

## Post-processing di FARM: filtro di Kalman

Verifica delle prestazioni e confronto con l'attuale correzione lineare stagionale, per le previsioni operative quotidiane

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Valutare le prestazioni del filtro di Kalman per gli scopi operativi.

Per il 2017:

- ▶ PM10 giornaliero (soglia  $50\mu\text{g}/\text{m}^3$ )
- ▶ O<sub>3</sub> orario
- ▶ NO<sub>2</sub> orario

Confronto tra:

- ▶ previsioni FARM a 48-71h ("*Farm*")
- ▶ per PM10, FARM corretto con coefficienti lineari ("*FarmG*")
- ▶ FARM "filtrato" con Kalman ("*FarmK*")
- ▶ misure delle stazioni di fondo (rurali, suburbane e urbane)

symbol	description	formula
MB	mean bias	$\frac{1}{n} \sum_{i=1}^n (M_i - O_i)$
MGE	mean gross error	$\frac{1}{n} \sum_{i=1}^n  M_i - O_i $
NMB	normalized mean bias	$\frac{1}{\bar{O}} \sum_{i=1}^n (M_i - O_i)$
NMGE	normalised mean gross error	$\frac{1}{\bar{O}} \sum_{i=1}^n  M_i - O_i $
RMSE	root mean squared error	$\left( \frac{1}{n} \sum_{i=1}^n (M_i - O_i)^2 \right)^{1/2}$
r	Pearson correlation coefficient	$\frac{1}{n-1} \sum_{i=1}^n \frac{(M_i - \bar{M})}{\sigma_M} \cdot \frac{(O_i - \bar{O})}{\sigma_O}$

symbol	description	formula
FAC2	fraction of predictions within a factor of two	$\frac{1}{n} \sum_{i=1}^n \left[ \frac{1}{2} \leq \frac{M_i}{O_i} \leq 2 \right]$
COE	Coefficient of Efficiency	$1 - \frac{\sum_{i=1}^n  M_i - O_i }{\sum_{i=1}^n  O_i - \bar{O} }$
IOA	Index of Agreement	$\begin{cases} 1 - \frac{\sum_{i=1}^n  M_i - O_i }{2 \cdot \sum_{i=1}^n  O_i - \bar{O} }, & \text{when } \frac{\sum_{i=1}^n  M_i - O_i }{2 \cdot \sum_{i=1}^n  O_i - \bar{O} } \leq 1. \\ \frac{2 \cdot \sum_{i=1}^n  O_i - \bar{O} }{\sum_{i=1}^n  M_i - O_i } - 1, & \text{when } \frac{\sum_{i=1}^n  M_i - O_i }{2 \cdot \sum_{i=1}^n  O_i - \bar{O} } > 1. \end{cases}$

symbol	description	formula
Acc	accuracy	$\frac{h + cn}{N}$
fBias	frequency bias	$\frac{h + fa}{h + m}$
POD	probability of detection	$\frac{h}{h + m}$
FAR	false alarm ratio	$\frac{fa}{h + fa}$
POFD	probability of false detection	$\frac{fa}{cn + fa}$

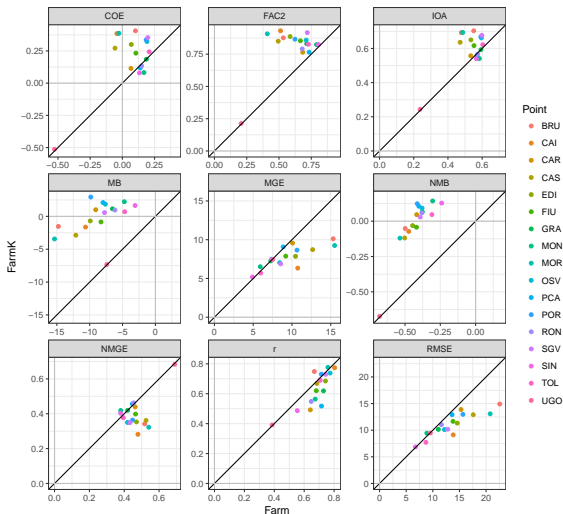
(*h*: hits, *m*: misses, *cn*: correct negatives, *fa*: false alarms, *N*: total)

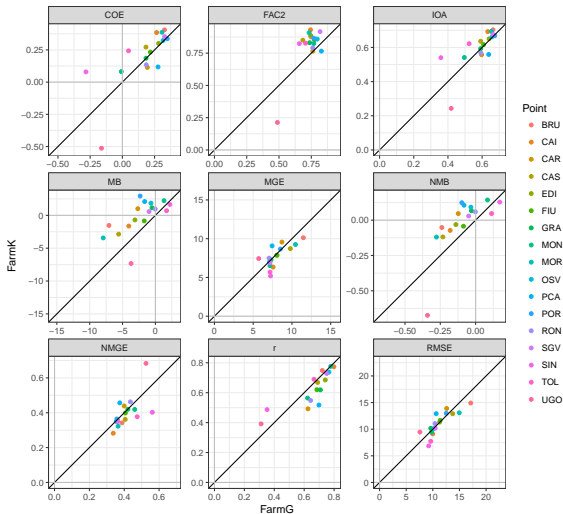
symbol	description	formula
ETS	equitable threat score	$\frac{H - h_r}{h + m + fa - h_r}$ where $h_r = \frac{(h + m)(h + fa)}{N}$
HSS	Heidke skill score	$\frac{(h + cn) - ec_r}{N}$ where $ec_r = \frac{(h + m)(h + fa) + (cn + m)(cn + fa)}{N}$

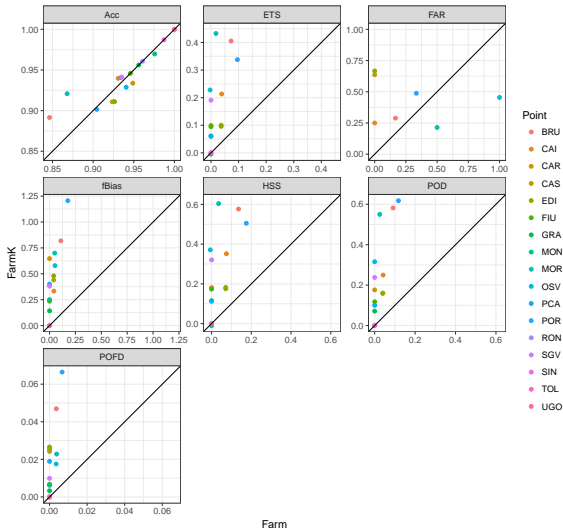
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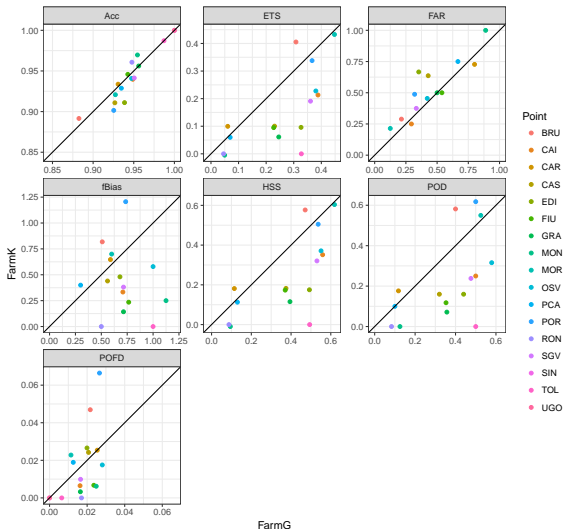
PM10

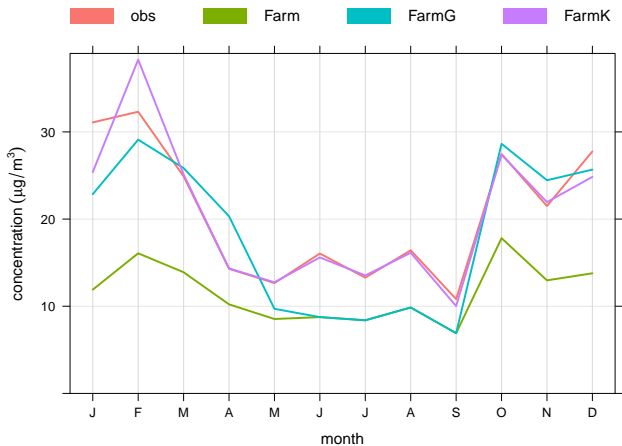


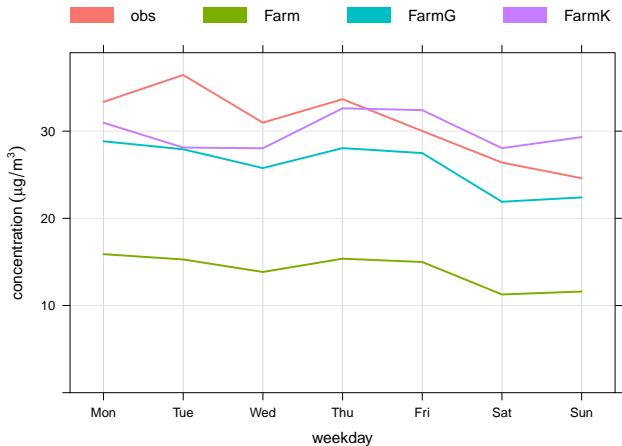




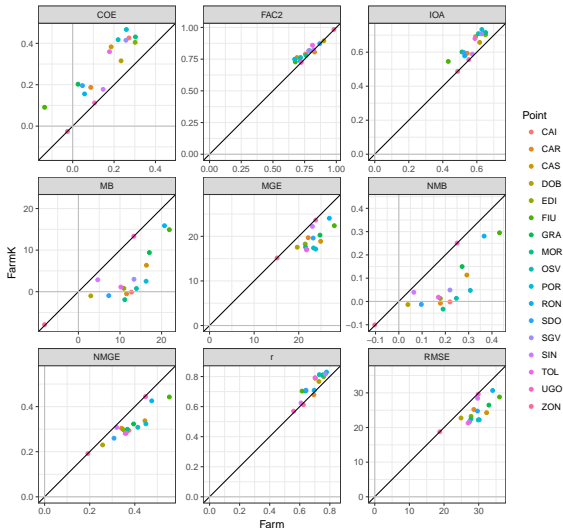




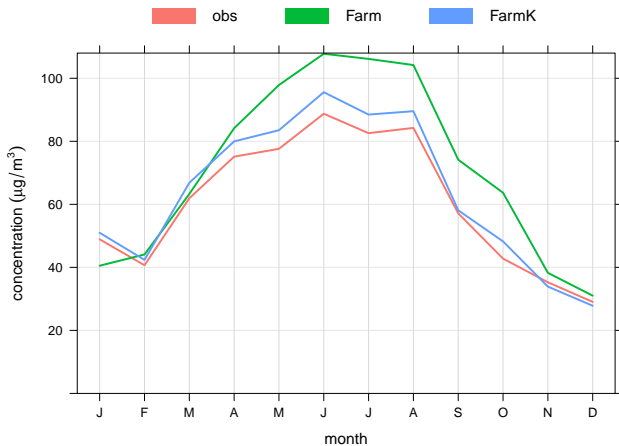


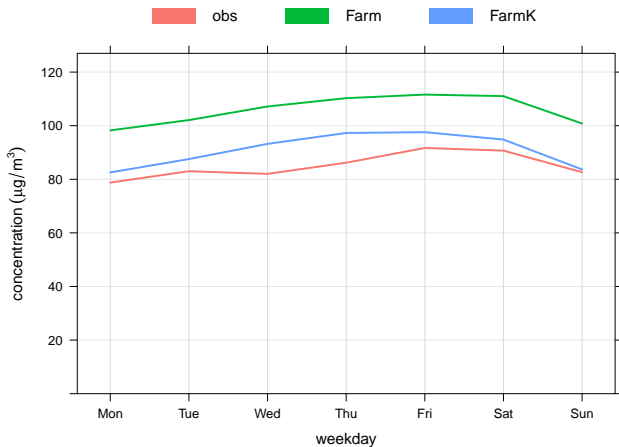


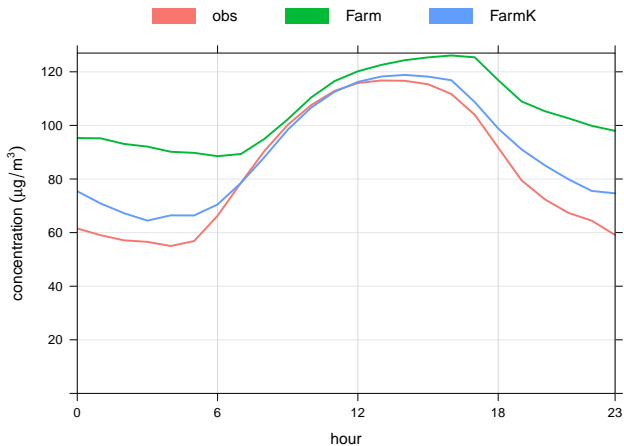
ozono



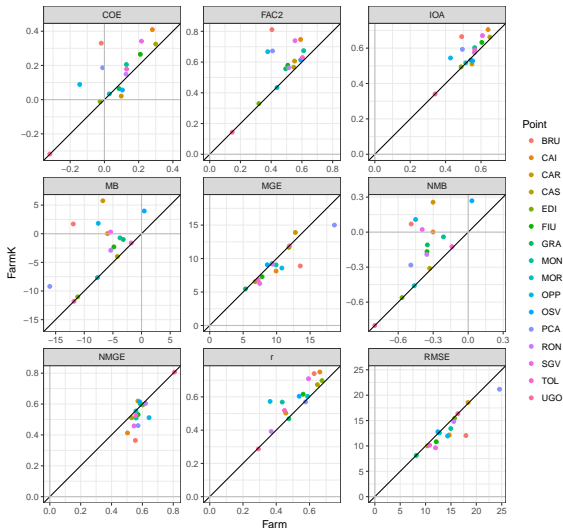


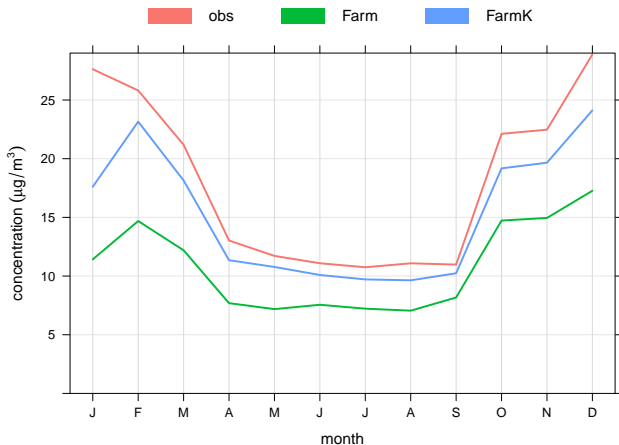


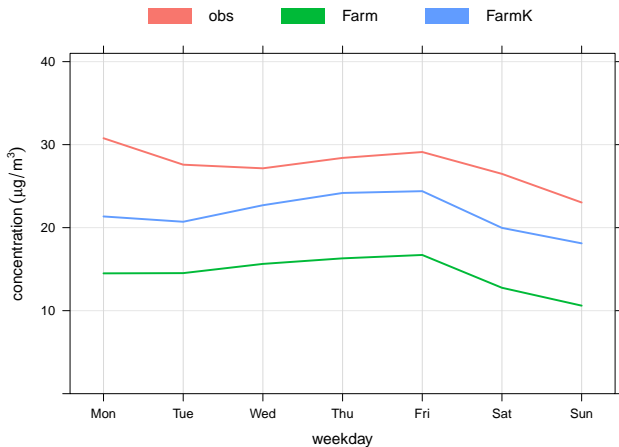


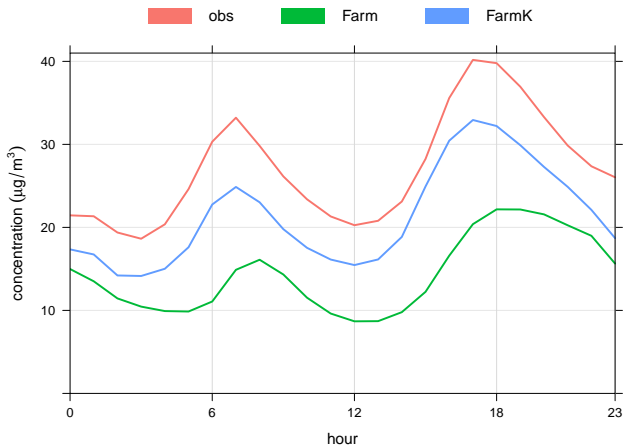


# biossido di azoto











# conclusioni

- ▶ **PM10**: riduce bias, ma per alcune stazioni perde un po' di correlazione; nelle previsioni di superamento

*FarmG* <sup>meglio di</sup>  $\succ$  *FarmK* <sup>meglio di</sup>  $\succ$  *Farm*

- ▶ **ozono**: annulla sovrastima diurna, riduce sovrastima notturna, migliora correlazione
- ▶ **biossido di azoto**: riduce sovrastima, migliora correlazione