



6th Performance and Monitoring Workshop

**VALIDATION OF LONG-TERM YIELD
ESTIMATES AND THEIR LEVEL OF
CONFIDENCE**

Outline

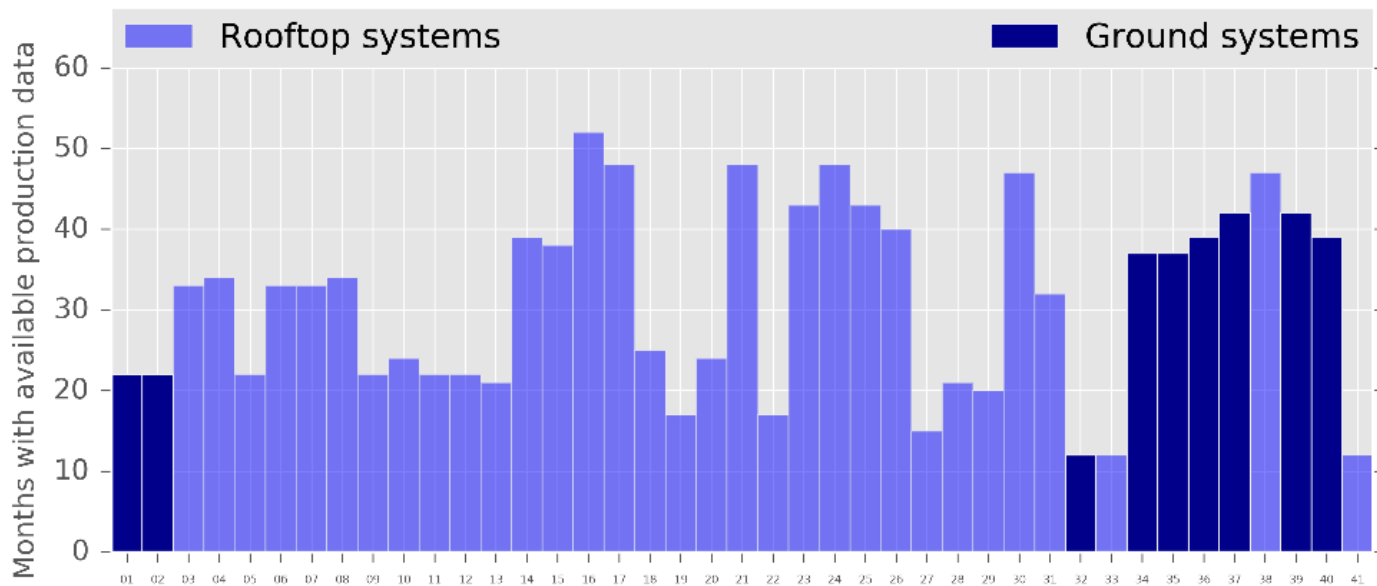
- Purpose
- Approach
- Results
- Conclusions

Purpose

- Validate initial long-term yield estimates based on monitoring data
- Explore the quality of the initial P50 and P90 yield estimates on single plants and on Portfolio level
- Quantify the potential reduction of risk with larger portfolios

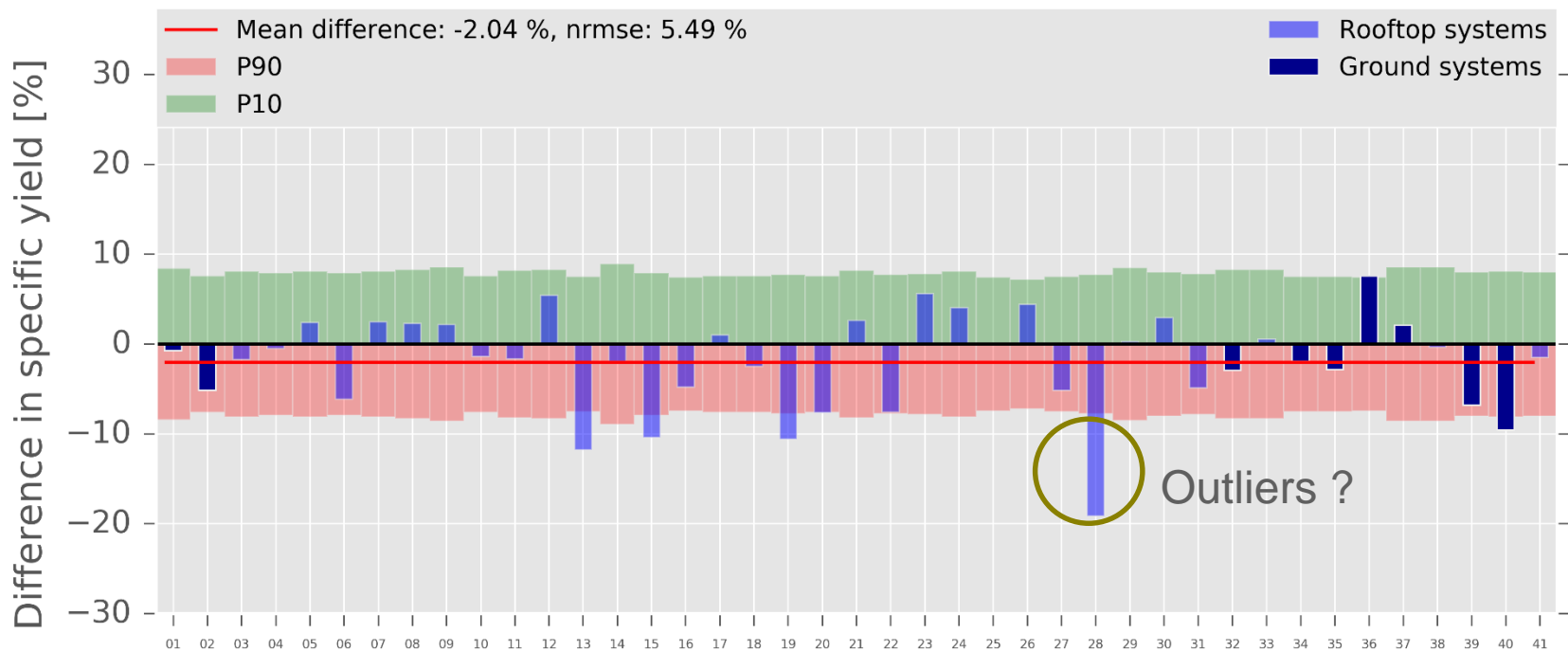
Approach

- Portfolio of 41 PV plants situated in Italy, mainland France and in French overseas departments and territories (DOM-TOM)
- Rooftop and ground mounted systems (from 10 kWp up to 12 MWp)
- Up to four years of operational data



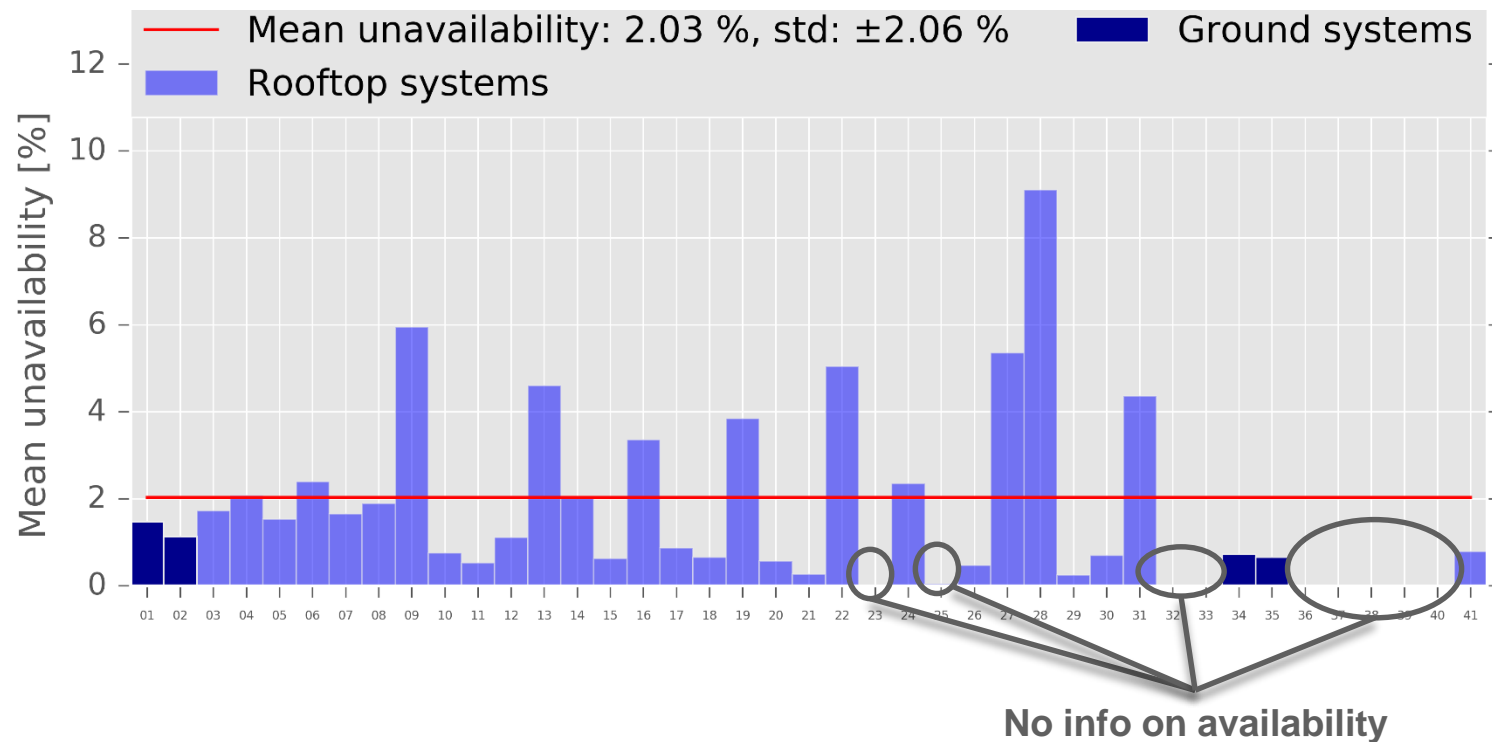
Yield (Measured – Estimated)

- Background color (red/green): P90 and P10 ($\pm 7\%$ - $\pm 9\%$ from P50)
- First plane (blue bars): difference (actual – estimated) in specific yield



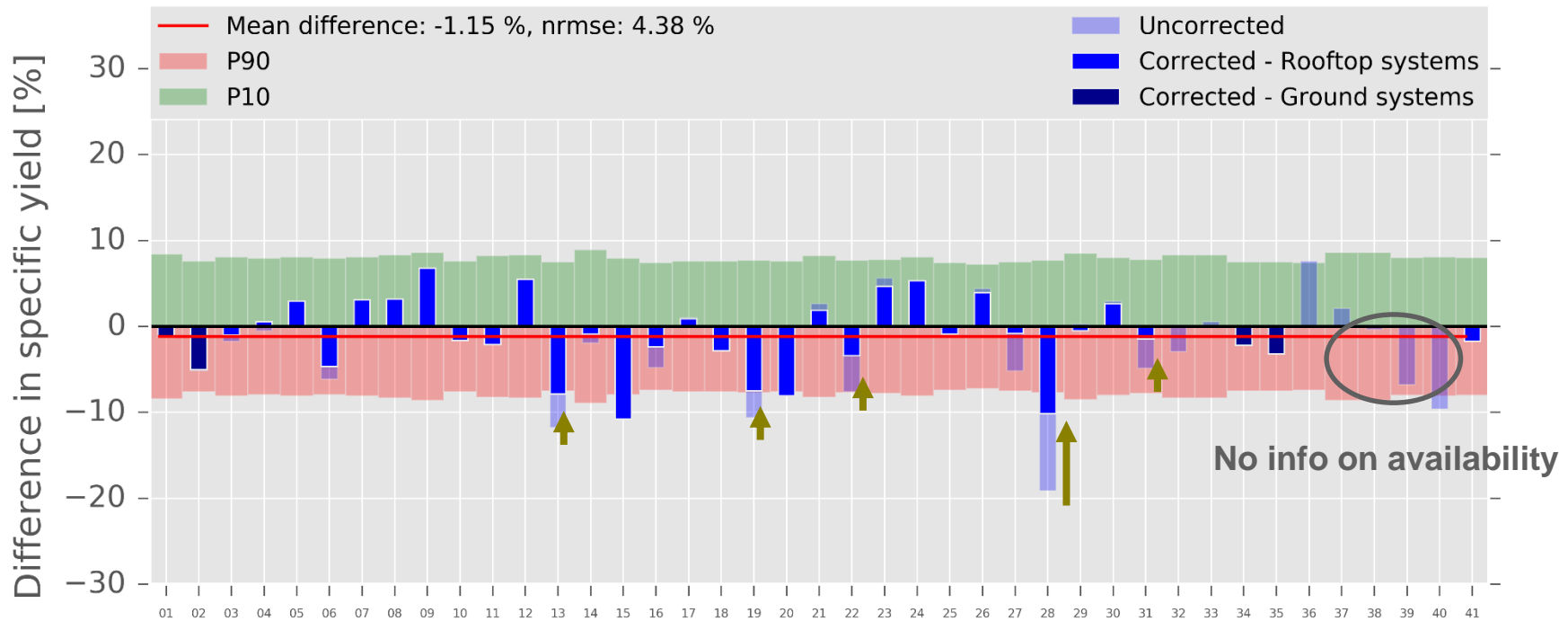
Availability

- Actual unavailability data from most of the PV plants (detailed O&M reports)
- Mean yearly unavailability is around 2% (typical assumption in LTYAs is 1%)



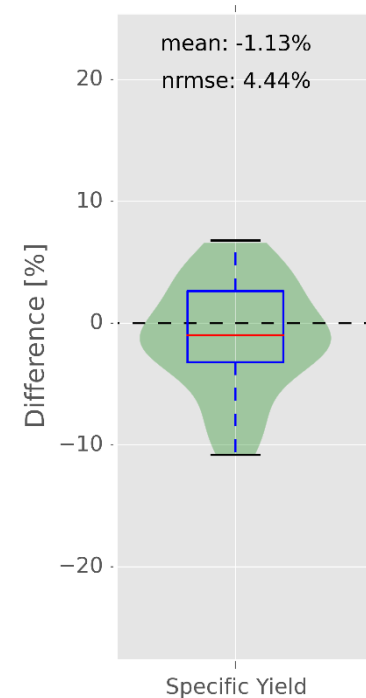
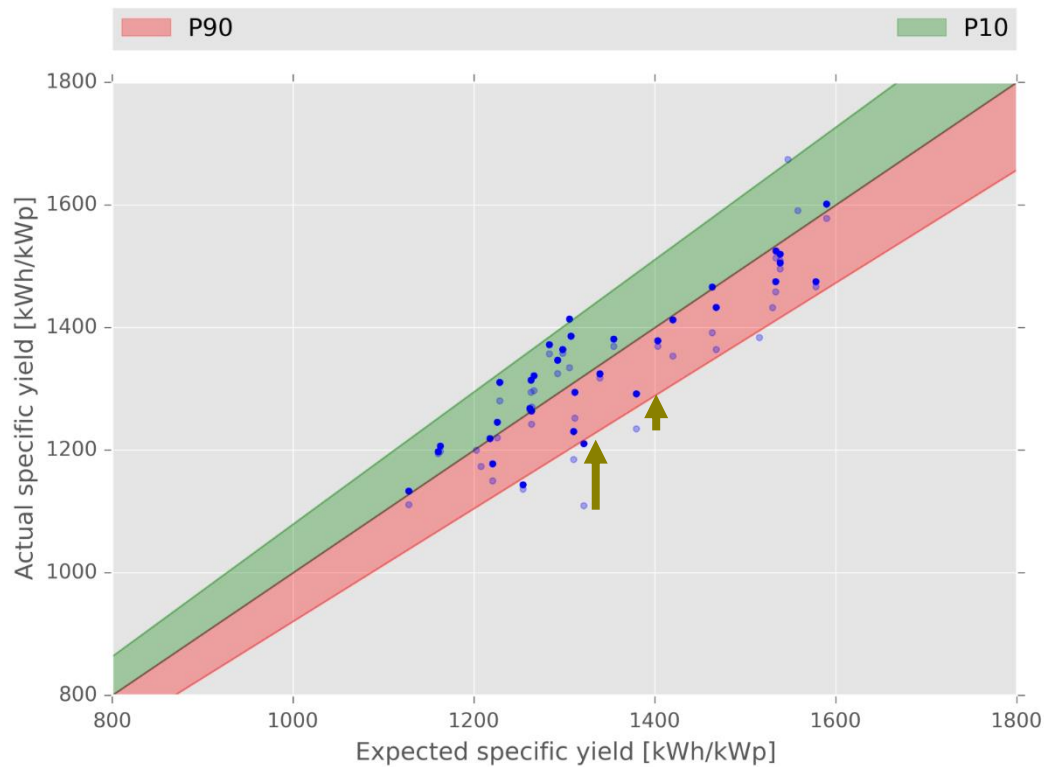
Yield Corrected with Actual Availability

- Deviations below the confidence margin (P90) disappear after correction
- 1.13% over-estimation (or under-performance?)

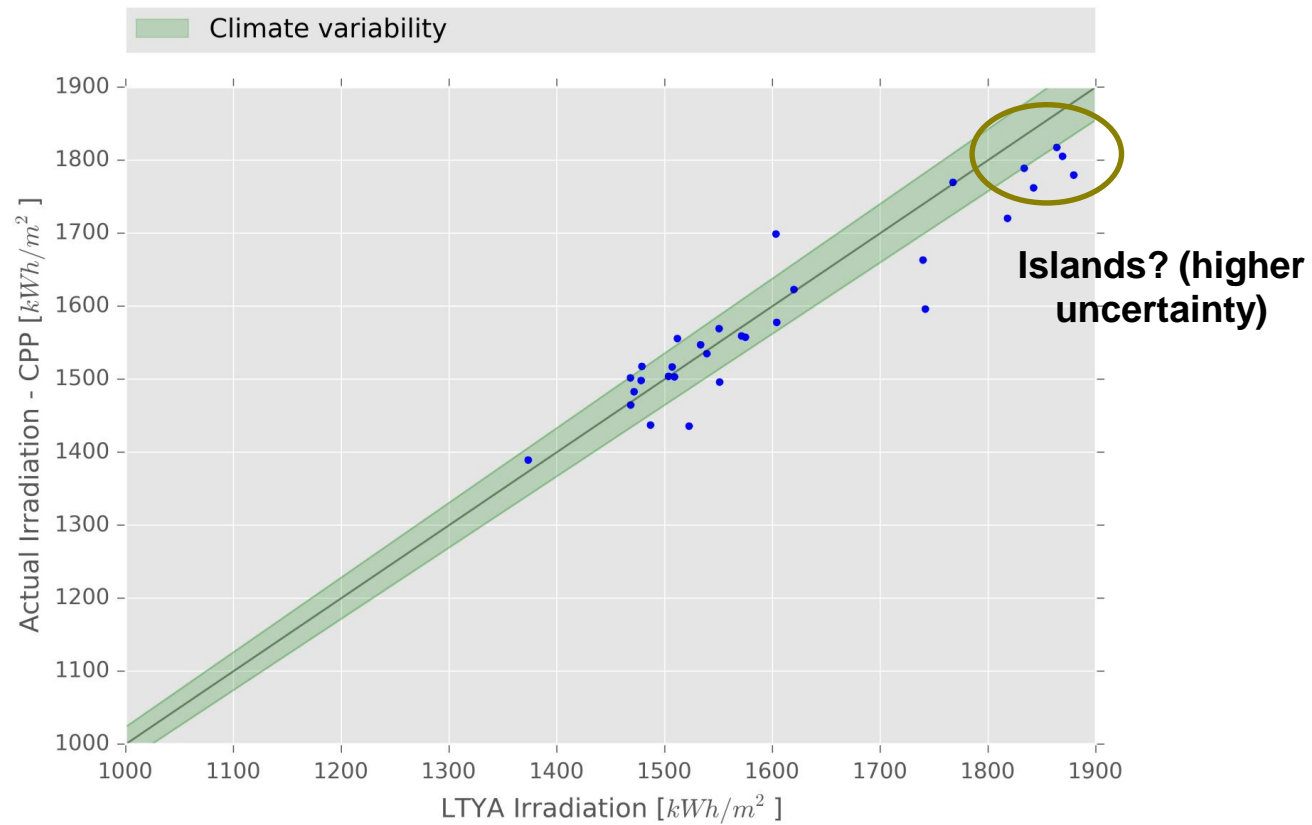


Yield Corrected with Actual Availability

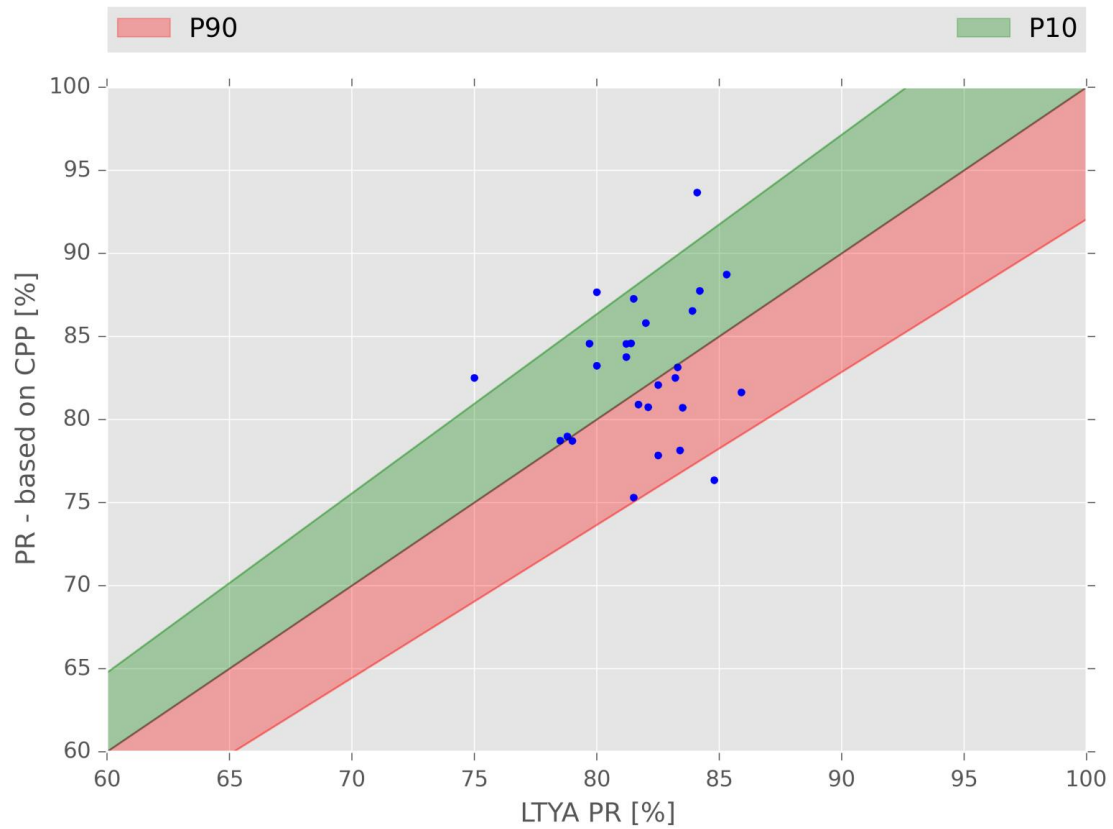
Same results presented in different format



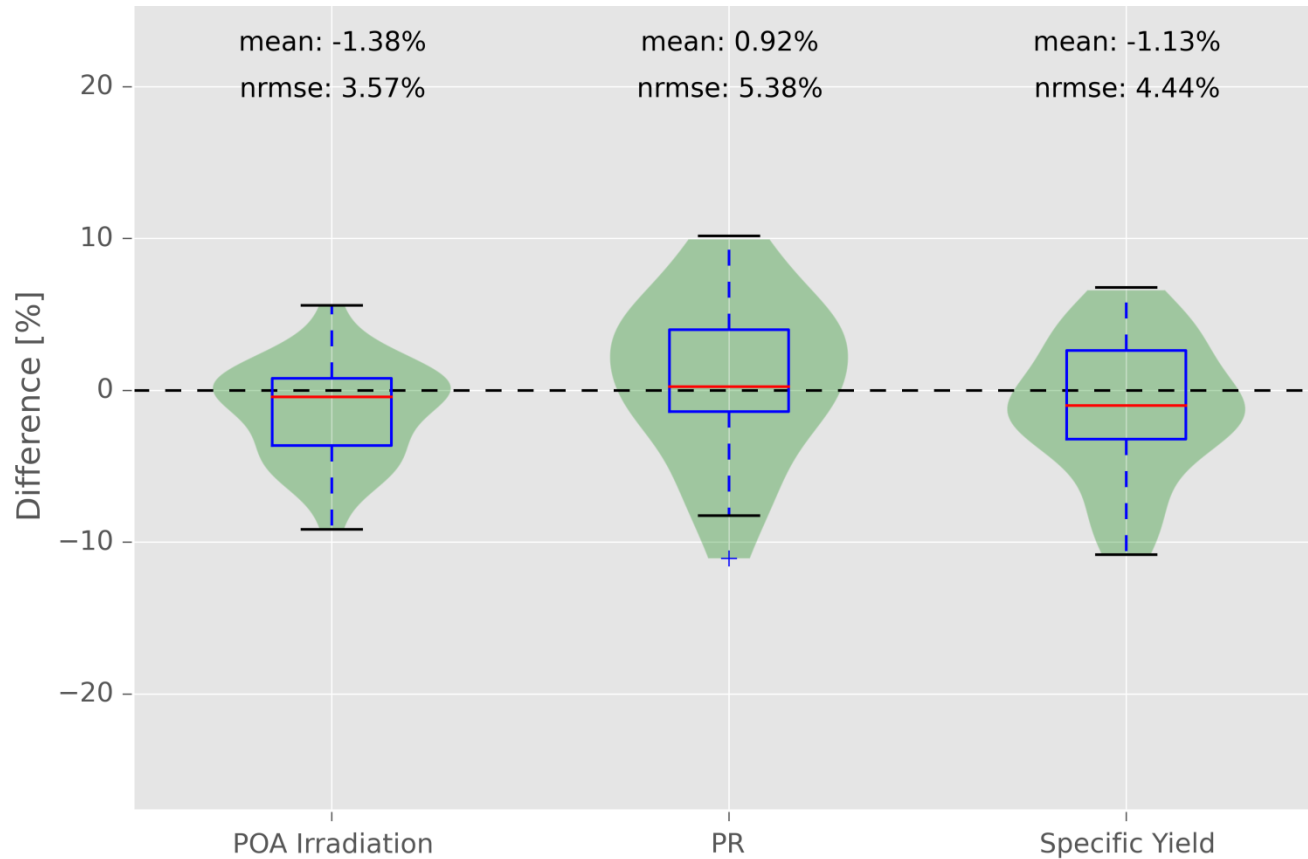
Irradiation (Long-term estimate vs 1st year)



Performance Ratio



Summary



Results at plant level

- For most of the PV plants across the analyzed portfolio the actual electricity production during first year of operation lies within expected uncertainty ranges
- Actual availability is lower than initial estimates in LTYA

Results at portfolio level

- Yield is slightly lower than initially estimated during the design phase (-1.15%)
- Dispersion (nRMSE) is around 4.4% for the analyzed portfolio which lies within normal expected ranges of uncertainty and it's similar to other reported values
- Deviations are typically expected to be mainly due to the variability of the solar resource and other site specific losses that are not precisely modelled during the design phase

Conclusions

- Initial estimates generally agree with actual electricity production over first years
- Dispersion (nRMSE) across analyzed portfolio of 41 PV plants is around 4.4%
- Uncertainty in LTYA for single site typically around $\pm 5\%$ to $\pm 10\%$
- Typical uncertainty range could decrease for a large portfolio to around 4.4%
- Outliers with energy yields below P90 largely caused by plant unavailabilities

Conclusions

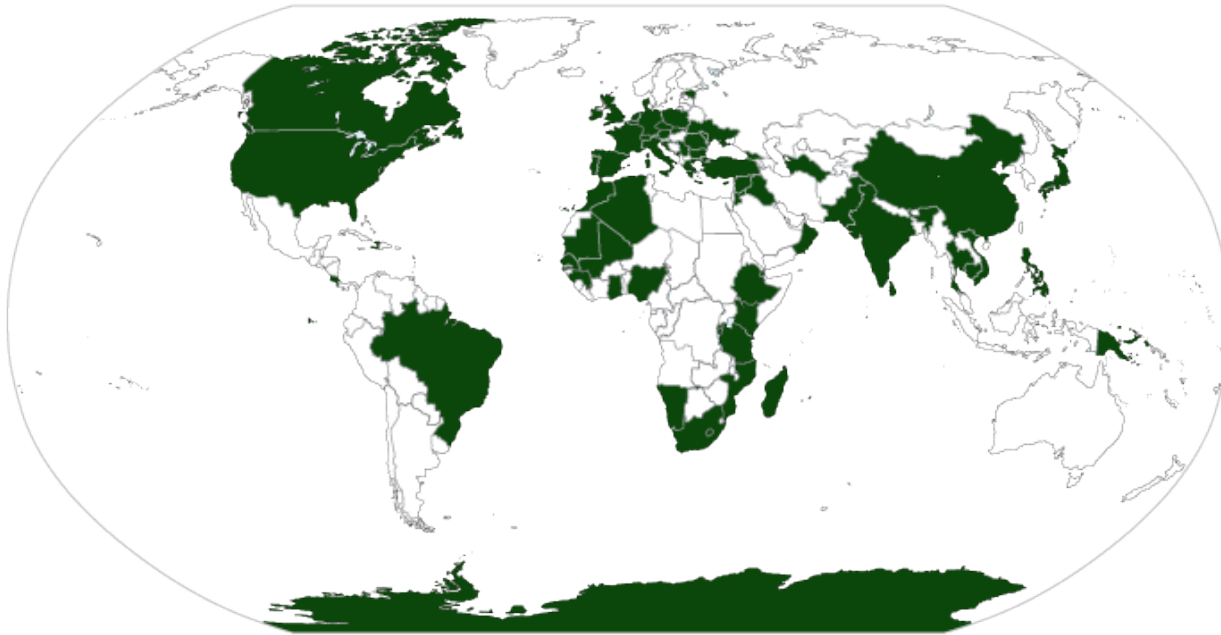
- Risk of unavailability needs to be addressed next to the solar resource uncertainty and O&M contracts
- Investing in a big portfolio of PV plants may be seen as a risk mitigation strategy
- Overall risk of not achieving expected energy yield decreases with increasing size and spatial spread of the portfolio
- Overall uncertainty will be influenced by number of plants, their geographical spread, PV module technologies, type of installations, system configuration, etc.

Acknowledgements



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Thank you!



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