Assessment of national air quality measures in Italy

focus on the Po Basin agreement

TFIAM – FAIRMODE workshop

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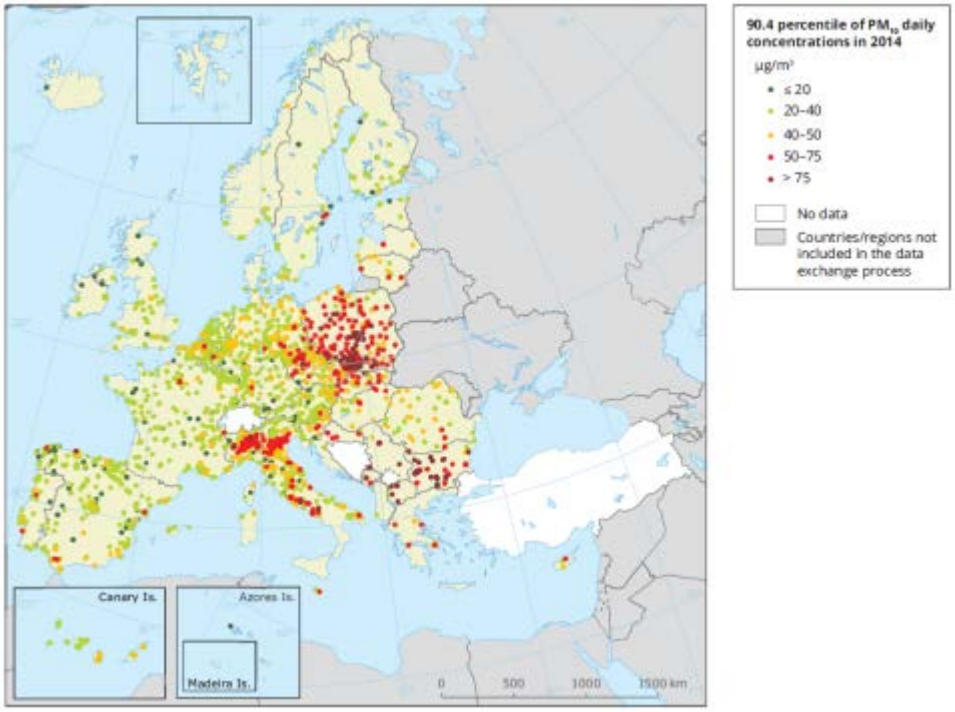
Outline

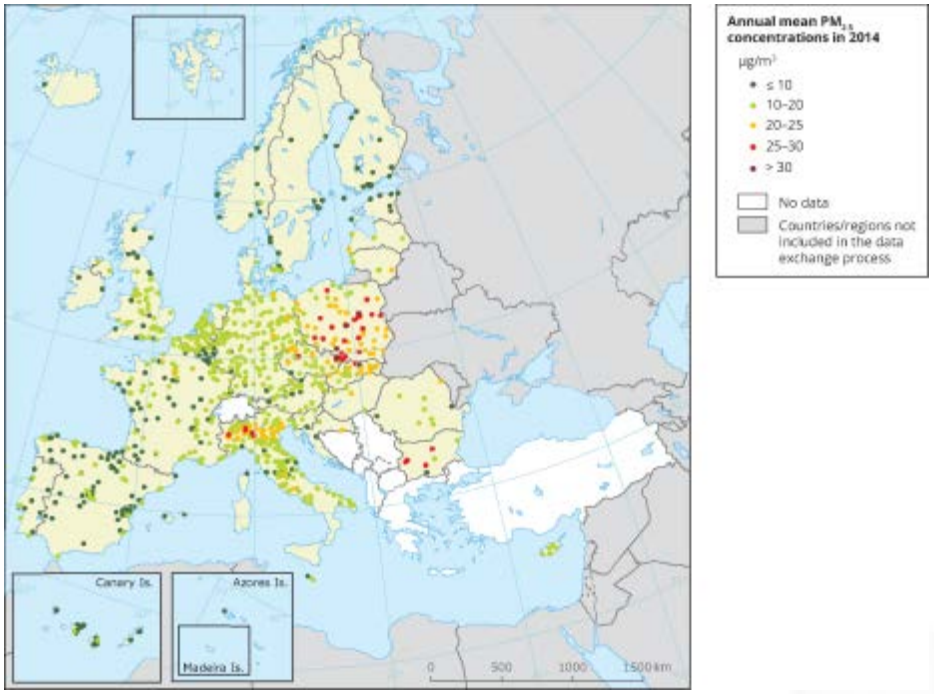
- **Po Basin Agreement**
- **IAM assessment on Italy**
- **Emission reductions**
- **Concentration reductions**

Concentrations in relation to limit and target values

PM10 – year 2014



PM2.5 – year 2014



Source: EEA, 2016

Po Basin Agreement

Agreement for the coordinated and joint adoption of measures to improve air quality in the Po Basin. December 19th, 2013.

- 5 **Ministries** (Environment, Economic Development, Infrastructure and Transport, Agriculture, Health)
- 8 **Regions**/autonomous Provinces (Lombardy, Emilia Romagna, Piedmont, Veneto, Valle d'Aosta, Friuli Venezia Giulia, Trento and Bolzano)

The signatory organizations, **recognized the meteoclimatic and orographic specificity of the Po River basin**, agree to identify and implement, **in a homogeneous and united way**, measures contrasting air pollution, in addition to those already in place.

The agreement will take to **short, medium and long-term interventions** in the main emission sectors:

biomass burning, freight transport, passenger transport, residential heating, industry and energy production, agriculture.

Po Basin Agreement

9 thematic workgroups:

- environmental certification of heat generators
- updating of emission limits of biomass fired industrial boilers
- mandatory cogeneration in new wood fired industrial boilers
- revision of incentives to energy efficiency in buildings
- update guidelines for Urban Mobility Plans
- study of lower speed limit on motorways
- automatic detection of registered Euro classes of road vehicles
- spreading electric mobility
- guidelines for the reduction of air emissions from agriculture - animal husbandry - manure and nitrogen fertilizers

worked during 2014-2015 discussing all the issues. The work ended in the spring 2016.

Po Basin Agreement

TO DATE RESULTS
(could be updated in 2017!)

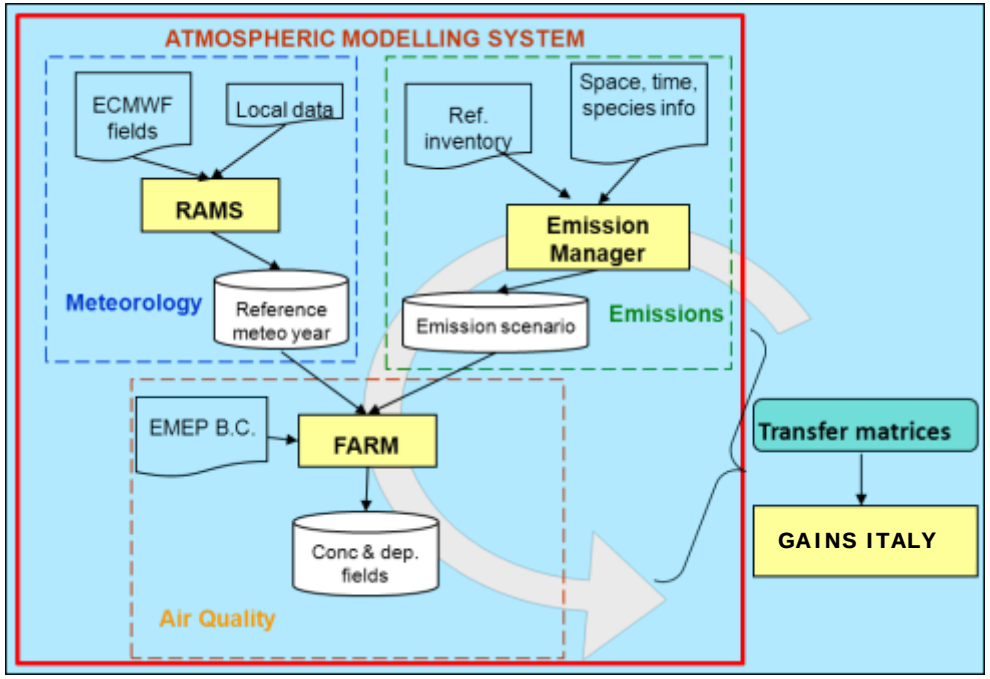
2 legal-binding measures:

- Law proposal on environmental certification of new residential heat generators fueled with wood-biomasses (emission classes for PM, VOCs, NO_x, CO)
- Law proposal on emission limits for existing biomass-fired industrial boilers (NO_x, SO_2, CO, VOCs, NH_3)

Some general proposals-suggestions without indications on quantitative modifications in consumptions-emissions, e.g.:

- New incentivation scheme for enhancing energy efficiency in residential buildings
- New guidelines for design of Urban Mobility Plans
- Monitoring study on real-world emissions on motorways with 100 km/h speed limit from the initial limit of 130 km/h
- ...

IAM system: MINNI (National Integrated Modeling system for International Negotiation on atmospheric pollution)



The system MINNI (www.minni.org) is composed of an Atmospheric Modelling System (AMS) and the Greenhouse Gas and Air Pollution Interactions and Synergies Model over Italy (**GAINS-Italy**)

Assessment of Po Basin agreement:

new emission scenario in GAINS-ITALY (2020, 2030)
→ AMS runs (meteo 2010)

- NUTS 2 geographical detail for emission input (Regions, in charge of AQ management)
- national energy scenarios
- harmonization of emissions with regional inventories

National IAM assessment of Po Basin Agreement – measures, 1

→ ENEA, supported by ISPRA-Rome and CRPA, made expert-judgement hypotheses to apply the identified measures on the whole country

- heat generators: from 1/1/2017 (following existing law on incentives for heat generators) all the sold biomass heat devices must be in class “3 stars” → baseline control strategy, modified EFs with legal limit
- biomass-fired industrial boilers: → modified EFs with the new ELVs
- enhancing energy efficiency in buildings: annual rates of restoration (0.5% for existing buildings, 0.2% new buildings) → reduced consumption (depending on climatic zones and fuel)
- new speed limit of 100 km/h (from 130 km/h) on motorways for passenger cars: COPERT 4 calculation of modified emissions (by fuel) → modified final emissions (outside GAINS)

National IAM assessment of Po Basin Agreement – measures, 2

- increase of electrical mobility: share of hybrid + plug-in over total passenger cars = 3.5% in 2020 and 13.6% in 2030 → modified consumptions (reduced in urban road transport and refineries, increased in power plants)

- Measures in the agriculture for cattle and urea consumption:
  - introduction of a low protein feeding strategy at the year 2030 for 13% of all the cattle → modified baseline control strategy
  - a more efficient use of urea-based fertilisers so to reduce ammonia emissions by 50% compared with the reference method → modified activity data, EF and control strategy

Results – emission reduction

2020 - Italy

IT 2020 (kt)	NOx	PM10	PM2.5	NH_3	NMVOC	SO_2
Baseline scenario	**689.00**	**193.66**	**145.00**	**397.00**	**829.00**	**142.00**
RH	*-5.95*	*-9.51*	*-9.21*	*-0.15*	*-15.69*	*-0.30*
TRA - road	*-15.98*	*-0.28*	*-0.28*	*-0.23*	*0.24*	*-0.01*
TRA - pp	*1.41*	*0.08*	*0.05*	*0.00*	*0.96*	*0.30*
AGR	*-*	*-*	*-*	*-6.66*	*-*	*-*
Po Basin scenario	**668.47**	**183.95**	**135.56**	**389.96**	**814.51**	**141.98**
variation %	-2.98	-5.01	-6.51	-1.77	-1.75	-0.01

RH = residential heating, TRA - road = road traffic, TRA – pp = power plants due to electric mobility, AGR = agriculture

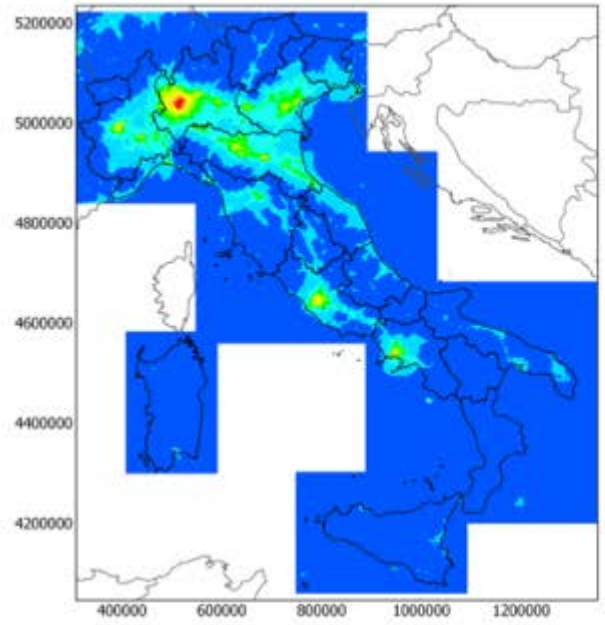
Results – emission reduction

2030 - Italy

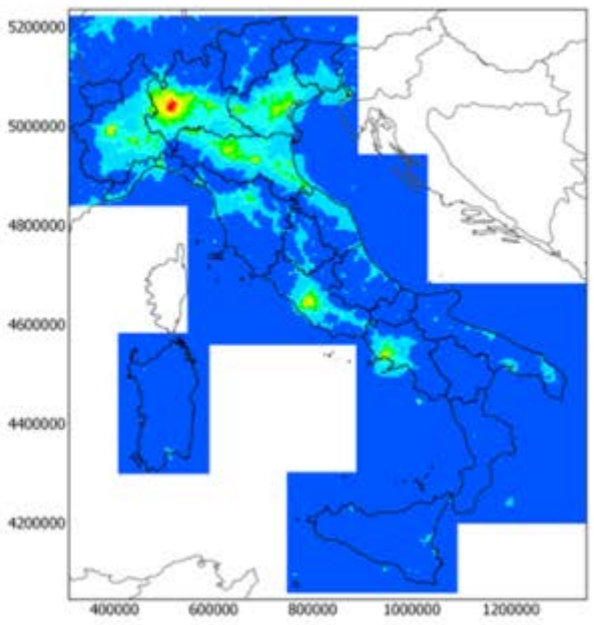
IT 2030 (kt)	NOx	PM10	PM2.5	NH_3	NMVOC	SO_2
Baseline scenario	**447.00**	**167.46**	**123.00**	**377.00**	**731.00**	**104.00**
RH	*-14.13*	*-26.06*	*-25.25*	*-0.17*	*-40.95*	*-0.36*
TRA - road	*-6.99*	*-0.05*	*-0.05*	*-0.31*	*-0.36*	*-0.01*
TRA - pp	*1.12*	*0.02*	*0.02*	*0.01*	*0.10*	*-0.07*
AGR	*-*	*-*	*-*	*-24.55*	*-*	*-*
Po Basin Scenario	**427.00**	**141.37**	**97.73**	**351.98**	**689.79**	**103.56**
variation %	-4.47	-15.58	-20.55	-6.64	-5.64	-0.42

RH = residential heating, TRA - road = road traffic, TRA – pp = power plants due to electric mobility, AGR = agriculture

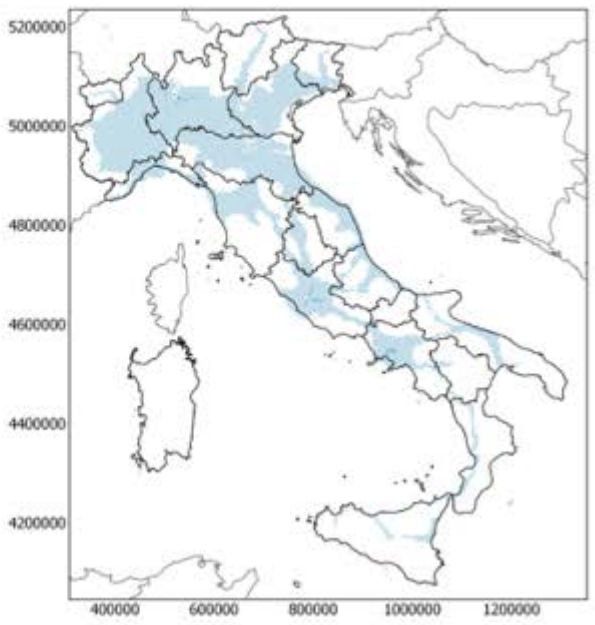
Results – AMS concentrations at 4 km horizontal resolution



BASELINE



BP



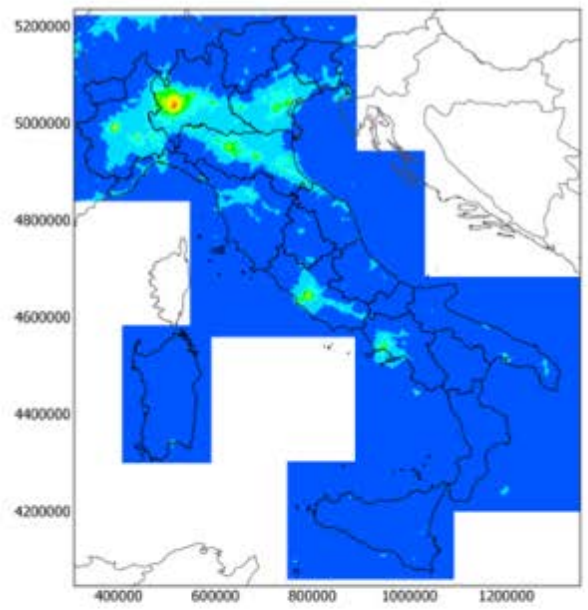
BASELINE – BP

NO2 (microg/m3)
- 0-5
- 5-10
- 10-15
- 15-20
- 20-25
- 25-30
- 30-35
- 35-40
- >40

differenza (microg/m3)
- <-5
- -5 - -2
- -2 - -1
- -1 - -0.1
- -0.1 - 0.1
- 0.1 - 1
- 1 - 2
- 2 - 5
- >5

2020 – NO_2 – yearly average

Results – AMS concentrations at 4 km horizontal resolution



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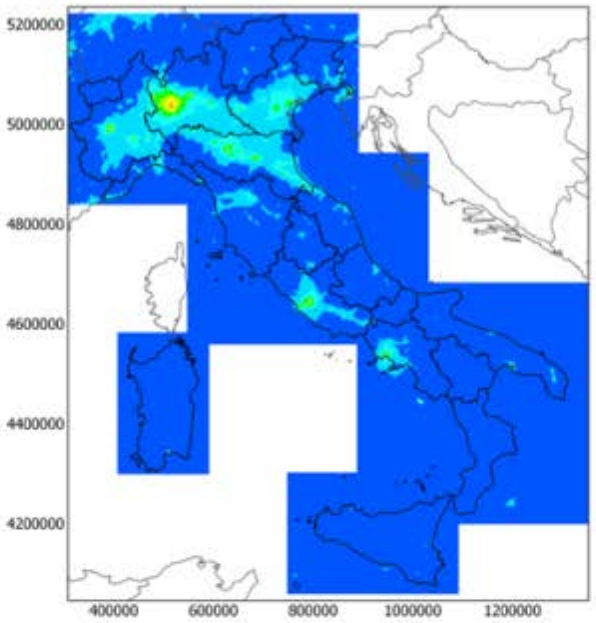

BP

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NO2 (microg/m3)

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- 5-10
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- >40

differenza (microg/m3)

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- -5 - -2
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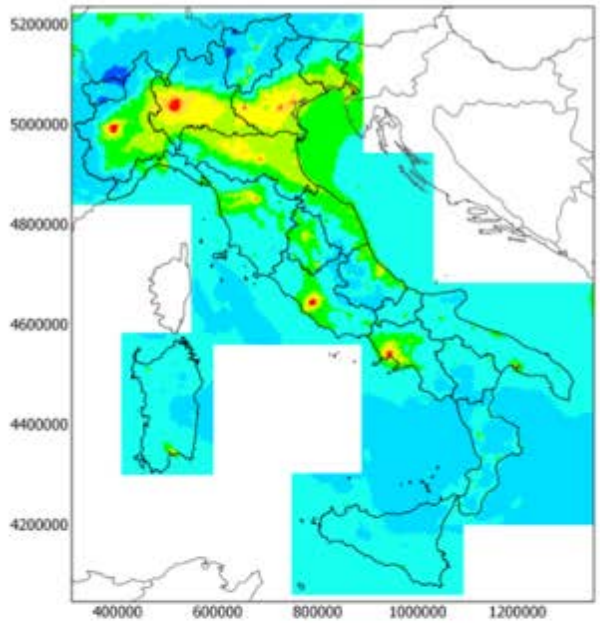
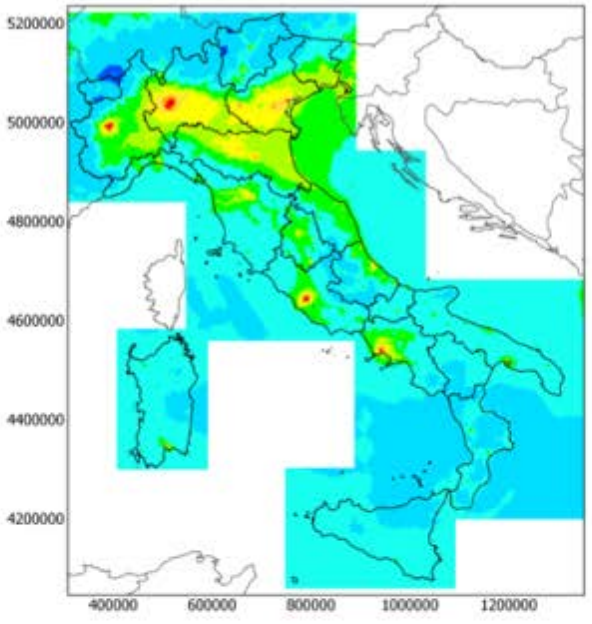
- -0.1 - 0.1
- 0.1 - 1
- 1 - 2
- 2 - 5
- >5

2030 – NO_2 – yearly average

Results – AMS concentrations at 4 km horinzontal resolution



BASELINE



BP

BASELINE – BP

PM2.5 (microg/m3)

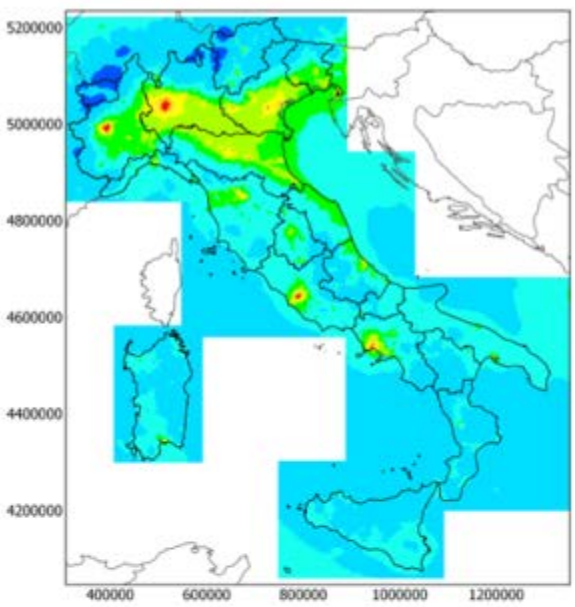
- 0-3
- 3-6
- 6-9
- 9-12
- 12-15
- 15-18
- 18-21
- 21-25
- >25

differenza (microg/m3)

- <-10
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2020 – PM2.5 – yearly average

Results – AMS concentrations at 4 km horizontal resolution



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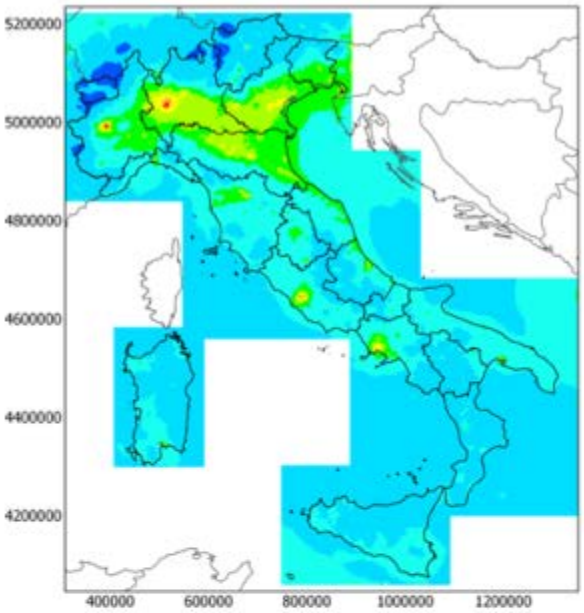
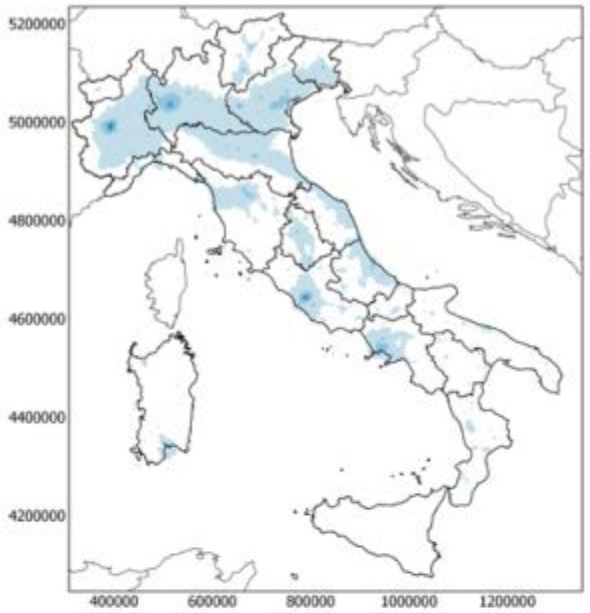


BP



BASELINE – BP

PM2.5 (microg/m3)
- 0-3
- 3-6
- 6-9
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- 12-15
- 15-18
- 18-21
- 21-25
- >25

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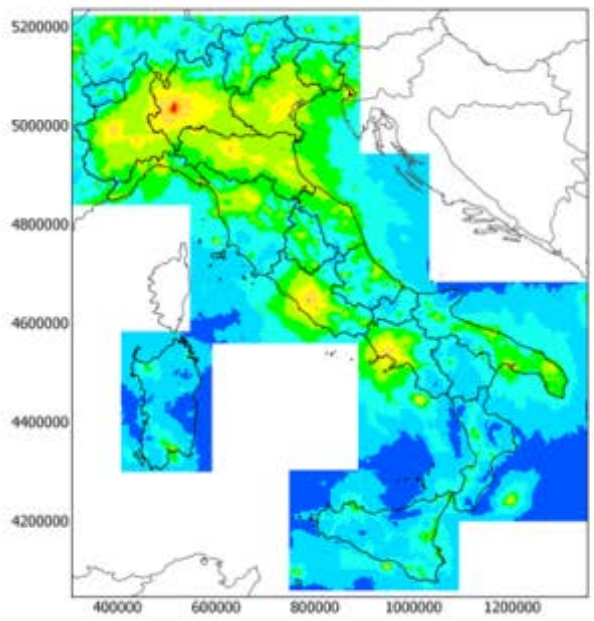
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2030 – PM2.5 – yearly average

Results – AMS concentrations at 4 km horizontal resolution



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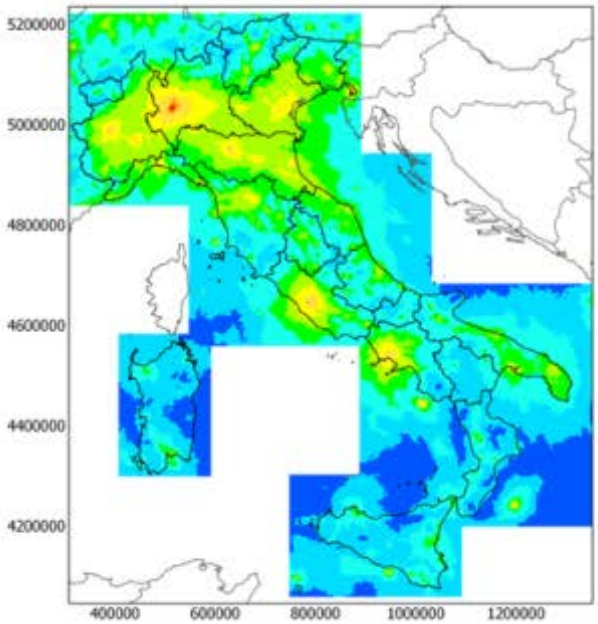

BP

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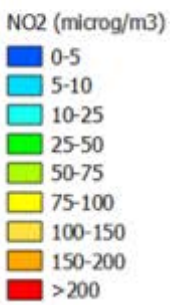
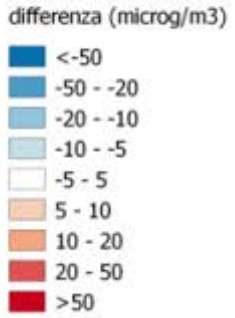
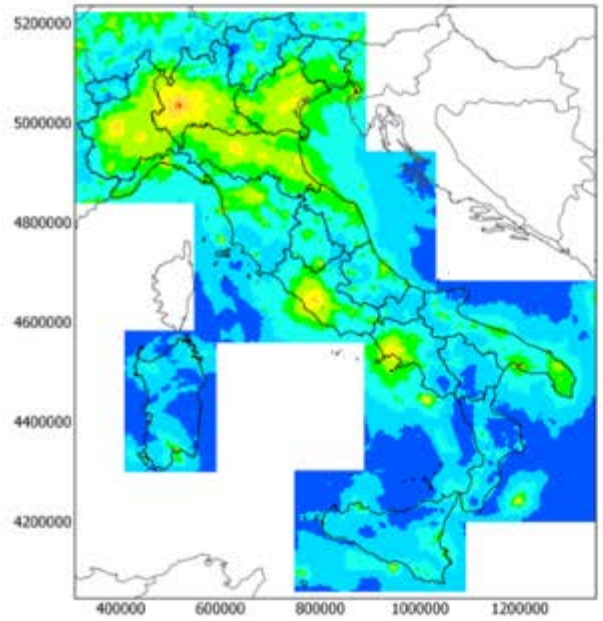


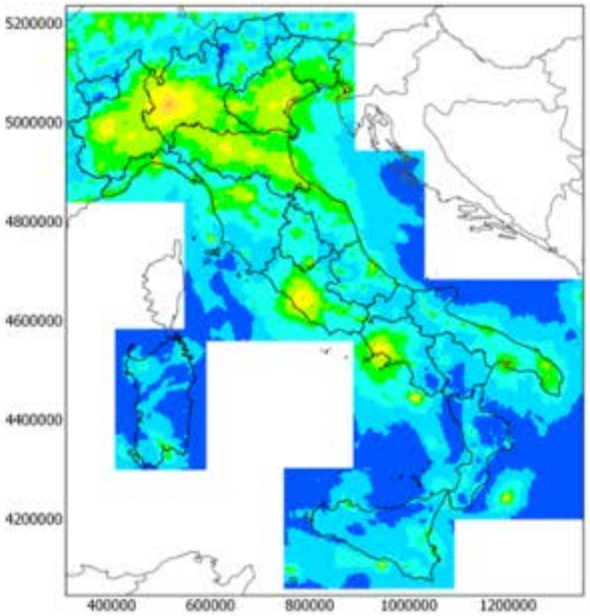


2020 – NO_2 – 19° higher hourly value (99.795° percentile)

Results – AMS concentrations at 4 km horizontal resolution

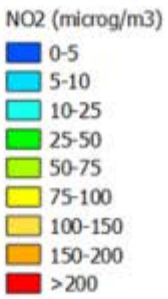


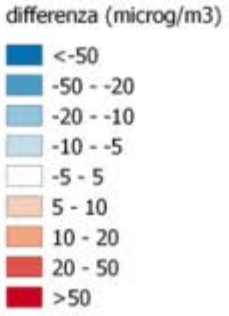
BASELINE



BP

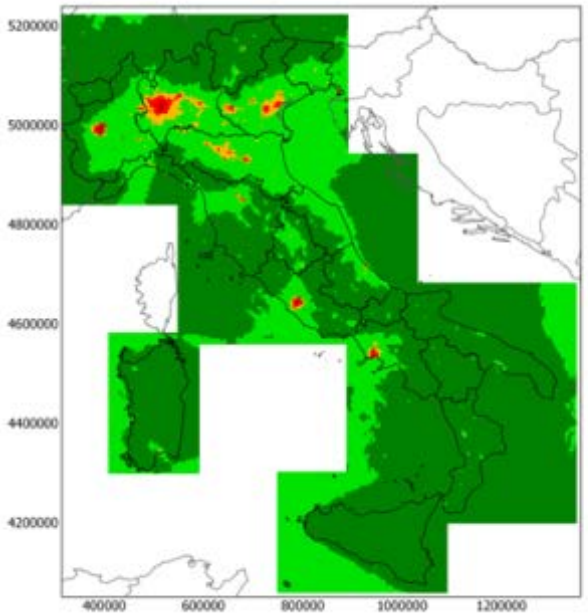
BASELINE – BP





2030 – NO_2 – 19° higher hourly value (99.795° percentile)

Results – AMS concentrations at 4 km horizontal resolution



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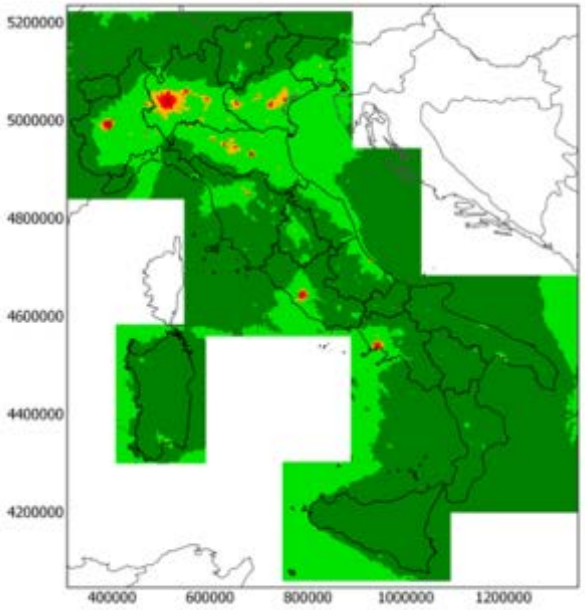


BP

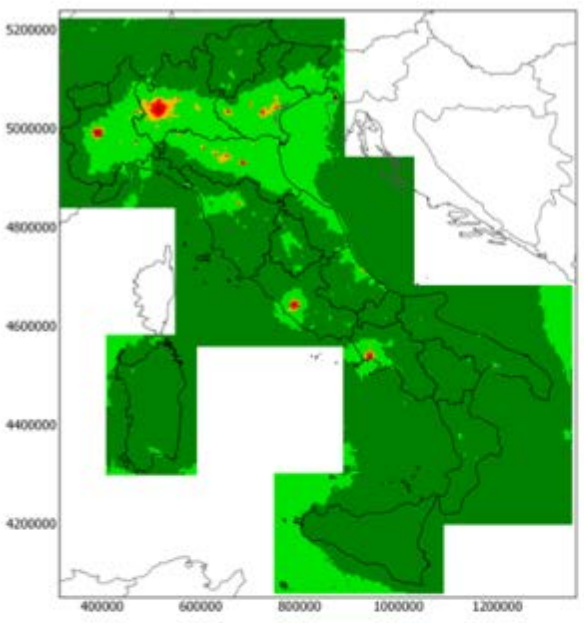
BASELINE – BP

PM10 - microg/m3
- <20
- 20-40
- 40-50
- 50-75
- >75

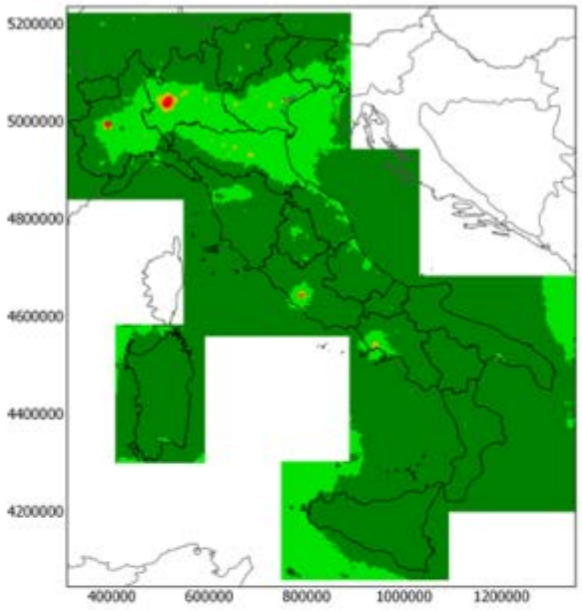
differenza (microg/m3)
- <-10
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2020 – PM10 – 36° higher daily value (90.4° percentile)

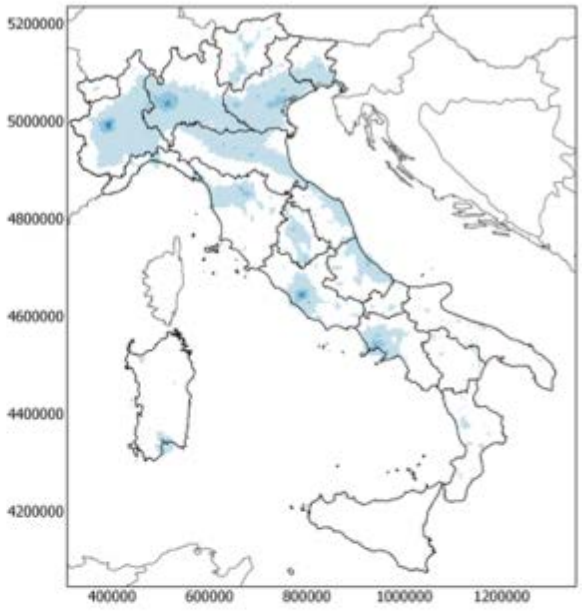
Results – AMS concentrations at 4 km horizontal resolution



BASELINE



BP



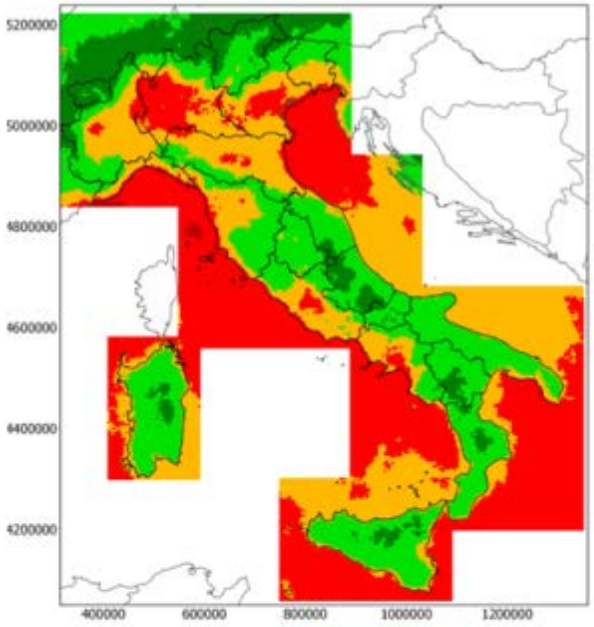
BASELINE – BP

PM10 - microg/m3
- <20
- 20-40
- 40-50
- 50-75
- >75

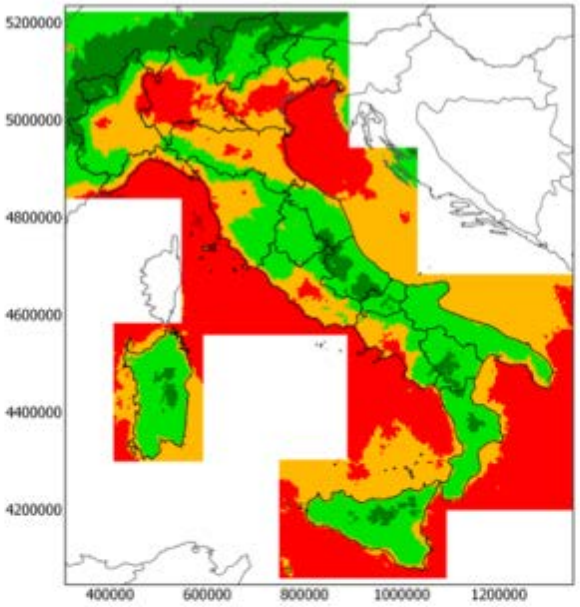
differenza (microg/m3)
- <-10
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2030 – PM10 – 36° higher daily value (90.4° percentile)

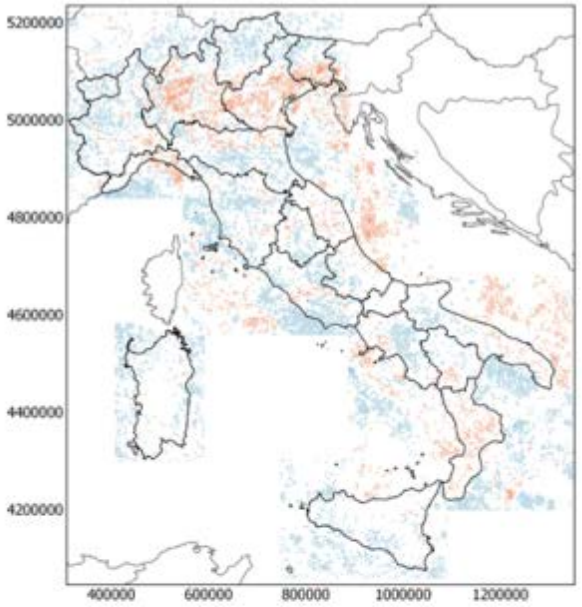
Results – AMS concentrations at 4 km horizontal resolution



BASELINE



BP



BASELINE – BP

O3 - microg/m3

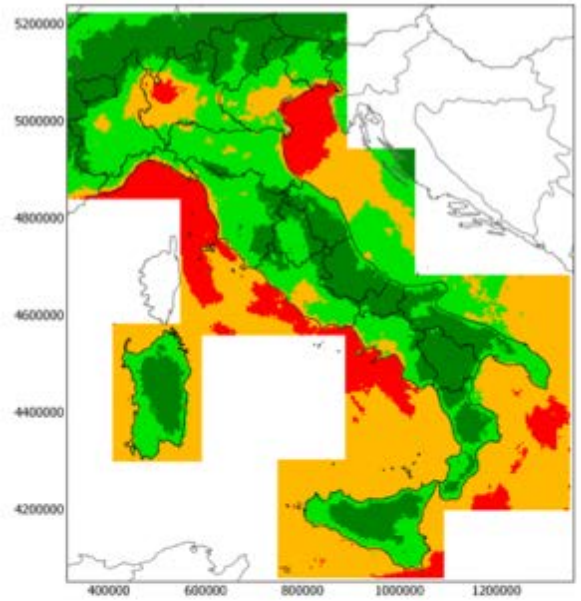
- <100
- 100-110
- 110-120
- 120-140
- >140

differenza (microg/m3)

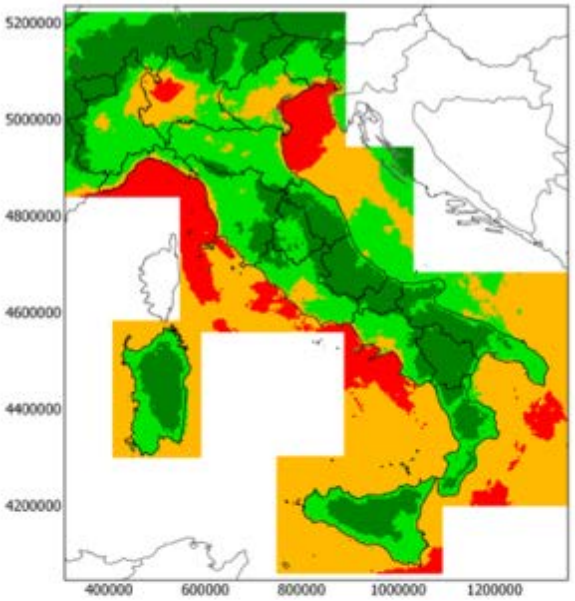
- <-10
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2020 – O_3 – 26° higher daily max of 8h running means (93.2° percentile)

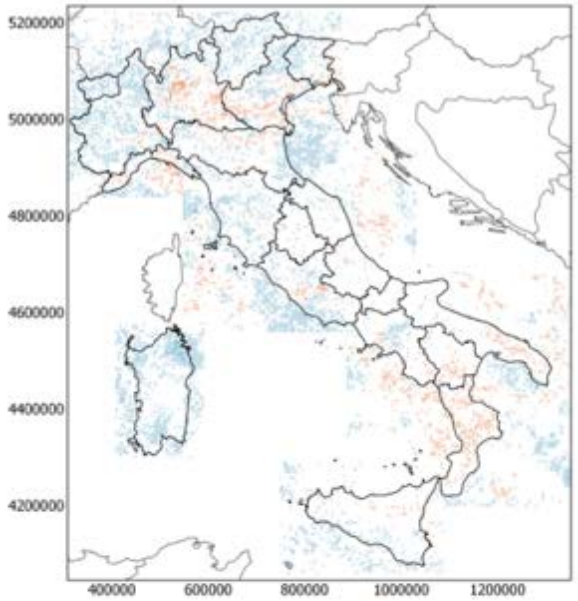
Results – AMS concentrations at 4 km horizontal resolution



BASELINE



BP



BASELINE – BP

O3 - microg/m3

- <100
- 100-110
- 110-120
- 120-140
- >140

differenza (microg/m3)

- <-10
- -10 - -5
- -5 - -2
- -2 - -0.5
- -0.5 - 0.5
- 0.5 - 2
- 2 - 5
- 5 - 10
- >10

2030 – O_3 – 26° higher daily max of 8h running means (93.2° percentile)

Some conclusions - 1

- NO_2, yearly average: exceedances remain in 2020 (Milan), disappear in 2030 (but values are near the limit)
- PM2.5, yearly average: exceedances remain in 2020 and 2030 in metropolitan areas (Turin, Milan, Rome?)
- NO_2, 99.795 percentile of hourly values: exceedances remain in 2020 (Milan), disappear in 2030 (but values are near the limit)
- PM10, 90.4 percentile of daily averages: exceedances remain in 2020 and 2030 in metropolitan areas (Turin, Milan, Rome)
- O_3, 93.2 percentile of daily max of 8h running mean: wide exceedances remain in 2020, exceedances remain in 2030 in Lombardy and near coastlines

Some conclusions - 2

- the type of measures seems effective, while the activity levels impacted could be increased (e.g share of electric cars, agriculture)
- in several cases, the reduction/cancellation of exceedances is driven by the baseline scenario more than the BP measures
- measures are largely qualititative → physiological uncertainty in the national-scale assessment of emission reduction: quantitivative hypotheses to be checked…
- ….and a new round of national workgroups' activity could start in 2017
- Regions could make different assumptions in their plans (entering in force in these months), our work will serve as a benchmark

Thank you for your kind attention!

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