



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

2019 PV Systems Symposium
Albuquerque, New Mexico

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SolarAnywhere[®]

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 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



August



November



January



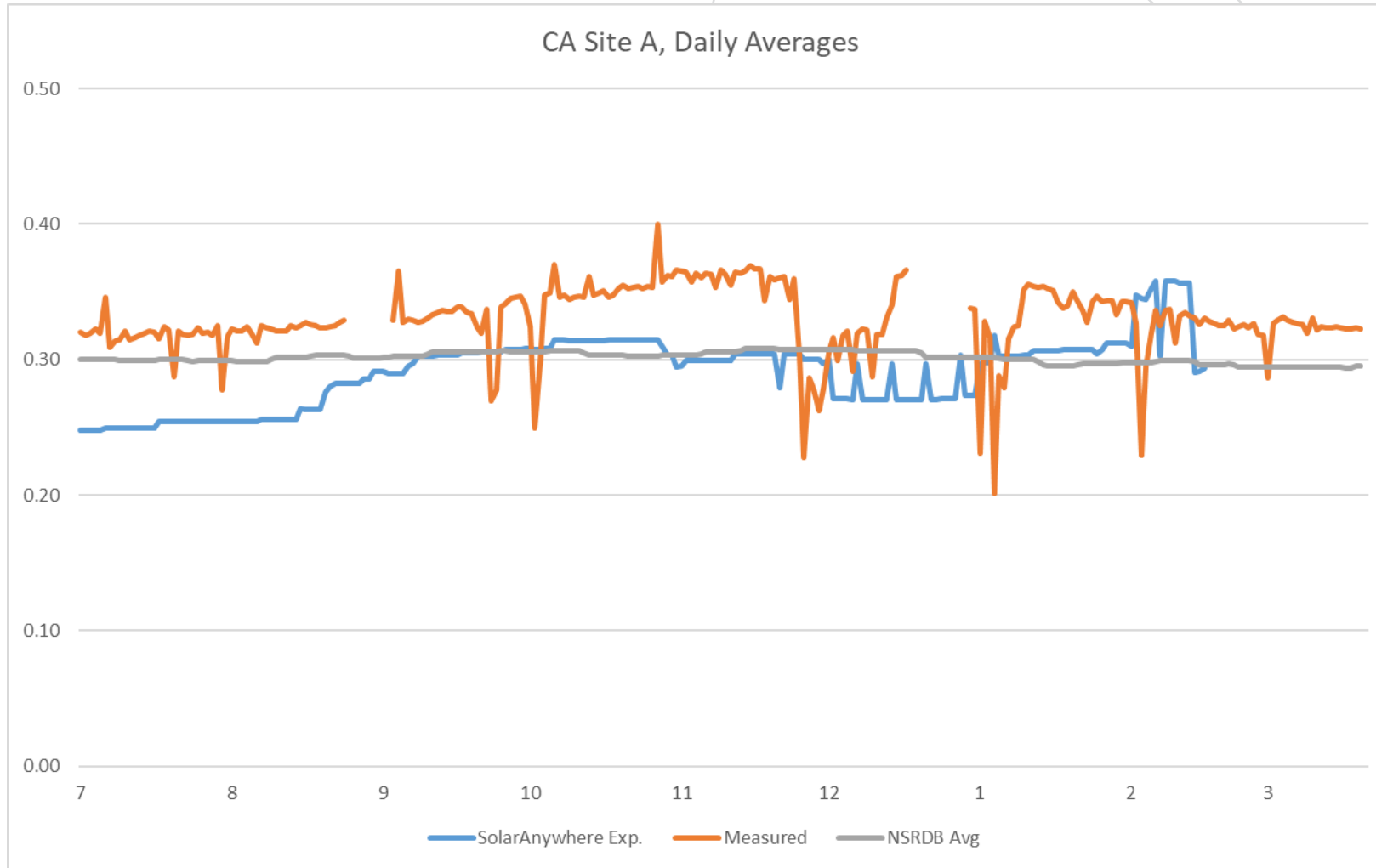
May

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

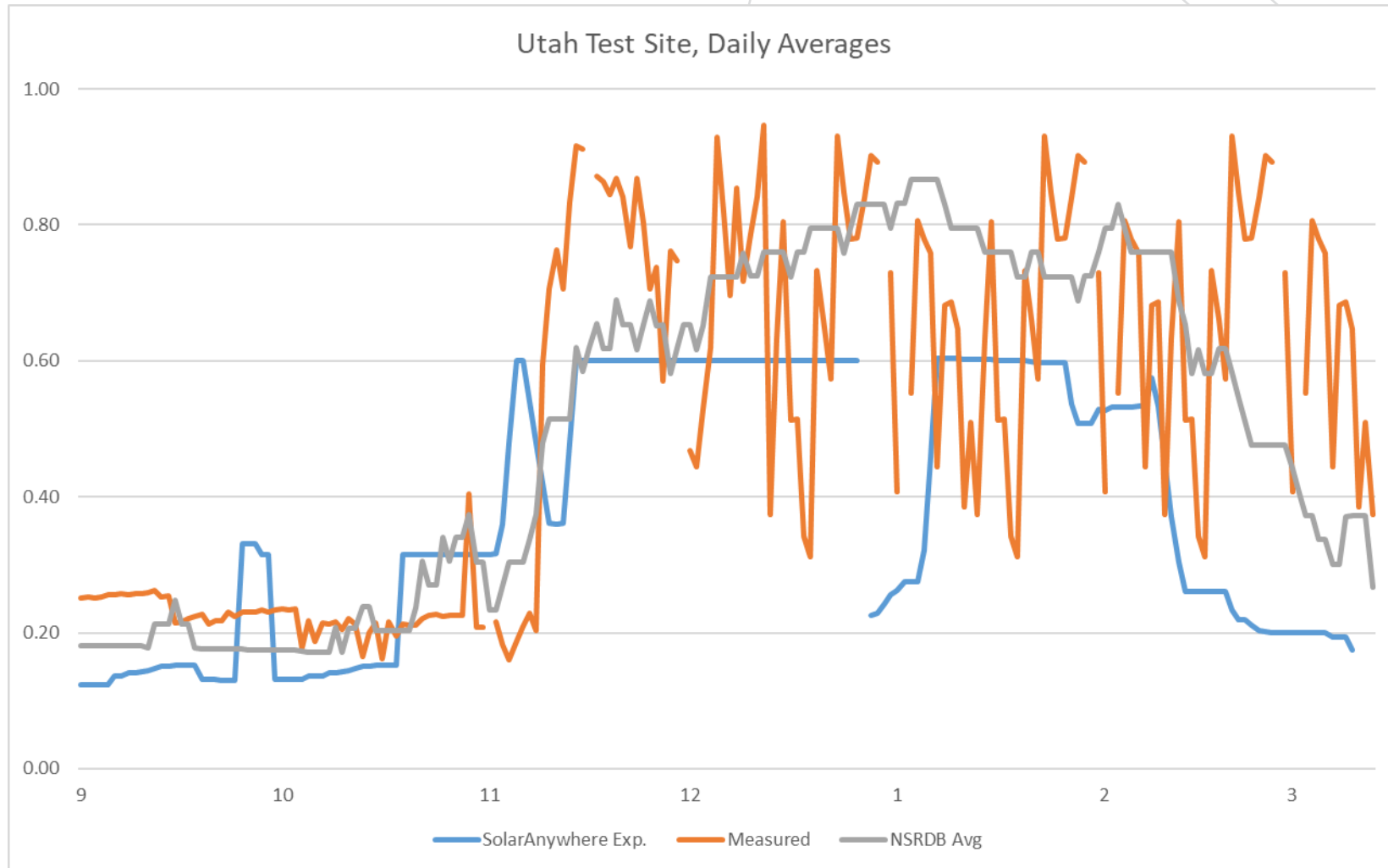


April

Utah Test Site



Utah Test Site

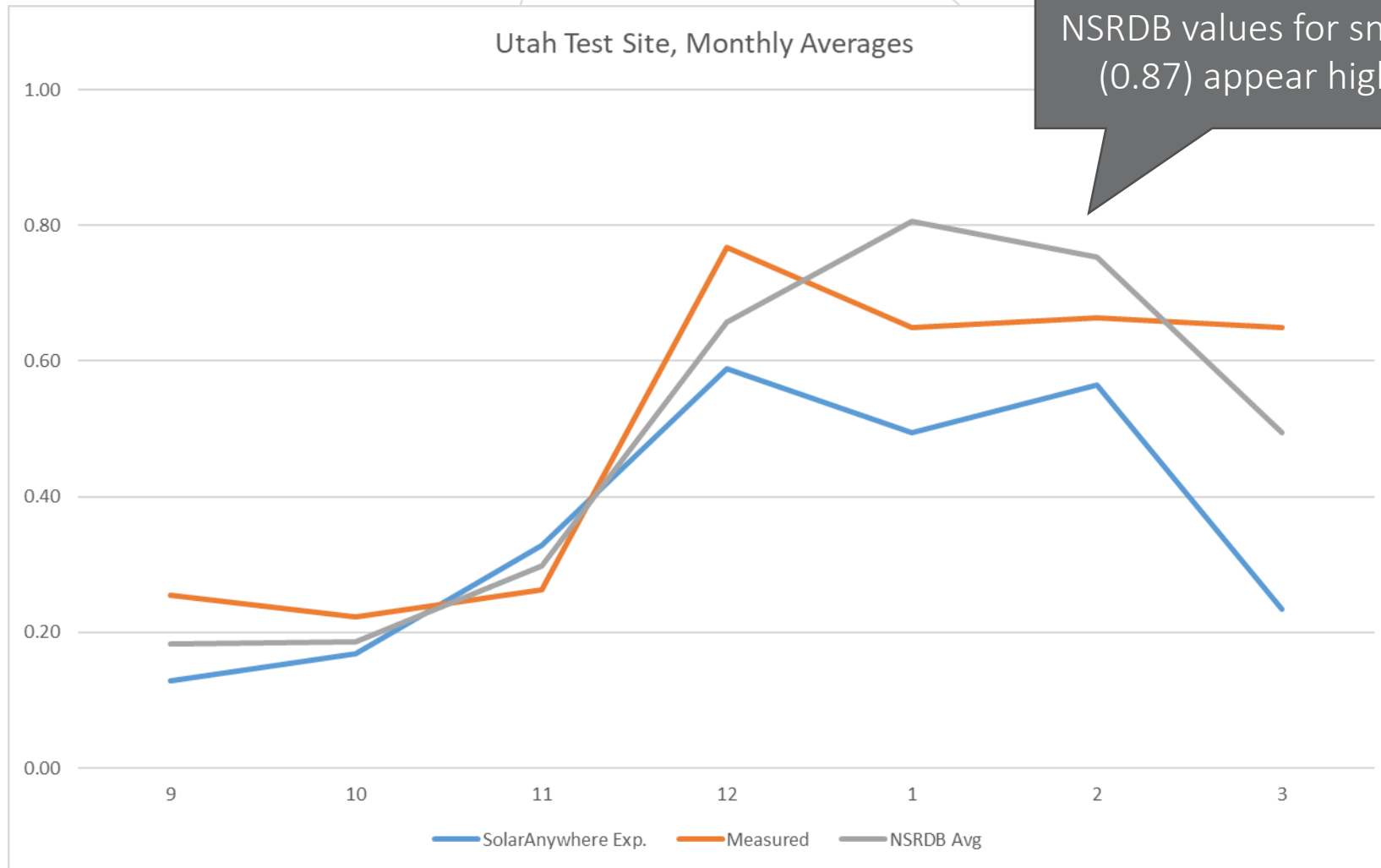


High seasonality

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.

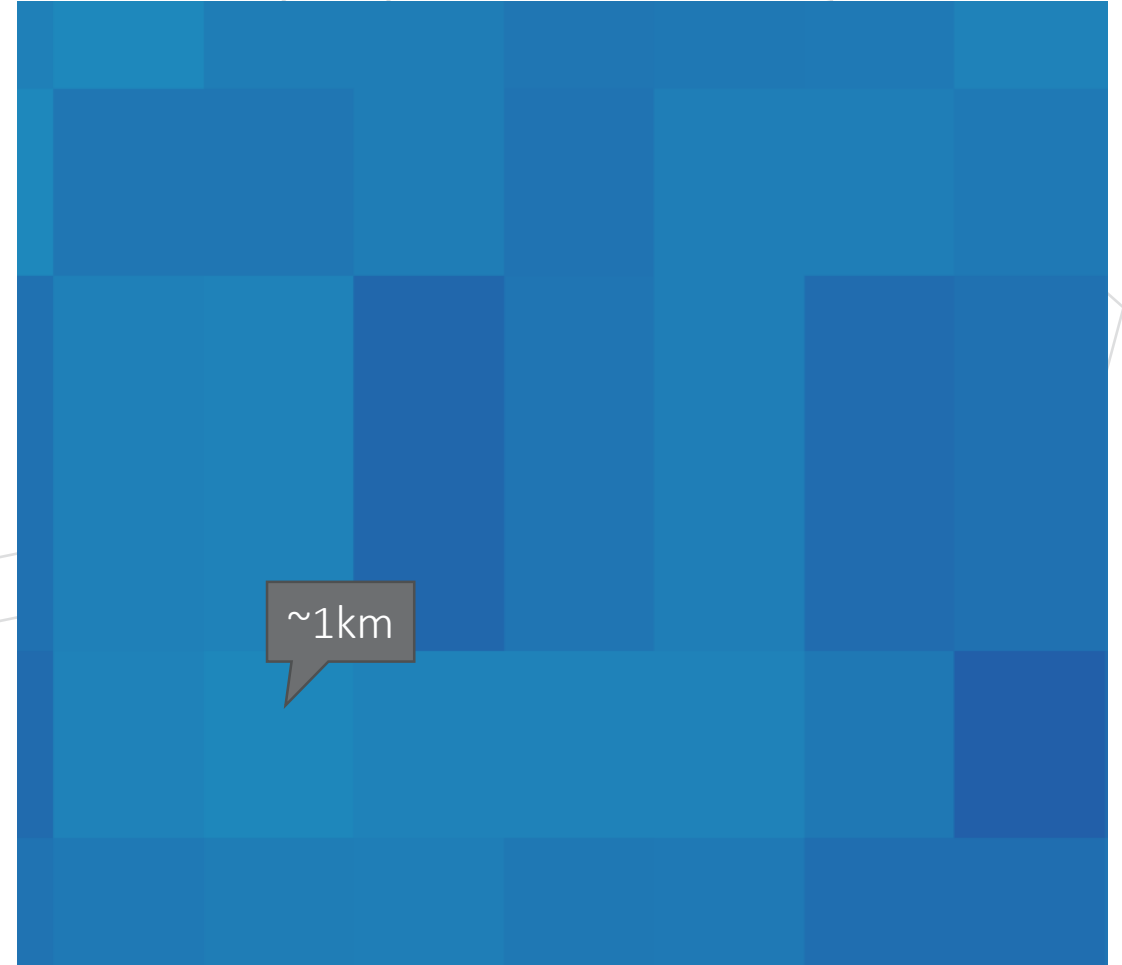
California Site B*

What's representative of the post-construction condition?



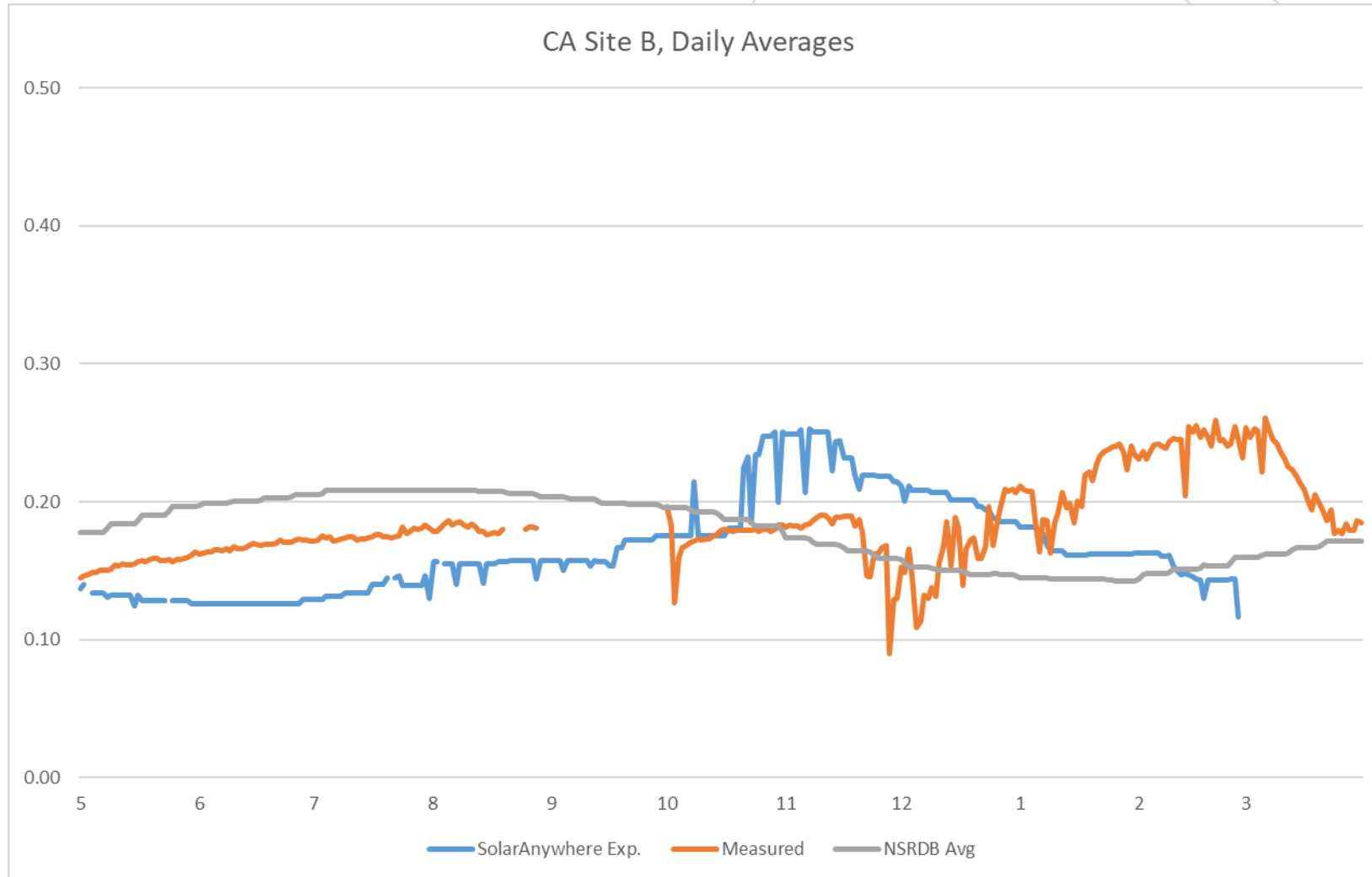
*actual project location not shown to protect confidentiality

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



Moderate seasonality

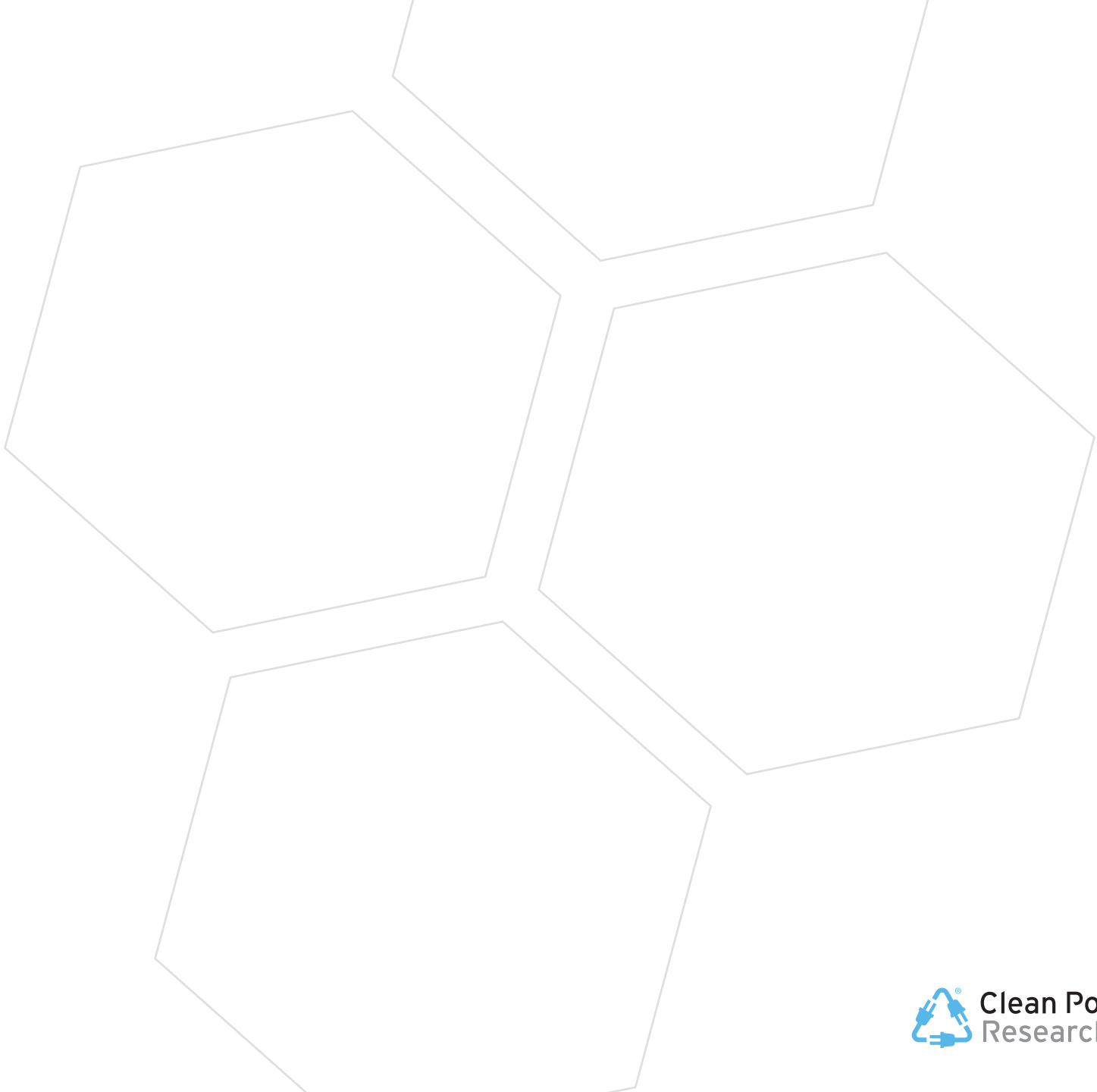
Moderate albedo

Poor correlation among sources

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 and 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.

Q & A



Thank you



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