### Meteorological Forecast Data

When the models have been trained on the observed data from the MetObs dataset, the models should be able to use similar forecast data from DMI. Energinet receives forecast data from DMI in different time resolutions, for this project the data set will be the hourly forecast data which comes in every 3rd hour 54 hours ahead. The way this is structured is that for the first hour, Energinet receives data from 1,4,7,10 etc. hours before. For the second hour it will be 2,5,8,11 etc. and for the third hour it will be 3,6,9,12. For the purpose of predicting hourly consumption in 48-hour intervals this data will have to be restructured to be 1,2,3,4 hours from one time step. This was done by unloading predictions into categories for each step ahead. So all the forecasts for 1 hour ahead was in one dataframe. This was stored in one dictionary. This allowed for one hour to be pulled from each category and put back into one big dataframe. This results in for one time step the next 48 hours of forecast data will be the next 48 rows of the dataframe. Then index 49 will be three hours after hour one and then the next 48 hours for that hour will be stored. This allows for predictions being done for single time steps 48 hours ahead, for each available time step. For the purpose of this project, the time horizon that the models will try to make forecasts for is the year of 2019. Thus the model will be tested on a complete seasonal year, and it should yield enough predictions to give insights to the performance of the models. An interesting topic to explore was how precise the forecast data were in relation to the actual observed values. Also, how much does the time ahead the values is predicted affect the precision of the forecast? The forecasted temperature seems to fit the observed values rather

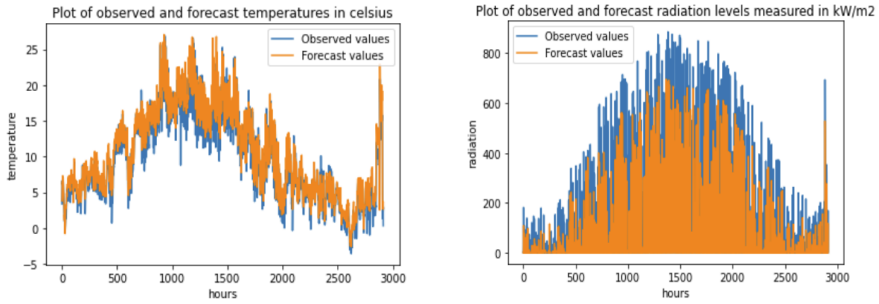


Fig. 1: plot of observed and forecast data for the temperature and radiation for forecasts 48 hours ahead only.

well. However, the forecasted radiation values seems to deviate quite a bit from the observed values. looking at the plot it seems to underestimate the radiation quite a bit. In order to get an understanding of how precise these forecasts are the $R^2$ value was calculated for both 1 and 48 hour ahead forecasts.

Looking at the $R^2$ values for temperature DMI is able to adequately forecast the temperature over the course of a year. Both for 1 and 48 hours ahead, the reduction in the $R^2$ value going from 1 hour to 48 hours is minimal and does not appear to be of any concern. However, the $R^2$ values for radiation suggests the same as the plots. There are significant errors in the forecast of sunlight, when

| $R^2$ values for forecast data | | |
|---|---|---|
| | 1 hour ahead | 48 hours ahead |
| temperature | 0.942 | 0.938 |
| Radiation | 0.705 | 0.674 |

Table 1: $R^2$ values for the year 2019 for 1 and 48 hours ahead forecasts.

compared to temperature. In terms of data quality this might turn out to be quite the factor for eventual error in the predictions. Since you want the training data to be as similar to the actual data as possible.