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

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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  $\boldsymbol{\tau}$  is adjusted as:

 $\boldsymbol{\beta}$  coefficients are calculated minimizing:

being  $\rho$  the check function:

$$\sum_{t=1}^{n} \rho_{\tau}(dni_{ob,t} - \beta_0 - \beta \cdot dni_{raw,t})$$

$$\rho_{\tau}(x) = \begin{cases} \tau x & \text{if } x \ge 0\\ (\tau - 1)x & \text{if } x < 0 \end{cases}$$

 $q_{\tau}(dni) = \beta_0 + \beta \cdot dni_{raw}$ 

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



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JΑ DJF 400 Raw ECMWF 200  $(W/m^2)$ лэр 400 ti 200 Postproc ECMWF 0 800 400 600 200 400 600 0 200 800 absolute error  $(W/m^2)$ ||A DIF 400 Raw **gSREPS** 200  $(W/m^2)$ dev. 400 ti 200 Postproc **gSREPS** 0 400 600 800 400 600 800 0 200 0 200 absolute error (W/m<sup>2</sup>)

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



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- 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



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## 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.
- 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.