Ricardo-AEA

An evaluation of the DELTA tool

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Outline

- Evaluate outputs from DELTA tool

- Compare with a spreadsheet based tool

- Discuss summary report

- Conclusions

Delta tool (annual formulation)

- Annual MQO

$$MQO = \frac{BIAS}{2U(\overline{O})} \leq 1$$

$$MQO = \frac{BIAS}{2ku_r^{RV}\sqrt{\frac{(1-\alpha)}{N_p^*}(\overline{O}^2) + \frac{\alpha * RV^2}{N_{np}}}} \leq 1$$
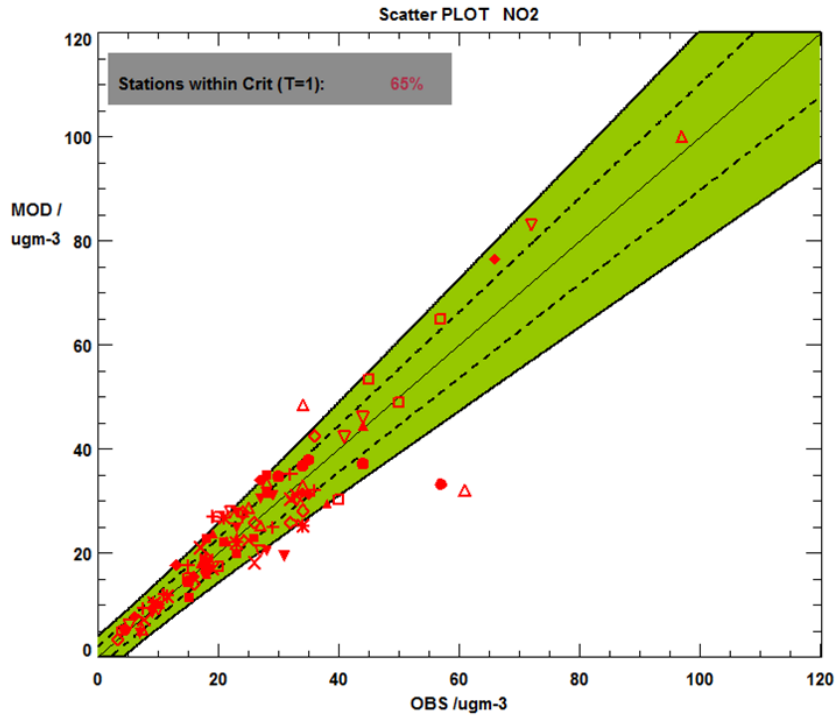
- Uncertainty parameters for NO_2, PM_{10} and $PM_{2.5}$

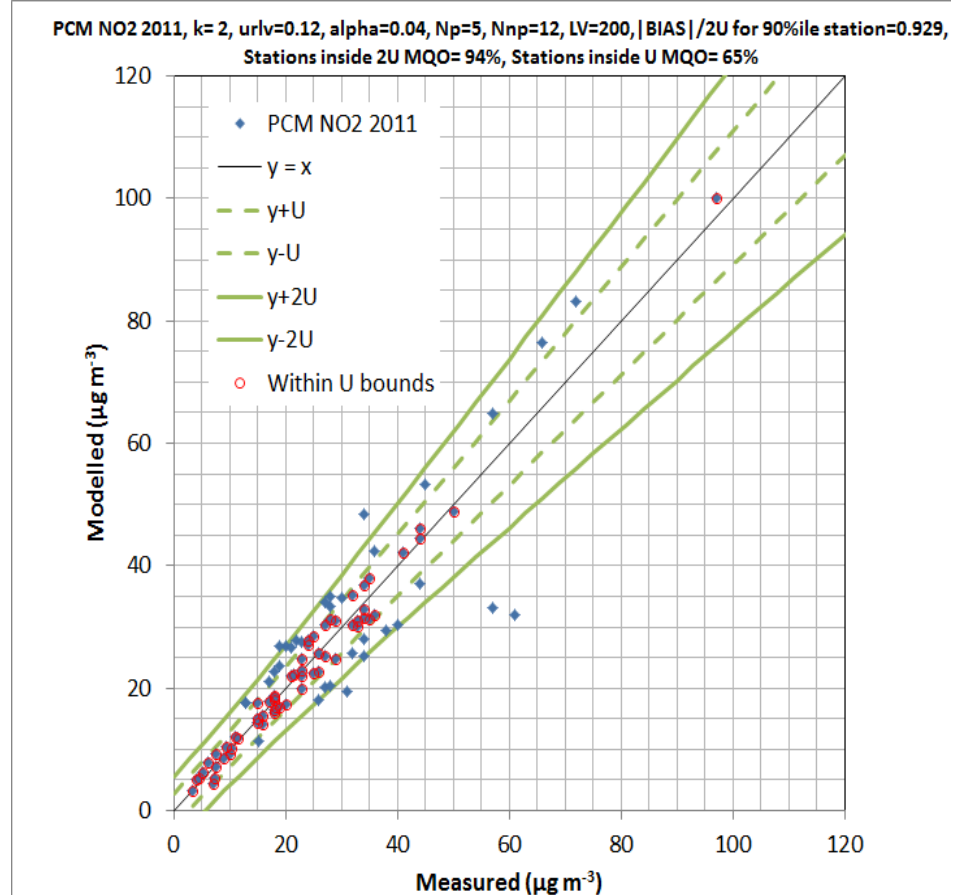| Source of uncertainty parameters	k	u_r^{RV}	α	N_p	N_{np}	LV
NO2 Delta v3.6 10 February 2014	2	0.12	0.04	5	12	200
PM10 Delta v3.6 10 February 2014	2	0.14	0.018	40	1	50
PM2.5 Delta v3.6 10 February 2014	2	0.18	0.018	40	1	25

DELTA tool (*Version 3.6*)

- Downloaded from JRC website Feb 2014

- Tested using 2011 measured and modelled concentrations

- 'PCM' model – developed for compliance assessment

DELTA tool (NO₂)

Scatter PLOT NO2

Stations within Crit (T=1): 65%

MOD / ugm-3

OBS /ugm-3

Eskdalemuir	Narberth	Leeds_Centre	Camden_Kerbsi	Derry	Strt/end Ind: 1-8760
Yarner_Wood	Wicken_Fen	London_Eltham	Glasgow_Centr	Barnsley_Gawb	Model (s): PCM
High_Muffles	Billingham	London_Bexley	Leamington_Sp	London_Maryle	Parameter: NO2
Aston_Hill	Sheffield_Tin	Manchester_Pi	London_Teddin	Plymouth_Cent	Scen: 2011
Bush_Estate	London_Blooms	Sheffield_Cen	Thurrock	London_Cromwe	Extra Values: No
Glazebury	Belfast_Centr	Rochester_Sto	Nottingham_Ce	Sandwell_West	Season: Year
Harwell	Newcastle_Cen	London_N_Kens	Bath_Roadside	Aberdeen	Day hours: All 24h
Ladybower	Cardiff_Centr	Tower_Hamlets	Manchester_So	Preston	Time Average: Preserved
Lullington_He	Middlesbrough	Oxford_Centre	Salford_Eccle	Portsmouth	Daily stats: preserved

PCM NO2 2011, k= 2, urlv=0.12, alpha=0.04, Np=5, Nnp=12, LV=200, |BIAS|/2U for 90%ile station=0.929, Stations inside 2U MQO= 94%, Stations inside U MQO= 65%

Modelled (µg m⁻³)

- ◆ PCM NO2 2011
- —— y = x
- – – – y+U
- – – – y-U
- —— y+2U
- —— y-2U
- ○ Within U bounds

Measured (µg m⁻³)

Uncertainty bounds	Percentage of sites within bounds as calculated by Delta and spreadsheet.	
	Delta tool	Spreadsheet tool
± U	65 %	65 %
± 2U	N/A	94 %

DELTA tool (PM$_{10}$)

Scatter PLOT PM10

Stations within Crit (T=1): 31%
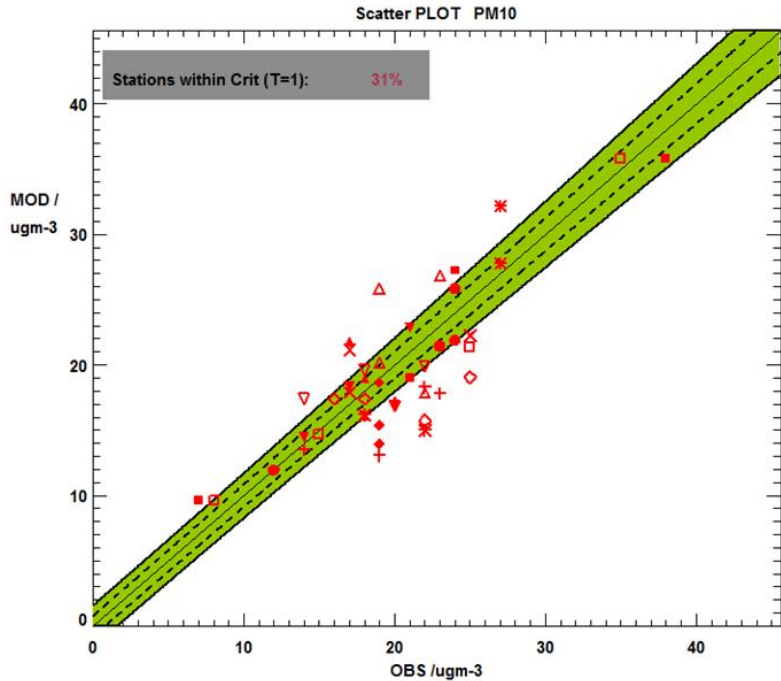
8_Harwell	14_London_N_K	20_Plymouth_C	32_Scunthorpe	4_Chesterfiel	Strt/end Ind: 1-8760
27_Auchencort	36_Camden_Ker	1_Aberdeen	3_Birmingham_	44_LONDON_MAR	Model (s): PCM
13_London_Blo	6_Glasgow_Cen	7_Grangemouth	2_AUCHENCORTH	29_LONDON_N_K	Parameter: PM10
16_Newcastle_	33_Thurrock	43_Inverness	34_York_Booth	28_HARWELL_PA	Scen: 2011
15_Middlesbro	18_Nottingham	45_Wrexham	19_Oxford_St_	26_Warrington	Extra Values: No
10_Leeds_Cent	25_StokeonTre	9_Hull_Freeto	38_Chepstow_A	35_Birmingham	Season: Year
11_Leicester_	22_Salford_Ec	12_Liverpool_	41_Stanfordle	31_Newport	Day hours: All 24h
24_Southampto	30_Derry	5_Edinburgh_S	42_Carlisle_R	17_Norwich_La	Time Average: Preserved
23_Sheffield_	40_London_Mar	21_Reading_Ne	39_Leeds_Head	46_Armagh_Roa	Daily stats: preserved

PCM PM10 2011, k= 2, urlv=0.14, alpha=0.018, Np=40, Nnp=1, LV=50, |BIAS|/2U for 90%ile station=1.28, Stations inside 2U MQO= 79%, Stations inside U MQO= 53%
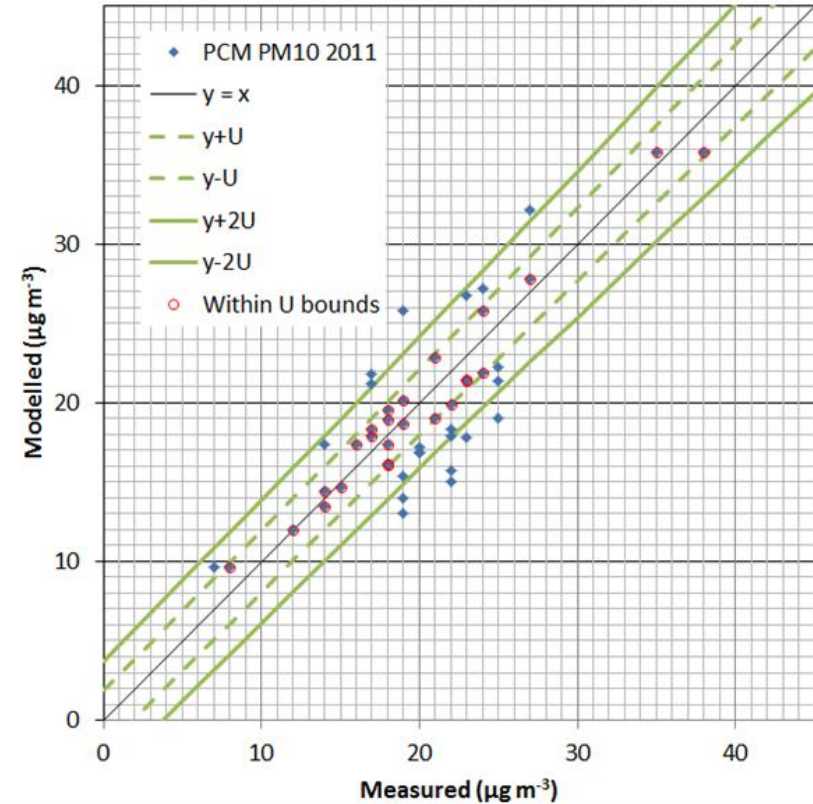
Uncertainty bounds	Percentage of sites within bounds as calculated by Delta and spreadsheet.	
	Delta tool	Spreadsheet tool
± U	31 %	53 %
± 2U	N/A	79 %

DELTA tool (PM$_{2.5}$)


Scatter PLOT PM25

PCM PM25 2011, k= 2, urlv=0.18, alpha=0.018, Np=40, Nnp=1, LV=25, |BIAS|/2U for 90%ile station=1.371, Stations inside 2U MQO= 79%, Stations inside U MQO= 39%
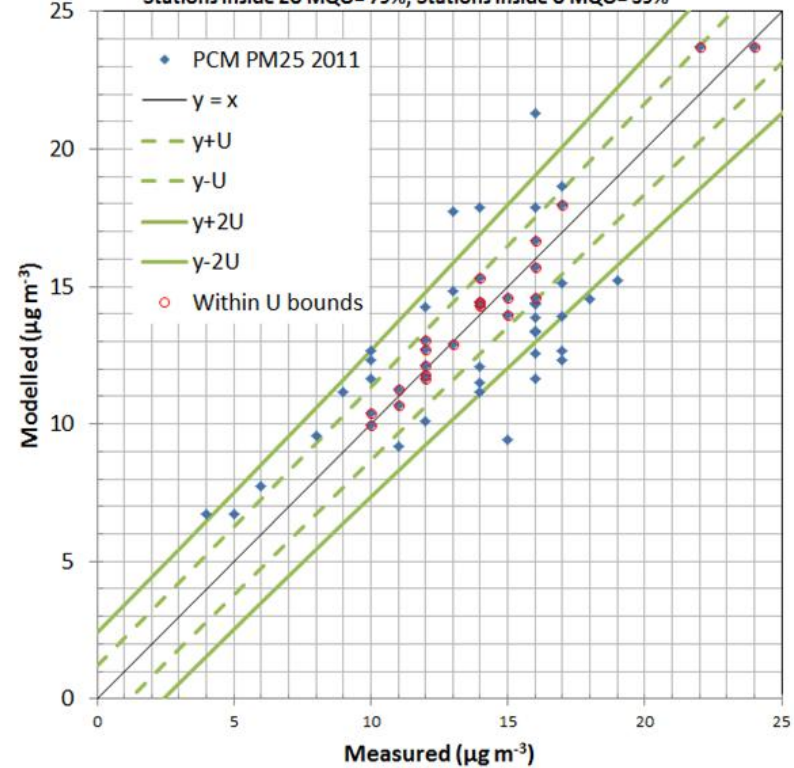
Uncertainty bounds	Percentage of sites within bounds as calculated by Delta and spreadsheet.	
	Delta tool	Spreadsheet tool
± U	N/A	39 %
± 2U	N/A	79 %

DELTA tool - issues

- Uncertainty bounds should be set at ±2U not ±U

- PM tool is under development but it would be useful to have parameters for FDMS TEOM

- Treatment of $PM_{2.5}$ appears inconsistent with others pollutants (annual limit value is used as the reference values for daily means)

- Uncertainty parameters could be displayed on scatter plots to enable easy version control

Summary report (NO₂)

SUMMARY Yearly STATISTICS — Nb of stations/groups: 94 valid / 94 selected
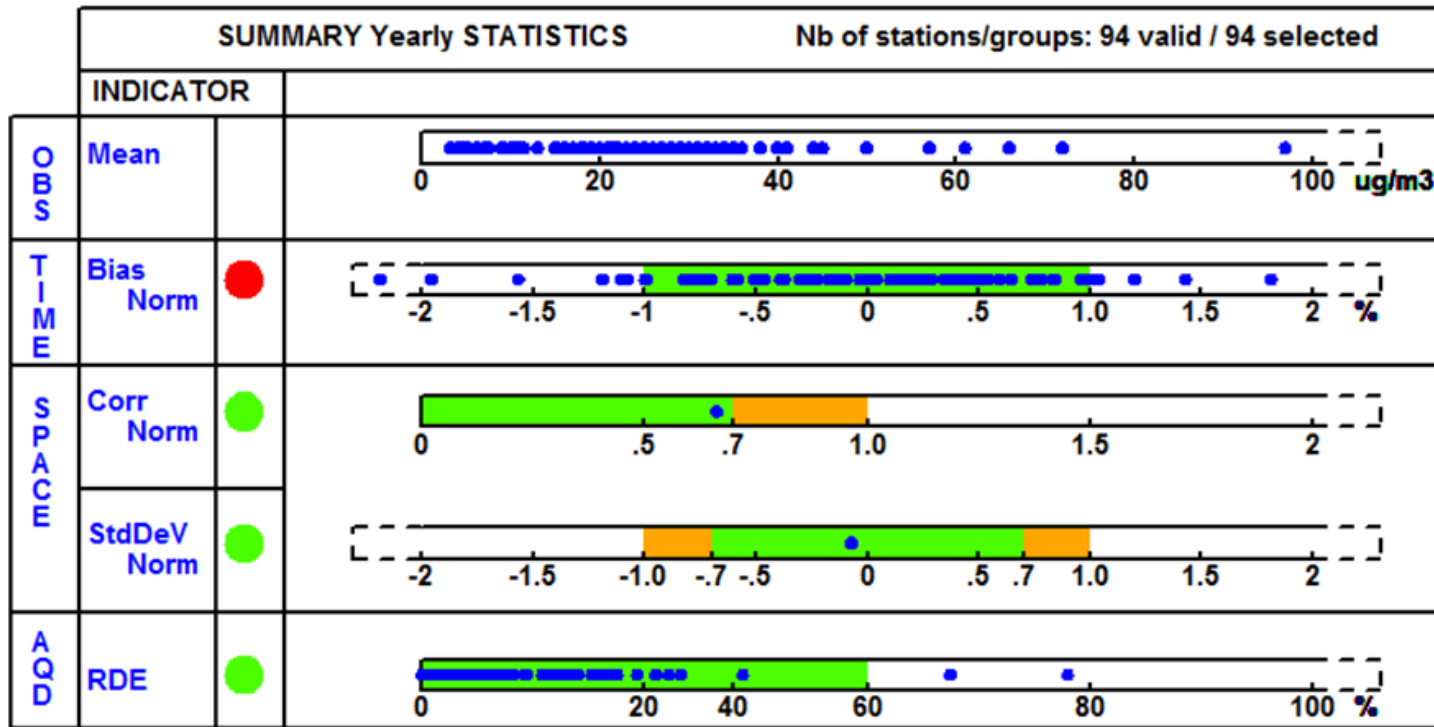
A simple display of range in measured concentrations

Apparently one of three MPC not clear why red dot assigned

It is not clear whether these relate to a MPC and where the green and orange thresholds originated from

Disappointed to see RDE still in here

Conclusions (1)

- We were able to 'verify' outputs using a spreadsheet for NO_2

- Less success for PM_{10} and $PM_{2.5}$

- Would like to see more meta data for DELTA outputs (version control). List parameters to calculate U.

- Need to define 'success' for model performance ± U or ± 2U in the scatter plot

Conclusions (2)

- Happy with overall approach in introducing measurement uncertainty into MQO

- For annual mean models scatter diagram makes other diagrams redundant

- Coloured 'performance' dots 🔴 🟡 🟢 not helpful

- A quantification of spatial representativity is unlikely to be practical

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