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Evaluation of Forecast MQO - Belgium

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Outline

- Application for OVL forecast model
- Suggestions for indicators
- Additional comments

OVL methodology

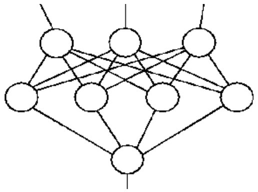
Input

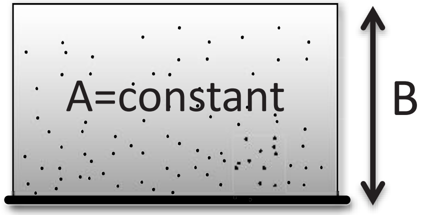
- PM10: last measurements (“A”)
- Meteo forecast which determines “B”

Boundary layer height + meteo

Process

- Neural network





Output

- PM10 forecasts (day0, day+N)

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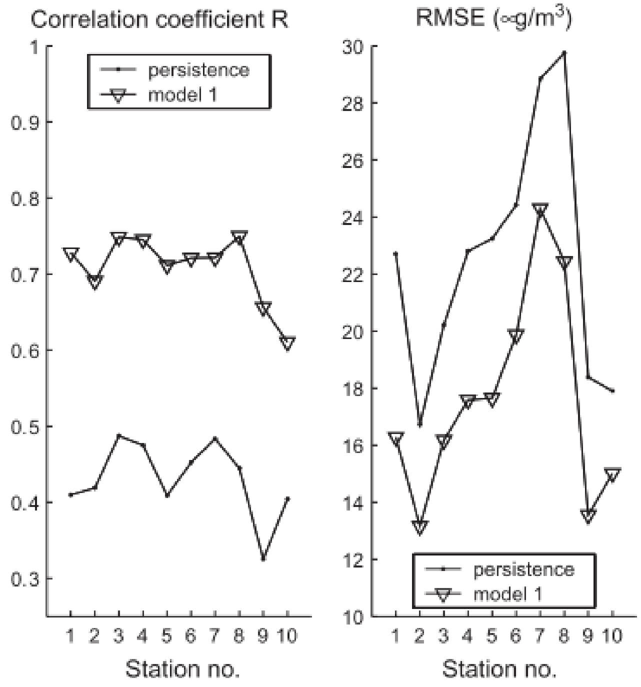
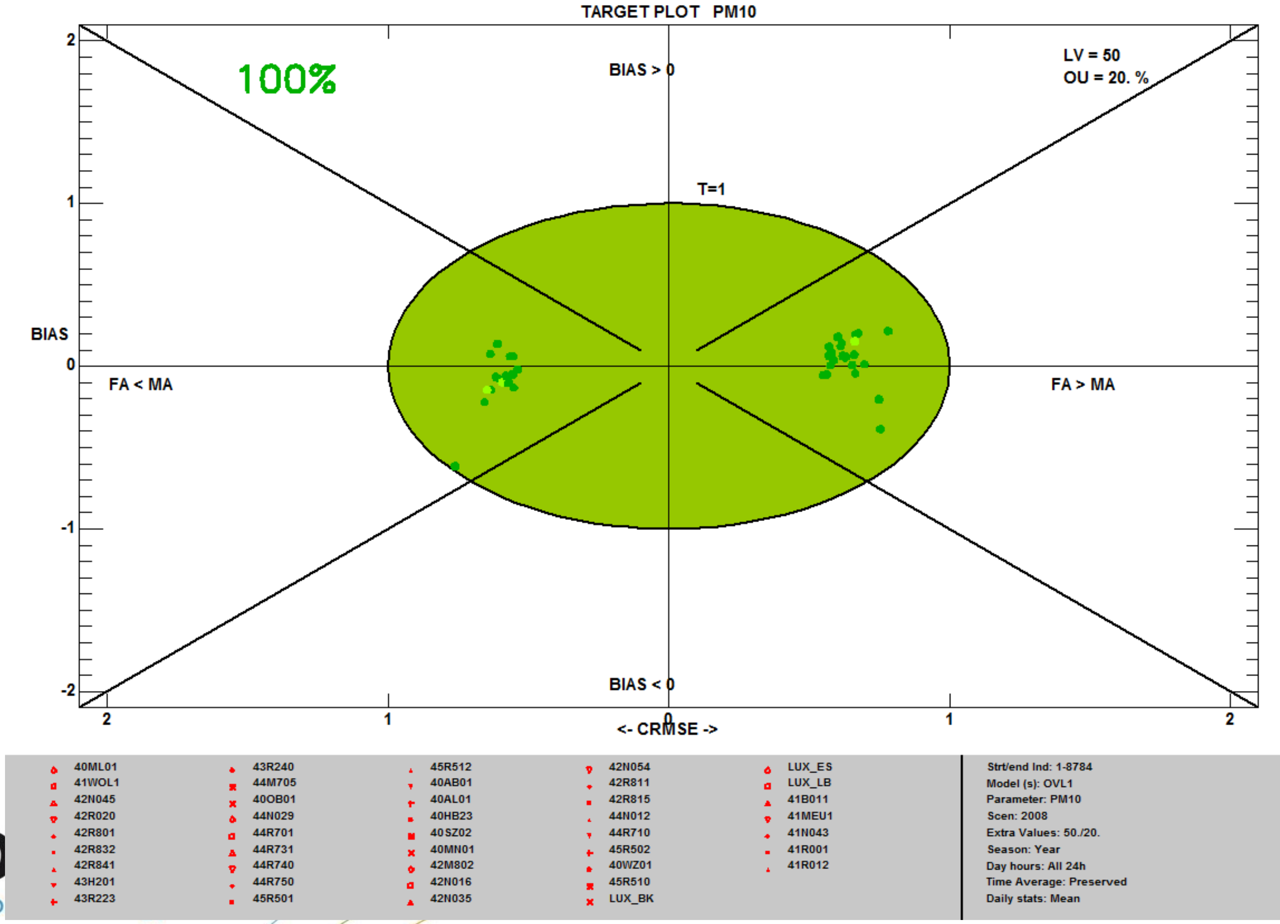
OVL methodology

» Hooyberghs, J., Mensink, C., Dumont, G., Fierens, F., Brasseur, O., 2005. A neural network forecast for daily average PM concentrations in Belgium. Atmos. Environ. 39, 3279–3289. doi:10.1016/j.atmosenv.2005.01.050



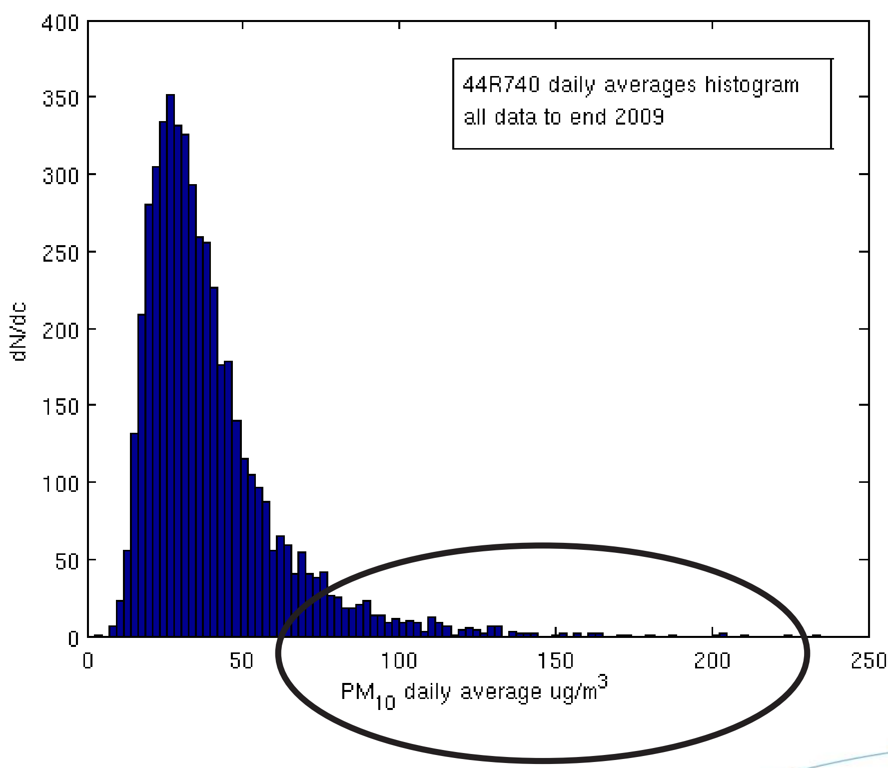
Sensitivity to OU

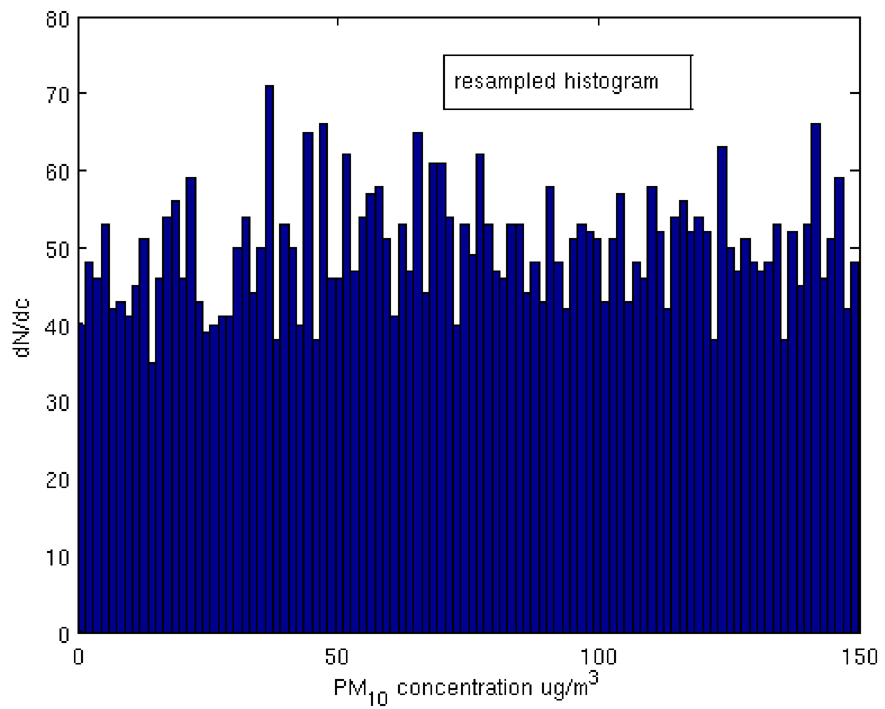
- Target diagram quite sensitive to OU
- LV = 50, OU = 0, 10, 20 %



Evaluation of FA vs. MA

» Improving exceedance predictions in OVL





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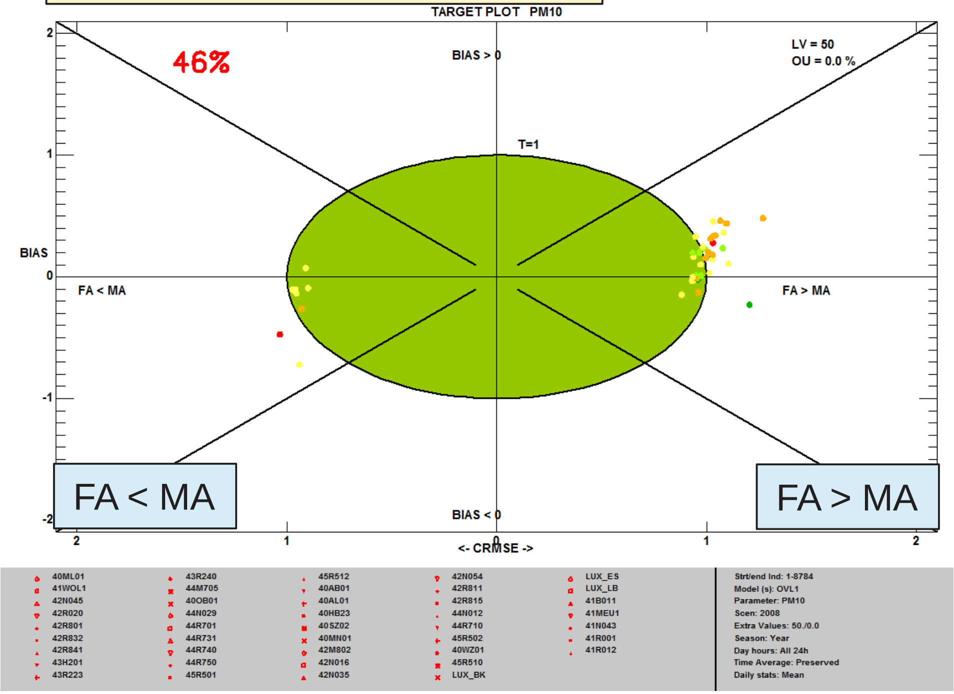
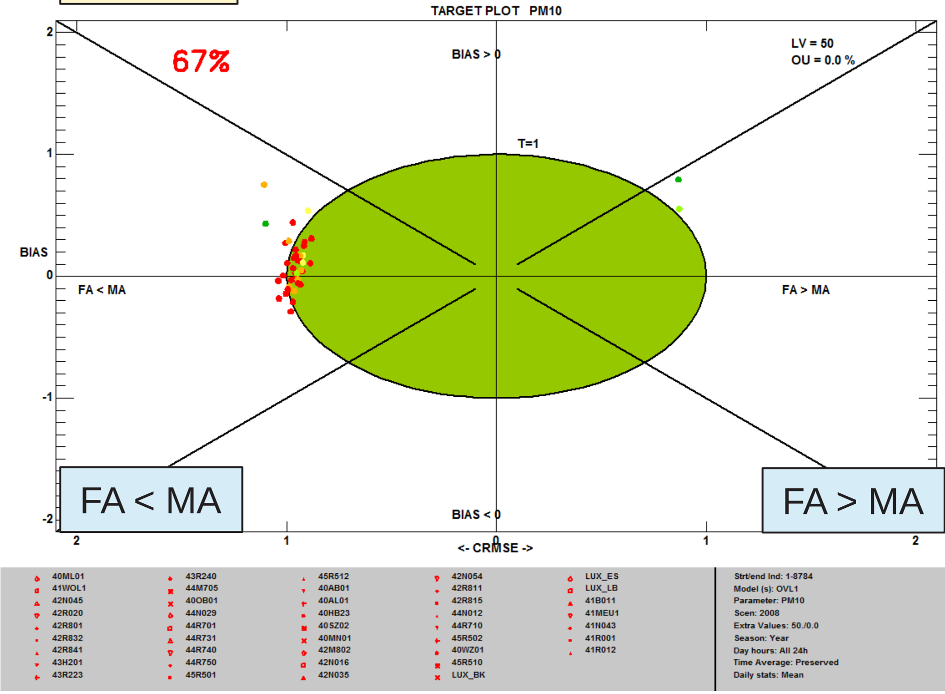
Evaluation of FA vs. MA

» Using 0 % OU, LV 50

Resampled distributions



“As is”



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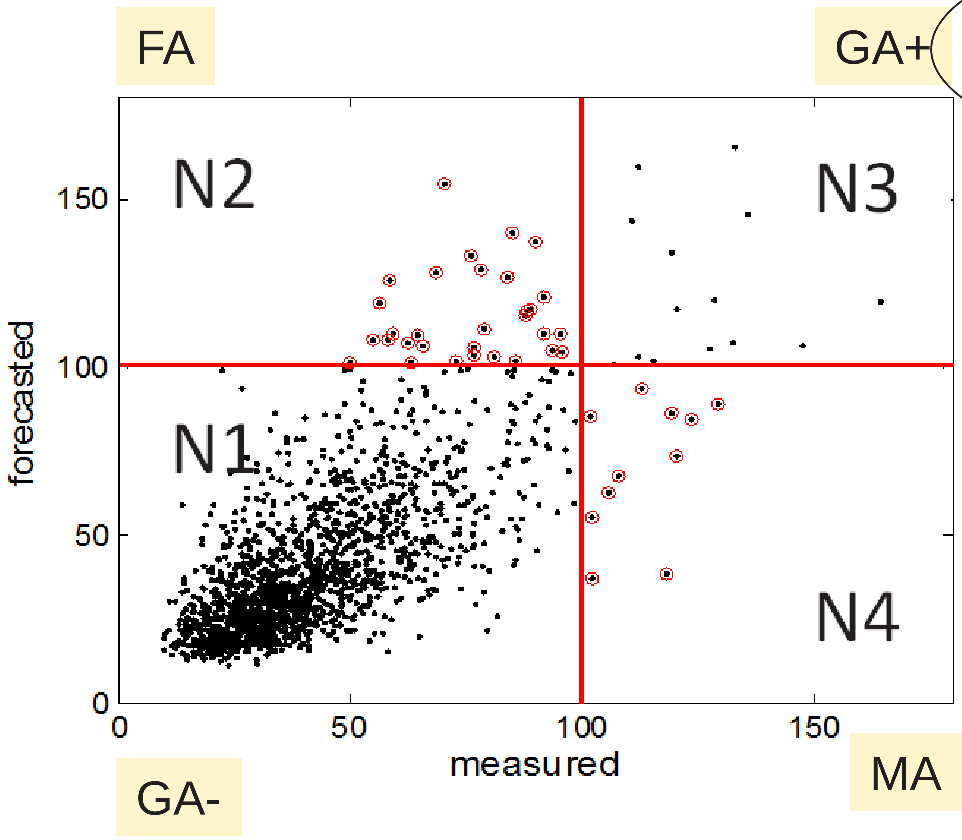
Threshold indicators



FCF :
Fraction of correctly forecasted exceedances

$$FCF = \frac{N3}{N3 + N4}$$

FFA :
Fraction of false alerts

$$FFA = \frac{N2}{N2 + N3}$$

FRE :
Fraction of realized exceedances

$$FRE = \frac{N3}{N2 + N3}$$

SFN :
Skill of forecasting non-exceedances

$$SFN = \frac{N1}{N1 + N2}$$

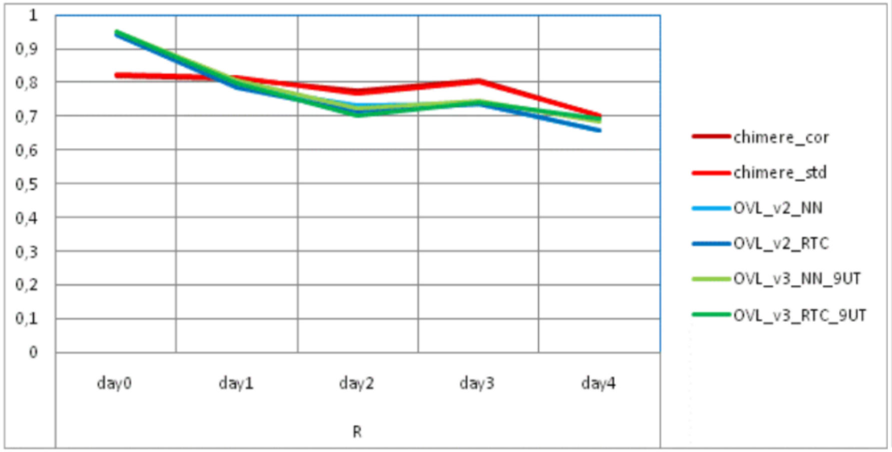
SI: Successindex

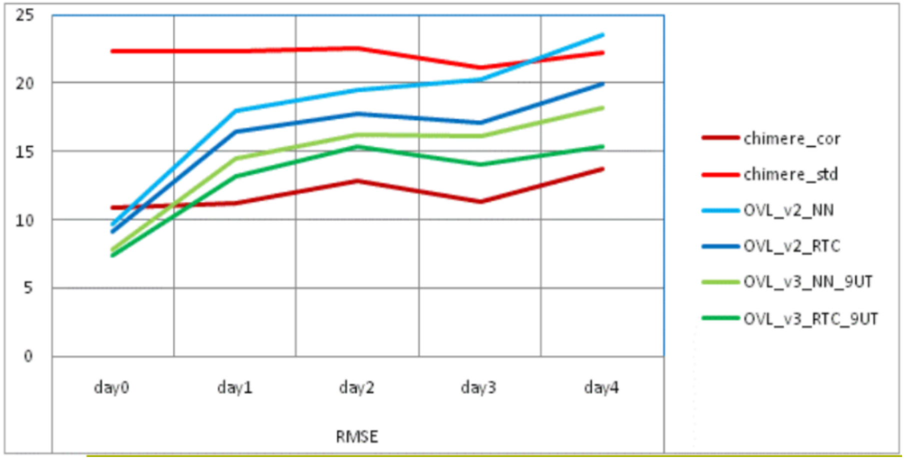
$$SI = \frac{N3}{N3 + N4} + \frac{N1}{N1 + N2} - 1 = FCF + SFN - 1$$

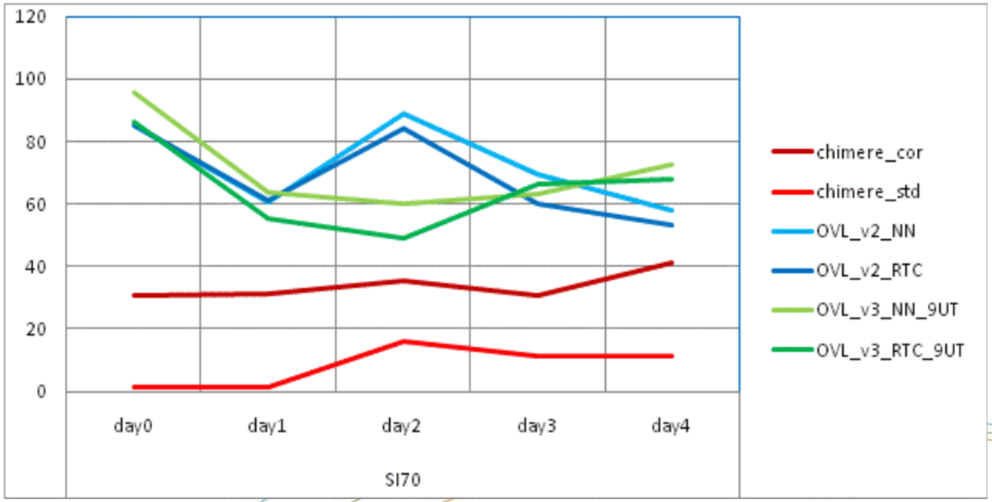
...

Comparison OVL vs. CHIMERE

» Y. Laumans / IRCEL (2010)







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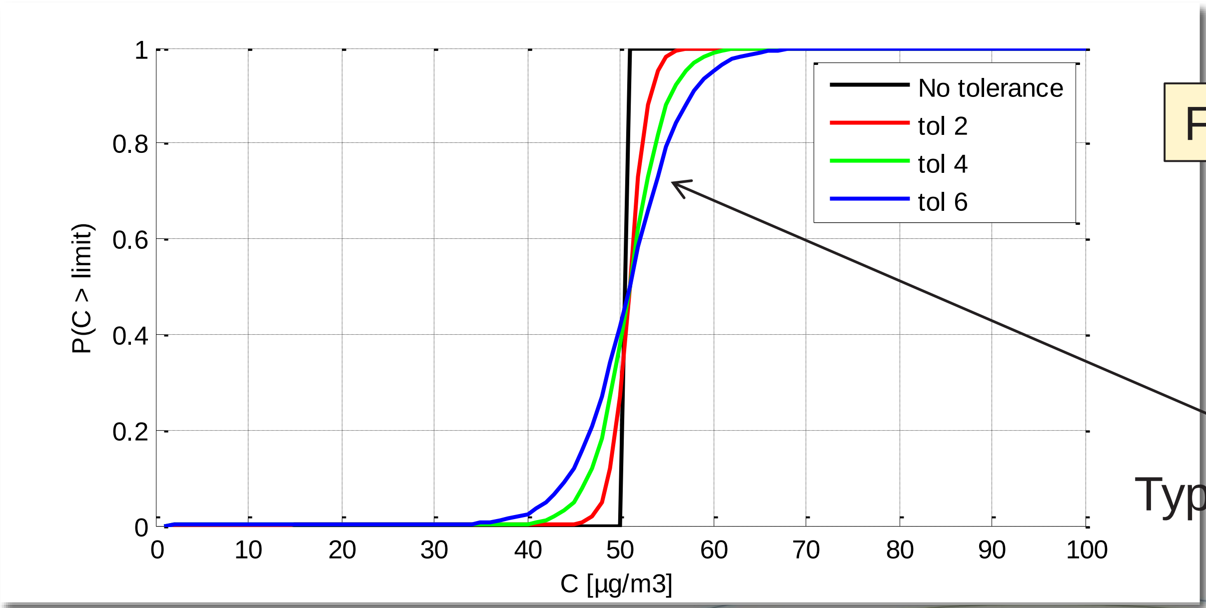
Integration of uncertainty…

- Dealing with observation uncertainty & threshold
  - Margin of tolerance
  - Nevertheless, still hard limit
- What about introducing tolerance on this threshold..
- Don’t count hard exceedances, count probabilities.



For model as well as obs.

Typical tanh – like shape

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Additional comments

- Target value definition

$$\text{Target}_{\text{forecast\_ji}} = \frac{\sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(M_{ji} - O_i\right)^2}}{\sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(O_{i-1} - O_i\right)^2}} \; with\_j = i-n,\ldots,i$$

$$\rightarrow \sigma_O\sqrt{2(1-\alpha)}$$

  - Time lag 1 in normalization → how to treat day+N forecasts ?
  - It become extra difficult for day+2 forecast to perform well
  - → timeseries auto-correlation !
  - However… does it make sense to have a persistence model for lag 3 or 4 ?
- It would be nice to have an evaluation of the performance vs. forecast horizon.

Conclusions

- Overall the idea of using persistence model as normalisation is relevant !
  - Time-lag in normalisation needs to be discussed
- Target plot quite sensitive to the value of the OU
- Behaviour of OVL fairly “poor” in target plot… doesn’t reflect our own experience… interesting !
- Using soft threshold might be more natural way in which to include uncertainty in trheshold exceedance indicators
- As far as threshold indicators go, probably the most important ones are FCF & FFA, or some combination thereof (FCF-FFA)…