

# Calibration Methods for Ensemble solar probabilistic forecasts in an insular context

Josselin Le Gal La Salle, Philippe Lauret, Mathieu David

► **To cite this version:**

Josselin Le Gal La Salle, Philippe Lauret, Mathieu David. Calibration Methods for Ensemble solar probabilistic forecasts in an insular context. 6th International Conference Energy & Meteorology (ICEM 2019), Jun 2019, Copenhagen, Denmark. hal-03270623

**HAL Id: hal-03270623**

**<https://hal.univ-reunion.fr/hal-03270623>**

Submitted on 25 Jun 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Days

Tuesday, 25th June

Wednesday, 26th June

Thursday, 27th June

Search

Speakers

**Calibration Methods for Ensemble solar probabilistic forecasts in an insular context** (689)**Josselin LE GAL LA SALLE**<sup>1</sup>, Philippe LAURET<sup>1</sup>, Mathieu DAVID<sup>1</sup>

1. Université de la Réunion, Saint-Denis, LA RÉUNION, Reunion

## Objective and Background

Reliable solar forecasts are needed to increase the penetration of solar power into the electricity grid.

In the realm of solar forecasting, most of the works have been devoted to deterministic or point forecasts. However, an estimation of the uncertainty associated with the forecast allows reducing balancing needs (e.g. energy storages), may help the grid operator in his decision-making process and, as a consequence, reduces the operation costs.

In this work, probabilistic day-ahead solar forecasts are generated by an ensemble prediction system (EPS). However, these ensemble methods are well-known to exhibit a low reliability resulting from lack of spread of the members of the EPS. Calibration methods have been proposed to tackle this problem. In particular, Ben Bouallegue proposed a method to calibrate solar forecasts produced by the COSMO-DE ensemble prediction in Germany . To the best of our knowledge, no works attempt to evaluate calibration methods in an insular context.

The objective of this work is therefore to compare the efficiency of three calibration methods in an insular context.

## Methods

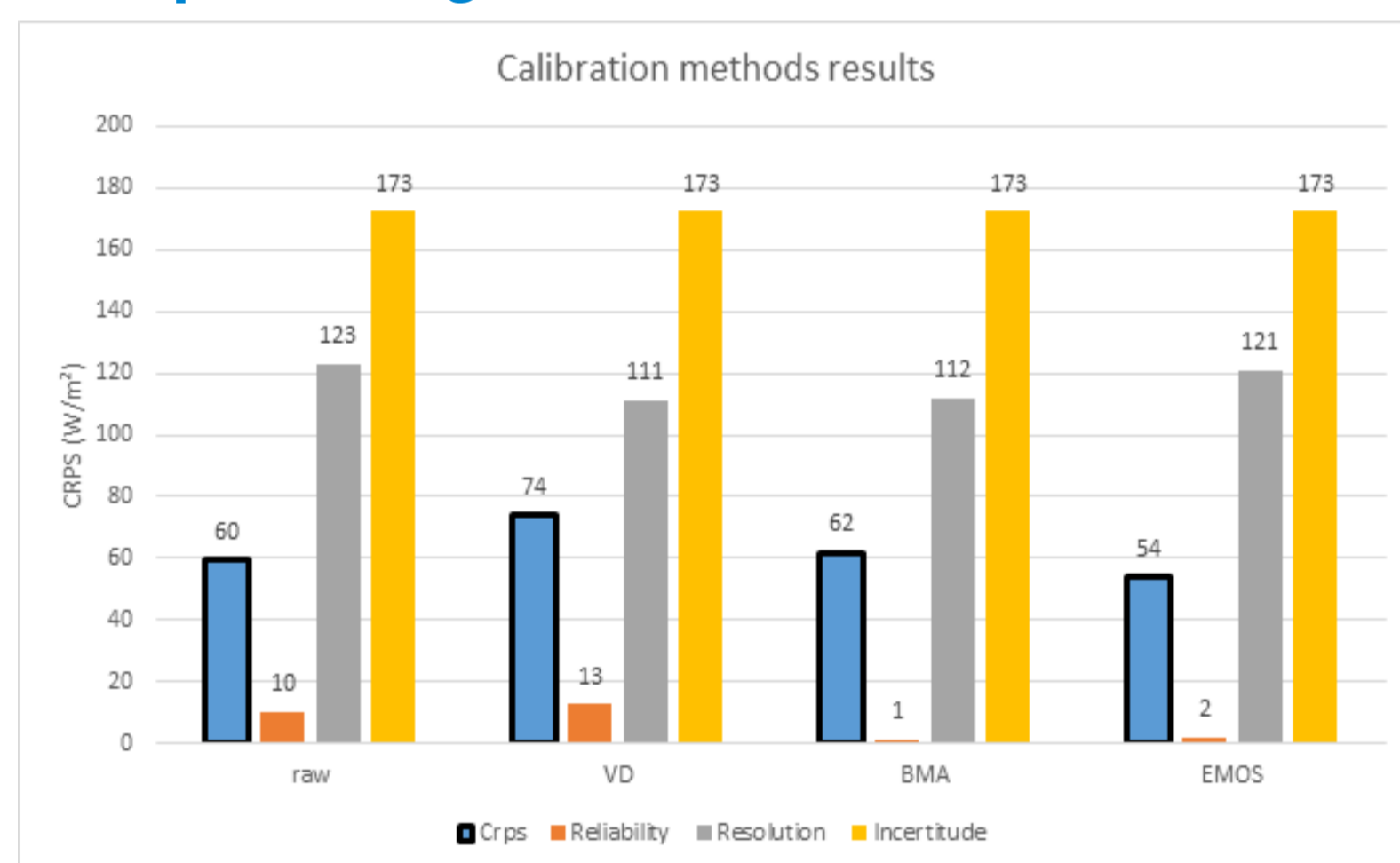
Day-ahead ensemble forecasts are provided by the Integrated Forecasting System (IFS) of the European Centre of Medium-Range Weather Forecasts (ECMWF) . The ensemble is composed of 50 perturbed members. The temporal resolution is 3 hours and the spatial resolution is of 0.2° in both longitude and latitude. Forecasts are evaluated against in-situ observation data collected on the site of Saint-Pierre in the south of Reunion island. One year of data (2012) is used to calibrate the models and another one (2013) is used to carry out a comprehensive testing procedure.

3 calibration methods identified in the literature are tested: "Variance Deficit (VD)" (2), "Ensemble Model Output Statistics (EMOS)" (3) and "Bayesian Model Averaging (BMA)" (4).

Rank histogram and the CRPS (Continuous Ranked Probability Score) with its decomposition into reliability, resolution and uncertainty are used to assess the quality and the skills of the different models. CRPS is a commonly used score for evaluating the overall skill of a probabilistic method. The decomposition proposed here will allow evaluating the impact of the calibration methods on the reliability and resolution components.

The performance of the calibrated models are evaluated against the original (raw) ensemble forecast.

## Principal Findings



As shown by the figure above, EMOS and BMA methods improve the reliability of the forecasts albeit the overall quality of BMA is slightly worse than the original raw ensemble i.e. CRPS BMA > CRPS Raw.

For the case under study, it appears that EMOS is the best option while the VD method should be discarded. Nonetheless, in comparison with the raw ensemble, the improvement brought by the methods may appear marginal.

## Conclusion

Three calibration methods of EPS have been tested in an insular context. This study reveals that two calibration methods were capable to tackle the lack of reliability of the solar forecasts. However, more work is needed to fully benefit from these calibration methods in an insular context.

1. Z., Ben Bouallegue. Statistical postprocessing of ensemble global radiation - forecasts with penalized regression. Meteorologische Zeitschrift p.253-264. 2016, Vol. 26, 3.
2. David M., Lauret P. Solar Radiation Probabilistic Forecasting. Wind Field and Solar Radiation Characterization and Forecasting p 7-8. s.l. : Springer, 2018.
3. Gneiting T., Raftery A., Westveld A, Goldman T. Calibrated Probabilistic Forecasting Using Ensemble Model Output Statistics and Minimum CRPS Estimation. Monthly Weather review p. 1098-1118. 2005, Vol. 133, 5.
4. Raftery A., Gneiting T., Balabdaoui F., Polakowski M. Using Bayesian Model Averaging to calibrate Forecast Ensembles. Monthly Weather review p. 1155-1174. 2005, Vol. 133, 5.