Comparison of remote- and ground-based albedo measurement for solar resource assessment

2019 PV Systems Symposium
Albuquerque, New Mexico

May 14, 2019
Data

Reduce risk on your solar project
Get the most accurate, bankable solar resource data.

SystemCheck®

Validate PV system performance
Automatically monitor and assess performance of PV systems and fleets.

FleetView®

Effectively integrate solar into your grid
Plan for solar adoption on your distribution system with site-to-feeder-specific PV production.

Forecast

Forecast solar power
Reliably predict production from utility-scale PV with the most accurate, solar-specific forecast.
Proven performance

- Est. 500,000 daily API calls
- Over 99.9% uptime
- Operational monitoring of 500,000 PV systems
- Operational forecasting for 10+GW solar
What’s the best source for albedo data for PV modeling?

- Many sources for albedo data, but limited validation for this purpose
- Inaccurate or changing data can be costly
- How should the data be used?

→ Start with the validation

*Today’s presentation will provide practical recommendations for working with albedo data based on the results of a collaborative study.*
Partners

Ground measurements
→ Reference data, specific locations

Remote measurements
→ Historical record, large area

PV modeling and project sponsorship
→ Impact
Setup

- Three sites: Two in California and one in Utah
- Up to 11 months of high-quality ground measurements
- Compare ground data to several remote sources including:
  - NSRDB albedo, a MODIS-based source augmented with snow data\(^{(1)}\)
  - An experimental albedo estimate derived from SolarAnywhere®

---

\(^{(1)}\) See Galen Maclaurin, Manajit Sengupta, Yu Xie, and Nicholas Gilroy "National Development of a MODIS-Derived Surface Albedo Data Set: An Improved Model Input for Processing the NSRDB," Renewable Energy Laboratory, December 2016.
Issues

• Spatial and temporal resolution
• Time – long-term averages, recent data, and future condition
• Annual and seasonal variability
• What sources of error should we be concerned about?
California Site A*

*actual project location not shown to protect confidentiality
California Site A

- High albedo
- Low seasonality
- Good correlation among sources
Utah Test Site

July

October

January

April
Utah Test Site

~1km
Utah Test Site

- High seasonality
- Moderate albedo
- OK correlation among sources
Utah Test Site

NSRDB values for snow (0.87) appear high.
California Site B

May

November

December

March

NB: Photos for May and November show met station, not albedometer.
California Site B*

What’s representative of the post-construction condition?

*actual project location not shown to protect confidentiality
Spatial resolution and tile selection of remote source must be considered.

Visible imagery from GOES-15. The left image shows a clear day in California. The right image shows farmland at maximum resolution.
California Site B

- Poor correlation among sources
- Moderate seasonality
- Moderate albedo

CA Site B, Daily Averages

- SolarAnywhere Exp.
- Measured
- NSRDB Avg
Conclusions

1. Decide / characterize the post-construction surface condition.
2. Run sensitivities on albedo to help determine the acceptable level of uncertainty. Is simple assessment of the ground surface sufficient?
3. Remote sources may be used if an only if the resolution and period is representative of (1).
4. If using a ground sensor, incorporate major seasonal effects (particularly snow) from a long-term (remote) data source. If aerial photos reveal variations within the site, measure multiple locations.
Thank you

For more information, contact:
Patrick Keelin
Lead Product Manager
pkeelin@cleanpower.com

Mark Grammatico
Senior Technical Account Executive
markg@cleanpower.com

www.cleanpower.com