The RE Data Explorer: High-Fidelity Renewable Energy Data and Tools for Southeast Asia and the Pacific

Galen Maclaurin, Group Manager, Geospatial Data Science Group

National Renewable Energy Laboratory



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Advanced Energy Partnership for Asia



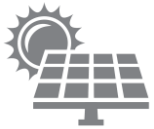
The Advanced Energy Partnership for Asia

USAID has partnered with the U.S. Department of Energy's national laboratories to support Asia EDGE and the growth of sustainable and secure energy markets across Asia.

This collaboration, **the Advanced Energy Partnership for Asia**, led by USAID and the National Renewable Energy Laboratory (NREL) helps partner countries transform their energy sectors.

www.nrel.gov/usaid-partnership

What We Do



Democratizing Data

Support researchers, industries, and governments with free and open renewable energy data



Data-driven Decision-making

Inform energy sector analysis and decision-making with high-quality data and tools



Level Playing Field

Assist governments in fostering more supportive policy, legal, and regulatory environments for private sector deployment and investment in advanced energy systems



Regional Integration

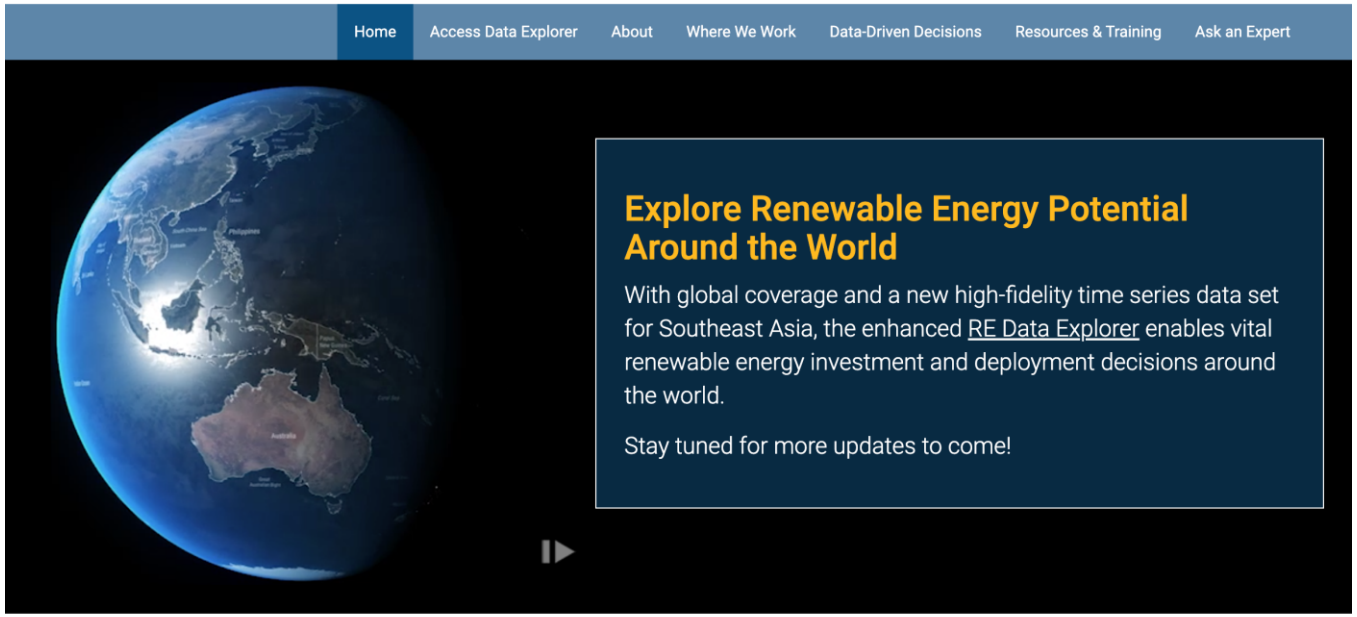
Advance regional energy system planning and operational practices for efficient cross-border energy trade

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Renewable Energy (RE) Explorer

- Web platform providing free:
  - Renewable energy data
  - Analytical tools
  - Trainings and Resources
- Designed for emerging energy markets:
  - Developers
  - Decision-makers
  - Researchers
- Users can access renewable energy data and related geospatial data sets to inform resource potential and energy planning



REexplorer
MAPPING OUR ENERGY FUTURE
www.re-explorer.org

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Technical Potential and Energy Cost Tools

The RE Data Explorer features data and tools to support:

- Early-stage prospecting
- System performance and cost modeling
- Regional energy planning

User friendly tools enable multiple stakeholders to explore different scenarios and understand regional contexts.

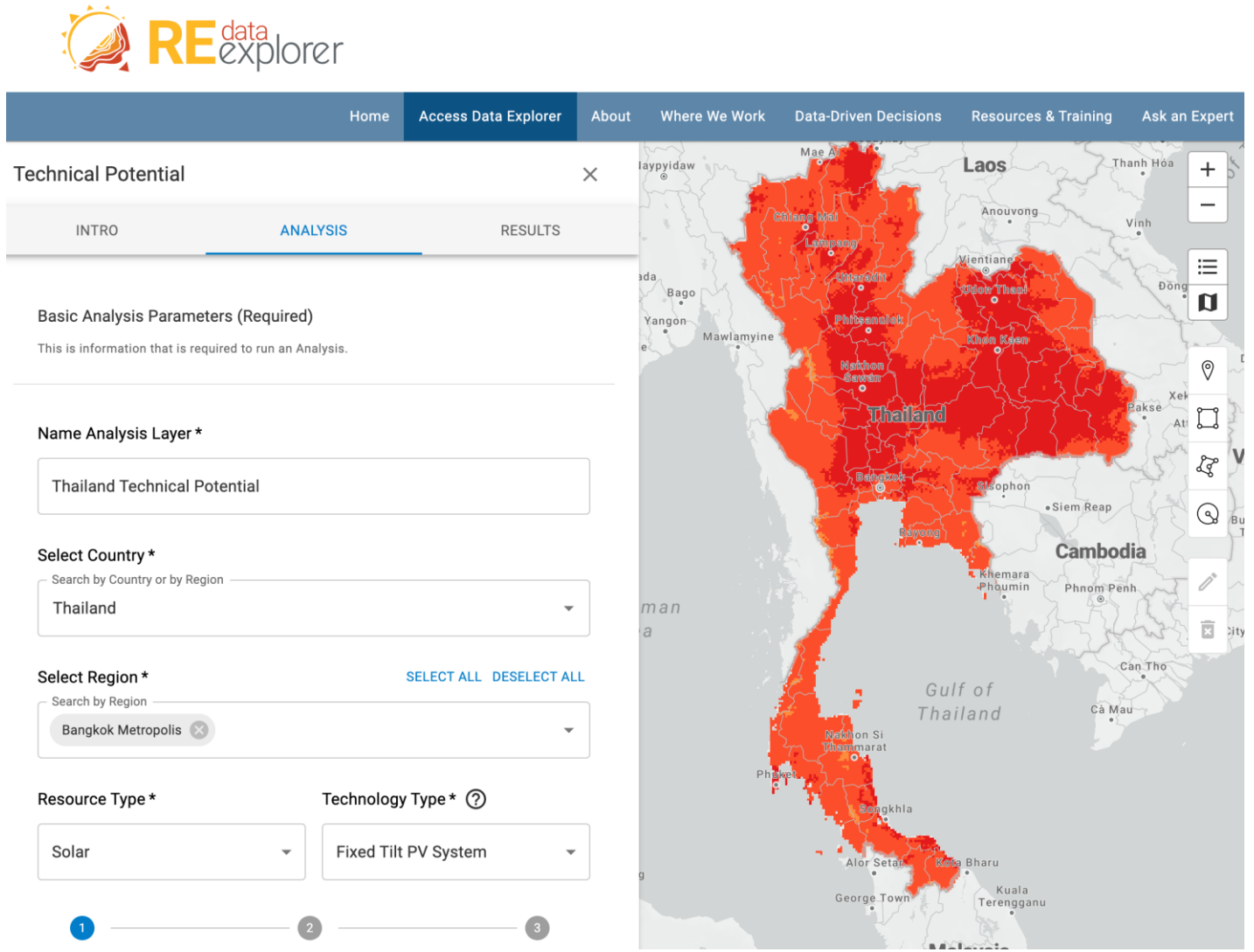


Image from www.re-explorer.org

Data Download Tools

The RE Data Explorer provides two data download options:

1. Individual layer downloads
2. Timeseries downloads

NREL also provides:

1. Application Programming Interfaces (APIs)
2. Highly Scalable Data Service (HSDS) hosted on Amazon Web Services

https://nsrdb.nrel.gov/data-sets/how-to-access-data

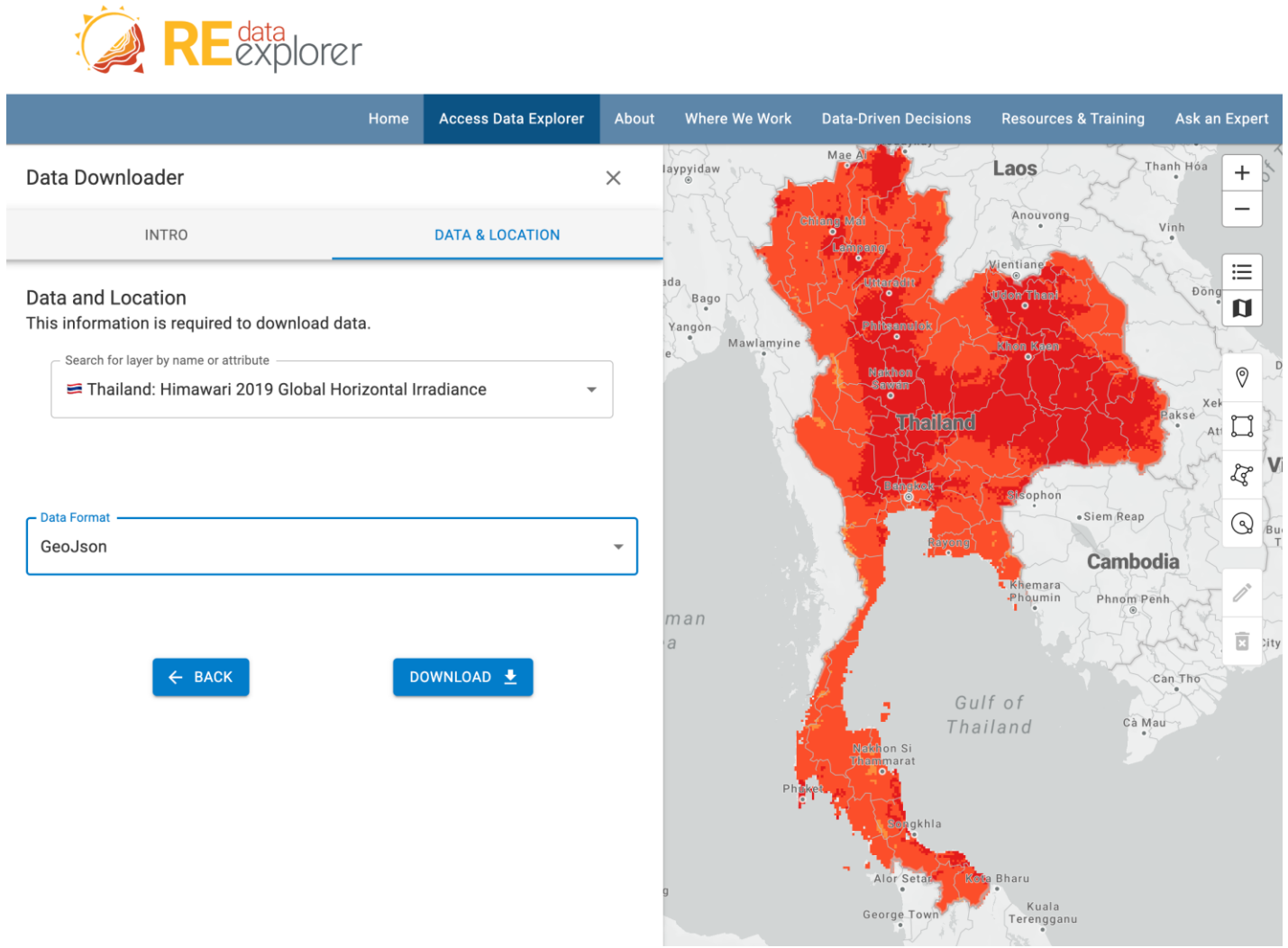


Image from www.re-explorer.org

Democratizing RE Resource Data

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Challenge: Growing need for free timeseries solar and wind resource data across the globe to support:

- Project feasibility assessments
- Regional and national target setting
- Power systems modeling
- Assessment of PV-Wind complementarity and hybrid potential

Solution: Develop high fidelity, long-term solar and wind resource data sets and make them freely available to the public on the RE Data Explorer and through NREL's Application Programming Interfaces (APIs).

Existing Timeseries Wind Resource Data Sets Produced by NREL



Solar Data Development Algorithm

NREL's Physical Solar Model (PSM)

- Models the transfer of solar radiation through Earth's atmosphere
- Considers interactions with atmospheric constituents (e.g., CO_2, O_3, H_2O) and land surface
- Characterizes absorption and scattering of solar radiation from clouds and aerosols
- Visit https://nsrdb.nrel.gov/ for more information.

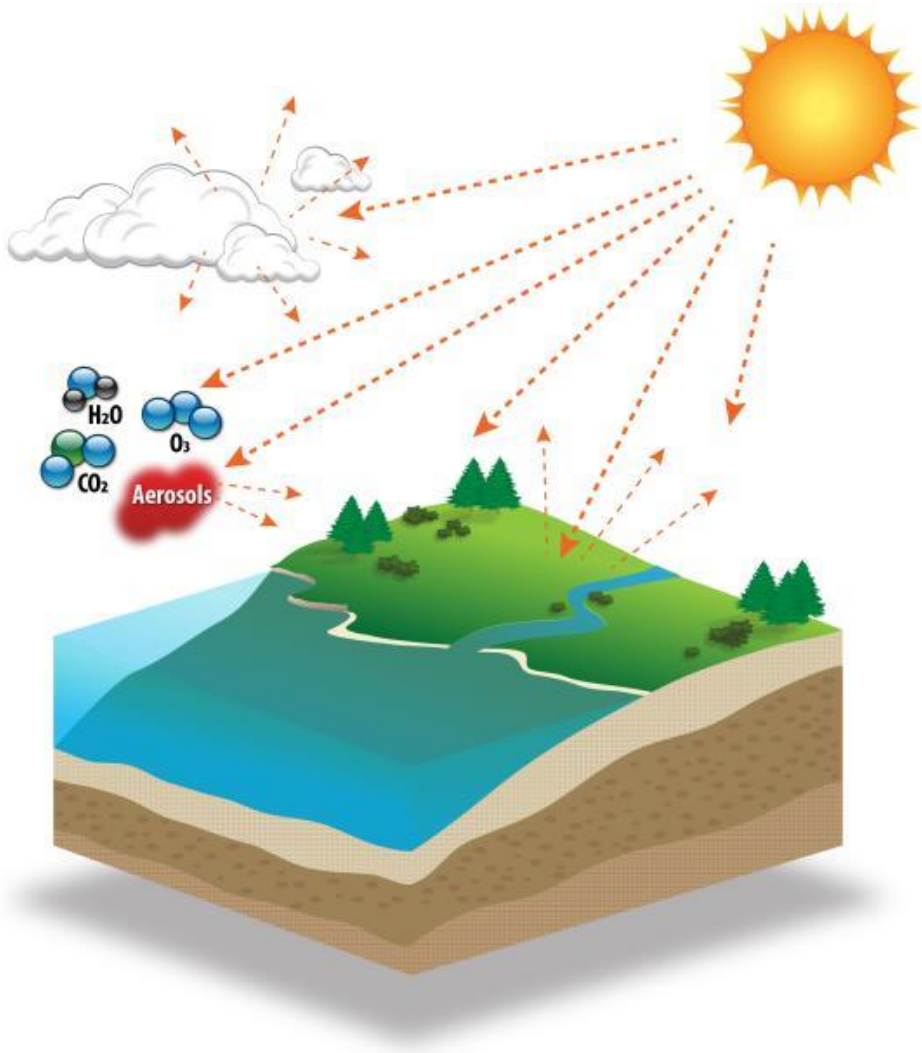
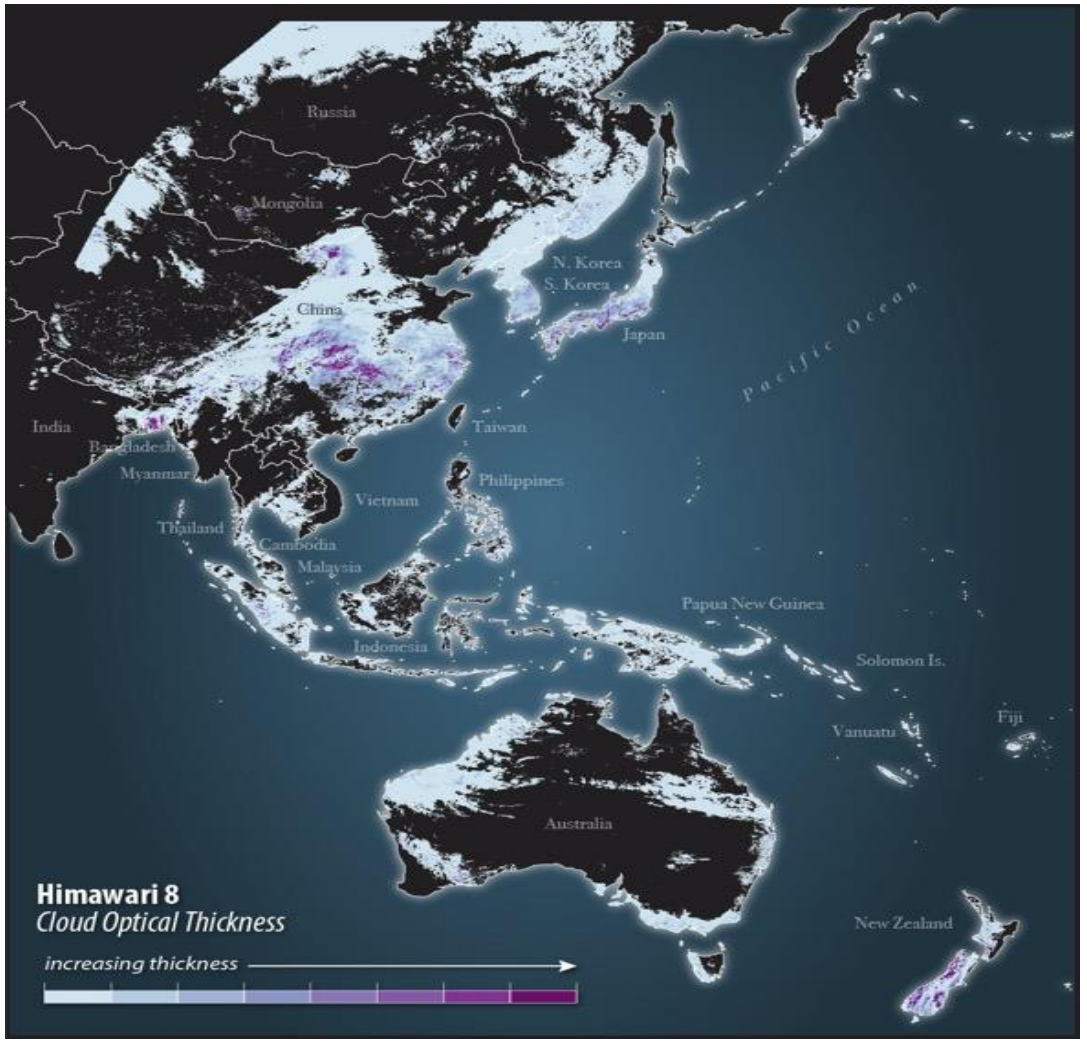


Illustration by Billy Roberts, NREL

Himawari Satellite Imagery

- Cloud characteristics are a key to estimate absorption and scattering of the incoming solar radiation
- Imagery from the Japanese Meteorological Agency's (JMA's) Himawari 7 and 8 satellites
- NREL partnered with the University of Wisconsin to model cloud type, thickness, and properties.



Cloud optical thickness shown for April 1, 2019. *Illustration by Billy Roberts, NREL*

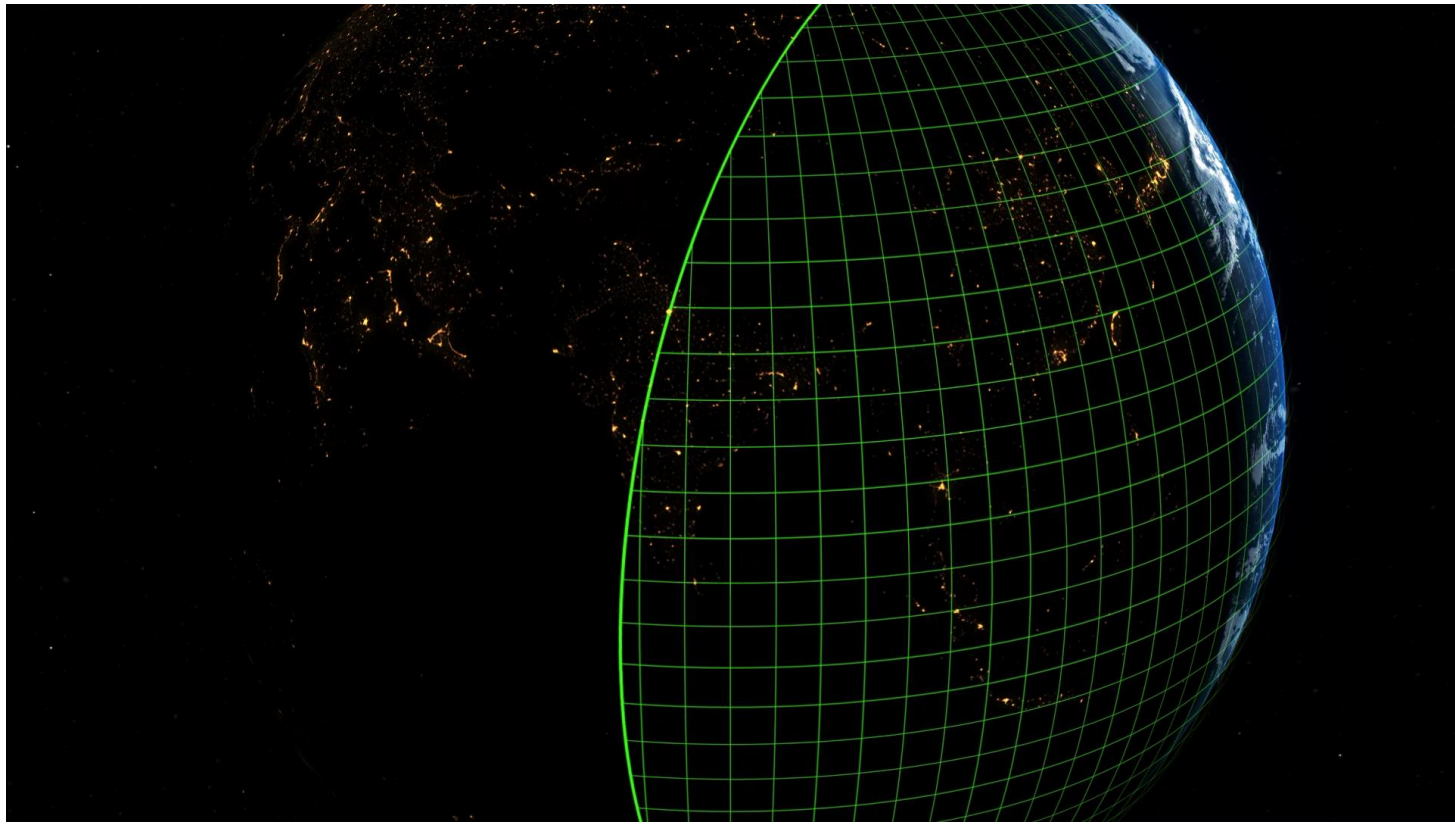
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Solar Data: SE Asia and Pacific

Released in February 2021:

- High fidelity solar radiation data covering SE Asia and much of the Indo-Pacific region.
- 10-years of high spatial and temporal resolution data and aTypical Meteorological Year (TMY) data set.
- Easily accessible, free, and open data.

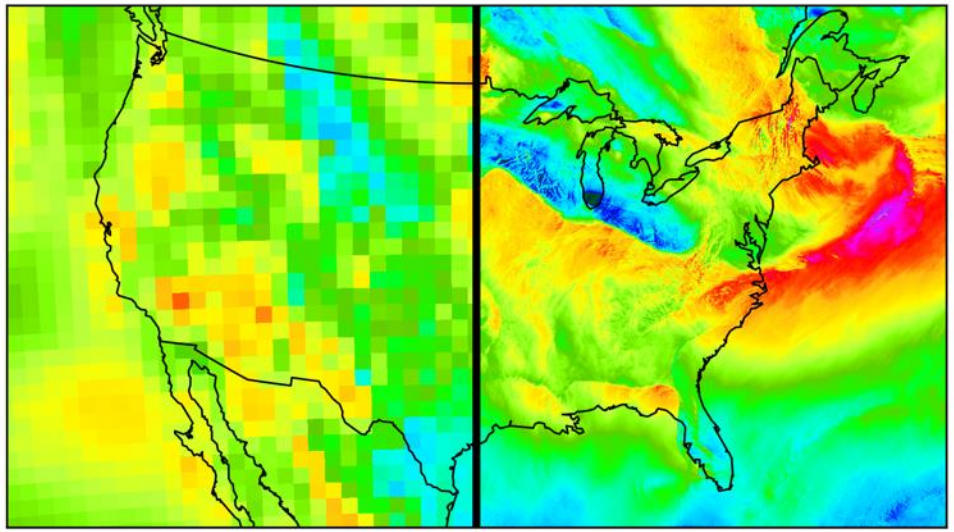


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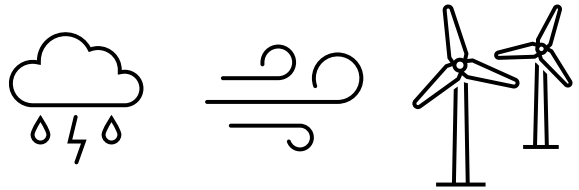
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What's Next: Wind Resource Data

OBJECTIVE: Downscale historical meteorological data to finer resolutions



54 km 3 km



VALUE PROPOSITION: Develop data that capture important atmospheric processes for the wind energy community:

- High-accuracy, meso-scale wind flow
- Sub-hourly to interannual resource variability
- Accurate vertical wind profile (wind shear)
- Ramping rates at fine temporal scales

A New Paradigm for Wind Resource Assessment

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Combine cutting edge techniques in numerical weather prediction and machine learning

Weather Research and Forecasting (**WRF**) Model + Generative Adversarial Networks (**GANs**) = Meso-Scale Wind Resource Timeseries Data

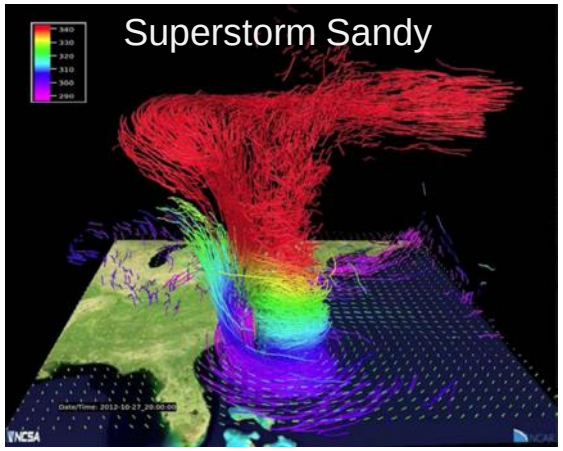


Figure Credit: Mel Shapiro, NCAR

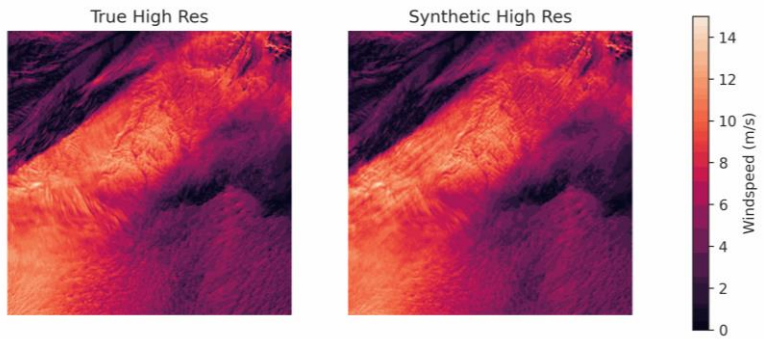
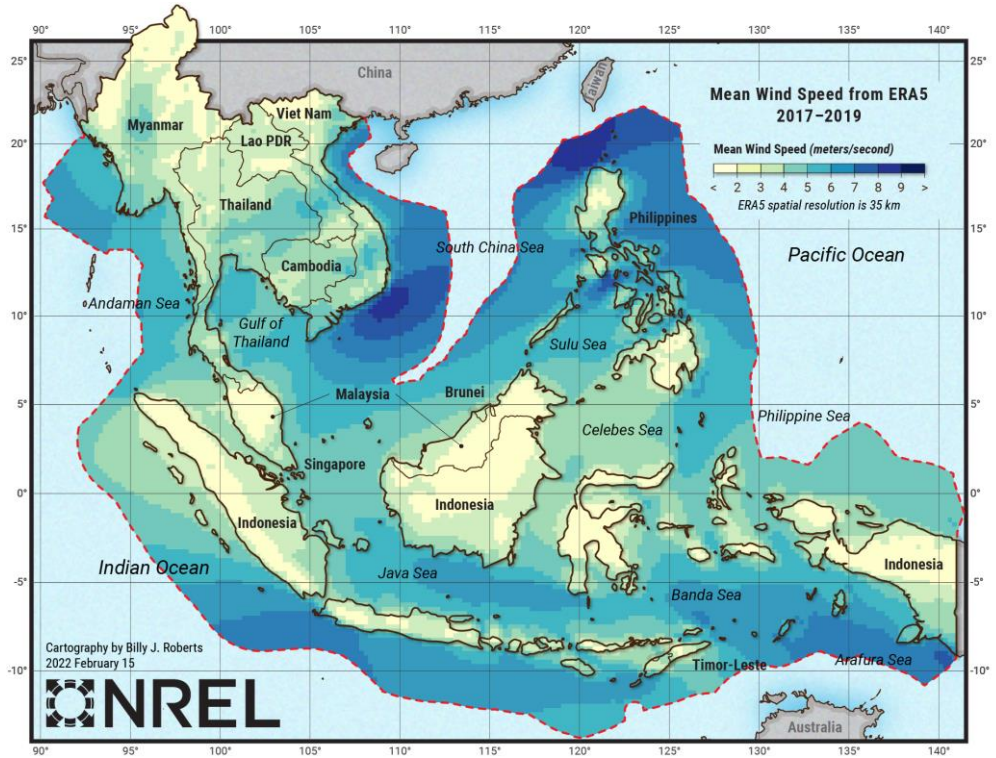


Figure Credit: Ryan King

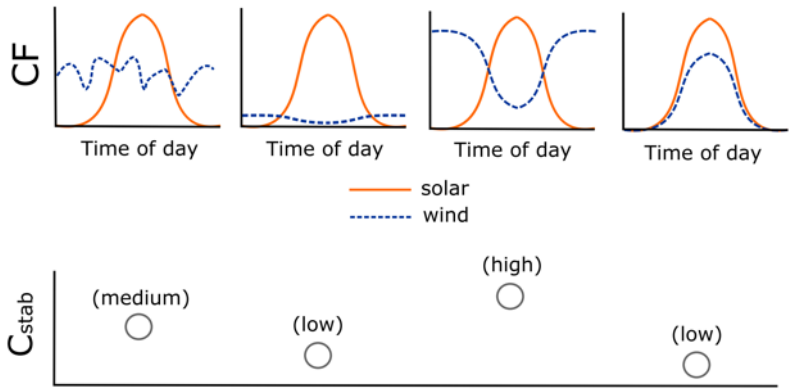


Solar and Wind Data for the Energy Transition

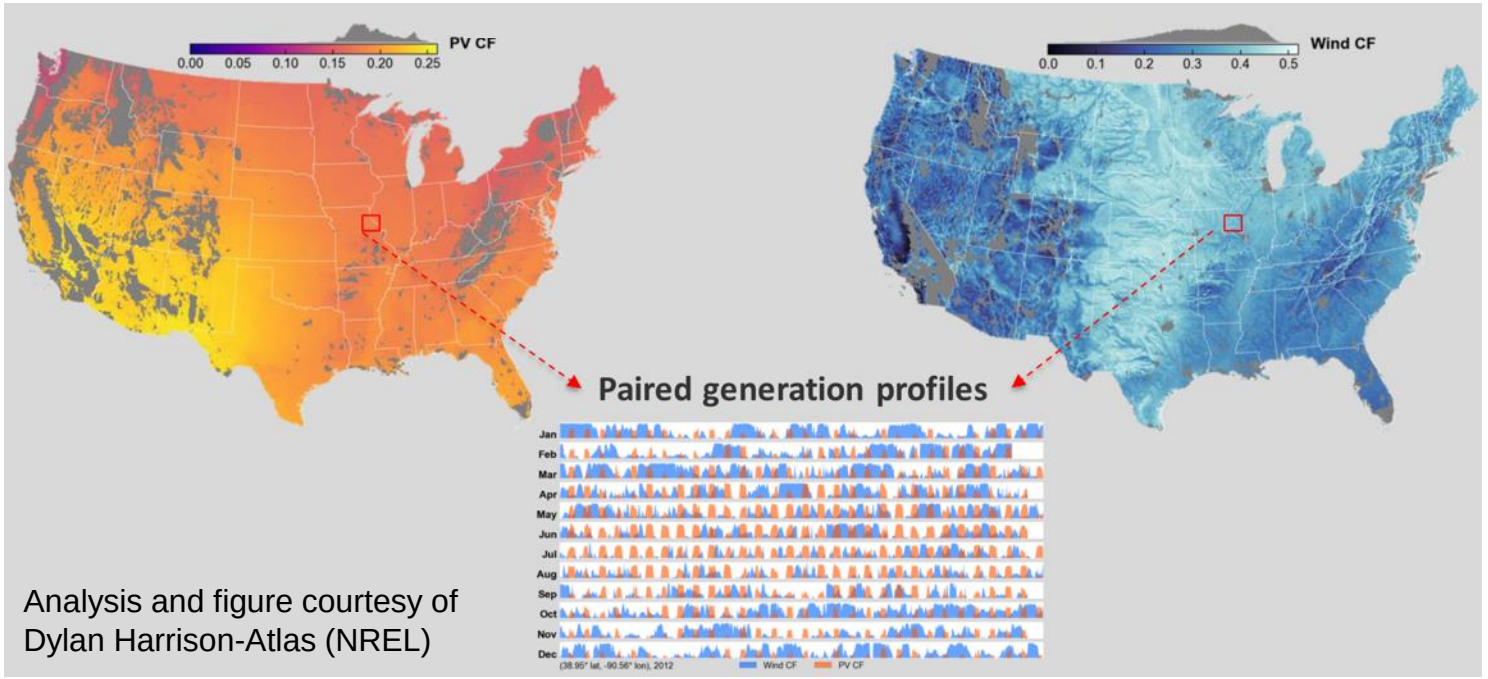
IMPACT: Solar and wind resource data together will support SE Asia in moving towards a net-zero energy future

Solar and Wind Resource Complementarity:

- Hybrid plants becoming more common
- Power system models require solar and wind timeseries data
- High levels of solar and wind generation bring opportunities as well as challenges



From Sterl, S., Liersch, S., Koch, H., Van Lipzig, N. P., & Thiery, W. (2018). A new approach for assessing synergies of solar and wind power: implications for West Africa. *Environmental Research Letters*, *13*(9), 094009.



Analysis and figure courtesy of Dylan Harrison-Atlas (NREL)

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Thank You!

Galen Maclaurin
Group Manager, Geospatial Data Science
NREL
galen.maclaurin@nrel.gov

Derina Man
Technical Lead, Advanced Energy Partnership for Asia
NREL
Derina.man@nrel.gov

Scott Bartos
Regional Energy Advisor for Asia
USAID/RDMA
sbartos@usaid.gov



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