On the development and application of weather models for wind energy

Part 2: Peter Kalverla, Wageningen University

"EUROS for wind energy" – 11 October, 2017

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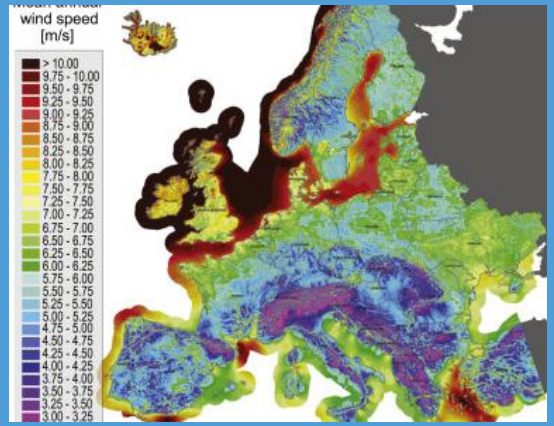
EUROS

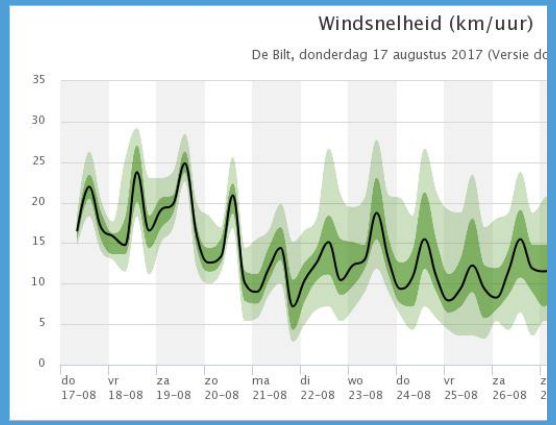
Use of (mesoscale) meteorological models

Among others:



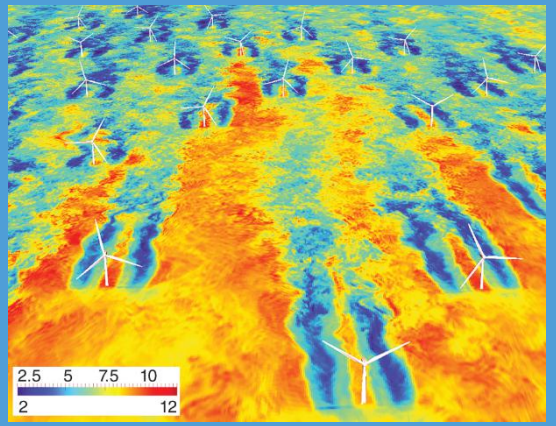
Resource assessment

Rodrigues et al., 2015



(Power) forecasting

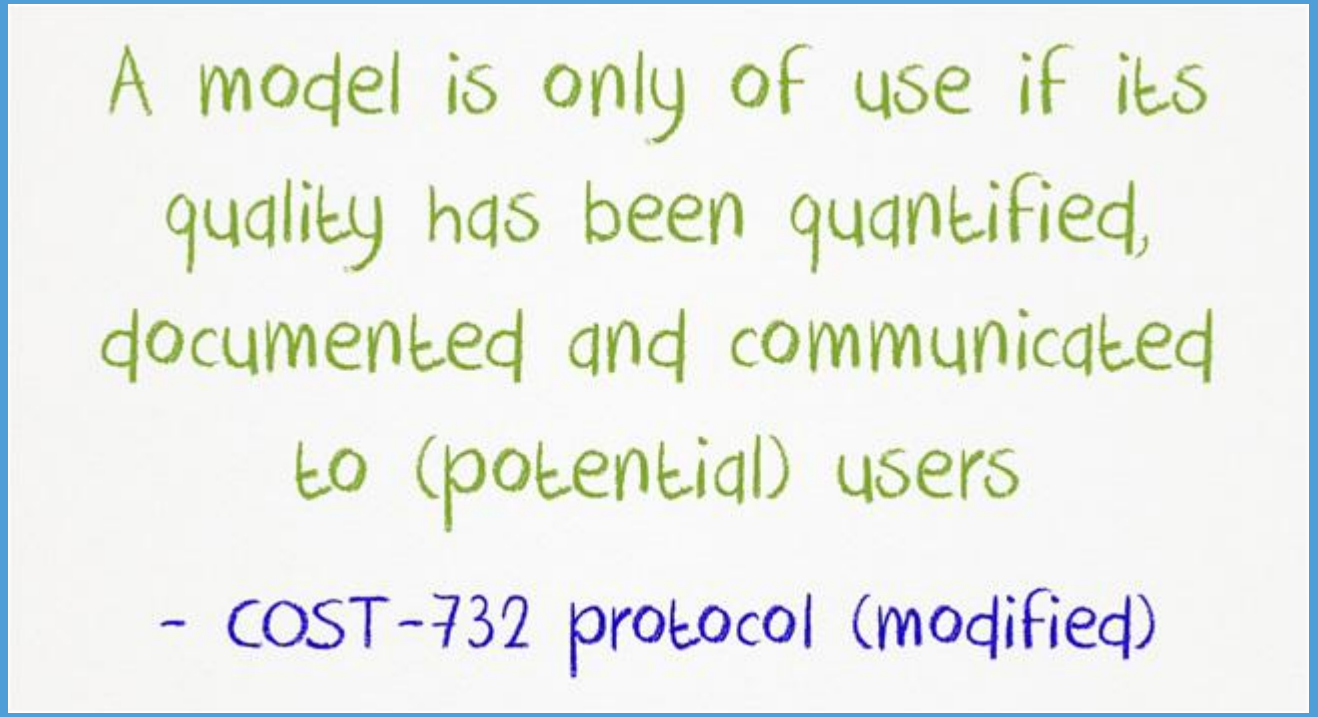
e.g. Foley et al., 2012



Realistic inflow fields

Sanz Rodrigo et al., 2017

Need for validation



Research questions

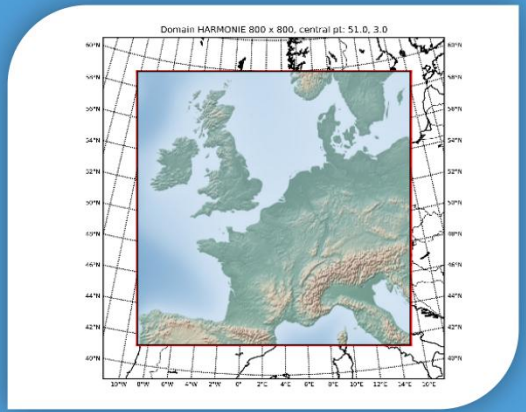
§ What is the typical performance of each model?

§ What are the differences between the models?

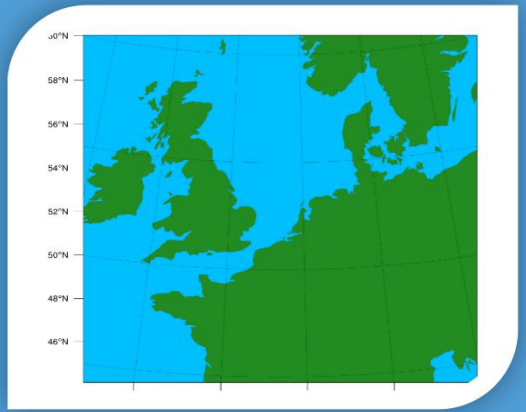
§ What are the differences between cases?

ECMWF-IFS

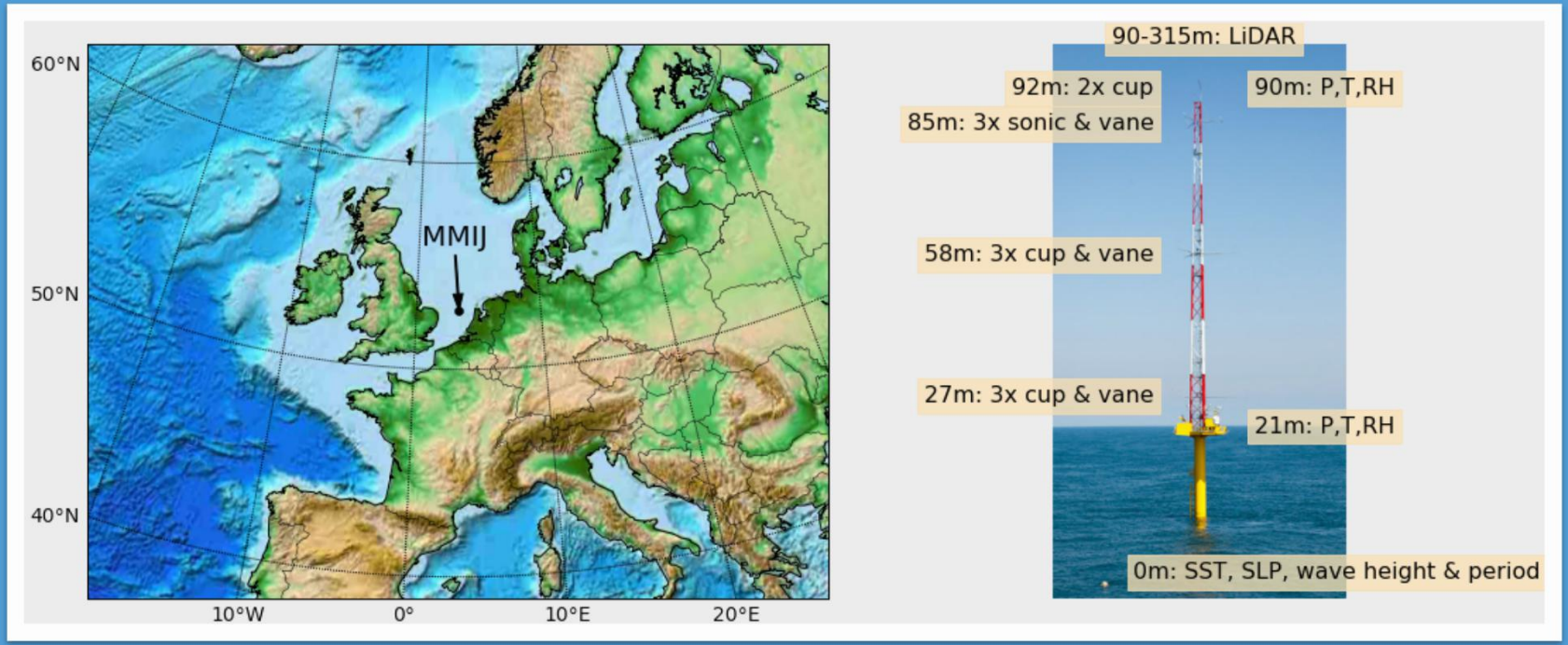
Harmonie (KNMI)



WRF-ARW

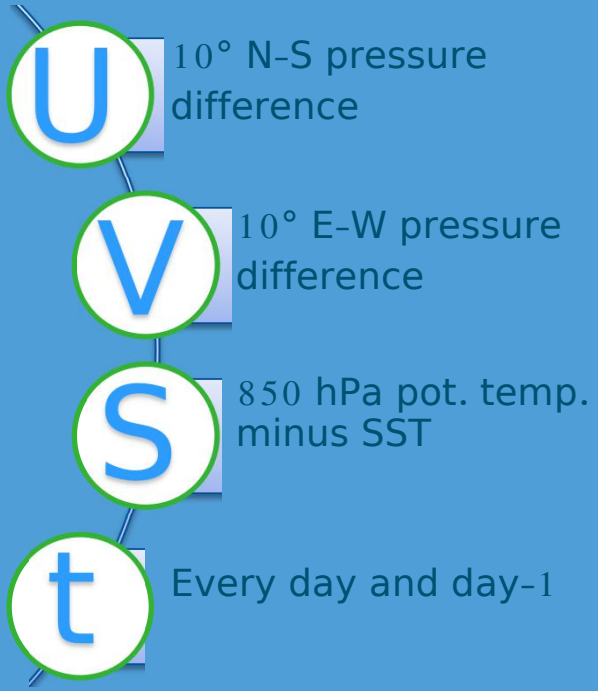


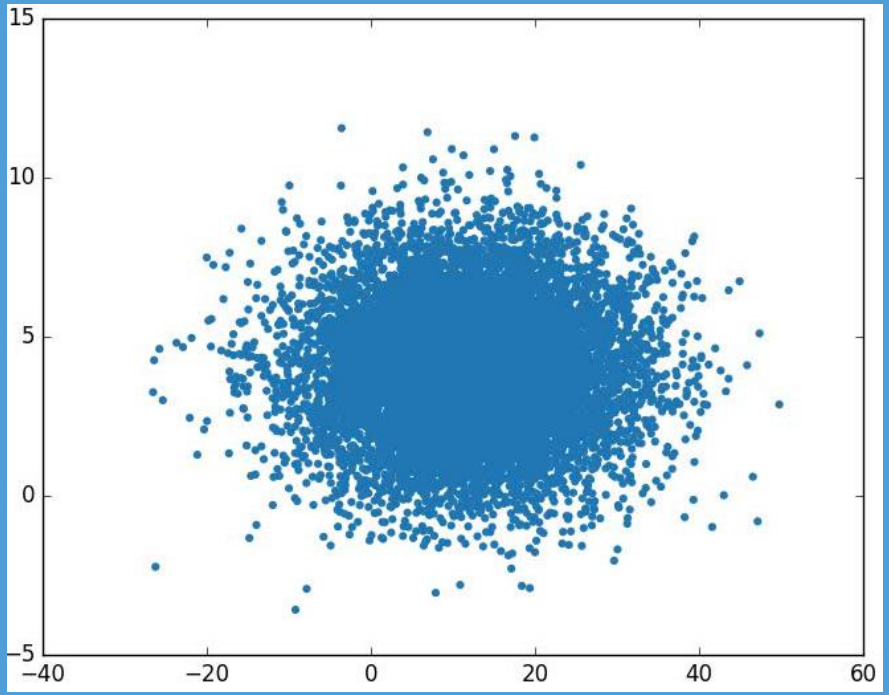
Data for validation: MeteoMast IJmuiden (MMIJ)



Kalverla et al., 2017, JWEIA – An observational climatology of anomalous wind events …

Case selection strategy: “UVS•t_2” clustering





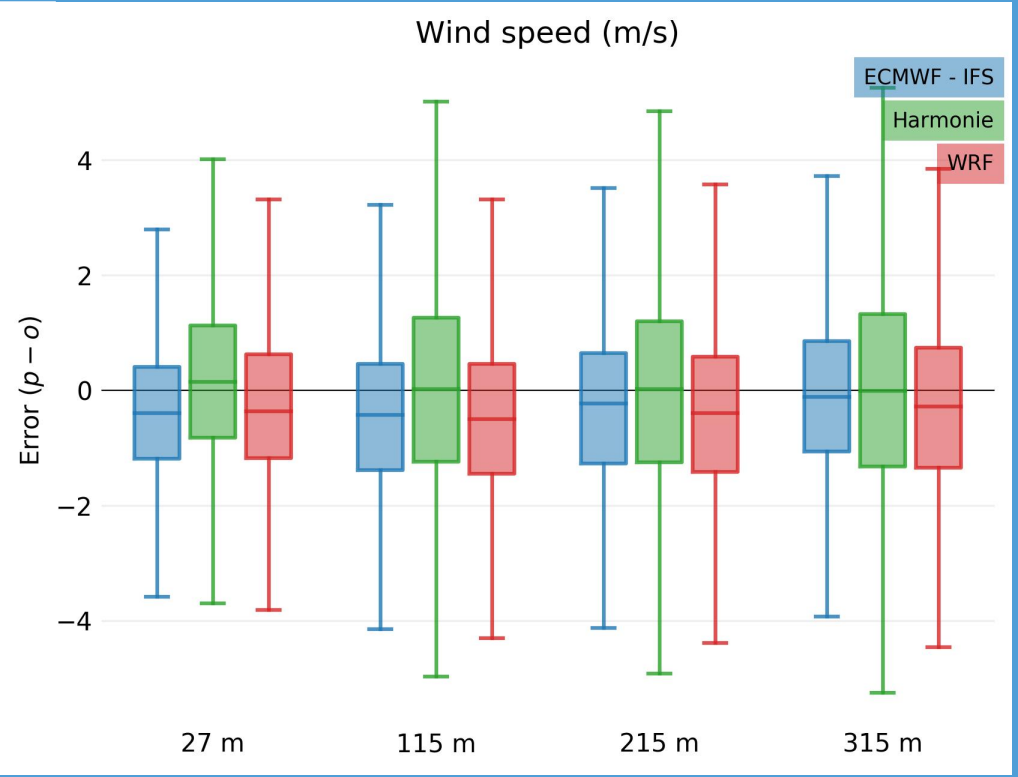
Select 30 cases representative for climatology

Weighted results

All bias: < 0.5 m/s

Typical spread: < 2m/s

Harmonie: smallest bias, larges
spread

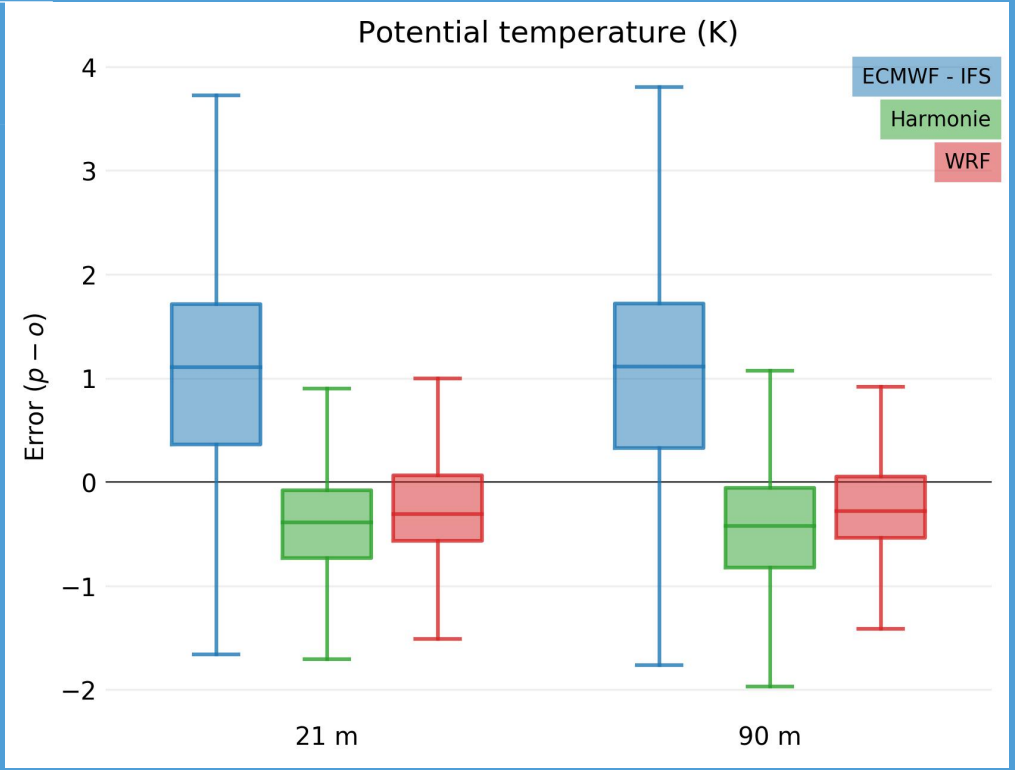


Weighted results

IFS 1 K too warm

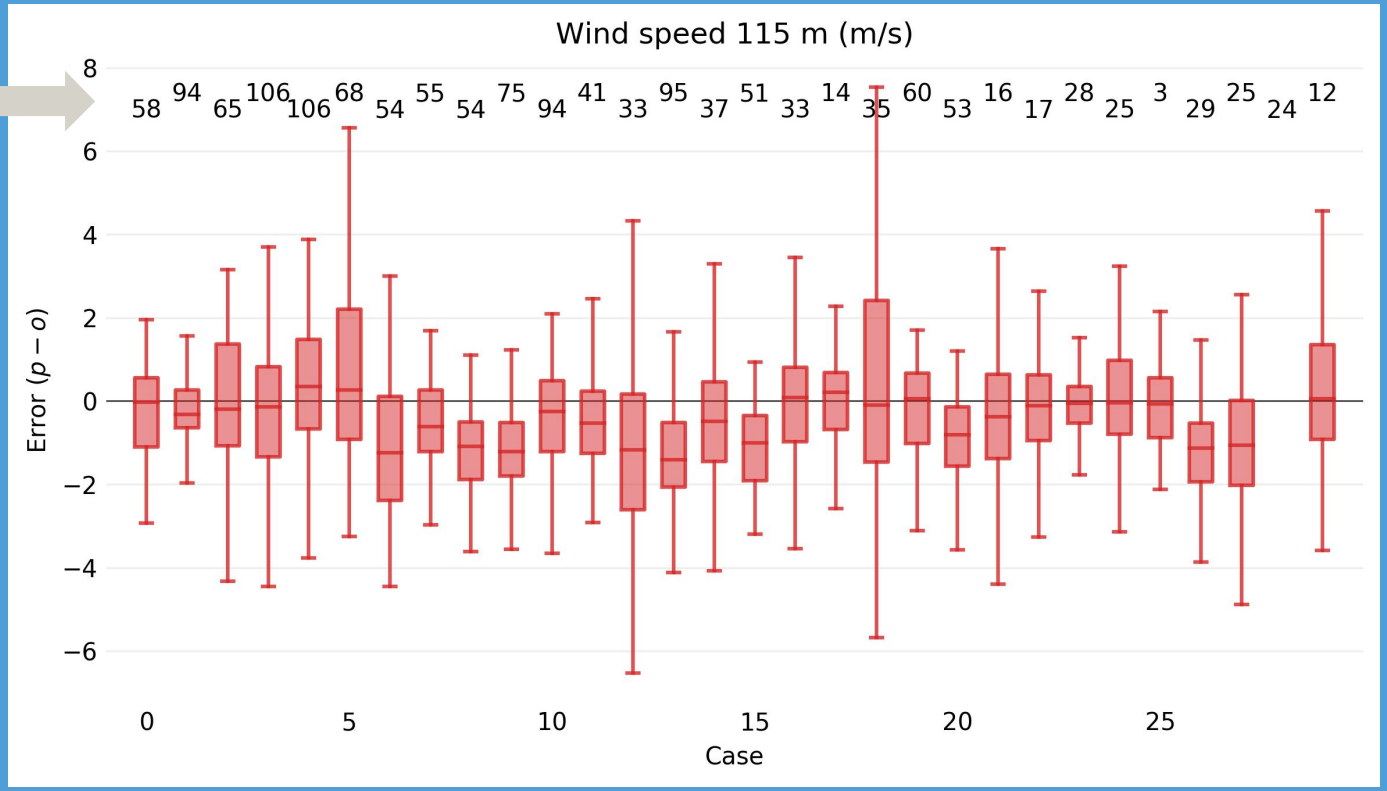
Others too cold

IFS much larger spread



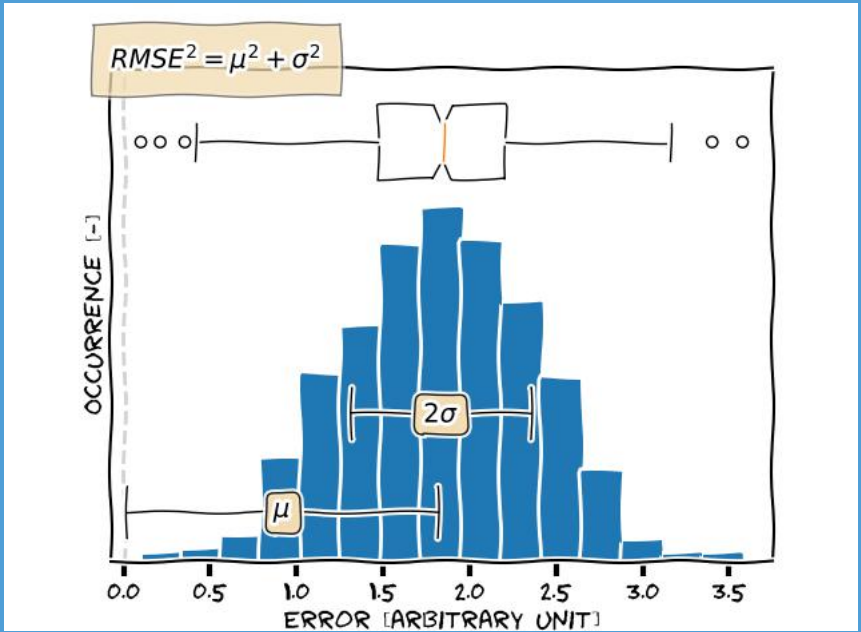
Results per case

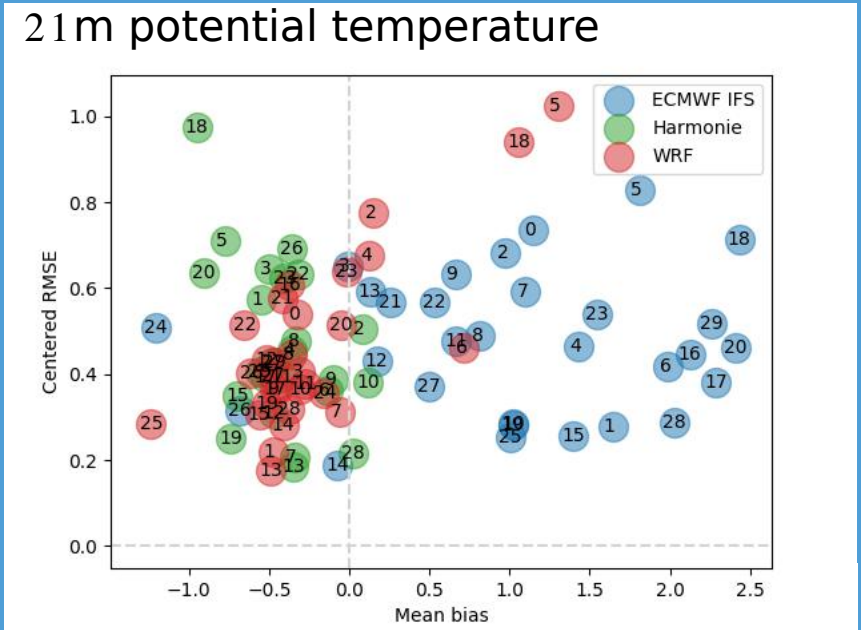
Number of cases in cluster



Introducing error diagrams

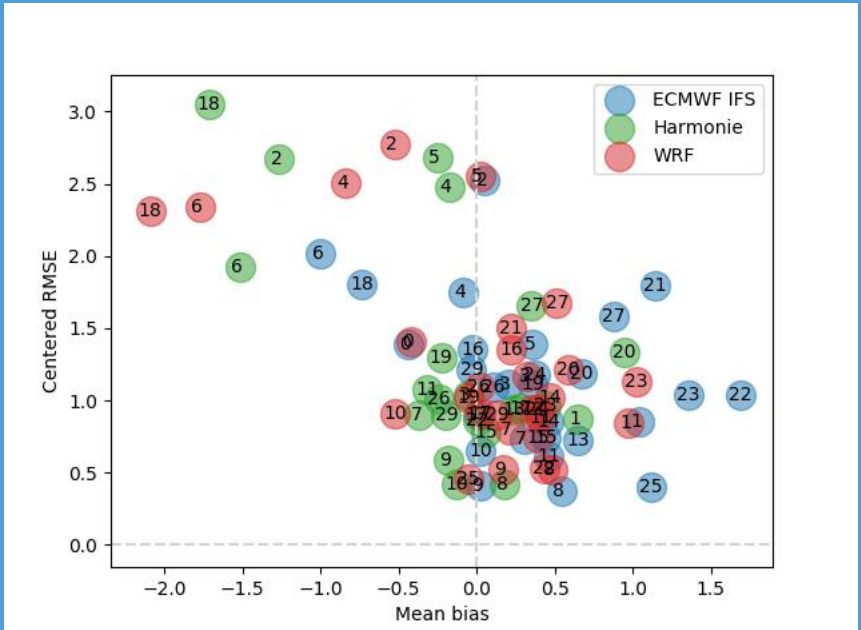
For quick comparison of 1st and 2nd moments of error distributions



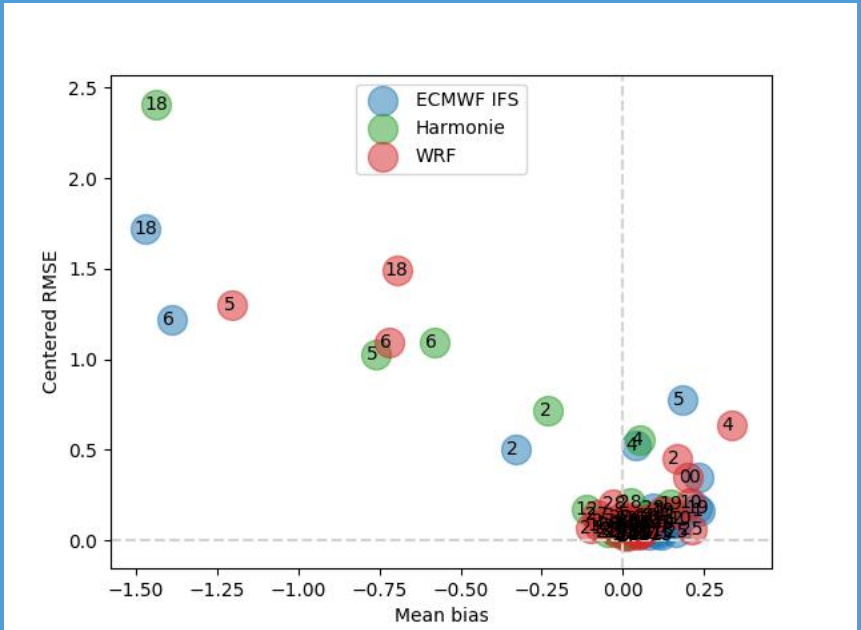


Models struggle to represent stable conditions

315m – 27m wind speed difference



90m – 21m virtual potential temp. diff.



Roadmap

Can we understand this behaviour?

How can model performance be improved?

Low-level jets and strong shear both common under stable conditions in spring and summer

Models perform poorly for stable conditions in spring and summer

"A statistical evaluation of three mainstream weather models against the IJmuiden observations at the North Sea"

"An observational climatology of anomalous wind events at offshore meteomast IJmuiden"

PhD Project

Take home

Wind speed bias < 0.5 m/s

Wind speed error std < 2 m/s

ECMWF temperature bias 1K

Performance “CasE seNsitIve”

Stable conditions most challenging

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