Calibration of direct normal irradiance (DNI) forecasts with quantile regression

Jose L. Casado-Rubio, Isabel Martínez-Marco, Carlos Yagüe

EGU2020: Sharing Geoscience Online, 4-8 May 2020

Description of the study

Direct normal irradiance (DNI) forecasts have been calibrated using the quantile regression method:

every quantile τ is adjusted as: $$q_\tau(dni) = \beta_0 + \beta \cdot dni_{raw}$$

β coefficients are calculated minimizing: $$\sum^{n} \rho_\tau(dni_{ob,t} - \beta_0 - \beta \cdot dni_{raw,t})$$

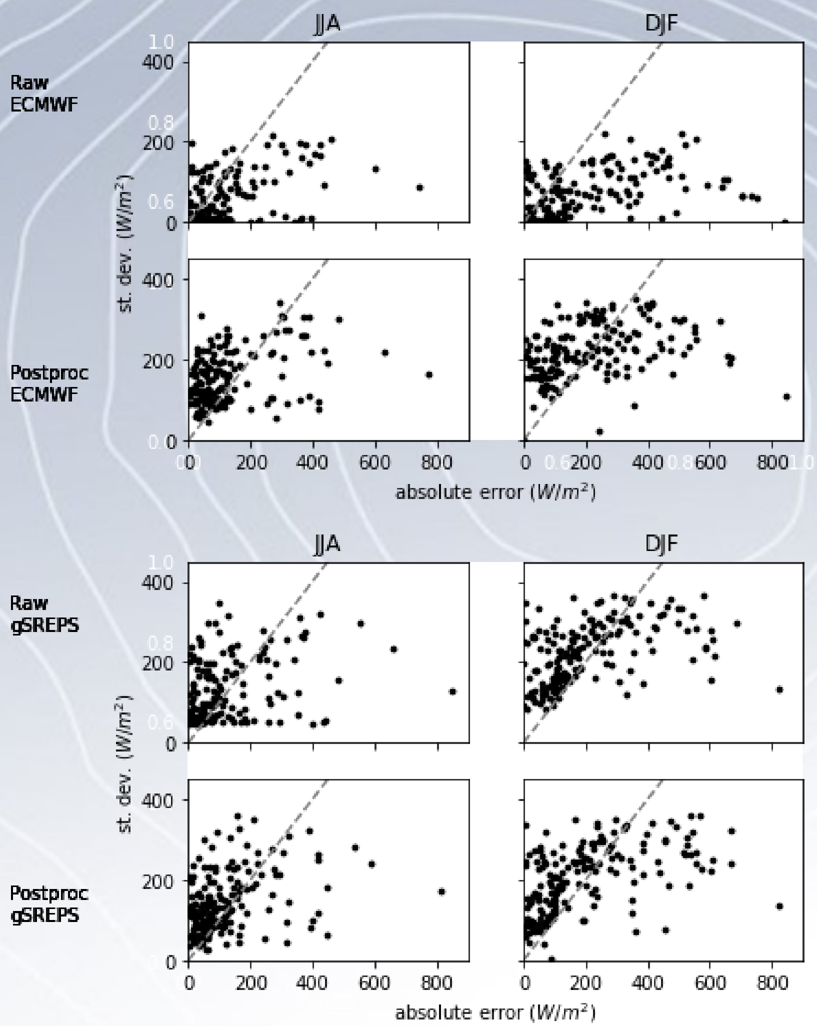
being ρ the check function: $$\rho_\tau(x) = \begin{cases} \tau x & \text{if } x \geq 0 \\ (\tau - 1)x & \text{if } x < 0 \end{cases}$$

Two models have been tested: ECMWF-EPS (50 members), and gSREPS, a local multimodel ensemble of 20 members run in AEMET.

The study has been carried out in Badajoz (south-west Spain) from 1st June 2017 to 31st May 2019.

(These results are under review at Meteorologische Zeitschrift)

Error vs. Spread

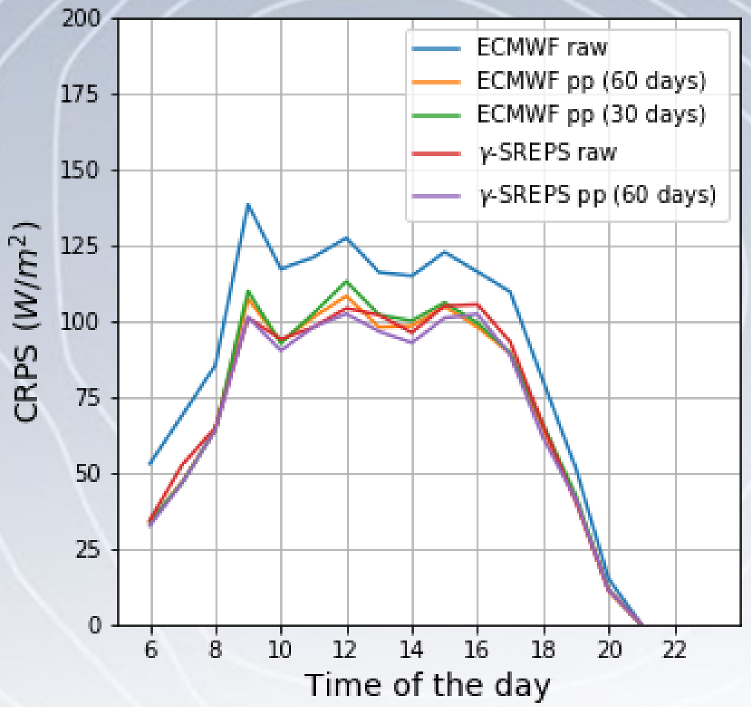


Comparison for ECMWF ang gSREPS models, taking raw and calibrated forecasts (summer and winter, D+1 forecasts)

- Spread too small in raw ECMWF forecasts.
- Uniform increase of spread when ECMWF forecasts are postprocessed, specially in winter.

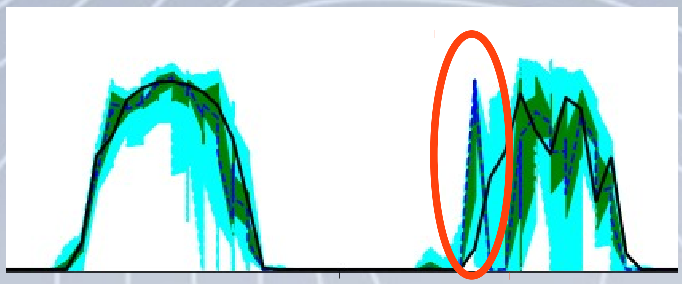
- Better spread for gSREPS.
- The postprocess has a minor impact.

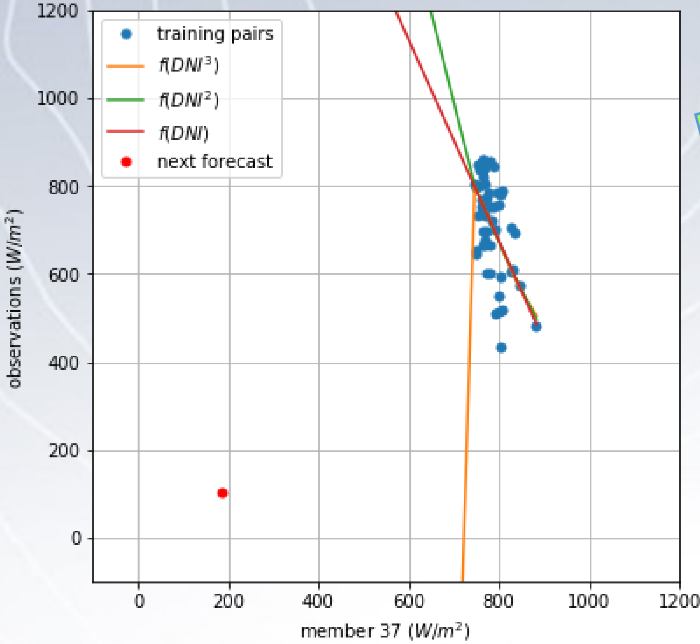
CRPS score



- 20% improvement for ECMWF calibrated forecasts (pp in figure)
- Using a 60 days training period gives a slightly better CRPS
- gSREPS is not significanly improved, though its raw forecasts were already good.

An anomalous case





Context

- After several weeks of sunny weather (blue dots) there is a cloudy day (red dot).
- The calibration produces a wrong prediction (red circle), because the regression line is meaningless.

Effects

- There is not enough variability in the training period to account for a sudden change.
- The forecasts need to be capped.
- Other not so blatant cases can be missed.
- This problem might be aggravated if more input parameters are used.