Project 5: Verification of high resolution and ECMWF wind speed forecasts for Iceland

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Eyrarbakki, S-Iceland Automatic weather station 3 m a.s.l.

Data:

- One year of data 2014-2015
- Observations: hourly wind speed measurments
- Model data, until 48h
 - HARMONIE: hourly
 - HIRLAM: 3-hourly
 - ECMWF: 6-hourly





Questions & methods

- How well does HARMONIE perform on an hourly basis?
- How well do the models perform at 24-48 h and compare?

Methods:

- Basic scores
- Categorical scores for low, medium, strong and very strong winds
- Taylor diagramme for models and lead times

Hourly data

24 hour forecasts of 10 m wind speed compared to observations



Eyrarbakki 12:00 wind speed forecast vs. observations



Mean Absolute Error 2.19 m/s Mean Error 0.03 m/s Mean Squared Error 8.09 m2/s2 Bias-corrected Root Mean Squared Error 2.84 m/s Pearson's Correlation Coefficient 0.80

Q-Q plot for Eyrarbakki wind speed 20140901-20150831



Eyrarbakki 12:00 wind speed forecast



- Good performance at low wind-speed
- Over-forecasting of higher wind speed leads to more misses
- Under-forecasting leads to less detection

24 hour forecasts

Three models

- ECMWF: hydrostatic, ~9 km horizontal resolution
- HIRLAM: hydrostatic, 5 km horizontal resolution
- HARMONIE: non-hydrostatic, 2.5 km horizontal resolution
- Forcasts:
 - 24-48 hours
 - Initialised at 12Z



Eyrarbakki 48 h fcst vs obs wsp 20140901-20150831



- ECMWF has a negative bias, underpredicts, especially at higher wind speeds
- HIRLAM has also a negative bias, but smaller
- HARMONIE has ~0 bias
- Bias corrected RMSE is similar for all models





- The higher the wind speed the better HARMONIE performs with regards to the other models
 - Higher probability of detection
 - Only slightly higher falsa alarm ratio
 - Frequency bias > 1 for very strong winds
 - ECMWF predicts wind speed > 15 m/s in only 2 cases
- Calm conditions (<5 m/s)
 - ECMWF with highest POD but also largest frequency bias





- Equitable Skill Score (ETS): Divergence for strong and very strong winds
- Symmetric Extremal Dependency index (SEDI): HARMONIE outperforms the others for highest wind category

Taylor Diagram

- Standard deviation observations: ~4.4 m/s HARMONIE has similar SD for all lead times
- Distance Obs-mode: BC-RMSE
 - ECM: 3.2 m/s
 - HIRLAM: 3.4 m/s
 - HARMONIE: 3.3 m/s
- Correlation: HARMONIE has the highest for 12-36h



For this one year of data HARMONIE outperforms the other two models in most aspects

Thank you!