

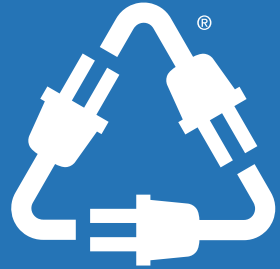
Extreme Weather Risk: Leveraging Data for PV Resilience

Evan Kyte

Product Manager, Clean Power Research



Advancing the Energy Transformation for 25+ Years



**Clean Power
Research®**

Expertise

- Secure, enterprise grade cloud software
- 65+ patents
- Partnered with Dr. Richard Perez

Industries Served

- 380+ solar industry accounts
 - Solar project development
 - Operations and maintenance
 - Energy market participation
 - Renewables planning, portfolio management
- 85+ utilities and energy agencies
 - Municipal
 - Investor-owned utility (IOU)
 - Co-ops



Trusted Software and Data Products

Utility Solutions



No-code workflow automation



Your view behind the meter



Trusted energy advisor

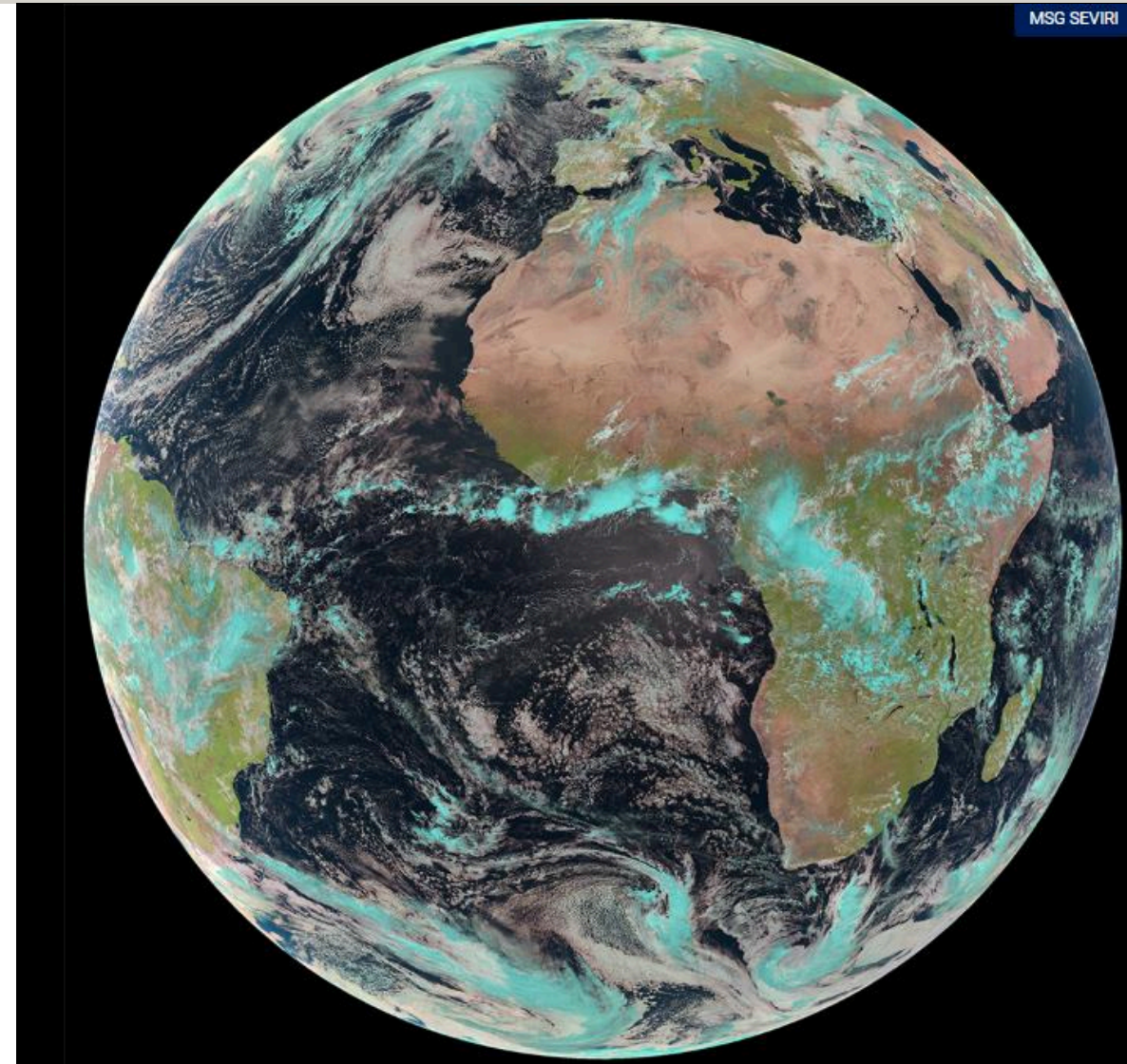
Solar Industry Solutions



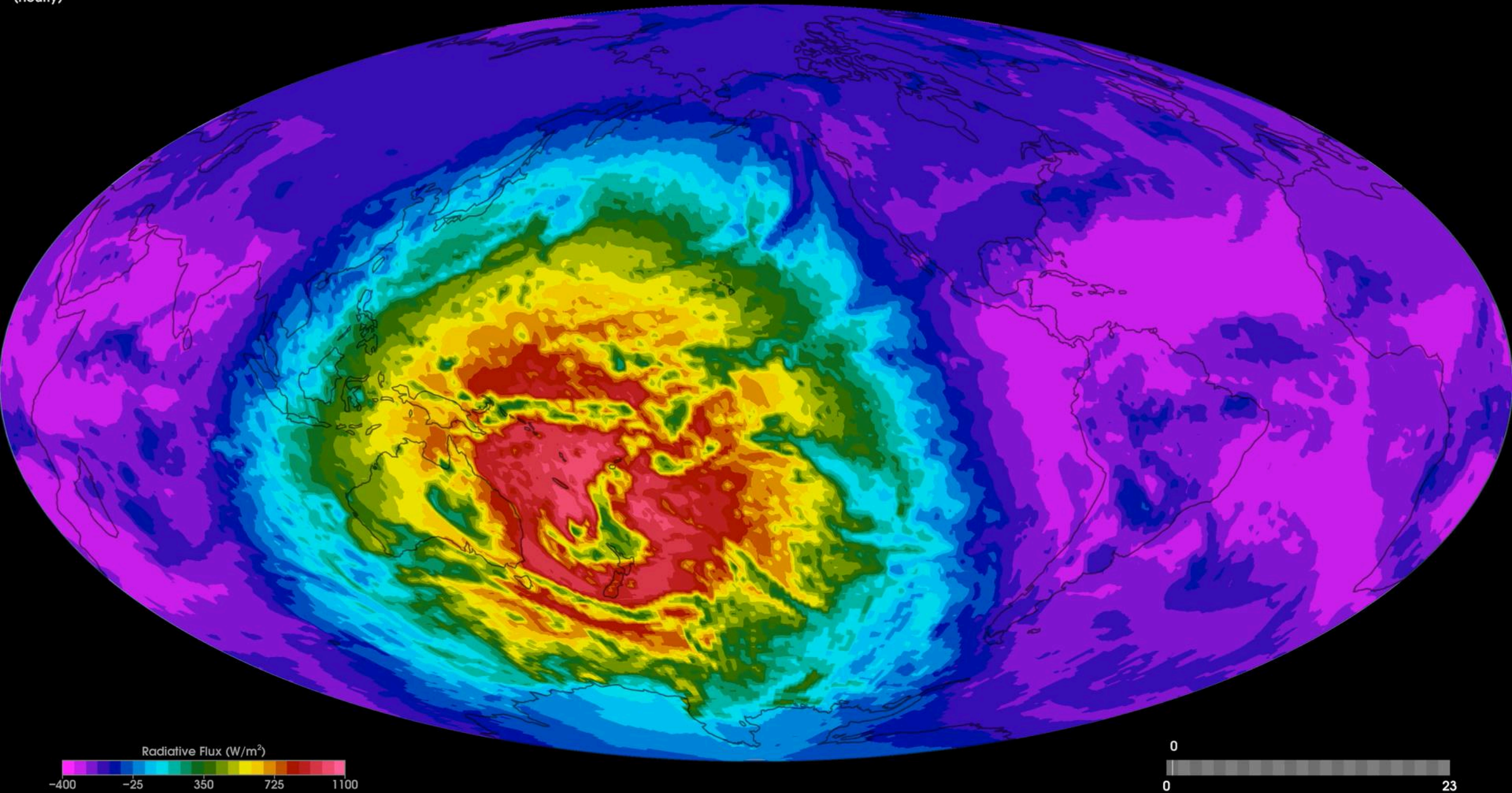
Solar data & intelligence

How it Works

SolarAnywhere[®]
estimates global
irradiance using
geostationary and
polar-orbiting satellite
data across various
wavelengths



Top of the Atmosphere Observed Net Flux, All-sky
(hourly)

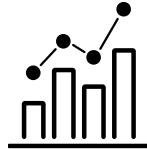


Global Leader in Solar Risk Assessment and Operational Data



The 'typical' year

Current methods of reducing yield uncertainty for large-scale solar projects



The '*atypical*' year

Novel methods of risk assessment for extreme weather and climate change for the solar industry





The '*typical*' year

Evaluating solar resource
potential for PV project
planning and design

Reducing Uncertainty Through Proven Industry Practices

1 Bankable Solar Resource Data

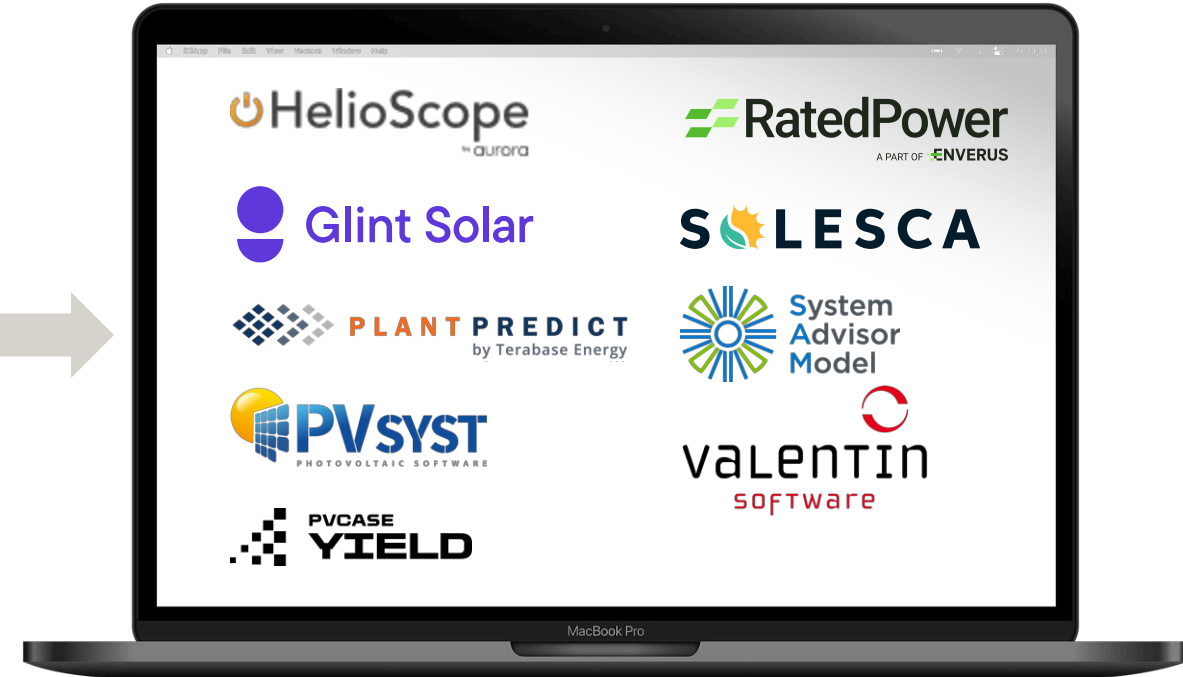
- TMY, PXX, Time Series
- Site-adaptation study

2 Additional Loss Factors

- Clipping, soiling, snow, and shading loss

3 Design Considerations

- Inverter sizing, stow strategy, bifacial panels, cleaning schedule, etc.

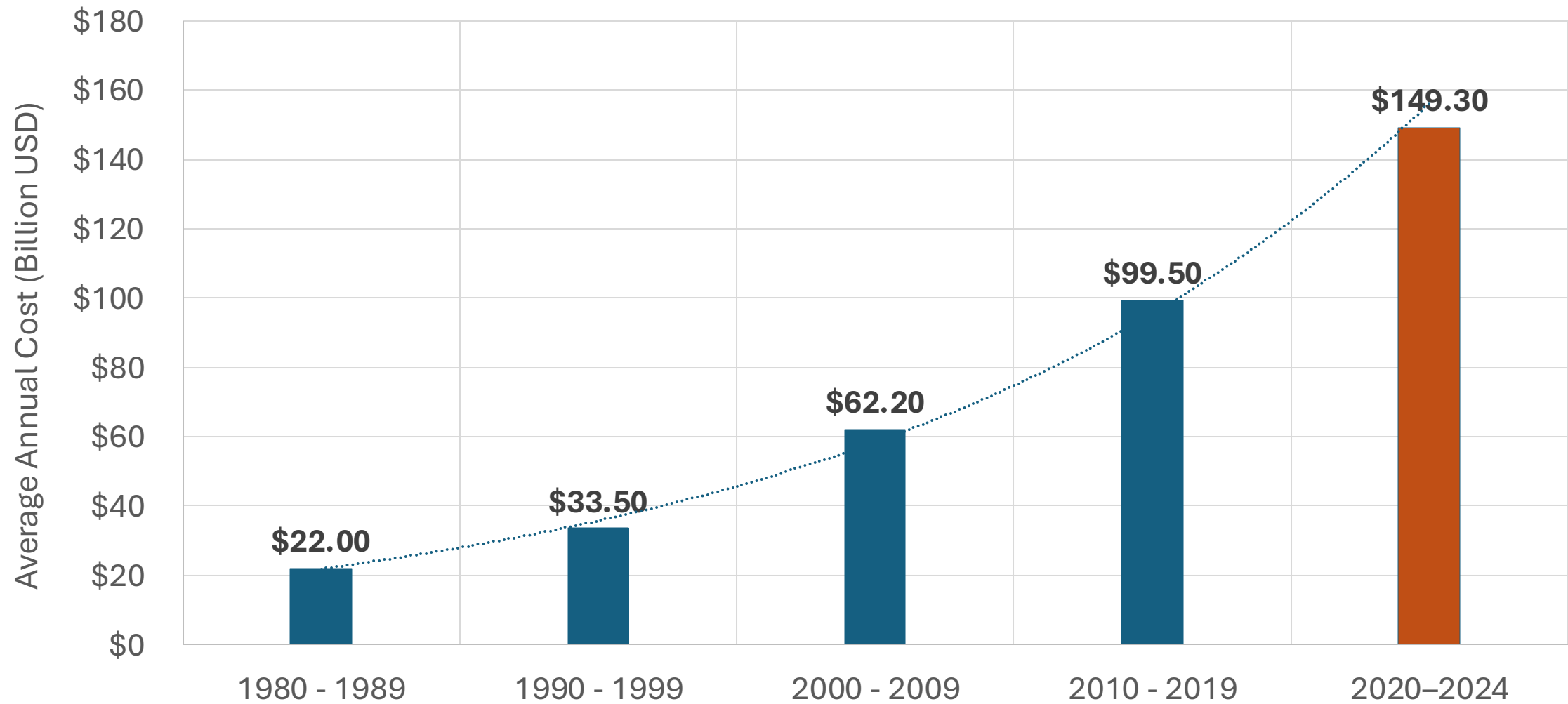




The '*atypical*' year

Capturing weather and
climate trends to improve
risk assessment for the
solar industry

Rising Costs of U.S. Weather and Climate Disasters (CPI Adjusted)



Source: NOAA Billion-Dollar Weather and Climate Disasters

How is extreme weather affecting the solar industry?



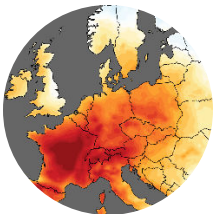
Hail Impact

Hail is the leading cause of insured losses for PV systems globally².



Wildfire & Smoke

Fire seasons in the U.S. have lengthened by an average of 78 days since the 1970s³.



Surface Temperature

Observed global temperature increased at an average rate of 0.36°F per decade since 1982⁴.



Flooding

Extreme rainfall is becoming longer, stronger, and more frequent—causing more flash floods and river overflows⁵.



Storms & Wind Gust

Tornado frequency increasing in the Southeast, Midwest, and Northeast U.S.⁶



Solar Variability

Shifts in cloud cover patterns may affect assumptions about solar resource variability, with impacts varying by region⁷.

Hailstorm Risk and Resilience: Case Studies and Industry Trends



Midway Solar Farm

Pecos County, Texas, May 2019

- 400k+ modules destroyed
- \$70–80M in losses
- Sparked demand for hail modeling



Fighting Jays Solar Farm

Fort Bend County, TX,
March 2024

- 1.2 GW solar capacity in county
- 1-in-500-year hail event
- Catastrophic damage vs. successful stow protocols



Industry Trends

- Hail = 54% of solar loss claims²
- Rising premiums, deductibles, and reduced coverage limits⁸

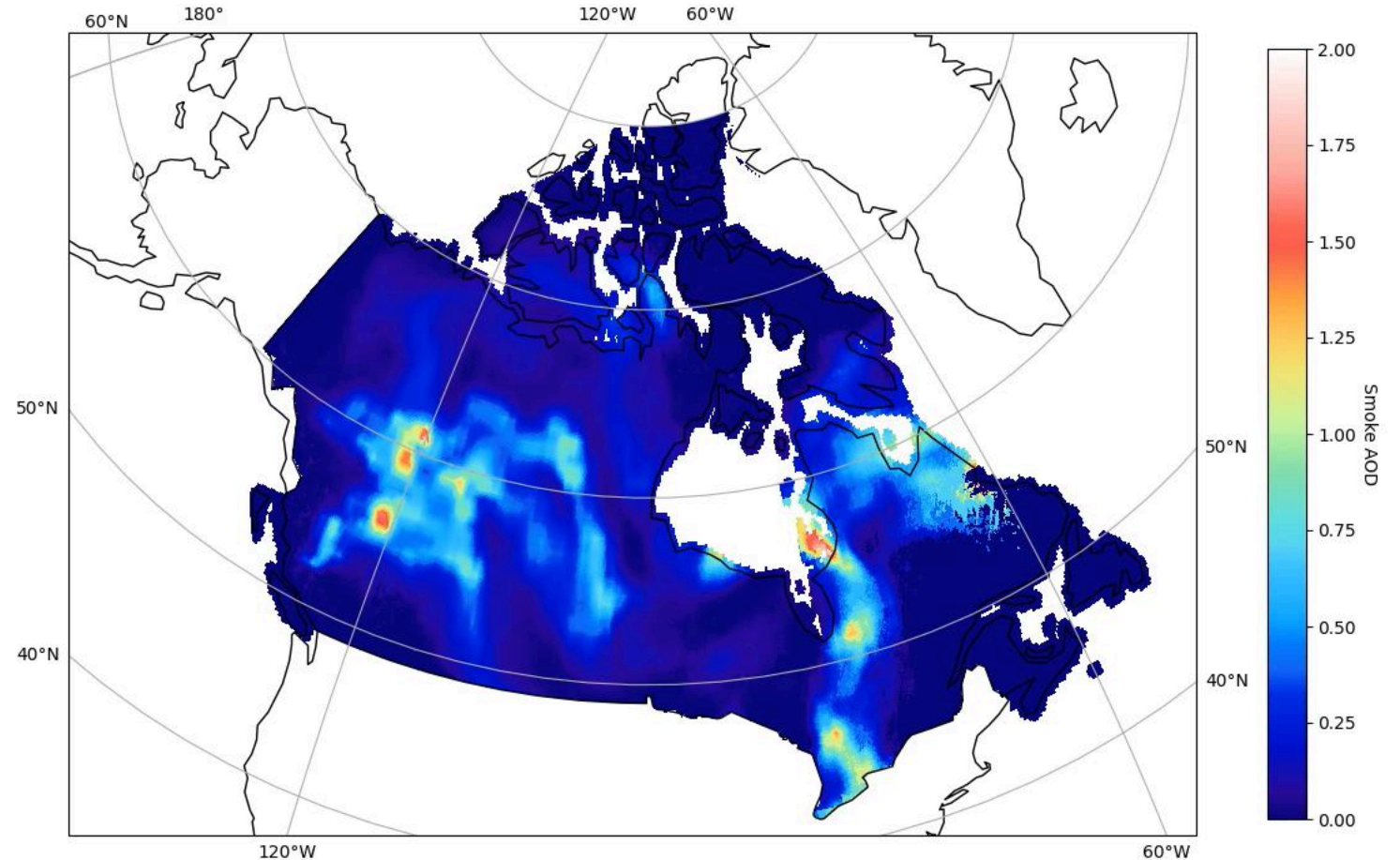
Mitigation Strategies

- Site-specific data & modeling
- Hail-hardened modules
- Proactive stow protocols

Quantifying Wildfire Smoke Impacts on Solar Energy in Canada

AOD Variability from Wildfire Smoke over Canada — July 17, 2023 (UTC)

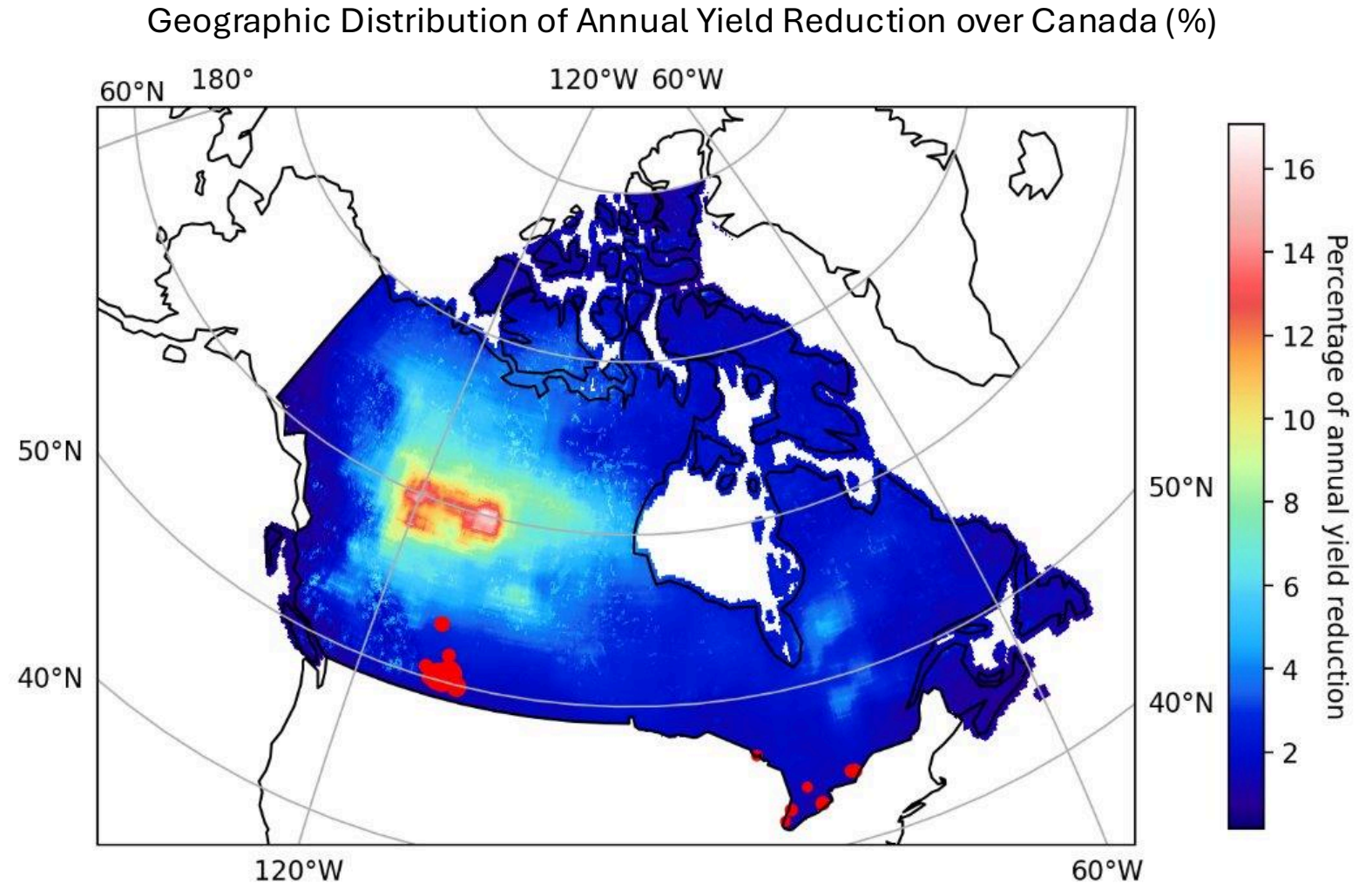
Solar resource losses exceeded 16% in wildfire regions, with notable impacts reaching areas far from active fires⁹



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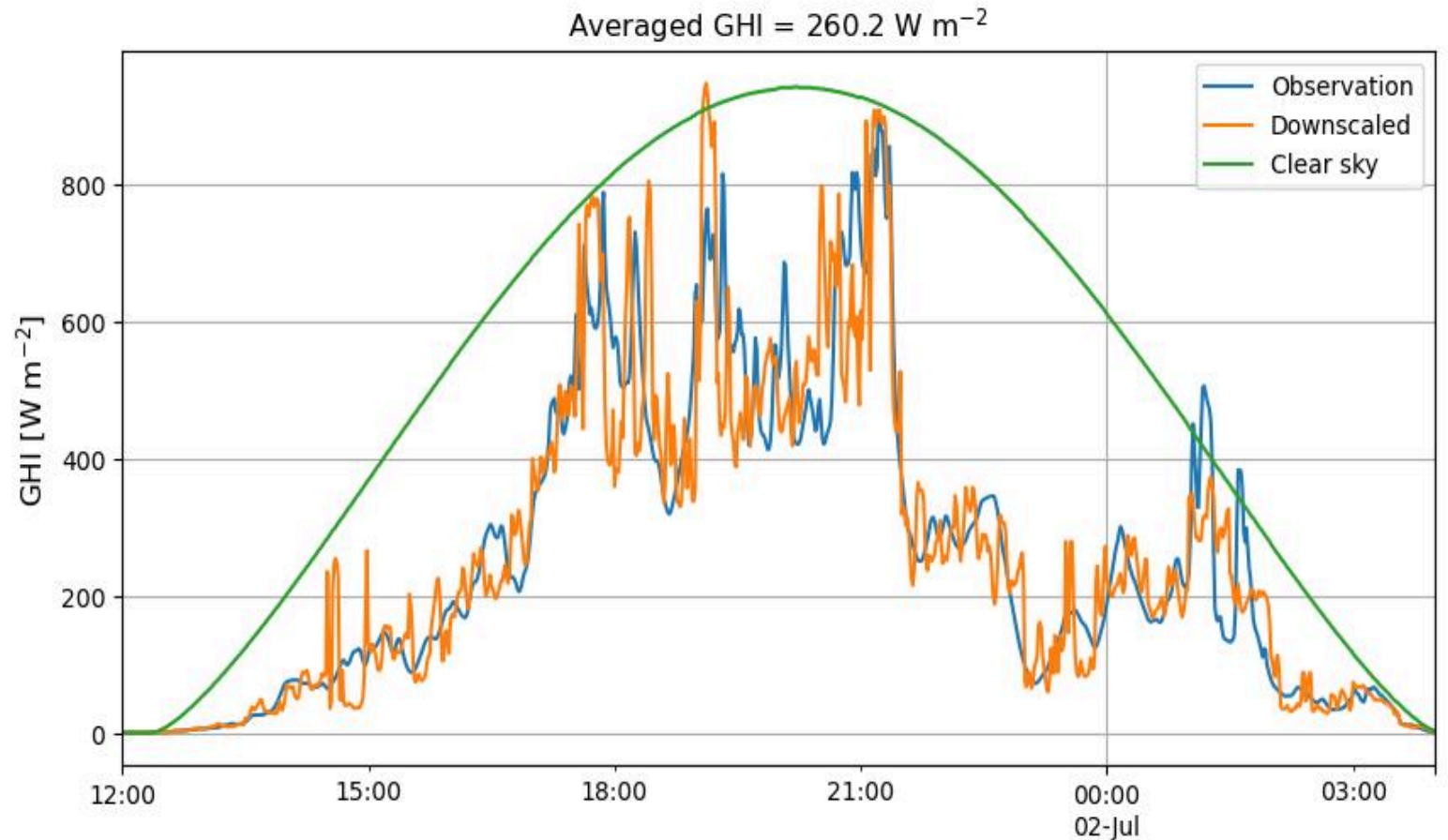


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AI-Based Modeling for High-Resolution Solar Variability

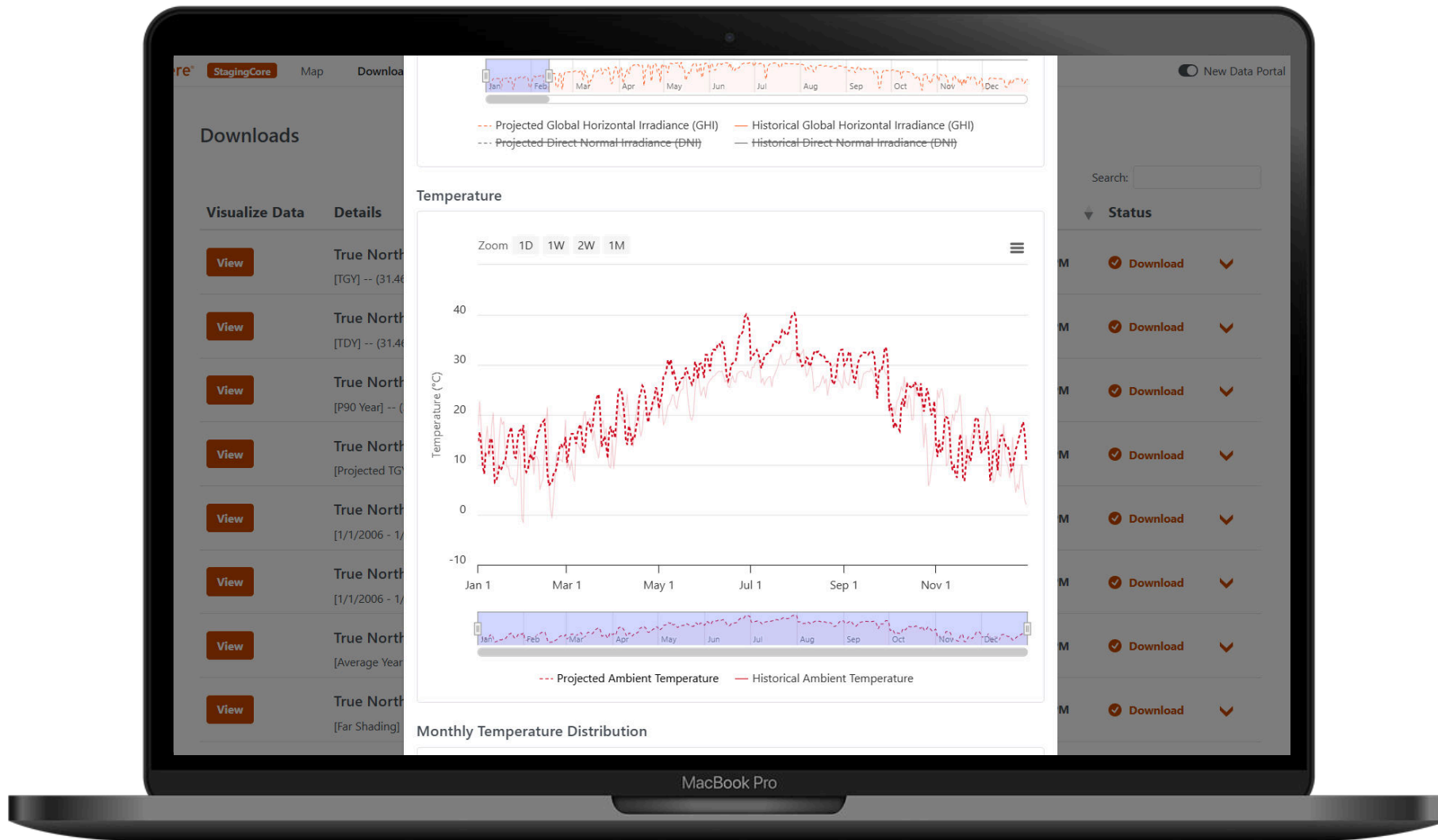
Generating synthetic 1-minute irradiance data from native satellite imagery matching observed variability

- Preserves satellite-derived solar insolation totals from physics-based models
- Captures intra-hour variability critical for clipping loss analysis



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Climate Modeling for Solar Industry Applications



- Third-party climate models with down-scaled outputs in industry-ready formats
- Support risk assessment and design decisions under future climate scenarios, including extreme heat and variability



Thank you!



Visit us at RE+

The Venetian, booth #V7537

Contact

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References

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3. [Wildfire Statistics 2025: The \\$893 Billion Burning Problem | Fire Statistics](#)
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8. [kWh Analytics Solar Risk Assessment 2025](#)
9. [Quantifying the effects of the 2023 Canada wildfires on surface solar irradiance | Request PDF](#)