Evaluation of DELTA's Model Performance Indicator (MPI) for high percentile concentrations

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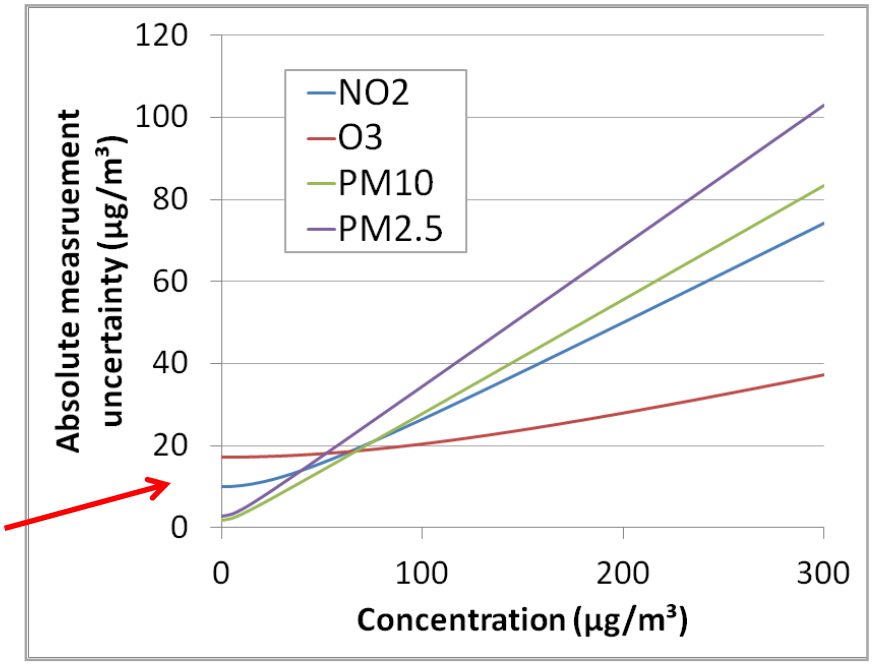
Context

- The Model Performance Indicator for high percentiles, MPI_{perc} is defined as:

$$MPI_{perc} = \frac{|M_{perc} - O_{perc}|}{\beta U_{95}(O_{perc})} \quad and \quad MPC: MPI_{perc} \leq 1$$

where

- M_{perc} is the modelled percentile concentration i.e. one of the high values from a (usually) annual dataset of modelled values e.g. 99.8% for NO_2
- O_{perc} is the observed percentile, defined in the same way as the modelled percentile
- β is a 'stringency' parameter, usually set to 2
- $U_{95}(O_{perc})$ is the absolute measurement uncertainty associated with the O_{perc} value
- MPC is the Model Performance Criteria



Does the high percentiles indicator make sense?

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- The Model Quality Indicator for time series data, *MQI* is defined as:

$$MQI = \frac{\sqrt{\frac{1}{N}\sum_{i=1}^{N}(O_i - M_i)^2}}{\beta\sqrt{\frac{1}{N}\sum_{i=1}^{N} U_{95}(O_i)^2}} = \frac{\mathrm{RMSE}}{\beta RMS_U} \quad \text{and MQO: MQI} \leq 1$$

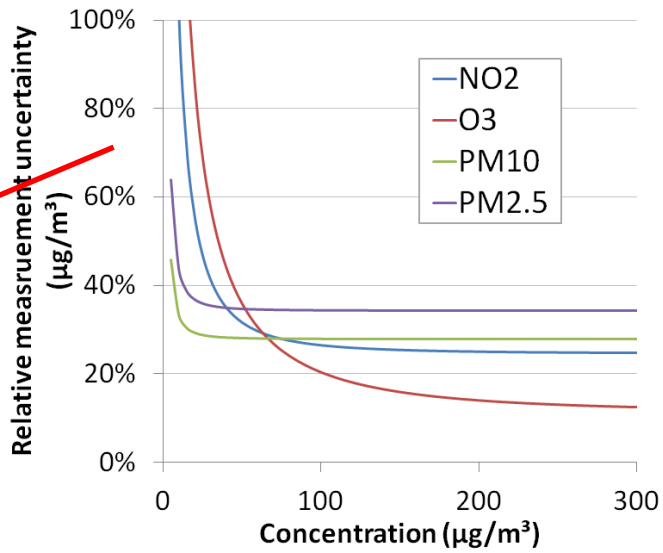
$$U_{95}(O_i) = U_{95,r}^{RV}\sqrt{(1-\alpha^2)O_i^2 + \alpha^2 . RV^2}$$

$$\sim U_{95,r}^{RV} . O_i$$

(for NO_2 & PM_{10}, as $\alpha^2 << 1$)

where

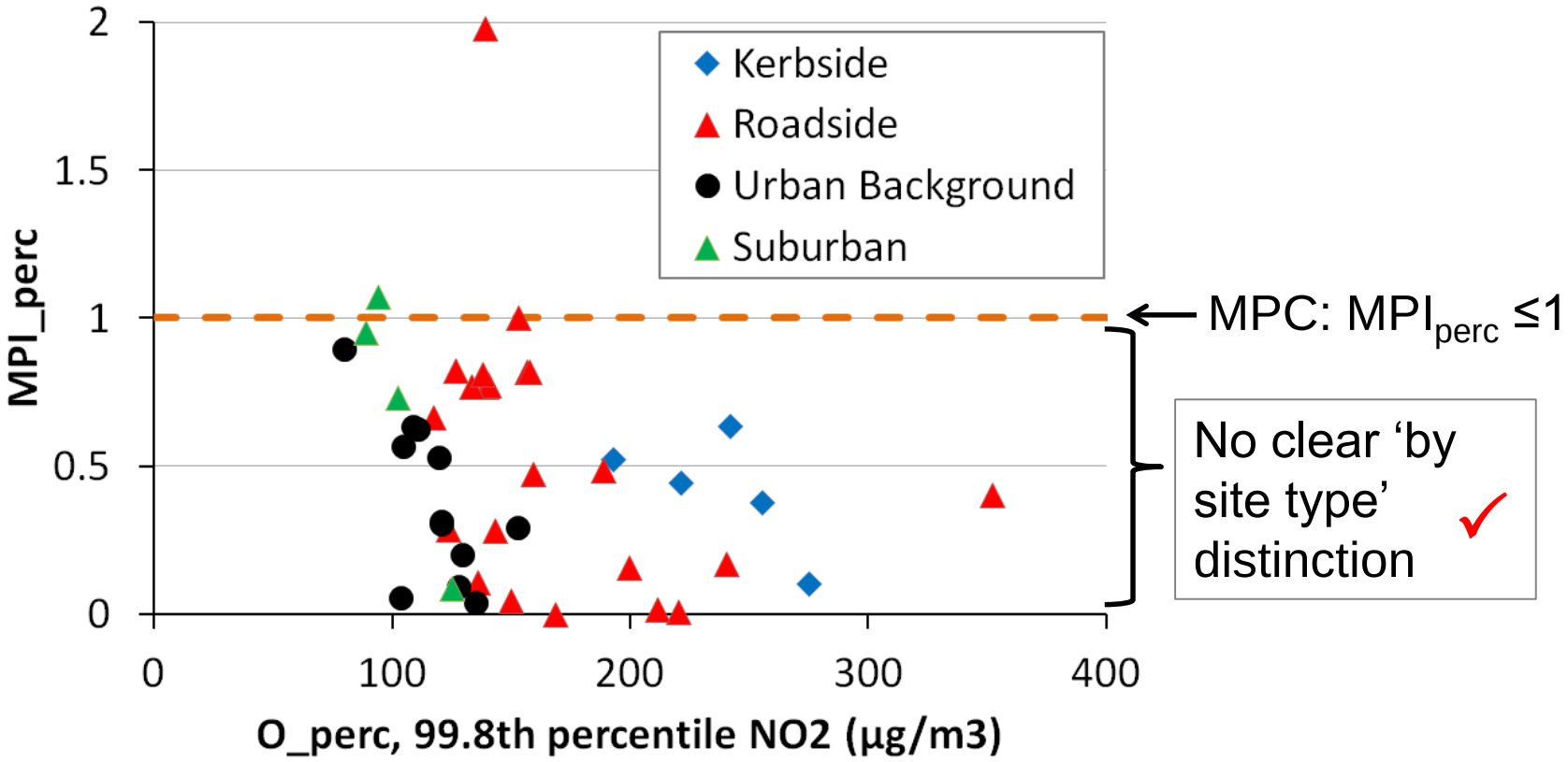
- M_i are the modelled values
- O_i are the observed values
- β is a 'stringency' parameter, usually set to 2



CERC

Is the indicator well behaved?

- Consider a dataset (London 2012) that contains data for 43 sites for NO_2
- Indicator looks ok



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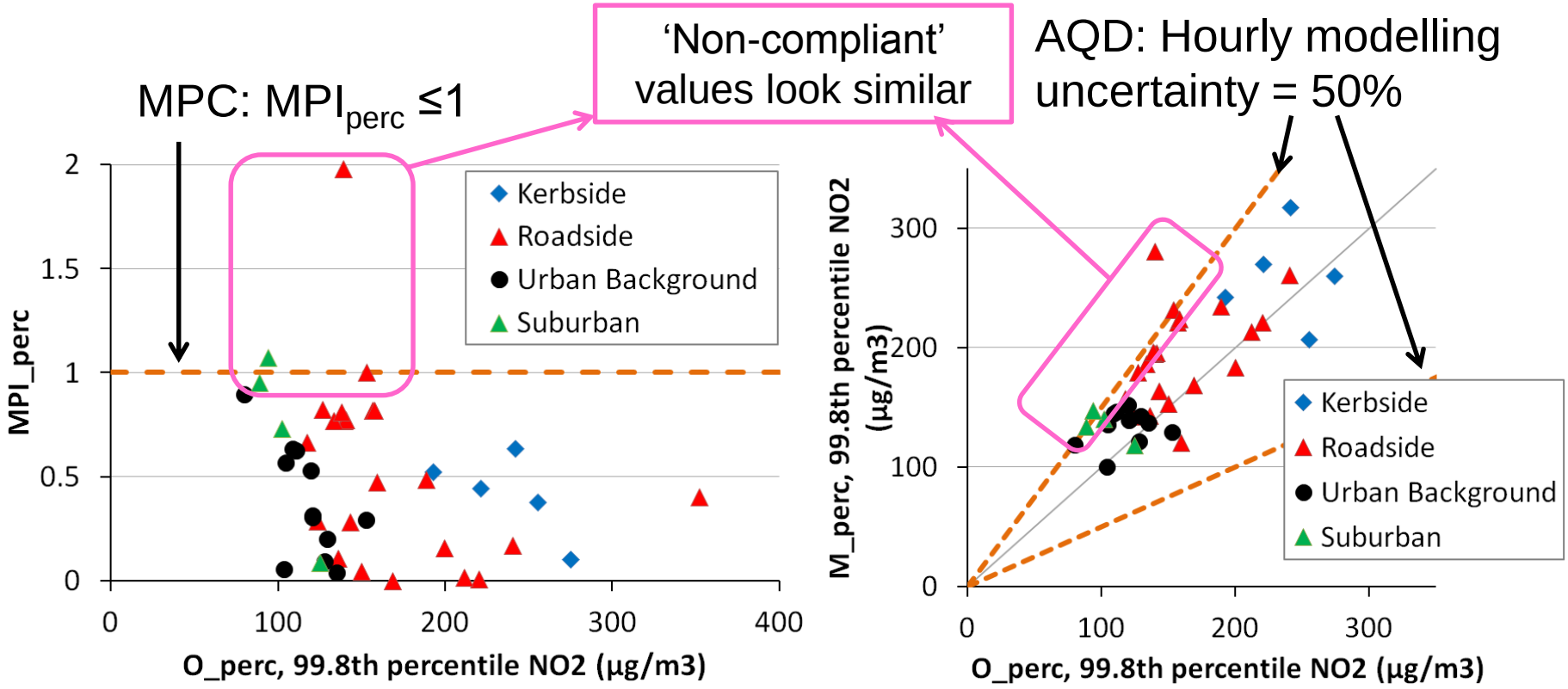

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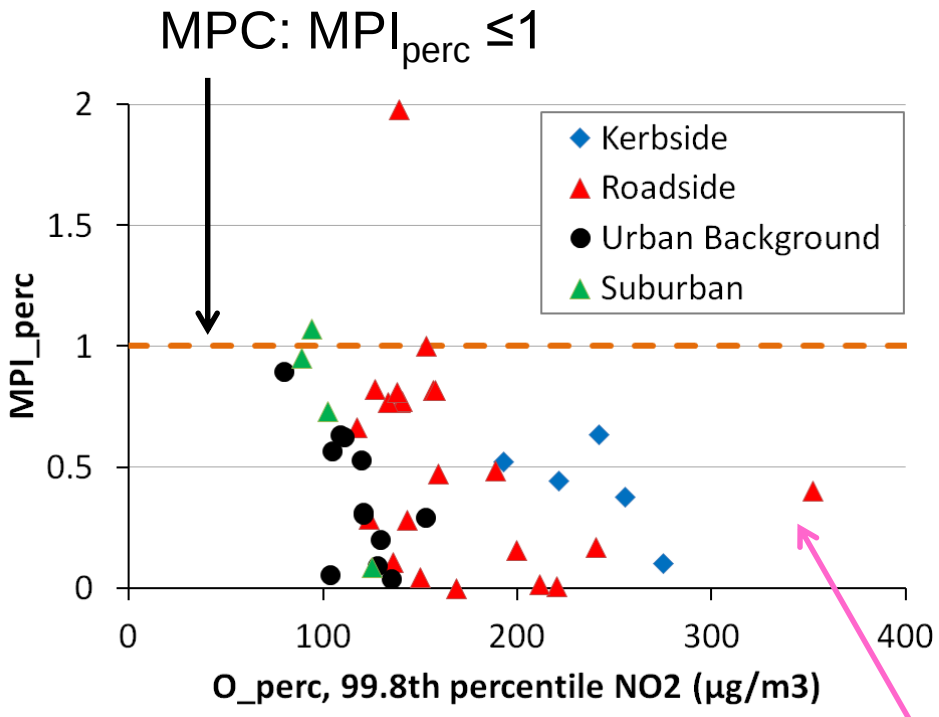

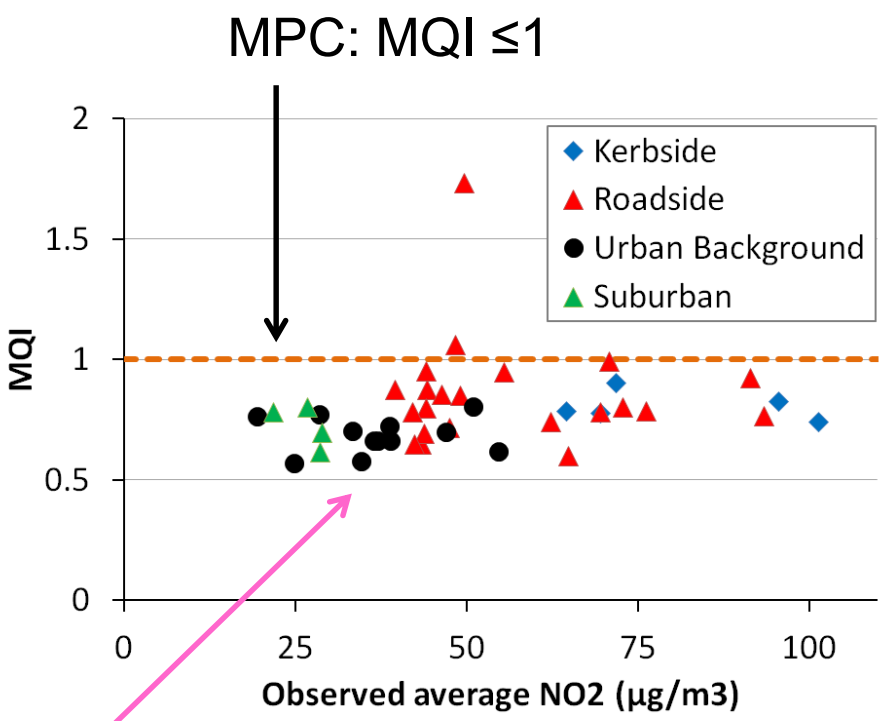

The hourly average indicators are all > 0.5. Is this just averaging?
Or is the difference related to the annual average $U_{95}(O_i)$ weighting?

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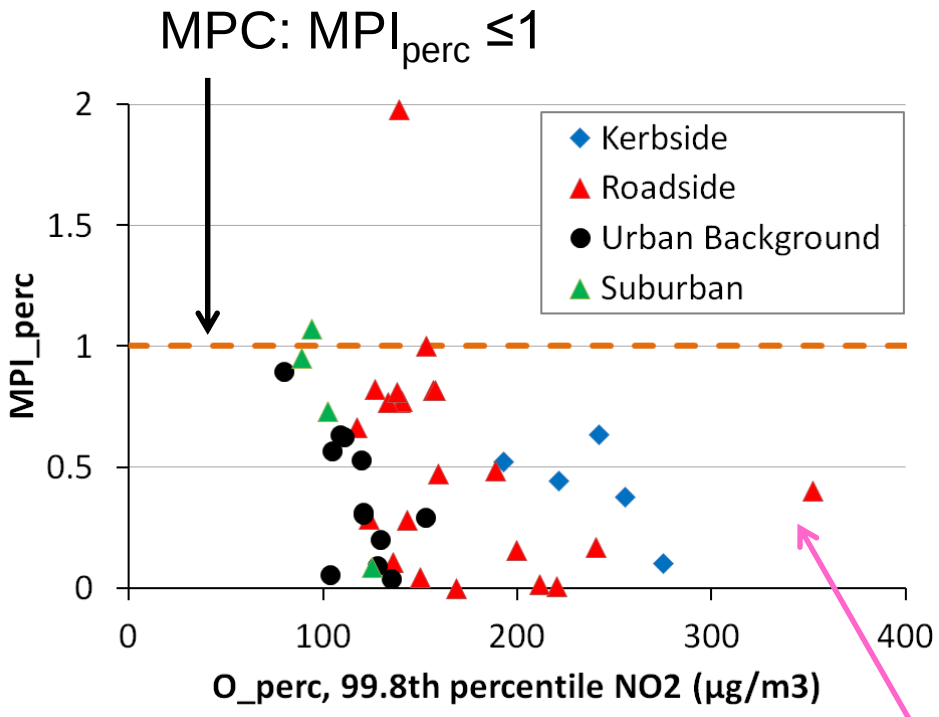

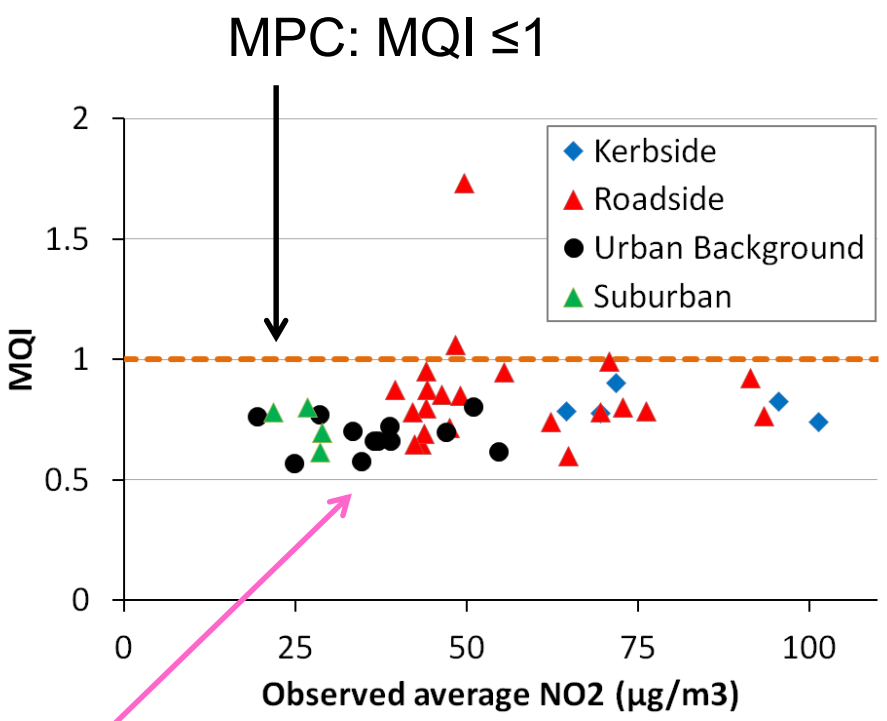

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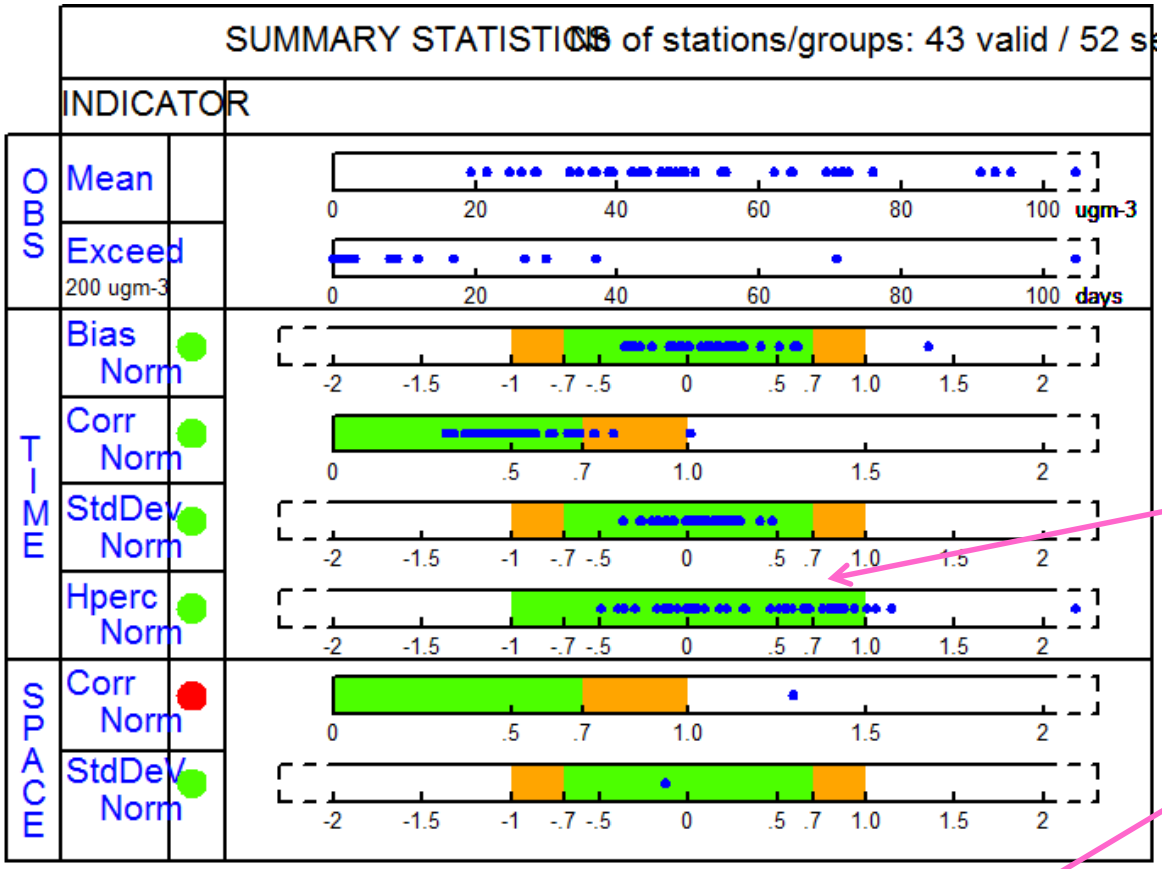
CERC

Is the indicator well behaved?

- Behaviour for other pollutants should be assessed

Is DELTA calculating the indicator correctly?



MPI_{perc} =H_{perc} should be positive by definition

$$MPI_{perc} = \frac{|M_{perc} - O_{perc}|}{\beta U_{95}(O_{perc})} \quad and \quad MPC: MPI_{perc} \leq 1$$

Summary

- Definition of MPI_{perc} is consistent with MQI
- Behaviour of MPI_{perc} for an extensive dataset of NO_2 concentrations is sensible
- Behaviour for other pollutants should be assessed
- There is at least one error with the implementation of the indicator within DELTA