Improving short-term wind power forecasts by means of ensembles of weather forecasts providers and historical numerical weather predictions

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1. rebase.energy
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Background

Historical weather forecasts data most appropriate for training

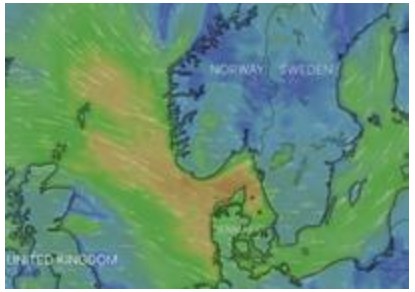
Historical forecasts

Overlapping

Non-overlapping

3 years

Weather forecasts



< 14 days

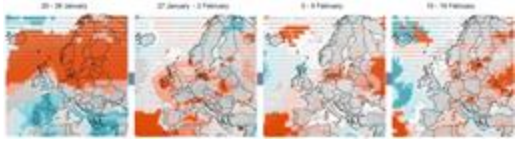
Reanalysis data

50-70 years

Meteorological measurements

100s years

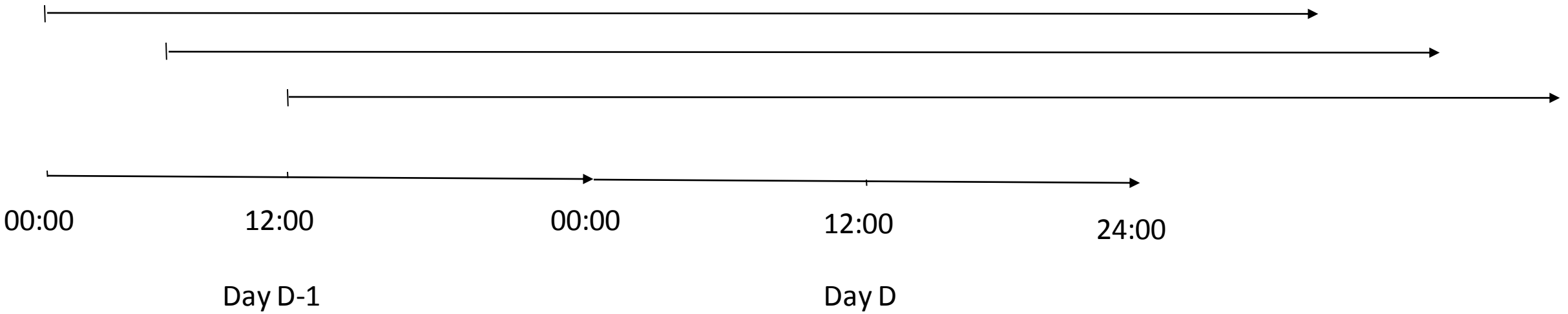
Subseasonal-to-Seasonal forecasts



Weeks to months

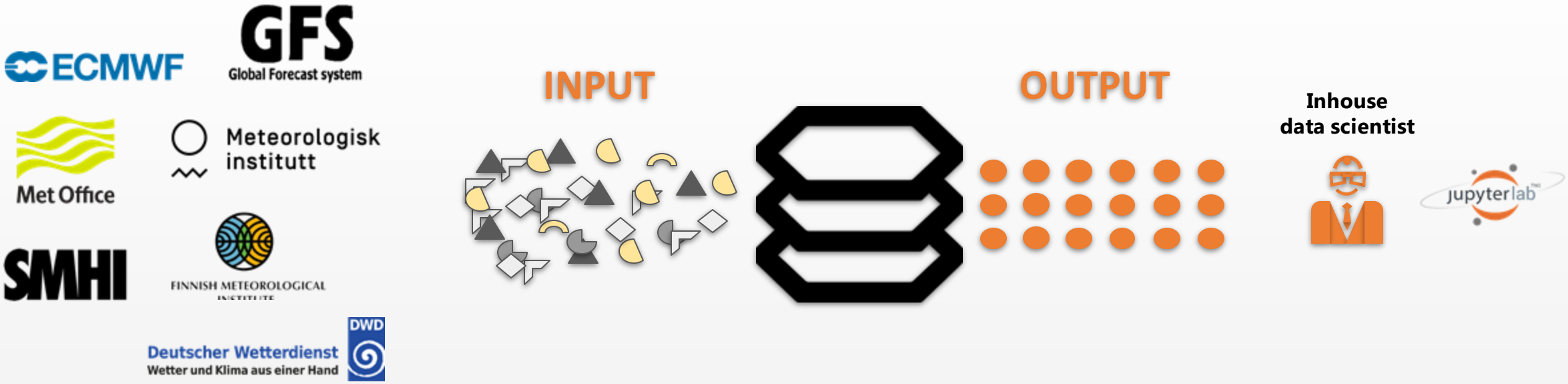
Now

Wind power forecasting for trading in day-ahead electricity markets



- New NWP forecasts available usually every 6 hours
- Most recent available forecast at 06:00 for trading in dayahead electricity markets (typically bids should be submitted by 12:00)
- Forecast lead time for next day trading: 18 – 42 hours

Aggregated and harmonised weather forecasts through API



Time consuming and tedious to aggregate energy-related weather data and make it operationally useful for training AI algorithms.

We provide aggregated and **harmonized weather data ready for AI** via our unique API

Research questions

- Can we improve wind power forecasting by using ensembles of various NWP models?
- Can we improve wind power forecasting by using overlapped historical NWP forecasts for training?

Analysis setting

Open dataset of windparks in Norway used for analysis

- Dataset provided **openly** by Norwegian Water Resources and Energy Directorate[1]
- The data is **hourly** output of active power production from **51 different wind farms**
- In current analysis 4 wind parks are considered:
  - **Roan, Storheia, Tonstad and Øyfjellet**

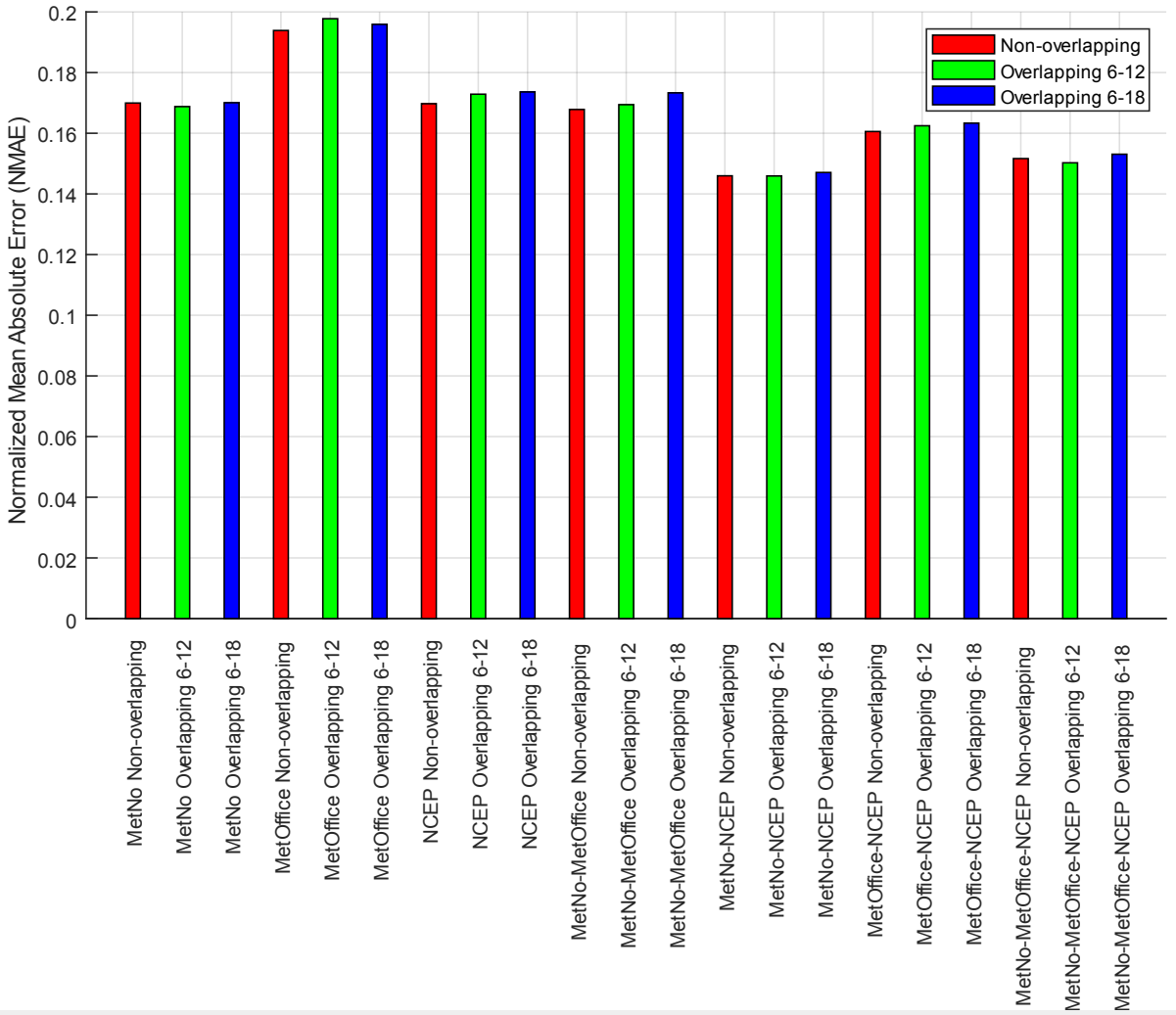
1. https://www.nve.no/energi/energisystem/vindkraft/vindkraftdata/

Training and test data sets

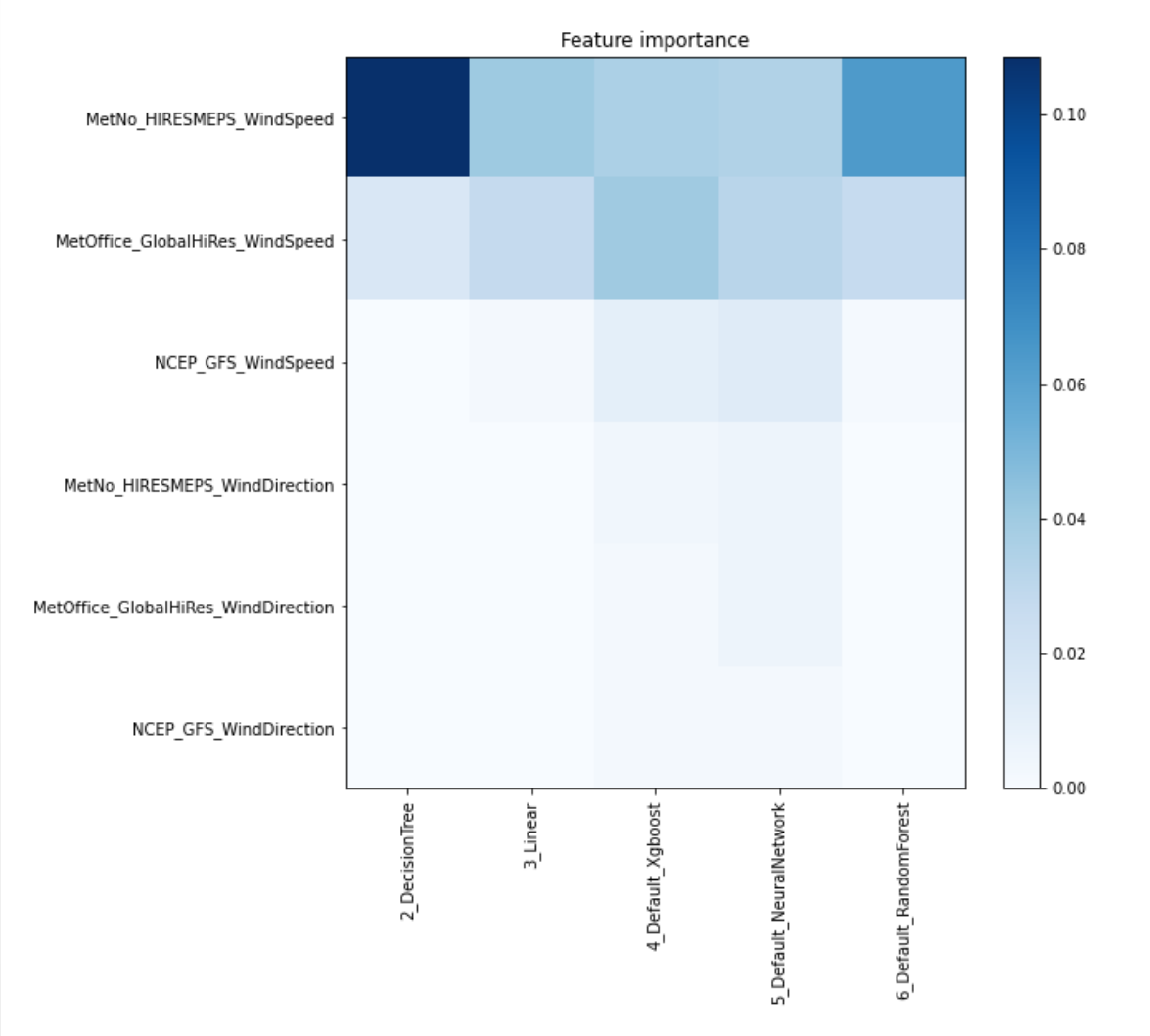
- The train/validation time period is **2021-01-01** to **2021-08-31 (8 months)**
- The test time period is **2021-09-01** to **2021-12-31 (4 months)**
- Test data include the 18-42 lead hours only
- Training data:
  - Non – Overlapping: 1-6 hours ahead NWP forecasts
  - Overlapping A: 1-12 hours ahead NWP forecasts
  - Overlapping B: 1-18 hours ahead NWP forecast
- NWP models: MetNo_HIRESMEPS (Norway), MetOffice_GlobalHiRes (UK), NCEP_GFS (USA)
- Training method: ensemble of decision trees, linear regression, gradient boosting, neural networks and random forest

Results

Forecasting accuracy



Feature importance



Conclusions

- Weather forecasts ensembles from different NWP models improve wind power forecasting accuracy
- Using overlapping historical weather forecasts for training has not clear effect. It depends on the specific case. It is good to try

Future work

- Use actual wind speed measurements for training
- Use reanalysis data for training
- Include more wind parks from Norway and other countries
- Train separate models for different lead times

Thank you

Contact

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