

WIND SPEED FORECAST  
SINGLE SITE VERIFICATION  
AT  
PEARSON AIRPORT  
FOR  
GEM-15 MODEL

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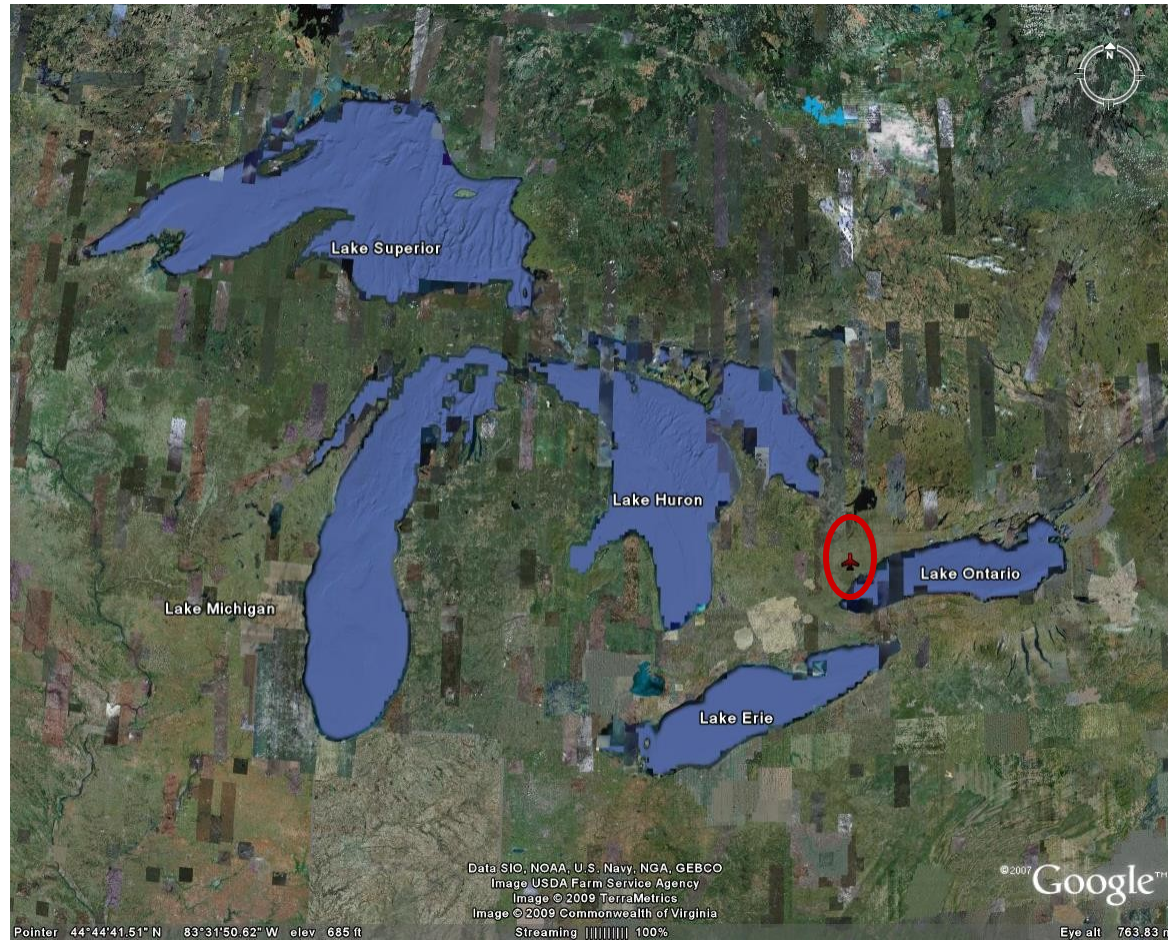
François Lemay (Canada)

# Data set description

## June 2007 – April 2009

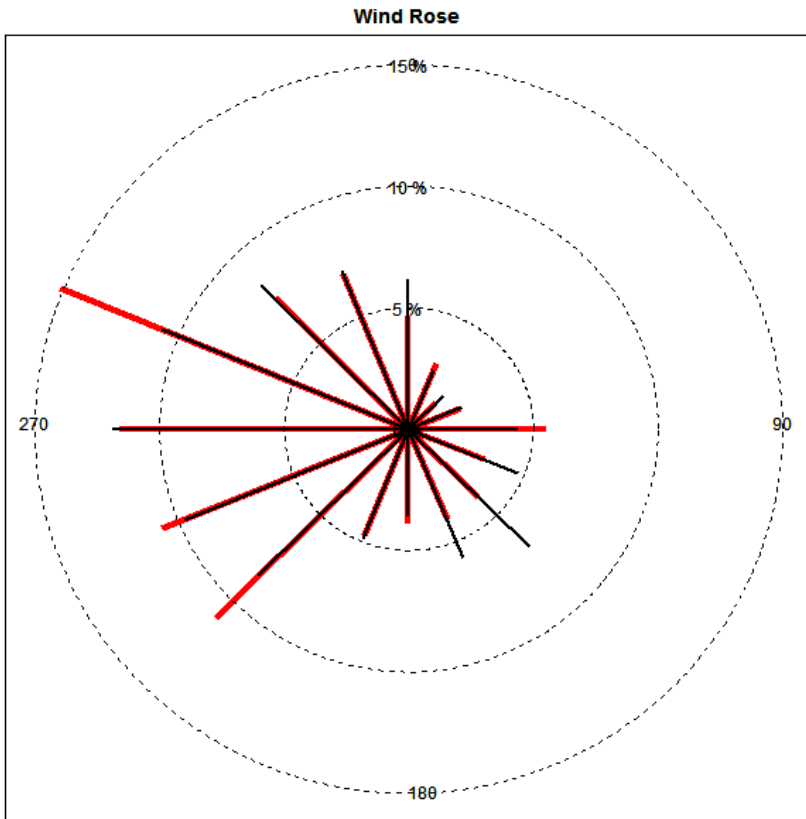
- Model :
  - Canadian GEM regional configuration
  - 15 km resolution
  - 30 min time-steps
  - Closest model point (no interpolation)
  - No post-treatment
  - 00Z and 12Z forecasts, 3 hour spin-up
  - All forecasts  $\leq$  15 hours integration time
- Observation:
  - Wind speed/direction (1 minute temporal resolution)
  - Pearson airport

# Location of Toronto Pearson Airport

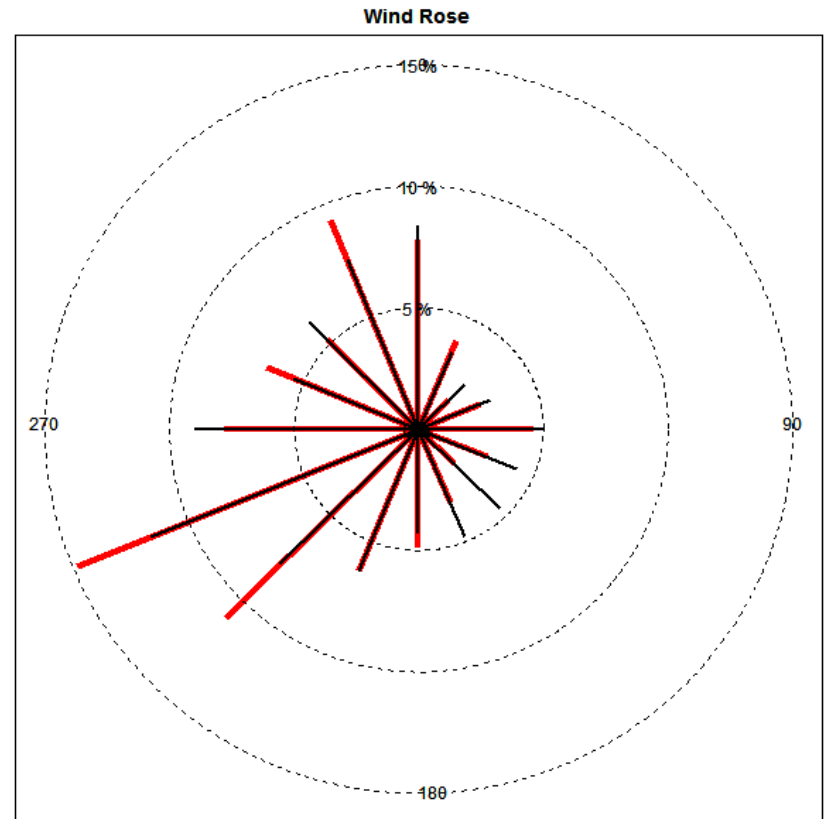


# Wind Rose

(model in red)



SUMMER JJA 2008



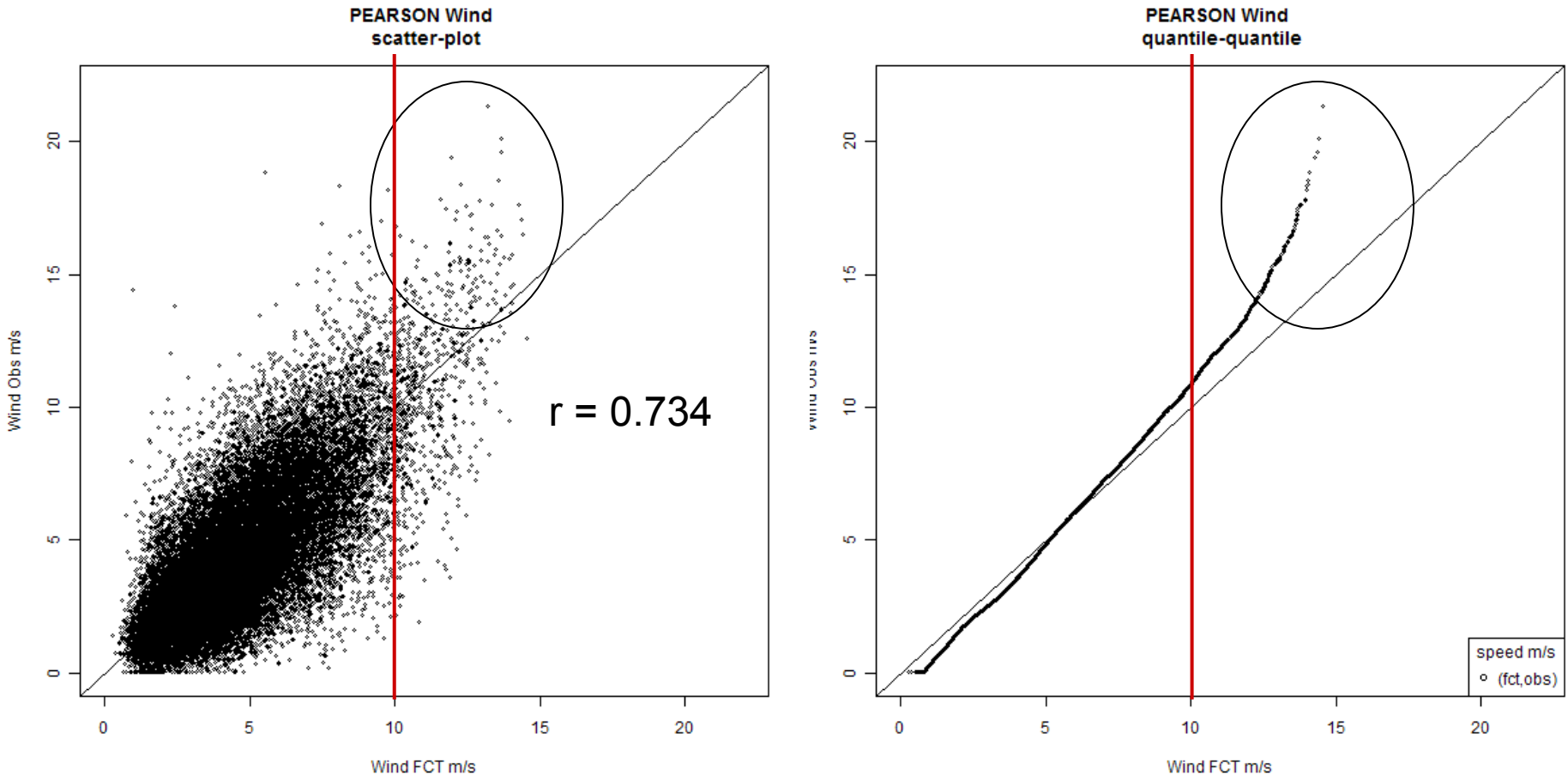
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Length of lines indicates number of wind events

# Methodology

- Verification questions
  - How is performance affected by :
    - WIND MAGNITUDE
    - SEASON
    - TIME OF DAY
- Users
  - Aviation (20 knots or 10 m/s cross over to IFR instrument flight rules)

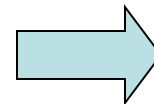
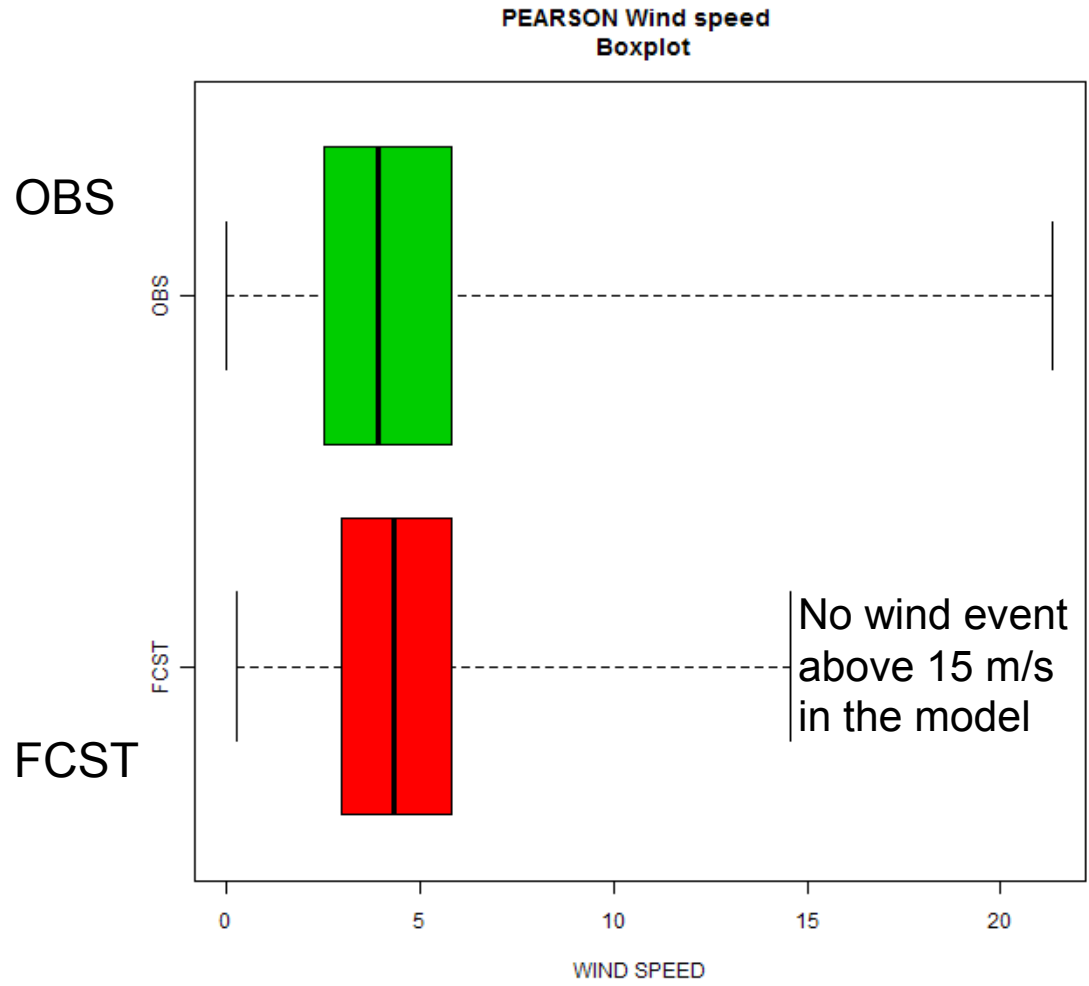
# Full period results



- Underestimation of high winds
- Slight overestimation of low winds

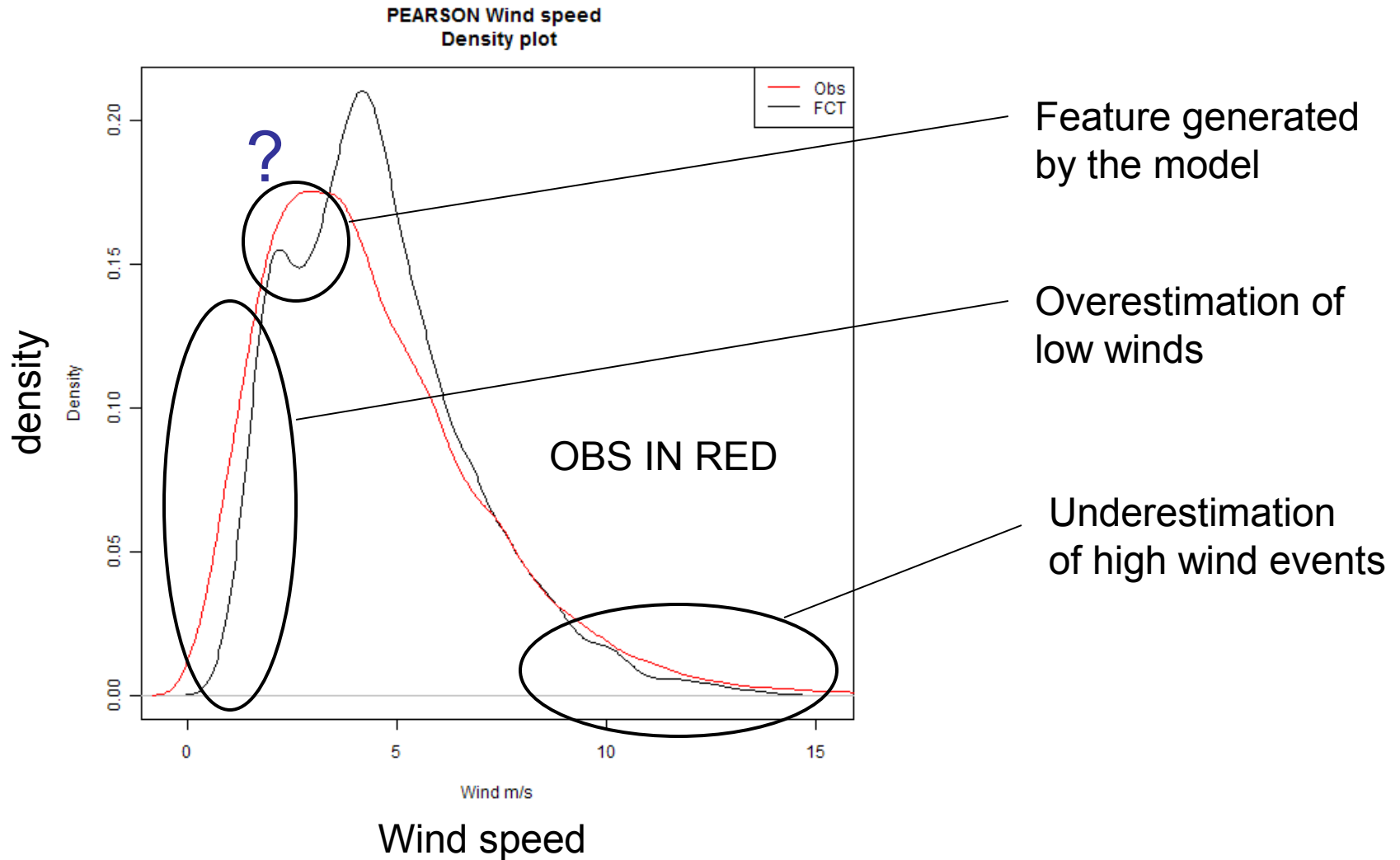
# Full period results

## Underestimation of high winds



15 km resolution  
Maybe different in  
higher resolution  
model

# Full period results wind distribution





# Full period results : category score

## warnings for speeds > 10 m/s

	O>10m/s	O<10m/s
F>10m/s	a=400	b=271
F<10m/s	c=657	d=27522

Threat score  $TS = CSI = \frac{a}{(a+b+c)}$  **0.301**

Range: 0 to 1  
Perfect score = 1  
No skill level = 0

Hit rate  $H = POD = \frac{a}{(a+c)}$  **0.378**

Range: 0 to 1  
Perfect score = 1

False alarm ratio  $F = \frac{b}{(a+b)}$  **0.404**

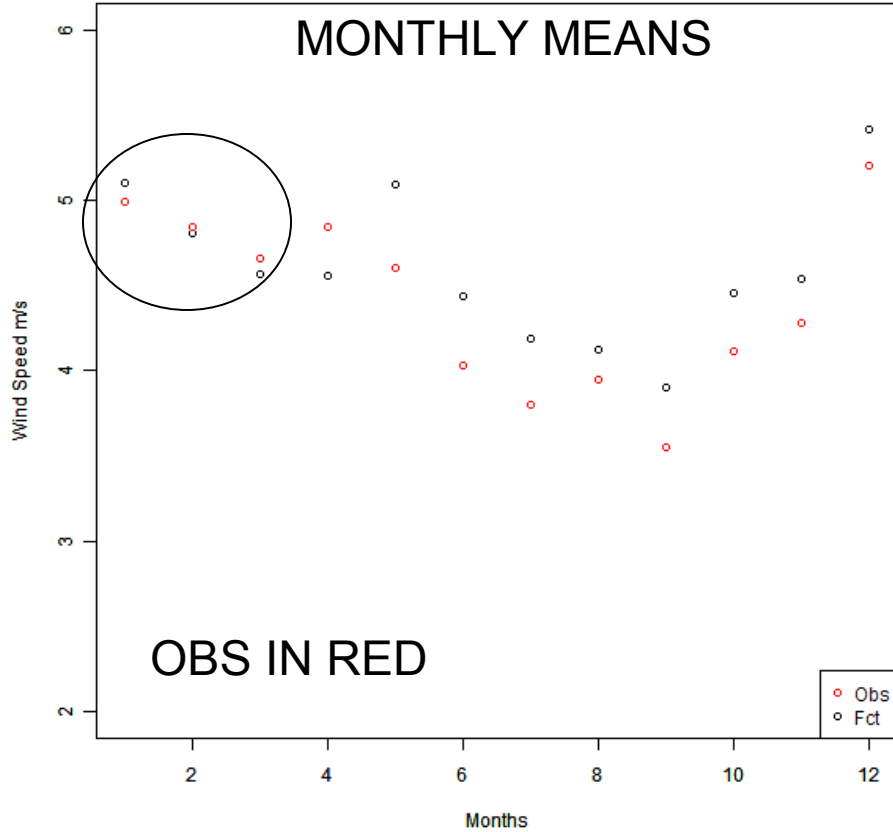
Range: 0 to 1  
Perfect score = 0

cf.: Anna Ghelli's  
tutorial

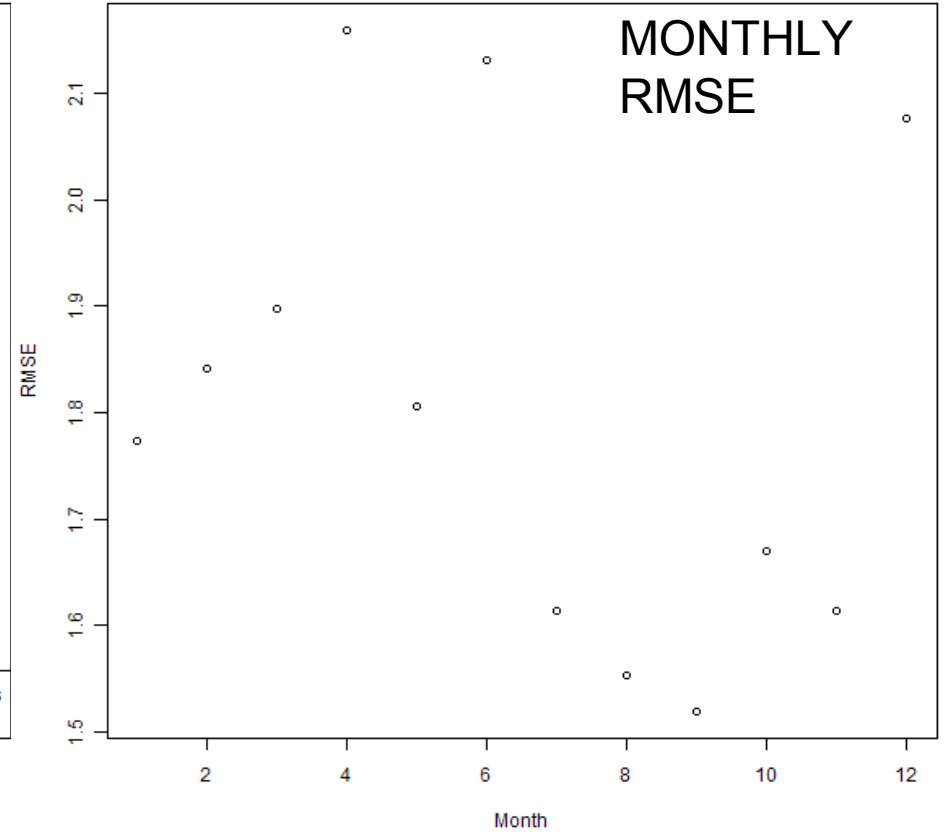
We could afford more false alarms to increase the number of hits...?

# Monthly time series

PEARSON Wind speed  
Monthly Means Time-Series



PEARSON Wind speed  
monthly RMSE



Low wind events dominate  
overestimation most of the time

Doing better in winter

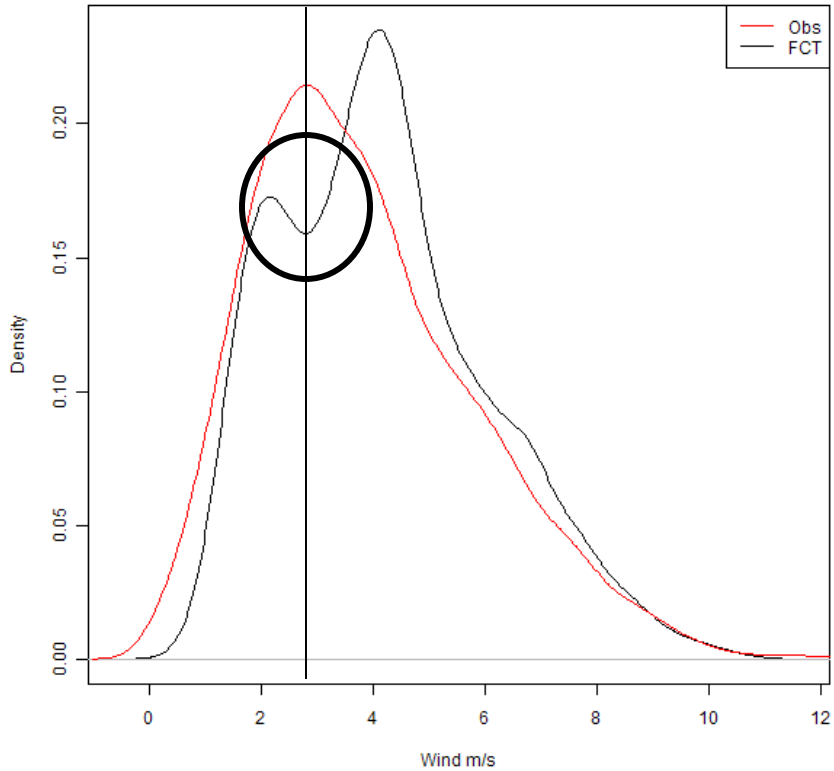
RMSE don't vary much (1.5 to 2.1)

No clear seasonal behavior

# Seasonal feature

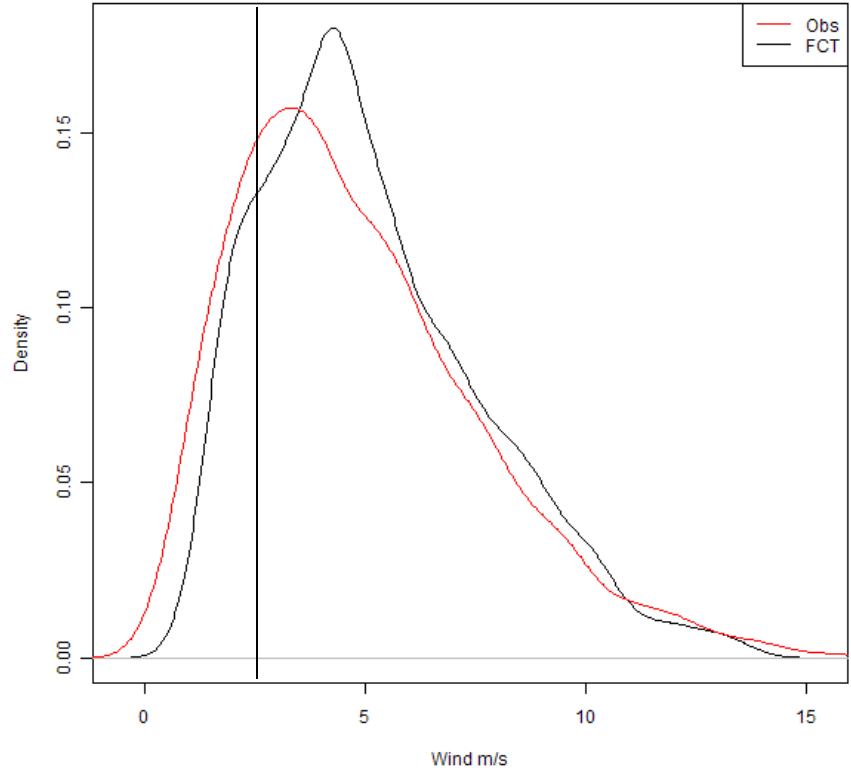
(OBS IN RED)

PEARSON Wind speed  
Density plot



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PEARSON Wind speed  
Density plot

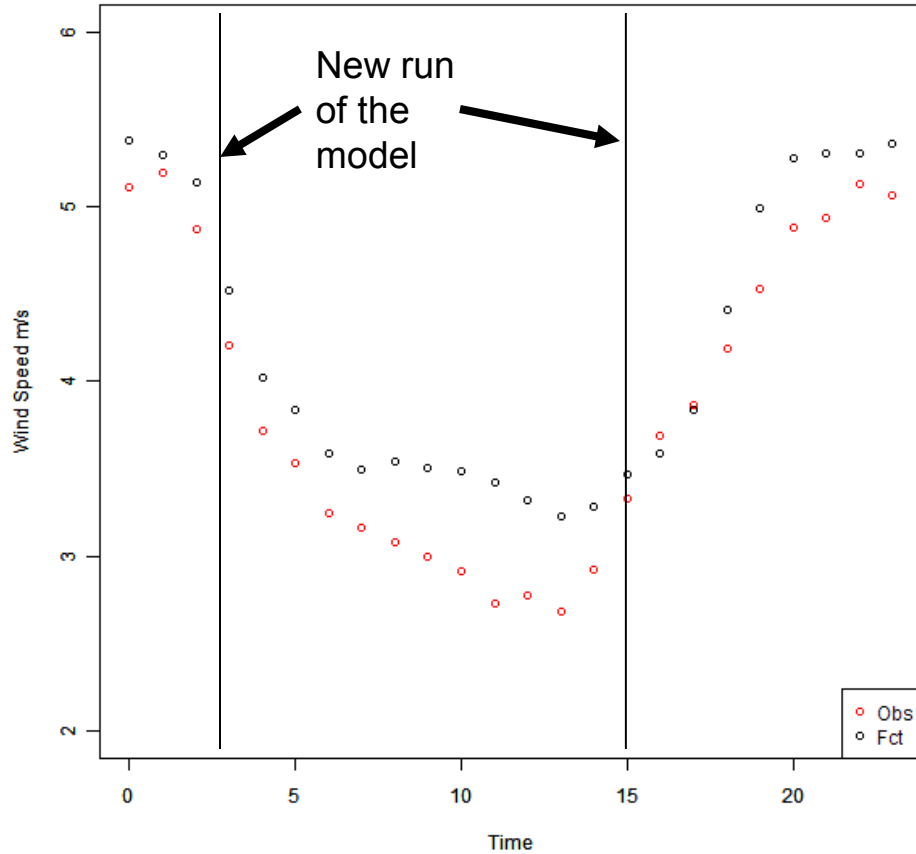


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# Diurnal behavior

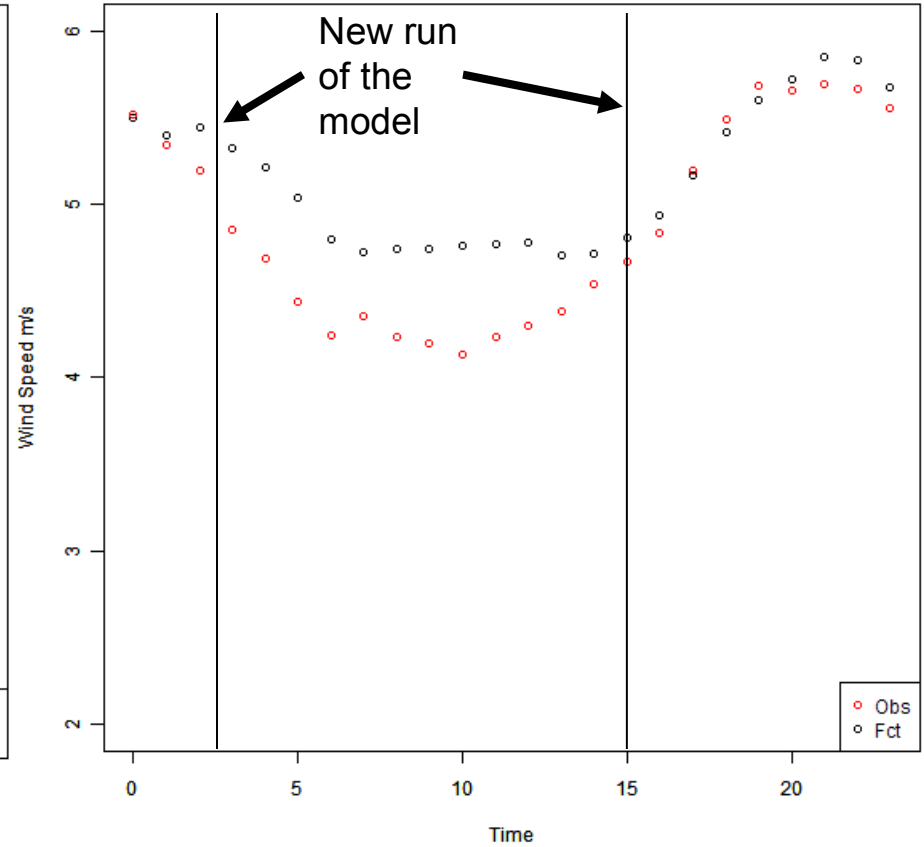
Hourly time series (obs in red)

PEARSON Wind speed  
Hourly Means Time-Series



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PEARSON Wind speed  
Hourly Means Time-Series



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The newer the model run, the better the result



May dominate diurnal effect

# Conclusion

## WIND MAGNITUDE

- Slight overestimation of low winds
- Underestimation of high winds (especially critical winds)
- Could afford more false alarms to increase hit rate

## SEASON

- Doing better in winter
- Strange model feature around 3 m/s in wind speed distribution

## TIME OF DAY

- Diurnal behavior of model performance might be caused by model run schedule.

**THANK YOU!**