



LIFE 15 IPE IT 013



Preliminary assessment and IAM models in LIFE IP *Po R*egions *E*ngaged to *P*olicies of *Air* (PREPAIR)

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Project area and beneficiaries

6 Regions

Emilia-Romagna, Lombardy,
Piedmont, Veneto, Friuli Venezia
Giulia, Province of Trento;

7 Environment Agencies

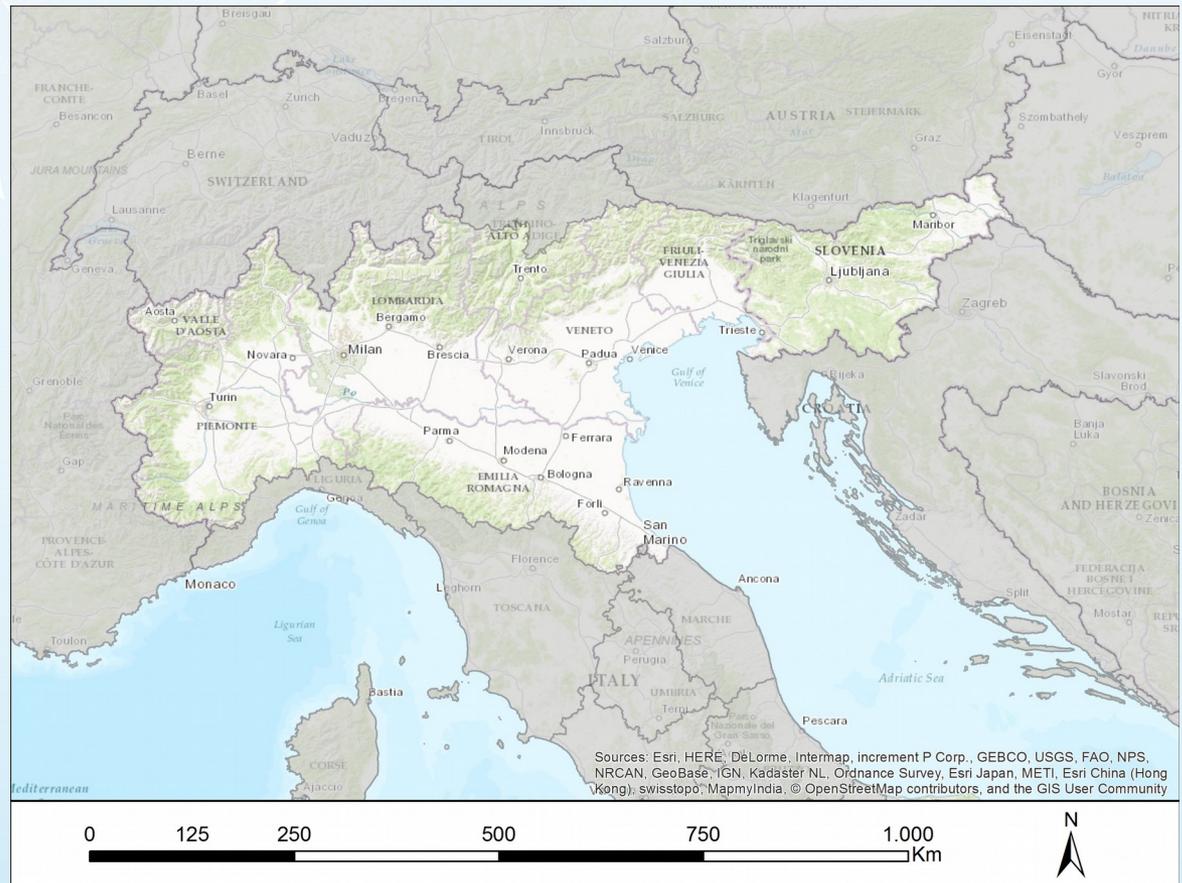
ARPAE Emilia-Romagna, ARPA
Lombardy, ARPA Piedmont, ARPA
Veneto, ARPA Valle d'Aosta,
ARPA Friuli Venezia Giulia,
Slovenian Environment Agency

3 Municipalities

Bologna, Turin, Milan

2 Private non-commercial agencies

ART-ER, FLA



From: 1/2/2017 to 31/01/2024 (7 years– 3 phases)



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Why an integrated project: aims and expected results

All the Regions have implemented air quality plans over the past decade, but these plans have not been fully succeeded in reducing levels of PM, NO₂ and O₃ within the EU standards. Coordinated and large-scale actions should be undertaken in the Po valley to further reduce the levels of background air pollution. **Po Valley Agreements on air quality** in 2005 and 2013 establishment of common actions on in the most important emission sources: **transport, biomass for domestic heating, energy efficiency, agriculture**, with the involvement of the Ministry for Environment and other competent Ministries

prepAIR will

- help the full implementation of AQPs and of measures of the Po Valley Agreement *on a larger territorial scale* → **environmental concrete actions by Regions and Cities**
- establish a permanent data sharing infrastructure for monitoring and assessing air quality and measures implementation in the project area → **technical actions by EAs**
- allow to assess and reduce pollutants transportation across the Northern Adriatic Sea
- act on multiple sectors/policies and on multiple pollutants (PM, NO₂, O₃, NH₃, VOC)

and wants to

- strengthen the synergies among Regions and Environment Agencies on air quality issues and policies
- establish a ***Permanent government platform*** composed by:
 - Representatives of the Regions involved in air quality issue
 - Representatives of the Authorities in charge of complementary funds
 - Stakeholders



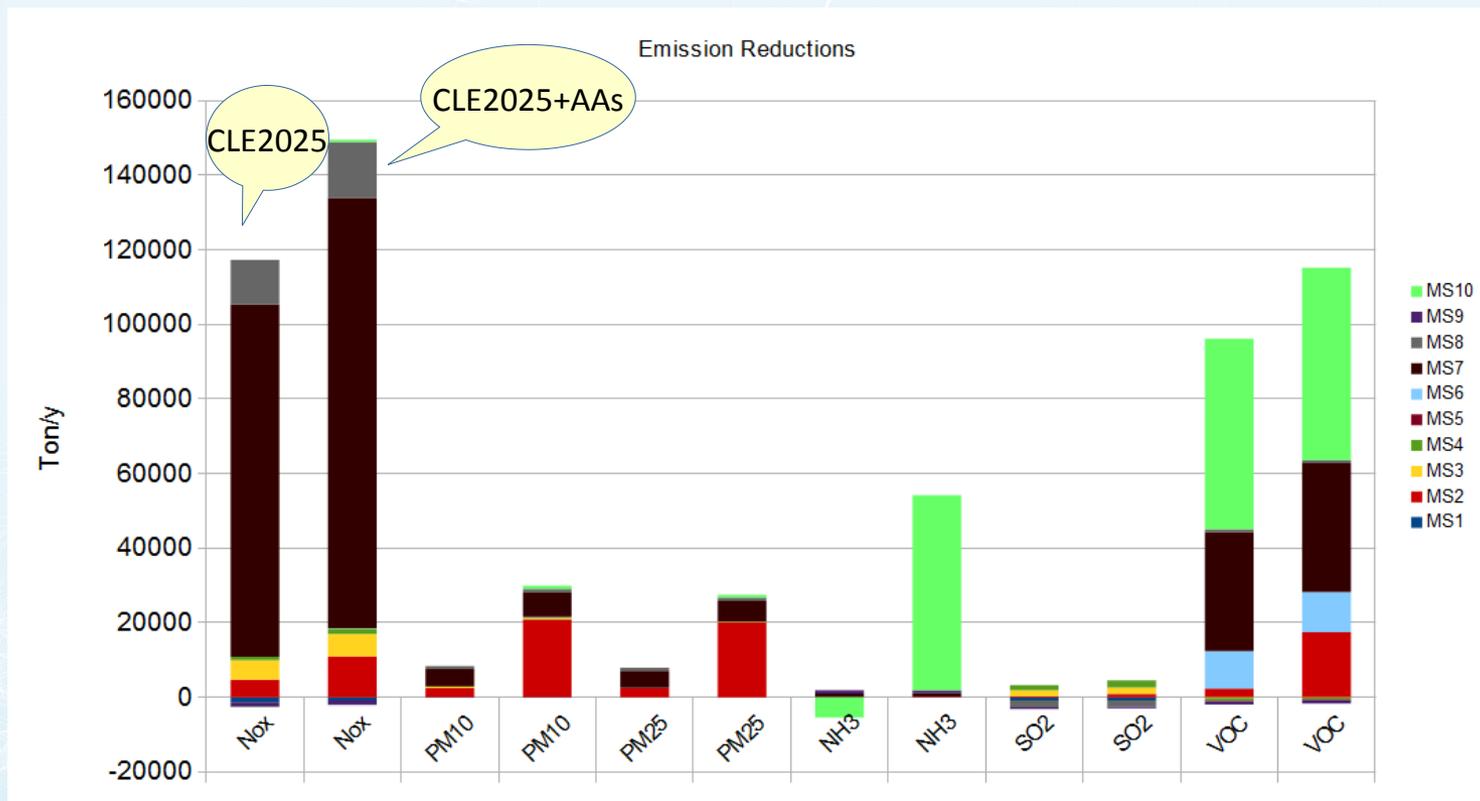
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Preliminary assessment and Emission Scenarios



- **2013 baseline scenario:** union of local or national inventories (in the case of Slovenia) developed in the different territorial areas, maintaining the greatest possible detail on the classification of the types of emission sources and with reference to the territory of each municipality.
- **2025 CLE “No plan” scenario:** scenario derived from a survey among local regional emission inventory compilers and the emission scenario SEN14 calculated with GAINS-Italy by ENEA.
- **2025 CLE +AAS scenario:** scenario with the implementation of all Regional Air Quality Plans, the Po Valley Agreement and the prepAIR actions. This scenario was evaluate following this methodology:
 - exclusion from the analysis of all the measures without an emission reduction target;
 - standardization of the emission reductions to 2025 as a common AQP reference year;
 - link of each measure to emission activities (SNAP and fuel codes);
 - prepAIR project actions: improve proportionally (through a percentage) the performance of AQPs measures that act in the same sectors;

Reduction Emissions Scenarios



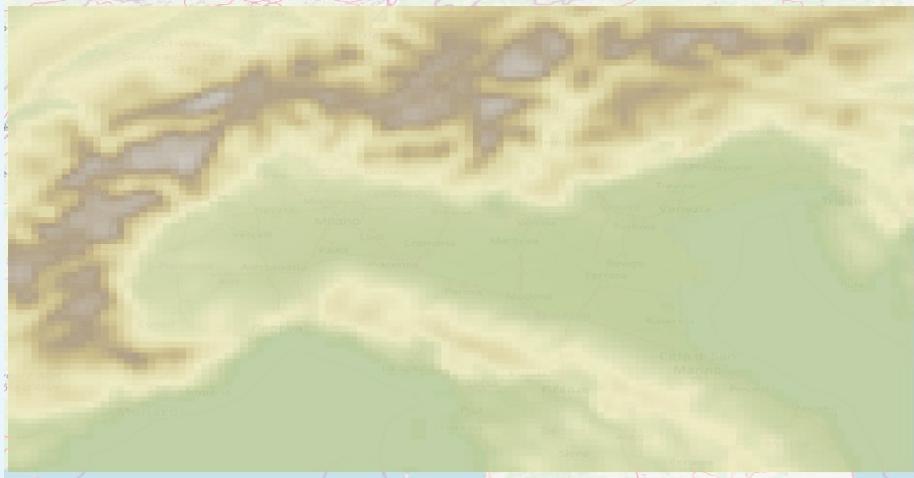
Reduction CLE2025+AAs respect to basecase 2013

NOx 39%, PM10 40%, PM25 42%, NH3 22% ,SO2 3%, VOC 19%



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Preliminary Assessment Simulation Setup



CTM: CHIMERE, implemented by ARPAE Emilia Romagna

Simulation year: 2016

Emission: Base Case (2013), CLE2025, CLE2025+AAs

Meteo: COSMO I7

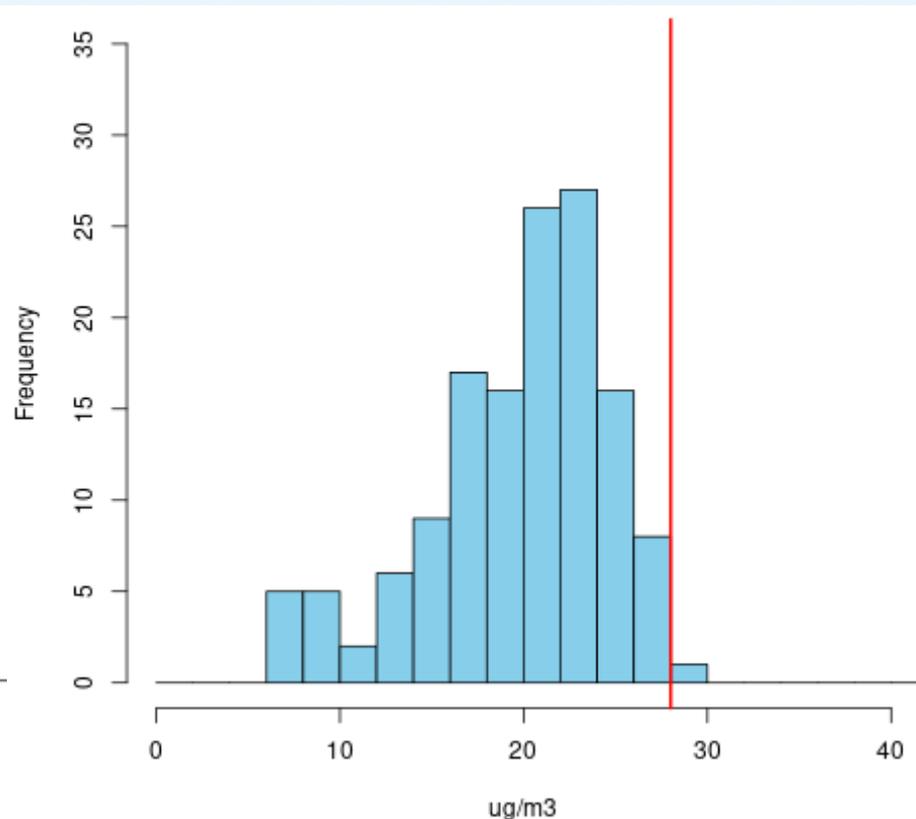
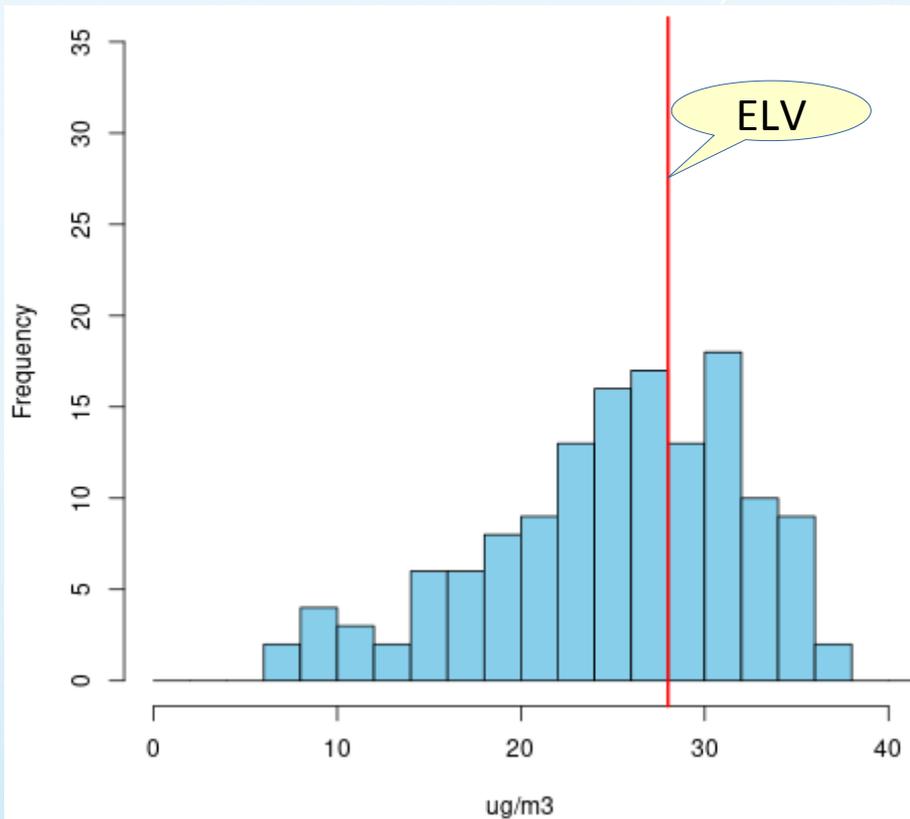
BC: Analysis fields from Prev'Air service

Horizontal resolution: SW Lon 6.25, Lat 43.1, Dx= 0.07 Dy=0.05

Frequency annual PM10 concentration distribution background station

Base case scenario

CLE2025+AAAs scenario





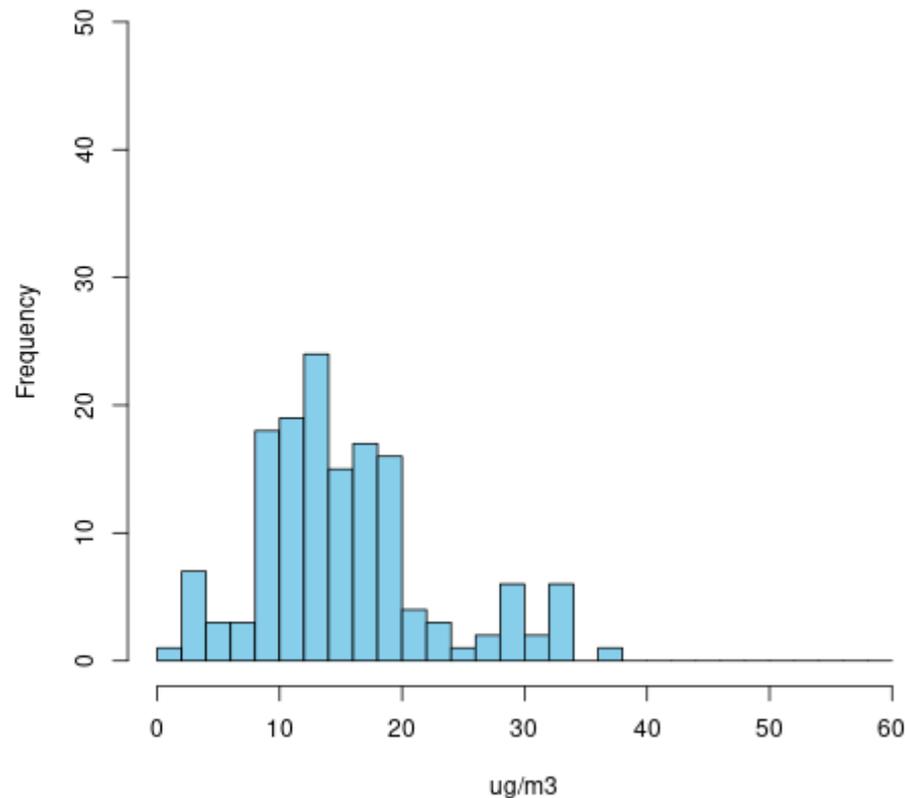
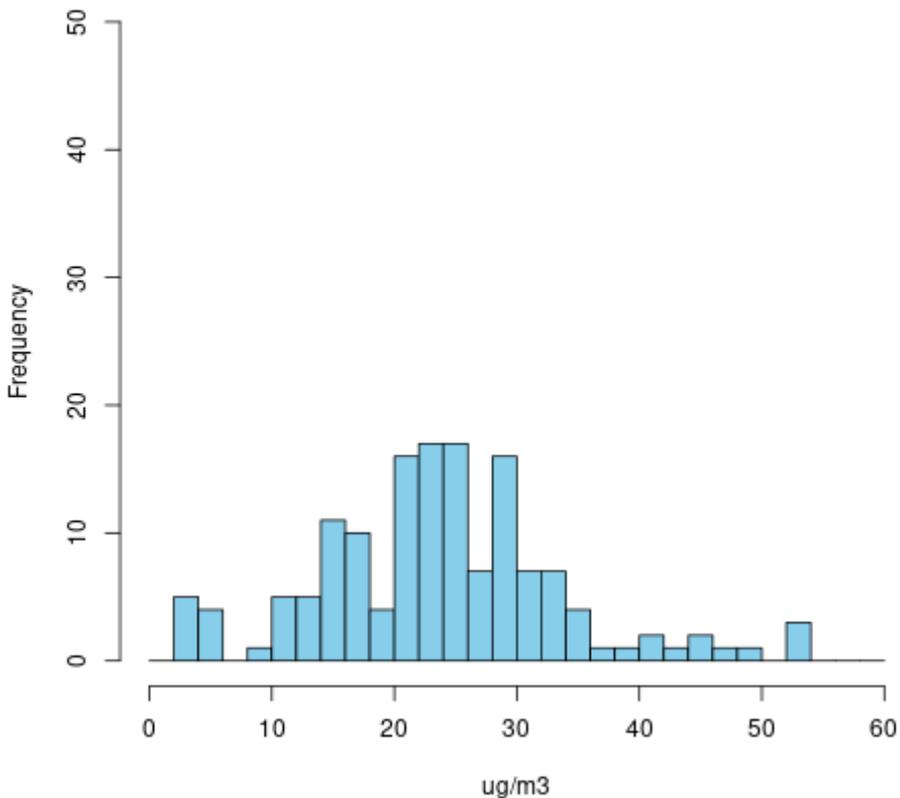
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Frequency annual NO₂ concentration distribution background station

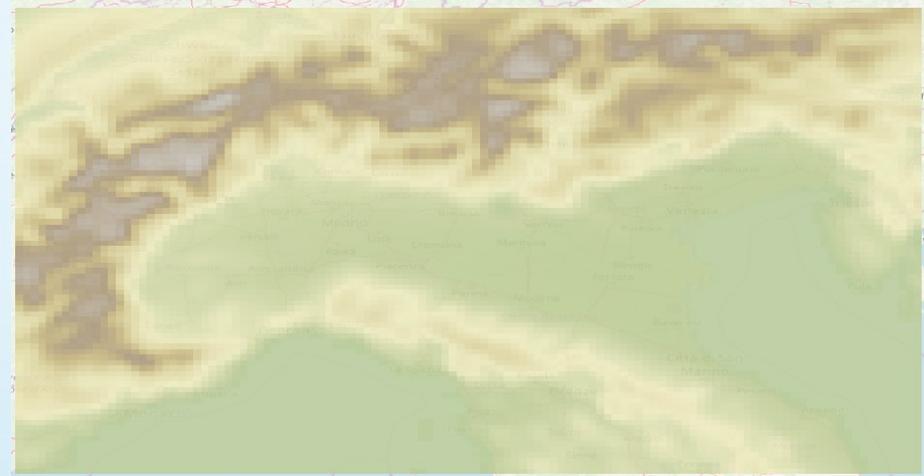
Base case scenario

CLE2025+AAs scenario



Derivation of source-receptor model for RIAT+ CTM Setup for training and validation simulations

- **Modelling domain and resolution:**
 - SW corner: lon=6,25 E, lat=43,10N;
 - dx=0,07°; dy=0,05°
 - FARM, implemented by ARPA Piemonte: 16 levels up to 7500 m. a.g.l (terrain following coordinates)
 - CHIMERE, implemented by ARPAE Emilia Romagna: 9 levels up to 500 hPa (terrain following coordinate)
- **Year:** 2018, from 01/01/2018 to 31/12/2018 with 1 hour time resolution
- **BC & IC fields:** analysis fields from Prev'Air service
- **Meteorological driver:** COSMO-I7 analysis (ARPAE implementation)
- **Emissions inventories:** prepAIR emission scenarios





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Derivation of source-receptor model for RIAT+

Training scenarios:

TRAINING	ID	NOx	VOC	NH3	PPM	SO2	
<i>prepAIR domain wide emission reductions</i>	T1	50 %	0	0	0	0	<i>fixed homogeneous percentage reductions</i>
	T2	0	50 %	0	0	0	
	T3	0	0	50 %	0	0	
	T4	0	0	0	50 %	0	
	T5	0	0	0	0	50 %	
	T6	50 %	50 %	50 %	50 %	50 %	
	T7	BASE	BASE	BASE	BASE	BASE	<i>between BASE and MFR</i>
	T8	MFR	MFR	MFR	MFR	MFR	
	T9	MFR	BASE	BASE	BASE	BASE	
	T10	BASE	MFR	BASE	BASE	BASE	
	T11	BASE	BASE	MFR	BASE	BASE	
	T12	BASE	BASE	BASE	MFR	BASE	
	T13	BASE	BASE	BASE	BASE	MFR	

Emissions reductions are performed over the entire **prepAIR** domain, either with levels between BASE scenario and MFR scenario (AQPs and **prepAIR** actions full implemented) or with levels reduced homogeneously in relative terms (SHERPA methodology).



Derivation of source-receptor model for RIAT+

Validation scenarios:

VALIDATION	ID	NO _x	VOC	NH ₃	PPM	SO ₂	
Reductions over Lombardia and Emilia Romagna	V1	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	BASE	between BASE and MFR
	V2	BASE	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	
	V3	BASE	BASE	0.6*(BASE+MFR)	BASE	BASE	
	V4	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	
Reductions over Piemonte and Veneto	V5	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	BASE	
	V6	BASE	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	
	V7	BASE	BASE	0.6*(BASE+MFR)	BASE	BASE	
	V8	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	
Local reductions (Bologna, Torino, Milano, Bergamo, Verona)	V9	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	BASE	
	V10	BASE	0.6*(BASE+MFR)	BASE	BASE	0.6*(BASE+MFR)	
	V11	BASE	BASE	0.6*(BASE+MFR)	BASE	BASE	
	V12	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	0.6*(BASE+MFR)	

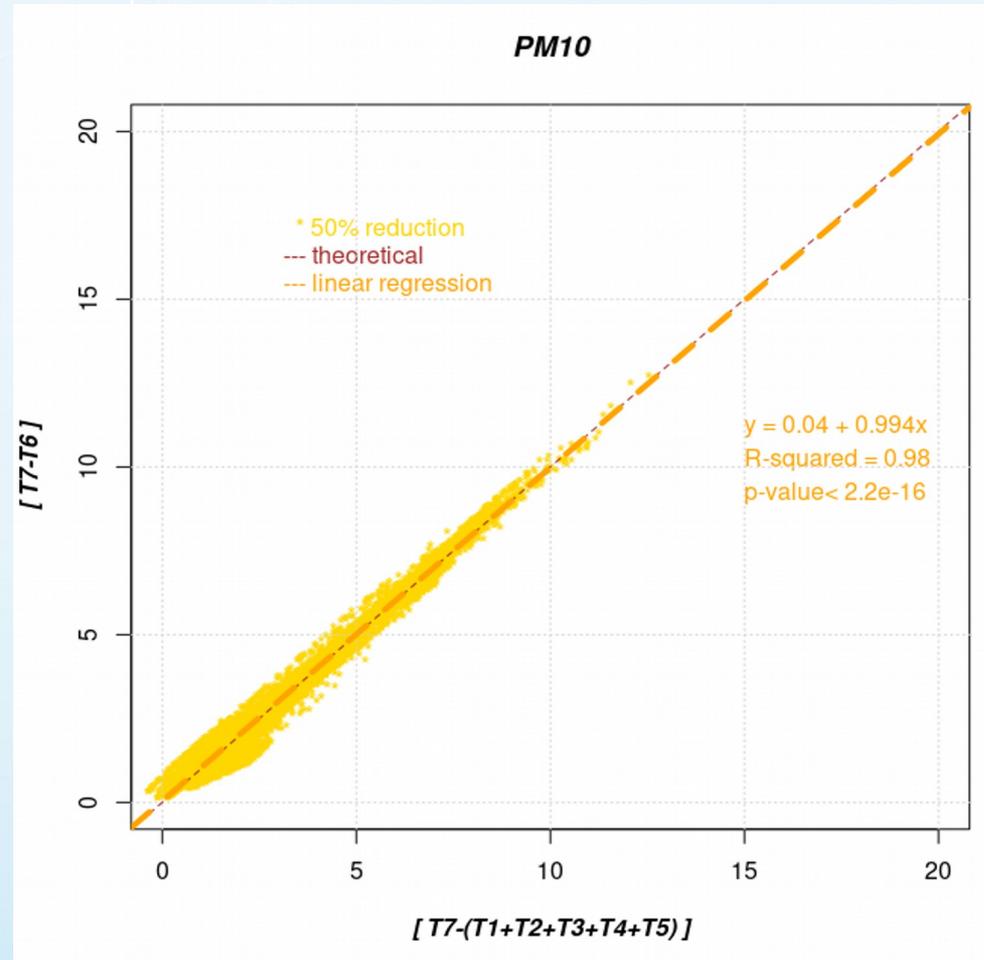
Derivation of source-receptor model for RIAT+,

FARM Linearity verification

Linearity is necessary to apply S/R SHERPA approach

X-axis: for each grid point, sum of the differences between *BASE* scenario (T7) and each pollutant reduction scenario with fixed percentage (50%, scenarios from T2 to T5)

Y-axis: for each grid point, difference between *BASE* scenario (T7) and scenario with 50% reduction for all pollutants (T6)



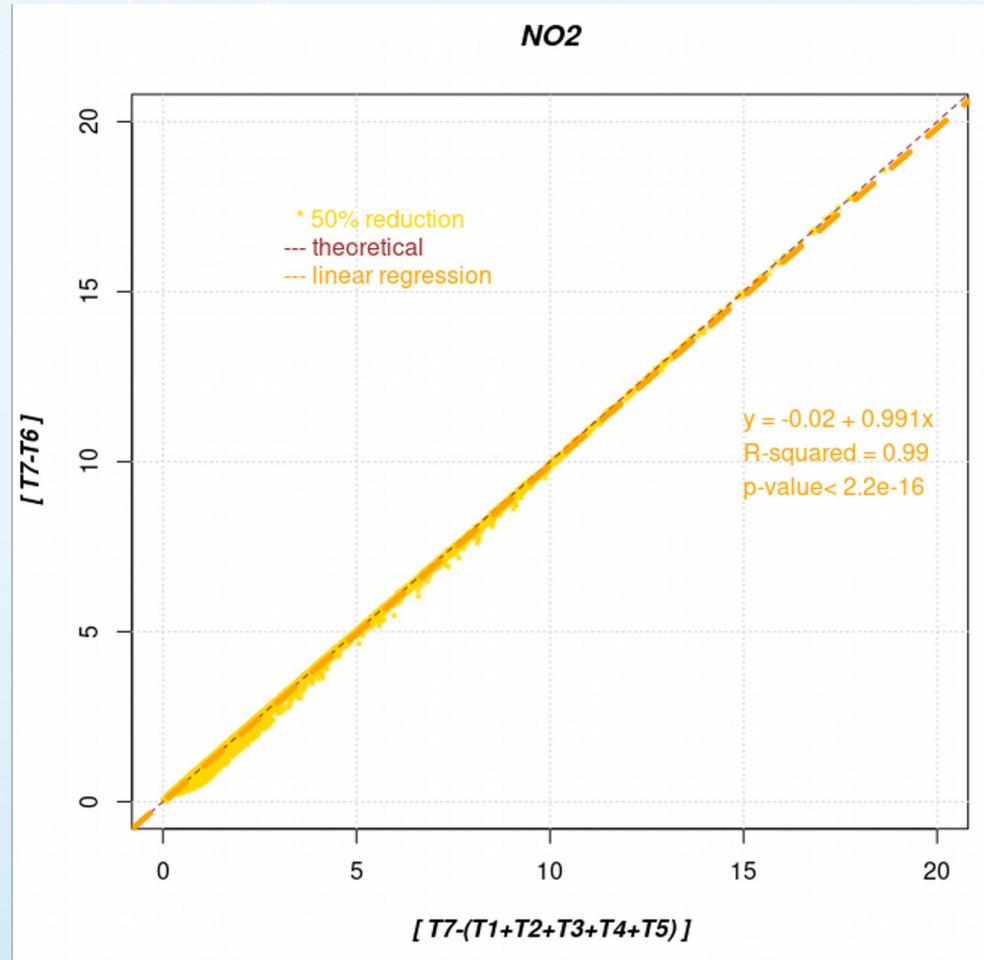
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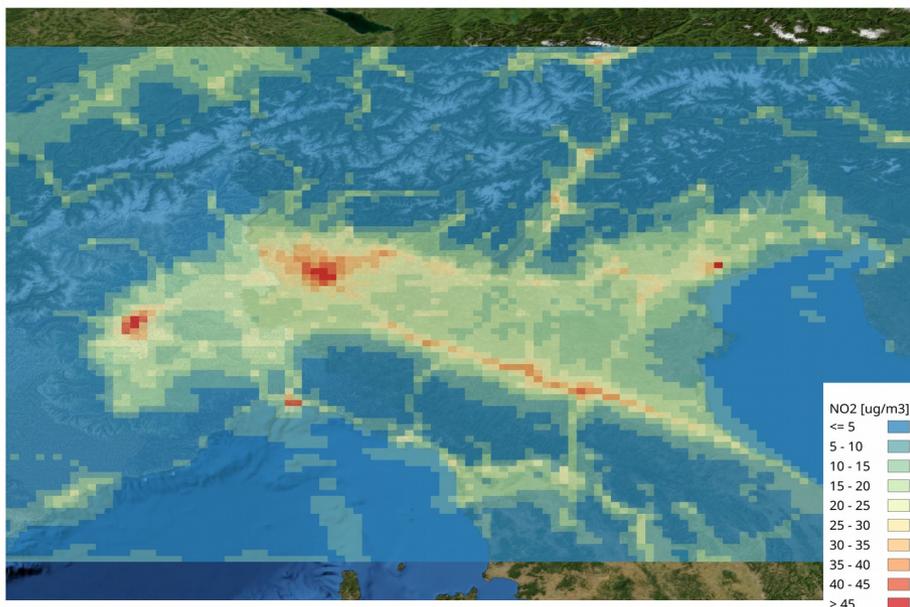
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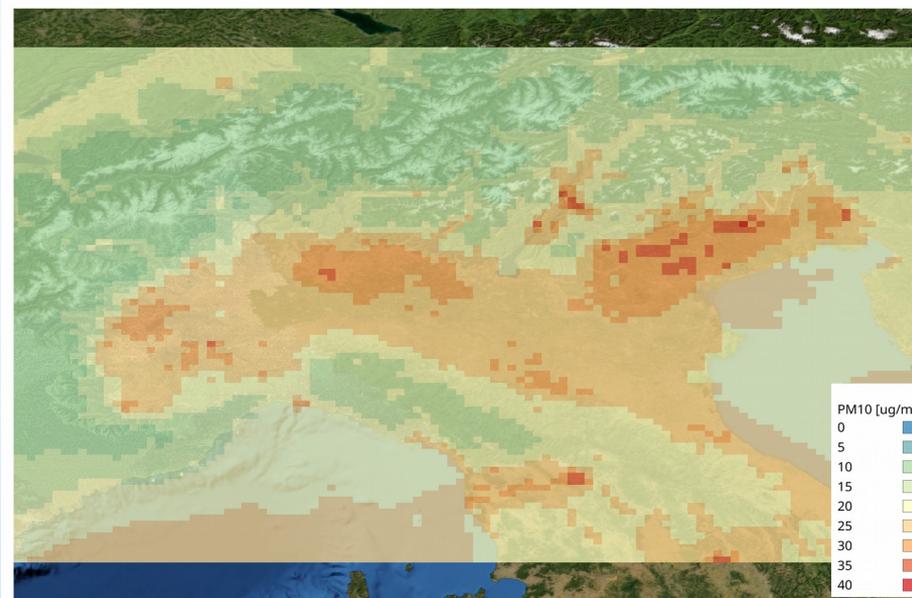
Derivation of source-receptor model for RIAT+

Training scenarios: base case

FARM NO2 annual mean



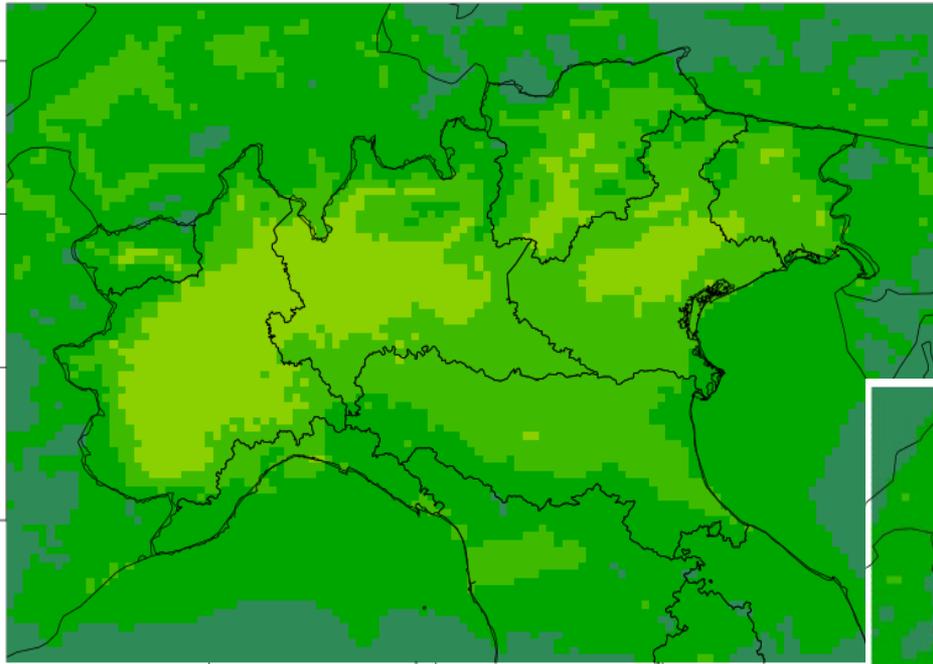
FARM PM10 annual mean



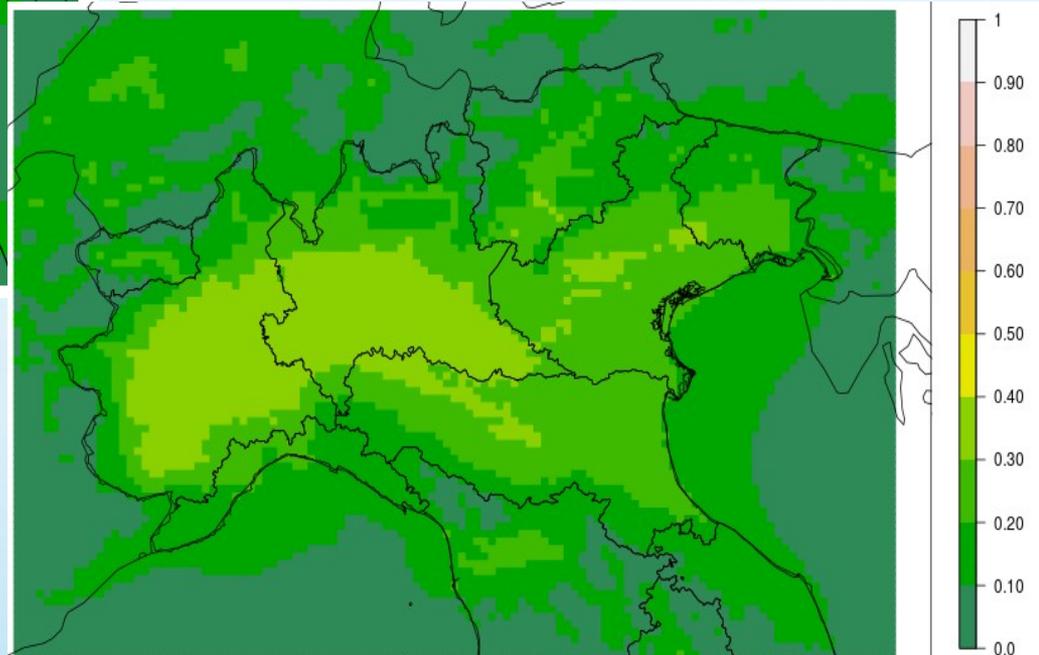
Derivation of source-receptor model for RIAT+

Training scenarios: FARM and CHIMERE

FARM % reduction PM10 T7-T6



CHIMERE % reduction PM10 T7-T6





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New RIAT+ implementation in *prepAIR*



A. Optimization RIAT+ Fortran code in order to allow the definition of a technologies database and emission activities specific for each region: in this way it will be possible to optimize the air quality in the entire Po Valley or a regional subdomain of it.

B. Updating the calculation of NTM measure: Application rate (AR) and Removal Efficiency (RE) will be carried out using the “base case scenario emissions” and not on the “virtual emissions”, as it is in the RIAT+ current version

C. Improvement and restyling of the RIAT+ interface.



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Conclusion and further development

- ➔ It seems possible with a significant reduction in emissions (NO_x 39%, PM₁₀ 40%, PM₂₅ 42%, SO₂ 3%, NH₃ 22%, VOC 19% respect base case) to comply AQD directive for the exceedances PM₁₀ daily limit value
- ➔ Possible differences in S/R function calculated with CHIMERE and FARM will be evaluated and used to provide more generality and strength to the IAM model
- ➔ The IAM model will be used to help politicians to define further measures



With the contribution
of the LIFE Programme
of the European Union

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Thank for your attention

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