



**HAL**  
open science

## Uncertainty Estimation in Hourly Photovoltaic AC Power with a Focus on Solar Plane-Of-Array Irradiance

Alexandre Mathieu, Martin Thebault, Gilles Fraisse, Simon Thebault, Simon Boddaert, Leon Gaillard

► **To cite this version:**

Alexandre Mathieu, Martin Thebault, Gilles Fraisse, Simon Thebault, Simon Boddaert, et al.. Uncertainty Estimation in Hourly Photovoltaic AC Power with a Focus on Solar Plane-Of-Array Irradiance. 2024 European PVPMC Workshop, Aug 2024, Copenhagen, Denmark. . hal-04793278

**HAL Id: hal-04793278**

<https://cnrs.hal.science/hal-04793278v1>

Submitted on 20 Nov 2024

**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.



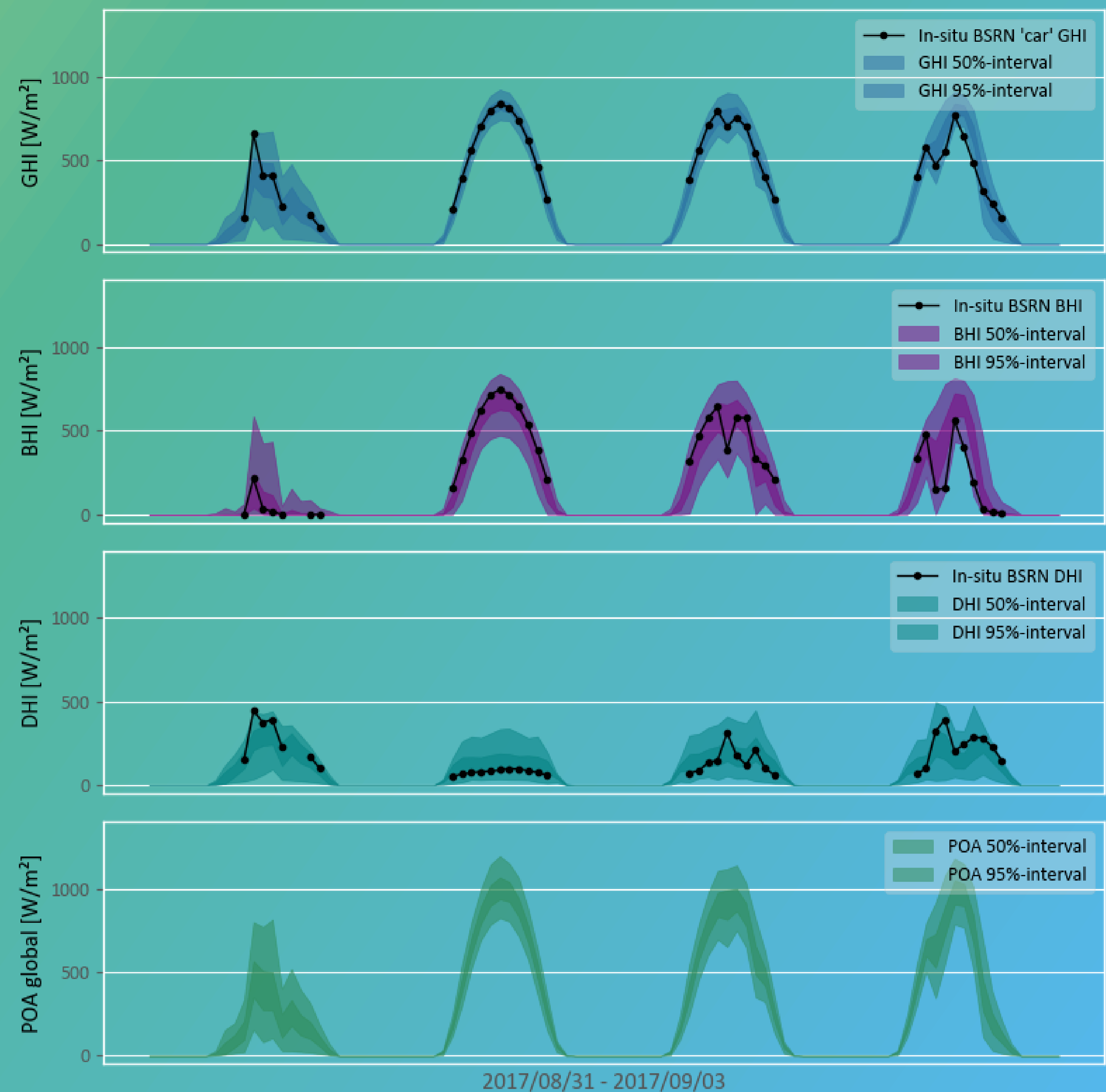
# Uncertainty Estimation in Hourly Photovoltaic AC Power

## with a Focus on Solar Plane-Of-Array Irradiance

Alexandre MATHIEU<sup>1,2,3</sup>, Martin THEBAULT<sup>2</sup>, Gilles FRAISSE<sup>2</sup>, Simon THEBAULT<sup>3</sup>, Simon BODDAERT<sup>3</sup>, Leon GAILLARD<sup>1</sup>

1. Heliocity, FRANCE
2. LOCIE, Université Savoie Mont Blanc, CNRS UMR5271, FRANCE
3. CSTB, FRANCE

Email: alexandre.mathieu@cstb.fr

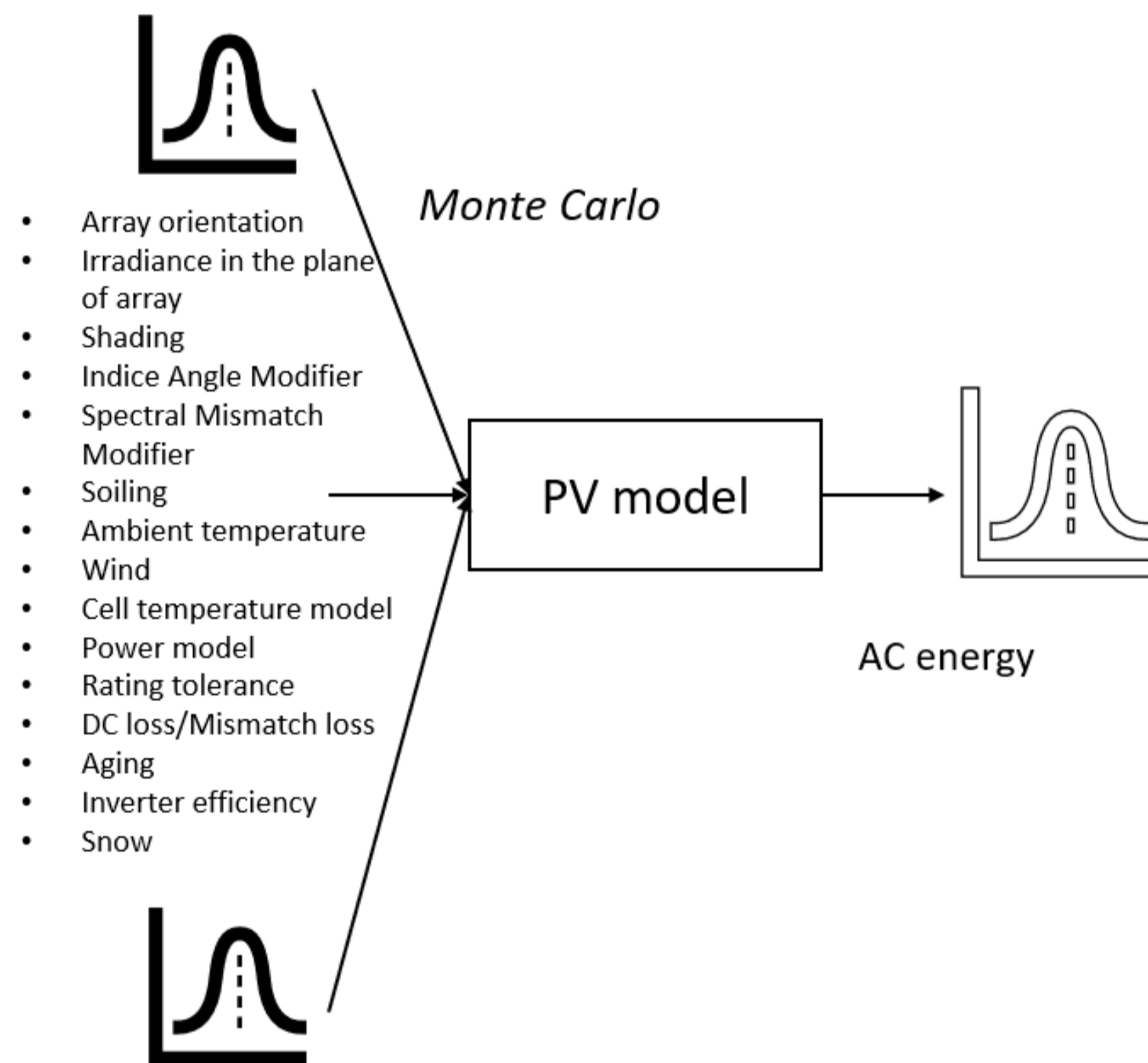


### Background

#### Objectives:

Establishment of a methodology to estimate PV performance uncertainties

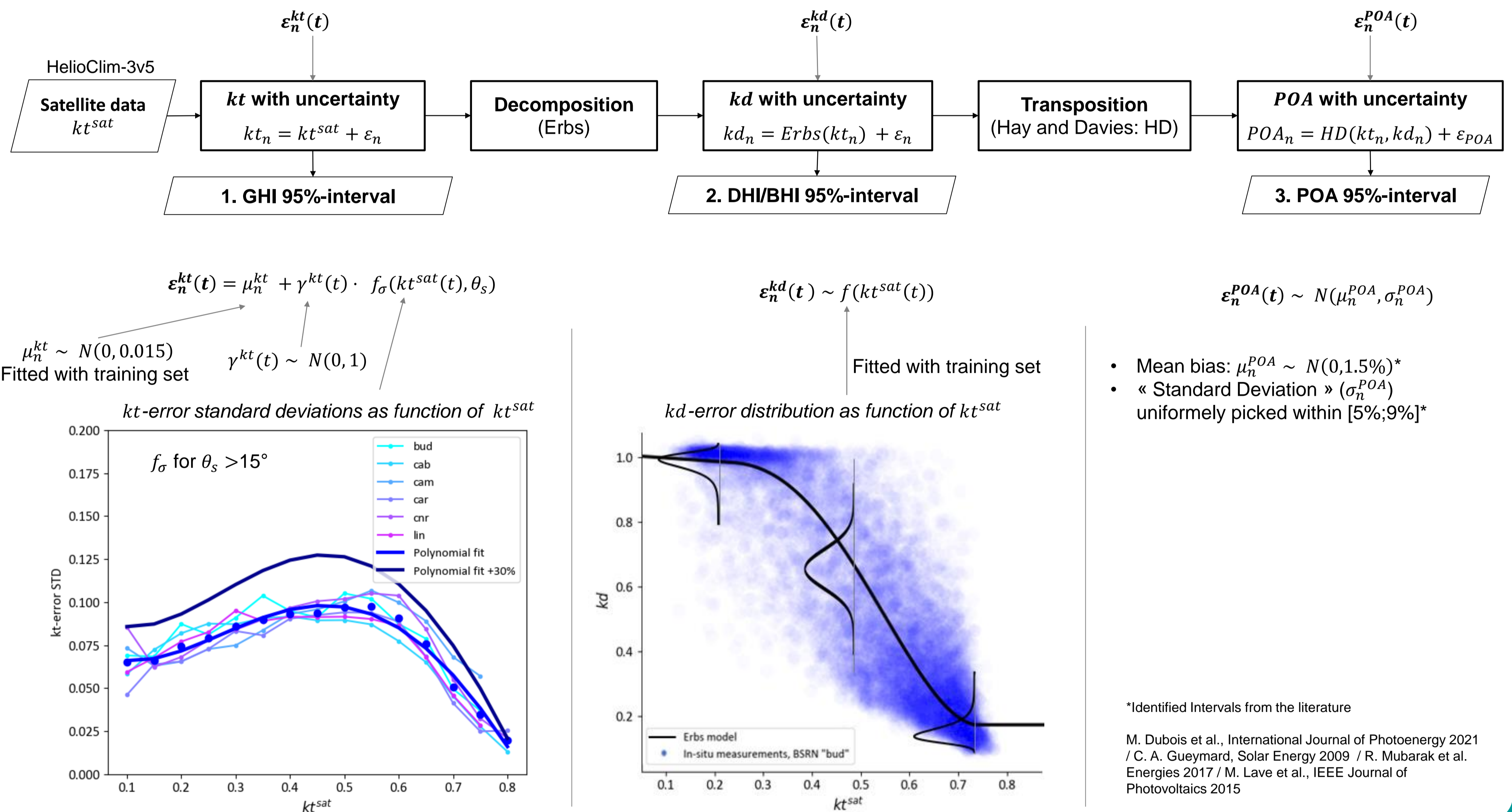
POA irradiance = major source of uncertainty\*



\*D. Thevenard, S. Pelland, Solar Energy 2013, 91, 432-445. / D. Moser et al. Technical Risks in PV Projects. Solar Bankability Project 2017.

### Methodology

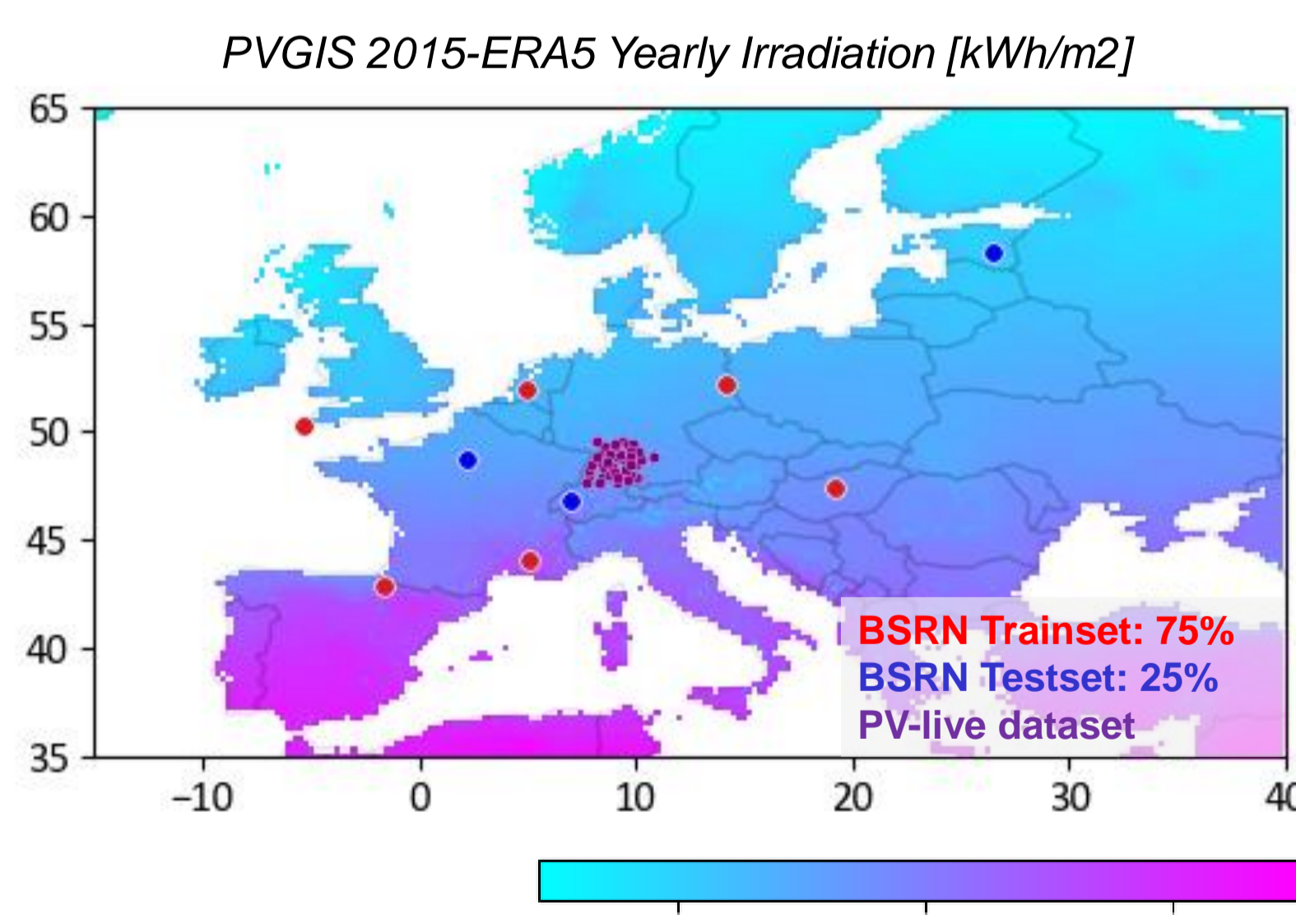
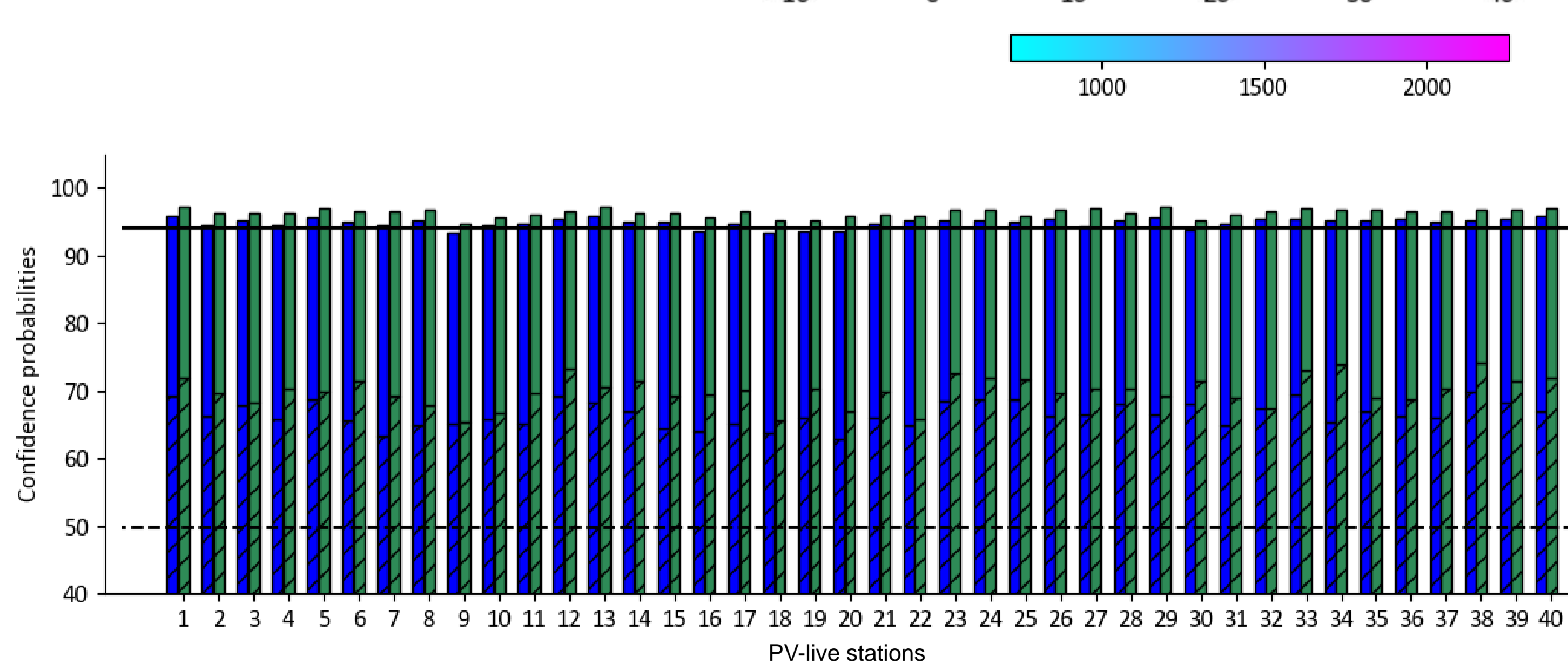
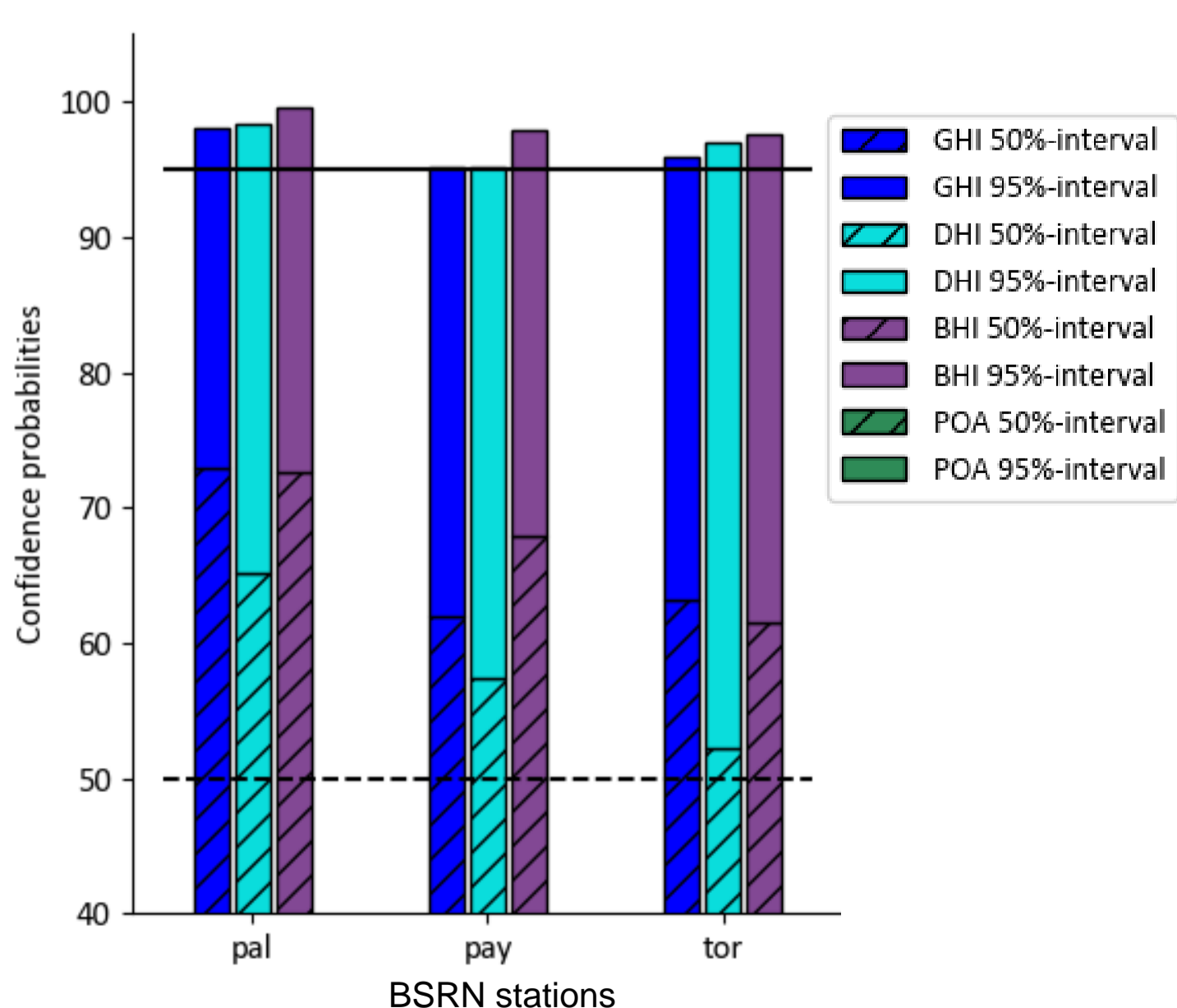
Uncertainties are estimated at **each step** of the modeling chain to generate the **Plane-Of-Array (POA) irradiance at a hourly granularity with Monte Carlo simulations.**



### Validation

The methodology is validated through 3 steps:

1. Trained on 6 BSRN stations
2. Tested on 3 other BSRN stations for GHI/BHI/DHI
3. Tested on 40 PV-live stations for POA-global (25° south)



### Conclusion

This study addresses AC-energy **uncertainties** with a focus on POA-irradiance at an **hourly** granularity within **Europe**.

Using **Monte Carlo** techniques, the developed methodology enables to generate 95% confidence intervals for:

- Global Horizontal Irradiance
- Beam Horizontal Irradiance
- Diffuse Horizontal Irradiance
- Plane-Of-Array (POA) irradiance.

Paper in progress

"Uncertainty Estimation of the Hourly Plane-Of-Array Irradiance from Satellite Data: An European Case Study"

The authors of the article would like to thank the ANRT funding as well as the co-financing between Heliocity and CSTB for the project "Methodology development to guarantee building photovoltaic systems' performance including failure modelling". This work has been supported by the French National Research Agency, through the Investments for Future Program (ref. ANR-18-EURE-0016 – Solar Academy).