Poster assignment on forecasting

For the forecasting assignment, you will compare different forecast models and evaluate how the forecast accuracy changes with forecast horizon.

Groups

For the assignment, you have to pair up in groups of two. Please self-enroll in a group on DTU Learn. If you cannot find a group member, please email arajen@dtu.dk.

Each group will be assigned a different weather station, where you will assess the forecast. The weather stations are all located in Denmark and owned by the Danish Meteorological Institute (DMI). The station assigned to each group can be found here. See this page for metadata for the different stations (such as the location and station name).

Measurement data

Forecast accuracy is assessed by comparing forecasted solar irradiance with actual measured irradiance on the ground. For this assignment, you will use global horizontal irradiance (GHI) measurements from the DMI weather station assigned to you.

To retrieve measurement data from DMI, follow the second part of this guide. The first step is to create a user and get an API key. The API key should be for the "**MetObs**" service, which gives access to near-real-time historical observations.

Once you have retrieved measurement data, you should conduct basic quality control, e.g., check if the maximum and minimum values are within the BSRN QC checks.

The DMI measurements have a frequency of 10 minutes, whereas the frequency of the forecast data is hourly. You will therefore need to resample the measurement data to 1-hour average values to match the forecast data. The measurement data is in UTC and right-labeled, meaning the timestamp 10:20 corresponds to the average value from 10:11 to 10:20. When resampling, ensure that you select the correct options for the **label** and **closed** parameters!

Forecast data

Forecasts of GHI have been retrieved for each DMI station at 6 am each day, starting on November 8th. Forecasts have been retrieved from 8 different NWP models from open-meteo.com. The forecast files are available on GitHub. Additional forecast files will be uploaded continuously until November 18th, such that you have 10 days of forecasts.

The forecast file name indicates the station and the time at which the forecast was retrieved. For example, the file "06031_20251109T0600.csv" contains the forecast for station 06031 (Tylstrup) and was retrieved at 6:00 am UTC on November 9th 2025. The forecast data is in UTC, and the values are right binned, meaning that GHI for the hour 02:00 is the average GHI during the period 01:01 to 02:00.

Each forecast file contains hourly forecasts of GHI for the next 7 days. Each column corresponds to a different NWP model. Note that the different models have different forecast horizons. Regional NWP models usually have shorter time horizons than global models. For example, the DMI Harmonie Arome model has a forecast horizon of 54 hours, whereas ECMWF's global IFS models have a forecast horizon of up to 10 days. The models denoted "_seamless" combined multiple forecast models, e.g., "dmi_seamless" uses the DMI forecast models for short forecast horizons (2-3 days) and ECMWF data for longer forecast horizons.

The forecasting data can be downloaded from GitHub here.

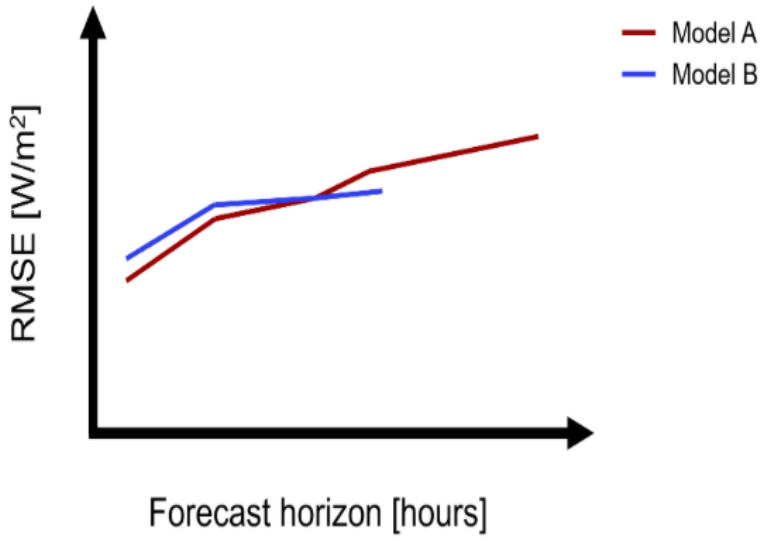
Once you've retrieved measurement data, you should read the forecast data into Python or your preferred data analytics tool. Make sure to plot the forecast and measured data. Do the forecasts look good? Do some models look better than others?

Quantifying forecast accuracy

Once you have parsed the forecast data files and the retrieved measurements from DMI, you are ready to begin quantifying the accuracy of the different forecast models. Several metrics can be used to quantify forecast error, each with its own strengths and limitations. In this assignment, we will evaluate forecast accuracy using two metrics: **Root Mean Square Error (RMSE)** and **Bias**.

You will calculate these error metrics for each forecast model and for every forecast horizon (e.g., forecast horizon of 1 hour, 2 hours, and so on). To do this, you have to compare the measured values from your DMI station with the forecasted values from the NWP models.

For example, when assessing the 1-hour forecast horizon, use the first hour from each forecast file to compute RMSE and Bias. Repeat this process for 2-hour, 3-hour forecasts, and so on. For each metric, you will need to use forecast data from **all forecast files** corresponding to your station.



Poster presentation

The results from your forecast comparison will be presented at the poster session on December 2nd from 1:00 to 5:00 p.m. Each group will give a 5-minute presentation of their poster, with the time split approximately evenly between the two group members. It is thus mandatory to attend the poster session.

Your poster should include comparison metrics of the different forecast models as a function of forecast horizon. You should also include one or more figures showing the forecasted and measured irradiance for a single day. For your presentation, think about why some models perform better than others (is it as you would expect)? Are some types of days easier to forecast than others (e.g., clear sky, cloudy, or broken clouds)?

Each group will need to print their poster in size A0, which can be done at the DTU Library. For recommendations on how to design an effective poster, please see this presentation.

Forecast competition

As briefly mentioned in the lecture notes, it is possible to make a better forecast by blending/combining different forecasts. Make an attempt to combine different forecasts (e.g., 80% Model A and 20% Model B) to improve the forecast scores. Based on the best method you derived, you will make your own blended forecast 4 days ahead for DTU forecasting the period from the 29th of November to the 2nd of December. You will need to submit this blended forecast on Friday, the 28th. The forecast files for DTU will be provided to you, meaning you will only need to apply your blending method and submit the forecast on DTU Learn.

The forecast should be submitted as a CSV format with the first column corresponding to the date/time in the format of (2025-11-29 02:00+00:00).

Grading

Your final grade for the course will be a combination of your performance on the quiz and the poster presentation. For the poster presentation, we will focus on your communication (presentation, poster design, etc.), how well you assessed the forecasts, as well as your ability to reflect on the exercise (e.g., did the forecast rank as expected, what would you have done differently?). You will not be graded on how well you perform in the forecast competition, but it is mandatory to submit a forecast.