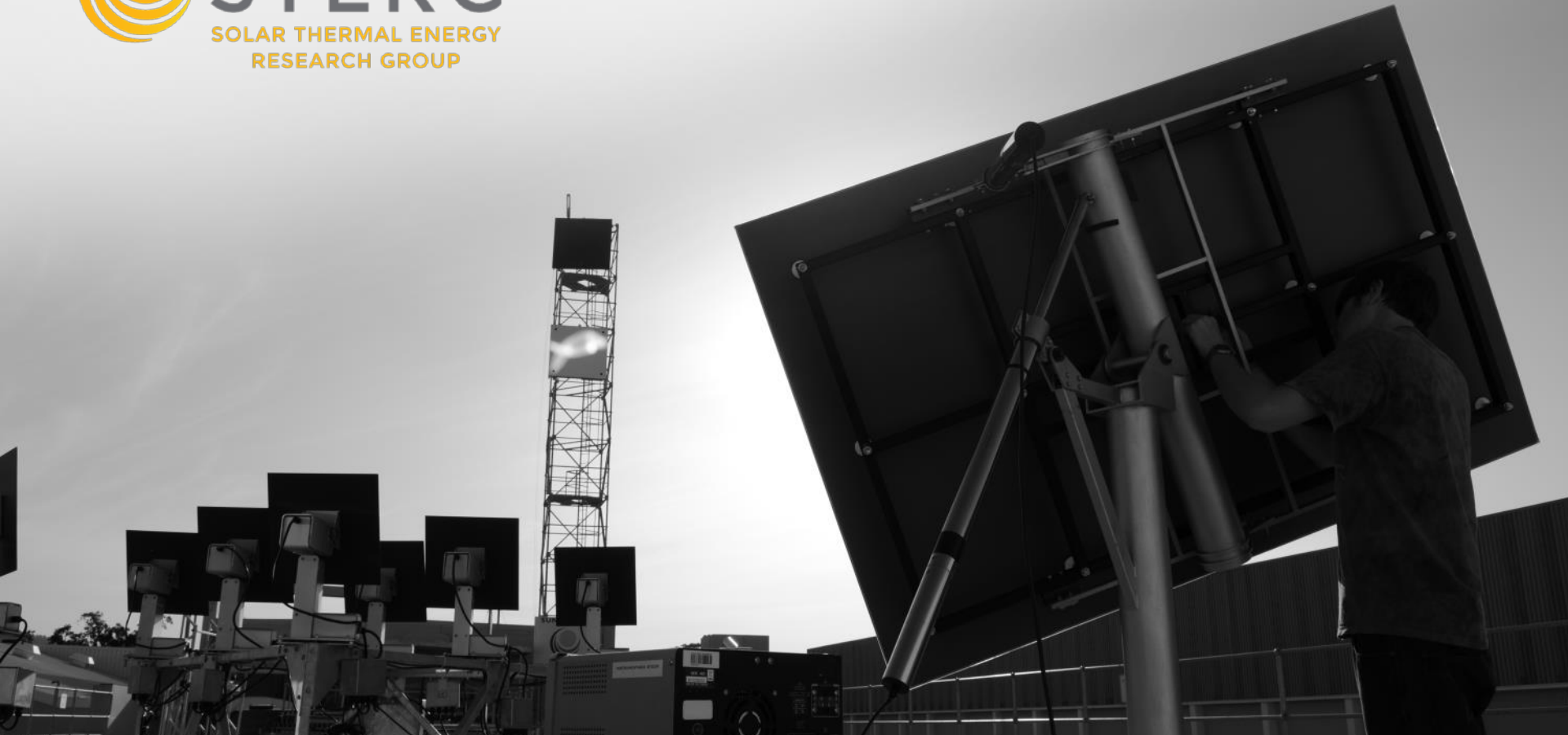
STERG

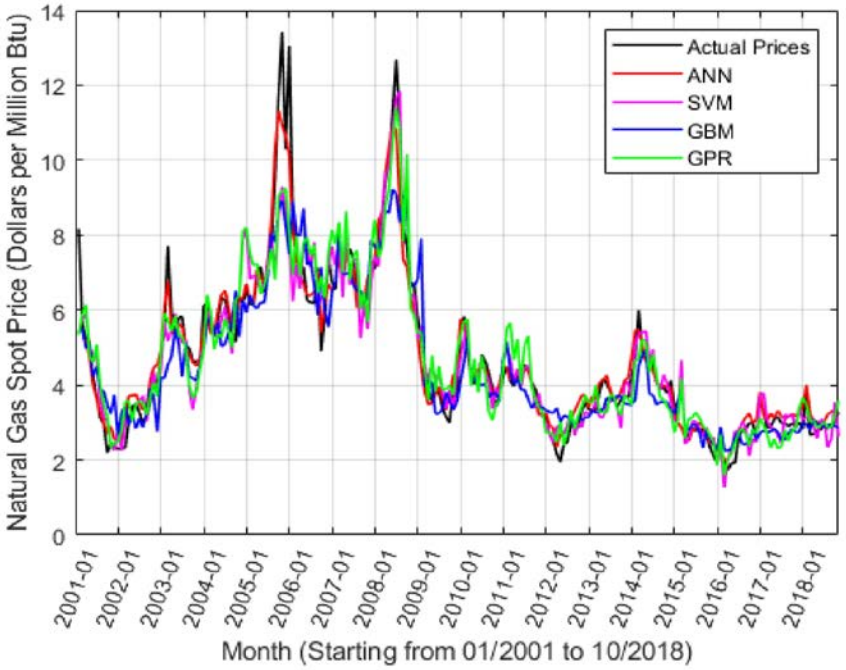
SOLAR THERMAL ENERGY RESEARCH GROUP



A practical guide to kernel construction for renewable energy Bayesian inference

Foster Lubbe (SU)
Thomas Harms (SU)
Jacques Maritz (UFS)

Status quo example of learning methods



- Long term natural gas spot price regression
- Influenced by complex market variables
- Probabilistic approach is valuable
- Probabilistic method must be non-linear and model-independent
- Gaussian process regression meets these requirements

Su et al., 2019

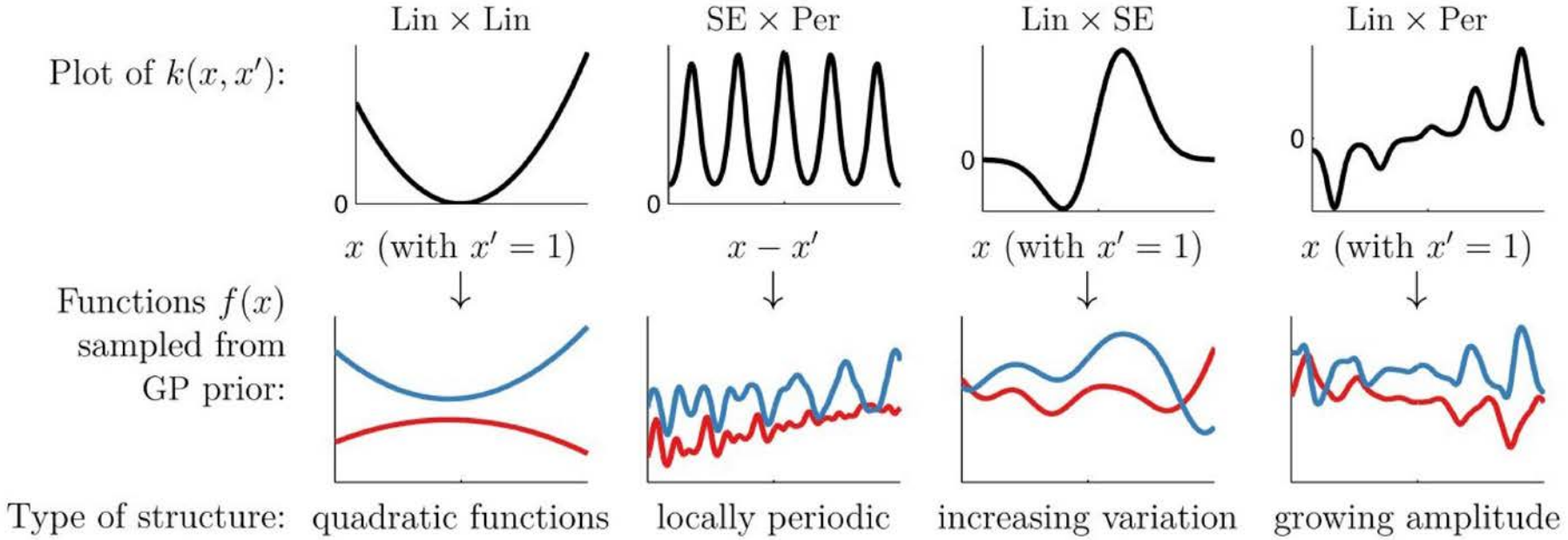
Consider the Solar Settlement in Freiburg, Germany

Kunzig and Locatelli, 2015

- Net producer of energy
- Surplus energy traded/stored
- Trading/utilization of energy is influenced by future state of energy resource
- Energy management could be strengthened by means of probabilistic models such as Gaussian process regression
- Probabilistic methods, together with large energy data, can be leveraged

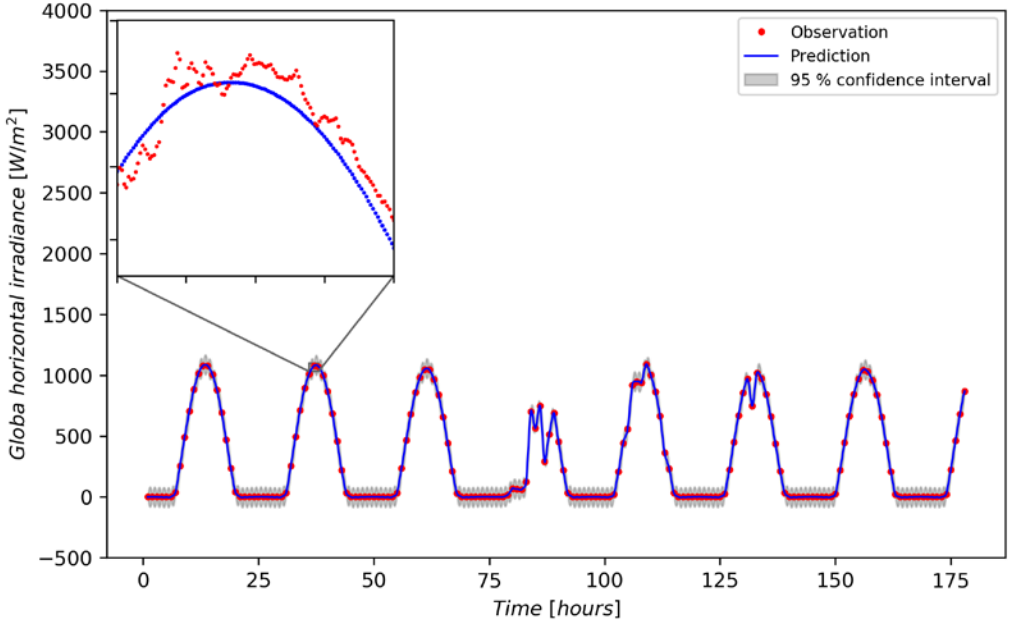
Function space view of Gaussian process

$$\begin{bmatrix} \mathbf{f} \\ \mathbf{f}_* \end{bmatrix} \sim \mathcal{N}\left(\begin{bmatrix} \mu \\ \mu_* \end{bmatrix}, \begin{bmatrix} \mathbf{K} & \mathbf{K}_* \\ \mathbf{K}_*{}^T & \mathbf{K}_{**} \end{bmatrix} \right)$$



Case study: Gaussian process applied

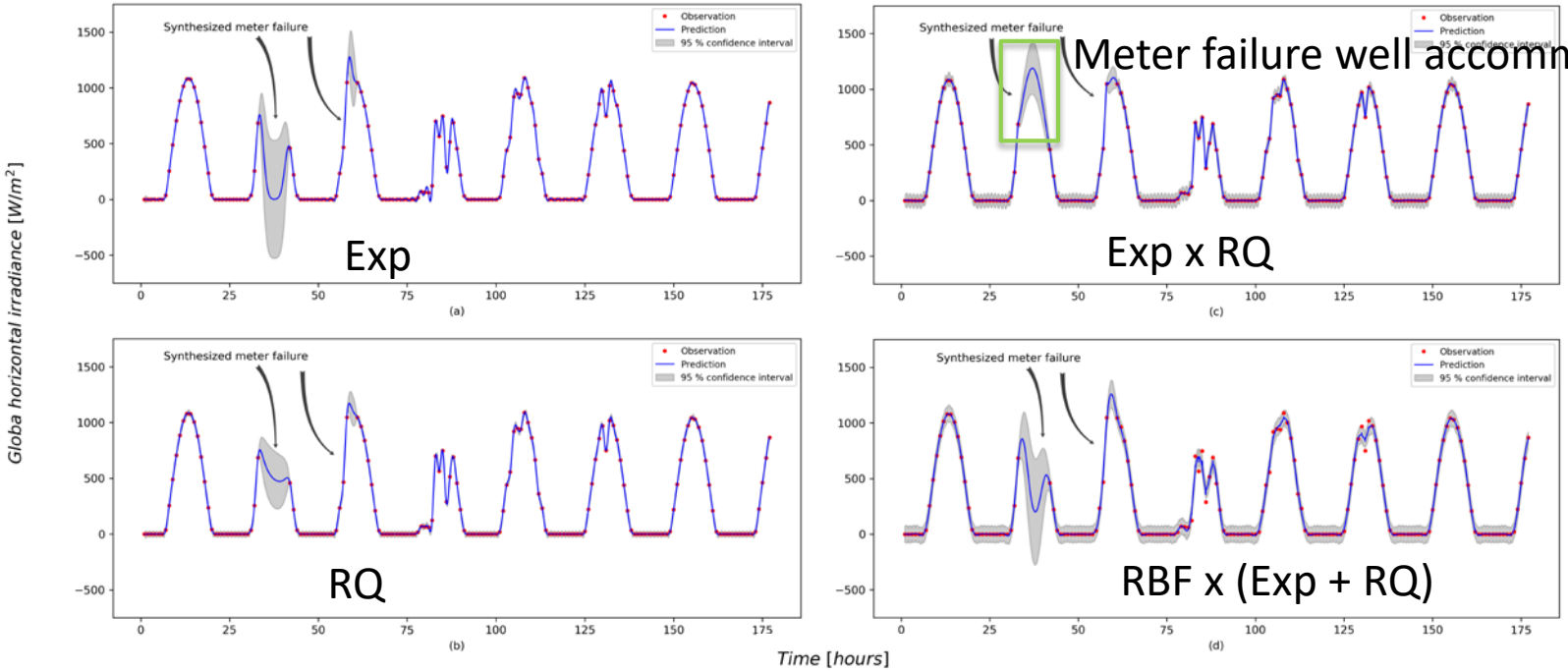
Stellenbosch Sauran GHI data (01/02/2015 – 08/02/2015)



- Hourly DNI observations
- GP trained on observations
- Minutely regression (y*)

Case study: Gaussian process applied

Simulated meter failure with different kernels

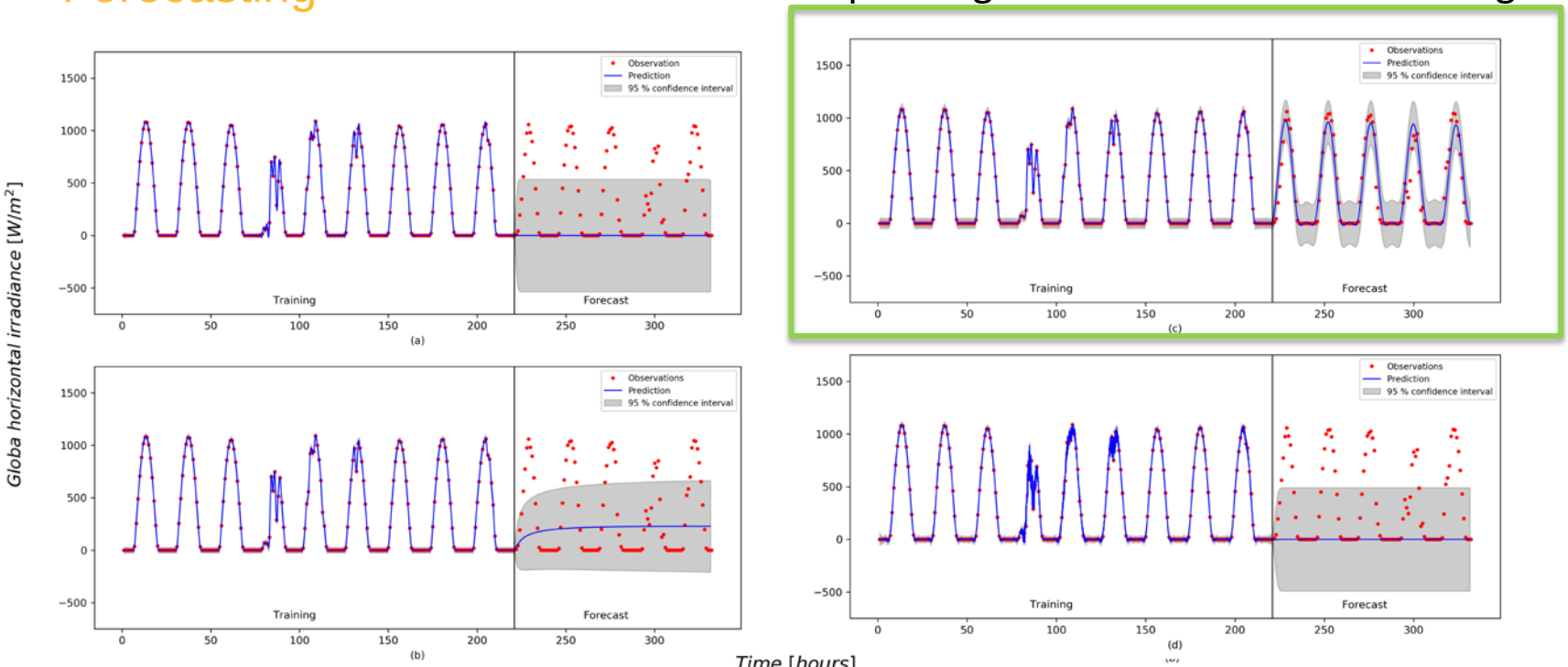


Meter failure well accommodated

Case study: Gaussian process applied

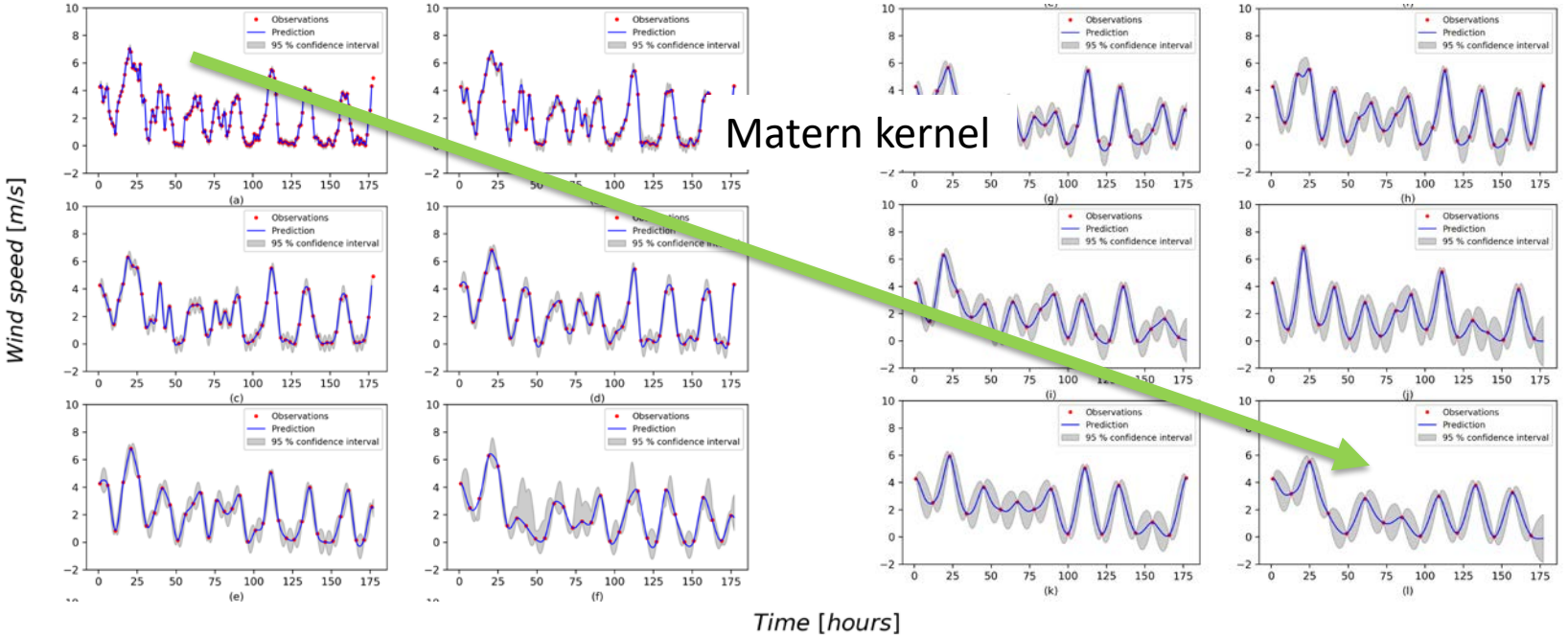
Forecasting

Exp x RQ good candidate for forecasting



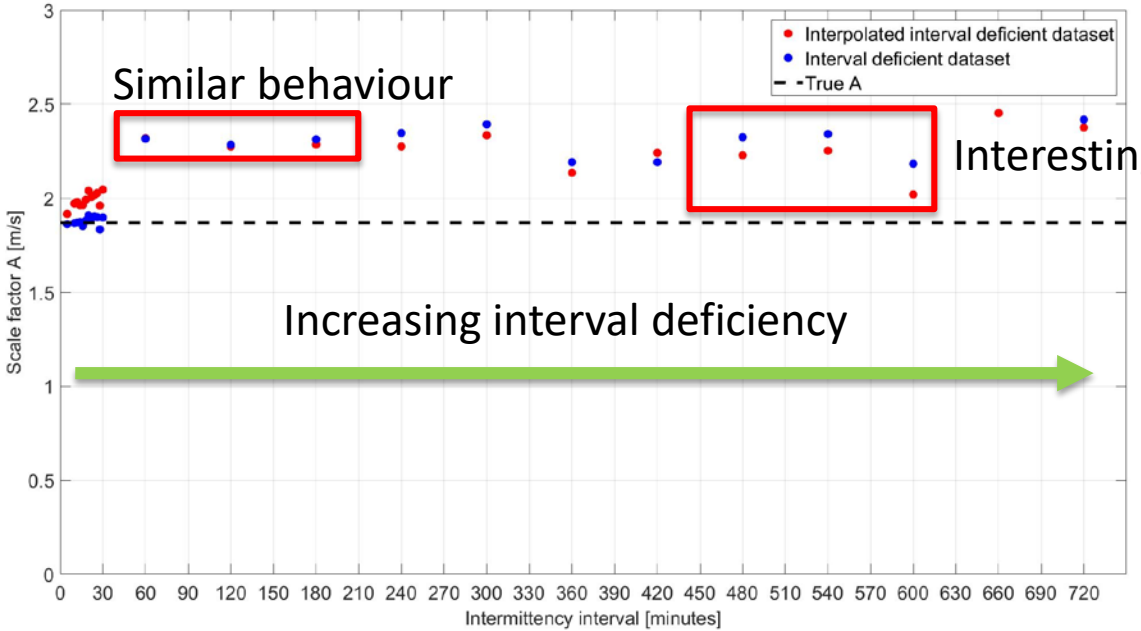
Case study: Gaussian process applied

Interval deficient wind speed data (01/02/2015 – 08/02/2015)

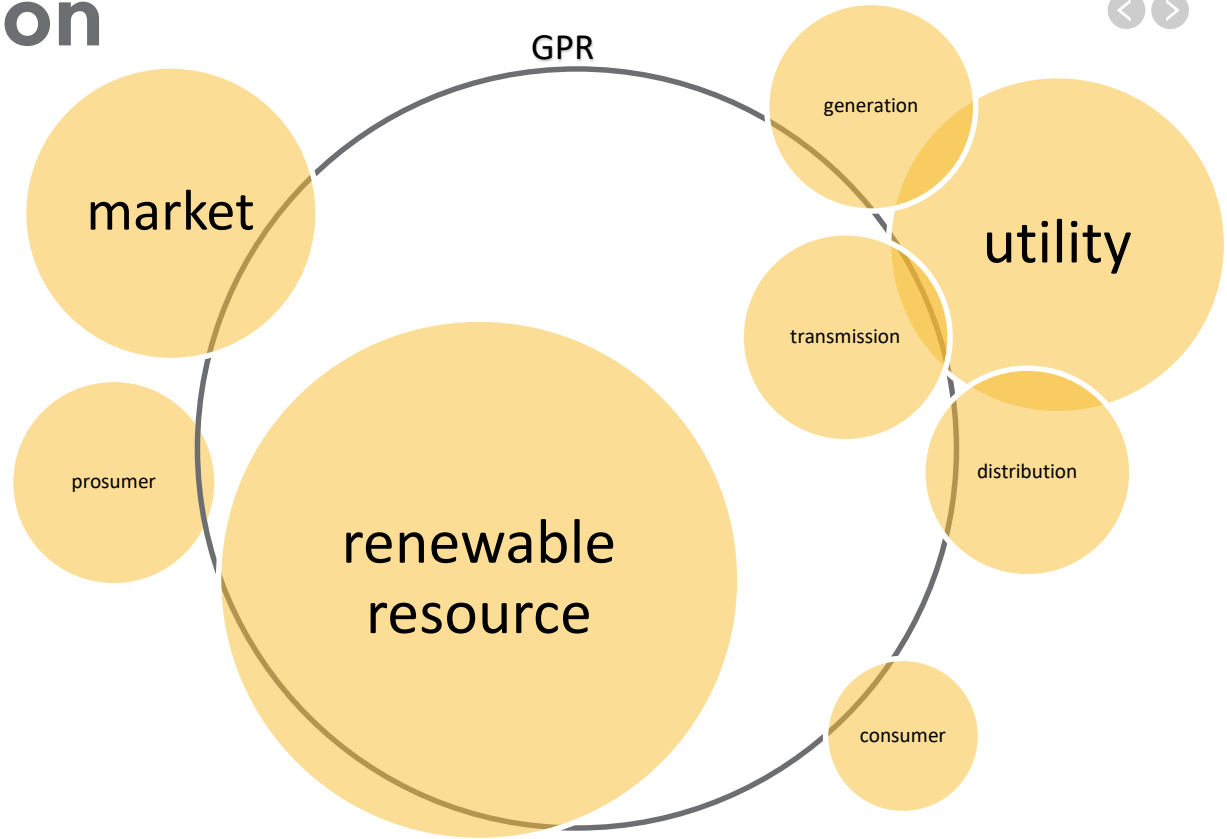


Case study: Gaussian process applied

Weibull scale factor



In conclusion



Thank you

ACKNOWLEDGEMENTS:

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