

# Solar Uncertainty Management and Mitigation for Exceptional Reliability in Grid Operations (SUMMER-GO)

Bri-Mathias Hodge, Ph.D.  
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# Project Overview

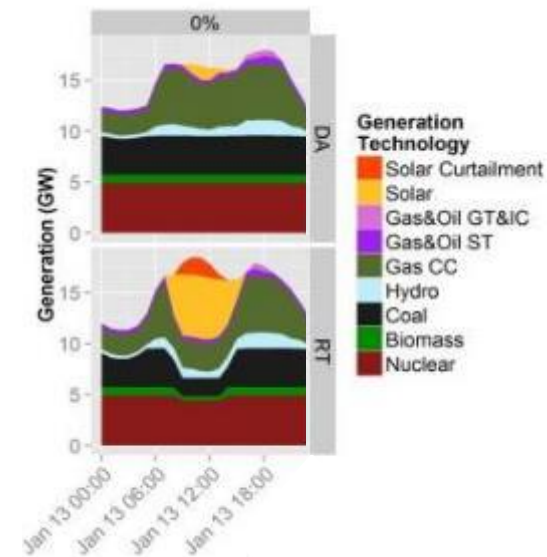
**SUMMER-GO is a suite of tools that enable the incorporation of probabilistic solar forecasts into operations to improve system reliability and will be validated in ERCOT's real-time operational test system.**

## Motivation

Deterministic solar under- and over-forecasting events can cause high solar curtailment or generation shortages, increased system costs, and reliability concerns.

## SUMMER-GO Objectives

- Design novel algorithms to create probabilistic solar power forecasts and automate their integration into power system operations to reduce operating costs while increasing reliability.
- Incorporate probabilistic solar forecasts into ERCOT's real-time operation environment through automated reserve and dispatch tools.
- Develop a situational awareness tool to help system operators understand the uncertainty in the solar power forecasts, and the impacts on operations.



# Probabilistic Forecasting with Bayesian Model Averaging

## Challenges of raw NWP ensemble:

- Under-dispersion, bias, and coarseness
- Inverter clipping

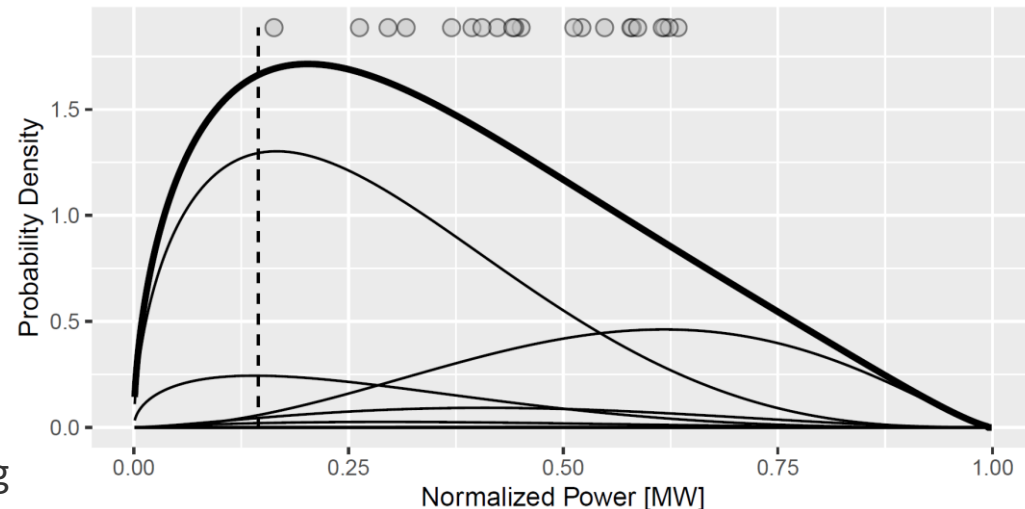
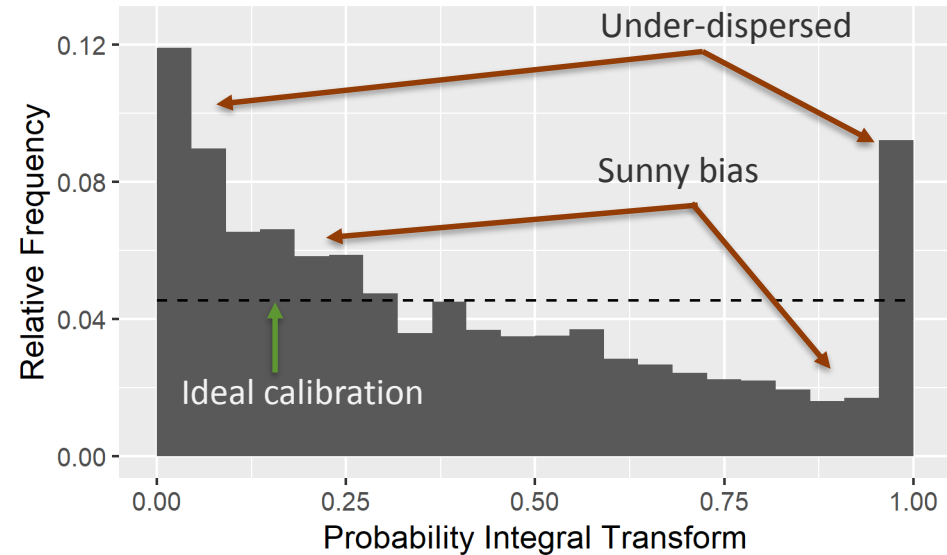
## Bayesian model averaging (BMA) post-processing:

- Member-by-member correction
- Members weighted based on historical performance
- Overall probability is a mixture:

$$p(y|f_1, \dots, f_K) = \sum_{k=1}^K w_k h_k(y|f_k)$$

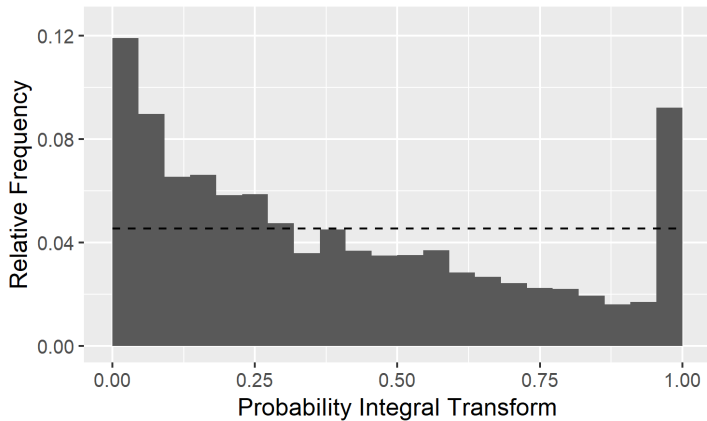
- Each ensemble member is dressed with a two-part model,  $h_k(y|f_k)$ :
  1. Beta kernel
  2. Estimate of probability of clipping

## Raw 21-member NWP ensemble

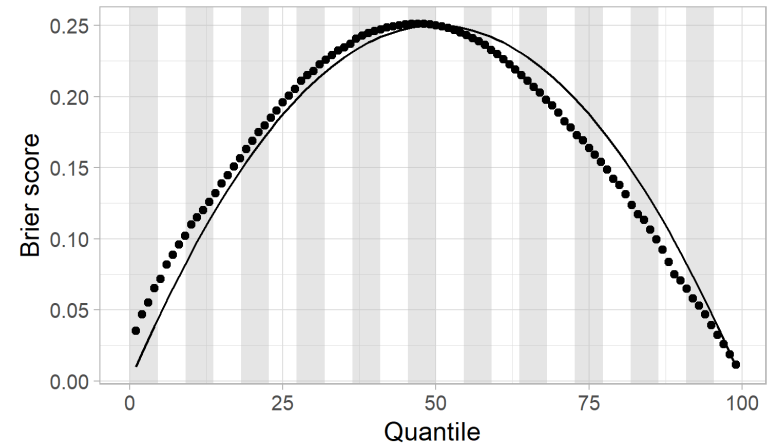
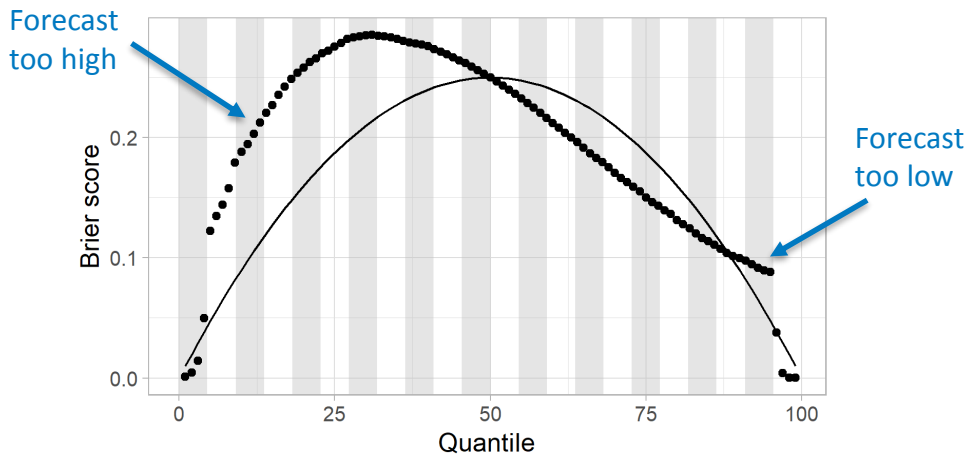
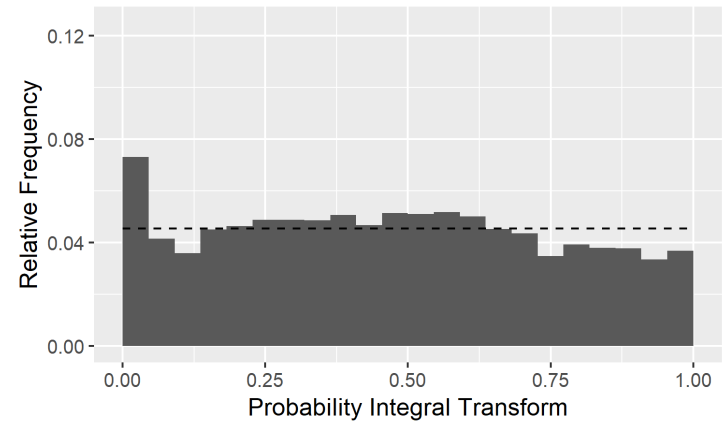


# Results of 1-Hour Ahead Forecast for 2018

## Binned Probability Forecast



## “Time-of-day” BMA Forecast



	Binned probability	BMA	Skill Score
CRPS	0.060	0.057	0.047
Central 90% interval width	0.299	0.306	-0.025