Differences between new & old MQO DELTA-TOOL v5.2 vs v5.4: Oslo case

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FAIRMODE
Forum for air quality modelling in Europe

Changes in U

Short-term uncertainty:

$$U^2 = U_{RV}^2(1-\alpha^2)C^2 + U_{RV}^2\alpha^2 RV^2$$

Long-term uncertainty:

$$U^2 = \frac{U_{RV}^2(1-\alpha^2)C^2}{N_p} + \frac{U_{RV}^2\alpha^2 RV^2}{N_{np}}$$

	β	U_r^{RV}	RV	α	N_p	N_{np}
NO_2	2	0.25	200 µg/m³	0.20	5.2	5.5
O_3	2	0.18	120 µg/m³	0.79	11	3
PM_{10}	2	0.28	50 µg/m³	0.13	30	0.25
$PM_{2.5}$	2	0.36	25 µg/m³	0.30	30	0.25

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Daily / Hourly MQO & MPC

	MQI	MQO	MPI	MPC
RMSE	$\frac{RMSE}{\beta\ RMS_U}$	$MQI \leq 1$		
BIAS			$\frac{\lvert\bar{M} - \bar{O}\rvert}{\beta\ RMS_U}$	$MPI \leq 1$
R			$\frac{\sqrt{2\sigma_O\sigma_M(1-R)}}{\beta RMS_U}$	
SD			$\frac{\lvert\sigma_M - \sigma_O\rvert}{\beta\ RMS_U}$	
Spatial R			$\frac{\sqrt{2\sigma_O\sigma_M(1-R)}}{\beta RMS_{\bar{U}}}$	$MPI \leq 1$
Spatial SD			$\frac{\lvert\sigma_M - \sigma_O\rvert}{\beta\ RMS_{\bar{U}}}$	
Exceedances			$\frac{\lvert M_{perc} - O_{perc}\rvert}{\beta\ (O_{perc})}$	$MPI \leq 1$

Yearly MQO & MPC

	MQI	MQO	MPI	MPC
RMSE	$\frac{\lvert\bar{M}-\bar{O}\rvert}{\beta\ RMS_{\bar{U}}}$	$MQI \leq 1$		
Spatial R			$\frac{\sqrt{2\sigma_O\sigma_M(1-R)}}{\beta RMS_{\bar{U}}}$	$MPI \leq 1$
Spatial SD			$\frac{\lvert\sigma_M-\sigma_O\rvert}{\beta\ RMS_{\bar{U}}}$	

- Both short-term and long-term MQI are now calculated for the 90th percentile station and used as performance indicator.

The AQD approach is currently used, i.e. the MQO must be fulfilled for at least 90% of the available stations.

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Changes in MQO

			AQD			Fairmode	
		LV µg/m³	DQO %	MQO %	MQO µg/m³	MQO %	MQO at LV µg/m³
NO_2	Hour	200	15%	50%	100	48%	96
	Year	40	15%	30%	12	29%	12
O_3	8h	120	15%	50%	60	26% → 36%	31 → 43
PM_{10}	day	50	25%	-	-	56%	28
	year	40	25%	50%	20	13% → 20%	5 → 9
PM_{25}	Day	25	25%	-	-	72%	18
	year		25%	50%	12.5	20% → 24%	5 → 6

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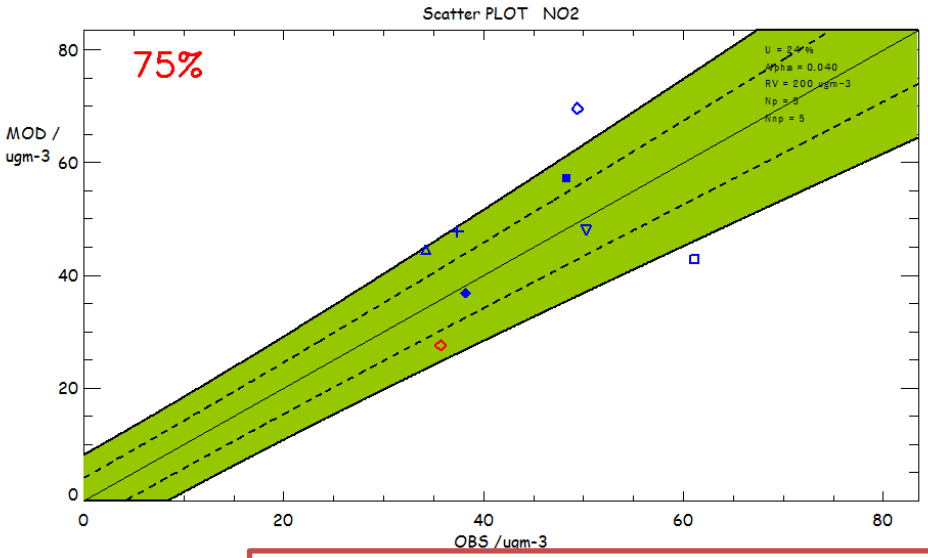
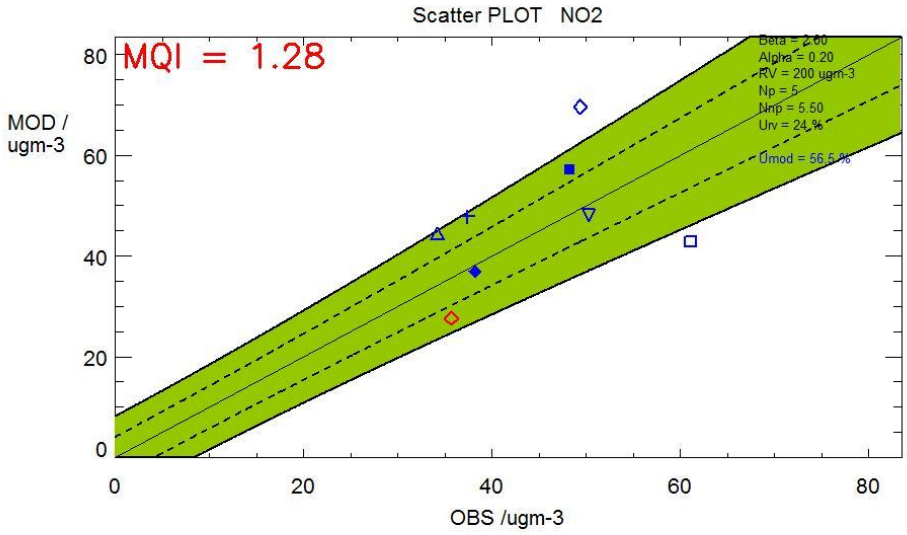
Benchmarking (NO_2 annual means µg/m³)

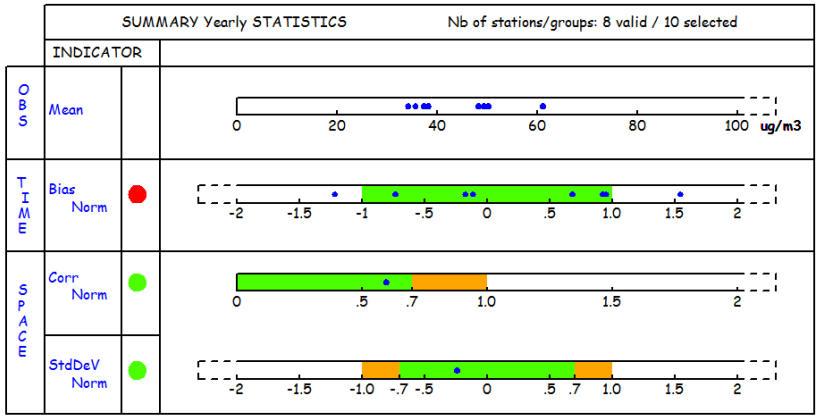


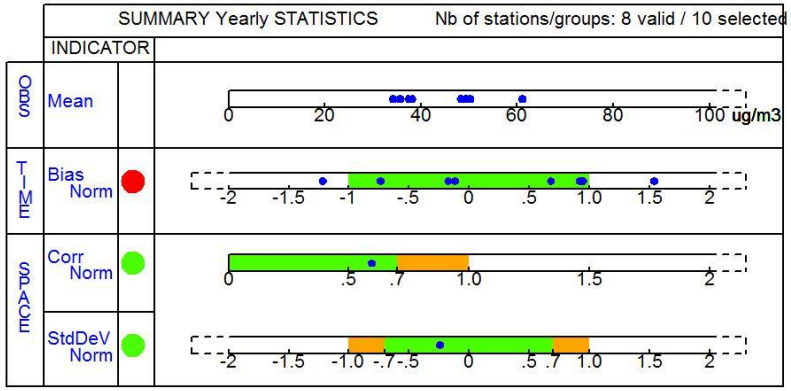


Alnabru
BygdoyAlle
Groenland
Hjortnes
Kirkeveien
Manglerud
Aakebergveien
E16_Sandvika

Same results in v5.2 and v5.4!

Strt/end Ind: 1-8760
Model (s): EPISODE
Parameter: NO2
Scen: 2013
Extra Values: No
Season: Year
Day hours: All 24h
Time Average: Preserved
Daily stats: preserved





Performance Criteria satisfied
Performance Criteria satisfied; Error dominated by corresponding Indicator
TIME: >90% of stations fulfills the Performance Criteria
SPACE: Dot fulfills the Performance Criteria
TIME: <90% of stations fulfills the Performance Criteria
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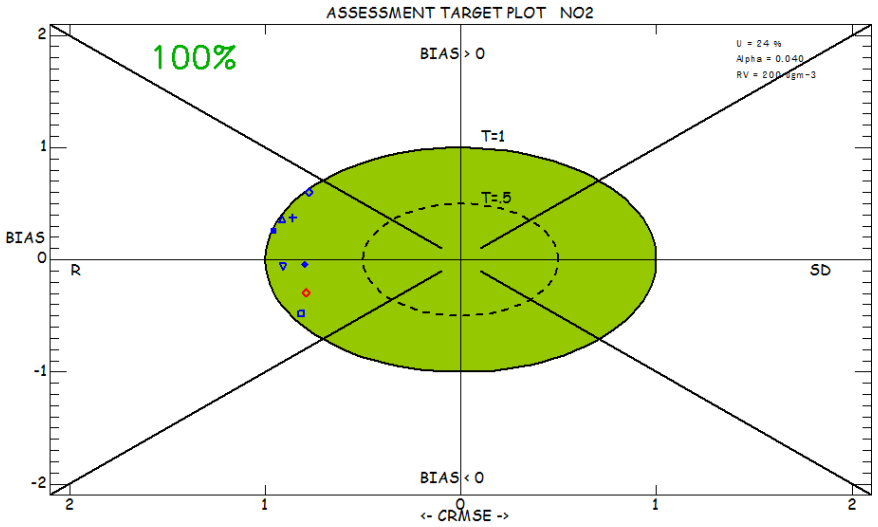
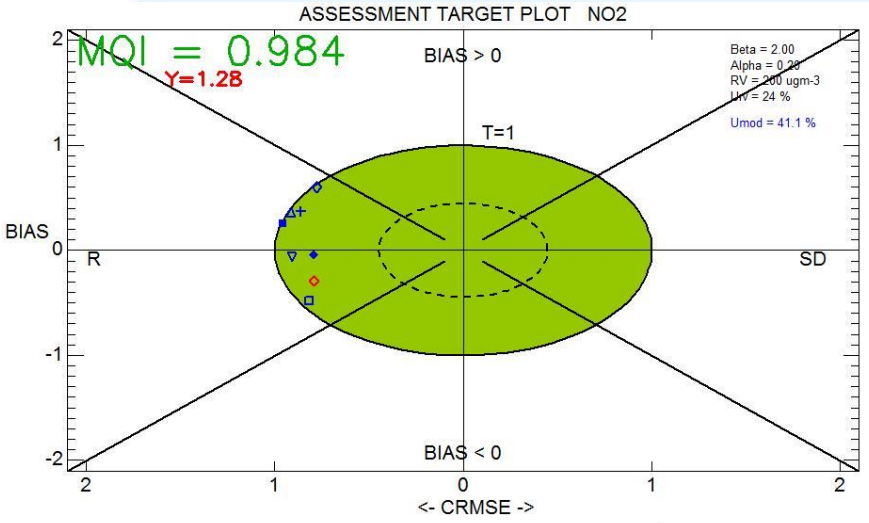
Benchmarking (NO_2 hourly values µg/m³)





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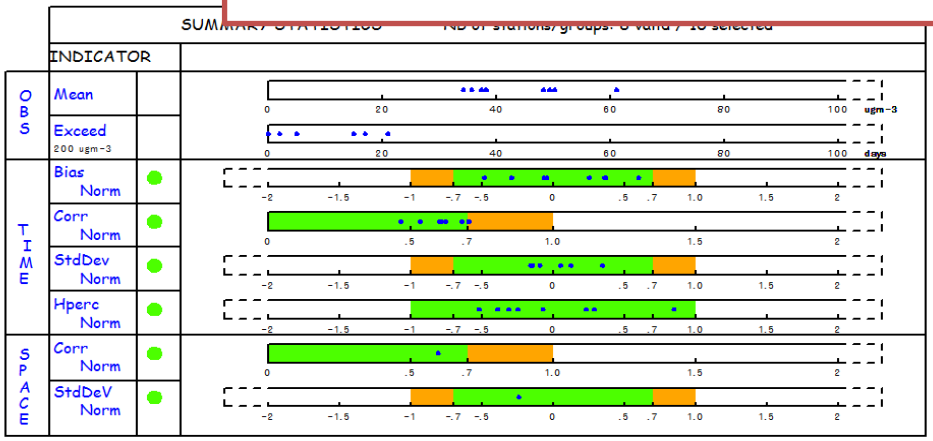

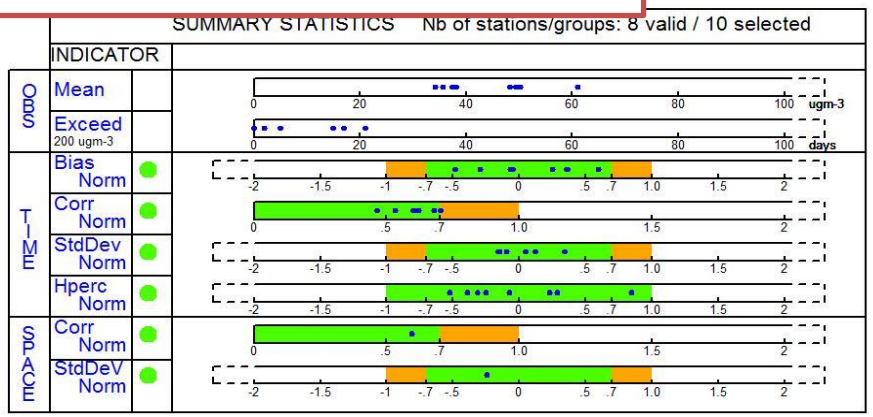

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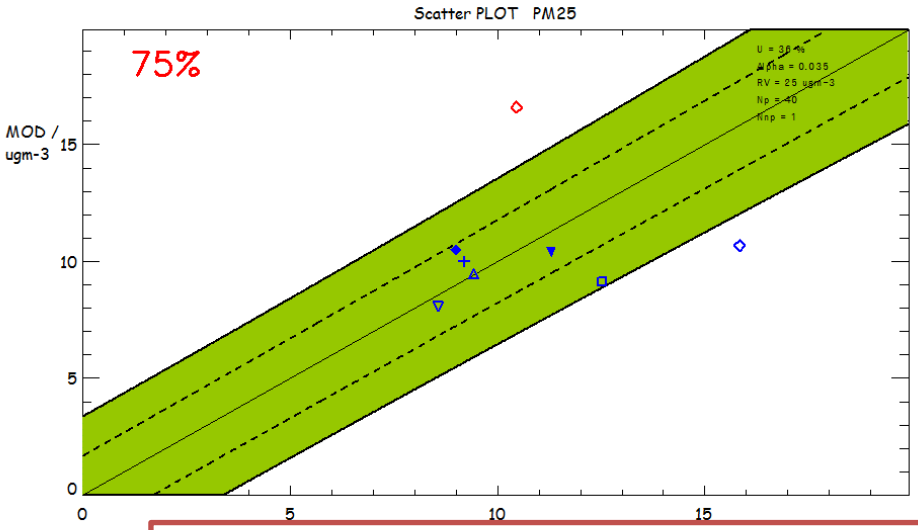
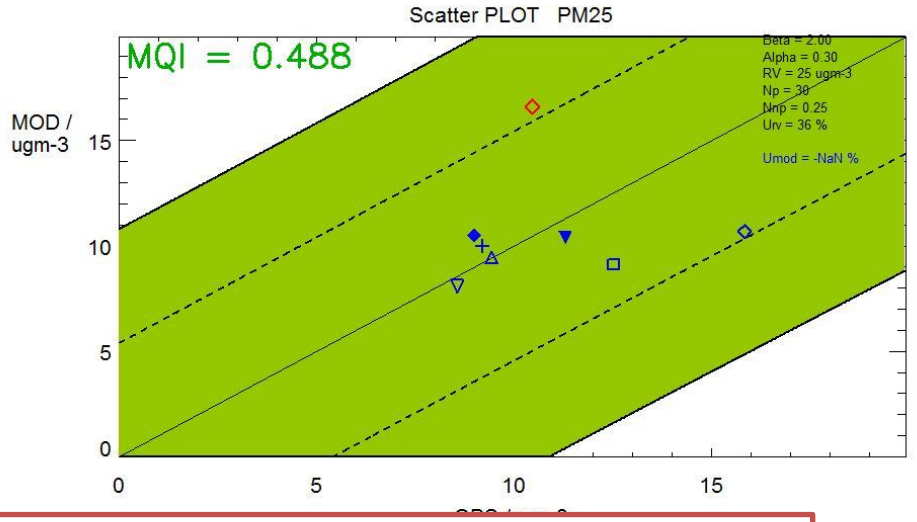
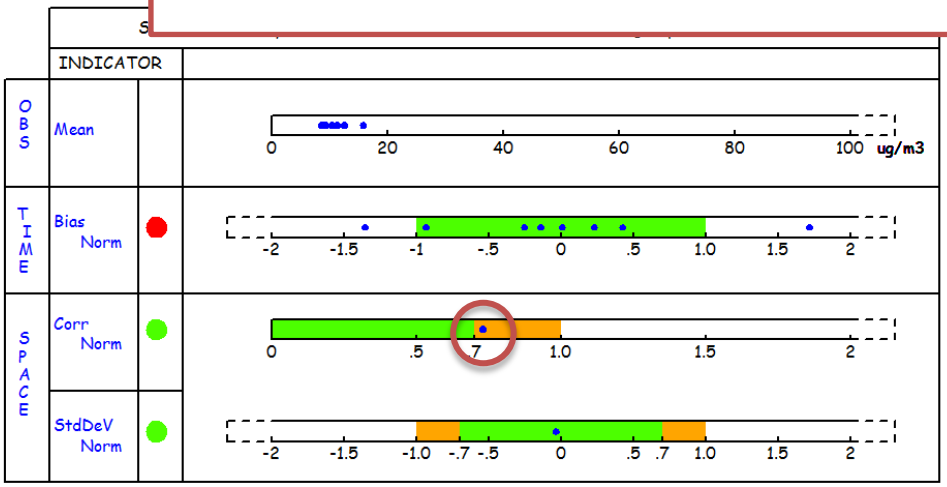
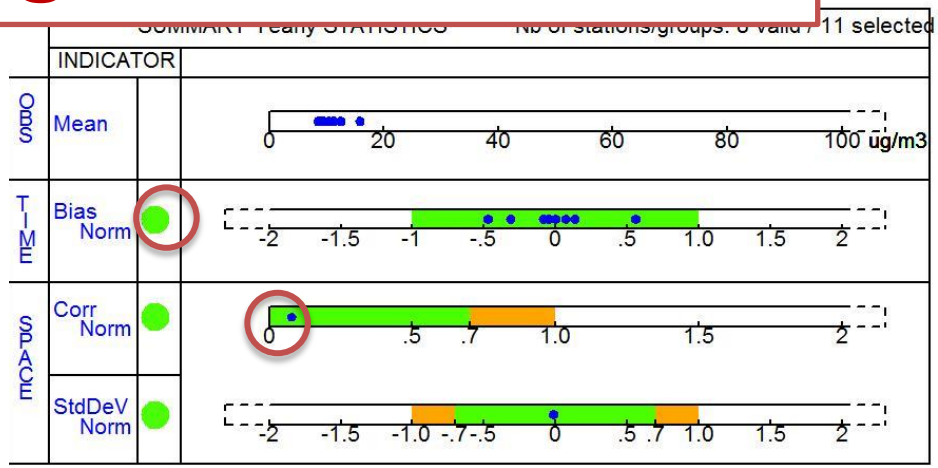
Benchmarking ($PM_{2.5}$ yearly conc. µg/m³)



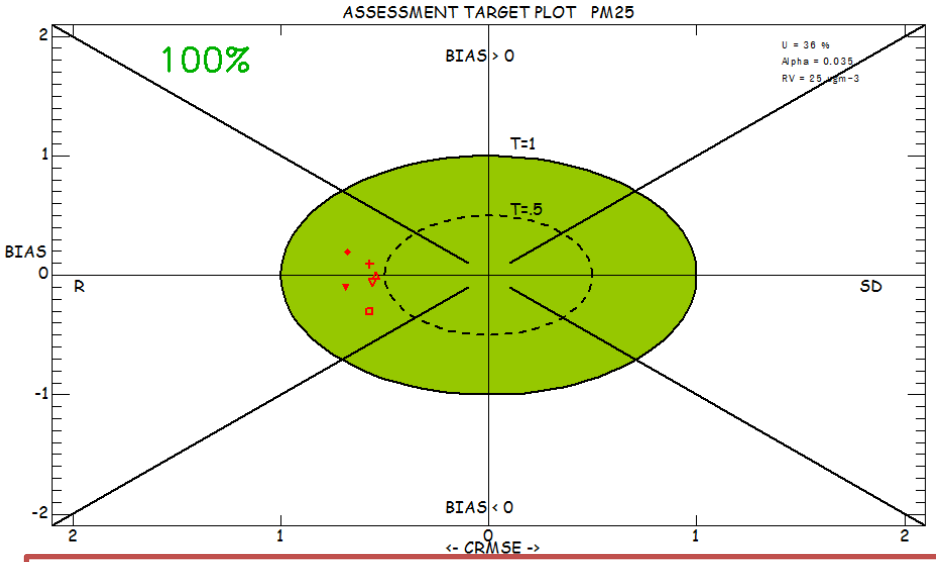


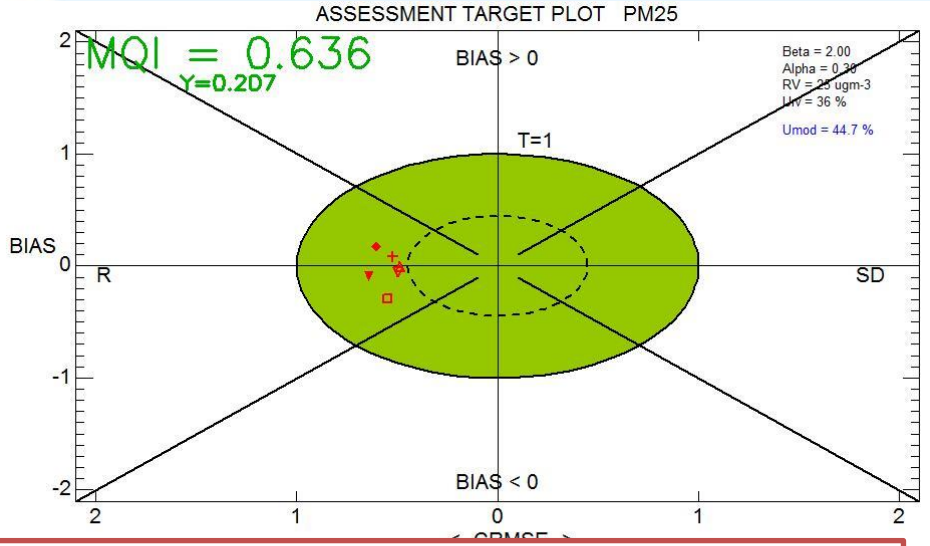
From not fulfilling the MQO in v5.2 to fulfilling in v5.4!



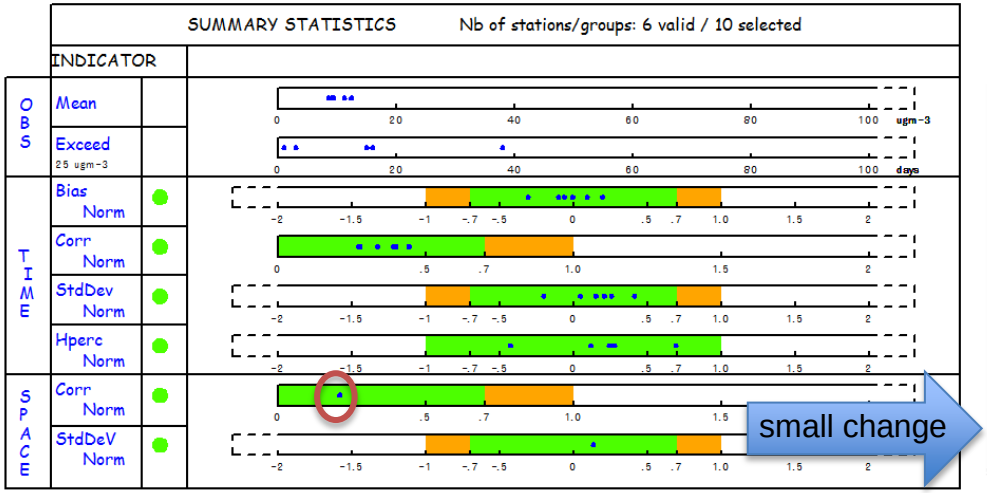


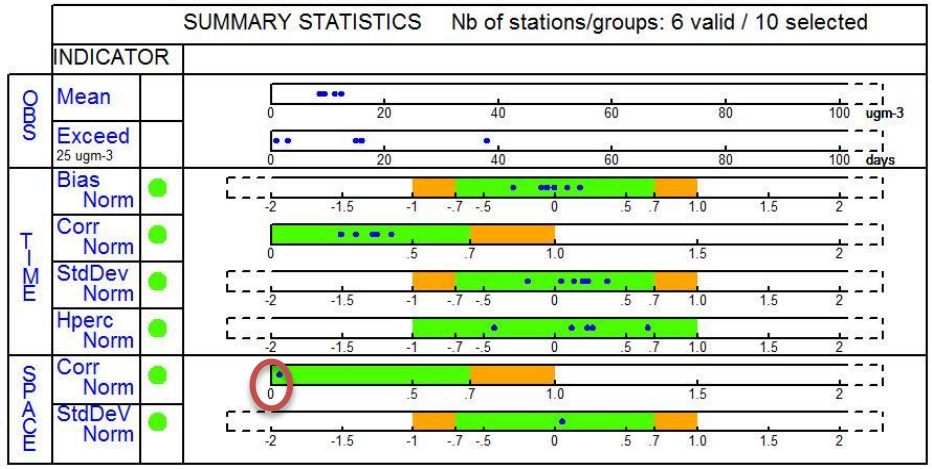
Benchmarking ($PM_{2.5}$ daily conc. µg/m³)



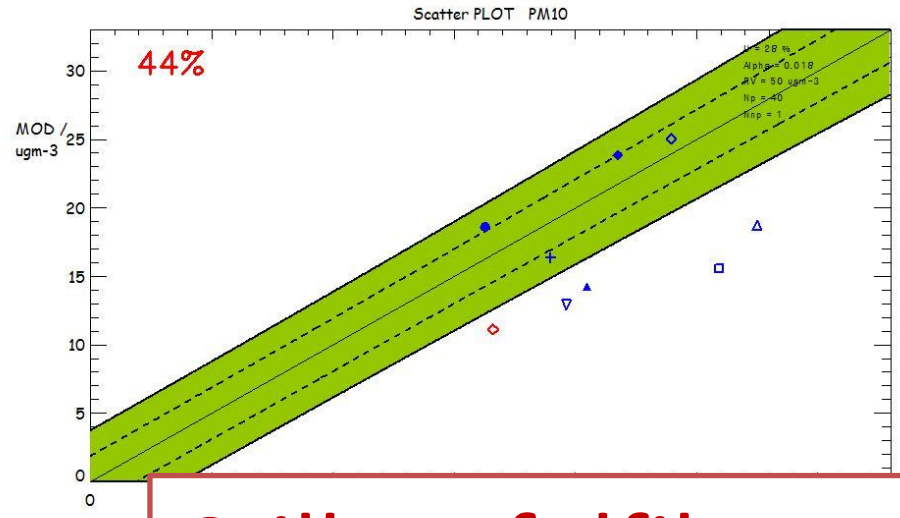


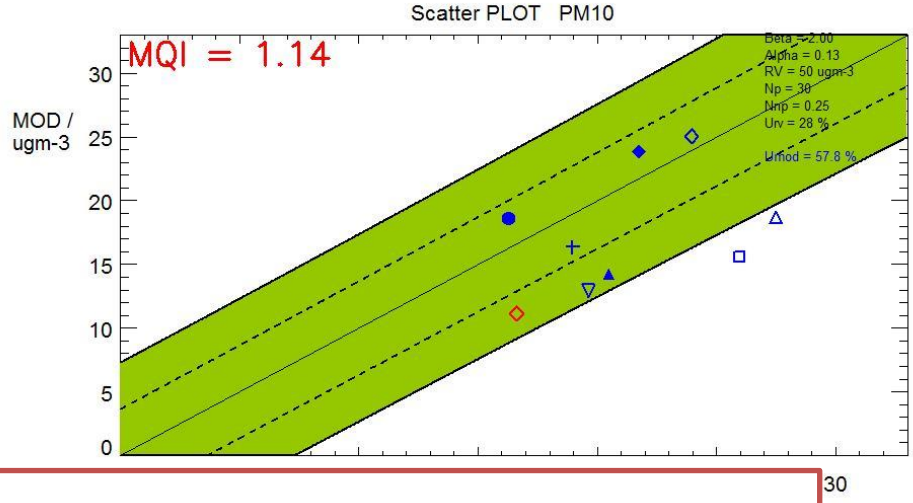
Almost the same results in v5.2 and v5.4!



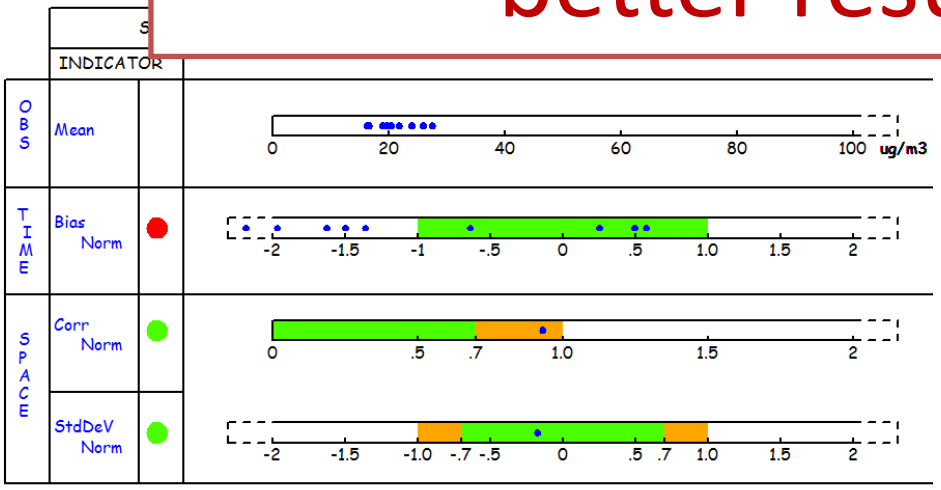


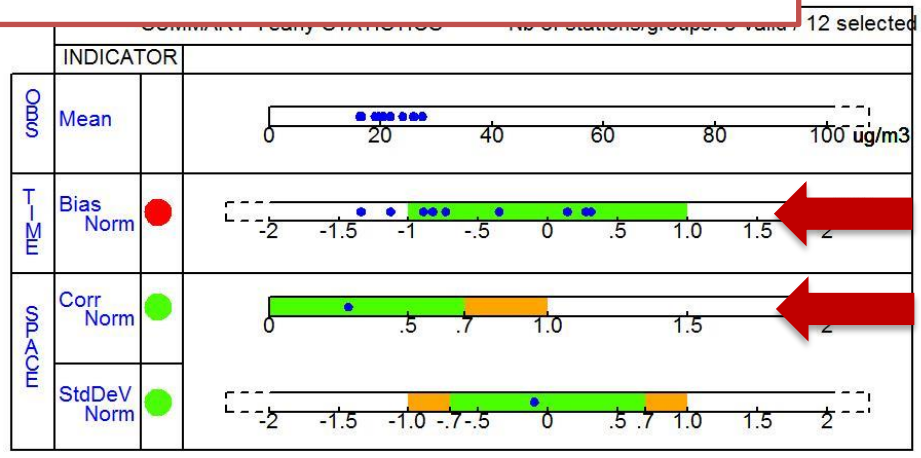
Benchmarking (PM_{10} yearly conc. µg/m³)





Still no fulfilment of MQO but much better results in v5.4!





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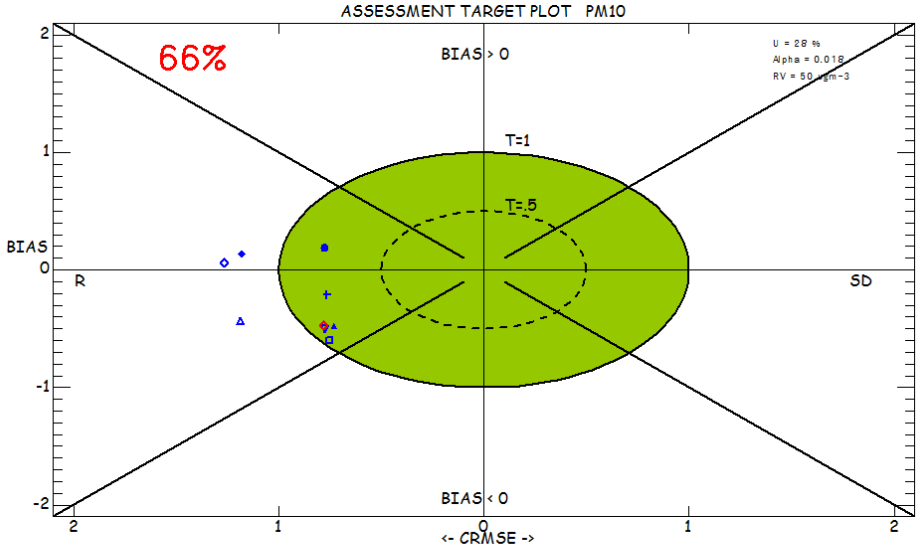

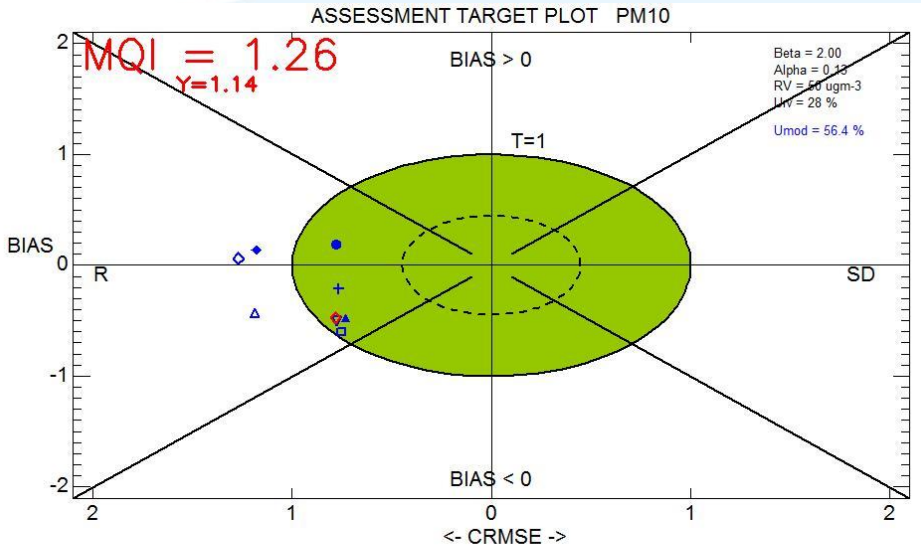

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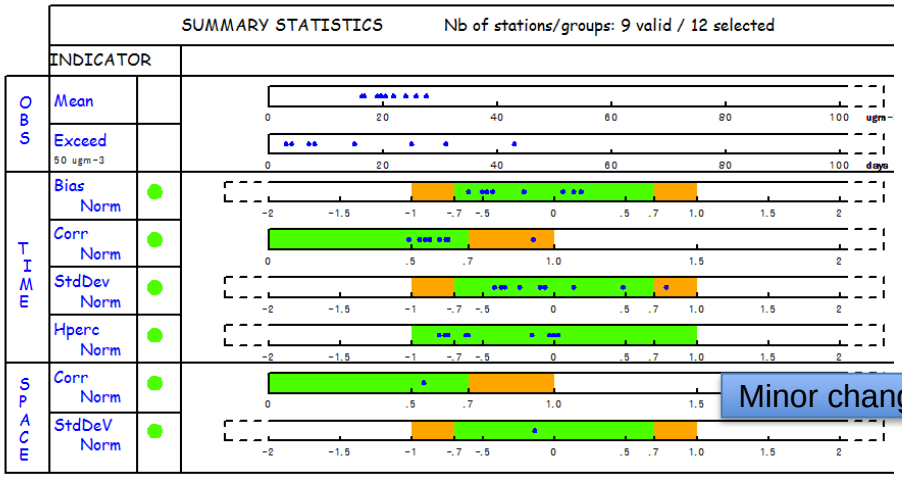
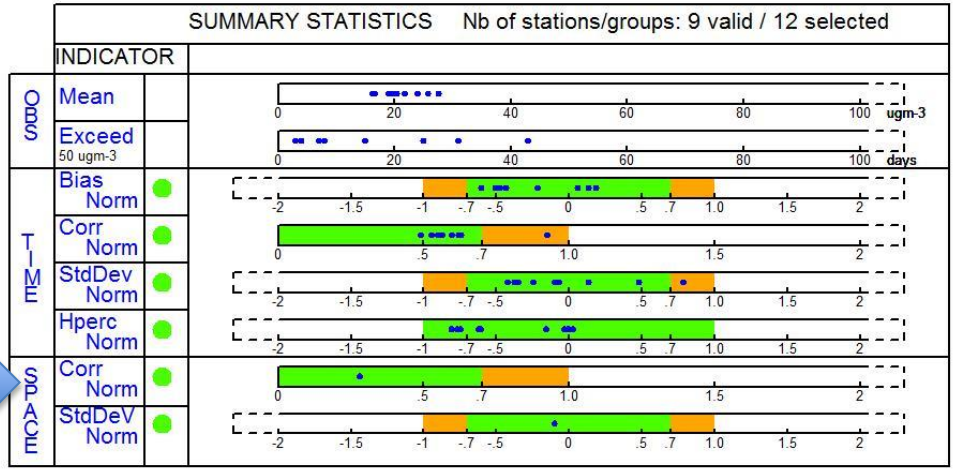


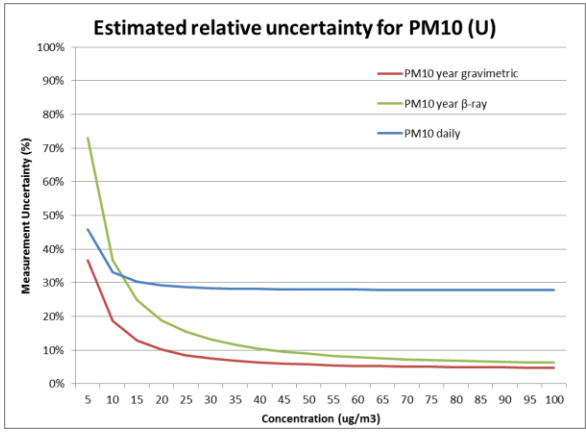
Minor change



Conclusions

Main changes and their impacts on Norwegian results:

- Change in the implementation of the 90th percentile constraint
  - Very useful to integrate this criteria of the AQD into the MQO. Especially in areas with nr of stations ≠ N x 10
- Update of the attenuation parameters for yearly PM_{10} and PM_{25}
  - Less stringent than previously for yearly MQO, especially for lower PM concentrations, where the beta-ray U_O is higher than the earlier used gravimetric U_O
  - Still problems with fulfilling the yearly NO_2 MQO
- Model uncertainty in the report's output
  - Useful indication to interpret the results.



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