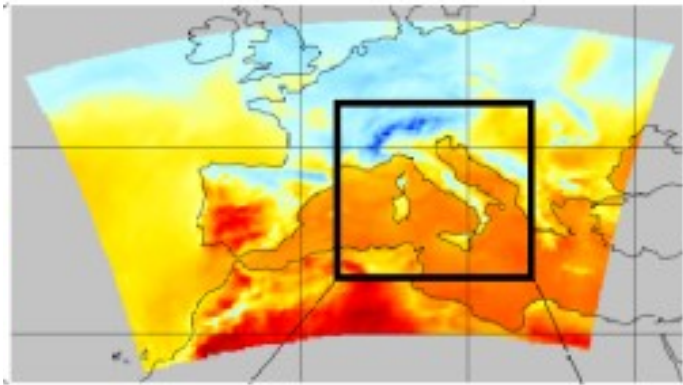


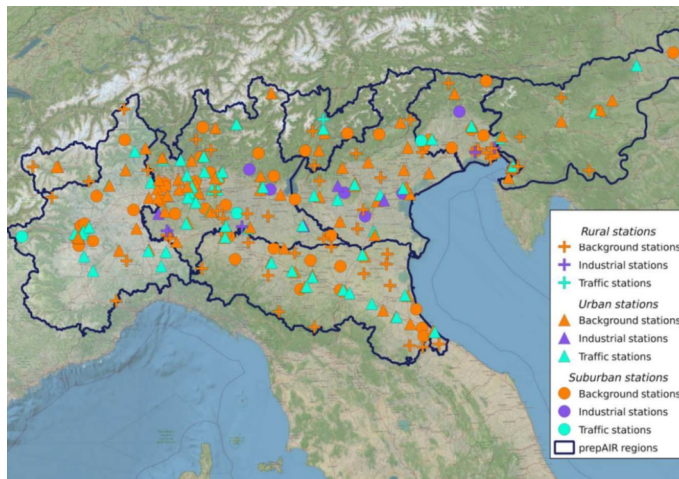
# Return on experience with the QA/QC protocol

Giulia Giovannini, Michele Stortini, Roberta Amorati, Lidia Bressan  
ARPAE-Italy Fairmode technical meeting , Oslo 18-20 October 2022

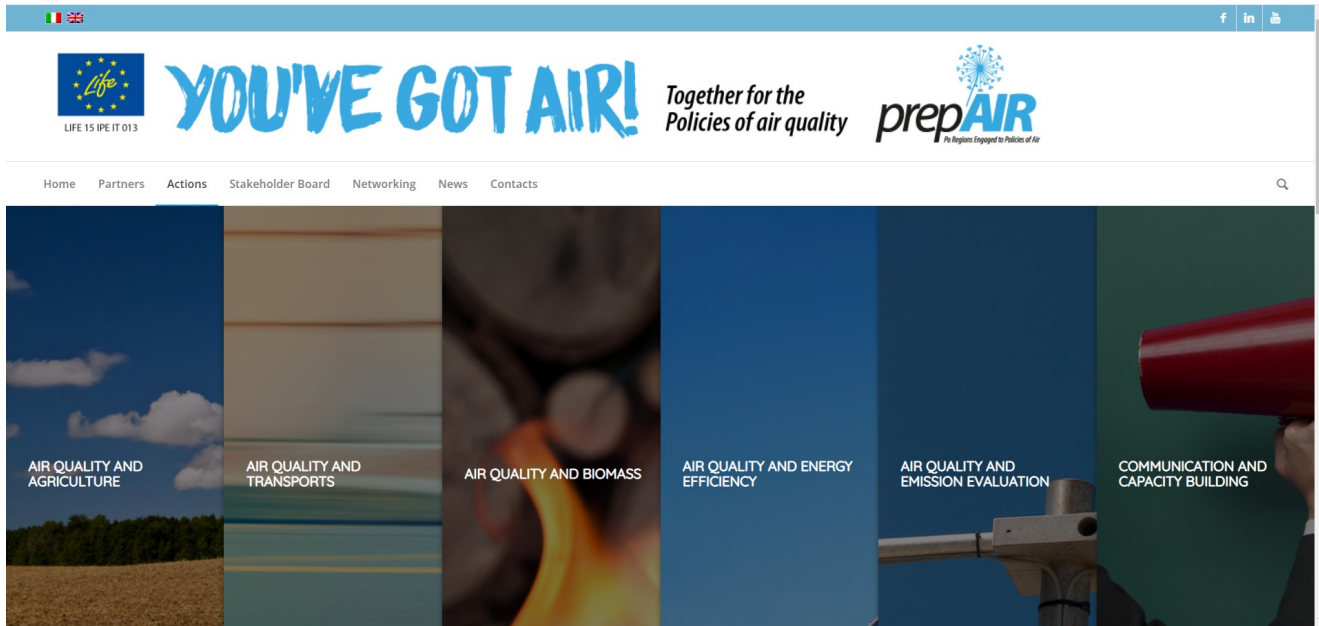
# Air Quality Modelling System



- PREPSLO: 5\*5km inner domain nested to kAIROS (italian SNPA model system) including Northern Italy and Slovenia.
- CTM:CHIMERE2017
- METEO: COSMO\_5MED
- BC: kAIROS
- Emission: PREPAIR project

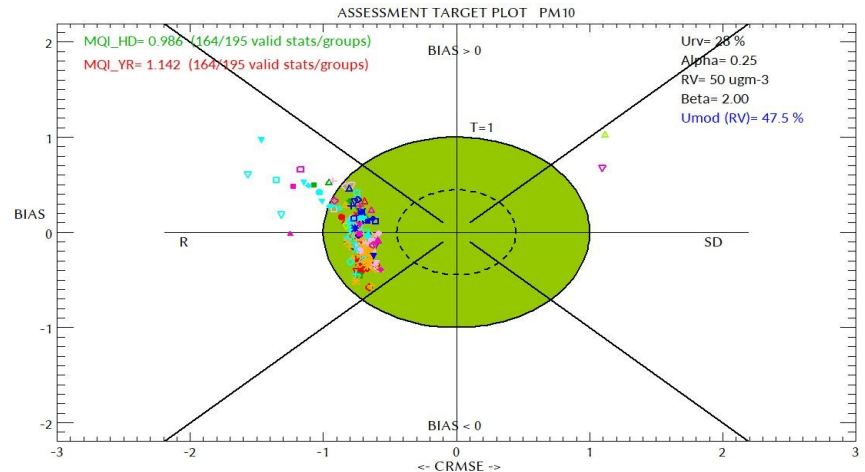
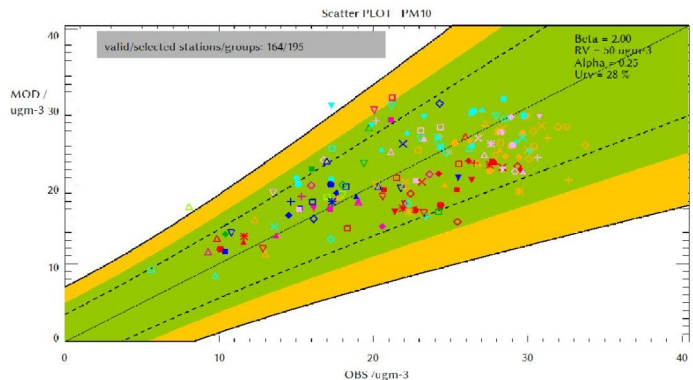


The monitoring station available in PREPAIR project.



PREPAIR (Po Regions Engaged to Policies of AIR) aims at implementing the measures foreseen in the regional plans and in the Po Valley agreement at a larger scale so to strengthen the sustainability and durability of results: the geographical coverage of the IP is the Po Valley with the regions and cities that mainly influence air quality in the basin. The IP actions are also extended to Slovenia in order to assess and reduce pollutants transportation also across the Adriatic sea

# PM10 - All regions - Background



○ MARECCHIA	● SANROCCO	● PARCORESISTEN	● CENTO	● FIU	Standard Ind: 1.8760
○ VERUCCHIO	● REMESINA	● FRANCHINIANGE	● VILLAFULVIA	● GRA	Model (s): PREPSLOano
○ SANLEO	● PARCOFERRAR	● SAVIGNANODI	● CAOPIE	● TAVAZZANO	Parameter: PM10
○ CITTADILLA	● SAVIGNANODIRI	● DELTACERVIA	● VESACCAFISOLA	● PARCOBERTOZZI	Scen: 2021
○ BADIA	● PARCOFERRAR	● GARDININMARGH	● PARCOBERTOZZI	● ROVERETOLGP	Extra Values: No
○ SARAGAT	● SANGUANO	● SANGUANO	● SANGUANO	● SANGUANO	Season: Year
○ CASTELLARANO	● DECENZONE	● CASTELLARANO	● CASTELLARANO	● CASTELLARANO	Day hours: All 24h
○ SUZZARO	● PARCOMONTECUC	● PARCOMONTECUC	● PARCOMONTECUC	● PARCOMONTECUC	Time Average: Preserve
○ FEBBIO	● CORTEBRUGNATE	● GHERARDI	● GHERARDI	● GHERARDI	Daily stats: Mean

○ MARECCHIA	● SANROCCO	● PARCORESISTEN	● CENTO	● FIU	Standard Ind: 1.8760
○ VERUCCHIO	● REMESINA	● FRANCHINIANGE	● VILLAFULVIA	● GRA	Model (s): PREPSLOano
○ SANLEO	● PARCOFERRAR	● SAVIGNANODI	● CAOPIE	● TAVAZZANO	Parameter: PM10
○ CITTADILLA	● SAVIGNANODIRI	● DELTACERVIA	● VESACCAFISOLA	● PARCOBERTOZZI	Scen: 2021
○ BADIA	● PARCOFERRAR	● GARDININMARGH	● PARCOBERTOZZI	● ROVERETOLGP	Extra Values: No
○ SARAGAT	● SANGUANO	● SANGUANO	● SANGUANO	● SANGUANO	Season: Year
○ CASTELLARANO	● DECENZONE	● CASTELLARANO	● CASTELLARANO	● CASTELLARANO	Day hours: All 24h
○ SUZZARO	● PARCOMONTECUC	● PARCOMONTECUC	● PARCOMONTECUC	● PARCOMONTECUC	Time Average: Preserve
○ FEBBIO	● CORTEBRUGNATE	● GHERARDI	● GHERARDI	● GHERARDI	Daily stats: Mean

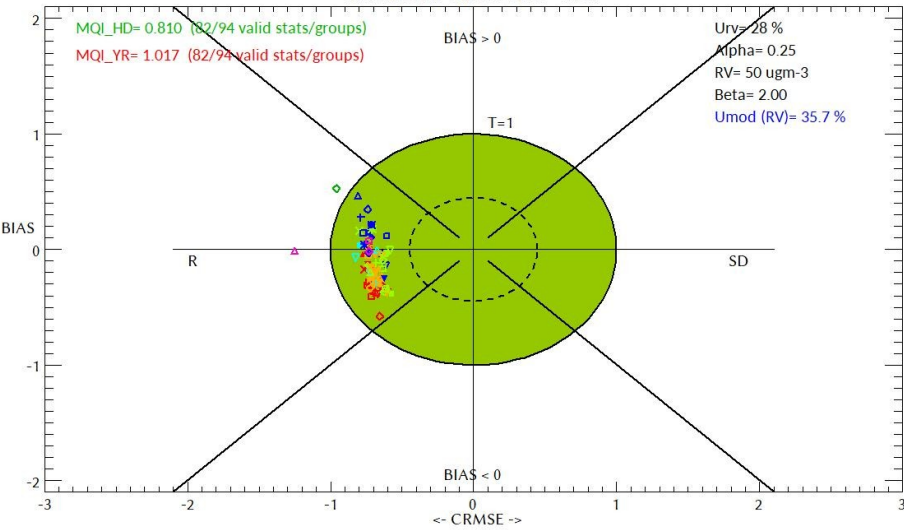
SUMMARY STATISTICS		Nb of stations/groups: 164 valid / 195 selected	
OBS	Mean	[Bar chart showing mean values for various stations]	
	Fix resd	[Bar chart showing fixed residuals]	
IIME	Bias Norm	[Bar chart showing bias norm]	
	T-R Norm	[Bar chart showing T-R norm]	
	StdDev Norm	[Bar chart showing standard deviation norm]	
	Hperc Norm	[Bar chart showing hpercent norm]	
	SPAC Norm	[Bar chart showing SPAC norm]	

- Only two stations are outside the green and orange areas of the scatter plot.
- In the summary report all indicators satisfy the performance criteria.
- In the assessment target plot MQI\_HD satisfies the performance criteria while the MQI\_YR is > 1.????

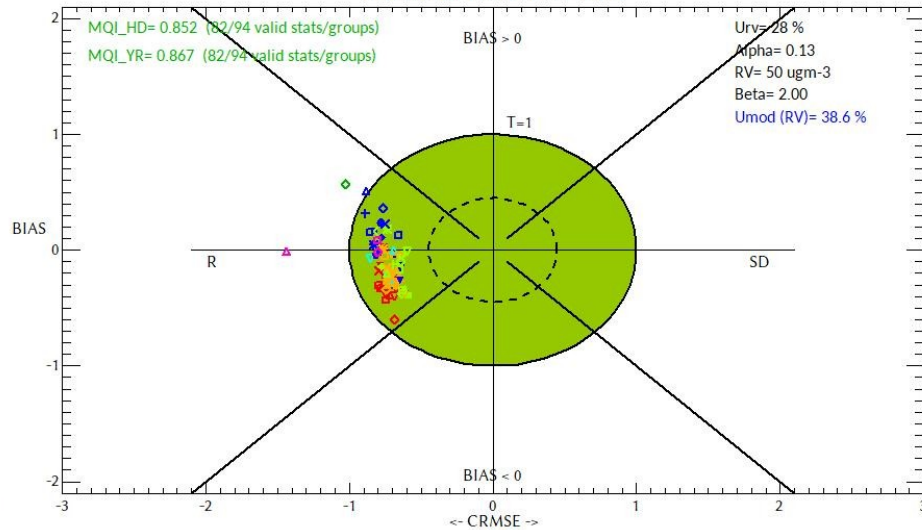
■ Performance Criteria satisfied  
■ Performance Criteria satisfied; Error dominated by coresponding Indicator  
■ TIME: 95% of stations fulfill the Performance Criteria  
● SPACE: 50% of stations fulfill the Performance Criteria  
● TIME: 45% of stations fulfill the Performance Criteria  
○ SPACE: Dot does not fulfill the Performance Criteria

# PM10 - All regions - Background - Plane

ASSESSMENT TARGET PLOT PM10



ASSESSMENT TARGET PLOT PM10



◊ MARECCHIA	✕ PARCOEDILCARA	▽ GHERARDI	▽ EDI	● PAVIAVIAFOLPE
◊ VERUCCHIO	✕ BESENZONE	▽ CENTO	▽ FIU	● VEPARCOBISSUO
◊ QTTADELLA	✕ PARCOMONTECUC	▽ VILLAFULVIA	▽ GRA	● MAGENTA
◊ SARAGAT	✕ PARCOPRESISTEN	▽ CAORLE	▽ TAVAZZANO	● VIQUARTIEREIT
◊ SLAZZARO	✕ FRANCHINIANGE	▽ DELTACERVIA	▽ VESACCAFISOLA	● ADRIA
◊ SANROCCO	▽ SAVIGNANO	▽ PARCOBERTOZZI	● nonem2	● ROBORSEA
◊ REMESINA	▽ GIARDINIMARGH	▽ BRU	● LIMITO	● SANDONADIPIAV
◊ PARCOFERRARI	▽ SANPIETROCAPO	▽ CAI	● RIVAGAR	● TURBIGO
◊ GAVELLO	▽ VIACHIARINI	▽ CAS	● CREMA	● PONTISULMINCI

◊ MARECCHIA	✕ PARCOEDILCARA	▽ GHERARDI	▽ EDI	● PAVIAVIAFOLPE
◊ VERUCCHIO	✕ BESENZONE	▽ CENTO	▽ FIU	● VEPARCOBISSUO
◊ QTTADELLA	✕ PARCOMONTECUC	▽ VILLAFULVIA	▽ GRA	● MAGENTA
◊ SARAGAT	✕ PARCOPRESISTEN	▽ CAORLE	▽ TAVAZZANO	● VIQUARTIEREIT
◊ SLAZZARO	✕ FRANCHINIANGE	▽ DELTACERVIA	▽ VESACCAFISOLA	● ADRIA
◊ SANROCCO	▽ SAVIGNANO	▽ PARCOBERTOZZI	● nonem2	● ROBORSEA
◊ REMESINA	▽ GIARDINIMARGH	▽ BRU	● LIMITO	● SANDONADIPIAV
◊ PARCOFERRARI	▽ SANPIETROCAPO	▽ CAI	● RIVAGAR	● TURBIGO
◊ GAVELLO	▽ VIACHIARINI	▽ CAS	● CREMA	● PONTISULMINCI

Str/End Ind: 1-8760  
 Model (s): PREPSLOeone  
 Parameter: PM10  
 Scen: 2021  
 Extra Values: No  
 Season: Year  
 Day hours: All 24h  
 Time Average: Preserve  
 Daily stats: Mean

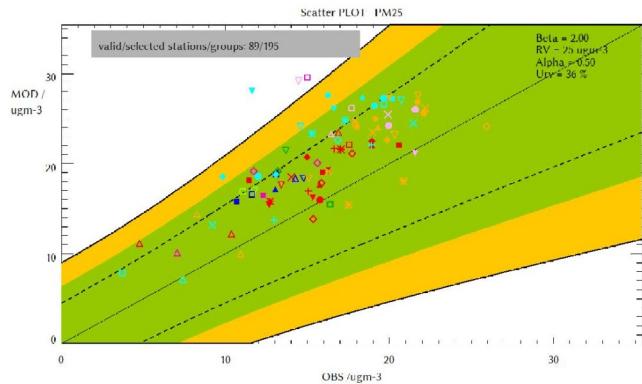
Str/End Ind: 1-8760  
 Model (s): PREPSLOeone  
 Parameter: PM10  
 Scen: 2021  
 Extra Values: No  
 Season: Year  
 Day hours: All 24h  
 Time Average: Preserve  
 Daily stats: Mean

New parameter for uncertainty:  
 Alpha=0.25, N\_p=30, N\_pp=1.5

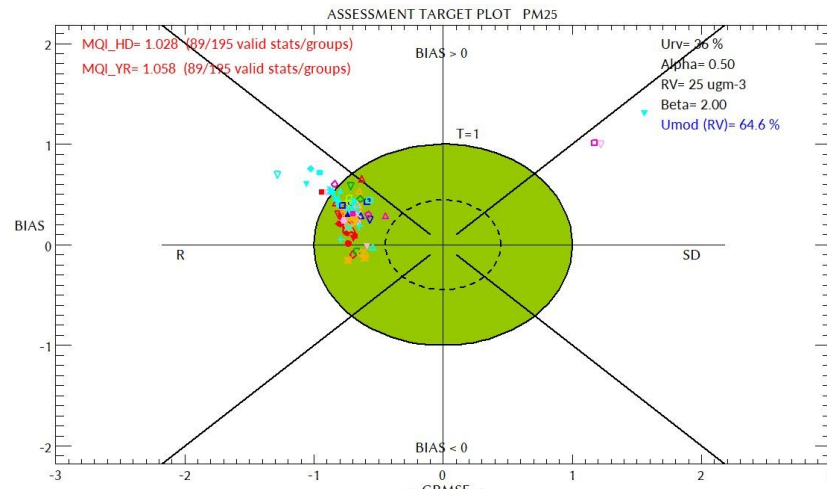
Old parameter for uncertainty:  
 Alpha=0.13, N\_p=20, N\_pp=0.25



# PM2.5 - All regions - Background



● MARECCHIA	● GAVELLO	● GHERARDI	● GRA	● BASSANO DEL GRAPPA	● DRYLAND IND: 1-8760
● SANLEONE	● PARCO EDILCARA	● VILLAFULVIA	● ROVERETO LGP	● BORGAROT CADUT	● Model (s): PREPSLOana
● OTTADELLA	● BESENZONE	● OSTELLATO	● SICHIO	● SANDONADI FAV	● Parameter: PM25
● BADA	● PARCO MONTECUC	● CAORLE	● BIRGOVAL	● BIELLASTURZO	● Scen: 2021
● SARAGAT	● PARCO PRESISTEN	● BALLIRANA	● BERGAMOVIAMEU	● DARIO2	● Extra Values: No
● CASTELLARANO	● SAVIGNANO	● PARCOBERTOZZI	● BORMIO	● PONTISULMINCI	● Season: Year
● GLAZZANO	● GARDIN MARGH	● CAS	● PAVIAFOLPE	● FOMANDRIA	● Day hours: All 24h
● SANROCCO	● SANPIETROCAPO	● CASTELLUCCIO	● AOSTAMONTFLEU	● CASIRATEDADDA	● Time Average: Preserve
● PARCO FERRARI	● EDI	● TRENTOPSC	● VERBANIGABAR	● VERBANIGABAR	● Daily stats: Mean



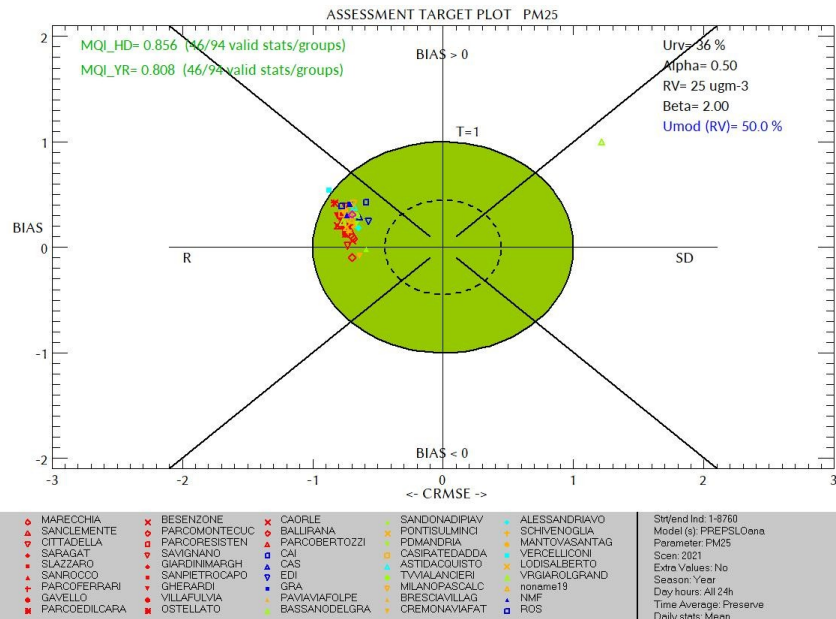
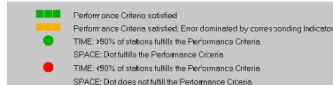
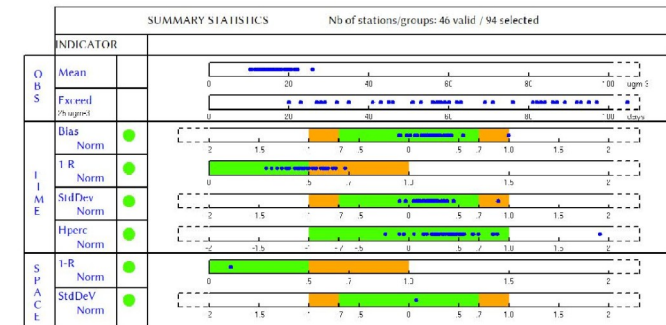
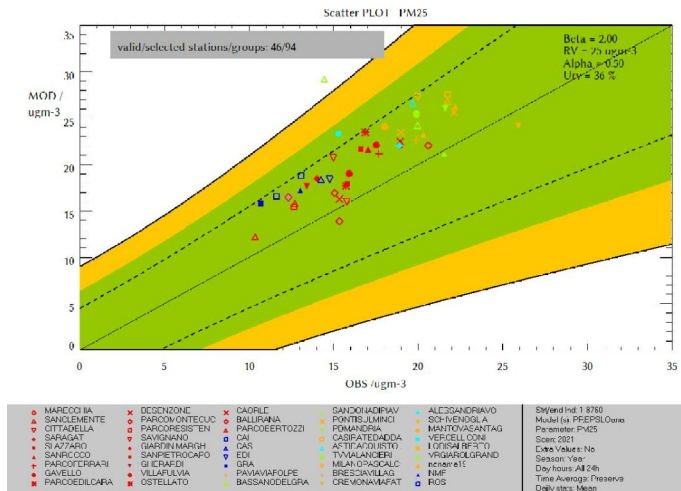
● MARECCHIA	● GAVELLO	● GHERARDI	● GRA	● BASSANO DEL GRAPPA	● DRYLAND IND: 1-8760
● SANLEONE	● PARCO EDILCARA	● VILLAFULVIA	● ROVERETO LGP	● BORGAROT CADUT	● Model (s): PREPSLOana
● OTTADELLA	● BESENZONE	● OSTELLATO	● SICHIO	● SANDONADI FAV	● Parameter: PM25
● BADA	● PARCO MONTECUC	● CAORLE	● BIRGOVAL	● BIELLASTURZO	● Scen: 2021
● SARAGAT	● PARCO PRESISTEN	● BALLIRANA	● BERGAMOVIAMEU	● DARIO2	● Extra Values: No
● CASTELLARANO	● SAVIGNANO	● PARCOBERTOZZI	● BORMIO	● PONTISULMINCI	● Season: Year
● GLAZZANO	● GARDIN MARGH	● CAS	● PAVIAFOLPE	● FOMANDRIA	● Day hours: All 24h
● SANROCCO	● SANPIETROCAPO	● CASTELLUCCIO	● AOSTAMONTFLEU	● CASIRATEDADDA	● Time Average: Preserve
● PARCO FERRARI	● EDI	● TRENTOPSC	● VERBANIGABAR	● VERBANIGABAR	● Daily stats: Mean

INDICATOR		SUMMARY STATISTICS		Nb of stations/groups: 89 valid / 195 selected	
OBS	Mean	[Bar chart showing mean values for 48 stations]			
	Exceed (%)	[Bar chart showing exceedance percentages for 48 stations]			
IIME	Bias Norm	[Bar chart showing bias norms for 48 stations]			
	1-R Norm	[Bar chart showing 1-R norms for 48 stations]			
	StdDev Norm	[Bar chart showing standard deviation norms for 48 stations]			
	Hperc Norm	[Bar chart showing Hperc norms for 48 stations]			
SPACE	1-R Norm	[Bar chart showing 1-R norms for 48 stations]			
	StdDev Norm	[Bar chart showing standard deviation norms for 48 stations]			

■ Performer once Criteria satisfied  
■ Performer once Criteria satisfied. Error dominated by corresponding Indicator  
● TIME: >90% of stations fulfill the Performance Criteria  
● SPACE: Not fulfill the Performance Criteria  
● TIME: <90% of stations fulfill the Performance Criteria  
● SPACE: Did not fulfill the Performance Criteria

- Only three stations are outside the green and orange areas of the *scatter plot*.
- In the *summary report* all indicators satisfy the performance criteria except for the Hperc Norm indicator. Overestimation of PM25
- In the assessment *target plot* both MQI indicators don't satisfy the performance criteria.

# PM2.5 - All regions - Background - Plane

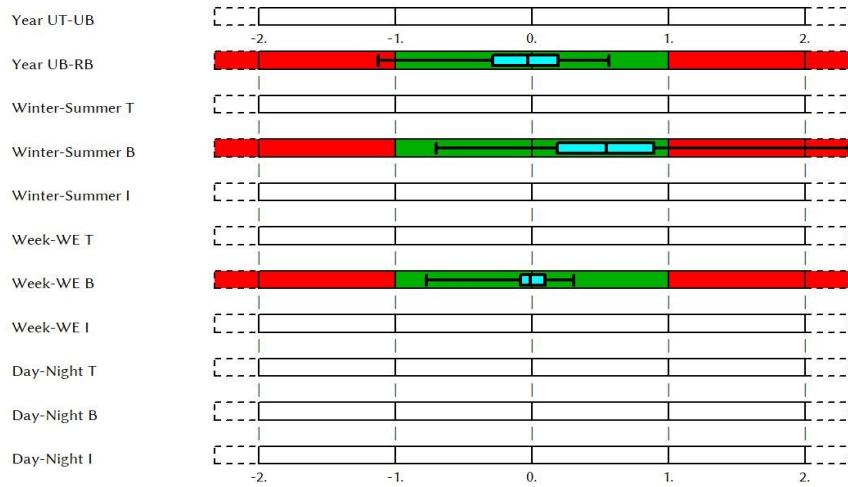


- Only one station is outside the green and orange areas of the *scatter plot*.
- In the *summary report* all indicators satisfy the performance criteria.
- In the assessment *target plot* both MQI indicators satisfy the performance criteria.

# Dynamic Evaluation by plane stations

## PM10

## PM2.5



StrVend Ind: 1-8760  
 Model (s): PREPSLOana  
 Parameter: PM10  
 Scen: 2021  
 Extra Values: 2  
 Season: Year  
 Day hours: All 24h  
 Time Average: Preserve  
 Daily stats: Mean



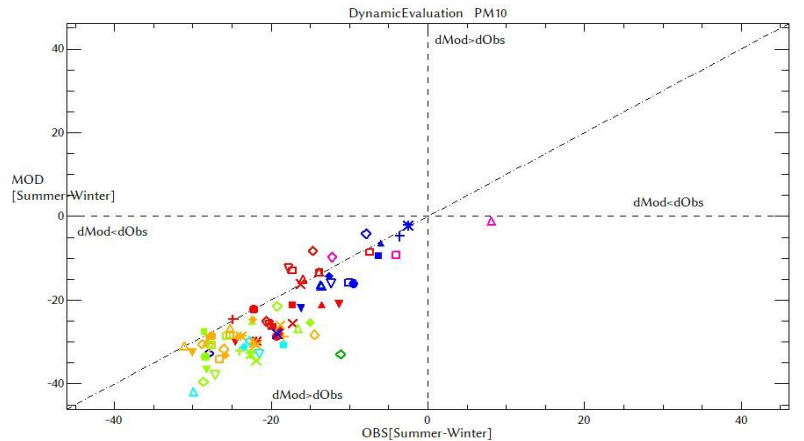
StrVend Ind: 1-8760  
 Model (s): PREPSLOana  
 Parameter: PM25  
 Scen: 2021  
 Extra Values: 2  
 Season: Year  
 Day hours: All 24h  
 Time Average: Preserve  
 Daily stats: Mean

- Both graphs show good performance for urban and rural background comparison as well as weekend / weekday.
- seasonal variation are very similar but for pm10 are red and pm25 are green



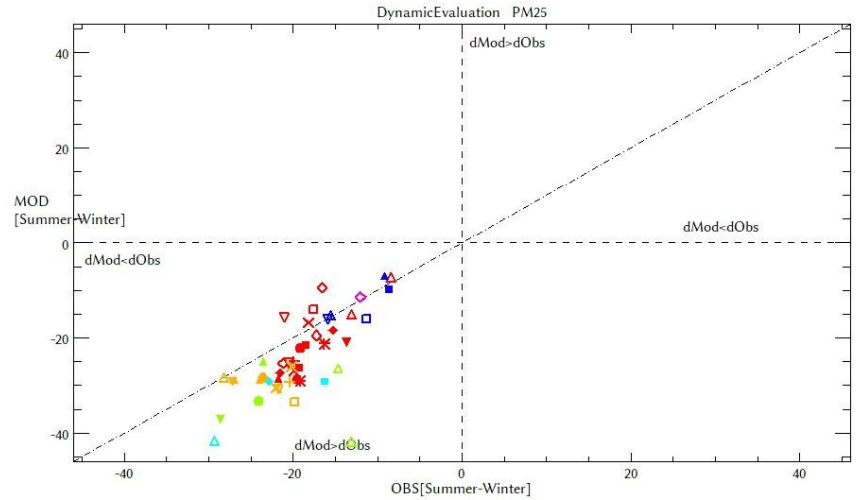
# Dynamic Evaluation bg plane stations

## PM10



◊ MARECCHIA	✕ PARCOEDILCARA	● CENTO	◆ FIU	● VEPARCOBISSUO	Str/End Ind: 1-8760
◊ VERUCCHIO	✕ BESENZONE	● VILLAFULVIA	◆ GRA	● MAGENTA	Model (s): PREPSLOena
◊ OTTADELLA	✕ PARCOMONTEC	● CADRIE	◆ TAVAZZANO	● VIGLIANTEREIT	Parameter: PM10
◊ SARAGAT	✕ PARCORESISTE	● DELTACERVIA	◆ VESACCAFISOLA	● ADRIA	Scen: 2021
◊ SLAZZARO	✕ FRANCHINANGE	● BRU	◆ ROBORSEA	● SANDONADIPIAV	Extra Values: No
◊ SANPIETRO	✕ SAVIGNANO	● PARCOBERTOZZ	◆ LIMITO	● EDI	Season: Summer(JJA)-Winter(DJF)
◊ REMESINA	✕ SANPIETROCAP	● CAI	◆ RIVAGAR	● TURBIGO	Day hours: All 24h
◊ PARCOFERRARI	✕ VIACHIARINI	● CAS	◆ OREMA	● PONTISULMINCI	Time Average: Preserve
◊ GAVELLO	✕ GHERARDI	● EDI	◆ PAVIAVIAFOLPE	● BORGOFRANCO	Daily stats: Mean

## PM2.5



◊ MARECCHIA	✕ BESENZONE	✕ CAORLE	● SANDONADIPIAV	● ALESSANDRIAVO	Str/End Ind: 1-8760
◊ SANCLEMENTE	✕ PARCOMONTEC	● BALLIRANA	● PONTISULMINCI	● SCHIVENOGLIA	Model (s): PREPSLOena
◊ OTTADELLA	✕ PARCORESISTE	● PARCOBERTOZZ	● PDMANORIA	● MANTOVASANTAG	Parameter: PM25
◊ SARAGAT	✕ PARCORESISTE	● CAI	● CASIRATEDADDA	● VERCELLICONI	Scen: 2021
◊ SLAZZARO	✕ GIARDINIMARGH	● CAS	● ASTIDACQUISTO	● LODISALBERTO	Extra Values: No
◊ SANPIETRO	✕ SANPIETROCAP	● EDI	● TVMALANGIERI	● VRGIAROLGRAND	Season: Summer(JJA)-Winter(DJF)
◊ PARCOFERRARI	✕ GHERARDI	● GRA	● MILANO FASALC	● noname13	Day hours: All 24h
◊ GAVELLO	✕ VILLAFULVIA	● PAVIAVIAFOLPE	● BRESCIAVILLAG	● NMF	Time Average: Preserve
◊ PARCOEDILCARA	✕ OSTELLATO	● BASSANO DELGRA	● CREMONAVIAFA	● SI0034A	Daily stats: Mean

Both graphs show the same performance but pm10 are red and pm25 are green in new dinamical plots

# Suggestions and further activity

General comment:

There are lots of plots and indicators; we have to better specify which are “mandatory”.

New dynamic evaluation is very interesting but scatterplot for UT-UB and UB-RB increment could be useful to better understand good MPI.

If  $MQI\_YR$  should be  $\leq 1$  also for time series data should be useful to have another column with the  $MQI\_YR$  indicator for each station, as in the case of  $MQI\_HD$  in `dumpfile.txt` of *target plot*; Target and scatter plot for yearly average starting from hourly data set could also be useful. Now yearly result can be obtained only from yearly data set.

Further model simulation to analyse the interannual model performance