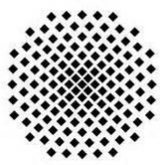


Supported by:



Federal Ministry
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Zentrum für Sonnenenergie- und
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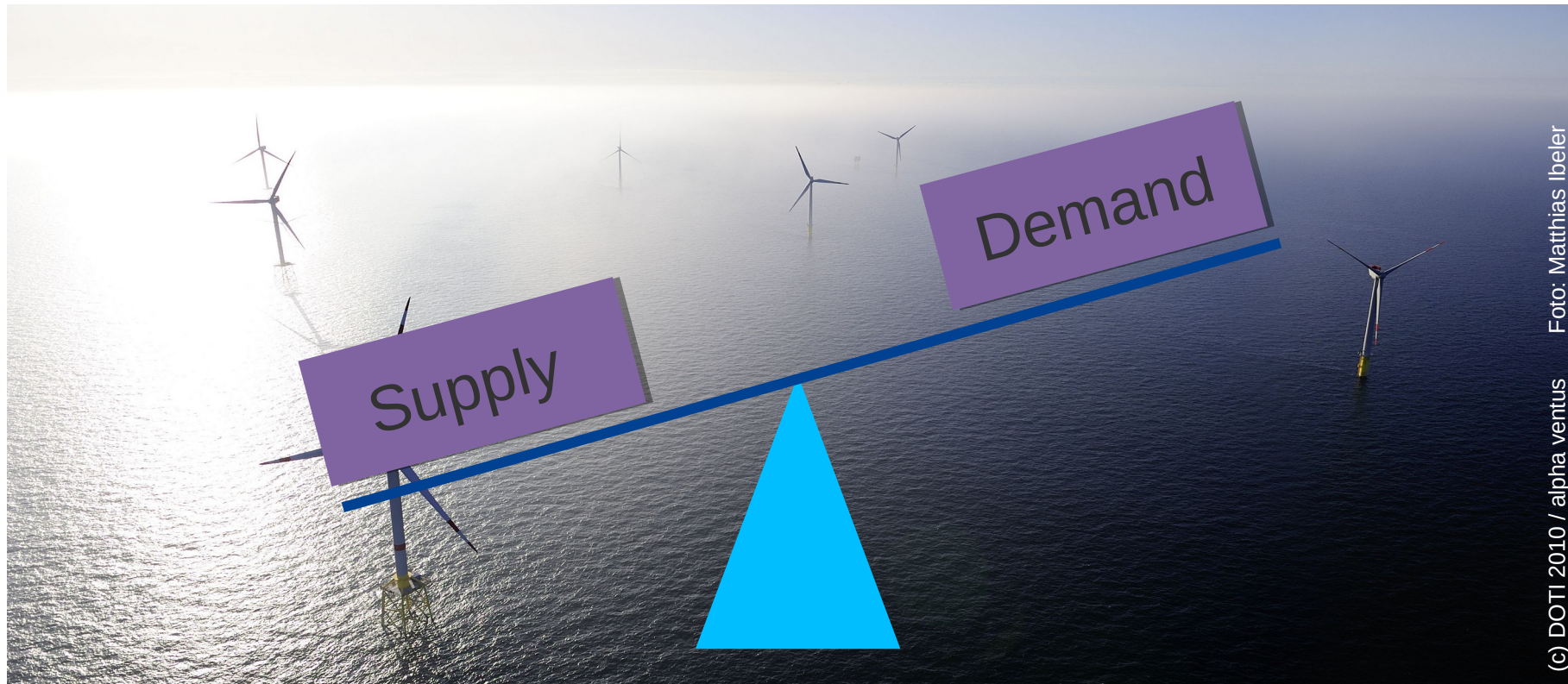
Project ParkCast: AI methods for short term wind power forecast

Linda Menger, Daniel Leukauf, Nico Klar, Katharina Strecker, Martin Felder, Anton Kaifel

03.02.2022

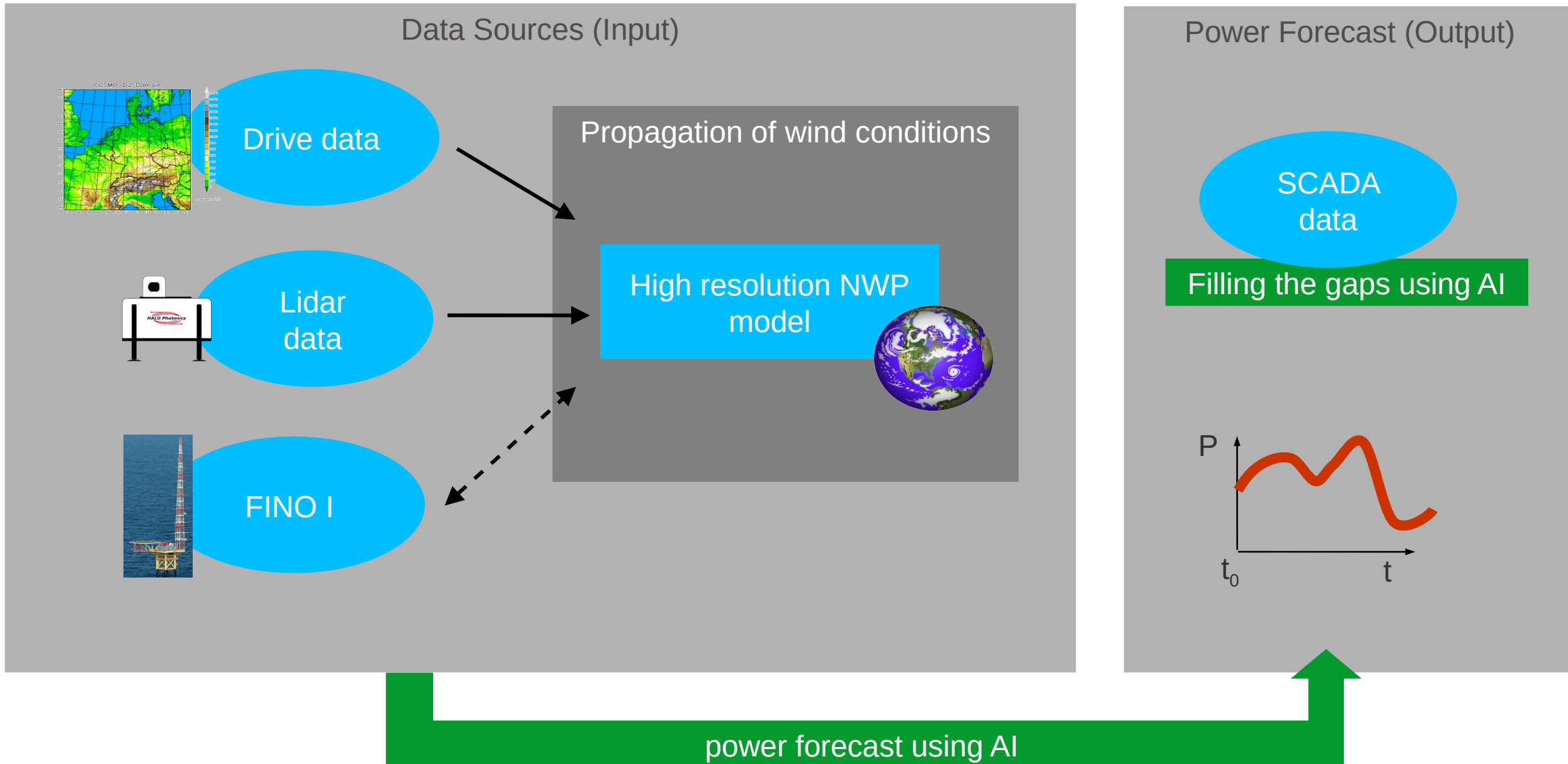


Why minute-scale forecasting?



(c) DOTI 2010 / alpha ventus Foto: Matthias Ibeler

How do we want to forecast in ParkCast?

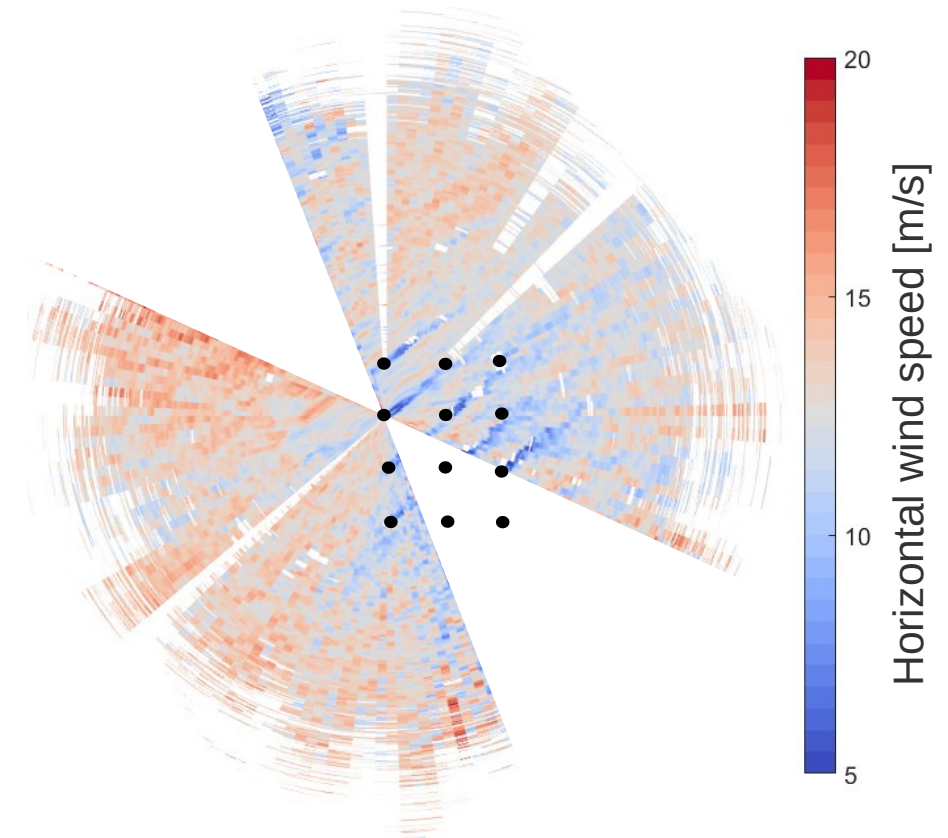
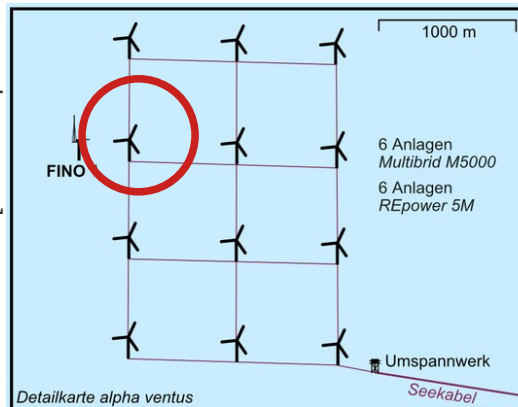


Input Data (LIDAR)

October 2019 – June 2021:
 Wind field measurements
 using long-range lidars
 StreamLine XR



[www.wikipedia.de]

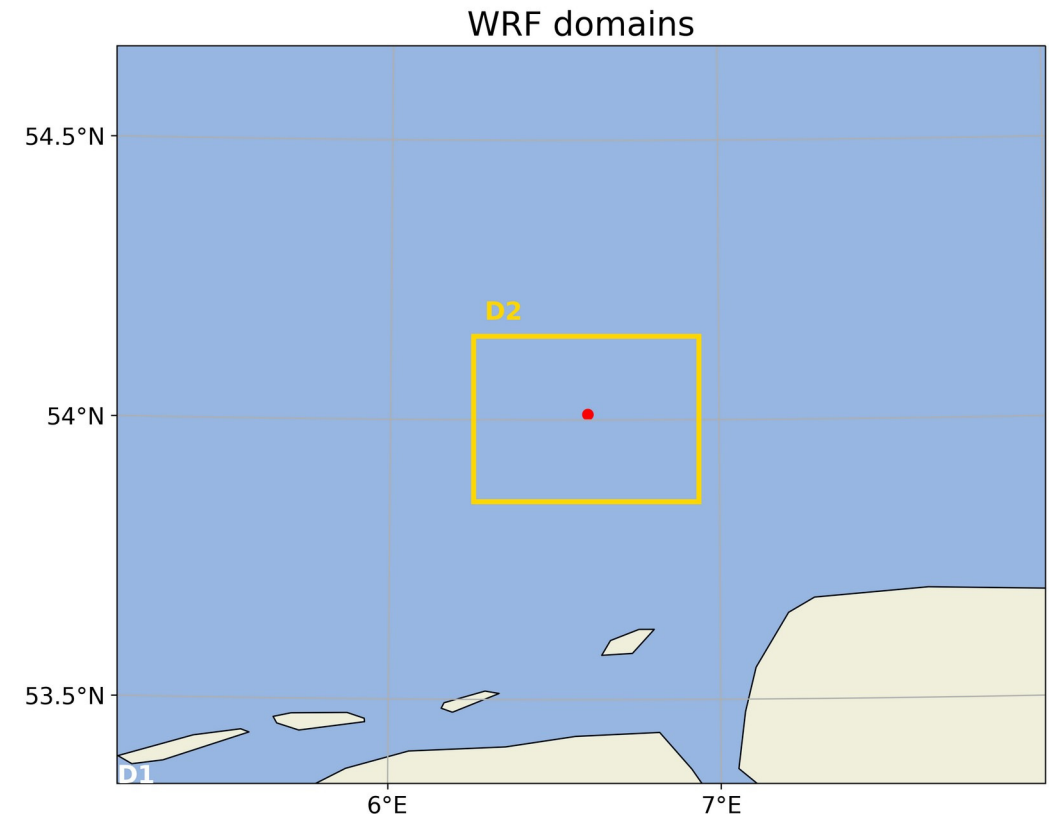


Input Data (WRF)

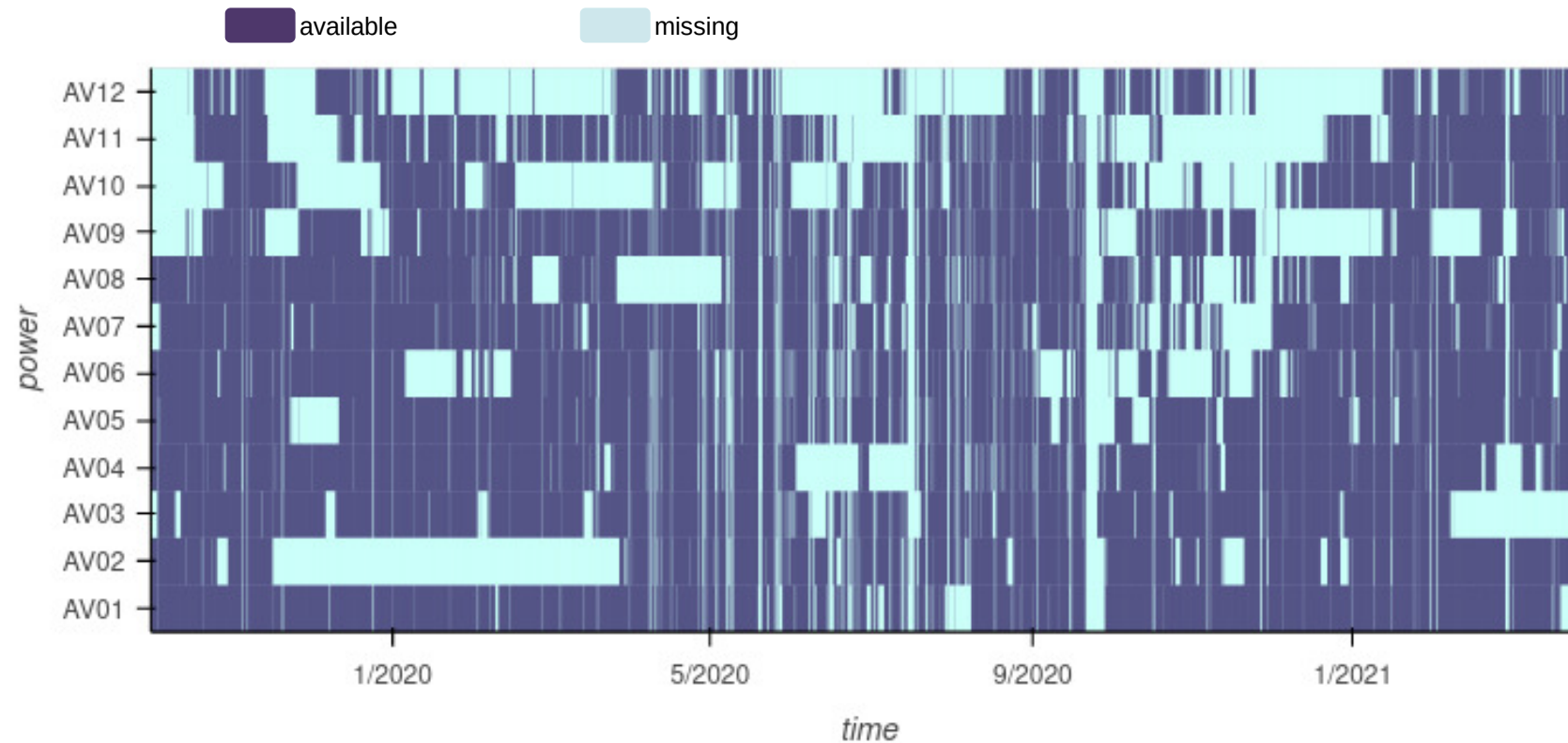
Boundary Data: COSMO-D2 ($\Delta x = 2.2$ km)

Prediction Setup:

- One domain ($\Delta x = 733$ m)
- Standard parameterizations
- With and without lidar data nudging

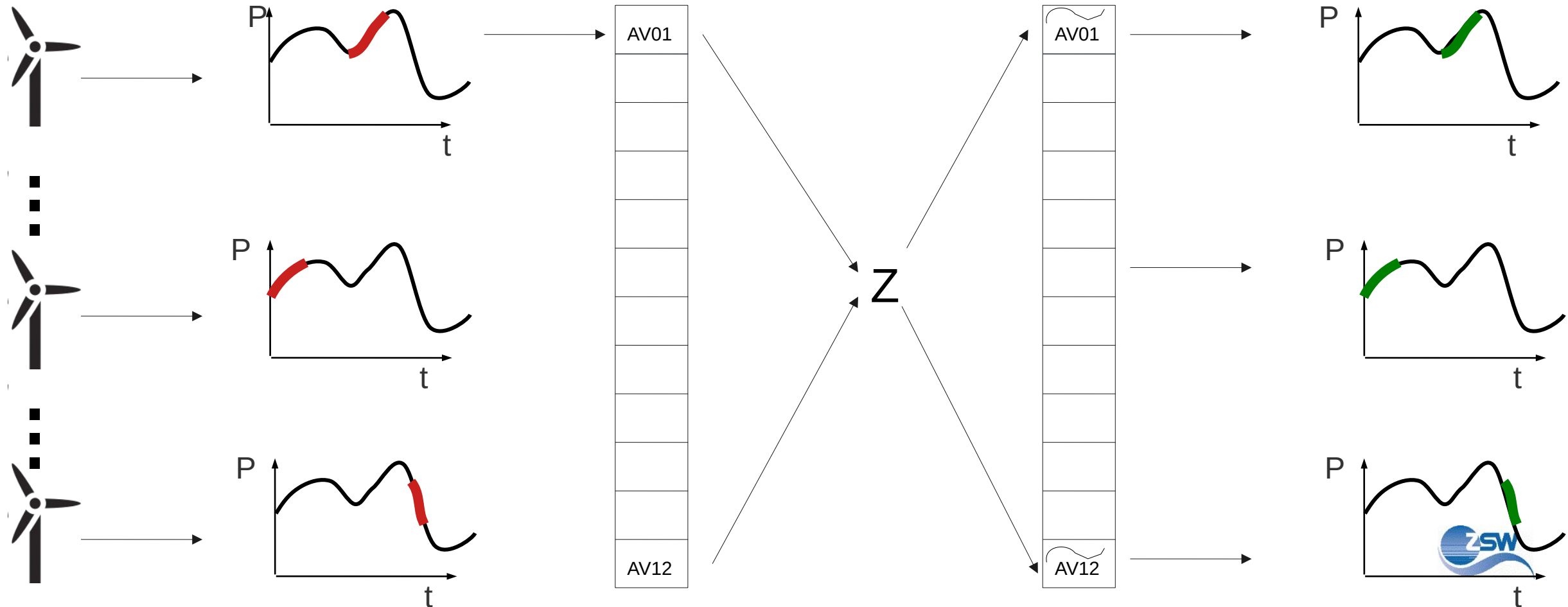


Target Data (Power)

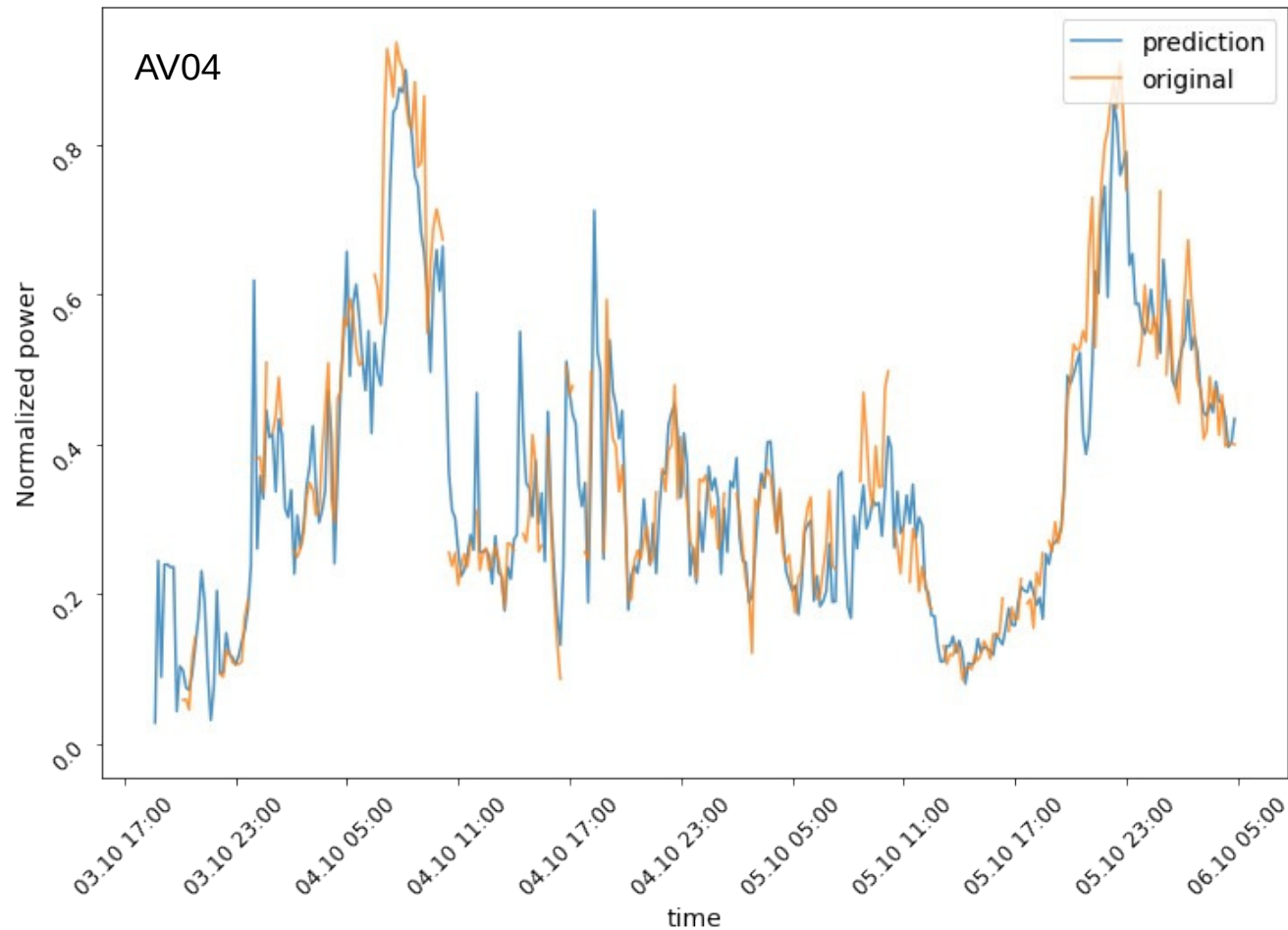


- gaps in data reduce the amount of training data
- periods with no turbine activity reduce yearly produced power

Filling the gaps in power data - autoencoder

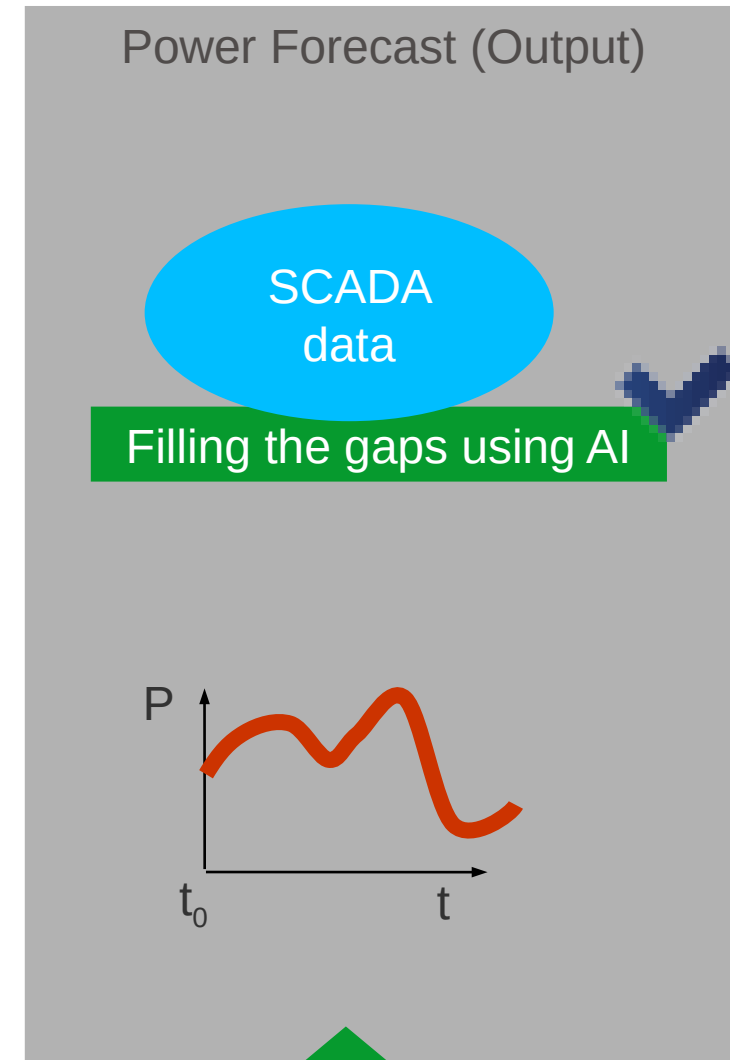
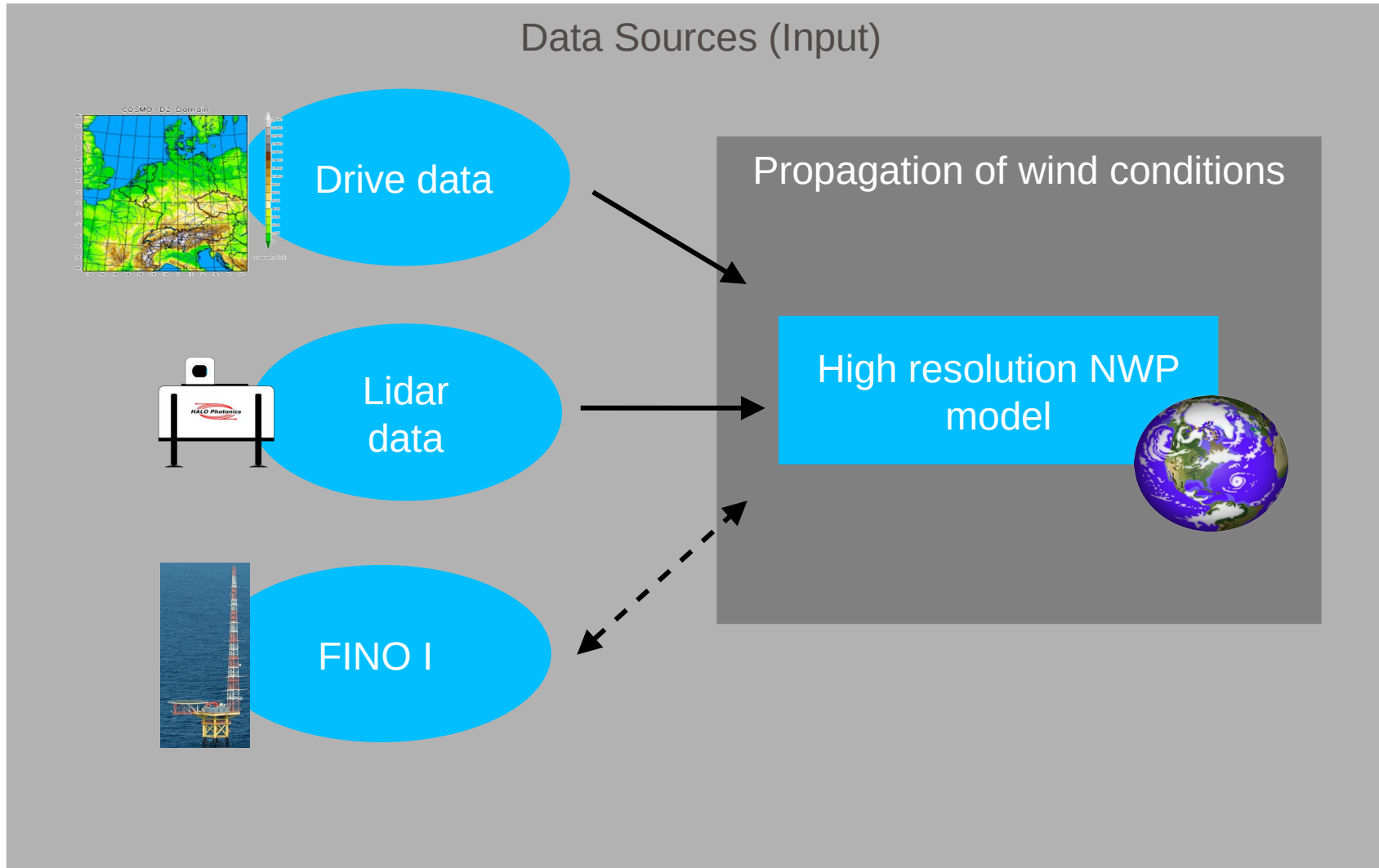


Filling the gaps in power data - results



RMSE: 6.19%

How do we want to forecast in ParkCast?



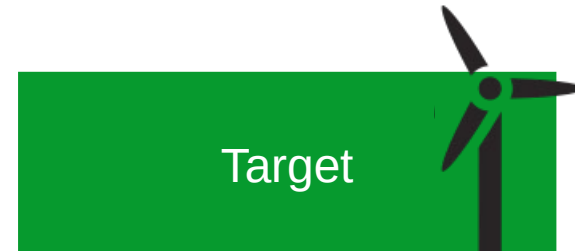
power forecast using AI

Single turbine prediction



various data sources used as **time series**

- Basis: COSMO + FINO
- WRF-Nudge: WRFnudge + COSMO + FINO

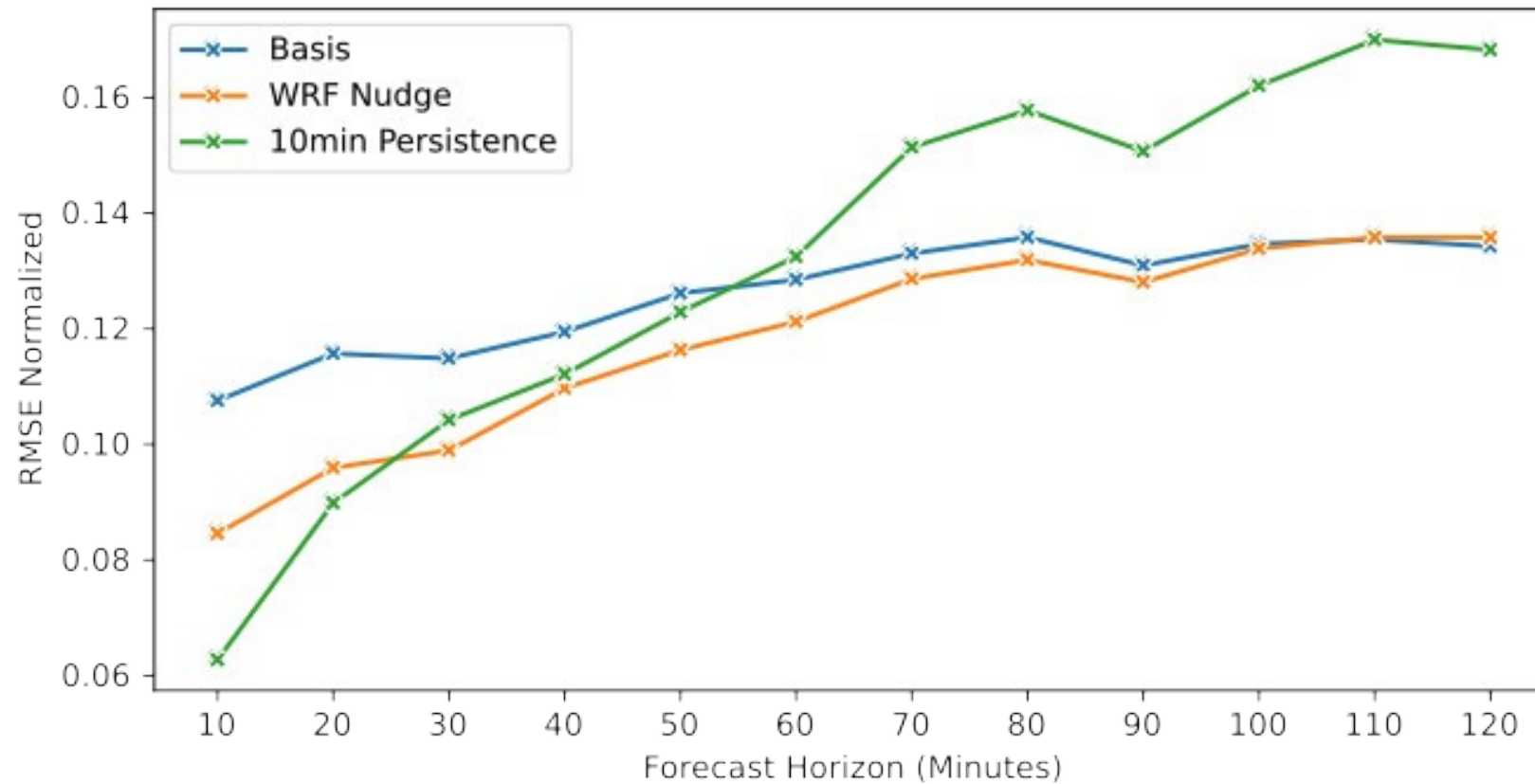


power data

120 Minutes in 10 minute steps every hour

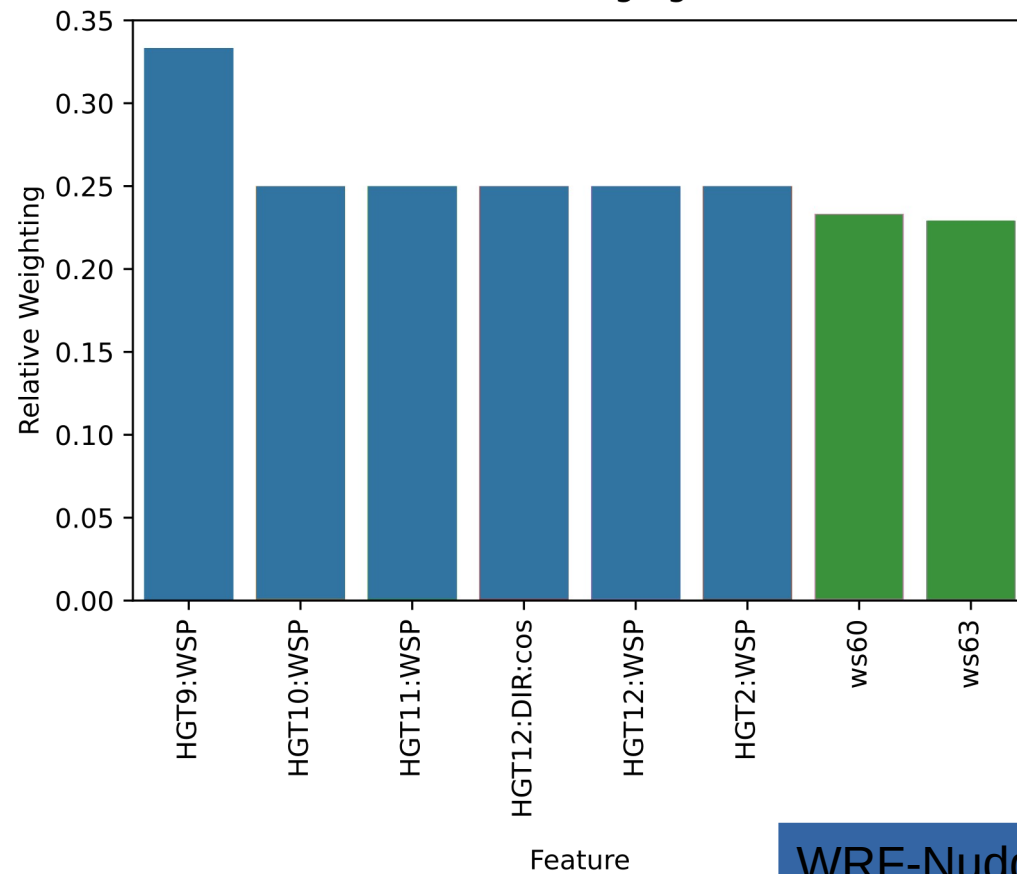
- **Additional Steps:**
 - optimization of metaparameters and network architecture
 - automatic feature selection

Results

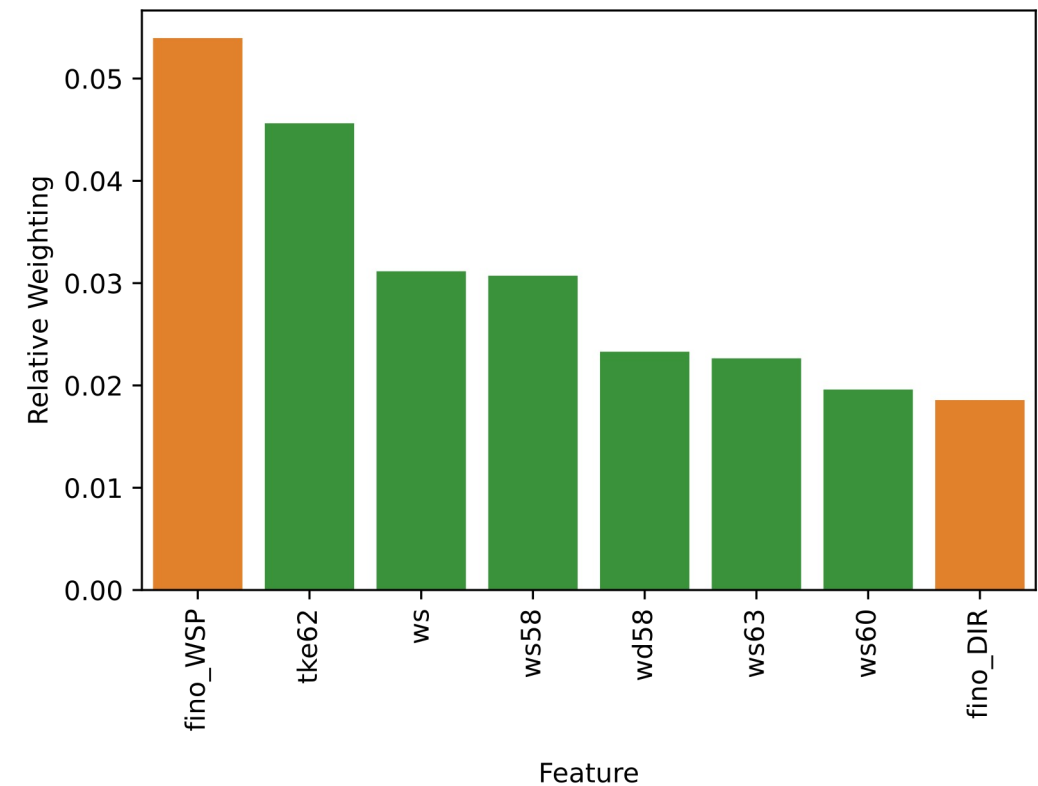


Important Features

WRF-Nudging



Shared Features Basis & WRF-Nudging



WRF-Nudge

COSMO

FINO

Conclusions

- Data availability is important!
- Successful gap filling using AI methods
- – How does this improve power forecast?
- Wind measurements from nearby are important for short-term power forecasts
 - Lidar Nudging improves power forecast
 - FINO windspeed is a crucial feature
- Forecast beats persistence after 20-30 minutes
- – How is this related to weather situations or wind ramps?

THANK YOU FOR YOUR ATTENTION!

Linda Menger

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Daniel Leukauf

Contact: Daniel.Leukauf@zsw-bw.de

USED DATA

Data was made available by the FINO (Forschungsplattformen in Nord- und Ostsee) initiative, which was funded by the German Federal Ministry of Economic Affairs and Energy (BMWi) on the basis of a decision by the German Bundestag, organised by the Projektträger Juelich (PTJ) and coordinated by the German Federal Maritime and Hydrographic Agency (BSH)