

Using a Langevin model for the simulation of environmental conditions in an offshore wind farm

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- Introduction
- Methodology
- Data
- Results
- Conclusions

- O&M (cost) optimization is focus of research
- Many simulation models/optimizations rely on artificially generated weather time series to test different strategies
- Novel approach to model significant wave height and wind speed
- Langevin process:
 - Equations fitted to the data
 - Used to generate artificial weather

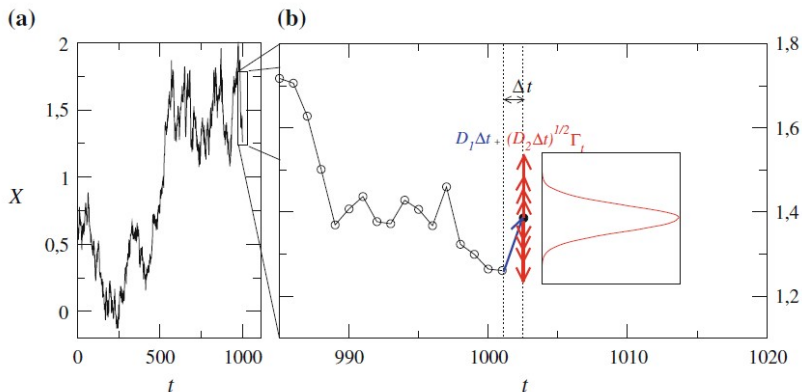
Langevin process

Deterministic contribution

$$F = D^{(1)}$$

Stochastic contribution

$$G = \sqrt{D^{(2)}}\Gamma_t$$



ECMWF:

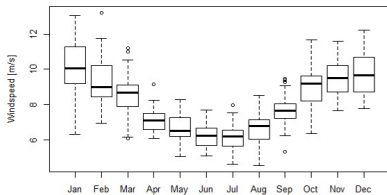
- Re-analysis
- 6h resolution
- Dogger Bank wind farm
- 37 years

Fino 1:

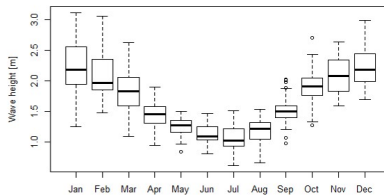
- Measurement from met-mast and buoy
- 10min/30min means
- Alpha Ventus wind farm
- 6 years

Results I

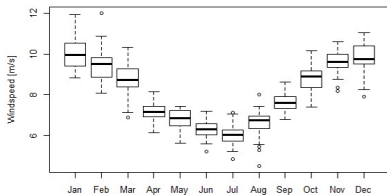
ECMWF - Wind



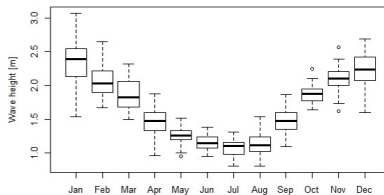
ECMWF - Wave

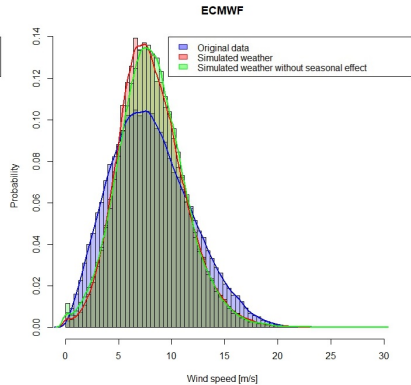
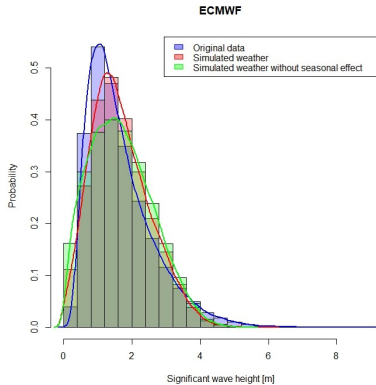


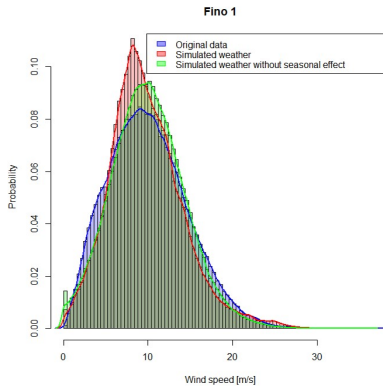
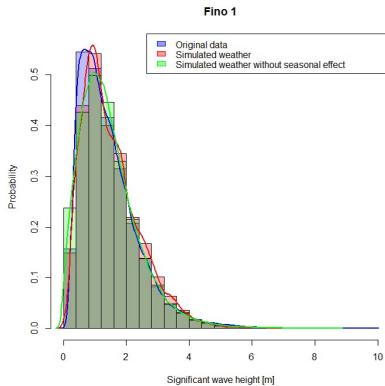
Simulation - Wind



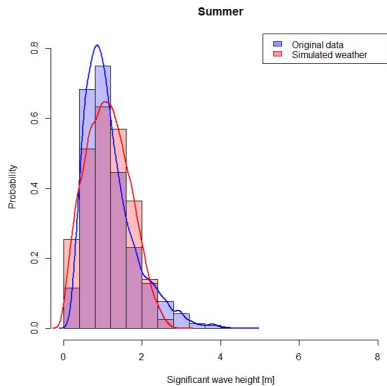
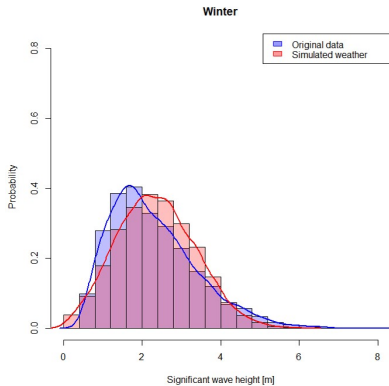
Simulation - Wave

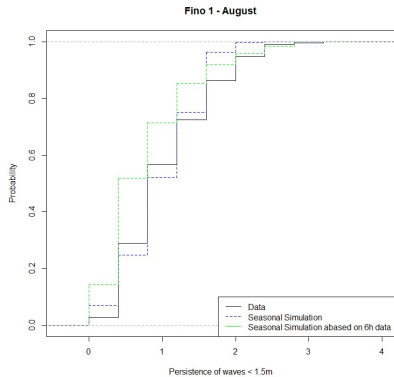
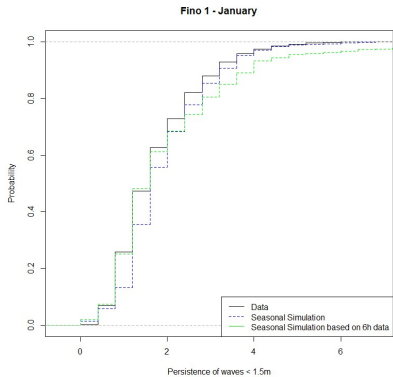


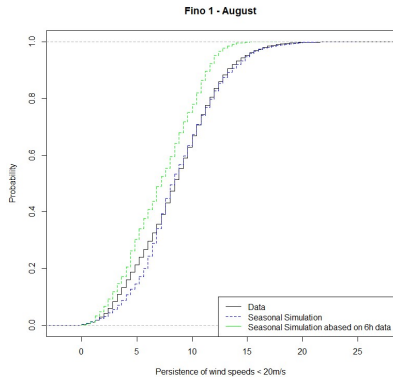
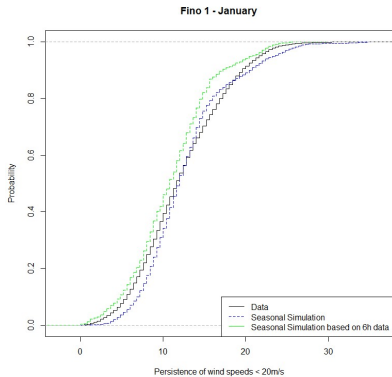




Results IV







- Langevin process is a good alternative
- Properties of waves represented very well (Distribution, Persistence)
- Higher sampling frequency \rightarrow better model
- 2D Langevin process for correlation (?)

Thank you for your attention



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