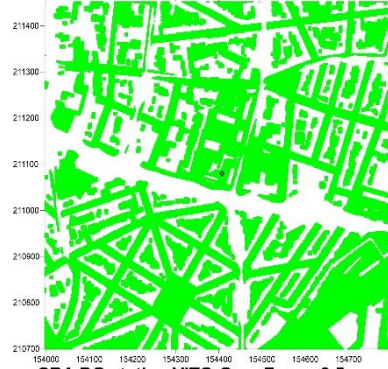
SRA BG station CERC_CIEMAT_1m



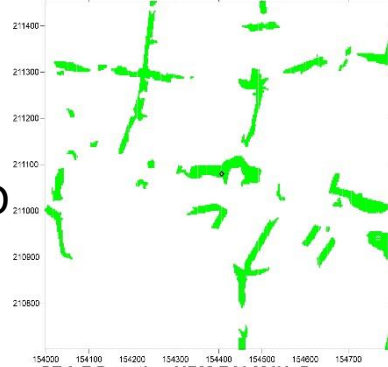
SRA BG station UOWM_ADREA_5m



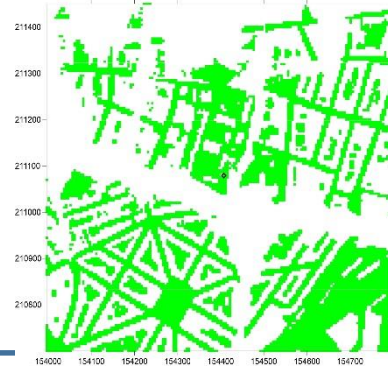
SRA BG station SZEO-OpenFoam_2m



SRA BG station VITO-OpenFoam_2.5m



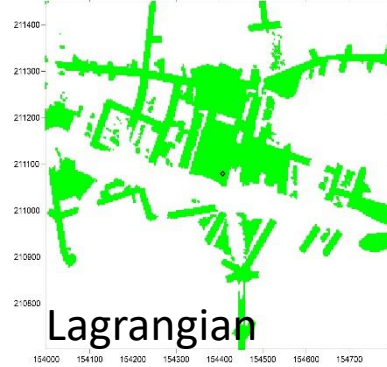
SRA BG station UPM-PALM4U_5m



CFD

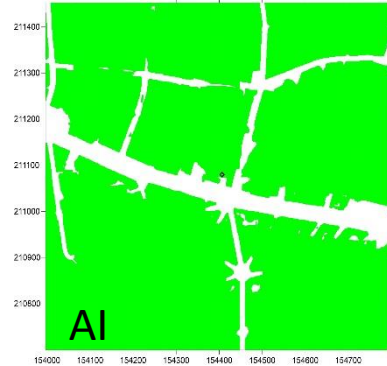
NO-Gaussian

SRA BG station ENEA_PMSS_3m



Lagrangian

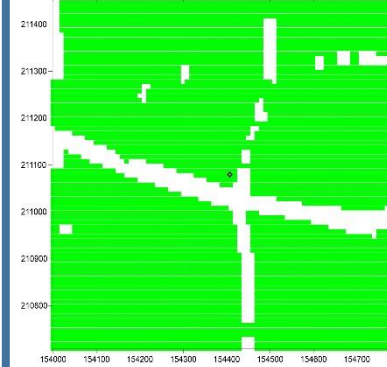
SRA BG station AIR-D-AI-3m



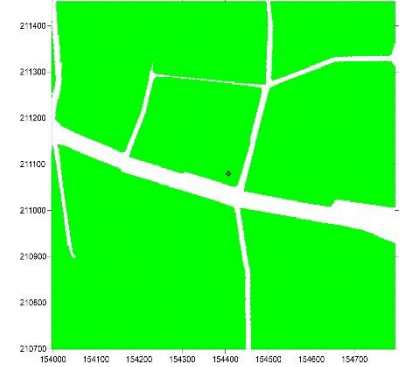
AI

Gaussian

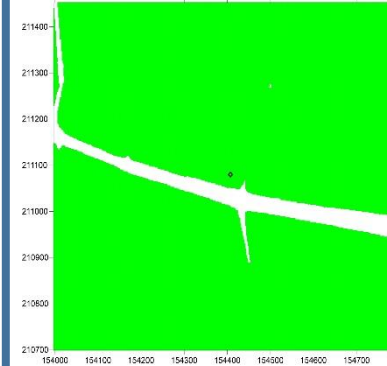
SRA BG station VITO-AtmoStreet10m



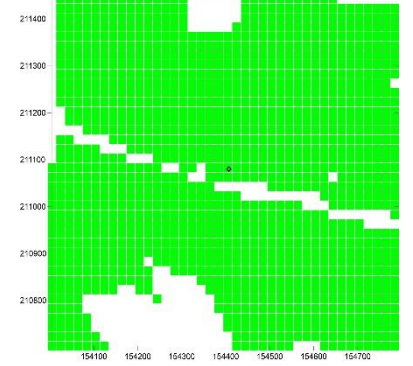
SRA BG station CERC_ADMS_2m



SRA BG station RICARDO_RAPIDAIR_2m



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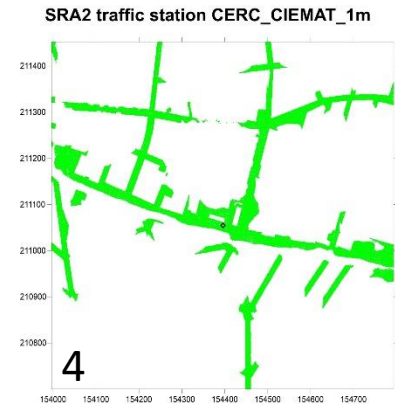
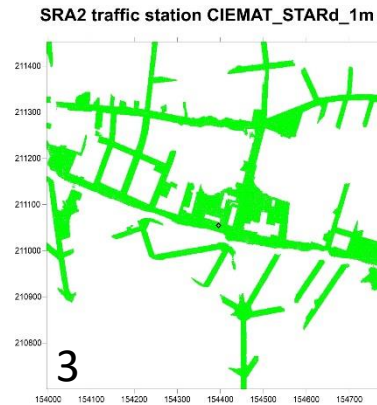
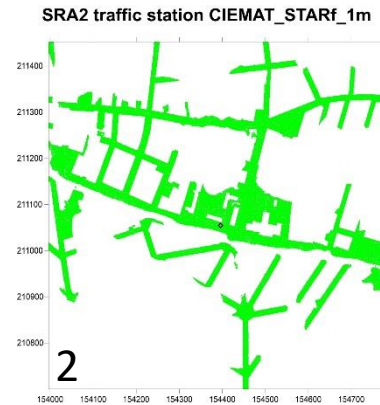
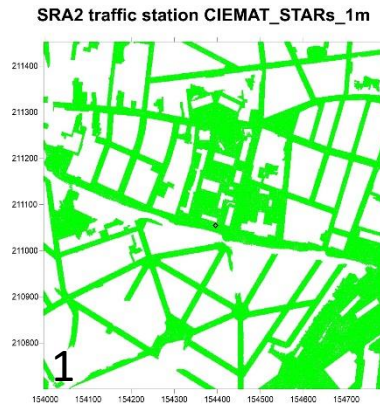


SRA with same model but different methodology

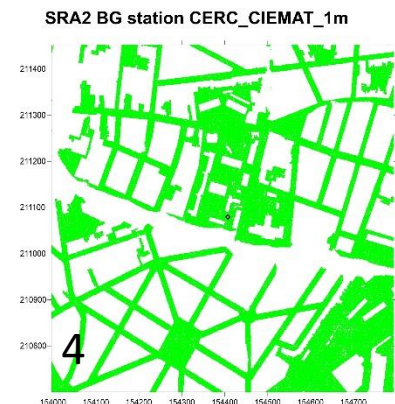
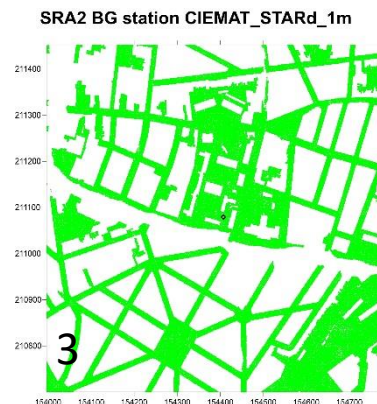
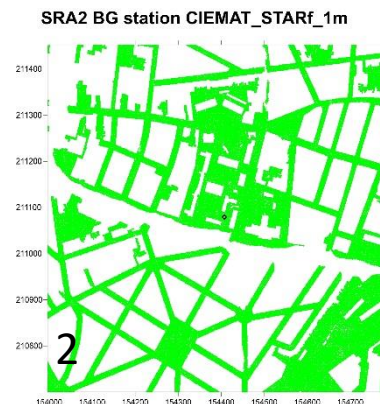
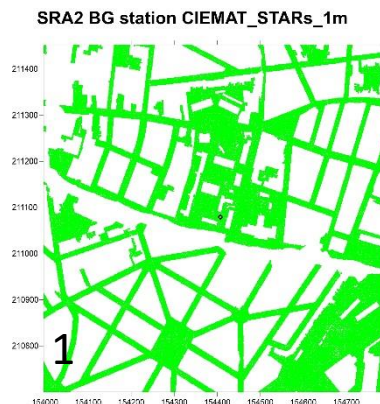
16 wind sectors, tolerance 20%

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2. CIEMAT wind factor. Wind speed bins. Weighted average
3. CIEMAT detailed. Reconstruction hour by hour time series of concentration map
4. CERC-CIEMAT. Wind sectors combined with emission scenarios.

Traffic station



Background station

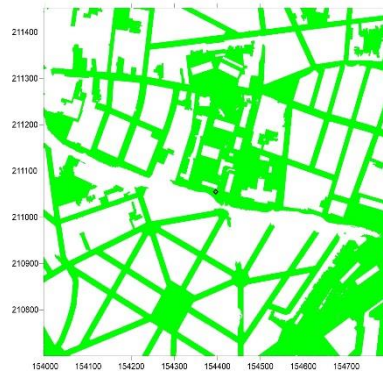


SRA with same model & methodology but different number of scenarios

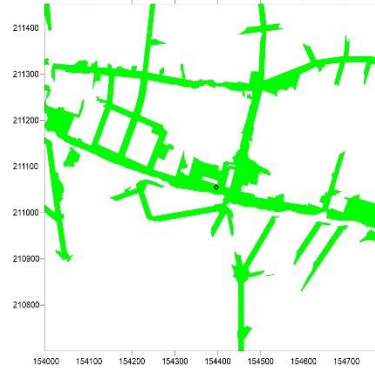
4, 8 and 16 wind sectors CIEMAT-DETAILED, tolerance 20%

Traffic station

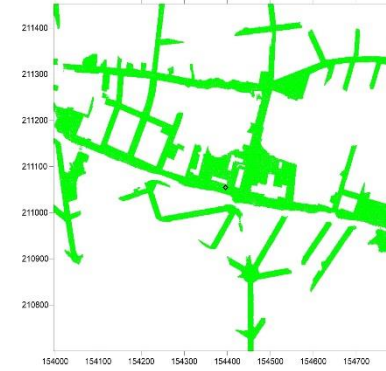
SRA2 traffic station CIEMAT_STARd_1m



SRA2 traffic station CIEMAT_STARd_1m

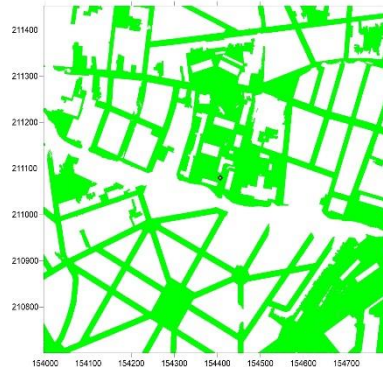


SRA2 traffic station CIEMAT_STARd_1m

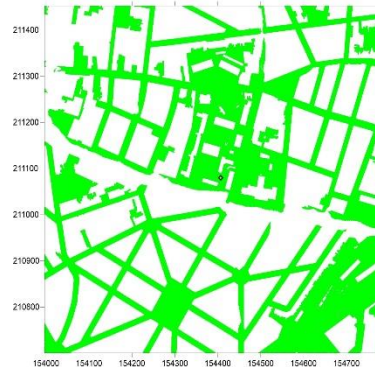


Background station

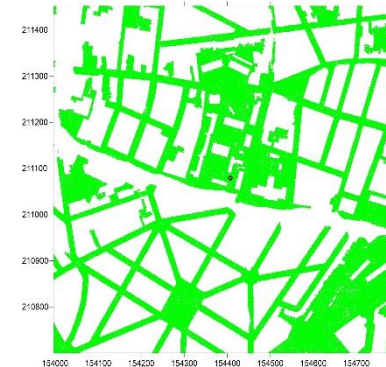
SRA BG station CIEMAT_STARd_1m



SRA BG station CIEMAT_STARd_1m



SRA2 BG station CIEMAT_STARd_1m



4 sectors

8 sectors

16 sectors

Comments about SRA

- More differences for the SRAs computed with tolerance 20% respect 10% for traffic station than for background station.
- Larger SRA for Gaussian models ... but not limited by buildings
- Large variability of SRAs (tolerance 20%) computed with NO-Gaussian models specially for the traffic station. Two groups with different SRA.
 - One group (3 CFD) with SRA covering almost all streets.
 - Another one (3 CFD, AI and Lagrangian) with SRA only main streets.
- Except for one of the Gaussian models, the estimated SRAs do not include most part of the main street, where traffic station is sited.
- For the background station,
 - SRAs computed with the same CFD model and different methodologies are rather similar
 - SRAs computed with the same CFD model and methodology but different number of scenarios are rather similar
- For the traffic station,
 - SRA computed with only wind sectors and one reference velocity is larger than the other more complex methodologies.
 - Using only 4 wind sectors scenarios gives rise larger SRA

Discussion