



# IEA PVPS Task 16, Subtask 2

## Enhanced data & bankable products

Prof. Philippe BLANC

Center Observation, Impacts, Energy  
MINES ParisTech / PSL Research University

[philippe.blanc@mines-paristech.fr](mailto:philippe.blanc@mines-paristech.fr)



# Overview

- Aim: establish methods meant to provide end-users with solar products and datasets along with uncertainty
  - From different combined Earth Observation sources (ground measurement, satellite, models)
  - For solar mapping, spatiotemporal variability analysis, long-term analysis for PV site screening, sizing and bankable datasets
- End-users: researchers, industries and developers in the PV domain but also CSTE, solar heating and buildings
- Outputs for end-users: benchmarking analyses, best-practices, standards and tutorials



# Overview

## The five activities of

- **Activity 2.1: Data quality & format**  
Philippe Blanc, MINES ParisTech, France, [philippe.blanc@mines-paristech.fr](mailto:philippe.blanc@mines-paristech.fr)
- **Activity 2.2: Merging of satellite, weather model and ground data**  
Jesus Polo, CIEMAT, Spain, [jesus.polo@ciemat.es](mailto:jesus.polo@ciemat.es)
- **Activity 2.3: Spatio-temporal high variability**  
Hans Georg Bayer, The University of the Faroe Islands, [HansGB@setur.fo](mailto:HansGB@setur.fo)
- **Activity 2.4: Long-term inter-annual variability**  
Kristian Pagh Nielsen, DMI, Denmark, [kpn@dm.dk](mailto:kpn@dm.dk)
- **Activity 2.5: Products for the end-users**  
Manuel Silva, University of Seville, Spain, [msilva@us.es](mailto:msilva@us.es)



## Activity 2.1: Data quality & format

- Activity leader: Philippe BLANC, MINES ParisTech, France
- Target audience: solar data provider, PV developers using in-situ measurements
- Objectives:
  - Best practices and consensus for automatic and expert data quality control methods
  - Benchmarking of gap filling methods
  - Peer review and quality assessment of in-situ datasets (pyranometric, PV production)
  - Development of best practices for data formats, based on requests and requirements of international agencies
  - Data dissemination and exchange using interoperable standards



## Activity 2.3: Spatio-temporal high variability

- Activity leader: Hans Georg Bayer, Univ. of the Faroe Islands
- Target audience: solar data provider, researchers, solar system integrators and grid operators
- Objectives:
  - Analysis of satellite data with high resolution in time and space and ground based sky images for the geostatistical characterization of the spatiotemporal variabilities.
  - Set up of methods
    - for the generation of cloud and irradiance fields
    - for the direct extraction of the characteristics of fluctuations of aggregated power of PV ensembles
  - Set up of methods for the validation of the synthetic fields
  - Analytical description of the smoothing of fluctuations in the aggregated power output



## Activity 2.4: Long-term inter-annual variability

- Activity leader: Kristian Pagh Nielsen, DMI, Denmark
- Target audience: solar system developers, consultants
- Objectives:
  - Review of current methods and suggestions
    - for definition for probability of exceedance (PoE; variability and uncertainty)
    - for generation of ensemble of multi-year solar data sets
  - Gathering a selection of high quality global long term data sets (NREL, Uni. Oregon, GEBA, NASA SSE).
  - Assessing the current PoE methods with respect to:
    - Statistical characteristics of yearly variability
    - Non-stochastic variability (trends, volcanos, etc.)
  - Assessing the current realistic (artificial) multi-year datasets with respect to:
    - Year to year variability of solar resources
    - Intra-year variability of solar resources



# Results and proposed activities from the 2<sup>nd</sup> Task experts meeting, March 7-8, 2018 in Paris





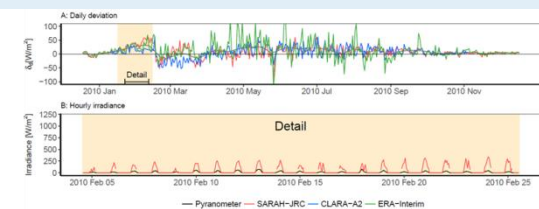
## Activity 2.1: Data quality and format

- Discussions on data format for time-series of solar radiation products
  - MET\_IEC Format : existing ASCII Comma-Separated-Value (CSV) format with specific tags [Hoyer-Klick, C., R. Meyer, S Wilbert \(2016\). The MET\\_IEC data format 1.0. A report of IEA SHC Task 46, 21 p.](#)
  - The perspective of NetCDF as a new data format: the end of ASCII files?  
Use of Climate and Forecast conventions and metadata (CF) enhanced with specificities of the MET\_IEC format
- Demonstration of the efficient use of satellite-based products for the Quality Control of in-situ pyranometric stations (Gracia-Amillo, JRC)
 

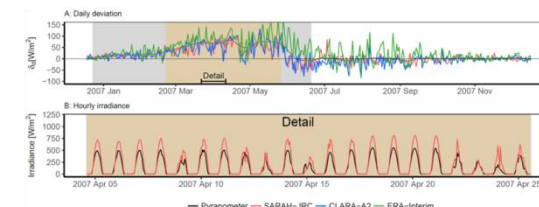
Urraca, R., Gracia-Amillo, A. M., Huld, T., Martinez-de-Pison, F. J., Trentmann, J., Lindfors, A. V., Sanz-Garcia, A. (2017). Quality control of global solar radiation data with satellite-based products. *Solar Energy*, 158, 49–62. [doi:10.1016/j.solener.2017.09.032](https://doi.org/10.1016/j.solener.2017.09.032)

  - Preparation of a workshop on Q1 2019 about benchmarking of QC and gap-filling methods

Snow/Frost



Soiling





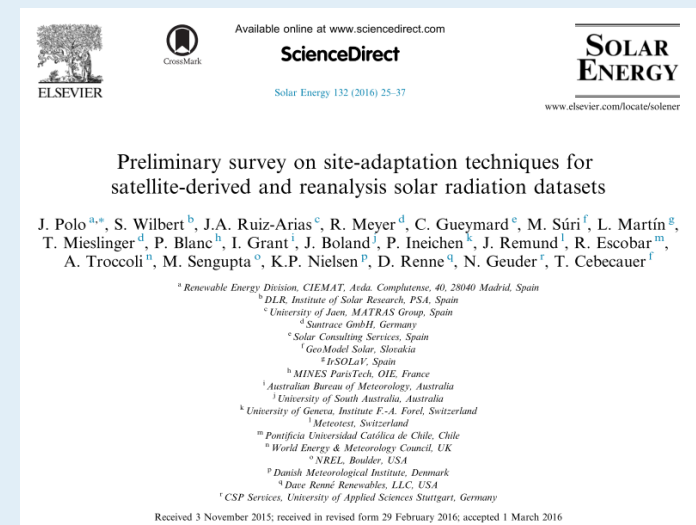


## Activity 2.2: Merging of satellite, weather model and ground data

- Proposition of a protocol for the benchmark for site adaptation (Q4 2019)

Polo et al. 2016, Preliminary survey on site-adaptation techniques for satellite-derived and reanalysis solar radiation datasets. *Solar Energy*, 132, 25–37.

[doi:10.1016/j.solener.2016.03.001](https://doi.org/10.1016/j.solener.2016.03.001)



- Preliminary results on the local adaptation of satellite-derived solar irradiance series: The Ad Hoc approach  
C. M. Fernández Peruchena (CENER)



## Activity 2.3: Spatio-temporal high variability

- Measurement of the Impact of rapid changes in solar irradiance,  
F. Kuonen (Bern Univ. of Applied Science)

Kuonen, F., U. Muntwyler. (2017). Impact of rapid changes in solar irradiance on the PV installation «Mont-Soleil» (SCCER-Demonstrator). 2017 Annual Conference, SCCER-FURIES

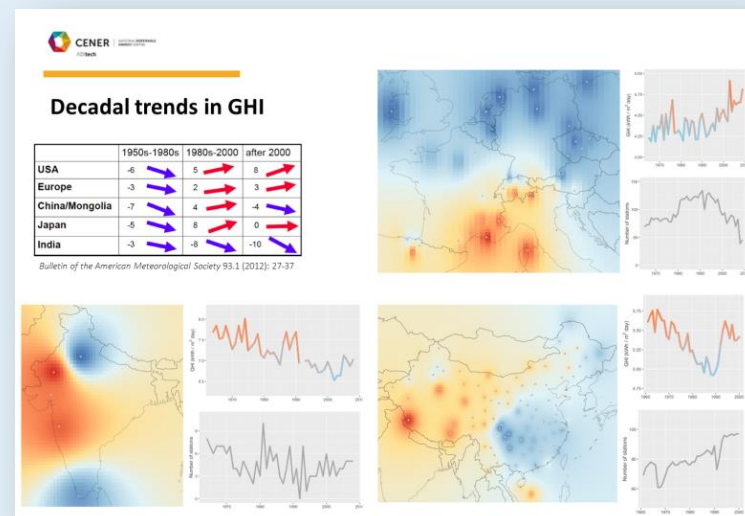




# Activity 2.4: Long-term inter-annual variability

- Creation of Synthetic solar data sets for risk analysis, M. Larraneta (GTER, CENER)
- Probability of exceedance: statistical analysis and climate projection (preliminary), M. Trolliet (MINES ParisTech)

- Solar resource assessment in the frame of Global Dimming and Brightening, C. M. Fernandez Peruchena (CENER)





## Activity 2.4: Long-term inter-annual variability

- Accounting for volcanic risks in synthetic datasets, K. Pagh Nielsen (DMI)
- Swedish long-term series of global radiation, W. Josefsson (SMHI)
- Inter-annual variability, V. Lara Fanego (Solargis, Slovakia)

