CT1 - Source apportionment to support AQ management

Clappier, P. Thunis, G. Pirovano, K. Cuvelier
S. Gilardoni, V. Riffault, V. Gianelle
CAMS Community

FAIRMODE
Forum for air quality modelling in Europe

FAIRMODE Plenary meeting -- 1-2 March 2021

CT1 - Source apportionment to support of AQ management

Agenda

02/03/2021 - 10:45-11:45

- ❑ Status of the inter-comparison exercise on NO_2 *(G. Pirovano)*
- ❑ Source apportionment with receptor models *(S. Gilardoni)*
- ❑ Update on CAMS related activities *(L. Rouil)*
- ❑ Support to the revision of EU rules on air quality *(A. Clappier)*

Guidance document on SA – Open Issues

Source apportionment guidance document published as JRC technical report (July 2020)

- **Extension to other pollutants (NO_2)**
- **A simplified guide for RMs**

- Use of RMs to improve model based approaches: the case of OA
- Source apportionment to support the ex-post assessment of AQP
- Combined source allocation / tagging approach to support planning

European Commission

CT1 - Source apportionment to support AQ management

Source apportionment of NO_2

Clappier, P. Thunis, G. Pirovano, K. Cuvelier

FAIRMODE
Forum for air quality modelling in Europe

Source apportionment of NO_2

Background…

We know that performing SA analysis, our results can be affected by errors and differences (among methods).

This issue must be carefully evaluated!

Particularly, we should always try to:

- **Explain** and **Quantify** them
- Check the "**fit for purpose**" of our methods

…It's a tricky issue when dealing with SA because (generally) no observations are available!

Guidance could support this process

RSE Ricerca Sistema Energetico

European Commission

Source apportionment of NO_2

Key issues...

In case of NO_2, which could be the key factors giving rise to possible errors/uncertainties and differences?

- **Chemistry (O_3 and VOC)**
- **Estimation of the "Background" concentration**
- **SA method (Tagging vs Brute Force)**

…Not all modelling setup can deal with these issues..

RSE Ricerca Sistema Energetico

European Commission

Source apportionment of NO_2

Main questions

- **Are your SA results for NO2 consistent?**

In other words, if your SA result are based on “brute force” impacts, are these behaving linearly over the whole range of emission reductions (0-100%)? If not, to what extent can it be considered consistent?

- **Are your SA results additive?**

In other words, is the sum of the impacts/contributions of two sources equal to the impact/contribution of the combined sources?
I.e. for two sources A and B: CAB=CA+CB?
Is this property influenced by the emission reduction strength?

- **Are your results influenced by the chemical profile of the considered sources?**

In other words, do you obtain different results if you reduce, for a specific source, only NOX emissions instead of all emitted chemical compounds (e.g. VOC, SO2,…)

- **How do you quantify the regional background?**

- **Can you identify any relationship between NO2 and NOX concentrations in your modelling results?**

In other words, can you perform your SA analysis in terms of NOX and then “convert” them to NO2?

- **Are “tagged contributions” and “impacts” comparable for NO2?**

If yes, under which conditions? (i.e. emission reduction strength, chemical regime,…)

- **Are you aware of any assumption in your modelling approach that might limit its range of applicability or influence the obtained results for the SA of NO2?**

RSE Ricerca Sistema Energetico

European Commission

Modelling Exercise – Setup & Analysis

Scenario number	Sector reduced/tagged	Emission reduced/tagged	Reduction/tagging strength
0	Base case		
1	A	NOx	100
2	B		
3	A & B		
4	A	All	
5	B		
6	A & B		
7	A	NOx	50
8	B		
9	A & B		
10	A	All	
11	B		
12	A & B		
13	A	NOx	25
14	B		
15	A & B		
16	A	All	
17	B		
18	A & B		
19	A	NOx	75
20	B		
21	A & B		
22	A	All	
23	B		
24	A & B		

- Sensitivity to the background level (e.g. O_3)
- Sensitivity to the time period (winter vs. summer)
- Comparison between "Contributions" and "Impacts"

Source apportionment of NO_2

Modelling Exercise – Output

Item	Description	Notes
Kind of data	Time series at a specific set of receptors, to be defined according to your experience and knowledge of the modelling area	Description of the receptors: - Coordinates - site classification - corresponding air quality station (if any) - Additional information
Species	NO2 (mandatory), NO (or NOX), O3,HNO3, NOz, $NO_3^=$ (on voluntary basis)	
Time resolution	Hourly	
Scenarios	All performed runs by blocks of 6	
Format	Netcdf or ASCII	

RSE Ricerca Sistema Energetico

European Commission

Source apportionment of NO_2

Modelling Exercise – Status of Update

Team	Country	Model	Domain & Period	Receptors & Sectors	31/01/2021	30/04/2021
VITO	Belgium	IFDM (Gaussian) + OSPM + RIO	Local domain consisting of Hoogstraten and Wuustwezel communities, rural to suburban 2017 (hourly)	Hoogstraten ST1, ST2,RT3,RT4,RT5, SB06, RB07, RB08 Traffic & Agriculture	**scen BF 01-03 07-09 13-15 19-21**	to be confirmed
NCSR "DEMOKRITOS"	Greece	??	??		NN	to be confirmed
UAVR	Portugal	CAMX	Aveiro region		NN	scen 01-06 scen 01-12 scen 13-18 OSAT (scen 00)
IASS	Germany	WRF-Chem	Nested domain over EU and Berlin 2015 February (hourly)	Berlin UB1, UB2, UB3 Traffic & Res. Heating	**scen TAG 01-03 07-09 13-15 19-21**	scen 01-24 (to be confirmed)
SenUVK	Germany	IMMIS	Both sides built street canyons in urban environment in Berlin 2015 (yearly)	Berlin UT1 (DEBE065) Different road transport fleets	**scen BF 01, 07, 13, 19**	Sensitivity analysis: background NOx and/or O3 variations, Meteorological variations: stability parameter, wind-speed. Chemistry scheme - variations
RIVM	Netherlands	??	??		NN	??
Atomki	Hungary	??	??		NN	??
ARIANET-ENEA	Italy	FARM	Regional domain in Italy		NN	scen 01-03 scen 07-09 scen 04-06 scen 10-24

Energetico

Source apportionment of NO_2 – Modelling exercise

Preliminary results… **Consistency**

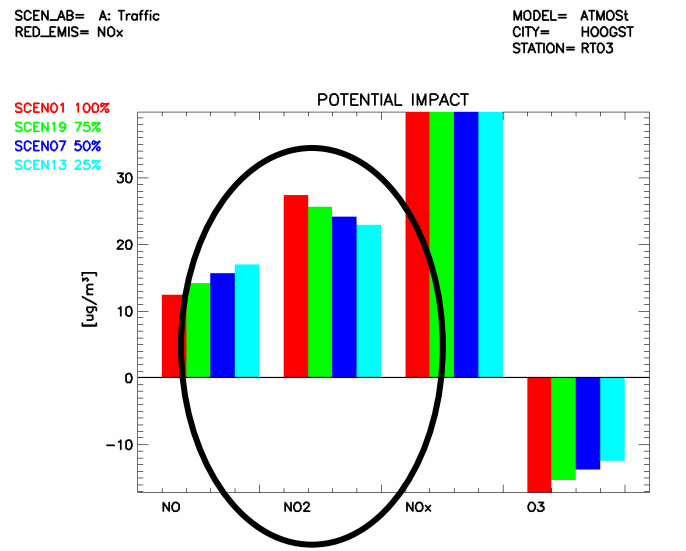
ATMOSst

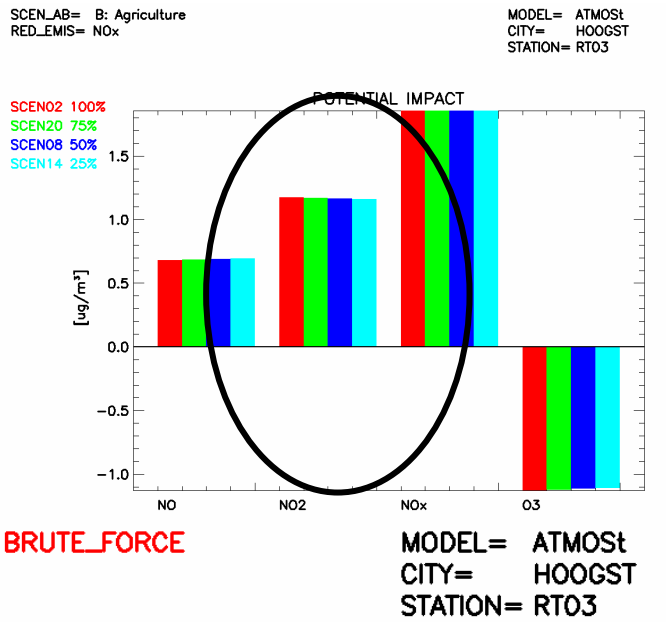
RT03

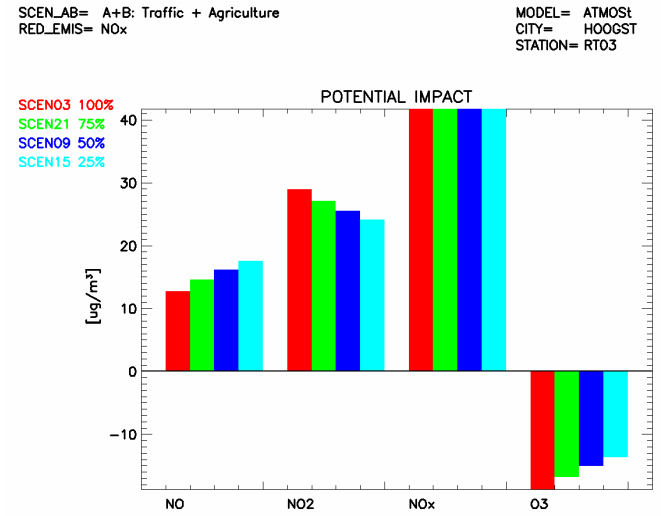
Rural station close to highway, no corresponding Airbase site

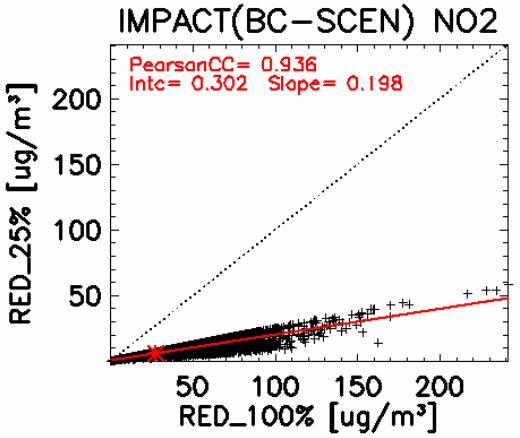
Brute Force

NOX reduction









Source apportionment of NO_2 – Modelling exercise

Preliminary results… **Additivity**

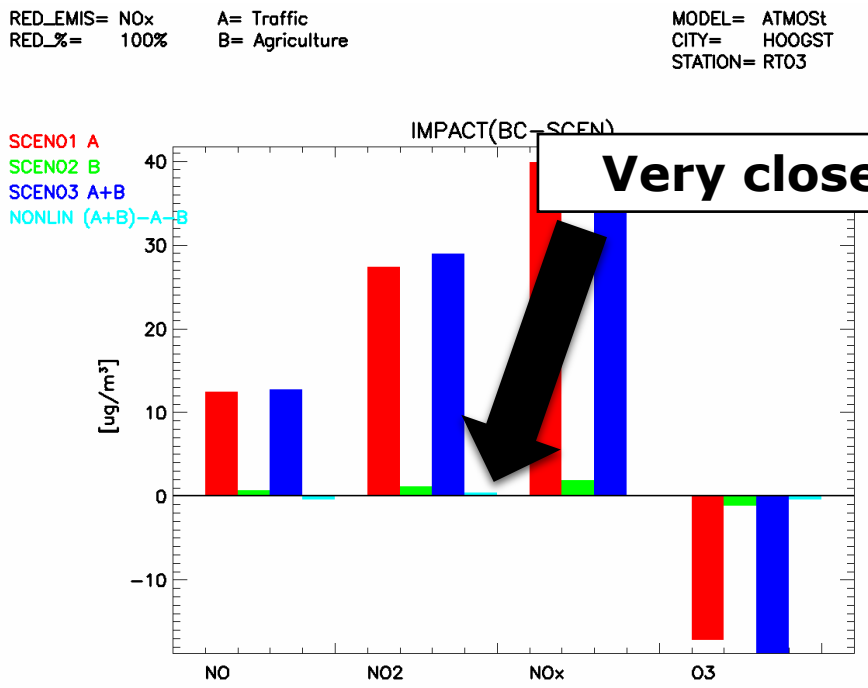
ATMOSst

RT03

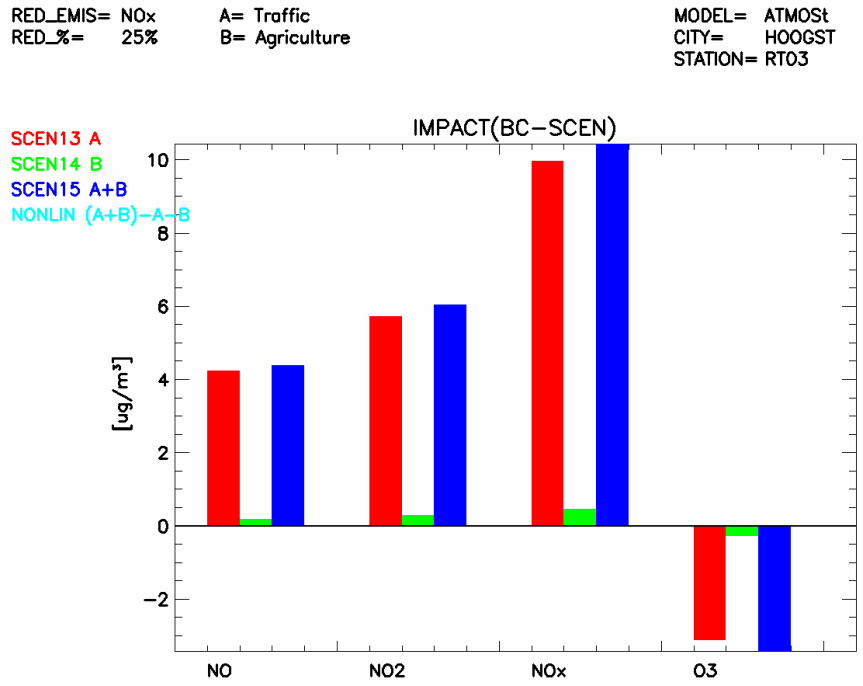
Rural station close to highway, no corresponding Airbase site

Brute Force

NOX reduction



Very close to linearity



Preliminary results… **Model assumptions**

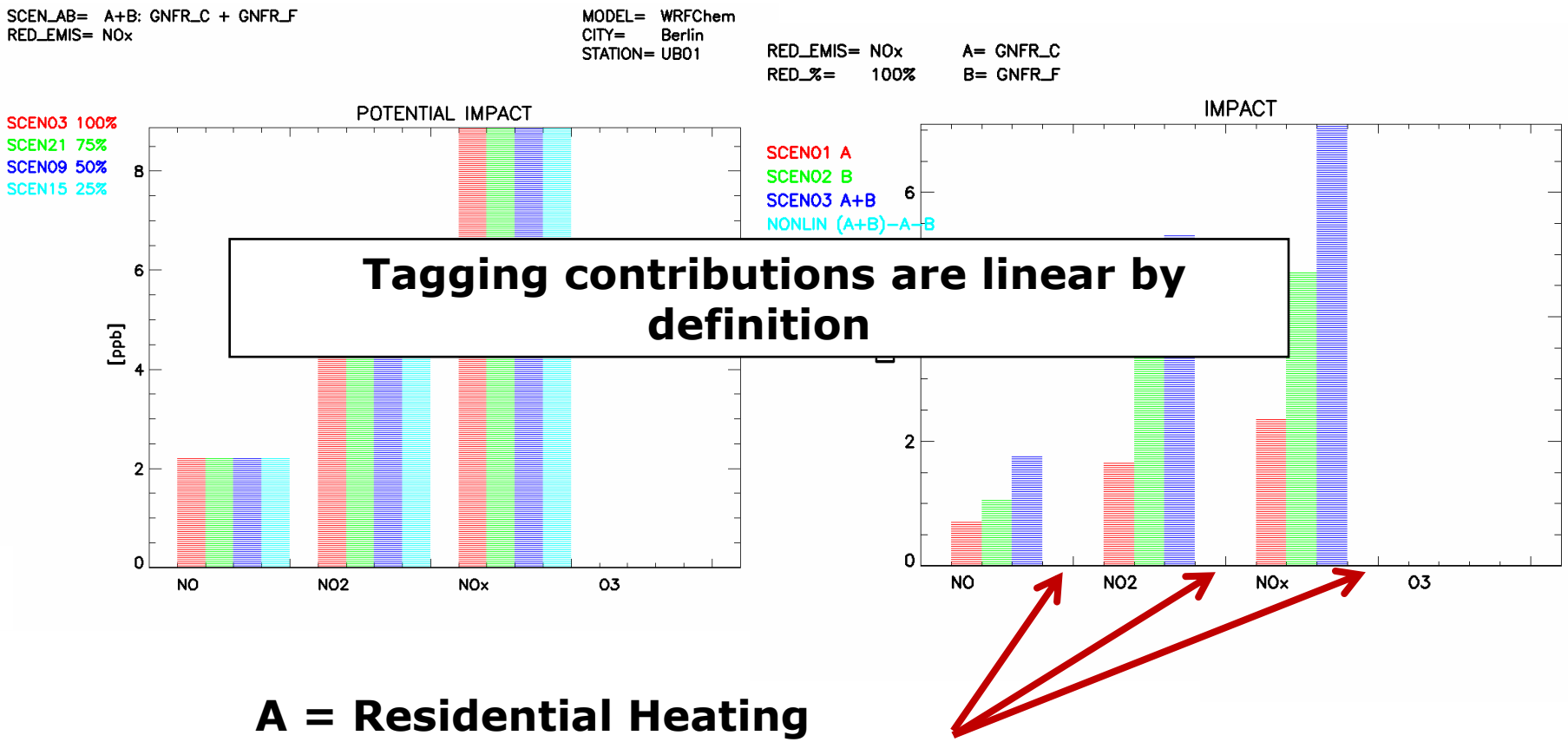
WRFChem

UB01

Berlin city - receptor corresponding to an Urban background site - corresponding to DEBE010 Airbase site

Tagging

NOX reduction



A = Residential Heating

B = Road Transport

RSE Ricerca Sistema Energetico

European Commission

Source apportionment of NO_2 – Modelling exercise

Preliminary results… **Tagging vs BF**

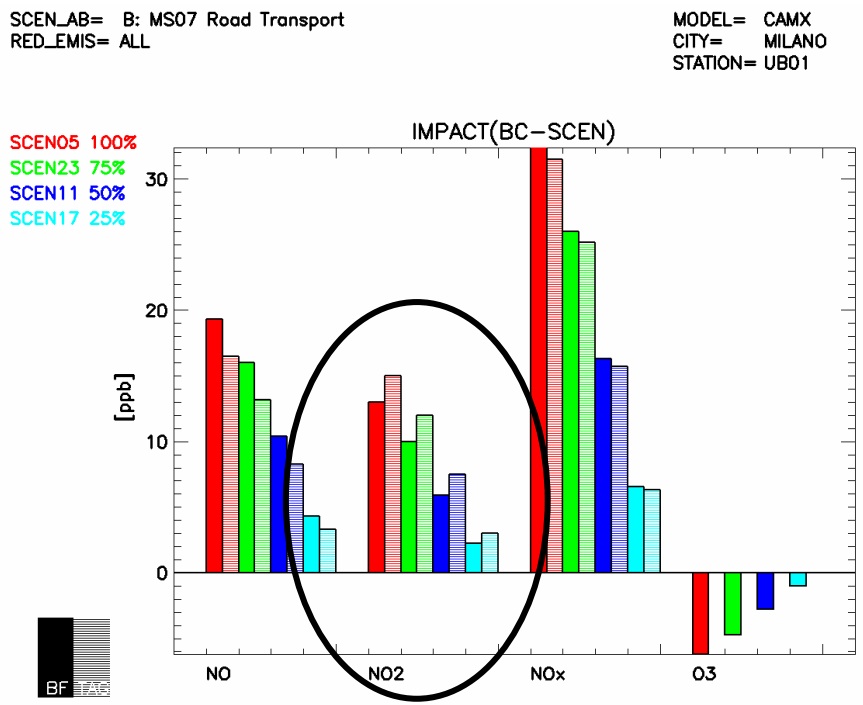
CAMx

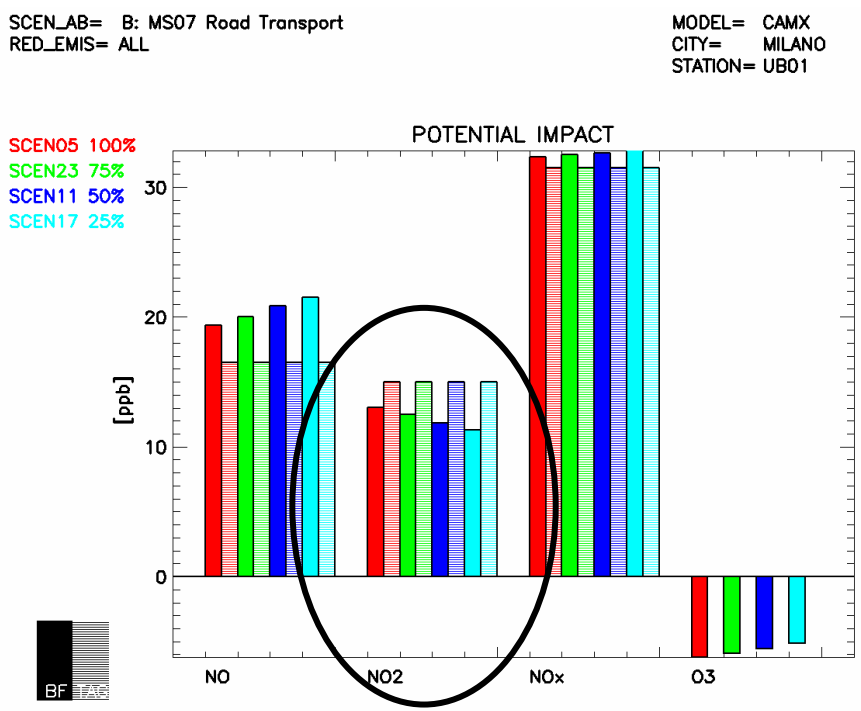
UB01

Milan city - receptor corresponding to an Urban background site

Tagging

ALL reduction





A = Industry

B = Road Trasnport

RSE Ricerca Sistema Energetico

European Commission

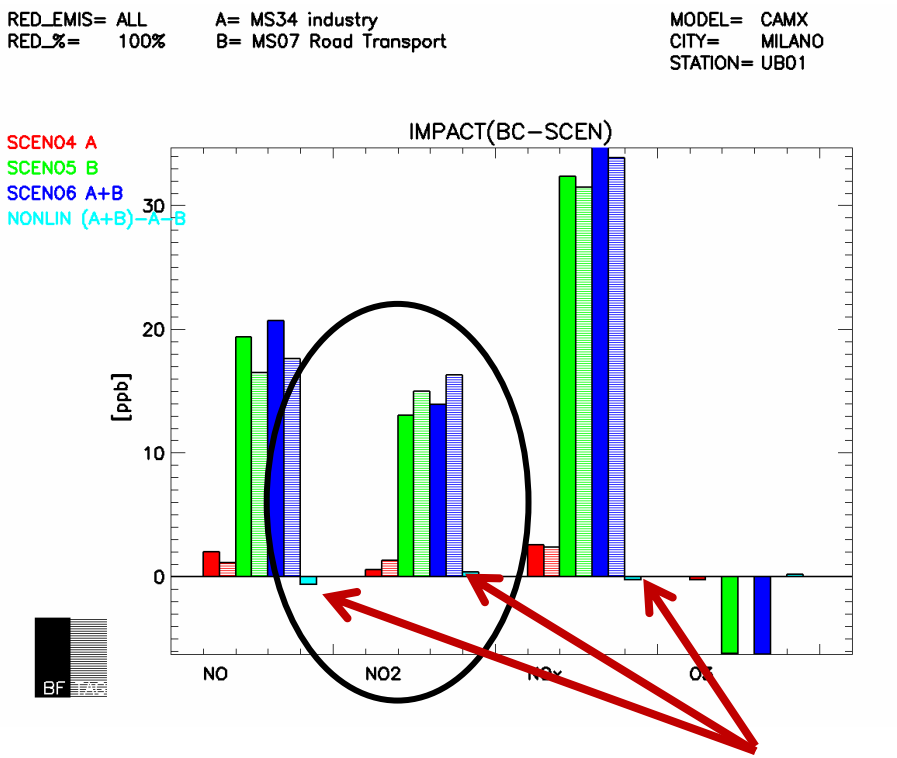
Source apportionment of NO_2 – Modelling exercise

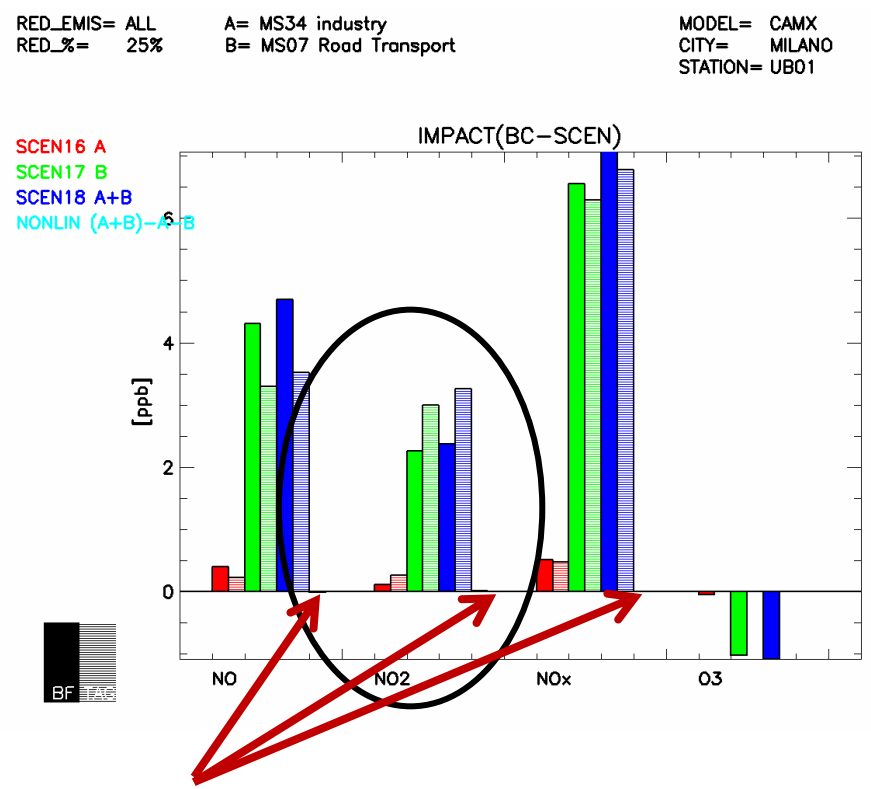
Preliminary results… **Tagging vs BF**

CAMx

UB01

Milan city - receptor corresponding to an Urban background site





Tagging

ALL reduction

A = Industry

B = Road Transport

RSE Ricerca Sistema Energetico

European Commission

Next steps…

- Analysis of the results
  - Check the status of results delivery (e-mail by 15 of March 2021)
  - CT1 delta tool available for participants (end of March)
  - Interaction with teams to check/analyse data and CT1 tool (April-May 2021)
  - Preliminary discussion of the obtained results (WebCo in June 2021)
  - Further analysis and possible updates to CT1 tool (summer 2021)
  - Final discussion in view of the technical meeting (September 2021)
  - Presentation of the results at the next technical meeting (October 2021)
- Use the results to feed the updated version of the guidance
- CEN/TC264/WG44 group… waiting for spring updates (!)