



Feedback on DELTA – NIMH experience

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The AQ model - WRF- CMAQ v.4.6

- **not used for AQ assessment** under the AQD

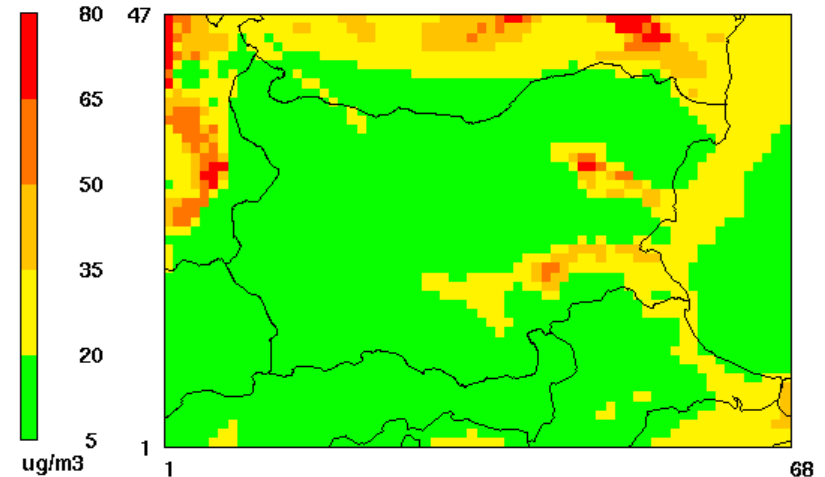
- **chemical weather forecast:** 72h hourly maps of

SO₂, O₃, NO₂, PM₁₀

- **5 nested domains:**
from 81km to 1 km

Surface PM₁₀

dx = dy = 9 km.



June 20, 2016 4:00:00
Min= 3 at (21,15), Max= 93 at (50,47)

<http://info.meteo.bg/cw2.2/>

DELTA used for:

- **model performance (AQ assessment)**

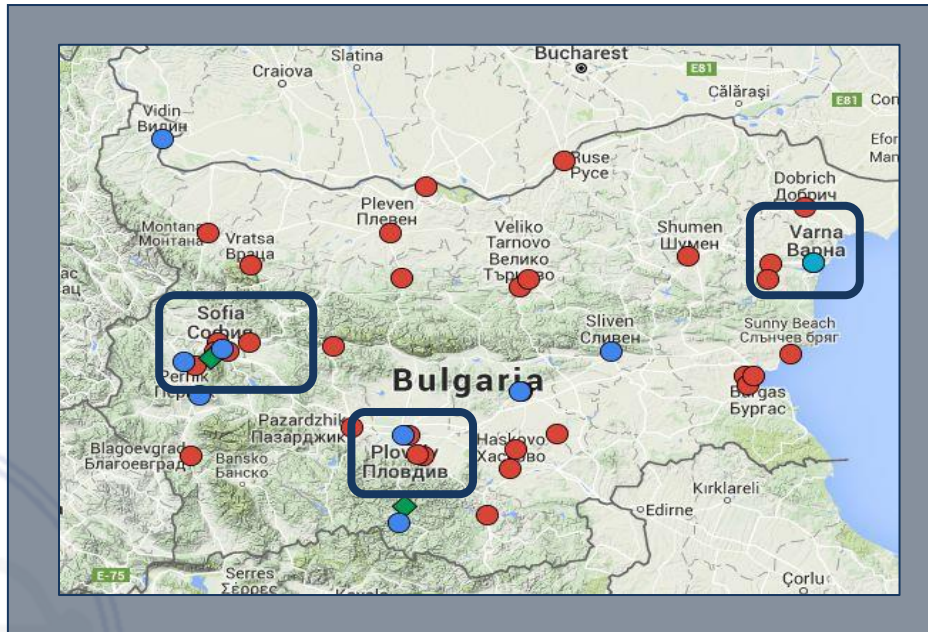
Bulgaria (9km) & Sofia (1km)

- **Forecast capabilities**



Air Quality Monitoring

Responsibility of Exec. Env. Agency Sofia



In 2015 : 50 stations

- 34 urban
- 9 traffic
- ◆ 2 rural
(mountains)
- 5 in
ecosystems

Stations per pollutant 2015:

SO₂ – 41; NO₂ - 39; O₃ – 27

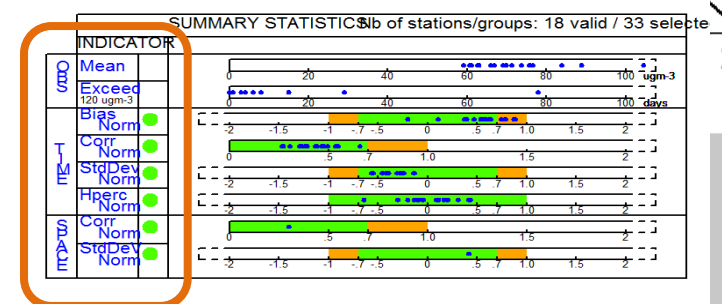
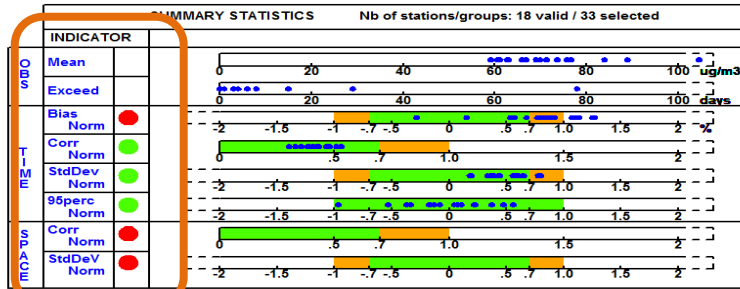
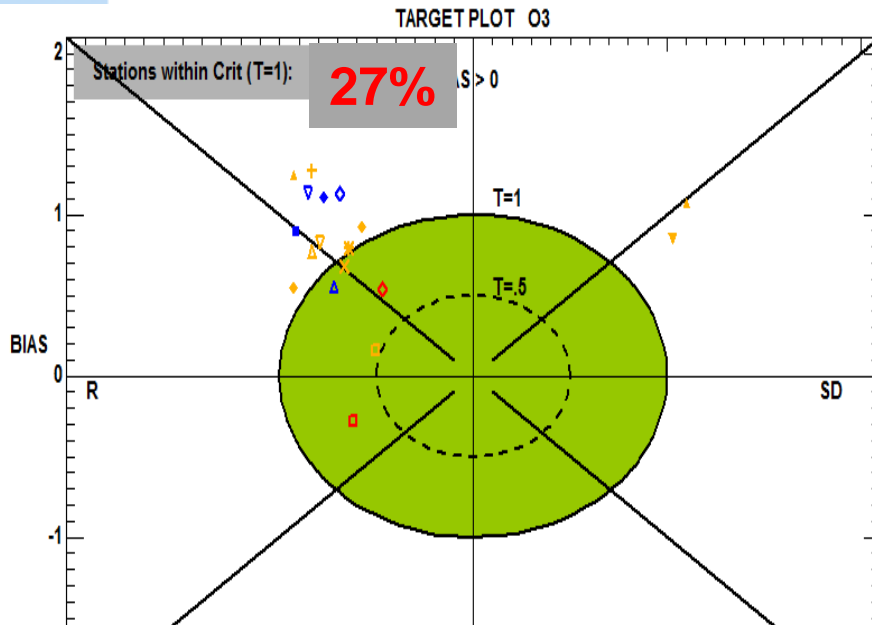
PM₁₀ – 48; PM_{2.5} - 10

in Sofia (1.6 mil. Inhabitants) - 5 AQ stations, 1 for PM_{2.5}



O3- 8hDMAx 2013 (18 valid stat.)

v.3.6(2014) and v.5.4 (2016)



- B60012A
- B60013A
- B60014A
- B60015A
- B60016A
- B60017A
- B60018A
- B60019A
- B60020A
- B60021A
- B60022A
- B60023A
- B60024A
- B60025A
- B60026A
- B60027A
- B60028A
- B60029A
- B60030A
- B60031A
- B60032A
- B60033A
- B60034A
- B60035A
- B60036A
- B60037A
- B60038A
- B60039A
- B60040A
- B60041A
- B60042A
- B60043A
- B60044A
- B60045A
- B60046A
- B60047A
- B60048A
- B60049A
- B60050A
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- B60052A
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- B60070A
- B60071A
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- B60082A
- B60083A
- B60084A
- B60085A
- B60086A
- B60087A
- B60088A
- B60089A
- B60090A
- B60091A
- B60092A
- B60093A
- B60094A
- B60095A
- B60096A
- B60097A
- B60098A
- B60099A
- B60100A

- 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
- SPACE: Dot does not fulfill the Performance Criteria



MQI & MQO - definition -

1/4

- v.3.6(2014) and v.5.4 (2016)

$$MQO_1 = \frac{|M-O|}{2U_o} \leq 1$$

$$MQO_4 = \frac{|M-O|}{\beta U_o} \leq 1, \text{ with } \beta = 2$$



“MQO₄ can be calculated for the 90th or 95th percentile station and used as performance indicator”,

90% of stations is implicitly accounted;
application for small number of stations

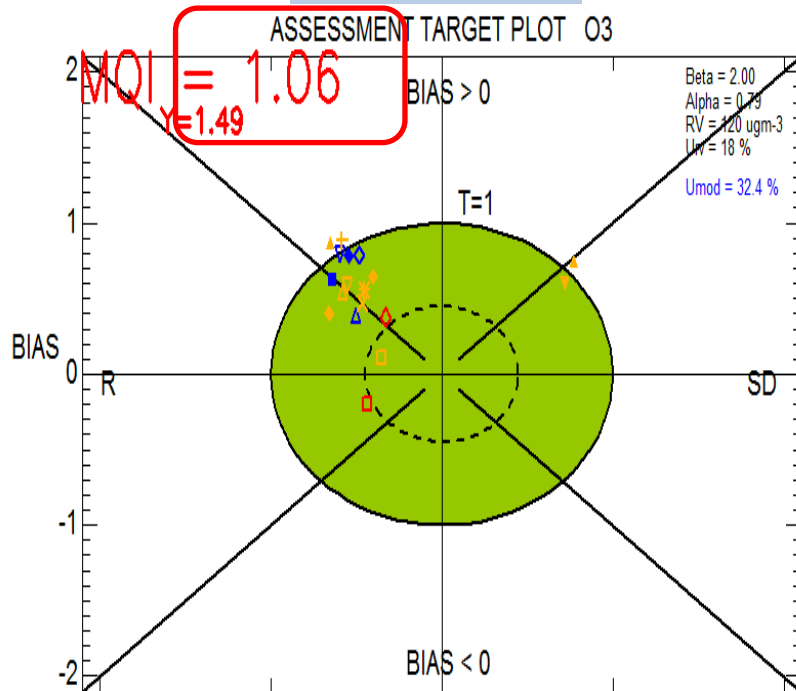




MQI & MQO – No. of stations -

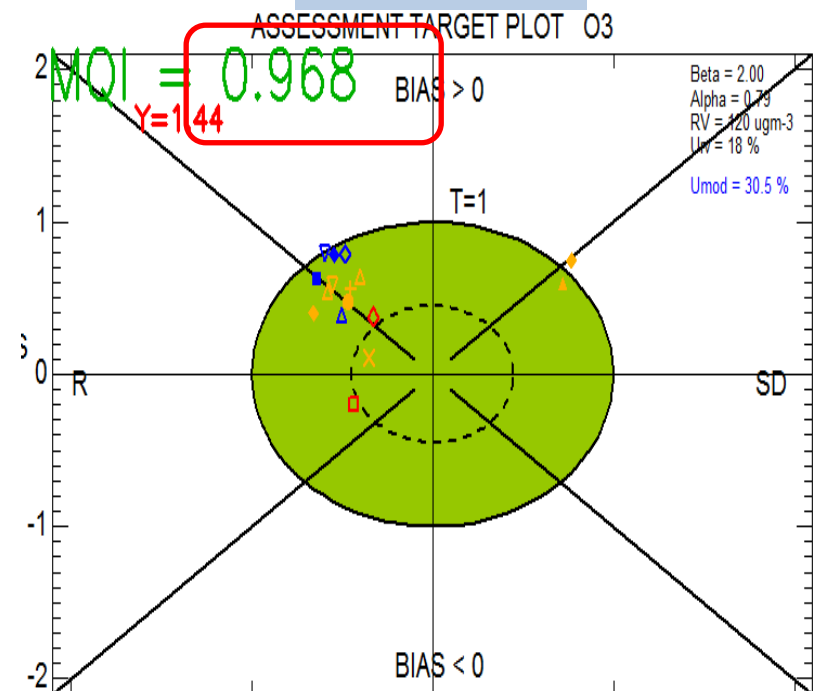
2/4

18 stations



BAD

16 stations



GOOD

???

? Exclusion of stations to obtain the MQO ?

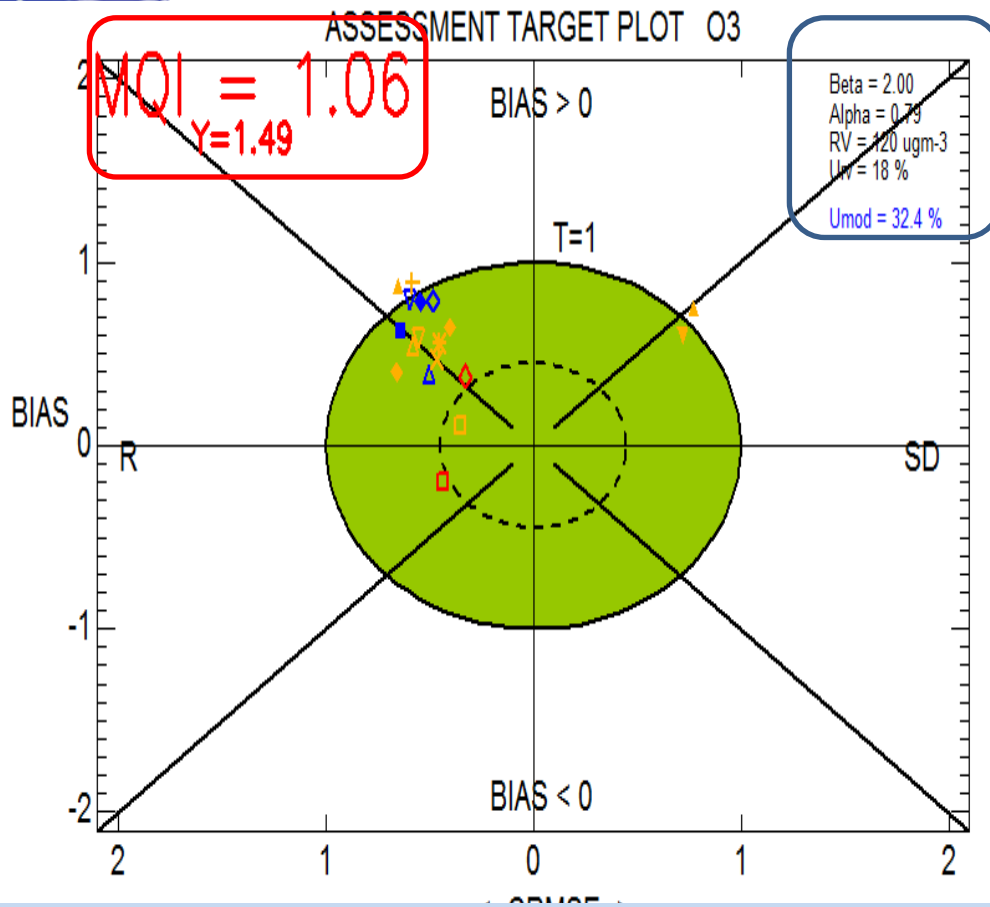
? Margin of tolerance for MQI ?





MQI & MQO - text on the diagram-

3/4



MQO : MQI ≤ 1

visual criteria “most of the points in the green area” valid?

Y (temporary info, but for O3 ?

Informative for experienced user

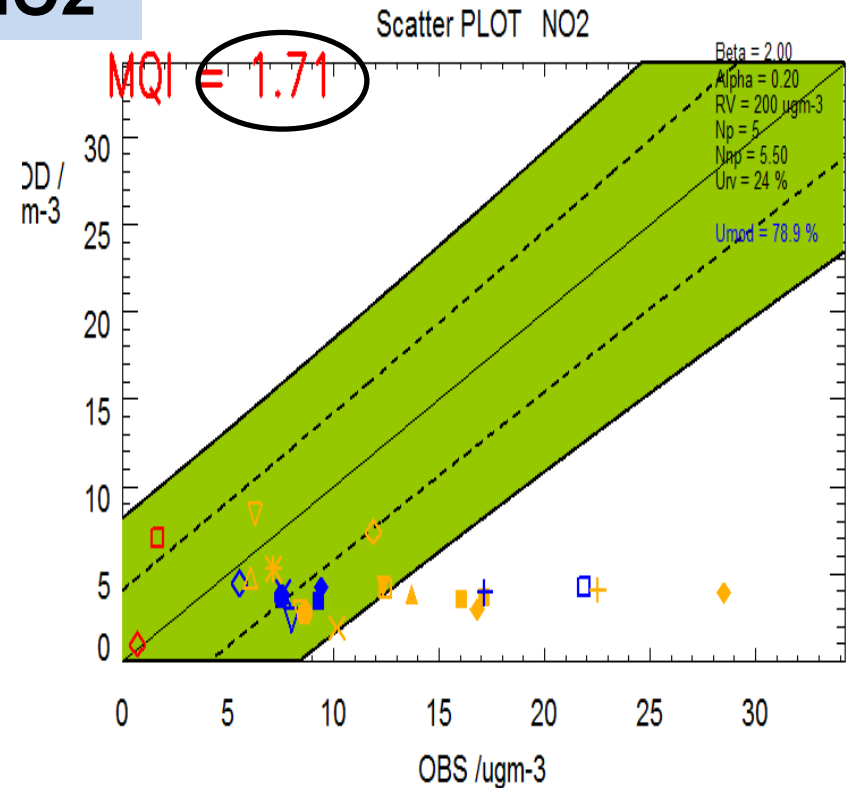
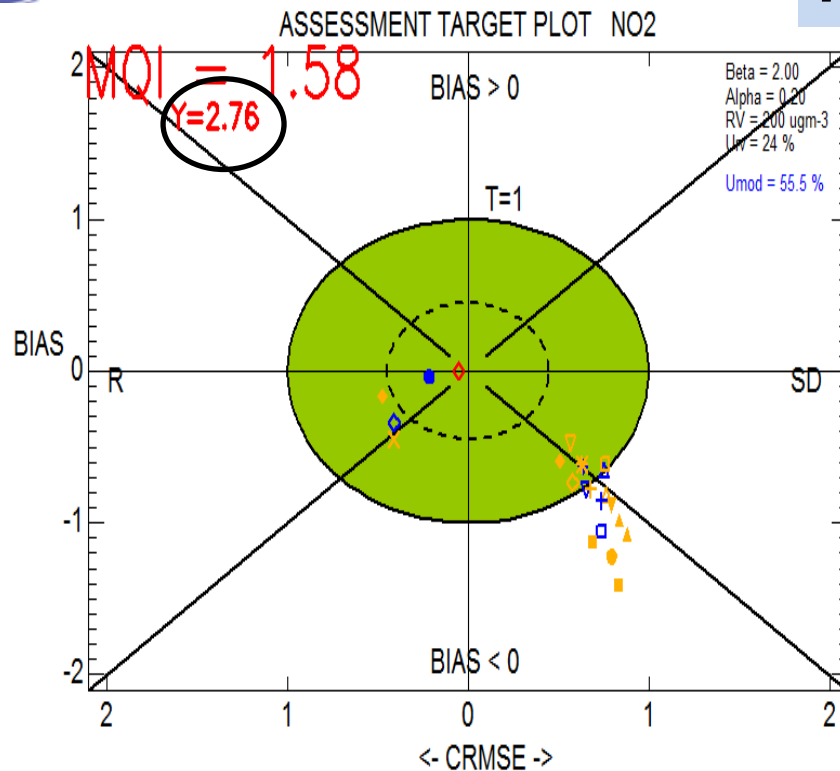
How to Interpret **Um** ?
Ur = 18%, Um=32% →
γ = 1.78

Should Um ≤ 1.75 Uo when MQI ≤ 1

“A value of γ can then be calculated as an output $\gamma = \sqrt{\left(\frac{M-O}{U_o}\right)^2 - 1}$ to provide info on the model uncertainty $U_M = \gamma U_o$ ”
 ??? $\gamma \leq 1.75$ with $\beta=2$



NO2



Y = 2.76
hourly input
MQI = 1.58

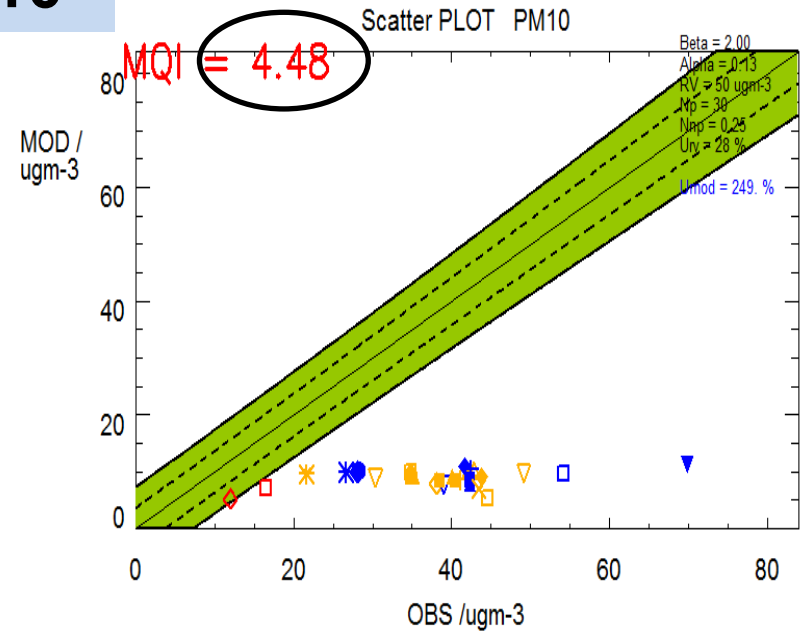
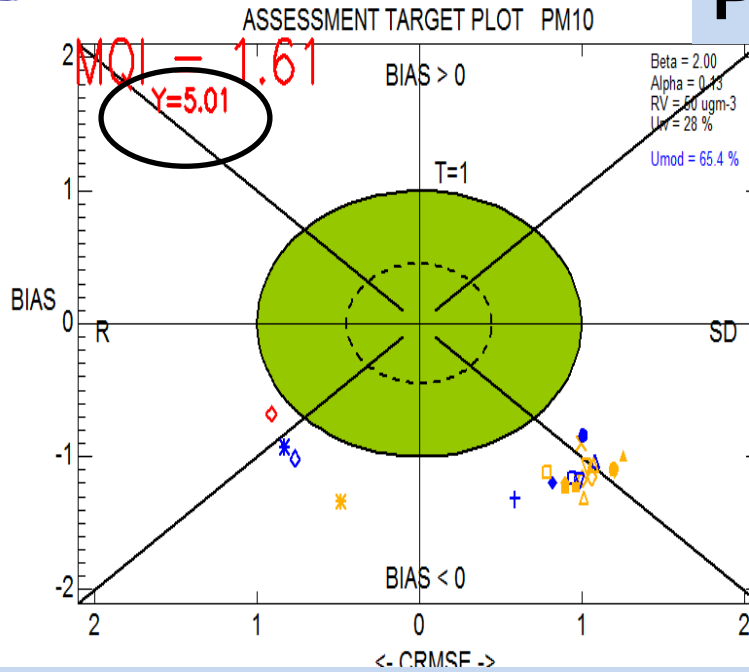
vs.

MQI = 1.71
yearly input
MQI = 1.71



MQI & MQO- Long vs. short term - 4/4

PM10



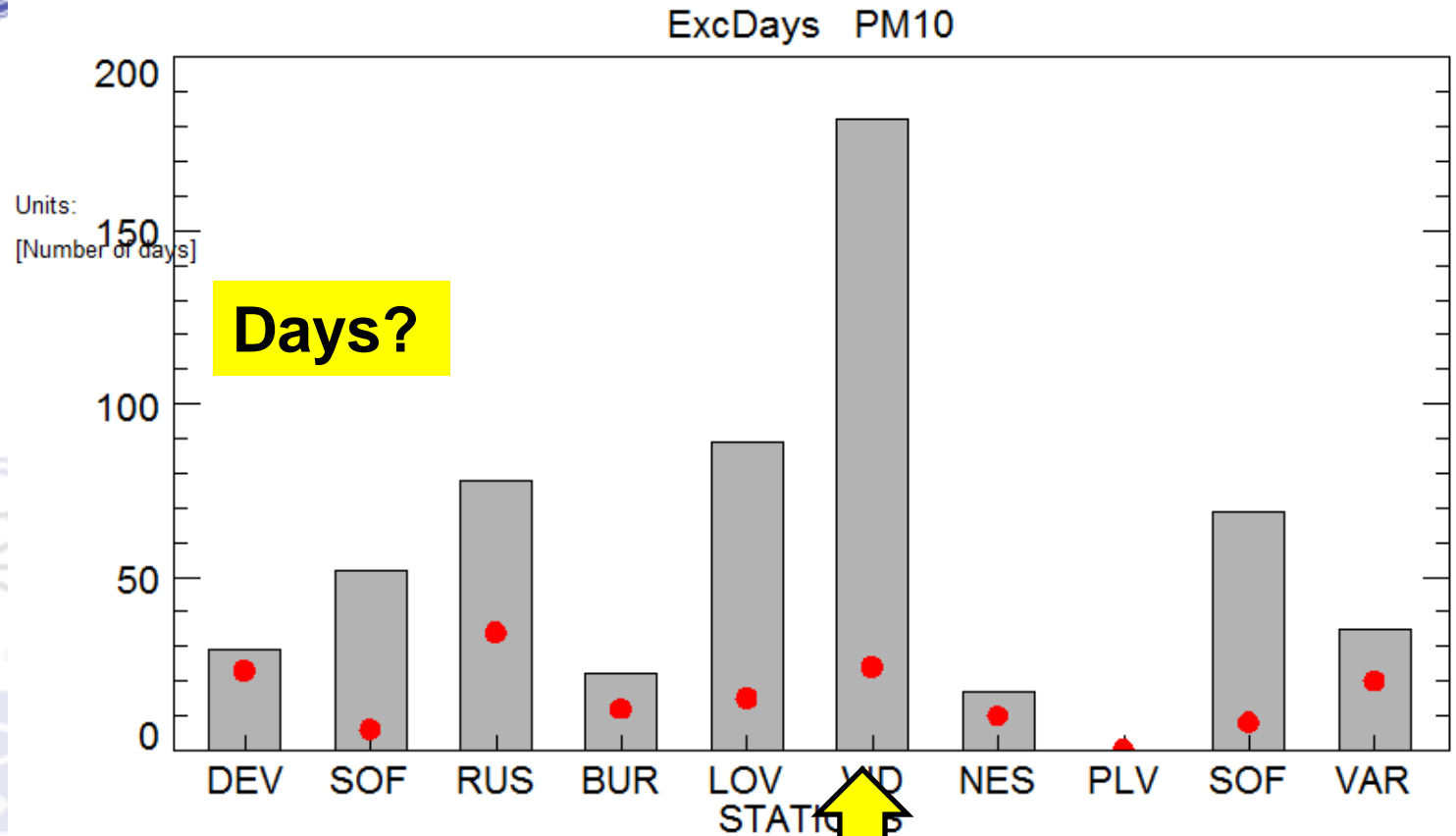
Y = 5.01
hourly input
MQI = 1.61

vs.

MQI = 4.48
yearly input
MQI = 4.48



Forecast & Excd. PM10 (2015)



● PM10-MOD-2015

□ OBS

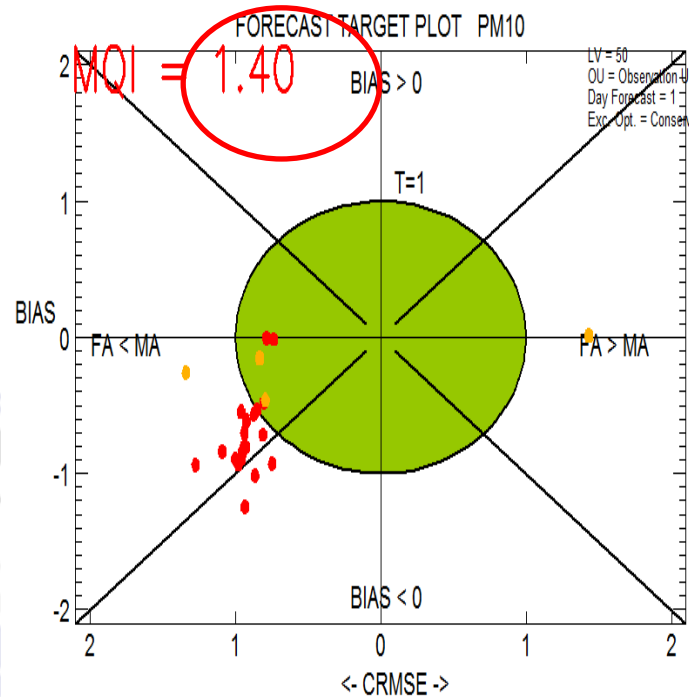
Obs. Data DLV excd - 23

Strt/end Ind: 1-8760
Model (s): MOD
r: PM10
5
ues: 50.
Year
Day hours: All 24h
Time Average: Preserved
Daily stats: Mean

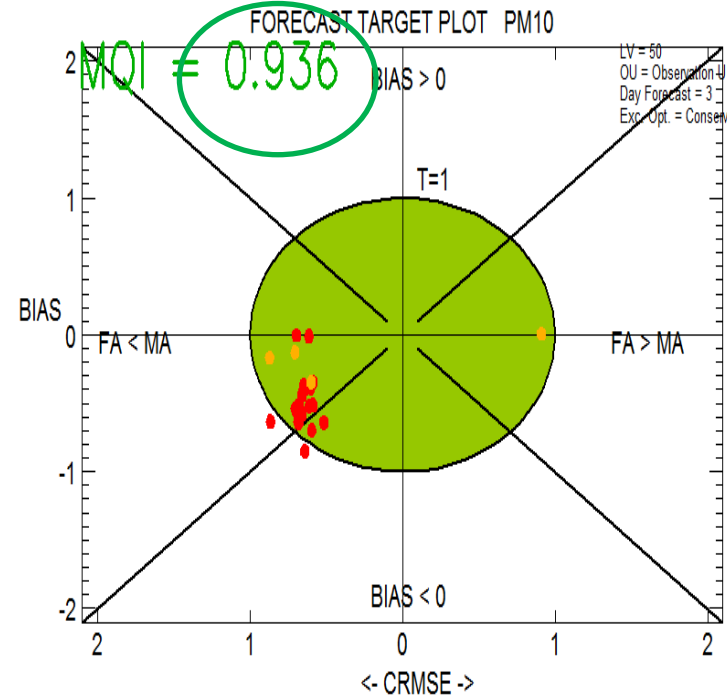


Forecast Target – forecast time length

day1



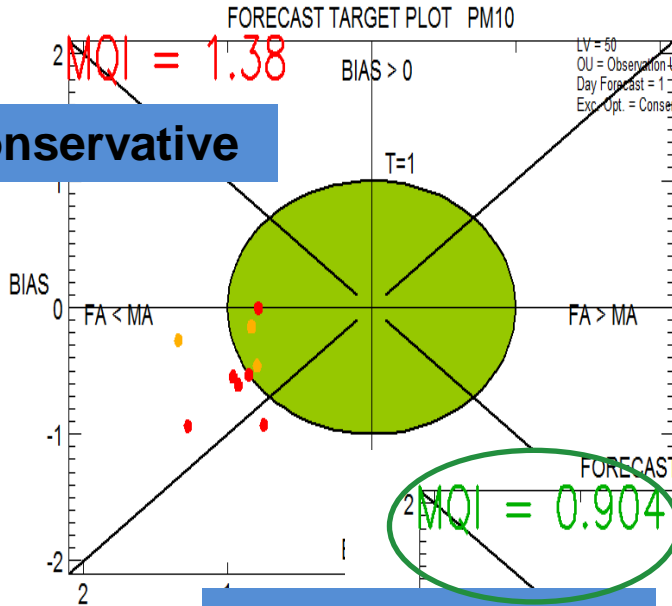
day3



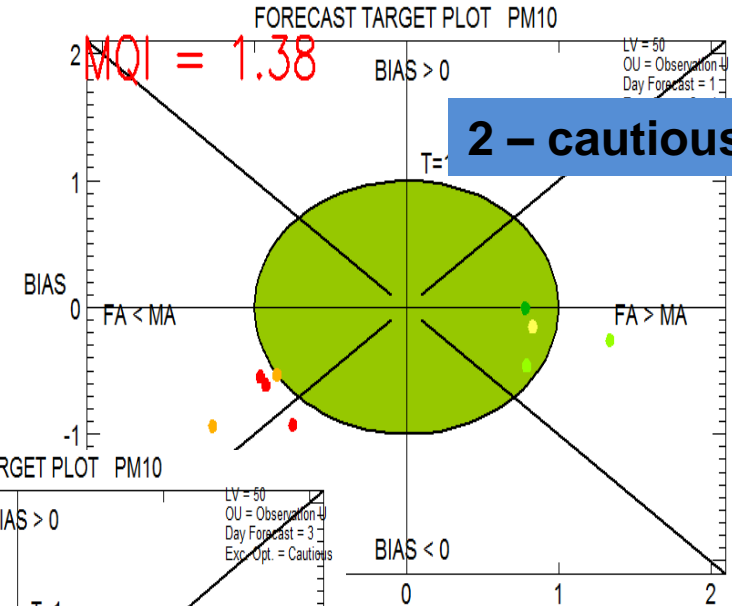


Forecast Target – flexibility options

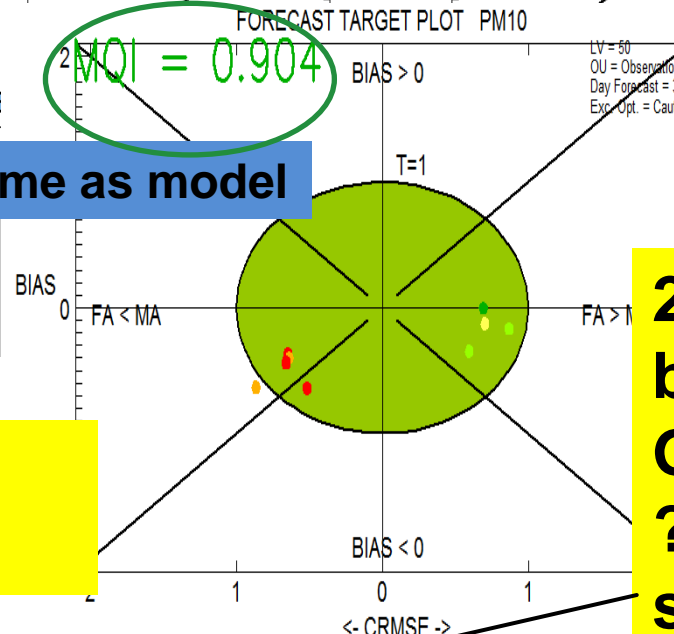
1 – conservative



2 – cautious



3 – same as model



2. FAR: should be:
Good: 0, Bad 1
? Color of good symbols

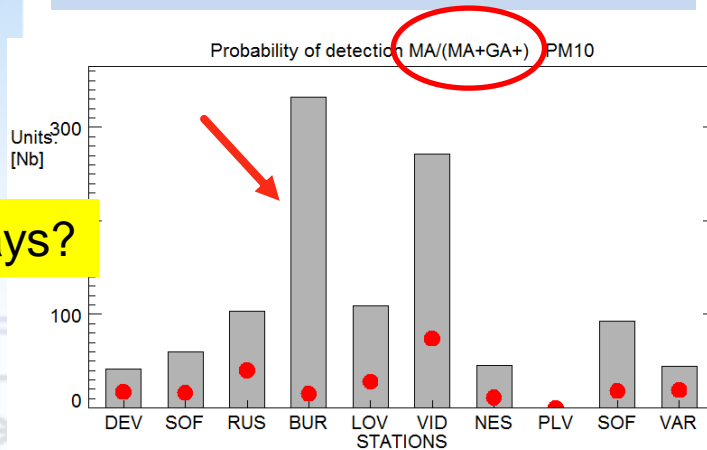
1. Better explain
1,2,3 options



Probability of Detection – flexibility

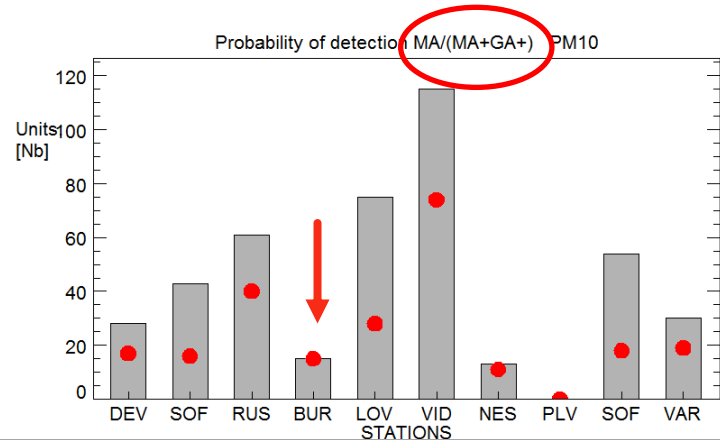
1. To Correct “Formula” expression

POD 1-conservat.



Days?

POD 3-same as mod



Differences in the **grey bars** (total obs. alarms)
e.g. at station BUR:
(MA +GA+)= **300 (option 1)** and = **20 (option 3)**.

Better explain 1,2,3 flexibility options



Values of GA+ from POD and FAR plots

GA+ = **Hits** = counts correctly predicted alarms

FA - false alarms, MA – missed alarms

Example for 1 station (options 50#999#1)

from the barplot POD

$$GA+/(MA+GA+) = 17/42;$$



$$\underline{GA+ = 17}, MA = 25$$

from the barplot FAR

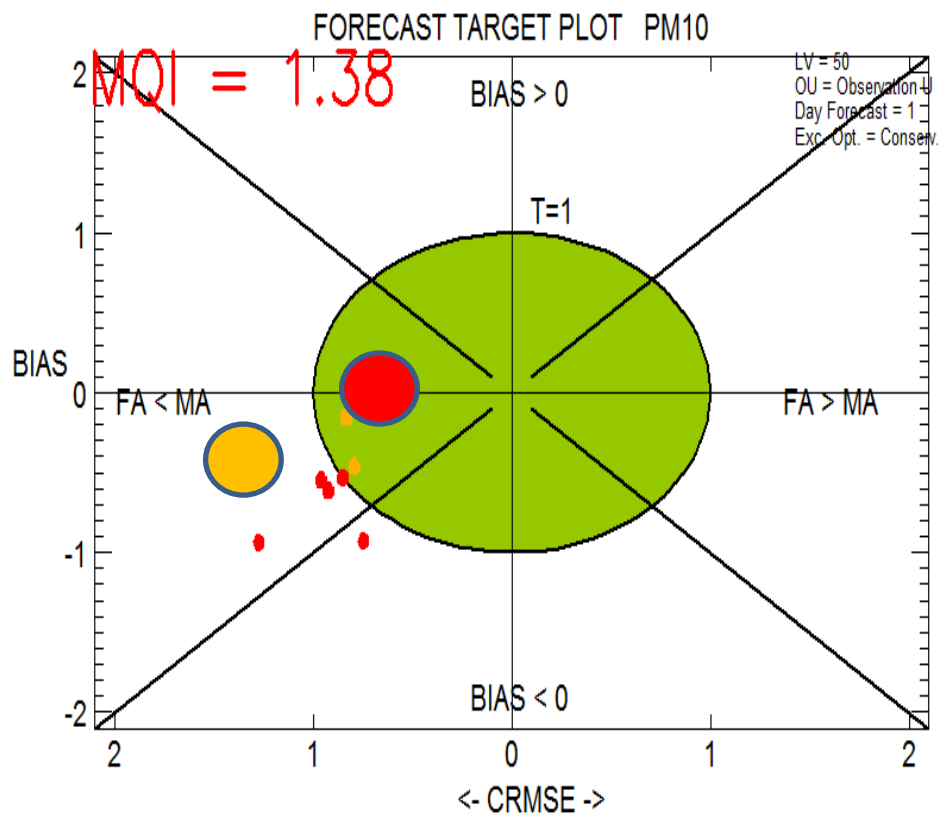
$$FA/(FA+GA+) = 17/27;$$



$$FA = 17, \underline{GA+ = 10}$$



Why are the values for “hits” different ?

Forecast indicators & position on Target ?



- FAR < 0.2
- 0.2 < FAR < 0.4
- 0.4 < FAR < 0.6
- 0.6 < FAR < 0.8
- 0.8 < FAR < 1.0

Strt/end Ind: 1-8760
 Model (s): MOD
 Parameter: PM10
 Scen: 2015
 Extra Values: 50./999/1.0/1.0
 Season: Year
 Day hours: All 24h
 Time Average: Preserved
 Daily stats: Mean

		
POD	0.40	0.05
FAR	0.63	1
CEI1	0.64	0.045
CEI2	0.52	0.52
MPI	0.013	0.014

Conclusions

- **MQO** – seem more stringent for PM , than for O3 and NO2
- **MQO** – to be uniform in the Guidance and User's Guide
- **Forecast** - methodology based on “contingency table” , **OU** – accounted, **MU** - further
- **Forecast** – flexibility options better explained
- **Forecast MPI** – check synergy with Target position



THANK YOU !

